

# User Manual for TeraRanger Evo People Counter (Bidirectional People Counting)



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## 1. Introduction

Small and discreet, the TeraRanger Evo People Counter measures pedestrian activity and it has numerous applications across a range of sectors including retail, hospitality and events, to name but a few.

This sensor module offers vertical and horizontal mounting options, and with a 0.05 m to 1.5 m detection range, it delivers an optimal solution for measuring people flow in corridors and allows door frame entrances integration.

Not only does the sensor register the number of people who have passed by, but importantly, also their direction of travel. This extra insight into direction of flow extends the applications beyond people counting measures, as it also allows an understanding of how people flow within and around a space.

Because the Evo People Counter is based on Time-of-Flight technology, personal privacy is protected and its technology is GDPR compliant by design.

### 1.1. About the TeraRanger Evo People Counter

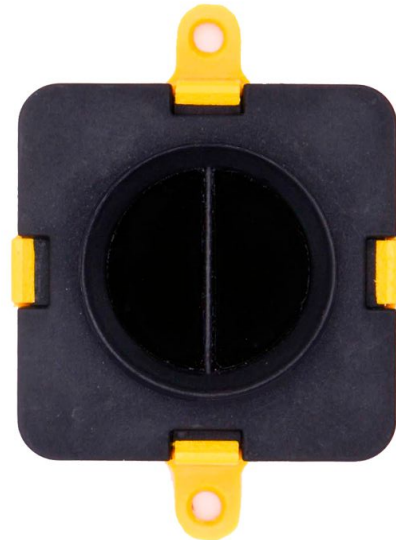


Figure 1. TeraRanger Evo People Counter sensor, top view

The Evo People Counter sensor has no open electronics and provides an ABS protected enclosure, resulting in a dust-proof and robust operation.

## 1.2. Technical Specifications

Table 1 - Technical specifications of TeraRanger Evo People Counter

Product code	TR-EVO-PPC-USB TR-EVO-PPC-UART
<b>Performance</b>	
Detection Principle	Infrared Time-of-Flight
Light Source Wavelength	940 nm
Use Environment	Indoor
Field of View	27°
<b>Electronics</b>	
Supply Voltage	5V DC +/-5%
Current Consumption Average	50 mA
Initialization Time	< 1 s
<b>Communication</b>	
Serial Interface	USB 2.0 Micro-B UART, +3.3V level, 115200,8,1, None
Visual Notification	3 x LEDs (built-in backboards)
<b>Mechanical data</b>	
Dimensions	42 x 30 x 13 mm (incl. backboard)
Weight	9 g (incl. backboard)
Operating Temperature	-20° C to 75° C
Housing Material	ABS
Mounting Style	2 holes for M2 screws

Type of Connection	USB Backboard: USB 2.0 Micro-B I2C/UART Backboard: DF13-7p connector
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### Conformity

Reference Standard	CE, RoHS
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Product code	TR-EVO-PPC-USB TR-EVO-PPC-UART
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### Performance

#### 1.2.1. Performance Table

Table 2 - Performance table of the Evo People Counter

Mode	Detection	Output
Horizontal Mounting Vertical Mounting	~ 0.05 m to 1.5 m ~ 2.0 m to 2.5 m ~25 Hz	<b>Sensor ID</b> <b>X:</b> People inside (In - Out) <b>Y:</b> People IN, <b>Z:</b> People OUT

#### 1.2.2. Communication interfaces

Table 3 - Communication interfaces for the Evo people counter

Evo People Counter	Communication Interfaces
USB	•
UART	•

## 2. Mechanical Integration

### 2.1. Modular design (clip-on, clip-off)

The mechanical design of the main sensor module (black) allows easy assembly to its backboard (yellow) using a simple 'clip-on' technique. When clipping the two together, please ensure there is no visible gap between the black and yellow parts.

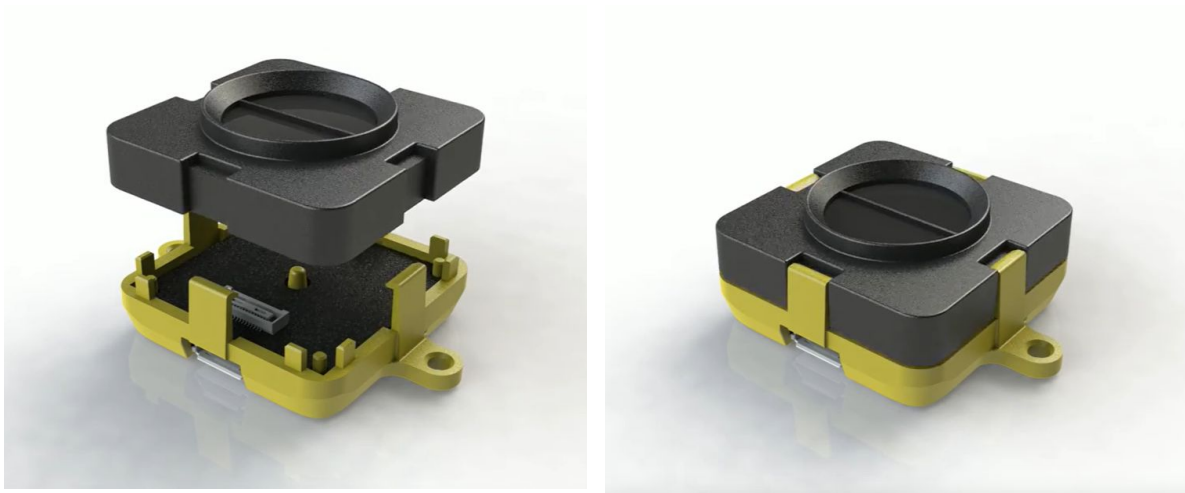


Figure 2 - Modular design of the TeraRanger Evo People Counter sensor

### 2.2. Mechanical design and mounting

The TeraRanger Evo People Counter sensor offers an ABS housing (both: sensor and backboard), with an option to mount the sensor using two holes compatible with M2 screws. Figure 3 illustrates the external dimensions of the TeraRanger Evo People Counter sensor.

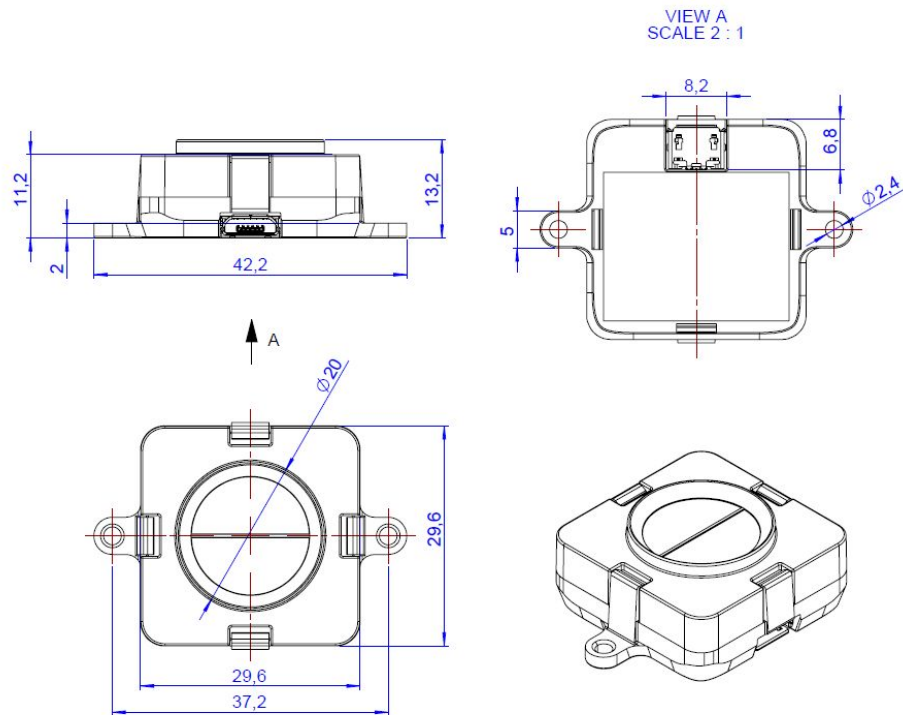


Figure 3 - TeraRanger Evo People Counter external dimensions, USB backboard

The USB Backboard includes two holes for mounting the sensor using standard M2 screws. The following methods can be used to mount the TeraRanger Evo People Counter sensor:

1. Front-panel mount using the M2 screws
2. Back-panel mount using the 2mm ledge on the front side of the sensor

Figure 4 illustrates the two different mount methods. The first solution (1) allows for easy surface attachment and rapid evaluation of the sensor. The second solution (2) provides a more discreet installation and supports design-in projects by installing the sensor behind a surface (e.g panel), ideally with 2mm thickness.



Figure 4 - Front-panel mounting (left image); back-panel mounting (right images)

## 2.3. Mounting solutions

When choosing a place for mounting the TeraRanger Evo People Counter, please consider the following recommendations:

- Mounting close to sources of heat or strong electromagnetic fields can decrease sensor performance
- Do not mount anything directly in front of the sensor or in a cone of approximately  $\pm 35^\circ$  around the central optical axis of the sensor
- It is advisable to avoid having other sources of Continuous Wave or modulated Infrared light sources near the sensor
- Please consider that dust, dirt and condensation can affect sensor performance
- It is not advised to add an additional cover in front of the sensor without any custom calibration (contact Terabee)
- For an optimal placement of the People Counting sensor, please follow this [application note](#)



*During assembly and integration, please observe all common ESD precautions. All optical surfaces (sensor front) should be kept clean and free from contact with chemicals.*



## 3. USB Backboard Use

### 3.1. LED Indication

#### 3.1.1. Normal operation

Three LED indicators are present on the USB backboard, and are visible through the back of the yellow plastic case.

Table 4 - LED indicators of the USB backboard

LED designator	Description
<b>PWR (ORANGE)</b>	The Power LED is ON whenever the sensor is powered
<b>RED</b>	Flashes briefly on startup to indicate proper initialization; then switches off
<b>GREEN</b>	Blinks 8 times at power up GREEN LED blinks every 5 seconds when the sensor is streaming data

#### 3.1.2. Error messages and troubleshooting

Table 5 - USB backboard LEDs troubleshooting

LED designator	Sequence	Signification	Corrective actions
<b>RED</b>	Continuous blinking	Sensor has detected a fault and has stopped functioning	Check that the sensor is properly connected to the backboard, then restart the sensor
<b>RED / GREEN</b>	Both LEDs blinking continuously	Sensor has detected a fault in sensor initialization process	Check USB output for details of the error  Verify that the sensor is properly connected and re-power the unit

## 3.2. Connecting the TeraRanger Evo People Counter to a Host Computer

### 3.2.1. Windows OS

In Windows it is possible to use any terminal emulation software for data display. Terabee works with and suggests using HTerm software. Please follow the provided link to download the software file (<http://www.der-hammer.info/terminal/>), and select the appropriate file for your platform.

*Tested with version 0.8.4 on Linux x64 and Windows 10 x64 platforms.*

When using Windows, extract the downloaded *zip* file to the selected folder, open it and double click on the “HTerm.exe” file.

When using Linux, extract the downloaded *tgz* file to the selected folder. Make sure that you have execution permission for the file “hterm” (command: `chmod u+x hterm`), double click on the “hterm” file or run it from terminal while in its directory: `./hterm`.



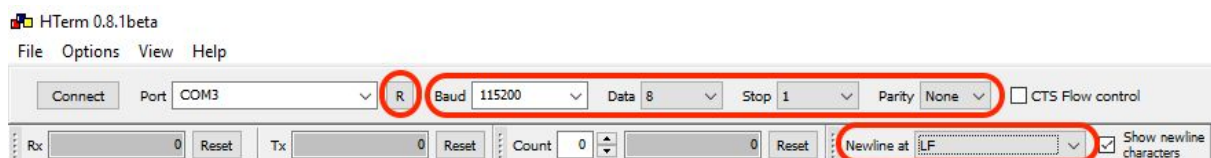
*On Linux, consider removing the modemmanager package if you are sure that it is not required by your system setup. This will shorten the initialization time of serial devices in the Linux system:*

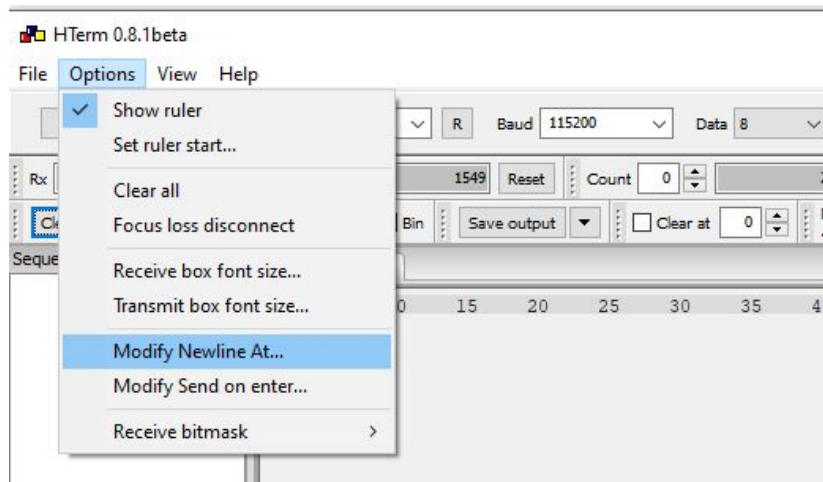
```
sudo apt purge modemmanager
```

Connect the TeraRanger Evo People Counter to a computer and select the corresponding USB port (click “R” button to refresh the port list). Please configure the software with the following parameters:

**Baud rate** : 115200 bit/s  
**Data bits** : 8  
**Stop bit** : 1  
**Parity bit** : None

For easier data reading, select the “LF” option from the “Newline at” drop-down field. See Figure 5 below for visual instructions.





Click on LF, and in the line-end marker select the header of the operating mode for easier data reading.

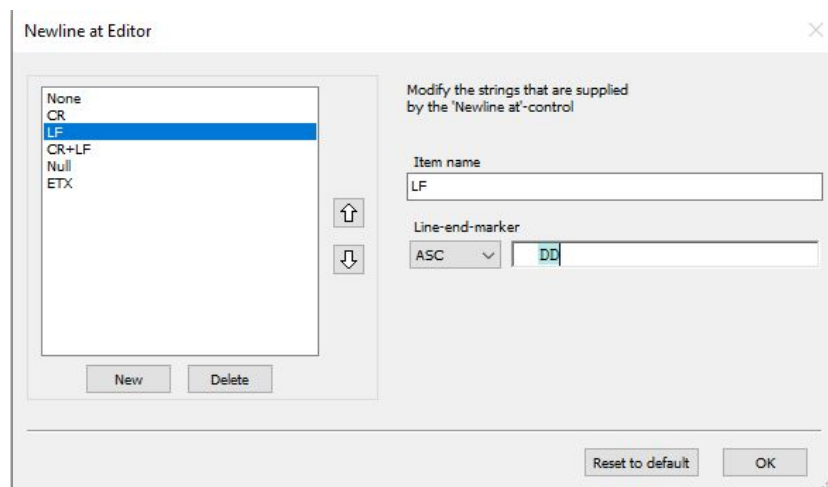


Figure 5 - HTerm parameters for TeraRanger Evo People Counter

Once the USB port is selected and the parameters correctly set, click on the **“Connect”** button.

The TeraRanger Evo People Counter data will now appear in the “Received data” box depending on the current working mode (see Figure 6).

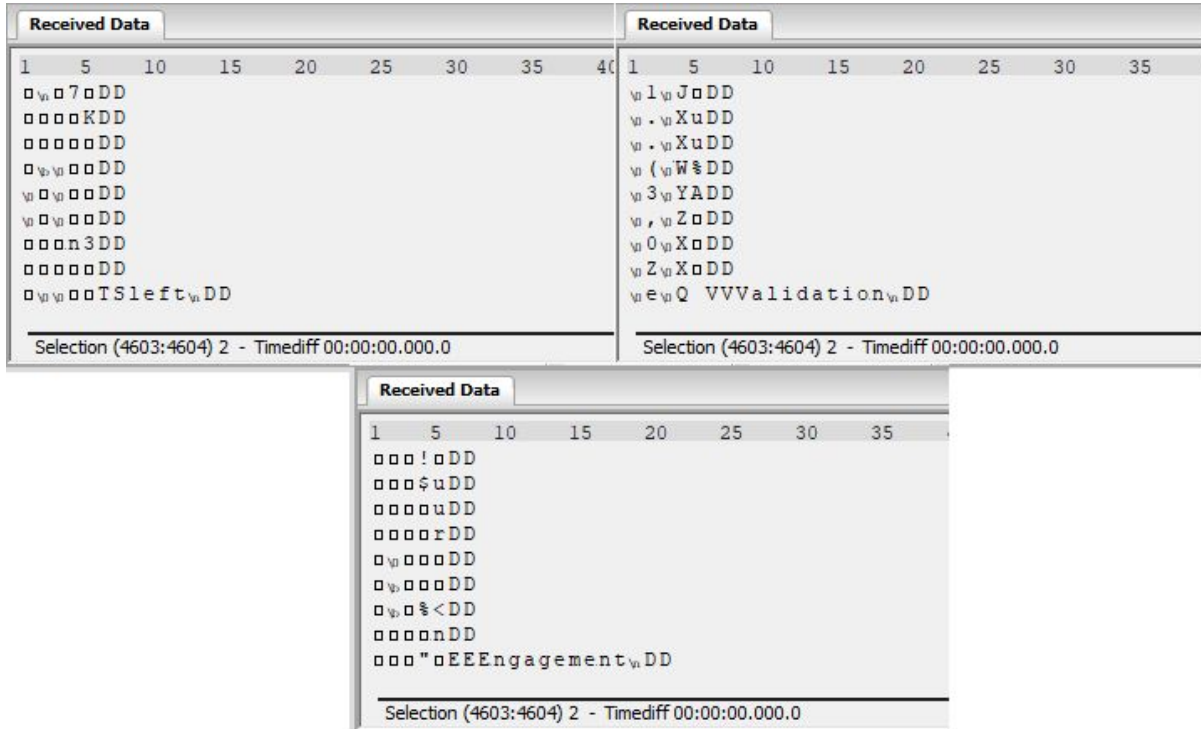


Figure 6 - Example of Data stream on HTerm software

## 4. I2C/UART Backboard Use

The TeraRanger Evo People Counter sensor can output data through a UART interface using an I2C/UART backboard.

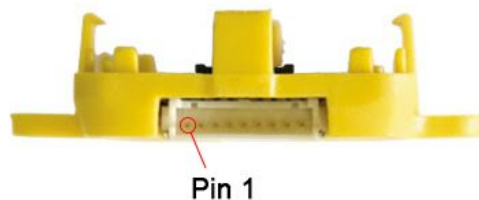


Figure 8 - I2C/UART backboard front view

### 4.1. I2C/UART pinout

The I2C/UART backboard uses a single 9 pin Hirose DF13 connector for interfacing to the host system. The mating connector is a Hirose DF13-9S-1.25C with crimping contacts

DF13-2630SCF (tin) or DF13-2630SCFA (gold). Please consider the mechanical stability of the mated connectors and avoid any kind of excess force on the connector (during installation and once integrated). Follow the recommendations in the Hirose DF13 series datasheet (available here:

<https://www.hirose.com/product/en/products/DF13>) to ensure a reliable connection.

Table 6 - Pinout and description (According to DF13 datasheet)

Pin	Designator	Description
1	Tx	UART transmit output. 3.3V logic
2	Rx	UART receive input. 3.3V logic
3	GND	Power supply and interface ground
4	SDA	I2C serial data line. 3.3V logic
5	SCL	I2C serial clock line. 3.3V logic
6	rfu	RESERVED FOR FUTURE USE
7	5V	+5V supply input
8	GND	Power supply and interface ground
9	rfu	RESERVED FOR FUTURE USE

## 4.2. LED Indicators

### 4.2.1. Normal operation

The I2C/UART Backboard has three built-in LEDs behind the yellow case to visualize feedback of the sensor status. Table 7 lists the functionality of each LED of the I2C/UART backboard.

Table 7 - LED indicators of the I2C/UART backboard

LED	Description
<b>PWR (orange)</b>	Power indicator, constantly ON when 5V is supplied
<b>Rx (red) Tx (green)</b>	I2C/UART receive and transmit indicators. Single blink for each data received or sent

#### 4.2.2. Troubleshooting

Table 8 - I2C/UART backboard LEDs troubleshooting

LED designator	Sequence	Signification	Corrective actions
<b>RED</b>	Continuous blinking	Sensor has detected a fault and has stopped functioning	Check that the sensor is properly connected to the backboard, then restart the sensor
<b>RED / GREEN</b>	Both LEDs blinking continuously	Sensor has detected a fault with the sensor initialization process	Check I2C/UART output for details of the error  Verify that the sensor is properly connected and restart

### 4.3. Electrical characteristics

Table 9 - TeraRanger Evo People Counter power consumption

Parameter	Minimum	Maximum	Average
<b>Power supply</b>			
Voltage input (V)	4.5V	5.5V	5V
Current consumption (mA)	25mA	75mA	50mA
<b>Interface logic levels</b> (referenced to +3V3)			
LOW	-	1	-
HIGH	2.3	-	-

## 5. USB/UART Normal Operation

### 5.1. Operation of the TeraRanger Evo People Counter sensor module

The TeraRanger Evo People Counter counts people passing by.

The output of the sensor is:

- A sensor ID, to allow the identification of the sensor when part of a multi-sensor installation
- A meter counting the difference between In and Out
- A meter counting the number of people passing by, from left to right (In)
- A meter counting the number of people passing by, from right to left (Out)

The sensor should be installed with the USB/UART Connector placed on the right side, as shown in figure 9.

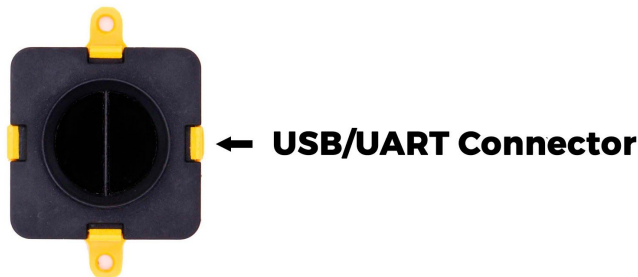


Figure 9: Sensor orientation for the Evo People Counter

The detection range of this mode can be adjusted from a minimum of 0.05 m to a maximum of 1.7 m. To detect a person passing the set detection range has to be breached.

### 5.2. Installation of Graphical User Interface Package

#### 5.2.1. Linux and Raspberry Pi

Instructions:

- Open a terminal in the `evo_people_counter` folder
- Type: `Pip install -r requirements.txt`
- Launch: `main.py` by typing: `python3 main.py`

## 5.2.2. Windows

Instructions:

- Double click on EvoPeopleCounter\_1.0 to launch executable and Install
- To launch the GUI double click on the icon "EvoPeopleCounter" on the Desktop
- To launch with terminal information, right click on the icon and choose "Open file location"
- Open a cmd terminal there and type the command: "cd .." and then  
`Python\python.exe pkgs\main.py`

## 5.3. Graphical User Interface (GUI)

The GUI allows you to:

- Set up the maximum and minimum range threshold of the people counting
- Test in near real-time the behavior of Evo People Counter sensor and report the status and counts related to its different modes

### **Important:**



Once you update the parameters through the GUI (e.g. Presence Detection Mode or thresholds with the sliders), **these parameters are automatically pushed to the TeraRanger Evo People Counter sensor**

You can read the details of the GUI on Figure 11 below.

The GUI uses the concept of classic people counting and will show the number of people that have entered a room or zone and the number of people that have left the zone or room. A simple subtraction is made to display the number of people calculated to be inside the room or zone, in real-time.

The sensor, however, has 3 outputs, including the calculated number of people inside, the number of people counted in or the number of people counted out. Whilst we use the term "In" and "Out" this could be substituted with the words left and right, signifying people passing the sensor in one direction or another. In this way you can use the sensor for classic people counting applications, but also for the simple measurement of footfall in a corridor or other defined area.



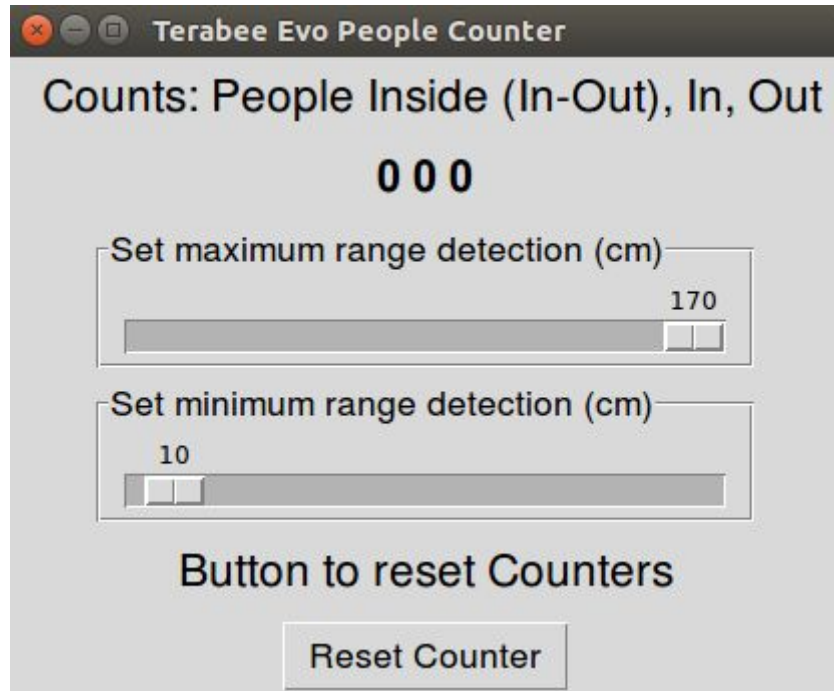


Figure 11: GUI in standard mode

### 5.3.1. *Bidirectional Traffic People Counting*

The three numbers below the title correspond to three meters:

- Meter 1 displays the difference between the 2<sup>nd</sup> and the 3<sup>rd</sup> meter (People Inside: In - Out)
- Meter 2 counts people passing by from left to right (In),
- Meter 3 counts people passing by from right to left (Out)

### 5.3.2. *Button to reset counters*

- Reset Bidirectional Counter: reset the counts to: 0 0 0

## 5.4. List of sensor commands available via USB/UART


The commands listed below can be used to push default parameters to an Evo People Counter sensor via a command line within an HTerm window, or through a Python script for example.


Table 10 - List of commands for TeraRanger Evo People Counter

Command (HEX)	CRC-8	Command description
00 55 03 MM NN SS TT	Dependent on the value of: MM,NN, SS,TT <sup>1</sup>	CHANGE BPTD THRESHOLDS SETTING: MMNN <= 1700 (millimeters) 50 <= SSTT (millimeters) (SSTT + 200) <= MMNN (millimeters)
00 55 08 00 00 00 00	7C	RESET BIDIRECTIONAL PEOPLE TRAFFIC COUNTING
00 61 01	E7	OUTPUT SETTING: BINARY OUTPUT PARAMETERS SETTINGS VALUES
00 61 02	EE	OUTPUT SETTING: TEXT OUTPUT PARAMETERS SETTINGS VALUES

<sup>1</sup> Where MM NN SS TT is max and min of BPTD thresholds in hexadecimal format. (order is very important)

Please refer to Section [Connecting the TeraRanger Evo to a Host Computer](#) for instructions on how to send commands to the TeraRanger Evo People Counter sensor using a host computer and the HTerm emulation software.

 Each command message frame must be transmitted in a continuous stream, ie. not byte by byte

 It is advised to maintain a time interval of a few microseconds between two messages for proper command registration

## 5.5. Details of the sensor output values

When streaming data using HTerm, the TeraRanger Evo People Counter sensor goes on streaming frames that contain a header of "DD" followed by two distances. Each distance is represented by two bytes and one CRC byte.

"DD"	Distance 1 (2 bytes)	Distance 2 (2 bytes)	CRC-8 (1 byte)
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Once the sensor detects and validates the Bidirectional Traffic People Counting, the sensor outputs the following frame that contains this additional information:

"PC"	Sensor_id (4 bytes)	People counter (4 bytes)	Count IN (2 bytes)	Count OUT (2 bytes)	CRC-8 (1 byte)
------	---------------------	--------------------------	--------------------	---------------------	----------------

Where: "PC": frame header.

Sensor\_ID

Counter = Counter IN - Counter OUT

Counter IN: number of people passing by from Left to Right

Counter OUT: number of people passing by from Right to Left

CRC\_8 Byte

### 5.5.1. *Reset counters*

**RESET COUNTERS : 00 55 08 00 00 00 00 7C**

This command will reset the counters for both presence detection and bidirectional people traffic detection modes.

### 5.5.2. *Parameters Command*

**PARAMETERS FRAMES (BINARY) : 00 61 01 E7**

This command provides users with all parameter values in binary form and returns the following frames:

"BP"	Maximum_Thresholds (2 bytes)	Minimum_Thresholds (2 bytes)
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## 6. General Remarks

- If the sensor is disconnected/powered down the counters are automatically reset.