TREK1000 Expansion Options Instructions

HOW TO EXPAND THE DECAWAVE TREK1000 WITH AN EVK1000

Version 1.01

This document is subject to change without notice

DOCUMENT INFORMATION

Disclaimer

DecaWave reserves the right to change product specifications without notice. As far as possible changes to functionality and specifications will be issued in product specific errata sheets or in new versions of this document. Customers are advised to check with DecaWave for the most recent updates on this product.

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Caution! ESD sensitive device. Precaution should be used when handling the device in order to prevent permanent damage.

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These TREK1000 and EVK1000 evaluation kits based on DecaWave's DW1000 IC are intended solely for use by competent engineering personnel for the purposes of evaluating the use of DecaWave's DW1000 IC in wireless location and communications systems.

The TREK1000 and EVK1000, as supplied from DecaWave, have not been certified for use in any particular geographic region by any regulatory body governing radio emissions in such regions.

The TREK1000 and EVK1000 are supplied under the following conditions: -
- The distribution and sale of the TREK1000 or EVK1000 is intended solely for use in future development of devices which may be subject to regulations or other authority governing radio emission.
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If the user has obtained the TREK1000 or EVK1000 for any purpose other than those listed above the user should return the TREK1000 or EVK1000 to the supplier immediately.

FCC NOTICE: This kit is designed to allow (i) product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and (ii) software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the conditions that this device not cause harmful interference to licensed radio stations and that this device accept harmful interference. Unless the assembled kit is designed to operate under Part 15, Part 18 or Part 95 of the FCC Rules, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under Part 5 of the FCC Rules.

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1 INTRODUCTION

The TREK1000 is an evaluation kit that allows the user to evaluate the DecaWave DW1000 IC in an RTLS environment in different use cases. The TREK1000 consists of 4 EVB1000 boards.

The EVK1000 consists of a pair of EVB1000 boards. Each pair of EVB1000 boards is configured to run a pre-programmed point-to-point two-way ranging demonstration application.

Purchasers of the TREK1000 that have previously purchased an EVK1000 can combine the kits to create an expanded system, albeit with limitations on the system performance.

1.1 Obtaining the Firmware Binary File from Decawave

Purchasers of the TREK1000 can get access to the binary file (along with source code and source code documentation) by contacting register@decawave.com and quoting the serial number found on the side of the box.

1.2 System Performance Limitations

When combining TREK1000 boards and EVK1000 boards the user should recognize that, although the boards are physically the same, they have been calibrated differently for the different use cases they were designed for.

There are many factors involved (including variances across boards, variances across calibration values, positioning of anchors, geometries of the room) that affect accuracy.

A TREK1000 kit typically delivers x-y R95 accuracy of <20 cm.

The user should expect that by mixing TREK1000 and EVK1000 that x-y R95 location accuracy may change by up to 15 cm.

1.3 Beyond Mixing a TREK1000 and an EVK1000

It should also be noted that the system limitation of Anchors and Tags in the TREK1000 software, as delivered, is 4 Anchors and 8 Tags (as only 3 DIP switches are assigned to IDs).

The TREK1000 system supports the following configurations:
- There must be at least 3 or 4 Anchors in the system
- There must be at least 1 Tag in the system but up to 8 Tags are supported by the software

Some specific system performance testing has been performed at these limits but actual performance will be subject to the same limitations as above, when mixing TREK-calibrated and EVK-calibrated boards in the same system.

Note: The examples given in the subsequent sections are confined to mixing a single TREK1000 with an EVK1000.

2   SETUP AND CONFIGURATION

The four EVB1000 boards that come with a TREK1000 are preloaded with TREK1000 firmware. This same binary file must be flashed onto the EVB1000 boards that come with the EVK1000 kit.

2.1   Purchase the ST-Link/V2 JTAG Programmer

Decawave uses the ST-LINK/V2 JTAG Programmer to connect to the EVB1000 board and program the code. This inexpensive JTAG tool is from STMicroelectronics or their distributers see (http://www.st.com/).

Figure 1: ST-Link/V2 JTAG Programmer

2.2   Install ST-LINK driver utility

Go to page http://www.st.com/web/en/catalog/tools/PF258168

This allows you to download ST Microelectronics part # STSW-LINK004 which is identified as the **STM32 ST-LINK utility**

Click on the download link to download file "stsw-link004.zip" which contains the "STM32 ST-LINK Utility_v2.4.0.exe" installer

Extract the Installer exe from inside the downloaded zip file and run it. This will install the ST-Link utility and driver software. We used default installation directories and options. Click "Next" button repeatedly and "finish" button at the end.

2.3   Connect ST-LINK to the EVB1000 Evaluation Board and loading the built image

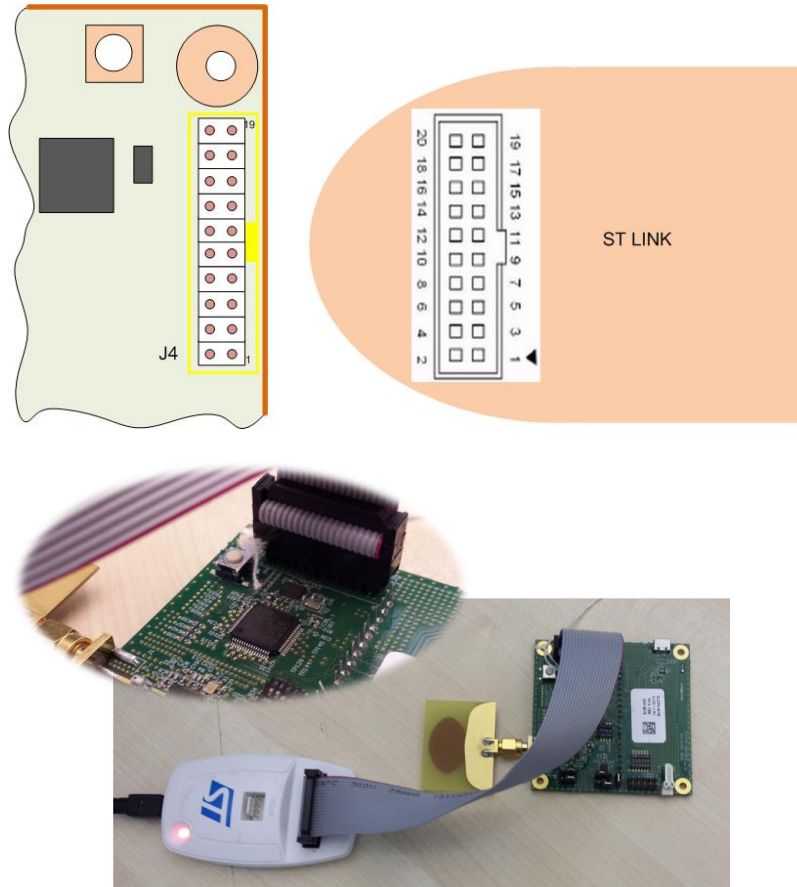The EVB1000 has a standard 20-PIN JTAG connector. The connections are shown in the figures below.

Figure 2: ST-LINK Connections

Connect ST-LINK as shown above and power up the EVB1000.

Run the ST-link "STM32 ST-LINK Utility" and in "Target" menu select "Settings" sub-option, and select SWD connection mode.
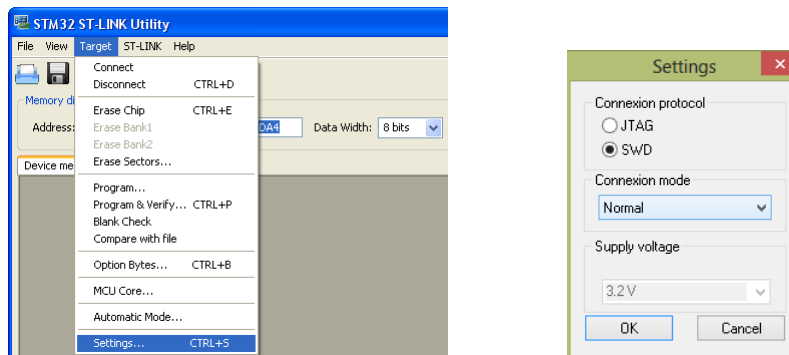

Figure 3: ST-LINK Utility Menus

- Use "Target" menu "Connect" sub-option to connect to the target device. The progress/status pane at the bottom will inform you of progress:

  : Connected via SWD.
  : Device ID: 0x418
  : Device flash Size: 256 Kbytes
  : Device family: STM32F10xxx Connectivity Line

- Use "File" menu "Open File..." sub-option to browse to and find the binary file called "DecaRangeRTLS_ARMrevx.yz.bin".
- Next select "Target" menu sub-option "Program & Verify" and click start when dialog below opens.
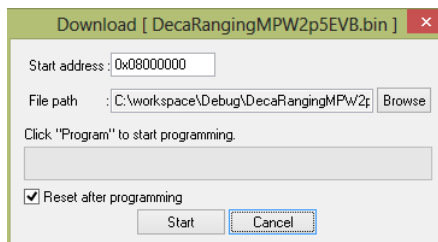

Figure 4: ST-LINK Progress

- The programming and verification will be done and the progress/status pane at the bottom will inform you of progress:
    - : [DecaRangeRTLS_ARM.bin] opened successfully.
    - : Flash memory programmed in 10s and 766ms.
    - : Verification...OK
- Once programming is complete you can disconnect the ST-Link and re-power the unit to begin execution of the newly loaded program.
- Tool bar icons 🔧🔧 can also be used to connect and disconnect the JTAG controller.

For details of operating the TREK1000 please refer to: "TREK1000 User Manual".

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3 ARRANGEMENTS FOR DIFFERENT USE CASES

This section shows the arrangement of the 6 x EVB1000 units when evaluating the 3 different topologies:

1. Tracking Use Case
2. Geo-Fencing Use Case
3. Navigation Use Case

3.1 Tracking Use Case

For evaluating the tracking use case the TREK1000 system is configured as:

- 3 Anchors
- 1 Tag

By adding the EVK1000 boards the system can be expanded to
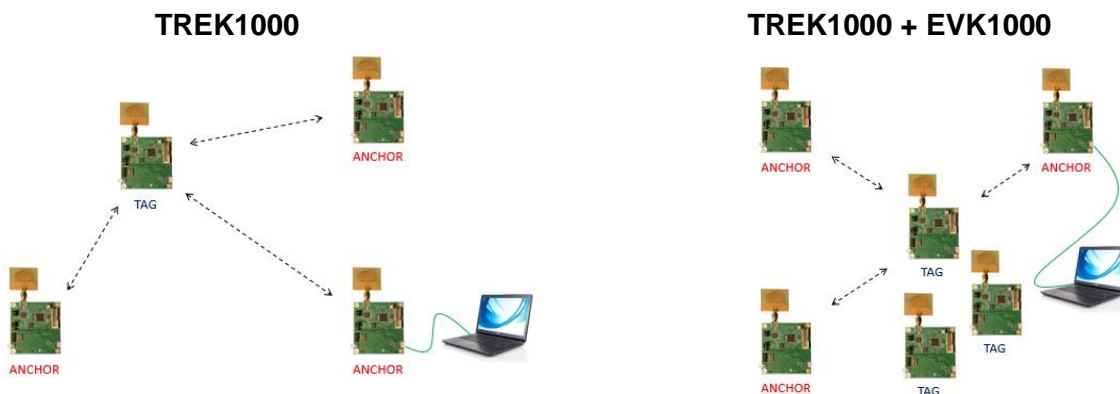
- 3 Anchors
- 3 Tags

TREK1000   **TREK1000 + EVK1000**

Figure 5: Tracking Use Case Options (1)

Alternatively, by using one of the EVK1000 boards as a 4th anchor in the arrangement:

- 4 Anchors
- 2 Tags

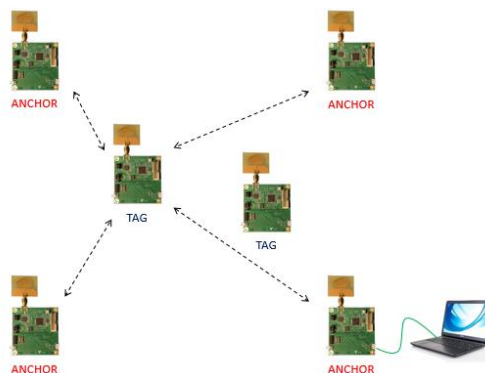the system can resolve the 2 solutions given by the trilateration algorithm.

Figure 6: Tracking Use Case Options: TREK1000+EVK1000 (2)

3.2 Geo-Fencing Use Case

For evaluating the geo-fencing use case the TREK1000 system is configured as:
- 1 Anchor
- 3 Tag

By adding the EVK1000 boards the system can be expanded to
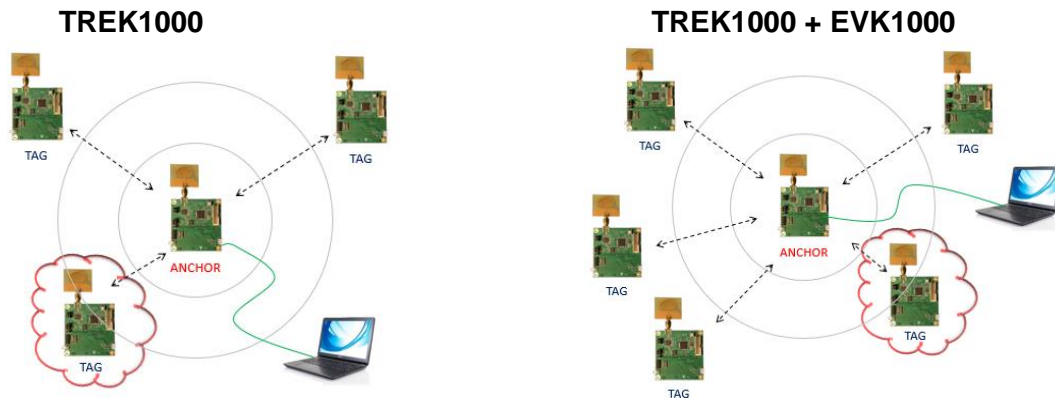- 1 Anchor
- 5 Tags

Figure 7: Geo-Fencing Use Case Options

3.3 Navigation Use Case

For evaluating the navigation use case the TREK1000 system is configured as:
- 3 Anchors
- 1 Tag

By adding the EVK1000 boards the system can be expanded to
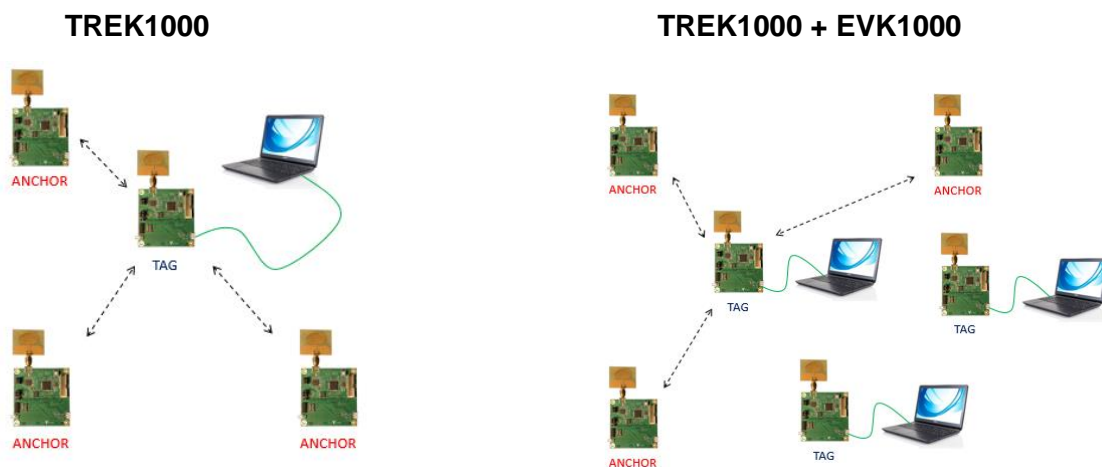- 3 Anchors
- 3 Tags

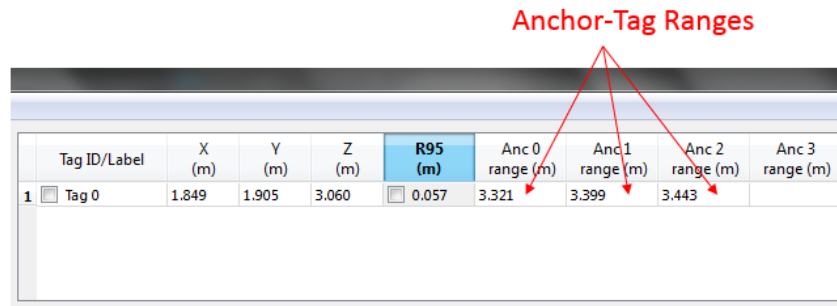**Figure 8: Navigation Use Case Options**

4   FINE TUNING FOR GREATER ACCURACY

When mixing boards that are calibrated differently there will be some errors introduced in the ranging measurements.

The TREK1000 contains a feature that allows the user to fine-tune the ranging results to each Anchor.

If the Anchor-Tag ranges are showing an error / bias in the measurement from the true distance this range error can be corrected out in the User Interface.
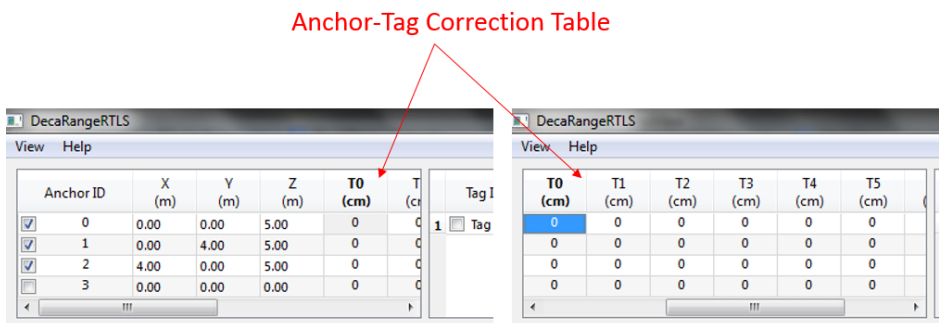

Figure 9: Anchor-Tag Ranges

Check 'Show Anchor-Tag Correction Table' in the Settings:Configuration Pane to show the corrections table. The table will contain a grid where the range to each Anchor can be adjusted (independently for each Tag).

The user enters an adjustment distance to the range in cm. The adjustment distance can be derived using the log-file to measure the average of a number of ranges to a particular anchor and comparing to the actual distance.

Figure 10: Anchor-Tag Correction Table

Once the observed error (e.g. due to different board calibrations) has been corrected away the system can be used in the various use cases with more accuracy.

5 REFERENCES

5.1 Listing

Reference is made to the following documents in the course of this document: -

Table 1: Table of References

Ref	Author	Date	Version	Title
[1]	DecaWave		1.03	TREK1000 User Manual

6 DOCUMENT HISTORY

Table 2: Document History

Revision	Date	Description
1.01	31st March 2015	Initial release

7 MAJOR CHANGES

Table 3: Major Changes – Revision 1.01

Page	Change Description
All	Initial Release

8 ABOUT DECAWAVE

DecaWave is a pioneering fabless semiconductor company whose flagship product, the DW1000, is a complete, single chip CMOS Ultra-Wideband IC based on the IEEE 802.15.4-2011 UWB standard. This device is the first in a family of parts that will operate at data rates of 110 kbps, 850 kbps and 6.8 Mbps.

The resulting silicon has a wide range of standards-based applications for both Real Time Location Systems (RTLS) and Ultra Low Power Wireless Transceivers in areas as diverse as manufacturing, healthcare, lighting, security, transport, inventory & supply chain management.

Further Information

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