

LeddarTech[®]



Leddar[™] Sight 16-Segment 2D LiDAR Sensor

USER GUIDE

TF ID 032700



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Leddar™ Configurator software: this software is based in part on the work of the Independent JPEG Group.

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Version History



Version	Description	Date (YYYY-MM-DD)
54A0058_V1.0_EN	Initial release	2021-04-28
54A0058_V1.1_EN	<ul style="list-style-type: none">Deleted all occurrences of fail-safe optionSection 2.1: updated installation screenshotsSection 6.5: updated ranges for models 36-A1 and 48-A1 in Table 38.	2021-06-11
54A0058_V1.2_EN	Changed IP67/IP69 to IP69	2021-07-02
54A0058_V1.3_EN	Section 1.1: specified tightening torque for USB access door Section 4.1: specified device ID code in Table 13	2021-09-10

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Document Conventions

This document uses the following conventions:

Name of menu > name of the window	Shows the access path to menus under each section of the Leddar™ Configurator.
Arial bold	The names of buttons, menus, dialog boxes, and the elements of the interface are in bold type .
	Note: Contains helpful suggestions and references to information included within this User Guide.
	Warning: Refers to a warning or important information to follow.

This document uses the metric system (SI).

1. Introduction

The Leddar™ Sight sensor enables developers and integrators to make the most of Leddar™ technology through integration in detection and ranging systems. The purpose of the Leddar Sight sensor is to be easily and rapidly integrated into various applications.

The Leddar Sight can be configured for elementary applications or perform more complex tasks depending on the hardware and software settings.

Its hermetic enclosure also makes it fit for any outdoor or industrial application, where water and dust ingress is likely to occur, making it the most robust 2D LiDAR sensor in LeddarTech's product portfolio.

1.1. Description

The Leddar Sight contains the following:

- Receiver assembly
- Source and control assembly

The Leddar Sight offers the following features:

- Horizontal field of view (FoV): 19°, 36°, 48°, and 99°
- 16 detection segments
- Real-time data acquisition and display (through USB)
- RS-485 port for measurement acquisition
- CAN bus for measurement acquisition
- IP69 enclosure

Interfaces available for custom application development:

- RS-485
- CAN bus
- Expansion connector (UART, CAN)

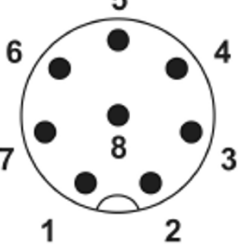


Fig. 1: Perspective back view

M12 connector


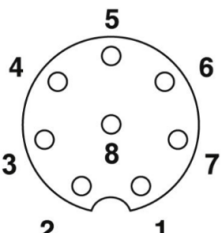
The connector used to connect the Leddar Sight is a circular M12, 8-pin connector. Table 1 below shows the pin definition.

Table 1: M12 connector pin definition and color code

Pinout	Pin #	Function	Color
	1	RS-485-	White
	2	DC_SUPPLY	Brown
	3	CAN+	Green
	4	CAN-	Yellow
	5	GND	Gray
	6	RS-485+	Pink
	7	GND	Blue
	8	GND	Red

Below is the information about the cable required to connect to the Leddar Sight (the cable must be ordered separately).

Table 2: Leddar Sight connection cable

M12 Connection Cable	Description
	M12 circular connector, 8-pos. female socket with #24 wires, 2 m, IP69, 2 A, 30 V, wire-ended
	Connection diagram (inverted compared to connector pinout in Table 1).

USB port

The USB port is a standard 2.0, 12-MBit/s port. This communication link is used by the Leddar Configurator software and provides a link for prototyping new applications (contact LeddarTech for the SDK).

The torque to be applied to the screws when tightening the USB access door is 70 oz-in (0.49 N-m). See Fig. 1.


Power connector

The power connector provides the sensor with a power source from 10 V to 30 V.

Receiver assembly

The receiver assembly contains the photodetector array (16 elements) and the controller for laser pulsing and data acquisition. Data acquisition is performed at a sampling frequency of 62.5 MHz.

The sensor assembly generates a full waveform per segment at the sensor measurement rate.

	<p><i>The sensor measurement rate varies according to the oversampling, accumulation settings and the pulse rate according to FoV configuration.</i></p> <p><i>Lens coating color for 48° configuration may change from one sample to another from greenish to bluish, but the inherent properties of the lens are not affected in the field of application of this product.</i></p>
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Source and control assembly

The receiver assembly controls the laser pulsing since the receiver data acquisition must be synchronized with the laser pulses. A temperature sensor located near the laser is used to implement temperature compensation on the ranging results.

The MCU recovers the waveforms generated by the receiver assembly, performs full-waveform analysis, and generates detection and ranging data. The data can be displayed in software after a connection has been established through the USB link.

The control assembly offers several external interfaces, but most are provided for custom application development and are not implemented in the current MCU firmware. Contact LeddarTech for future enhancements of the firmware.

The following diagram illustrates how the components of the sensor interact with one another.

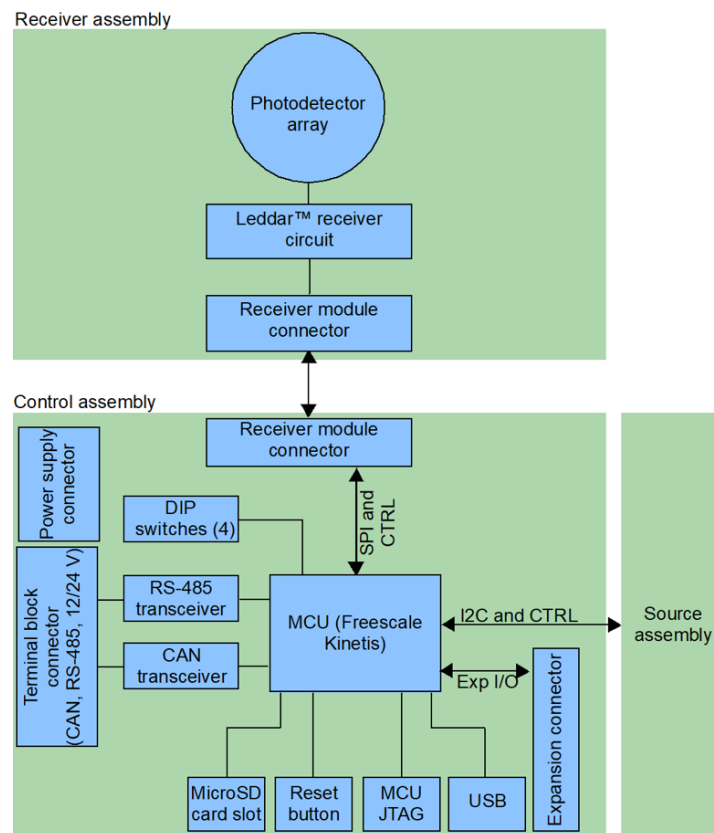


Fig. 2: Leddar Sight working diagram

The receiver assembly includes the reception optics and the photodetector circuit.

The control assembly includes the terminal block, the MCU, and the external interfaces.

The source assembly includes the laser, the laser drivers, and emission optics.

RS-485 port

The RS-485 (ANSI/TIA/IEA-485) is a two-wire, half-duplex differential serial communication port often used in electrically noisy environments.

CAN bus

The CAN bus is implemented via a differential pair. Pin 3 connects to CAN-High (CAN+) and pin 4 to CAN-Low (CAN-). The ISO 11898 standard describes the CAN technology.

1.2. Underlying Principles

Created by LeddarTech, Leddar™ (light-emitting diode detection and ranging) is a unique sensing technology based on the laser illumination (infrared spectrum) and the time-of-flight of light principle. The laser emitters illuminate the area of interest (pulsed typically at 100 kHz). The multichannel sensor receiver collects the backscatter of the emitted light and measures the time taken for the emitted light to return to the sensor.

A 16-segment photodetector array is used and provides multiple detections and ranging segments. The full-waveform analysis enables detection and distance measurement of multiple objects in each segment, provided foreground objects do not fully obscure objects behind them.

Fig. 3 illustrates the illumination area and detection segments. The 16 segments provide a profile of the object in the beam. In other installations, the 16 segments can locate and track one or multiple objects in the beam.

Table 3: Distances per segment (channel)

Segment	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Distance (m)	9.71	8.52	7.55	6.79	6.18	5.68	5.26	4.91	4.61	4.82	5.18	5.62	6.18	6.88	7.80	8.97

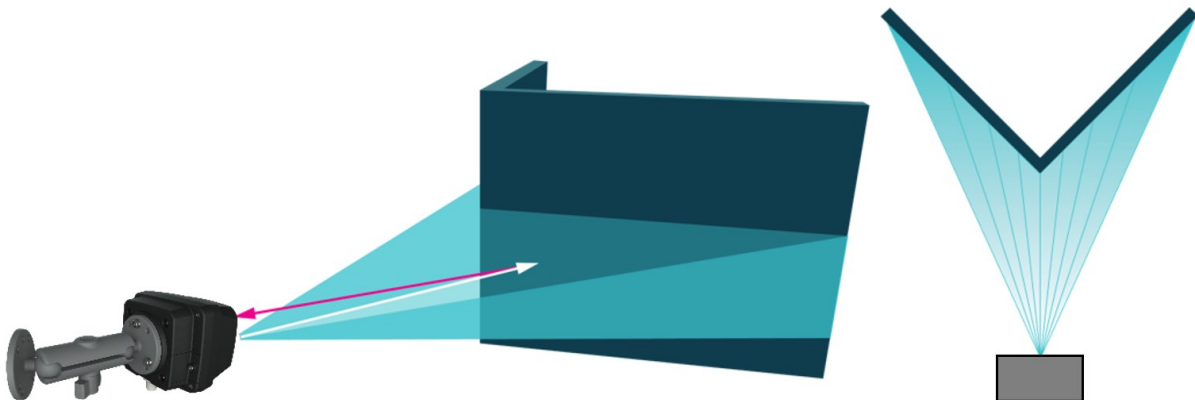


Fig. 3: Illumination area and detection zone

The core of Leddar sensing is the pulsing of diffused light, collection of reflected light, and full-waveform analysis (including oversampling and accumulation). The light source type, the number of light sources, and the illumination and reception beam can all be tailored to fit specific application requirements such as detection range, beam, and spatial resolution.

2. Getting Started

This chapter presents the steps to install Leddar™ Configurator and start using the Leddar Sight.


2.1. Setup

This section explains the Leddar™ Configurator installation and the procedure to set up the Leddar Sight. All software operations are described in section “5. Leddar Configurator.”

To install Leddar Configurator:

Download the LeddarInstaller.exe file from our website at: www.leddartech.com/resources/#product-download/.

In the **Product Download** section, select **Leddar Configurator Software** then click **LeddarInstaller.exe**. Double-click the file to start the installation.

	<p><i>For Microsoft Windows® XP, an upgrade of Microsoft components and a restart may be required. The installation will automatically resume after restarting the computer.</i></p>
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1. On the computer desktop, double-click the  **Leddar™ Configurator** icon.
2. In the **Welcome to the Leddar Configurator Setup Wizard** dialog box, click **Next**.



Fig. 4: Welcome dialog box

3. In the **End-User License Agreement** dialog box, read the terms of the agreement, select the **I accept the terms in the License Agreement** check box, and click **Next**.

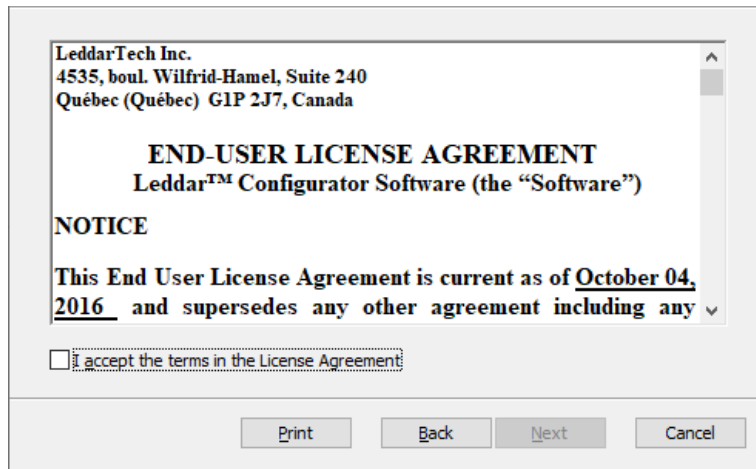



Fig. 5: End-User License Agreement dialog box

4. In the **Product Types** dialog box, the **Leddar™ Software Development Kit** check box is selected by default.

	<p><i>If you do not want to install the development kit, clear the check box.</i></p>
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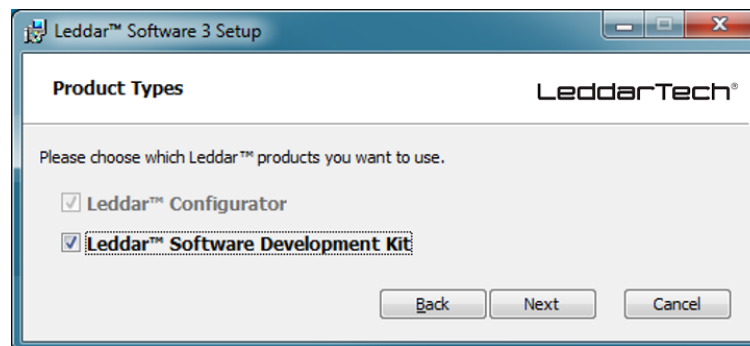


Fig. 6: Product Types dialog box

5. Click **Next**.
6. In the **Destination Folder** dialog box, click **Next** to select the default destination folder.
OR
Click the **Change** button to choose a destination folder.

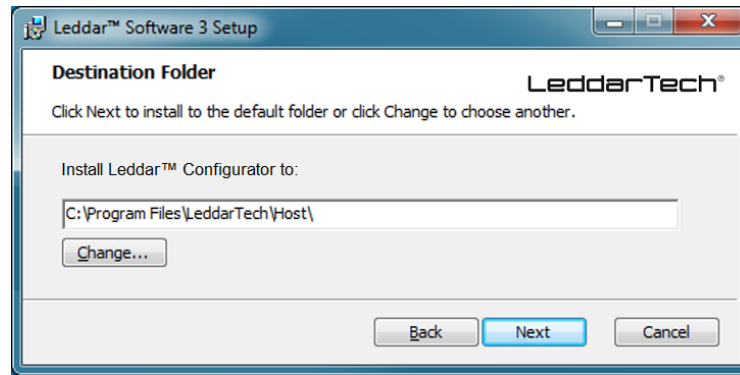


Fig. 7: Destination Folder dialog box

7. In the **Ready to Install Leddar™ Configurator** dialog box, click the **Install** button.

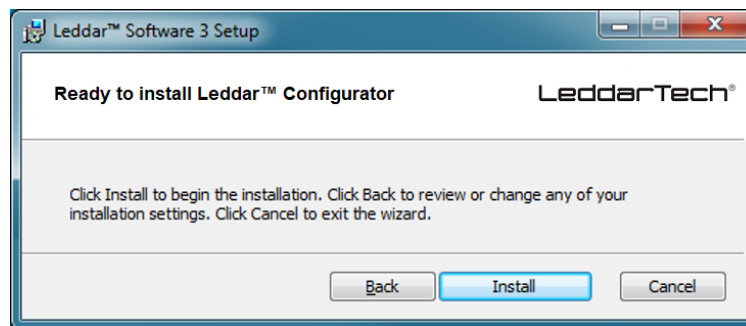


Fig. 8: Installation dialog box

8. In the **Leddar™ Configurator Setup Wizard Completed** dialog box, click **Finish**.



Fig. 9: Completing the installation


Leddar Configurator creates an icon on the computer desktop.

2.2. Connecting to the Sensor

The first time the sensor is connected to a computer, a few seconds are required for Windows™ to detect it and complete the installation.

Once the installation is completed, you can connect to the sensor.

To connect to the sensor:

1. Connect the power wire to a power outlet.
2. Connect the USB cable to the sensor and to the computer.
3. On the computer desktop, double-click the **Leddar™ Configurator** icon.
4. In Leddar™ Configurator, click the  **Connect** button.

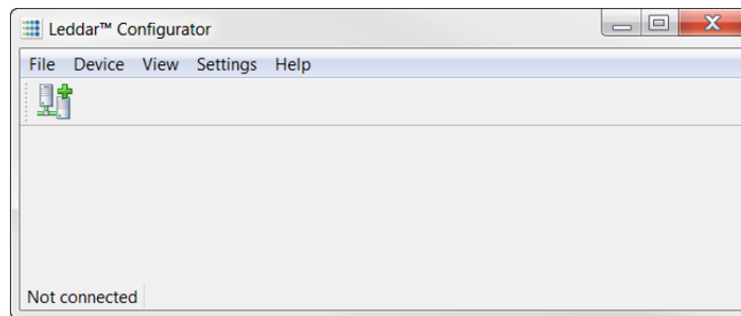


Fig. 10: Connecting to a sensor

5. In the **Select a connection type** list of the **Connection** dialog box, select the **IS16/M16/Evaluation Kit USB/Leddar Sight** option.

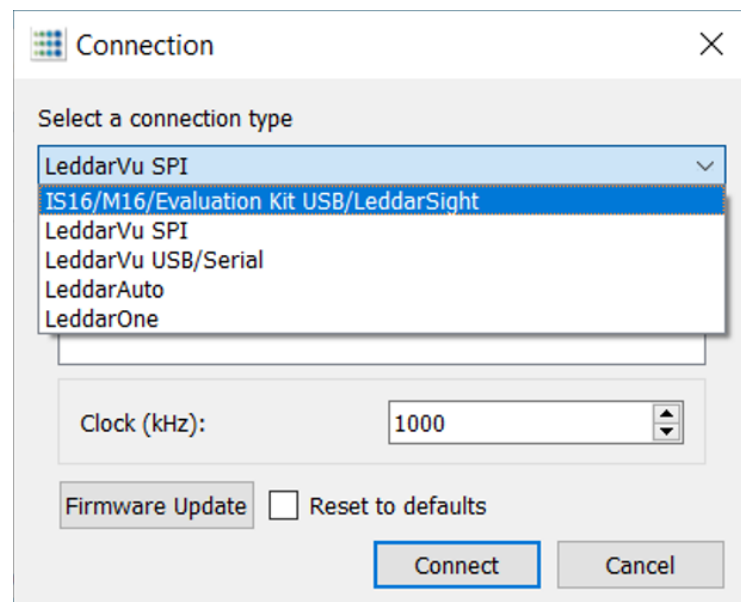



Fig. 11: Connection dialog box

6. In the product list, select the product and click the  **Connect** button.
The main window displays the detections (green lines) in the segments (white lines).

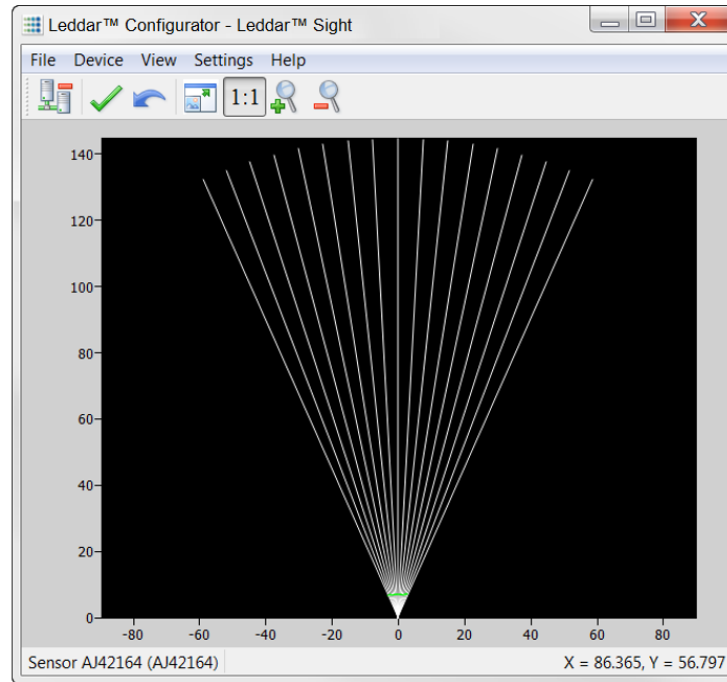


Fig. 12: Main window

A complete description of Leddar Configurator features and parameters for the Leddar Sight can be found in section “5. Leddar Configurator.”

3. Measurements and Settings

This chapter presents measurements, settings, and zone definition for the Leddar Sight.

3.1. Distance Measurement

Distance is measured from the surface of the rear side of the casing.

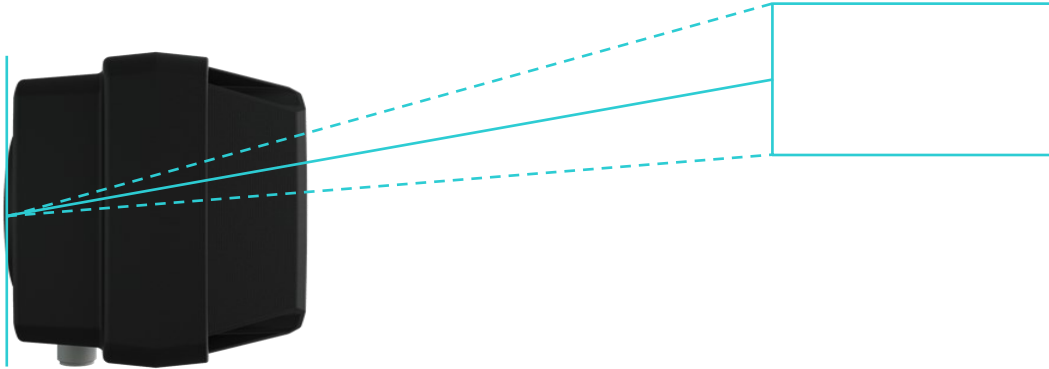


Fig. 13: Distance measurement

The dashed lines illustrate 1 of the 16 segments and the solid line indicates the distance measured by the sensor in that segment.

3.2. Data Description

Data displayed in the **Raw Detections** dialog box allow you to precisely define the desired detection parameters (**View** menu > **Raw Detections**).

Raw Detections

Min Amplitude: 0.0

Max Amplitude: 1024.0

Min Distance: 0.0

Max Distance: 100.0

☒ 1 ☒ 9
☒ 2 ☒ 10
☒ 3 ☒ 11
☒ 4 ☒ 12
☒ 5 ☒ 13
☒ 6 ☒ 14
☒ 7 ☒ 15
☒ 8 ☒ 16

☐ Freeze

Seg	Distance (ft)	Amplitude	Flags
1	7.335	536.1	9
2	7.143	539.9	9
3	7.013	530.3	9
4	6.835	546.9	9
5	6.822	544.0	9
6	6.903	535.9	9
7	6.810	536.5	9
8	6.922	535.6	9
9	6.722	544.9	9
10	6.803	545.3	9
11	6.765	550.7	9
12	6.909	537.9	9
13	6.831	543.9	9
14	7.072	533.0	9
15	7.096	528.4	9
16	7.543	536.8	9

Fig. 14: Raw Detections dialog box

An object crossing the beam of the sensor is detected and measured. It is qualified by its distance, segment position, and amplitude. The quantity of light reflected to the sensor by the object generates the amplitude. The bigger the reflection, the higher the amplitude will be.

The amplitude is expressed in counts. A count is the unit value of the used ADC in the receiver. The fractional of counts is caused by the accumulation to achieve more precision.

Table 4: Raw Detection field description

Field	Description
Segment (Seg)	Beam segment in which the object is detected
Distance	Position of the detected object
Amplitude	Quantity of light reflected by the object and measured by the sensor
Flags	8-bit status (bit field). See Table 5.

The **Flag** parameter provides the status information that indicates the measurement type.

Table 5: Flag value description

Bit Position	Bit = 0	Bit = 1
0	Invalid measurement	Valid measurement
1	Normal measurement	Measurement is the result of demerging processing.
2	Normal measurement	Interference was detected in the current frame.
3	Normal measurement	Received signal is above the saturation level. Measurements are valid (VALID is set) but have lower accuracy and precision. Consider decreasing the Laser Intensity value.
4	Reserved	Reserved
5	Reserved	Reserved
6	Normal measurement	Detection is within the crosstalk zone.
7	Reserved	Reserved

The **Flag** field provisions for 8 bits encoded as a bit field. Three bits are currently used. The following table lists the implemented decimal values of the status bit field.

Table 6: Status value description

Status Value (Decimal)	Status Value (Binary)	Description
1	00000001	Normal measurement (valid)
9	00001001	Saturated signal (valid)

3.3. Acquisition Settings

Acquisition settings allow you to define parameters to use for detection.

To open the **Acquisition Settings** dialog box, select **Device > Configuration > Acquisition**.

3.3.1. General Settings

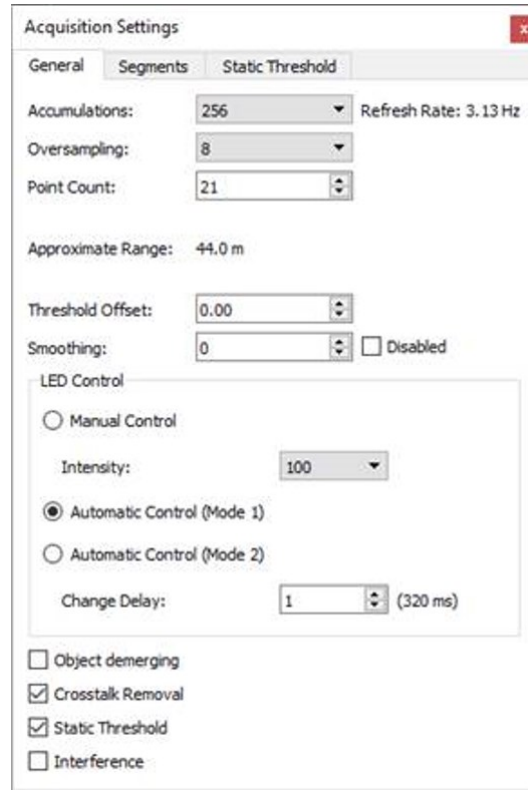


Fig. 15: General tab – Acquisition Settings dialog box


To apply new acquisition settings, click the  **Apply** button in the main window.

Table 7: Acquisition settings description

Parameter	Description	Range
Accumulations	Number of accumulations Higher values enhance range and reduce measurement rate and noise.	1
		2
		4
		8
		16
		32
		64
		128
		256
		512
		1 024

Parameter	Description	Range
Oversampling¹	Number of oversampling cycles Higher values enhance accuracy/range and reduce the measurement rate.	1 2 4 8
Point Count	Number of base sample points Allows you to set the maximum detection range.	2 to 64
Approximate Range	Set the Point Count value using the up and down arrows to view the approximate range in meters or feet.	Varies
Refresh Rate	The theoretical measurement rate indicated in Hz The real measurement rate is shown in the Device State window under View > State . Refer to section “3.4 Measurement Rate” on page 31 for more details.	Varies
Threshold Offset	Modification to the amplitude threshold Higher values decrease sensitivity and reduce range.	-5 to 100.00
Smoothing	Object smoothing algorithm Used to smooth the sensor measurements. The behavior of the smoothing algorithm can be adjusted by a value ranging from -16 to 16. Higher values enhance the sensor precision but reduce the sensor reactivity. The smoothing algorithm can be deactivated by selecting the Disabled check box or by entering -17 in the Smoothing field. The measurement smoothing algorithm is advised for applications that need to measure slowly moving objects with high precision. For applications requiring to quickly track moving objects, the smoothing should be configured with a value lower than 0 or simply deactivated.	-16 to 16 Disabled at -17
LED Control	Laser power control options Allow you to select between Manual and Automatic power control. In Automatic mode, the laser power is adjusted according to incoming detection amplitudes. The current laser power level is visible in the View > State > Device State window.	100% 90% 80% 65% 50% 35% 20% 10%
Change Delay	Minimum frame delay between power changes Smaller numbers speed up the response time of the laser power adjustment.	Varies
Object Demerging	Near-object discrimination Allows you to ease the discrimination of multiple objects in the same segment. Object demerging is only available for a minimum of 8 oversamplings and a minimum of 256 accumulations. The number of merged pulses	N/A

¹ Oversampling of 1 and 2 might lead to accuracy below specification.

Parameter	Description	Range
	that can be processed for each frame is also limited. A status field is available in the device states window (Leddar Configurator), indicating if the sensor processes all merged pulses. The measurement precision of demerged objects tends to be of lower quality than on usual detections.	
Crosstalk Removal	Inter-channel interference noise mitigation Crosstalk is a phenomenon inherent to all multiple-segment time-of-flight modules. It causes a degradation of the distance measurement accuracy of an object when one or more objects with significantly higher reflectivity are detected in other segments at a similar distance. This option enables an algorithm to compensate for the degradation due to crosstalk. This algorithm increases the computational load of the sensor microcontroller. It is recommended to disable the Crosstalk Removal option if the sensor is configured to run at a rate higher than 50 Hz.	Enabled Disabled
Static Threshold	Default amplitude value (based on distance) under which detections are discarded to mitigate noise. It can be deactivated to gain more sensitivity.	Enabled Disabled
Interference	When enabled, this setting allows you to compare the previous and current frames to detect false positive detections and discard them.	Enabled Disabled

Threshold Offset

The Threshold Offset is a value that allows you to modify the detection amplitude threshold.

A default detection threshold table was determined to provide robust detection and minimize false detections caused by noise in the input signal.

Fig. 16 presents the threshold table for a LED Intensity of 16. This table is effective when the Threshold Offset value is 0.

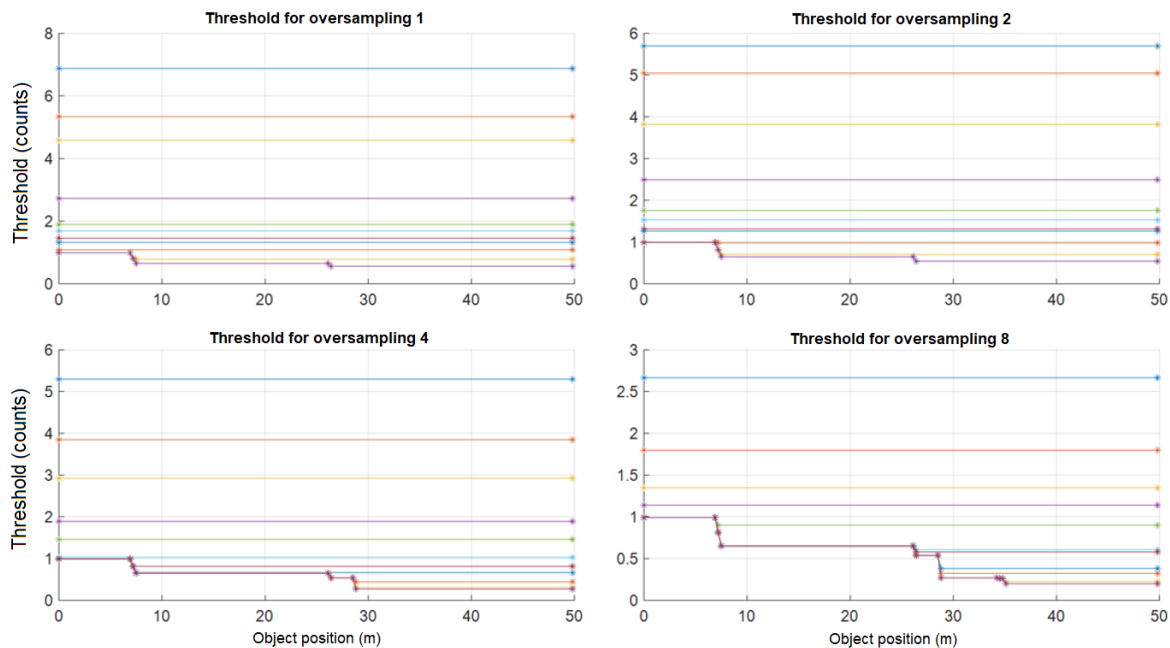
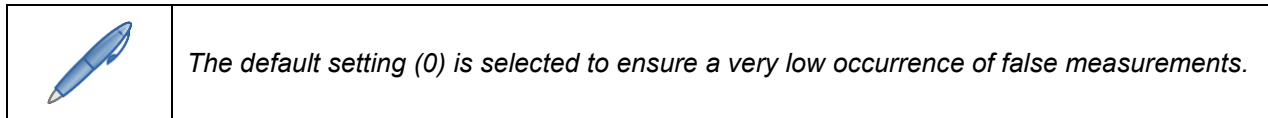


Fig. 16: Detection thresholds

The multiple lines in each graph present the thresholds for a few accumulations of 1 (top curve), 2, 4, 8, 16, 32, 64, 128, and 256 (bottom curve). Accumulations of 512 and 1024 are also available, although not shown (provide the lowest thresholds).

The **Threshold Offset** parameter has the effect of offsetting each value in the threshold table by the selected value. This provides a means of reducing (positive value) or increasing (negative value) the sensor's sensitivity. Increasing the Threshold Offset value allows ignoring (will not result in a measurement) signals with an amplitude higher than the default threshold. Decreasing the value of the Threshold Offset allows measurements of amplitude signals lower than the default threshold.



False measurements are likely to occur when reducing the Threshold Offset (negative values). These false measurements are very random in occurrence, while true measurements are repeatable. For this reason, it may be useful in some applications to use a higher sensitivity and filter out the false measurements at the application level. For example, this can be useful in applications that require long detection ranges or detection of small or low-reflectivity targets.

Laser Intensity

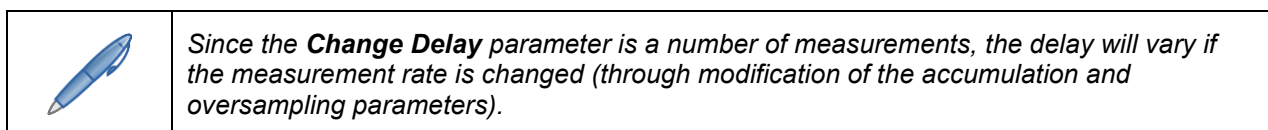
There are a total of 8 supported laser power levels. Their approximate relative power is as follows: 10%, 20%, 35%, 50%, 65%, 80%, 90%, and 100%.

There are three power control modes:

- Manual
- Automatic mode 1
- Automatic mode 2

With the Manual mode, the light power source of the sensor is set to a fixed value. This mode can be used in a controlled environment of sensor FoV.

For Automatic mode, the **Change Delay** parameter allows you to define the number of measurements required before allowing the sensor to increase or decrease the light source power level by one. For example, with the same Change Delay, the maximum rate of changes (per second) of the light source power will be twice higher at 12.5 Hz than at 6.25 Hz. The Change Delay can be set by the number of detection frames and the number of saturated segments that can be tolerated (Automatic mode 1 only).



Keeping the sensor in Automatic power mode (default setting) ensures it adapts to varying environments. Close range objects may reflect so much light that they can saturate the sensor, reducing the quality of the measurements. This mode will adapt the light output within the Change Delay setting to reach the optimal amplitude. On the other hand, low amplitudes provide lower accuracy and precision. The Automatic power mode will select a laser intensity that provides the highest intensity to avoid the saturation condition.

This automatic light source power mode will select a light source intensity that provides the highest intensity that avoids the saturation condition. Automatic mode 2 will adapt the light output within the Change Delay to reach at least one or more segments in saturation condition to provide the highest detection range. This mode is useful to keep the highest detection range into non-saturated segments when a strongly reflective object is detected.



When a strongly reflective or nearby object is present in the field of view while monitoring farther distances, the automatic adjustment will reduce the effective range of the sensor (reduced Laser Intensity value) and may prevent detection of long-range or low-reflectivity objects. For these applications, Manual mode with laser power set to 100% may be a better setting.

Smoothing

The smoothing algorithm increases the precision of the measurement at the cost of the sensor reactivity. The algorithm works by averaging consecutive measurements over a given time history. The history length of the filter is defined as a function of the measurement noise level. It also changes according to the oversampling and accumulation settings. The history length of the averaging filter can also be adjusted by a parameter ranging from -16 to 16. Select the **Disabled** check box or set the value to -17 to disable smoothing. Higher values increase the sensor precision but reduce its reactivity. An example of the behavior of the measurement smoothing algorithm is shown in Fig. 17 below.

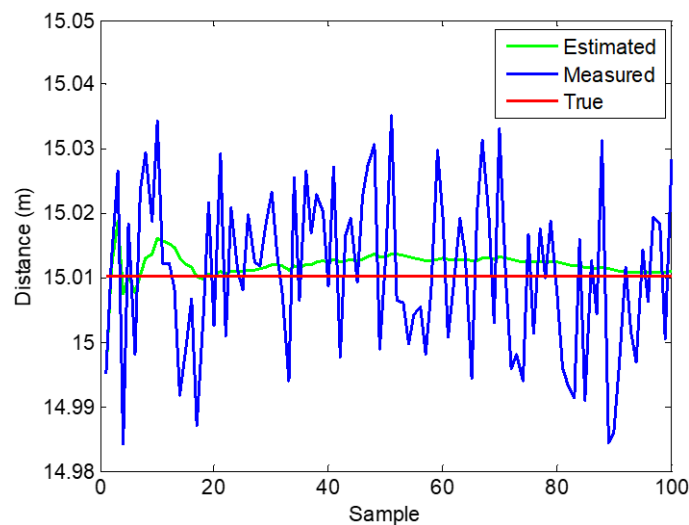


Fig. 17: Measurement smoothing example

The red line represents the true target distance, the blue curve corresponds to the target distance measured by the sensor without smoothing, while the green curve is the smoothed measurements. Noteworthy is that the smoothing algorithm dramatically improves the measurement precision (standard deviation).



*The smoothing algorithm is recommended for applications that require highly precise measurements of slowly moving objects. For applications that track quickly moving objects, it is advised to decrease the **Smoothing** parameter's value or disable the smoothing algorithm. Select the **Disabled** check box or set the value to -17 to disable smoothing.*

3.3.2. Enabling and Disabling Segments

To open the **Acquisition Settings** dialog box, select **Device > Configuration > Acquisition**.

Segments are enabled by default.

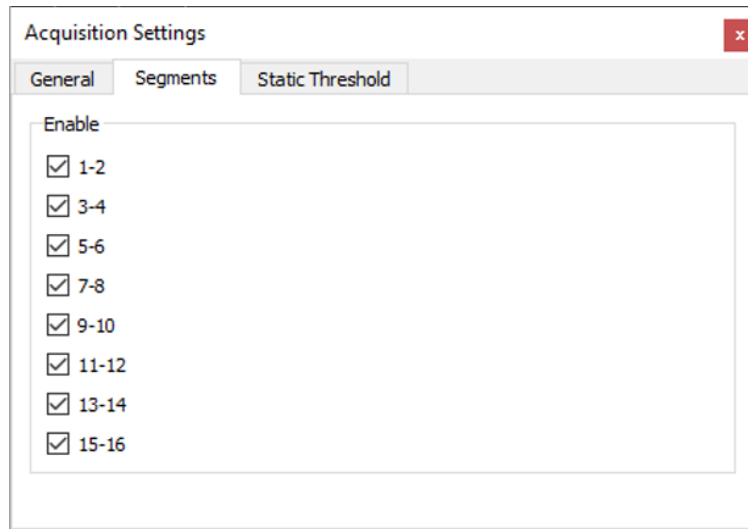


Fig. 18: Segments tab – Acquisition Settings dialog box

The corresponding segments will appear with gray square lines in the main window when you deselect segments, as shown below.

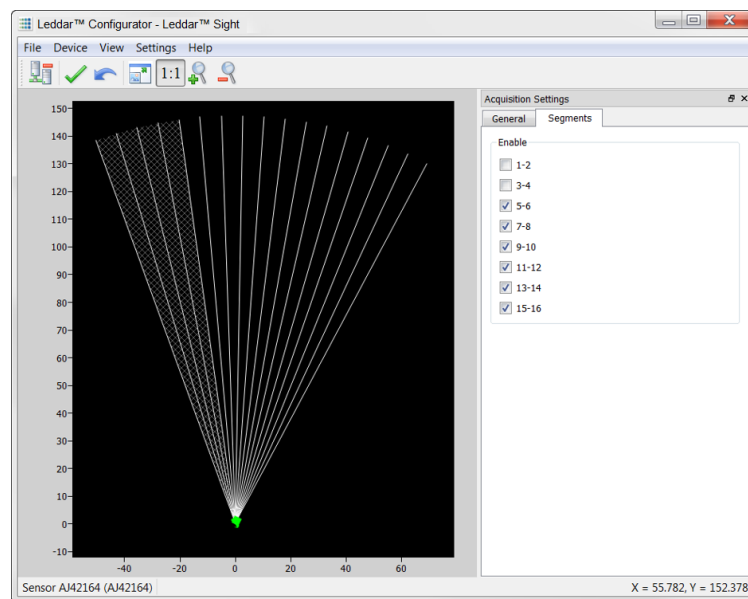



Fig. 19: Disabled segments example

To apply new acquisition settings, click the  **Apply** button in the main window.

3.3.3. Static Threshold

The **Static Threshold** tab displays the current threshold applied in accordance with the acquisition settings.

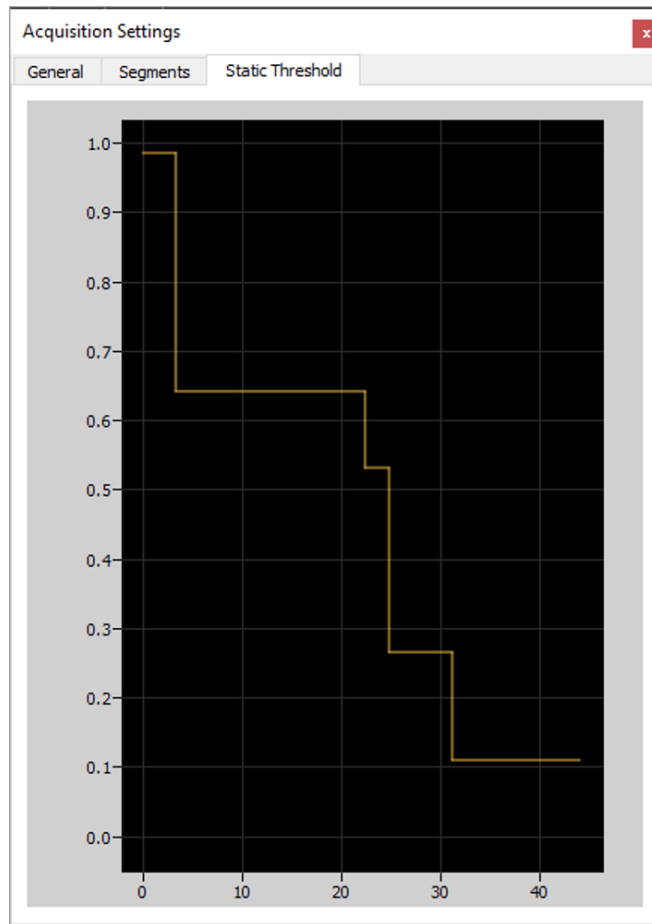


Fig. 20: Static Threshold tab – Acquisition Settings dialog box

The **Static Threshold** can be disabled in the **General Acquisition Settings** tab.

3.4. Measurement Rate

The sensor acquires an input waveform for each segment at a base rate.

Table 8: Base rate

Product FoV Configuration		Base Rate (Hz)
Horizontal	Vertical	
19°	0.3°	1 600
19°	3°	6 400
36°	0.2°	6 400
48°	0.3°	6 400
48°	3°	6 400

Product FoV Configuration		Base Rate (Hz)
Horizontal	Vertical	
48°	5.1°	6 400
48°	5.5°	6 400
99°	0.3°	6 400
99°	3°	6 400

Multiple acquisitions are used to perform accumulations and oversamplings and generate a final waveform that is then processed to detect the presence of objects and measure their position.

The theoretical measurement rate is, therefore:

$$\text{Measurement rate} = \frac{\text{Base rate}}{\text{Accumulations} * \text{oversamplings}} * \frac{8}{\text{Enabled segment pair}}$$

For example, with 256 accumulations and an oversampling value of 8, and a base rate of 6 400 Hz with all segment pairs enabled:

$$\text{Measurement rate} = \frac{6400}{256 * 8} * \frac{8}{8} = 3.125 \text{ Hz}$$

The data processing time is not taken into account in this calculation. Hence, the actual measurement will almost always be lower than the theoretical value. The actual measurement rate depends on the complexity of the scene, and the algorithms enabled.

Refer to section “3.3.2 Enabling and Disabling Segments” on page 30 for more details.

Table 9: Theoretical measurement rate

Accumulation	Oversampling	Measurement Rate (Hz)	
		Base Rate 6 400 Hz	Base Rate 1 600 Hz
1 024	8	0.78125	0.1953125
512	8	1.5625	0.390625
256	8	3.125	0.78125
128	8	6.25	1.5625
64	8	12.5	3.125
32	8	25	6.25
1 024	4	1.5625	0.390625
512	4	3.125	0.78125
256	4	6.25	1.5625
128	4	12.5	3.125
64	4	25	6.25
32	4	50	12.5
16	4	100	25

3.5. CPU Load

The measurement rate varies with the accumulations and oversampling settings. The higher the rate, the higher the processing load is on the source and control assembly microcontroller. The **Point Count** parameter also impacts the processing load since it affects the number of sample points to process for each segment.

Given the high flexibility of parameter settings, it is possible to create a processing load that exceeds the capacity of the microcontroller. When the microcontroller load is exceeded, the theoretical measurement rate will not be obtained.

The load (**CPU Load**) is displayed in the **Device State** window (**View** menu > **State**). It is recommended to verify the load when modifying the **Accumulations**, **Oversampling**, and **Point Count** parameters. The measurement rate will be lower than the calculated rate, and the measurement period may be irregular when the load nears or reaches 100%.

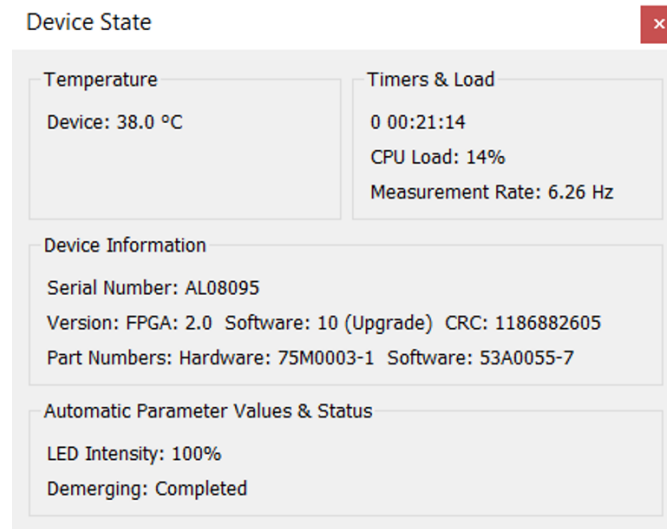


Fig. 21: Device State window

3.6. Serial Port Settings

Several serial port settings are available to adjust data acquisition through the RS-485 link. Typical serial port settings such as baud rate and start/stop bit can be configured to the desired values.

A baud rate of 115 200 bps is recommended to provide the best data transfer rate and measurement rate up to 50 Hz. The following serial port settings are configurable:

Table 10: Serial port settings description

Parameter	Value
Port Number	1
Baud Rate (bps)	9 600
	19 200
	38 400
	57 600
	115 200

	230 400 ² 460 800 ² 921 600 ²
Parity	None Odd Even
Stop Bits	1 2
Address	1 to 247
Detections³	0 to 48

The **Detection** parameter is the maximum number of detections to output in Modbus data transfers (Get Detections – function code 0x41). This information can be used to match the data transfer rate to the sensor measurement rate (the sensor will drop measurements if the measurement rate exceeds the data transfer rate).

To give an “equal chance” to each segment, the sensor parses all segments to output their nearest measurement. It then passes to the second nearest, etc., until either there are no more detections to output or the configured number of detections is reached.

The following table lists the theoretical maximum number of detections that can be transferred for different baud rates and measurement rates. This assumes the host can sustain the resulting data transfer rate.

Table 11: Maximum detections per baud rate / Measurement rate settings

Baud Rate (bps)	Measurement Rate (Hz)					
	1.5625	3.125	6.25	12.5	25	50
921 600⁴	48	48	48	48	48	48
460 800⁴	48	48	48	48	48	48
230 400⁴	48	48	48	48	48	48
115 200	48	48	48	48	48	32
57 600	48	48	48	32	32	14
38 400	48	48	48	44	20	8
19 200	48	48	44	20	8	2
9 600	48	44	20	8	2	2

² To avoid errors, it is recommended not to select these rates. Availability according to selected serial port.

³ This parameter can be limited to 40 if used with a 0x6A Modbus function.

⁴ To avoid errors, it is recommended not to select these rates. Availability according to selected serial port.

3.7. CAN Port Settings

The CAN port settings are available to adjust data acquisition through the CAN link. Typical CAN port settings such as baud rate, Tx and Rx ID, frame format, inter-message and inter-cycle delay, flag information, the maximum number of detections to output, and the message mode can be configured. The following CAN port settings are available:

Table 12: CAN port settings

Parameter	Value
Port Number	1
Baud Rate (kbps)	10 20 50 100 125 250 500 1 000
Base Tx ID	The CAN arbitration ID used for data messages from the sensor containing the detections. The arbitration ID of the messages containing the number of detections will be this value plus one (see the protocol documentation).
Base Rx ID	The CAN arbitration ID used for data messages to the evaluation kit (see the protocol documentation).
Frame Format	Standard Extended
Inter-Message Delay	0 to 65 535 milliseconds
Inter-Cycle Delay	0 to 65 535 milliseconds
Flag Information	Enabled (see Table 27 on page 49) Disabled (see Table 29 on page 50)
Detection	1 to 96
Message Mode	Single Multiple

The CAN port supports two frame format standards: the standard 11 identifier bits and the extended 29 identifier bits.

For a CAN host device that uses limited resources, it is possible to slow down the CAN data transmission by adding configurable delays from 0 to 65 535 milliseconds:

- The **Inter-Message Delay** parameter is a delay to add between two CAN messages.
- The **Inter-Cycle Delay** parameter is a delay to add between two acquisition cycle message blocks. It is primarily used to send detection in continuous mode.

The **Flag Information** parameter, when activated, gives an 8-bit field additional information of measurement.

The **Detection** parameter is the maximum number of detections to output in the CAN bus. This can be used to limit the range of message IDs used in multiple message mode. In order to give an equal chance to each segment, the sensor parses all segments to output their nearest measurement and then moves to the next

nearest, and so on until either there are no more detections to output or the configured number of detections is reached.

The **Message Mode** parameter is the type of transmission data on the CAN link. Two message modes are available. Refer to section “4.2 CAN Bus” on page 42 for more details.

4. Communication

4.1. Serial Port

The RS-485 port on the sensor uses the Modbus protocol using RTU transmission mode only. This section describes the commands that are implemented.

For more information on the Modbus protocol, visit www.modbus.org.

Report server ID (function code 0x11)

This function returns information on the sensor in the following format:


Table 13: Report server ID message

Offset	Length	Description
0	1	Number of bytes of information (excluding this one). Currently, 0x95 since the size of the information returned is fixed.
1	32	Serial number as an ASCII string
33	1	Run status 0: OFF, 0xFF: ON. Should always return 0xFF; otherwise, the sensor is defective.
34	64	The device name as a Unicode string
98	16	The software part number as an ASCII string
114	16	The hardware part number as an ASCII string
130	8	The full firmware version as 4 16-bit values
138	4	The firmware 32-bit CRC
142	2	The firmware type (LeddarTech internal use)
144	2	The FPGA version
146	4	Device option flags (LeddarTech internal use)
150	2	Device identification code (20 for Leddar Sight sensor)

Get detections (function code 0x41)

This function returns the detections/measurements in the following format:

The first byte is the number of detections in the message. Because of the limitation on a Modbus message length, a maximum of 48 detections will be returned. This is not a problem as you are very unlikely to have more than 48 detections in a real-world application.

	<i>This maximum can be configured to a lower value using the Leddar Configurator software (serial port configuration) or the Write Register command described below.</i>
---	--

Following the first byte, each detection has five bytes:

Table 14: Get detection message (detection fields)

Offset	Length	Description
0	2	Denotes the distance in centimeters (little-endian). Distance unit is defined by holding register 14.
2	2	The amplitude times 64 (that is, amplitude = this field / 64) (little-endian)
4	1	Low 4 bits are flags describing the measurement: Bit 0: Detection is valid (will always be set). Bit 1: Detection was the result of object demerging. Bit 2: Interference was detected in the current frame. Bit 3: Detection is saturated. High 4 bits are the segment number.

Three more data fields follow the detection list:

Table 15: Get detection message (trailing fields)


Offset	Length	Description
0	4	Timestamp of the acquisition (little-endian), expressed as the number of milliseconds since the device was started.
4	1	Current laser power as a percentage of maximum
5	1	Current acquisition statuses. This is an 8-bit field with 1 bit currently defined (all others are reserved): Bit 1: Object demerging is completed if 1 when this function is activated.

For an example of a 0x41 Modbus function (user-defined), refer to Appendix A.

Get detections and flags info (function code 0x6A)

This function returns the detections/measurements in the following format:

The first byte is the number of detections in the message. Because of the limitation on a Modbus message length, a maximum of 40 detections will be returned.

	<i>This maximum can be configured to a lower value using the Leddar Configurator software (serial port configuration) or the Write Register command described below. This configuration parameter is the same as the original "Get detection" (0x41) function, but if it is over 40 detections, it will be internally overriding to a maximum of 40 detections for this "Get detection and flags info" (0x6A) function.</i>
---	---

Following the first byte, each detection has six bytes:

Table 16: Get detection message (detection fields)

Offset	Length	Description
0	2	The distance in centimeters (little-endian). Distance unit is defined by holding register 14.

Offset	Length	Description
2	2	The amplitude times 64 (that is, amplitude = this field / 64) (little-endian)
4	1	4 bits are flags describing the measurement (all others are reserved): Bit 0: Detection is valid (will always be set). Bit 1: Detection is the result of object demerging. Bit 2: Interference was detected in the current frame. Bit 3: Detection is saturated. Bit 6: Detection is within the crosstalk zone.
5	1	Segment number

Three more data fields follow the detection list:

Table 17: Get detection message (trailing fields)

Offset	Length	Description
0	4	Timestamp of the acquisition (little-endian), expressed as the number of milliseconds since the device was started.
4	1	Current laser power as a percentage of maximum
5	1	Current acquisition statuses. This is an 8-bit field: Bit 0: Reserved Bit 1: Object demerging is completed if 1 when this function is activated. Bit 2: Reserved


Read input register (function code 0x4)

Table 18 lists the registers implemented for this command.

Table 18: Read input register message

Address	Description
0	Sensor temperature in degrees Celsius. Fixed point value with an 8-bit fractional part (that is, the temperature is the register value divided by 256).
1	Detection status for polling mode: 0: Detections not ready 1: Detections ready: this register is reset to 0 on reading input registers from addresses 13 to 207 or on execution of “get detections” function (code 0x41 or 0x6A).
2	Detection zone outputs bit field (1 zone per bit) Bit 0: Object in advanced detection zone (0 = no detection in advanced detection zone, 1 = detection in advanced detection zone). Only this zone is currently available.
13	The least significant byte is the current LED power as a percentage of maximum. Most significant byte is acquisition statuses. This is an 8-bit field: Bit 0: Reserved Bit 1: Object demerging is completed if 1 when this function is activated. Bit 2: Reserved
14	Low 16 bits of timestamp (number of milliseconds since the sensor was started)
15	High 16 bits of timestamp

Address	Description
16-31	Distance in centimeters of first detection for each segment, zero if no detection in a segment. Distance unit is defined by holding register 14.
32-47	Amplitude of first detection for each segment times 64 (that is, amplitude = this register / 64), zero if no detection in a segment
48-63	Distance of second detection for each segment
64-79	Amplitude of second detection for each segment
80-95	Distance of third detection
96-111	Amplitude of third detection
112-127	Distance of fourth detection
128-143	Amplitude of fourth detection
208	The least significant byte is the current laser power as a percentage of maximum. Most significant byte is acquisition statuses. This is an 8-bit field: Bit 0: Reserved Bit 1: Object demerging is completed if 1 when this function is activated. Bit 2: Reserved
209	Low 16 bits of timestamp (number of milliseconds since the sensor was started). This register content is same as input register 14.
210	High 16 bits of timestamp. This register content is same as input register 15.
211-226	Distance in centimeters of first detection for each segment, zero if no detection in a segment. Distance unit is defined by holding register 14.
227-242	Amplitude of first detection for each segment times 64 (that is, amplitude = this register / 64), zero if no detection in a segment
243-258	Flags of first detection for each segment. Refer to Table 33.
259-274	Distance of second detection for each segment
275-290	Amplitude of second detection for each segment
291-306	Flags of second detection for each segment
307-322	Distance of third detection
323-338	Amplitude of third detection
339-354	Flags of third detection
355-370	Distance of fourth detection
371-386	Amplitude of fourth detection
387-402	Flags of fourth detection

	<i>As per the Modbus protocol, register values are returned in big-endian format.</i>
---	---

For an example of a 0x04 Modbus function (read input register), refer to Appendix B.

Read holding register (function code 0x3), write register (function code 0x6), and write multiple register (function code 0x10)

Table 19 lists the registers implemented for these commands (see section 3.3 for a more detailed description of parameters).

Table 19: Read holding register message definition


Address	Description
0	Exponent for the number of accumulations (that is, if the content of this register is n, 2 ⁿ accumulations are performed)
1	Exponent for the number of oversamplings (that is, if the content of this register is n, 2 ⁿ oversamplings are performed)
2	Number of base samples
3	Reserved
4	Detection threshold as a fixed-point value with an 8-bit fractional part (that is, threshold value is this register divided by 256). The range is limited to a maximum of 100.0 and to a variable minimum determined by the accumulation and oversampling settings (read back the register to know the actual value set).
5	Laser power as a percentage of maximum. A value above 100 is an error. Only the Laser Intensity values defined in section 3.3.1 should be used. If a value is specified that is not one of the predefined values, the closest predefined value will be used. The register can be read back to know the actual value set.
6	Bit field of acquisition options with 6 bits currently defined (all others are reserved): Bit 0: Automatic laser intensity enabled Bit 2: Object demerging enabled Bit 3: Crosstalk Removal disabled (disabled if set to 1) Bit 8: Automatic laser intensity mode: 0 = Mode 1 1 = Mode 2 Bit 9: Static detection threshold table usage disabled Bit 10: Interference algorithm enabled
7	Change delay in the number of measurements
8	Maximum number of detections (measurements) returned by functions 0x41 and 0x6A ⁵
9 and 10	Reserved
11	Smoothing: stabilizes the sensor measurements. The behavior of the smoothing algorithm can be adjusted by a value ranging from –16 to 16. Select the Disabled check box or set the value to –17 to disable smoothing.
12 and 13	Reserved
14	Distance units: mm = 1 000 cm = 100 dm = 10 m = 1
15	Communication segment activation: bit field of the selected segment to activate.
16	Reserved
17	Reserved

⁵ Can be limited to 40 if used with a 0x6A Modbus function.

Address	Description
18	Acquisition segment pair activation: bit field of selected segment pair to activate.
19 to 26	Reserved
27	Port configuration stop bits: set to 1 or 2
28	Port configuration parity: 0 = None 1 = Odd 2 = Even
29	Port configuration baud rate (bps): 0 = 9 600 1 = 19 200 2 = 38 400 3 = 57 600 4 = 115 200 5 = 230 400 ⁶ 6 = 460 800 ⁶ 7 = 921 600 ⁶
30	Port configuration Modbus module address: set from 1 to 247.

To set up the port configuration, it is recommended to do a Read Holding Register and a Write Multiple Register command for the entire range of Modbus holding register address from 27 to 30 inclusively.

The Write Register and Write Multiple Register command execution will fail if this sensor is USB connected to a host device; error code “4” will be returned.

	<i>As per the Modbus protocol, register values are returned in big-endian format.</i>
---	---

A request for a register that does not exist will return the error code “2.” Trying to set up a register to an invalid value will return error code “3.” If an error occurs while trying to execute the function, error code “4” will be returned.

4.2. CAN Bus

The CAN bus in single message mode uses the 1872 (0x750) base ID to send all detection messages. When sending detection, one 0x751 message will be sent, followed by as many 1872 (0x750) base ID messages as needed.

The CAN port in multiple message mode uses a maximum range from 1874 (0x752) ID to 1922 (0x782) of standard message or a maximum range from 1874 (0x752) ID to 1970 (0x7B2) of the message with detection flag information. When sending detection, one 0x751 message will be sent, followed by messages on ID range from 1874 (0x752) to as needed in multiple message mode.

Four message IDs are available (these IDs can be modified with the Leddar Configurator software).

⁶ To avoid errors, it is recommended not to select these rates. Availability according to selected serial port.

1856 (0x740) (Rx base ID)

This is an 8-byte message length for command request that the sensor listens to: the first byte (byte 0) describes the main function, and the rest of the message bytes are used as arguments. Undescribed bytes are reserved and must be set to 0.

Table 20: CAN bus request message

Function Request (Byte 0)	Function Request Description	Function Argument (Byte 1)
1	Legacy: send detections once	--
2	Legacy: start sending detections continuously (the sensor will send a new set of detections each time they are ready without waiting for a request).	--
3	Stop sending detections continuously.	--
4	Send detection once.	Bit field of operation mode (this overrides the CAN operation mode field in CAN port configuration 3): Bit 0: 0 = return detection in single message mode, 1 = return detection in multiple message mode Bit 1: Reserved Bit 2: Reserved Bit 3: Detection flag message activation
5	Start sending detections continuously (that is, the sensor will send a new set of detections each time they are ready without waiting for a request).	Bit field of operation mode (this overrides the CAN operation mode field in CAN port configuration 3): Bit 0: 0 = return detection in single message mode, 1 = return detection in multiple message mode Bit 1: Reserved Bit 2: Reserved Bit 3: Detection flag message activation
6	GET input data (read-only)	See Table 21.
7	GET holding data	See Table 22.
8	SET holding data	See Table 23.


	<i>The GET and SET function messages always return an answer message on the 1873 (0x751) base ID. See the section below.</i>
---	--

Table 21: CAN bus request message (GET input data)

Input Data Type (Byte 1)	Input Data Description
0	Temperature
1	Device identification and option
2	Firmware version
3	FPGA version
4 to 9	Serial number
10 to 20	Device name
21 to 23	Software part number
24 to 26	Hardware part number
27	Detection zone

Table 22: CAN bus request message (GET holding data)

Holding Data Type (Byte 1)	Holding Data Description
0	Acquisition configuration
1	Reserved
2	Detection threshold
3	Laser power percent (%)
4	Acquisition option
5	Auto-acquisition average frames
6	Smoothing
7	Distance resolution
8	Communication segment enabled
9	CAN port configuration 1
10	CAN port configuration 2
11	CAN port configuration 3
12	Test mode
13	Reserved
14	Acquisition segment pair enabled


Table 23: CAN bus request message (SET holding data)

Holding Data Type (Byte 1)	Holding Data Description	Argument	Argument Description
0	Acquisition configuration	Byte 2	Exponent for the number of accumulations (that is, if the content of this register is n, 2 ⁿ accumulations are performed)

Holding Data Type (Byte 1)	Holding Data Description	Argument	Argument Description
		Byte 3	Exponent for the number of oversamplings (that is, if the content of this register is n, 2 ⁿ oversamplings are performed)
		Byte 4	Number of base samples
1	Reserved	--	--
2	Detection threshold	Byte 4	Detection threshold as a fixed-point value with a 19-bit fractional part (that is, the threshold value is this register divided by 524 288) The range is limited to a maximum of 100.0 and to a variable minimum determined by the accumulations and oversamplings (read back the register to know the actual value).
		Byte 5	
		Byte 6	
		Byte 7	
3	Laser power percent (%)	Byte 2	Laser power as a percentage of maximum A value above 100 is an error. Only the Laser Intensity values defined in section 3.3.1 should be used. If a value is specified that is not one of the predefined values, the closest predefined value will be used. The register can be read back to know the actual value set. Note that this value is ignored if the Automatic laser intensity is enabled.
4	Acquisition option	Byte 2	Bit field of acquisition options with 4 bits currently defined (all others are reserved): Bit 0: Automatic laser intensity enabled Bit 2: Object demerging enabled Bit 3: Crosstalk Removal disabled (disabled if set to 1) Bit 8: Automatic laser intensity mode: 0 = Mode 1 1 = Mode 2 Bit 9: Static detection threshold table usage disabled Bit 10: Interference algorithm enabled
		Byte 3	
5	Auto-acquisition average frames	Byte 2	Change delay in the number of measurements
		Byte 3	
6	Smoothing	Byte 2	Smoothing: used to stabilize the sensor measurements. The behavior of the smoothing algorithm can be adjusted by a value ranging from -16 to 16. Select the Disabled check box or set the value to -17 to disable smoothing.
7	Distance units	Byte 2	Distance units: mm = 1 000

Holding Data Type (Byte 1)	Holding Data Description	Argument	Argument Description
		Byte 3	cm = 100 dm = 10 m = 1
8	Communication segment enabled	Byte 2	Bit field of the activated segment for communication
		Byte 3	
9	CAN port configuration 1	Byte 2	Baud rate (kbps): 0 = 1 000 1 = 500 2 = 250 3 = 125 4 = 100 5 = 50 6 = 20 7 = 10
		Byte 3	Frame format: 0 = Standard 11 bits 1 = Extended 29 bits
		Byte 4	Tx base ID
		Byte 5	
		Byte 6	
		Byte 7	
10	CAN port configuration 2	Byte 4	Rx base ID
		Byte 5	
		Byte 6	
		Byte 7	
11	CAN port configuration 3	Byte 2	CAN operation mode bit field: Bit 0: 0 = return detection in single message mode, 1 = return detection in multiple message mode Bit 1: Inter-message delay activation Bit 2: Inter-cycle delay activation Bit 3: Detection flag message activation
		Byte 3	Maximum number of detections (measurements) returned per CAN detection message transaction: 1 to 96
		Byte 4	Inter-message delay, 0 to 65 535 milliseconds
		Byte 5	
		Byte 6	Inter-cycle delay, 0 to 65 535 milliseconds
		Byte 7	

Holding Data Type (Byte 1)	Holding Data Description	Argument	Argument Description
12	Reserved	--	--
13	Reserved	--	--
14	Acquisition segment pair enabled	Byte 2 Byte 3	Bit field of segment pair enabled for acquisition

	<i>The SET command execution will fail if this sensor is USB connected to a host device; an error answer message will be returned.</i>
---	--

1873 (0x751) (Tx Base ID + 1)

This is an 8-byte message that indicates the number of detections that will be sent or the answer to the GET and SET command requests.

Table 24: CAN bus answer message

Answer Data (Byte 0)	Answer Data Description	Additional Answer Data (Byte 1 to Byte 7)
Equal to or less than 96	Number of detections	See Table 25.
128 + 6	Answer to GET input data request	Success: see the format in Table 26. Fail: byte 2 to byte 7 are set to 0xFF.
128 + 7	Answer to GET holding data request	Success: see the format in Table 23. Fail: byte 2 to byte 7 are set to 0xFF.
128 + 8	Answer to SET holding data request	Success: return echo of the SET command request. Fail: byte 2 to byte 7 are set to 0xFF.

Table 25: CAN bus number of detection message

Data	Data Return Description
Byte 0	Number of detections
Byte 1	Reserved
Byte 2	Current laser power as a percentage of maximum
Byte 3	Current acquisition statuses. This is an 8-bit field: Bit 0: Reserved Bit 1: Object demerging is completed if set to 1 when this function is activated. Bit 2: Reserved
Byte 4	Timestamp of the acquisition, expressed as the number of milliseconds since the module was started.
Byte 5	
Byte 6	
Byte 7	

Table 26: CAN bus answer message (GET input data)

Input Data Type (Byte 1)	Input Data Description	Argument	Argument Description
0	Temperature	Byte 4	Temperature as a fixed-point value with a 16-bit fractional part (that is, the temperature value is this register divided by 65 536)
		Byte 5	
		Byte 6	
		Byte 7	
1	Device identification and options	Byte 2	Device identification code
		Byte 3	
		Byte 4	Device option flags (LeddarTech internal use)
		Byte 5	
		Byte 6	
		Byte 7	
2	Firmware version	Byte 2	Firmware build version
		Byte 3	
		Byte 4	Firmware 32-bit CRC
		Byte 5	
		Byte 6	
		Byte 7	
3	FPGA version	Byte 2	FPGA version
		Byte 3	
		Byte 4	Firmware type (LeddarTech internal use)
		Byte 5	
		Byte 6	Run status 0: OFF, 0xFF: ON. Should always return 0xFF; otherwise, the sensor is defective.
4 to 9	Serial number	Byte 2 to byte 7	Serial number as an ASCII string (max. 32 bytes)
10 to 20	Device name	Byte 2 to byte 7	Device name as a Unicode string (max. 64 bytes)
21 to 23	Software part number	Byte 2 to byte 7	Software part number as an ASCII string (max. 16 bytes)
24 to 26	Hardware part number	Byte 2 to byte 7	Hardware part number as an ASCII string (max. 16 bytes)
27	Detection zone	Byte 2	Detection zone outputs bit field (1 zone per bit) Bit 0: object in advanced detection zone (0 = no detection in advanced detection zone, 1 = detection in advanced detection zone). Only this zone is currently available.
		Byte 3	

Input Data Type (Byte 1)	Input Data Description	Argument	Argument Description
		Byte 4	Reserved
		Byte 5	
		Byte 6	
		Byte 7	

1872 (0x750) (Tx base ID)

This is an 8-byte message containing detection use in single message mode. Two types of messages are supported: standard detection message and detection message with flag information.

The standard detection message contains two detections: if the number of detections is odd, the last message will be 0 filled in the last 4 bytes. The message is separated into two parts with the same format:

- Data bytes 0 and 1 contain the distance in units defined by “distance units” holding data.
- Data byte 2 and the 4 LSBs of byte 3 contain the amplitude as a 12-bit value. This value must be divided by 4 to obtain the amplitude (that is, 2 bits for the fractional part).

The 4 MSBs of byte 3 contain the segment number.

Table 27: Standard CAN bus detection message

Byte 7	Byte 6	Byte 5	Byte 4	Byte 3	Byte 2	Byte 1	Byte 0
Segment (n+1)	Amplitude (n+1)	Distance (n+1)		Segment (n)	Amplitude (n)	Distance (n)	

The detection message with flag information contains only one detection, and the format is as follows:

- Data bytes 0 and 1 contain the distance in units defined by “distance units” holding data.
- Data bytes 2 and 3 contain the amplitude. This value must be divided by 64 to obtain the amplitude (6 bits for the fractional part).
- Byte 4 contains the flag information, as described in Table 28 below.

Table 28: Flag information of measurement

Bit 0	Detection is valid (will always be set).
Bit 1	Detection was the result of object demerging.
Bit 2	Interference was detected in the current frame.
Bit 3	Detection is saturated.
Bit 4	Reserved
Bit 5	Reserved
Bit 6	Detection is within the crosstalk zone.
Bit 7	Reserved

Byte 5 contains the segment number.

Data bytes 6 and 7 are reserved.

Table 29: CAN bus detection message definition with flag information

Byte 7	Byte 6	Byte 5	Byte 4	Byte 3	Byte 2	Byte 1	Byte 0
--	--	Segment (n)	Flag (n)	Amplitude (n)		Distance (n)	

1874 (0x752) (Tx base ID + 2)

This is an 8-byte message for multiple message mode using the same format as 0x750 message (see above). Detections are sent on a message ID range from 1874 to $[1874 + (\text{number of detections} / 2) + (\text{number of detections modulo})]$ in standard detection message and sent on a message ID range from 1874 to $[1874 + \text{number of detections}]$ in detection message with flag information. The range of message IDs can be limited by the maximum number of detections to CAN port output.

Example: Module with 1874 base ID: 19 detections are sent.

- From 1874 to 1884, message ID in standard detection message
- From 1874 to 1882, message ID in standard detection message on a sensor setup of 16 maximum amount of detections
- From 1874 to 1893, message ID in detection message with flag information
- From 1874 to 1890, message ID in detection message with flag information on a sensor setup of 16 maximum amount of detections

For an example of a CAN bus detection request, refer to Appendix C.

5. Leddar Configurator

The Leddar™ Configurator provides configuration parameters and operation functionalities for Leddar™ products.

5.1. Introduction

The Configurator interface can be resized manually or set to full-screen view.

All dialog boxes that do not include a selection of action buttons at the bottom, such as **Connect**, **OK**, **Cancel**, etc., are dockable at the top, the bottom, or on the right side of the main window.

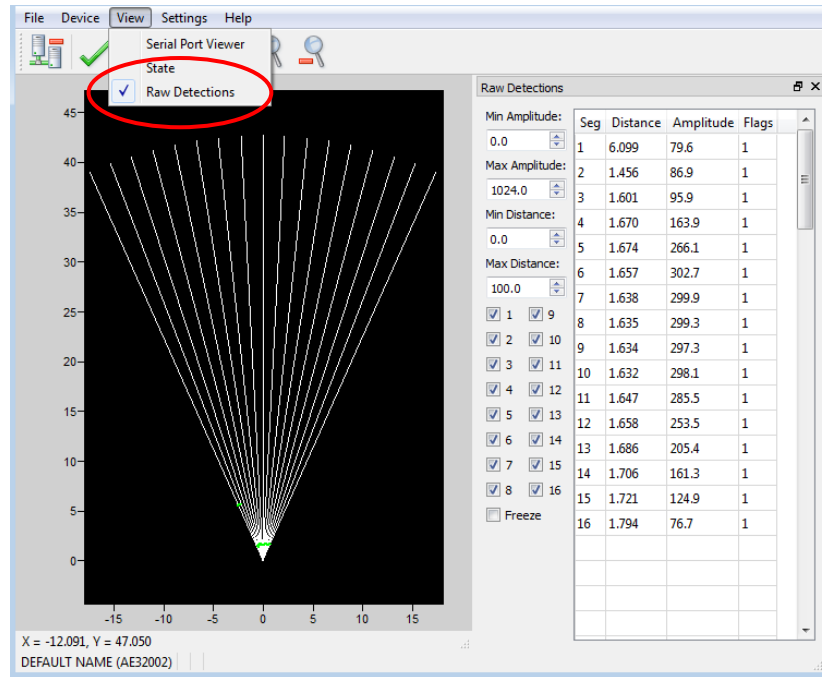


Fig. 22: Raw Detections dialog box docked on the side of the main window

When a dialog box or a window is already open, a check mark appears next to the command on the menu.

5.2. Connection Window

The following is a description of the information shown in the **Connection** dialog box.

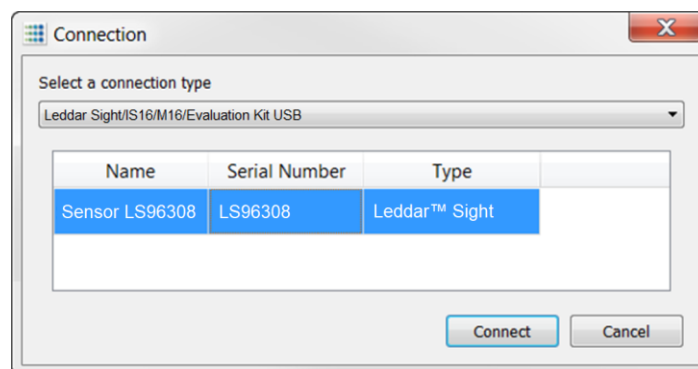


Fig. 23: Connection dialog box

Select a connection type

The connection type you are using.

The device list, in the center of the **Connection** dialog box, displays the devices currently detected.

Name

The device name can be modified (see section 5.4.1).

Serial Number

The serial number of the device as assigned by LeddarTech.

Type

The product name.

5.3. Leddar Configurator Main Window

After connecting to the device, the main window opens.

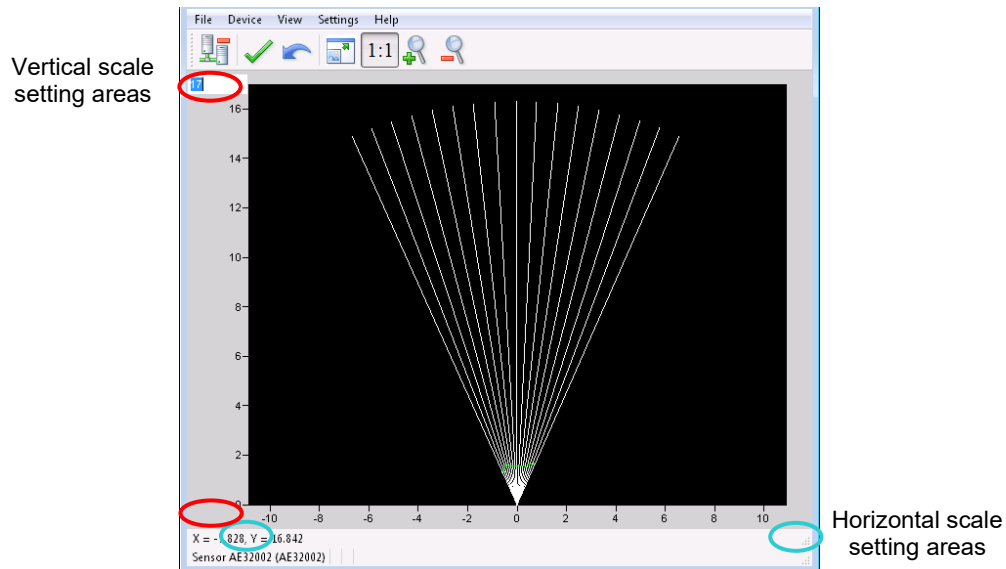


Fig. 24: Leddar Configurator main window


The measurements are plotted in a symbolic graph containing the 16 segments (white lines) originating from the sensor. Detections are drawn as arcs in their corresponding segments. Only valid measurements are displayed. A more detailed description of the measurements can be obtained in the **Raw Detections** dialog box (see section 5.11 on page 72).

The numbers X and Y displayed at the bottom are the mouse cursor position coordinates.


5.3.1. Toolbar Display Controls

The toolbar includes several buttons for adjusting the view of the main window display.


5.3.2. Fit to Window

The  **Fit to Window** button allows you to expand the display to fit the dimensions of the computer screen.


5.3.3. Force Equal Horizontal and Vertical Scales

When the  **Equal Scaling** button is selected (button highlighted), the original ratio of the display is kept or restored. The horizontal and vertical scales will be set to the same values, and the beam will be displayed in accordance with the beam properties (for example, the display will show a 48° beam for a 48° sensor).

Click the button again to change the vertical and horizontal scales independently.

	<p><i>When in equal scaling mode, you cannot zoom the display horizontally or vertically. That is, holding the <Control> or <Shift> key down while zooming in or out will have no effect. The scales cannot then be modified by entering values in the fields shown in Fig. 24 above.</i></p>
---	---

5.3.4. Zoom In

Click the  **Zoom In** button to zoom in vertically and horizontally around the center of the display.

5.3.5. Zoom Out

Click the  **Zoom Out** button to zoom out vertically and horizontally around the center of the display.

5.3.6. Scale



The window opens with the default scale setting. The horizontal and vertical scales can be changed manually by entering new values in the fields accessible by clicking the areas shown in Fig. 24 above.

To apply the changes, click anywhere in the main window.



5.3.7. Panning and Zooming

The display in the main window can be panned and zoomed in different ways. Panning and zooming is done relative to the mouse cursor position.

You can move up, down, and sideways by clicking and dragging the display.

To zoom the display in and out, use the mouse wheel alone. This has the same effect as clicking the  **Zoom In** or  **Zoom Out** button, respectively (see sections 5.3.4 and 5.3.5 above).

To zoom the display horizontally, hold the **<Control>** key of the computer keyboard down while using the mouse wheel.

	<p>The  Equal Scaling button must not be selected (not highlighted).</p>
---	--

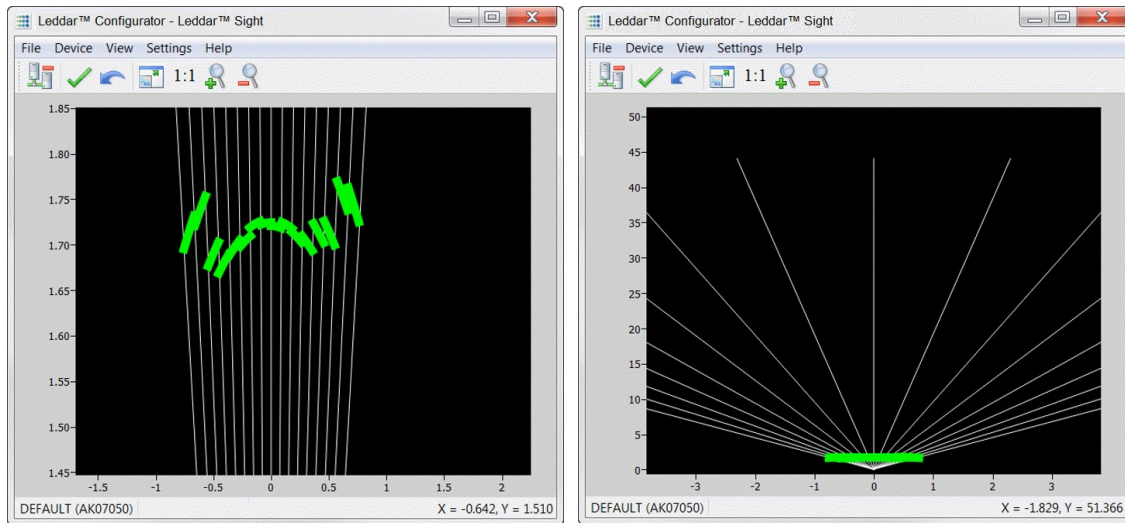



Fig. 25: Zooming in (left) and out (right) horizontally

To zoom the display vertically, hold the **<Shift>** key down while using the mouse wheel.



The **1:1 Equal Scaling** button must not be selected (not highlighted).

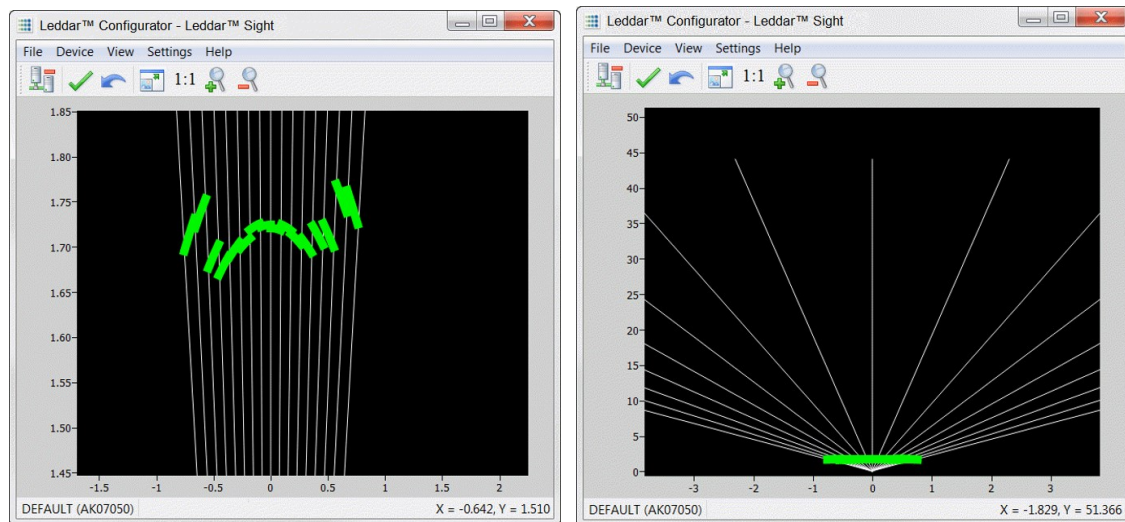


Fig. 26: Zooming in (left) and out (right) vertically

The measurements of a detection point appear as a pop-up when you point to it with the mouse cursor for a more accurate assessment of the detection. Detection points are shown in green lines (arcs) in the main window for visibility reasons.

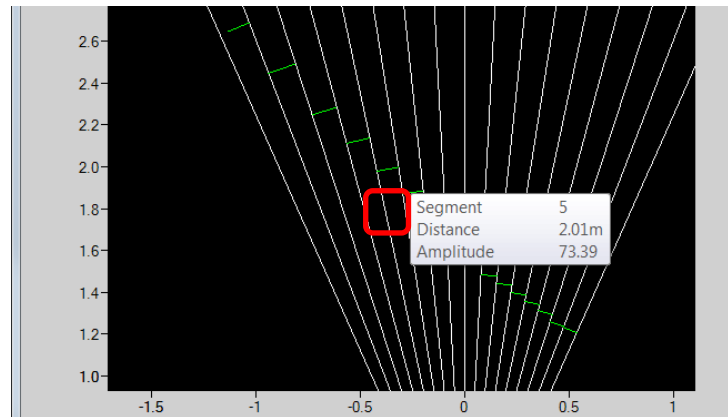


Fig. 27: Detection point coordinates

5.3.8. Changing the Sensor Origin

The sensor origin can be modified by clicking the sensor origin at the bottom of the segments.

To do so, use the mouse cursor to point to the bottom of the segments (a red dot appears), then click and drag it to the desired position.

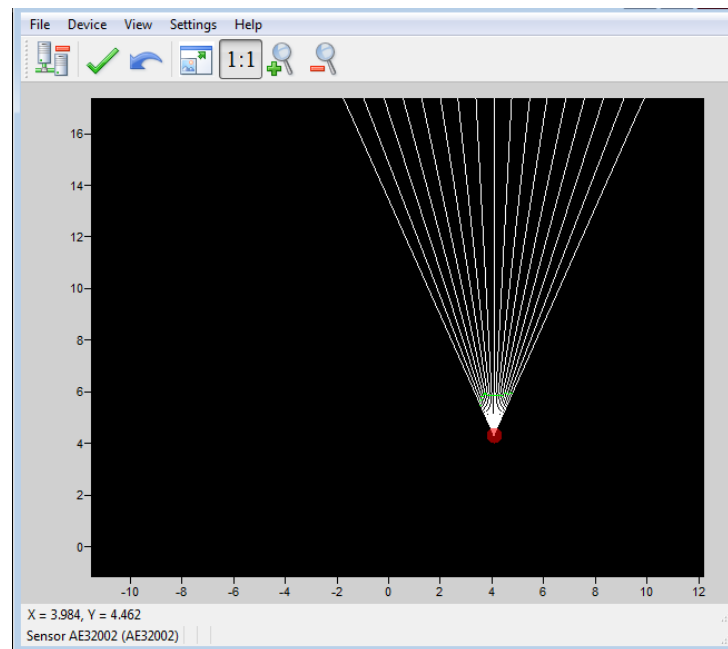


Fig. 28: Dot indicator to modify the sensor origin

If you click and drag the sensor origin, the sensor position is displayed in the status bar, as shown in Fig. 29 below.

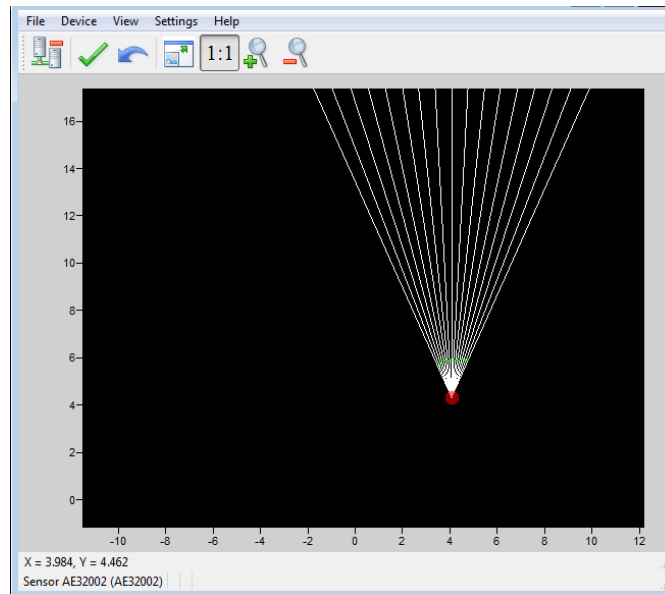


Fig. 29: Sensor position display

To apply the changes, click the  **Apply** button.

The sensor origin is saved in the sensor and can also be modified by editing the parameters in the sensor position settings window (see section “5.4.3 Module Position”).

5.3.9. Changing the Sensor Orientation

The sensor origin may be rotated to match the physical position of the sensor. If you do so, the main window display can better match the physical installation of the sensor. For example, if the sensor is installed above the ground, the sensor origin can be set to reflect its position.

Use the mouse cursor to point to the top of the segments (the top turns red), then click and drag it to the desired position.

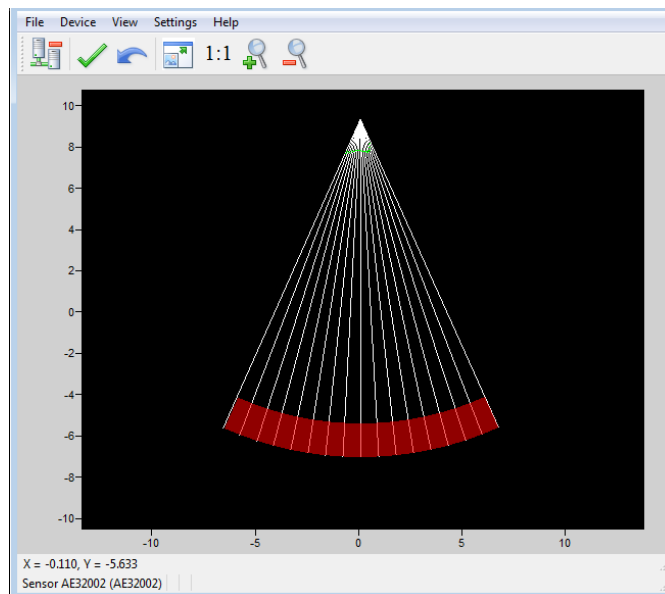


Fig. 30: Red bar to rotate the sensor position

To apply the changes, click the  **Apply** button.

The sensor orientation is saved in the sensor and can also be modified by editing the parameters in the sensor position settings window (see section “5.4.3 Module Position”).

5.4. Settings

The sensor stores several settings. Once saved in the sensor, these parameters are effective at each power-up. The Leddar Configurator software loads these parameters upon each connection.

5.4.1. Device Name

When you connect to a sensor for the first time, it has a default name. You can change that name at any time.

To change the device name:

1. Connect to a device.
2. In the **Device** menu, select **Configuration**, then click **Device Name....**

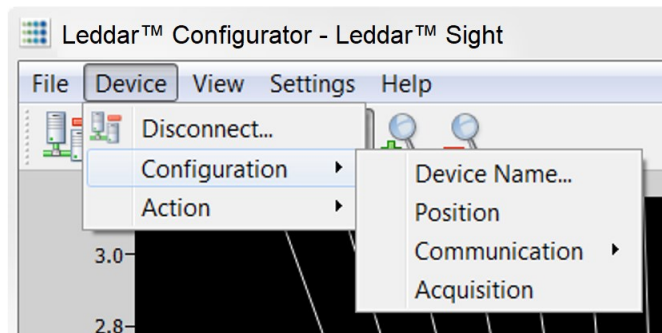


Fig. 31: Device menu – Configuration menu items

3. In the **Name** field of the **Device Name** dialog box, enter the new name of the device and click **OK**.

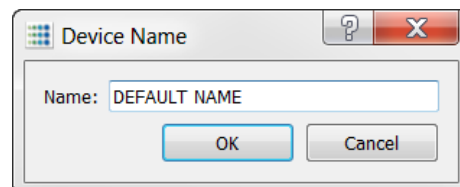



Fig. 32: Device Name dialog box

4. To apply the change, click the  **Apply** button in the Leddar Configurator main window.

5.4.2. Acquisition Settings

The Acquisition Settings function allows you to define parameters to use for detection and distance measurement.

To open the **Acquisition Settings** dialog box, select **Device**, then **Configuration**, then **Acquisition**.

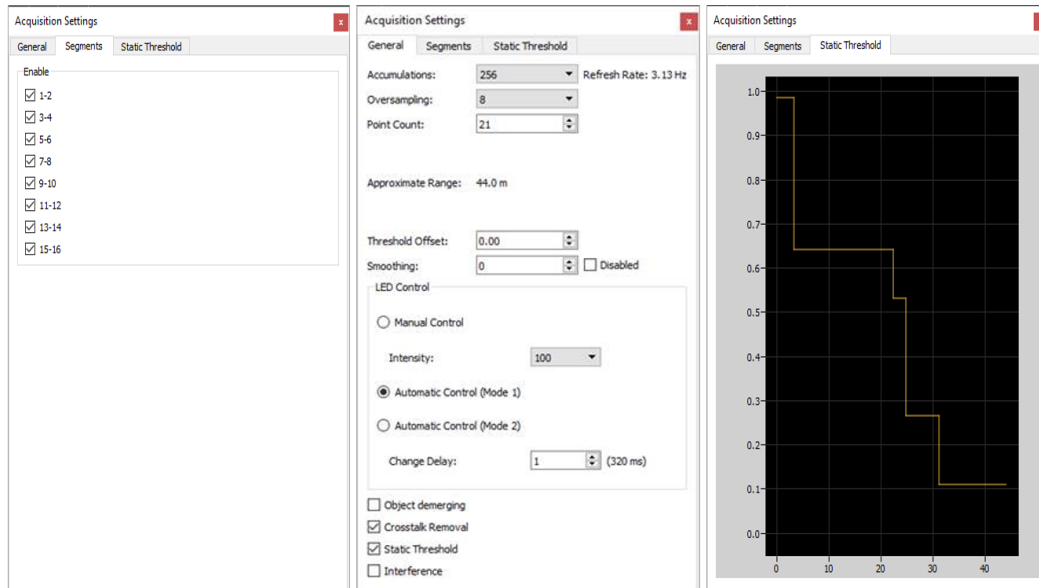


Fig. 33: Acquisition Settings dialog boxes

To apply the changes, click the  **Apply** button in the main window.

Refer to section 3.3 on page 25 for more details on all the parameters.

5.4.3. Module Position

The Module Position function allows you to define the module position with respect to the reference of the system it is used in. See sections 5.3.8 and 5.3.9 above for more details.

To open the **Module Position** dialog box, in the **Device** menu, select **Configuration**, then click **Position**.

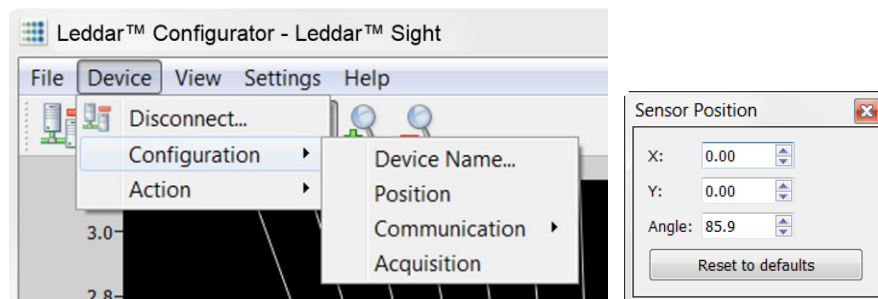


Fig. 34: Device menu – Sensor Position dialog box

Change the numbers either using the arrows or by entering the value manually.

Click the **Reset to defaults** button to re-place the segments to their original manufacturing positions.

5.4.4. Advanced Detection Zones

An Advanced Detection Zone is a configurable setting that allows you to display detections only if they are located in the specified zone.

To open the **Advanced Detection Zones** dialog box, in the **Device** menu, select **Configuration**, then click **Advanced Detection Zones....**

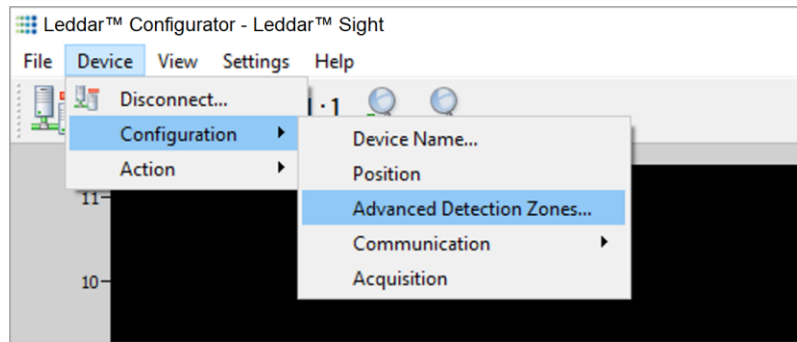


Fig. 35: Device menu – Configuration and Advanced Detection Zones menu items

In the **Advanced Detection Zones** dialog box, enter configuration lines to define the zone of interest.

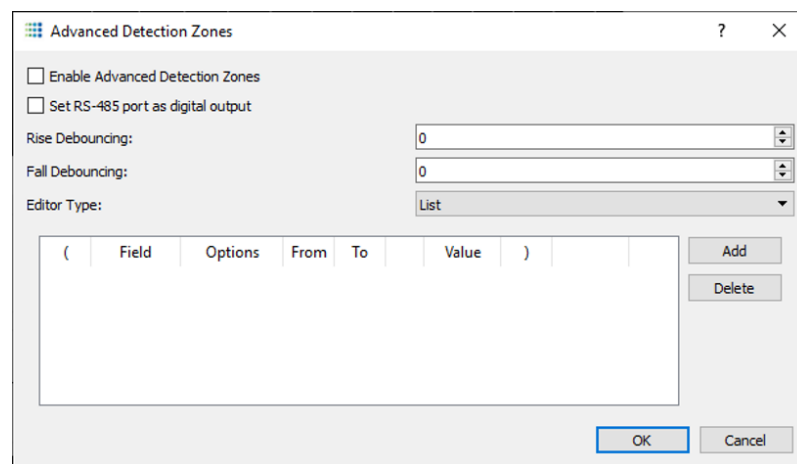


Fig. 36: Advanced Detection Zones dialog box

Rise Debouncing

Number of frames during which there is a detection in the detection zone necessary to output a bit of “presence.”

Fall Debouncing

Number of frames during which there is no detection in the detection zone necessary to output a bit of “no presence.”

5.4.5. General

The module's **General** communication settings are configurable.

To open the **General Settings** dialog box, in the **Device** menu, select **Configuration**, then **Communication**, then click **General**.

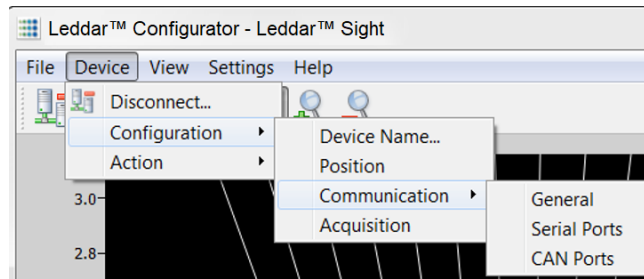


Fig. 37: Device menu – Configuration and Communication menu items

In the **General Settings** dialog box, in the **Distance Units** list, select the units with which you want to work.

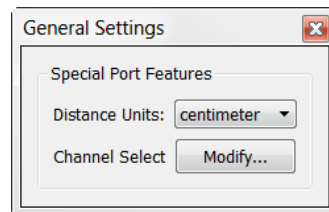


Fig. 38: General Settings dialog box

The number of channels used is set to 16 by default, but you can remove some of them to suit your application through the **LeddarHost** dialog box. Next to **Channel Select**, click **Modify** and clear the desired check boxes.

In Modbus and CAN communications, you can either enable or disable one or more channels.

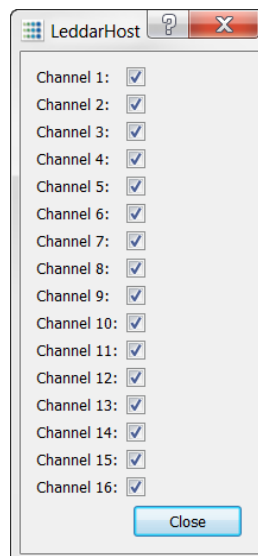


Fig. 39: LeddarHost dialog box

5.4.6. Serial Ports

The sensor's serial port settings are configurable.

To open the **Serial Ports Settings** dialog box, in the **Device** menu, select **Configuration**, then **Communication**, then click **Serial Ports**.

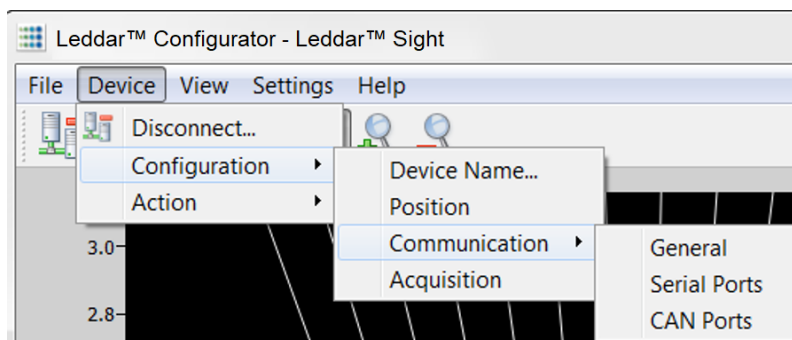


Fig. 40: Device menu – Configuration and Communication menu items

In the **Serial Port Settings** dialog box, you can change the numbers using the arrows or by entering the value manually.

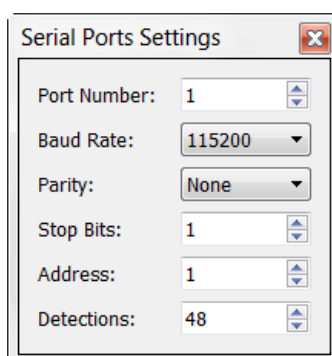


Fig. 41: Serial Ports Settings dialog box

*The **Detection** parameter can be limited to 40 if used with a 0x6A Modbus function.*

The following table describes the serial port settings.

Table 30: Serial port settings description

Parameter	Value
Port Number	Select 1 for the RS-485 port on the terminal block.
Baud Rate (bps)	9 600
	19 200
	38 400
	57 600
	115 200
	230 400 ⁷
	460 800 ⁷
	921 600 ⁷

⁷ To avoid errors, it is recommended not to select these rates. Availability according to selected serial port.

Parameter	Value
Parity	None Odd Even
Stop Bits	1 2
Address	1 to 247
Detections ⁸	0 to 48

5.4.7. CAN Ports

The sensor CAN port settings are configurable.

To open the **CAN Port Settings** dialog box, in the **Device** menu, select **Configuration**, then **Communication**, then click **CAN Ports**.

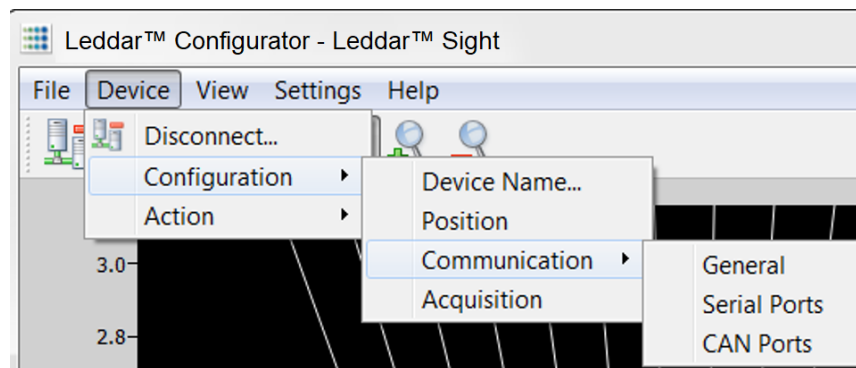


Fig. 42: Device menu – Configuration and Communication menu items

In the **CAN Port Settings** dialog box, you can change the numbers using the arrows or by entering the value manually.

⁸ This parameter can be limited to 40 if used with a 0x6A Modbus function.

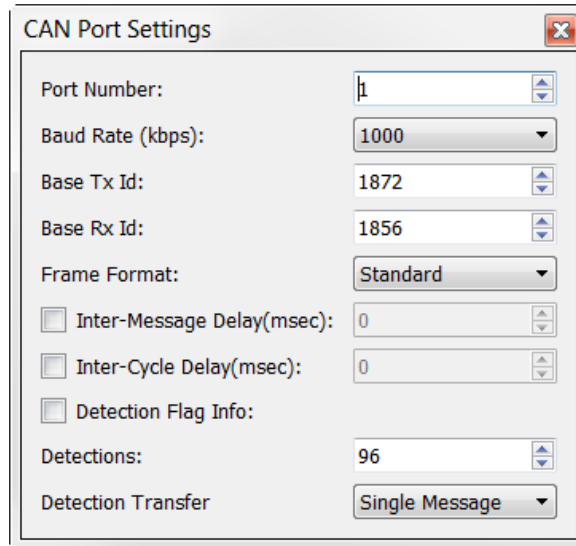


Fig. 43: CAN Port Settings dialog box

The following table describes the CAN port settings.

Table 31: CAN port settings description

Parameter	Value
Port Number	Select 1 for CAN communication.
Baud Rate (kbps)	10 20 50 100 125 250 500 1 000
Base Tx ID	The CAN arbitration ID used for data messages coming from the evaluation kit containing the detections. The arbitration ID of the messages containing the number of detections will be this value plus one (see the protocol documentation).
Base Rx ID	The CAN arbitration ID used for data messages sent to the evaluation kit (see the protocol documentation)
Frame Format	Standard Extended
Inter-Message Delay	0 to 65 535 milliseconds
Inter-Cycle Delay	0 to 65 535 milliseconds
Detection Flag Info	The information on the detection flag is displayed in the main window.
Detections	1 to 96
Detection Transfer	Single or multiple messages

5.5. Saving and Loading a Configuration

The software configuration for a device can be saved to a file. This enables you to back up settings and restore them in case of a system failure or in case you want to revert to earlier settings. You can also retrieve the configuration that was stored with a record file.

To save a configuration:

In the **File** menu, click **Save Configuration...**

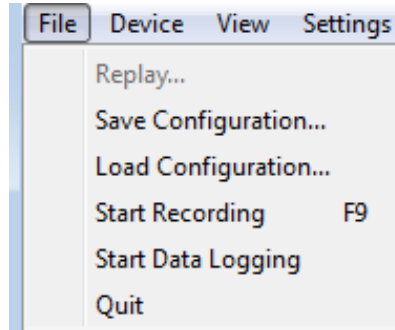


Fig. 44: File menu

To load a configuration:

In the **File** menu, click **Load Configuration...**

5.6. Configuring Detection Records

Detection records provide playback of detections recorded by a device. This visual information can be useful for verification, troubleshooting, or training purposes. Detection records allow for a full data playback stored in a *.lrl file that can later be reloaded and replayed.

To configure the detection record:

1. In Leddar Configurator, select the **Settings** menu, then click **Preferences...**



Fig. 45: Settings menu

2. In the **Preferences** dialog box, click **Recording**, then **Recorder**.

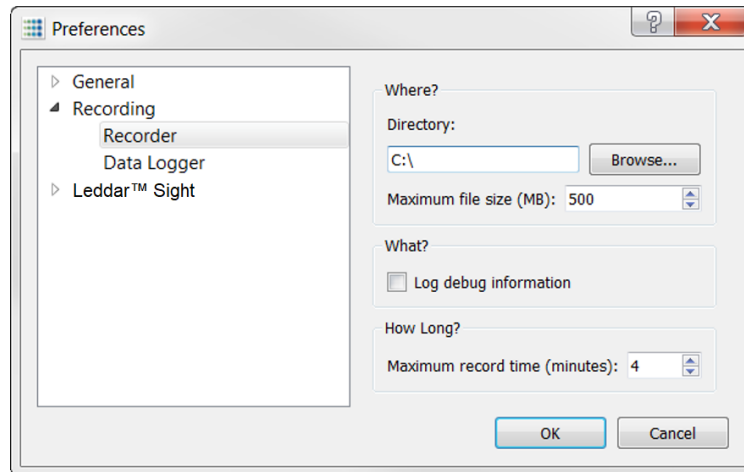


Fig. 46: Preferences dialog box

3. Under **Directory**, click the **Browse...** button to select the path to save the detection record file.
4. In the **Maximum file size (MB)** box, set the maximum file size using the arrows or by entering the value manually.
5. Under **What?** select the **Log debug information** check box.
6. Under **How Long?** next to **Maximum record time (minutes)**, set the length of time for recording using the arrows or by entering the value manually. At the end of that period, the recording will stop even if the file size has not reached its maximum.
7. Click **OK** to save the settings.

A complete description of the elements found in the recording **Preferences** dialog box follows the next two procedures.

To start a recording:

In the **File** menu, click **Start Recording**.

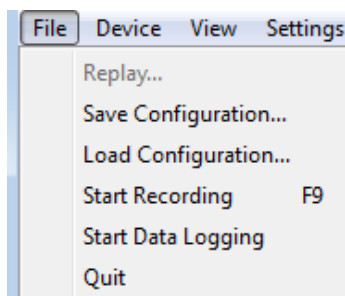


Fig. 47: File menu to start a recording

To stop a recording manually:

In the **File** menu, click **Stop Recording**.

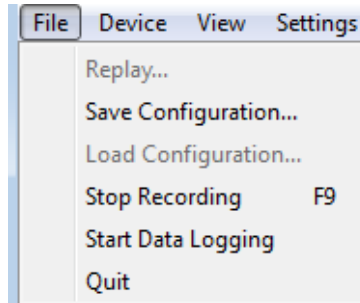


Fig. 48: File menu to stop a recording

The following is a description of the elements available in the recording **Preferences** dialog box.

Record directory

The record directory is the folder in which all record files will be saved. These files are in a proprietary format, with the extension *.lrl, and can only be opened and viewed with the Leddar Configurator software.

Maximum file size

Record files can be quite large. Set the maximum file size as needed. The recording stops for the current file once it reaches the maximum file size and automatically switches the recording to another file. This is to keep record files of manageable sizes.

Debug

These check boxes are reserved for the use of LeddarTech for debug purposes.

Maximum record time

The value entered as the **Maximum record time** defines the length of the time for recording. At the end of that period, the recording will stop even if the file size has not reached its maximum.

5.7. Using Detection Records

Once you have completed a recording, you can review it and extract part of the recording.

The **Record Replay** dialog box offers the same functions as a regular video player: a stop button, a play button, and frame-by-frame forward and backward buttons are available.

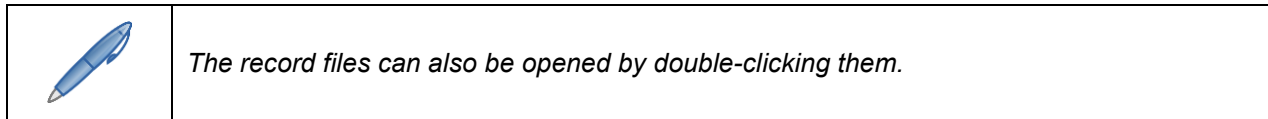
The **Position** slider lets you move directly to the desired position.

The **Playback Speed** slider lets you adjust the speed of the recording playback; faster is to the left.

The **Start**, **End**, and **Extract** buttons allow you to select a portion of the recording and extract it for further reference or analysis.

To play a record:

1. If you are connected to a device, disconnect from the device.
Another option is to open another Leddar Configurator main window.



2. In the **File** menu, click **Replay....**

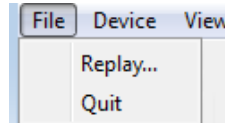


Fig. 49: File menu to open a recording

3. In the **Record Replay** dialog box, click the **Browse...** button to select a file.

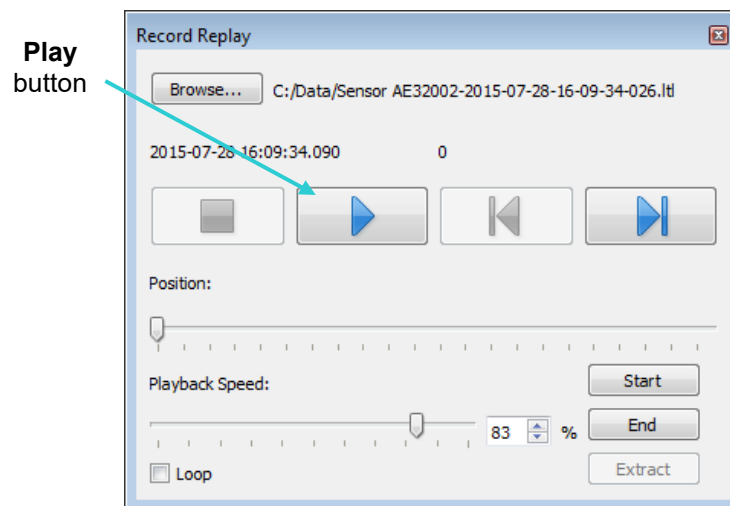


Fig. 50: Record Replay dialog box

4. Click the **Play** button to start the playback.

To extract a record file segment:

1. Set the **Position** slider to the position where you want the file segment to start and click the **Start** button.
2. Set the **Position** slider to the position where you want the file segment to stop and click the **End** button.

OR

Play the record and stop it at a position of interest, then click the **Start** button; restart playing the record, stop it again at a position of interest, and then click the **Stop** button.

3. Click the **Extract** button to extract and save that file segment.

5.8. Data Logging

The Data Logging function is used to output the data to a .txt file. This file can be imported to a software application (such as Microsoft Excel) for offline analysis.

The duration of the record is indicated in the status bar.

Each line of the generated text file contains the information related to a single detection.

Table 32: Field description of the log text file

Time (msec)	Segment [0 15]	Amplitude [0 512]	Distance (m)	Status
12 735 204	7	0.9	33.61	1

In this table:

- **Time** indicates the timestamp of the detection from when the sensor was connected to the power supply.
- **Segment** refers to the location of the detection (line, column).
- **Amplitude** of the detection indicates the strength of the returned signal.
- **Distance** indicates the distance of the detection in meters or feet depending on the distance unit configured in the **Preferences** menu.
- **Status** corresponds to a flag value. Refer to section “5.11 Raw Detections” for more details.

To use the data logging function:

1. In the **Settings** menu of Leddar Configurator, click **Preferences....**



Fig. 51: Settings menu

2. In the **Preferences** dialog box, select **Recording**, then click **Data Logger**.

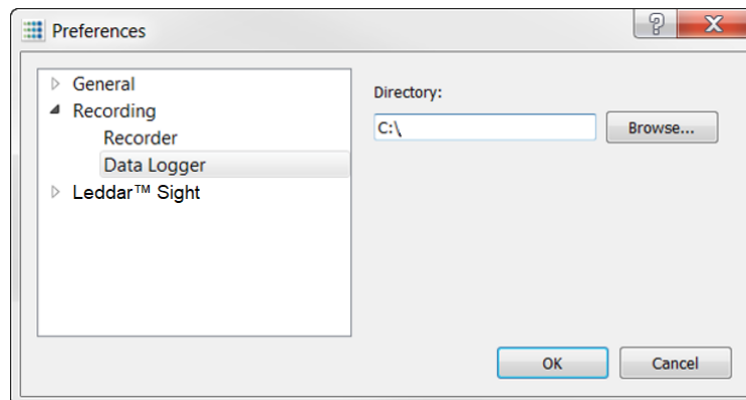


Fig. 52: Preferences dialog box for logging data

3. Under **Directory**, click the **Browse...** button to select the path where you want to save the log and click **OK**.

4. In the **File** menu, click **Start Data Logging**.

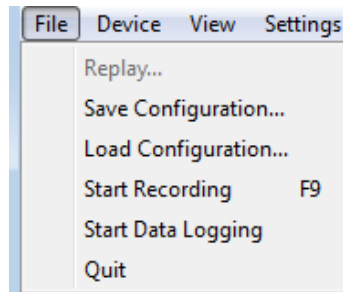


Fig. 53: File menu to start data recording

5. To stop recording, click **Stop Data Logging** in the **File** menu.

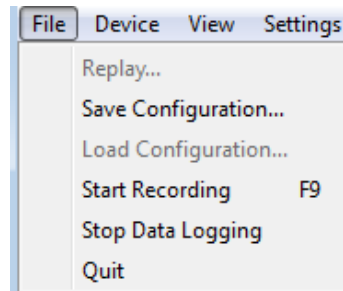


Fig. 54: File menu to stop data recording

A .txt file is saved in the selected directory.

5.9. Device State

Information about a device is accessible when connecting to a device in the **Connection** window or by clicking the **State** command in the **View** menu.

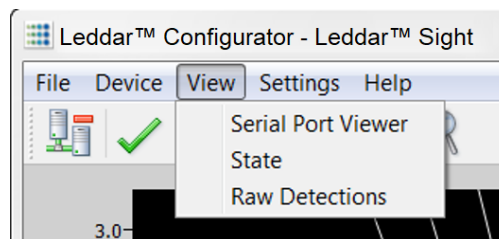


Fig. 55: View menu

The **Device State** window opens.

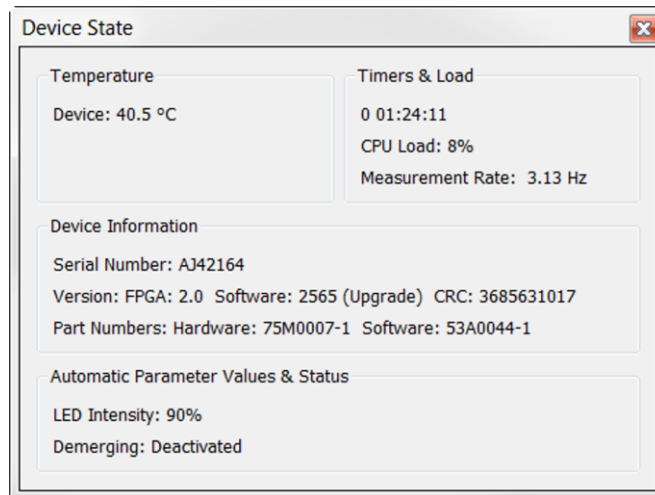


Fig. 56: Device State window

Temperature

This section indicates the temperature of the device.

Timers & Load

This feature provides information on the time elapsed since the last sensor reset in days, hours, minutes, and seconds.

The **CPU Load** indicates how much of the sensor processor capacity is in use. When the load reaches nearly 100%, the processor may no longer be able to process all the data. The effective frame rate may be impacted.

The **Measurement Rate** indicates the rate at which the sensor measures the speed and dimension of static or moving surfaces.

Device Information

The **Serial Number** is the number of the device as assigned by LeddarTech.

The **Version** includes the following:

- **FPGA:** The firmware version of the device.
- **Software:** The software version of the device.
- **CRC:** Indicates the firmware version to ensure that it is authentic.

The **Part Numbers** provide the hardware and software part numbers of a device as assigned by LeddarTech.

The **LED Intensity** (laser intensity) is the current laser power in use by the module. It automatically adapts to too strong/too weak detections when properly activated in the **Acquisition settings** dialog box.

Demerging indicates the current object demerging status when activated in the acquisition settings. It may be:

- **Partial:** When the demerge sensor did not process all pulses characteristic of merged objects.
- **Completed:** When the sensor processed all pulses characteristic of merged objects.

5.10. Preferences

Preferences are used to change various settings related to the display of Leddar Configurator.

Open the **Preferences** dialog box by clicking the **Preferences...** command in the **Settings** menu.

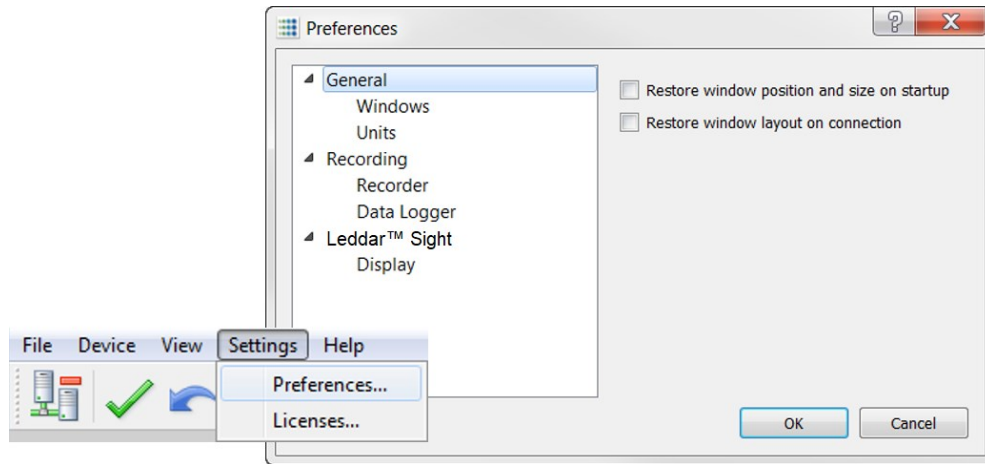


Fig. 57: Settings Menu – Preferences dialog box

Windows

The following two options allow you to select how the content of the main window will be displayed in Leddar Configurator.

- The **Restore window position and size on startup** option starts Leddar Configurator at the same place on the computer desktop and at the same size it was when it was closed.
- The **Restore window layout on connection** option connects to the evaluation kit at the same size it was and with all docked dialog boxes or windows that were displayed when it was closed.

Units

The unit that is applied to distances displayed in Leddar Configurator.

The temperature is the unit used when displaying temperatures.

Recording

The **Recorder** parameter lets you choose how data files are recorded.

The **Data Logger** parameter lets you select a directory to store logs.

Display

The **Detection Arc Thickness** parameter allows you to modify the pixel width of the displayed green detection arcs in the main window.

5.11. Raw Detections

The **Raw Detections** dialog box allows you to view detection values in many ways. It provides filters to isolate segments and detection parameters.

To open the **Raw Detections** dialog box, click **Raw Detections** in the **View** menu.

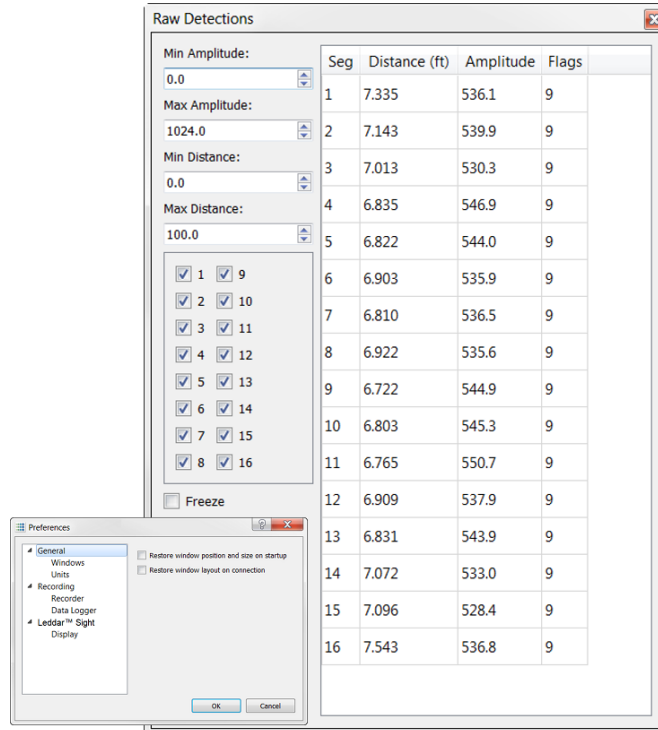


Fig. 58: View menu – Raw Detections dialog box

Fig. 59 shows an example of raw detections. When there is no detection in some segments, only the segments where detection occurred appear in the list.

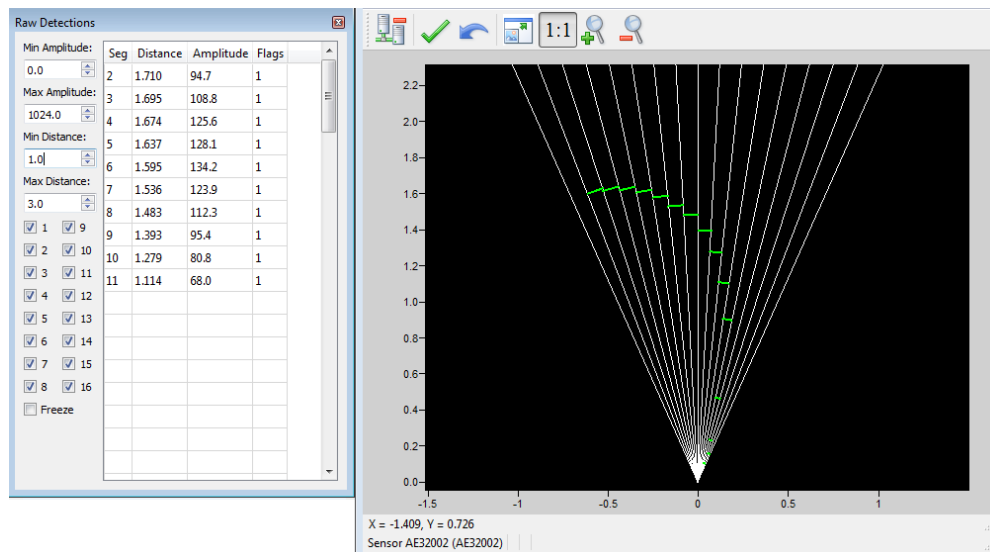


Fig. 59: Example of detection filtering in the Raw Detections dialog box

The following is a description of the parameters in the **Raw Detections** dialog box.

Min and Max Amplitude

The value entered in the **Min Amplitude** field shows only detections of amplitude higher than or equal to that value in meters. For example, if the minimum amplitude is set to 5, only the detections of amplitude 5 and higher will be displayed.

The value entered in the **Max Amplitude** field will show only detections of amplitude lower than or equal to that value in meters. For example, if the maximum amplitude is set to 8, only the detections of amplitude 8 and lower will be displayed.

Setting a value in both fields will result in a range of amplitude to display.

Min and Max Distance

The value entered in the **Min Distance** field will show only detections at a distance greater than or equal to that value. For example, if the minimum distance is set to 10, only the detections at a distance of 10 and more will be displayed.

The value entered in the **Max Distance** field will show only detections at a distance smaller than or equal to that value. For example, if the minimum distance is set to 20, only the detections at a distance of 20 and less will be displayed.

Setting a value in both fields will result in a range of distance to display.

Check boxes 1 to 16

Check boxes 1 to 16 allow you to select which segments to display.

Freeze

When selected, the **Freeze** option allows you to freeze the values displayed in the **Raw Detections** dialog box. To return to the live display, clear the check box.

Seg

The **Seg** column lists the segment for which there is a detection according to the filters used. The segment numbers are read from left to right, starting at 1.

Distance and Amplitude

The **Distance** column displays the distance of the detection, and the **Amplitude** column displays its amplitude.

Flag

The **Flag** column displays a number that represents a detection type. See Table 33.

Table 33: Flag value description

Bit position	Bit 0	Bit 1
0	Invalid measurement	Valid measurement
1	Reserved	Reserved
2	Normal measurement	Interference was detected in the current frame.

Bit position	Bit 0	Bit 1
3	Normal measurement	Received signal is above the saturation level. Measurements are valid (VALID is set) but have lower accuracy and precision. Consider decreasing the Laser Intensity value.
4	Reserved	Reserved
5	Reserved	Reserved
6	Normal measurement	Detection is within the crosstalk zone.
7	Reserved	Reserved

The **Flag** field provisions for 8 bits encoded as a bit field. Three bits are currently used. The following table lists the implemented decimal values of the status bit field.

Table 34: Status value description

Status Value (Decimal)	Status Value (Binary)	Description
1	00000001	Normal measurement (valid)
9	00001001	Saturated signal (valid)

5.12. View Serial Port Data

When using a device through a serial port (for example, using an RS-485 to USB adapter cable), it is possible to establish a connection to the sensor and display the sensor measurements in Leddar Configurator.

To view the serial port data:

1. In the **View** menu, click **Serial Port Viewer**.

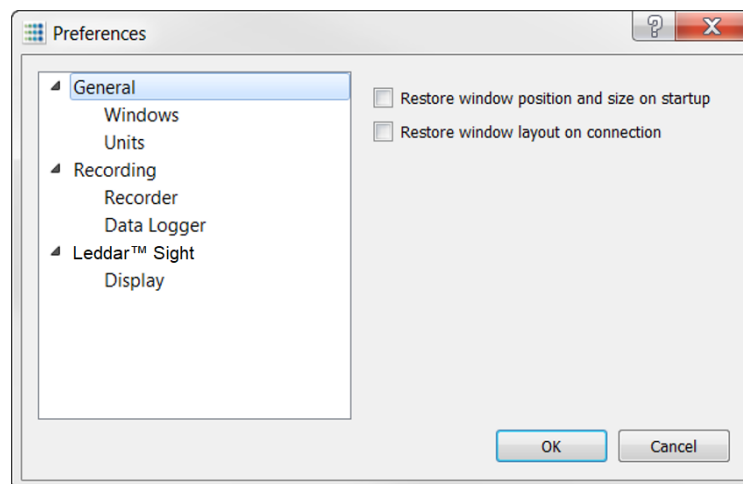


Fig. 60: View menu – Preferences dialog box

2. In the **Port** list of the **Serial Port Viewer** dialog box, select the serial port of the connected sensor.

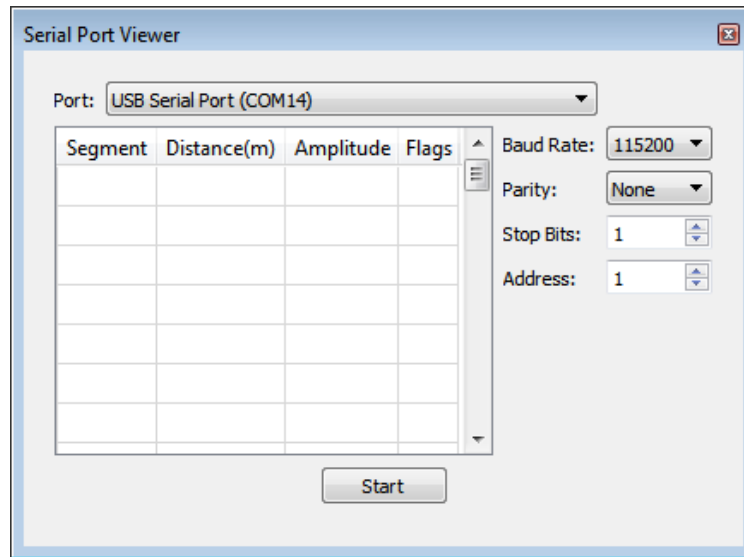


Fig. 61: Serial Port Viewer dialog box

3. Click the **Start** button to establish the connection and display the measurements.

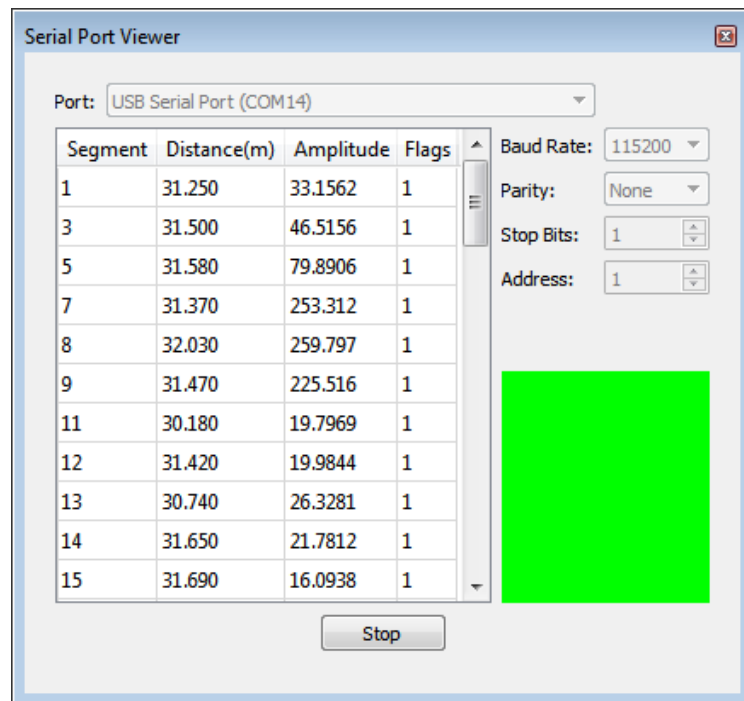


Fig. 62: Serial port measurement

6. Specifications

6.1. General

Table 35: General specifications

Model	SIGHT-16-19-A1 (19° x 0.3°) SIGHT-16-19-B1 (19° x 3°)	SIGHT-16-36-A1 (36° x 0.2°)	SIGHT-16-48-A1 (48° x 5.1°) SIGHT-16-48-B1 (48° x 0.3°) SIGHT-16-48-C1 (48° x 3°) SIGHT-16-48-D1 (48° x 5.5°)	SIGHT-16-99-A1 (99° x 0.3°) SIGHT-16-99-B1 (99° x 3°)
Dimensions (mm, D x H x L)	87 x 92 x 112	91 x 92 x 112	79 x 92 x 112	77 x 92 x 112
Weight (g)	493	413	400	420
Interface	USB, RS-485, CAN			
Power supply	12 V to 30 V			
Power consumption	<4 W			

6.2. Environmental

Table 36: Environmental specifications

Operating temperature	-40 °C to +65 °C
Storage temperature	-40 °C to +65 °C
Relative humidity	5% to 95%

6.3. Regulatory Compliance

The Leddar Sight complies with the following standards.

- Eye safety: IEC 60825-1:2014 Class 1
- Shock: IEC 60068-2-29:2008 (up to 50 G)
- Vibration: IEC 60068-2-64:2008 (up to 6 Grms)
- Ingress protection rating: IP69 IEC 60529
- CE: Compliant
- EMC: IEC/EN 61000-3-2, 3
IEC/EN 61000-4-2, 3, 4, 5, 6, 8, 11
IEC/EN 61000-6-3
- RoHS: 2011/65/EU amended 2015/863

6.4. Optical

Table 37: Optical specifications

	Features					
Model	Beam width, HFoV	Beam height, VFoV	Laser pulse rate (Hz)	Photodetector array size	Wavelength	Laser risk group
SIGHT-16-19-A1	19°	0.3°	12 800	1 x 16	905 nm (infrared)	IEC 60825-1:2014 (3 rd Ed.), Class 1 laser product
SIGHT-16-19-B1	19°	3°	51 200			
SIGHT-16-36-A1	36°	0.2°				
SIGHT-16-48-A1	48°	5.1°				
SIGHT-16-48-B1	48°	0.3°				
SIGHT-16-48-C1	48°	3°				
SIGHT-16-48-D1	48°	5.5°				
SIGHT-16-99-A1	99°	0.3°				
SIGHT-16-99-B1	99°	3°				

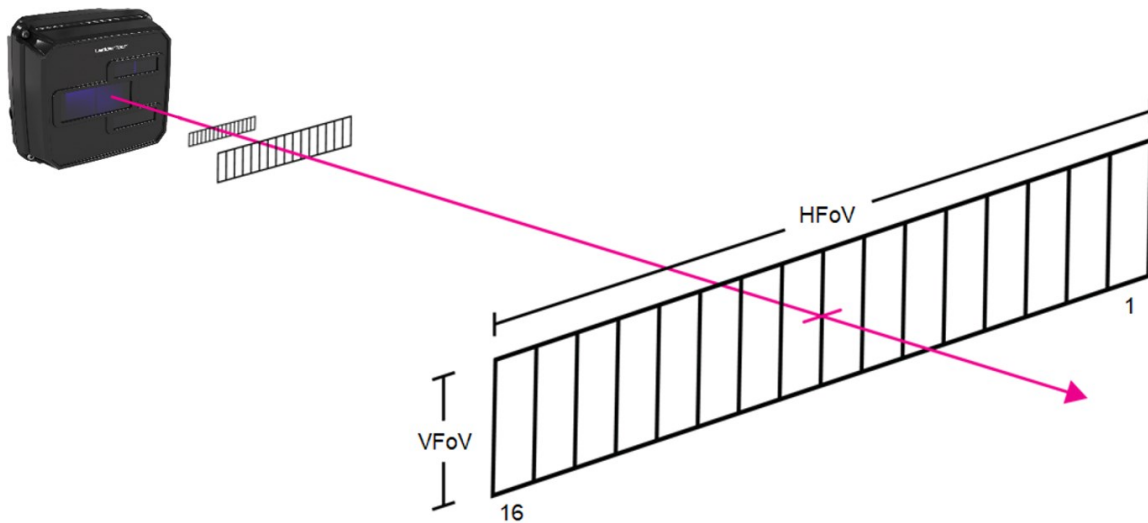


Fig. 63: Horizontal field of view (HFoV) and vertical field of view (VFoV)

6.5. Performance

Table 38: Sensor performances

Model	Performance Metrics and Values						
	Range ⁹ (m)			Measurement accuracy ¹⁰ (cm)	Measurement precision (mm)	Measurement rate (Hz)	Measurement resolution (cm)
	80% Reflectivity ¹¹	50% Reflectivity ¹¹	10% Reflectivity ¹¹				
SIGHT-16-19-A1	57	49	25	±5	±6	Up to 100 ¹²	±1
SIGHT-16-19-B1	28	24	15				
SIGHT-16-36-A1	38	33	17				
SIGHT-16-48-A1	19	17	11				
SIGHT-16-48-B1	31	28	15				
SIGHT-16-48-C1	21	20	13				
SIGHT-16-48-D1	20	18	12				
SIGHT-16-99-A1	15	12	9				
SIGHT-16-99-B1	11	9	6				

⁹ Typical specification at 6.25 Hz for central segment.

¹⁰ For oversampling of 4 and more.

¹¹ Target dimensions: 50 cm x 50 cm.

¹² See Table 9 on page 33 for typical measurement rate calculation.

6.6. Dimensions

6.6.1. 19° Configuration

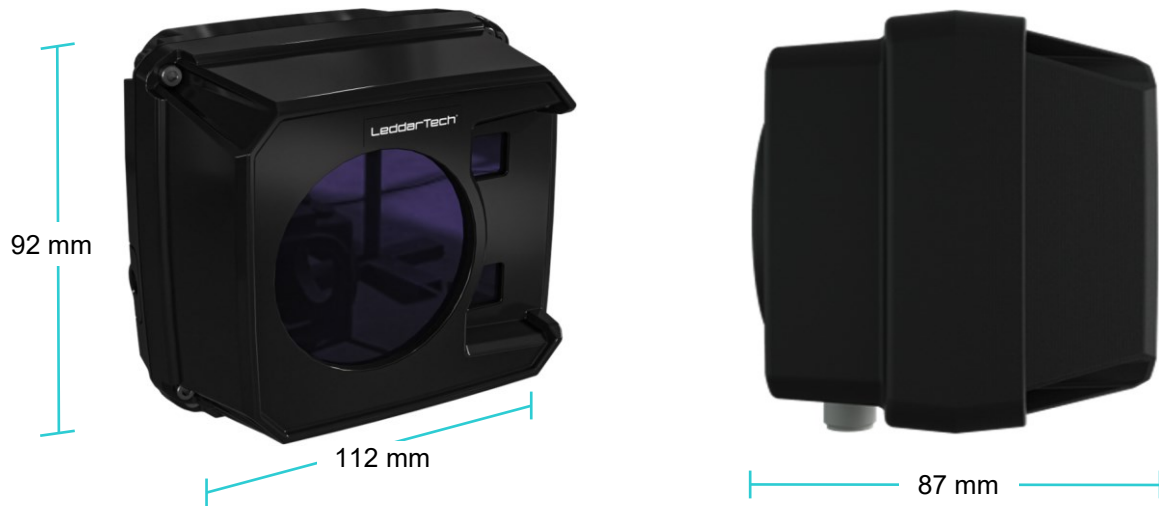


Fig. 64: 19° configuration sensor dimensions

6.6.2. 36° Configuration



Fig. 65: 36° configuration sensor dimensions

6.6.3. 48° Configuration

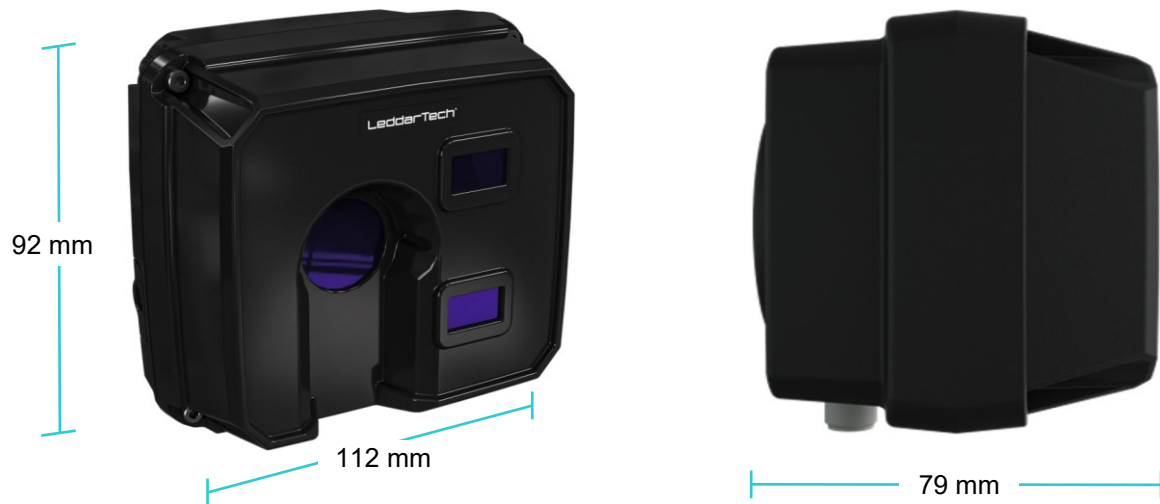


Fig. 66: 48° configuration sensor dimensions

6.6.4. 99° Configuration

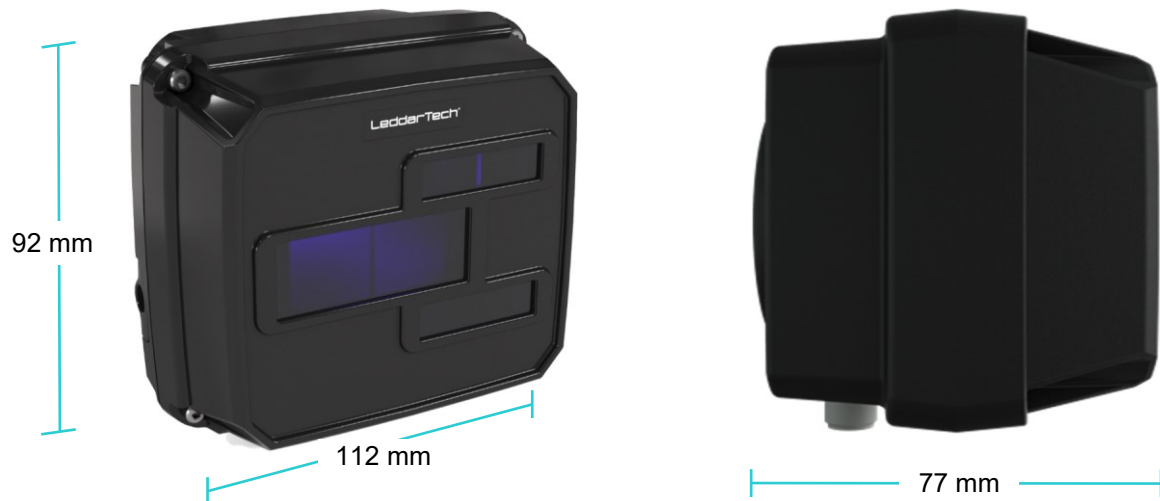



Fig. 67: 99° configuration sensor dimensions

7. Troubleshooting

Contact LeddarTech for troubleshooting information concerning the Leddar Sight sensor.

8. Maintenance

Opening the casing	 <i>Do not try to open the casing, as it may loose its hermeticity with regard to IP69. Opening the casing will automatically void the warranty.</i>
Cleaning the casing and the windows	<ul style="list-style-type: none"> • Blow off dust using compressed air. • Clean with a soft cloth and mild soap.

For any questions or concerns on how to safely perform maintenance operations on the Leddar Sight sensor, contact LeddarTech support at support@leddartech.com.

9. Disposal

Like any electronic equipment, the Leddar Sight sensor contains environmentally unsustainable components. Dispose of in an environmentally responsible manner.

10. Technical Support

For technical enquiries, contact LeddarTech technical support at support@leddartech.com to easily:

- follow up on your requests
- find quick answers to questions
- get valuable updates

Also, see the contact information at the end of this document.

Please have all relevant information such as part numbers, serial numbers, and pictures to facilitate support.

Appendix A. Example of a 0x41 Modbus Function

Transmit data stream message

01 41 C0 10

Use the 0x41 command to read the Modbus address # 01, using the CRC C0 10.

Received data stream message

01 41 10 CA 01 58 04 01 DA 01 2F 04 11 C0 01 94 04 21 D0 01 2F 04 31 B6 01 BF 04
41 C6 01 76 04 51 B3 01 D5 04 61 C7 01 7E 04 71 AE 01 EB 04 81 C2 01 93 04 91
AD 01 F5 04 A1 C6 01 55 04 B1 B2 01 F1 04 C1 CC 01 48 04 D1 B0 01 DA 04 E1 D3
01 2D 04 F1 CF 61 02 00 64 03 0F DB

Get detection messages (first byte)

Modbus address: 01 hex = 1 = address#1

Function code: 41 hex = 65 = function 0x41

Number of detections: 10 hex = 16 = 16 detections

Get detection messages (detection fields); refer to Table 13 on page 37.

(1) CA 01 58 04 01:

Distance (cm): 01 CA hex = 458 cm

Amplitude (count): 04 58 hex = 1112 / 64 = 17.375 counts

Segment/Flags #: 01 hex (segment #0, flag = valid)

(2) DA 01 2F 04 11:

Distance (cm): 01 DA hex = 474 cm

Amplitude (count): 04 2F hex = 1071 / 64 = 16.734 counts

Segment/Flags #: 11 hex (segment #1, flag = valid)

(3) C0 01 94 04 21:

Distance (cm): 01 C0 hex = 448 cm

Amplitude (count): 04 94 hex = 1172 / 64 = 18.313 counts

Segment/Flags #: 21 hex (segment #2, flag = valid)

(4) D0 01 2F 04 31:

Distance (cm): 01 D0 hex = 464 cm

Amplitude (count): 04 2F hex = 1071 / 64 = 16.734 counts

Segment/Flags #: 31 hex (segment #3, flag = valid)

(5) B6 01 BF 04 41:

Distance (cm): 01 B6 hex = 438 cm

Amplitude (count): 04 BF hex = 1215 / 64 = 18.984 counts

Segment/Flags #: 41 hex (segment #4, flag = valid)

(6) C6 01 76 04 51:

Distance (cm): 01 C6 hex = 454 cm

Amplitude (count): 04 76 hex = 1142 / 64 = 17.844 counts

Segment/Flags #: 51 hex (segment #5, flag = valid)

(7) B3 01 D5 04 61:

Distance (cm): 01 B3 hex = 435 cm

Amplitude (count): 04 D5 hex = 1117 / 64 = 17.453 counts

Segment/Flags #: 61 hex (segment #6, flag = valid)

(8) C7 01 7E 04 71:

Distance (cm): 01 C7 hex = 455 cm

Amplitude (count): 04 7E hex = $1150 / 64 = 17.969$ counts

Segment/Flags #: 71 hex (segment #7, flag = valid)

(9) AE 01 EB 04 81:

Distance (cm): 01 AE hex = 430 cm

Amplitude (count): 04 EB hex = $1259 / 64 = 19.671$ counts

Segment/Flags #: 81 hex (segment #8, flag = valid)

(10) C2 01 93 04 91:

Distance (cm): 01 C2 hex = 450 cm

Amplitude (count): 04 93 hex = $1171 / 64 = 18.267$ counts

Segment/Flags #: 91 hex (segment #9, flag = valid)

(11) AD 01 F5 04 A1:

Distance (cm): 01 AD hex = 429 cm

Amplitude (count): 04 F5 hex = $1119 / 64 = 17.484$ counts

Segment/Flags #: A1 hex (segment #10, flag = valid)

(12) C6 01 55 04 B1:

Distance (cm): 01 C6 hex = 454 cm

Amplitude (count): 04 55 hex = $1109 / 64 = 17.328$ counts

Segment/Flags #: B1 hex (segment #11, flag = valid)

(13) B2 01 F1 04 C1:

Distance (cm): 01 B2 hex = 434 cm

Amplitude (count): 04 F1 hex = $1115 / 64 = 17.422$ counts

Segment/Flags #: C1 hex (segment #12, flag = valid)

(14) CC 01 48 04 D1:

Distance (cm): 01 CC hex = 460 cm

Amplitude (count): 04 48 hex = $1096 / 64 = 17.125$ counts

Segment/Flags #: D1 hex (segment #13, flag = valid)

(15) B0 01 DA 04 E1:

Distance (cm): 01 B0 hex = 432 cm

Amplitude (count): 04 DA hex = $1242 / 64 = 19.406$ counts

Segment/Flags #: E1 hex (segment #14, flag = valid)

(16) D3 01 2D 04 F1:

Distance (cm): 01 D3 hex = 467 cm

Amplitude (count): 04 2D hex = $1069 / 64 = 16.703$ counts

Segment/Flags #: F1 hex (segment #15, flag = valid)

Get detection messages (trailing fields); refer to Table 14 on page 38.

CF 61 02 00 64 03 0F DB:

TimeStamp (ms): 00 02 61 CF hex = 156111 ms = 156 s.

Light source POWER (%): 64 hex = 100 = 100%

Bit field acq. (reserved): 00 hex = 0

CRC (16-bits Modbus) = 0F DB

Appendix B. Example of a 0x04 Modbus

Transmit message

01 04 00 00 00 30 F0 1E

Use the 0x04 command to read 48 consecutive registers starting at address 00. On device with Modbus address 01, using the CRC F0 E1.

Received message

01 04 60 2D 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 64 89 9B 00 2B 01 CB 01 DF 01 C3 01 D4 01 BB 01 CC 01 B5 01 CA 01 B0 01 C5 01 AE 01 CA 01 B4 01 D2 01 B3 01 D9 04 00 03 EB 04 30 03 D0 04 4D 04 08 04 6C 04 09 04 77 04 21 04 84 03 E8 04 85 03 D8 04 6E 03 DD FA 29

Header

(Address 0) Module temperature: 2D 00 hex = $11520/256 = 45.0^{\circ}\text{C}$

(1) Status for polling mode: 00 01 hex = 1 = Detections ready

(13) Light source power & Acquisition statuses: 01 64 hex, acquisition status = 01 hex = automatic light power, light source power = 64 hex = 100 = 100%

(14&15) TimeStamp: 00 2B 89 9B hex = 2853275 = 2853275 ms (2853 s)

Modbus footer

Modbus CRC-16: FA 29 hex

Distance (first detection only)

(Address 16) Segment #0 = 01 CB hex = 459 cm

(17) Segment #1 = 01 DF hex = 479 cm

(18) Segment #2 = 01 C3 hex = 451 cm

(19) Segment #3 = 01 D4 hex = 468 cm

(20) Segment #4 = 01 BB hex = 443 cm

(21) Segment #5 = 01 CC hex = 460 cm

(22) Segment #6 = 01 B5 hex = 437 cm

(23) Segment #7 = 01 CA hex = 458 cm

(24) Segment #8 = 01 B0 hex = 432 cm

(25) Segment #9 = 01 C5 hex = 453 cm

(26) Segment #10 = 01 AE hex = 430 cm

(27) Segment #11 = 01 CA hex = 458 cm

(28) Segment #12 = 01 B4 hex = 436 cm

(29) Segment #13 = 01 D2 hex = 466 cm

(30) Segment #14 = 01 B3 hex = 434 cm

(31) Segment #15 = 01 D9 hex = 473 cm

Amplitude (first detection only)

(Address 32) Segment #0 = 04 00 hex = $1024 / 64 = 16$ counts

(33) Segment #1 = 03 EB hex = $1003 / 64 = 15.672$ counts

(34) Segment #2 = 04 30 hex = $1072 / 64 = 16.75$ counts

(35) Segment #3 = 03 D0 hex = $976 / 64 = 15.25$ counts

(36) Segment #4 = 04 4D hex = $1101 / 64 = 17.203$ counts

(37) Segment #5 = 04 08 hex = $1032 / 64 = 16.125$ counts

(38) Segment #6 = 04 6C hex = $1132 / 64 = 17.688$ counts

(39) Segment #7 = 04 09 hex = $1033 / 64 = 16.140$ counts

(40) Segment #8 = 04 77 hex = $1143 / 64 = 17.859$ counts

(41) Segment #9 = 04 21 hex = $1057 / 64 = 16.516$ counts

(42) Segment #10 = 04 84 hex = $1156 / 64 = 18.063$ counts

(43) Segment #11 = 03 E8 hex = $1000 / 64 = 15.625$ counts

(44) Segment #12 = 04 85 hex = 1157 / 64 = 18.078 counts
(45) Segment #13 = 03 D8 hex = 984 / 64 = 15.375 counts
(46) Segment #14 = 04 6E hex = 1134 / 64 = 17.719 counts
(47) Segment #15 = 03 DD hex = 989 / 64 = 15.453 counts

Appendix C. Example of a CAN Bus Detection Request

The controller sends the following:

ID	Data
0740	01

This message sends a request to receive the **sensor** detections only once.

The Leddar **sensor** answers the following:

ID	Data
0751	0F
0750	BD 00 85 00 C8 00 CA 10
0750	CE 00 AD 21 CB 00 3A 32
0750	C8 00 A1 42 C6 00 ED 52
0750	C4 00 FB 62 C5 00 2C 73
0750	C6 00 3A 85 C7 00 EC 92
0750	C6 00 7D A2 C9 00 0D B2
0750	CD 00 72 C1 CE 00 3F D1
0750	D1 00 5F E1 00 00 00 00

The following explains the first three lines of the answer:

ID: 0751 Data: 0F

0751 indicates that the data in this message will be the number of sent detections.

The number of sent detections is 0F hex = 15 detections; therefore, there are seven 0750 messages each containing two detections and one 0750 message containing only one detection.

ID: 0750 Data: BD 00 85 00 C8 00 CA 10

0750 = 8-byte message containing two detections.

Detection 1:

Distance is 00 BD hex = 189 cm

Amplitude is 085 hex/4 = 133/4 = 33.25

Channel is 0

Detection 2:

Distance is 00 C8 hex = 200 cm

Amplitude is 0 CA hex / 4 = 202/4 = 50.25

Channel is 1

ID: 0750 Data: CE 00 AD 21 CB 00 3A 32

0750 = 8-byte message containing two detections.

Detection 1:

Distance is 00 CE hex = 206 cm

Amplitude is 1 AD hex / 4 = 429/4 = 107.25

Channel is 2

Detection 2:

Distance is 00 CB hex = 203 cm

Amplitude is 2 3A hex / 4 = 570/4 = 142.5

Channel is 3



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