



## **Proximity Unit ICD**

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Version 1.0

## 1 Introduction

This ICD describes the interface to access TRX NEON's Proximity Unit ranging and elevation data over Bluetooth.

Ranging outputs are based on 500 MHz ultra-wideband ranging signals in the 4 GHz band. Using ultra-wideband signals enables accurate range measurements even in high multipath environments.

Pressure and range data between Proximity Units are combined to compute relative elevation. Additionally, still time is provided for alerting purposes.



Figure 1. NEON Proximity Unit with Belt Clip Attached to Pants

## 2 Hardware Configuration

The Proximity Unit can be paired with any Bluetooth device using **Secure Simple Pairing (SSP)** with **no man-in-the-middle (MITM) protection**. The device's friendly name will appear as TRX\_XXXX, where XXXX is the last 4 hexadecimal digits of the Device ID.

When the pushbutton is pressed, the Proximity Unit will turn on. To turn off the Proximity Unit, hold the button until the top LED turns green. While the Proximity Unit is on, the top LED will blink periodically to indicate the status of the device. **Green** indicates that the device is on, but does not have a Bluetooth connection. **Cyan** indicates that the device has a Bluetooth connection. **Red** indicates low battery. The bottom LED indicates the charging status of the Proximity Unit. It will be **green** when the device is plugged in and charging, and will turn **off** when the battery is fully charged.

### 3 Common Message Frame Format

Data messages sent and received through the Bluetooth connection will be serialized according to the following format. All fields will be transmitted with **little endian** order. Shaded fields make up a common header for application data, while unshaded fields are application dependent.

**Table 1 – Message Frame Format**

Field Name	Data Type	Details
Delimiter	uint16	Always 0x2A2A.
Message Length	uint8	The total length of the message content (unshaded fields) in bytes.
Message ID	uint8	The payload type of this message.
Payload	uint8[ ]	Variable length array of payload data. See individual message descriptions below for details.
Checksum	uint16	The checksum is determined by computing the XOR of the message content (unshaded fields). If the Message Length is odd, the final byte is assumed to be 0x00 in the checksum computation.

### 4 Supported Application Message Types

The Proximity Unit currently supports the following message types. The Message ID field in the Message Frame should be set according to **Table 2**, below. Shaded cells indicate messages sent **from** the Proximity Unit, while unshaded cells indicate messages sent **to** the Proximity Unit. See **Section 5** for details on individual messages.

**Table 2 – Supported Message IDs**

Message Name	Message ID	Message Length (in bytes, incl. Message ID)	Summary
Name	0x01	26	Associates a Device ID with a name string.
Range	0x02	18	Reports distance to a remote Proximity Unit.
Set Name	0x81	21	Sets the name string associated with the user's Proximity Unit.
Homing Control	0x82	5	Enter/Exit Homing Mode.

## 5 Application Message Details

All currently supported message types are described in detail below.

### 5.1 Name Message (0x01)

Name Messages are sent periodically, and are used to associate Device IDs with username strings. When the Proximity Unit detects a remote device, it will report the remote's ID and name (if available) in this message. A name is represented as an ASCII string, with a **maximum size of 20 characters**. The message format is described in **Table 3**, below. Note that the local device's name will also be reported periodically in a Name Message – in this case, the Device ID will match that of the local device (i.e. the device connected via Bluetooth), and the Local Name Flag will be set to 1.

**Table 3 – Name Message Payload Format**

Field Name	Data Type	Details
Local Name Flag	uint8	Set to 1 if this Device ID / Name pair corresponds to the user's device, or 0 if it corresponds to a remote device.
Device ID	uint32	ID number of the local/remote device.
Name	uint8[20]	Character array containing the name of the local/remote device. Length can be up to 20 characters.

### 5.2 Range Message (0x02)

Range Messages are sent whenever the Proximity Unit receives a range from a remote device. These messages include the ID of the remote device, as well as a distance estimate in 2D and in elevation. Fields are described in **Table 4**.

**Table 4 – Range Message Payload Format**

Field Name	Data Type	Details
Device ID	uint32	ID number of the remote device.
Still Time	uint8	Time since the remote device moved (according to the accelerometer) in seconds. This number will saturate at 255.
Range	float	Estimated 2D distance to remote device, in meters.
Relative Elevation	float	Estimated elevation distance to remote device, in meters. Positive numbers indicate the remote is at a higher altitude, while negative numbers indicate the remote is at a lower altitude.
Relative Elevation Error	float	Error in estimated relative elevation, in meters.

### 5.3 Set Name Message (0x81)

Set Name Messages are used to assign a name to the local device. This name will be shared with other devices over the ranging network, so it will be visible to other users in real time. A name is represented as an ASCII string, with a **maximum size of 20 characters**. Note that a total of 20 characters must always be sent. If the name is shorter, the unused characters should be set to 0x00. Message fields are described in **Table 5**.

**Table 5 – Set Name Message Payload Format**

Field Name	Data Type	Details
Name	uint8[20]	Character array containing the local device name. Name length can be up to 20 characters. A total of 20 characters must always be sent.

### 5.4 Homing Control Message (0x82)

Homing Control Messages can be used to switch the Proximity Unit into Homing Mode. In Homing Mode, the tracker will receive ranges more frequently, but only from ONE remote device. This uses considerable bandwidth on the ranging network, so Homing Mode will automatically be disabled after 10 seconds of use. To extend this time, Homing Control Messages must be sent periodically (for example, every 5 seconds).

Field Name	Data Type	Details
Device ID	uint32	ID number of the remote device to be selected for Homing Mode. Set to 0 to disable homing and return to normal operation.

## 6 Installing Firmware Updates

Connect the Proximity Unit to a Windows computer using a micro-USB to USB cable. Press the power button before the top LED stops flashing purple (within two seconds of connecting) to activate boot loader mode. The Proximity Unit will display a solid purple LED when boot loader mode is activated.

A new drive named "BOOTLOADER" will appear. Copy and paste the firmware update software (.hex file) into the BOOTLOADER folder. The top LED will blink purple as the firmware is loaded onto the Proximity Unit.

Once the firmware upgrade is complete, the Proximity Unit LED will be solid green.