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# Contents

1 Description and Features .................................................................................................................. 6

2 Introduction ......................................................................................................................................... 7
   2.1 Purpose and Scope of this Document ........................................................................................... 7
   2.2 Terminology .................................................................................................................................. 7
   2.3 LiDAR Technology Overview ..................................................................................................... 7

3 Functional Specification ..................................................................................................................... 8
   3.1 Depth Camera Specification ........................................................................................................ 8
      3.1.1 Camera Accuracy Health .................................................................................................... 8
   3.2 Depth Camera Controls and Data Format .................................................................................. 8
   3.3 Depth Quality Metrics ................................................................................................................ 9
   3.4 Depth Start Point (Ground Zero Reference) ............................................................................. 10
      3.4.1 Depth Origin X-Y Coordinates .......................................................................................... 12
   3.5 Image Formats and Color Camera Functions ............................................................................ 12
   3.6 IMU Specification and Operating Modes .................................................................................. 13
   3.7 L515 Device Firmware Update (DFU) ...................................................................................... 14
      3.7.1 Update ............................................................................................................................... 14

4 Intel® RealSense™ LiDAR Camera L515 Hardware Specification .................................................... 15
   4.1 L515 Device Components ......................................................................................................... 15
   4.2 Color Camera Properties .......................................................................................................... 15
   4.3 Camera L515 Power Consumption ........................................................................................... 15
   4.4 Camera Interface ....................................................................................................................... 16
   4.5 Camera L515 Storage and Operating Conditions .................................................................. 17
      (1) Controlled conditions should be used for long term storage of product. .......................... 17
      (2) Short exposure represents temporary max limits acceptable for transportation conditions. 17
   4.6 Material, Vendor and Device ID ............................................................................................... 17
      4.6.1 Camera L515 Product Identifier and Material Code ...................................................... 17
      4.6.2 Vendor Identification (VID) and Device Identification (DID) ..................................... 17

5 Software (SDK) ................................................................................................................................. 18
   5.1 Intel® RealSense™ Software Development Kit 2.0 ................................................................. 18

6 Mechanical Specifications .................................................................................................................. 19
   6.1.1 Mechanical Dimensions ...................................................................................................... 19
   6.2 L515 Cover Material Cleaning Procedure ............................................................................. 20

7 Regulatory Ecology Compliance ........................................................................................................ 21
   7.1 System Laser Compliance ....................................................................................................... 21
      7.1.1 Certification Statement ..................................................................................................... 21
      7.1.2 Explanatory Label .............................................................................................................. 21
      7.1.3 Cautionary Statements ..................................................................................................... 21
      7.1.4 Embedded Laser Information .......................................................................................... 22
      7.1.5 US FDA Accession Number .......................................................................................... 22
   7.2 Regulatory Compliance .............................................................................................................. 23
      7.2.1 Manufacturer’s Information .............................................................................................. 23
      7.2.2 EU Single Place of Contact ............................................................................................ 23
   7.3 Ecology Compliance ................................................................................................................... 23
7.3.1 China RoHS Declaration ................................................................. 23
7.3.2 Waste Electrical and Electronic Equipment (WEEE) ..................... 24

8 Appendix A – L515 Product Box ......................................................... 25

Figures
Figure 1-1. Intel® RealSense™ LiDAR Camera L515 Exploded View .................... 6
Figure 3-1. Depth Quality Metric Illustration ............................................ 10
Figure 3-2. LiDAR Camera Depth Start Point Reference .............................. 11
Figure 3-3. LiDAR Camera X-Y Depth Origin Reference .............................. 12
Figure 5-1. RealSense Viewer – L515 ..................................................... 18
Figure 6-1. Intel® RealSense™ LiDAR Camera L515 .................................. 19
Figure 6-2. Intel® RealSense™ LiDAR Camera L515 Cooling Vents .......... 20
Figure 8-1. L515 Product Box ................................................................ 25

Tables
Table 2-1. Terminology Table ................................................................. 7
Table 3-1. Depth Specification ............................................................... 8
Table 3-2. Depth Camera Controls ......................................................... 8
Table 3-3: Depth and Infrared Data Formats .......................................... 9
Table 3-4: Depth Quality Metrics .......................................................... 9
Table 3-5: Depth Quality Specification .................................................. 10
Table 3-6. LiDAR Depth Start Point ....................................................... 11
Table 3-7. Image Formats ................................................................. 12
Table 3-8. Color Camera Controls ......................................................... 12
Table 3-9. Inertial Measurement Specifications ....................................... 13
Table 4-1. Main components ............................................................... 15
Table 4-2. Color Camera Properties ...................................................... 15
Table 4-3. Power Requirements .......................................................... 16
Table 4-4. Power Consumption ........................................................... 16
Table 4-5. Storage and Operating Conditions ........................................ 17
Table 4-6. Product Identifier and Material Code ..................................... 17
Table 4-7. Vendor ID and Device ID Table ............................................ 17
Table 6-1. Intel® RealSense™ LiDAR Camera L515 Mechanical Dimensions 19
Table 7-1. U.S. FDA Accession Number ............................................... 22
## Revision History

<table>
<thead>
<tr>
<th>Revision Number</th>
<th>Description</th>
<th>Revision Date</th>
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<tbody>
<tr>
<td>001</td>
<td>Initial release</td>
<td>December 2019</td>
</tr>
<tr>
<td>002</td>
<td>• Section 1. Description and Features</td>
<td>June 2020</td>
</tr>
<tr>
<td></td>
<td>• Section 3.1.1. Camera Accuracy Health</td>
<td></td>
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<td></td>
<td>• Section 3.4. Depth Start Point (Ground Zero Reference)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Section 7.1.4. Embedded Laser Information</td>
<td></td>
</tr>
<tr>
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<td>• Table 3-2. Depth Camera Controls</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Table 3-4. Depth Quality Metrics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Table 3-5. Depth Quality Specification</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Table 3-6. Depth Start Point</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Table 3-7. Image Formats</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Table 4-2. Color Camera Properties</td>
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<td>• Table 4-5. Storage and Operating Conditions</td>
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<td>• Figure 3-2. LiDAR Camera Depth Start Point Reference</td>
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</tr>
<tr>
<td></td>
<td>• Figure 6-1. Intel® RealSense™ LiDAR Camera L515</td>
<td></td>
</tr>
<tr>
<td>003</td>
<td>• Table 3-1. Depth Specification</td>
<td>January 2021</td>
</tr>
<tr>
<td></td>
<td>• Table 3-2. Depth Camera Controls</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Table 3-7. Image Formats</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Figure 3-3. LiDAR Camera X-Y Depth Origin Reference</td>
<td></td>
</tr>
</tbody>
</table>

---

§ §
## 1 Description and Features

<table>
<thead>
<tr>
<th>Description</th>
<th>Features</th>
</tr>
</thead>
</table>
| The Intel® RealSense™ LiDAR Camera L515 is Intel’s first release of a LiDAR camera enabling highly accurate depth sensing in a small form factor. Small enough to fit in the palm of your hand, the L515 is 61mm in diameter and 26mm in height. At approximately 100g, it’s designed to be easily situated on any system, or attached to a tablet or phone. It also runs at less than 3.5W, considerably lower than competing time-of-flight (TOF) solutions. All depth calculations run on the device resulting in true platform independence. With a short exposure time of <100ns per depth point, even rapidly moving objects can be captured with minimal motion blur. Optimized for indoor lighting, the L515 processes over 23 million depth points per second via a custom made ASIC. The product has been designed for use case flexibility with the inclusion of an RGB camera and an inertial measurement unit. | - Depth Capture from 0.25 to 9m\(^{(1)}\)  
- 2MP RGB Camera\(^{(2)}\)  
- Inertial Measurement Unit (IMU)  
- Up to 30FPS Depth at 1024x768 (XGA)  
- Up to 30FPS Color at 1920x1080 (FHD)  
- Class 1 Laser Compliant  
- Device Accuracy Health\(^{(2)}\)  

\(^{(1)}\) Tested at 95% reflectivity.  
\(^{(2)}\) RGB camera always on. |

### Minimum System Requirements

- USB 3.1 Gen1  
- Ubuntu*16.xx/18.04 LTS  
- Windows*10 (build 15063 or later)

---

**Figure 1-1. Intel® RealSense™ LiDAR Camera L515 Exploded View**

![Exploded View of L515 Camera][1]

---

[1]: #
2 Introduction

2.1 Purpose and Scope of this Document

This document captures the specifications for the Intel® RealSense™ LiDAR Camera L515.

2.2 Terminology

Table 2-1. Terminology Table

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth</td>
<td>Depth video streams are like color video streams except each pixel has a value representing the distance away from the camera instead of color information.</td>
</tr>
<tr>
<td>FOV</td>
<td>Field Of View (FOV) describes the angular extent of a given scene that is imaged by a camera. A camera’s FOV can be measured horizontally, vertically, or diagonally.</td>
</tr>
<tr>
<td>Host System</td>
<td>Computer or SOC connected to depth camera</td>
</tr>
<tr>
<td>IR Laser</td>
<td>This refers to the source of infrared (IR) light used for illuminating a scene, object, or person to collect depth data.</td>
</tr>
<tr>
<td>IMU</td>
<td>Inertial Measurement Unit is a system-in-package for the detection of acceleration in 3 dimensions and rotations in 3 dimensions.</td>
</tr>
<tr>
<td>LiDAR</td>
<td>Light Detection and Ranging is a remote sensing technology that measures the distance to objects and targets using a combination of laser light and receivers.</td>
</tr>
<tr>
<td>MEMS</td>
<td>Micro-Electro-Mechanical System</td>
</tr>
<tr>
<td>RH</td>
<td>Relative humidity</td>
</tr>
<tr>
<td>TBD</td>
<td>To Be Determined. In the context of this document, information will be available in a later revision.</td>
</tr>
</tbody>
</table>

2.3 LiDAR Technology Overview

The Intel® RealSense™ LiDAR Camera L515 uses an IR laser, a MEMS, an IR photodiode, an RGB imager, a MEMS controller, and a vision ASIC. The MEMS is used to scan the IR laser beam over the entire field-of-view (FOV). The L515 vision ASIC will process the data from the reflected beam captured by the photodiode and will output a depth point representing the accurate distance of a specific point in the scene from the camera. Aggregation of the depth points will generate a point cloud depth data representing the full scene.
3  Functional Specification

3.1  Depth Camera Specification

Table 3-1. Depth Specification

<table>
<thead>
<tr>
<th>Depth Resolution</th>
<th>Number of depth points per second</th>
<th>FOV1</th>
<th>Range @ 15% reflectivity2</th>
<th>Range @ 95% reflectivity2</th>
</tr>
</thead>
<tbody>
<tr>
<td>QVGA (320x240)</td>
<td>2.3M</td>
<td>70° x 55°</td>
<td>0.25 - 3.9m</td>
<td>0.25 - 9m</td>
</tr>
<tr>
<td>VGA (640x480)</td>
<td>9.2M</td>
<td>70° x 55°</td>
<td>0.25 - 3.9m</td>
<td>0.25 - 9m</td>
</tr>
<tr>
<td>XGA (1024x768)</td>
<td>23.6M</td>
<td>70° x 55°</td>
<td>0.25 - 2.6m</td>
<td>0.25 - 6.5m</td>
</tr>
</tbody>
</table>

1 Due to mechanical tolerances, FOV can vary +/- 2 degrees.

2 Max range is specified for the center 10% ROI of the image, as long as the operating conditions are met.

3.1.1 Camera Accuracy Health

In order to ensure the long-term optimal accuracy of the L515’s cutting edge depth technology, Intel® has implemented an additional accuracy assurance method utilizing the RGB camera. The feature runs on the host as part of the Intel® RealSense™ SDK 2.0 and will require a few RGB frames to be sent to the host. These RGB frames are used to analyze the scene and compared with the depth camera to verify alignment between both cameras.

The accuracy health-test and maintenance feature is automatically enabled and all customers gain this feature without any user interaction.

To ensure complete transparency, this functionality is in the Intel® RealSense™ SDK 2.0 open source SDK (LibRealSense).

3.2 Depth Camera Controls and Data Format

In order to achieve optimal performance of the camera, three presets are offered based on the desired range of the application.

Table 3-2. Depth Camera Controls

<table>
<thead>
<tr>
<th>Preset</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Range</td>
<td>This preset is useful when there is no ambient light in the scene (fully indoors use case, with no light coming through windows). With this preset the laser power is set to maximum as well as the receiver gain which optimize the depth quality in indoor conditions.</td>
</tr>
</tbody>
</table>
### Preset Description

**Short Range**
This preset lowers the laser power and gain so that close objects do not oversaturate the receiver. This allows operation at a close distance to objects. This setting may not be good if objects further away in the scene also need to perform well.

**No Ambient Light**
Same as Max Range preset, this preset is useful when there is no ambient sunlight in the scene. The main difference between the presets is the laser power which is lower on this preset to avoid false depth on objects that are on longer distances than the ambiguity range (10m-VGA, 6.5m-XGA).

**Low Ambient Light**
This preset is recommended for environments where there may be a low amount of ambient sunlight present. Similar to Max Range preset the laser power is set to maximum but the receiver gain is reduced to avoid saturation of the camera due to ambient sunlight. The preset is also recommended for cases that the user wants to detect close objects (<50cm).

Table 3-3: Depth and Infrared Data Formats

<table>
<thead>
<tr>
<th>FORMAT</th>
<th>KEY</th>
<th>TYPE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth</td>
<td>Z</td>
<td>16b UINT</td>
<td>Depth format equating to distance from the device subassembly planar surface to the object.</td>
</tr>
<tr>
<td>Infrared</td>
<td>Y8</td>
<td>8b UINT</td>
<td>IR image representing the intensity of the reflected IR laser reflected off the objects in the scene.</td>
</tr>
<tr>
<td>Confidence</td>
<td>C</td>
<td>4b UINT</td>
<td>Provides a per pixel confidence value, 0xF equals high confidence and 0x0 represents low confidence.</td>
</tr>
</tbody>
</table>

### 3.3 Depth Quality Metrics

Table 3-4: Depth Quality Metrics

<table>
<thead>
<tr>
<th>METRIC</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth Accuracy</td>
<td>Represents the average difference of valid pixels relative to ground truth.</td>
</tr>
<tr>
<td>Depth Standard Deviation</td>
<td>Represents the total spread (noise) of the depth values relative to ground truth.</td>
</tr>
</tbody>
</table>
Figure 3-1. Depth Quality Metric Illustration

Table 3-5. Depth Quality Specification

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth Accuracy – Avg</td>
<td>&lt; 5mm @ 1m</td>
<td>VGA resolution, 95% reflectivity</td>
</tr>
<tr>
<td></td>
<td>&lt; 14mm @ 9m</td>
<td></td>
</tr>
<tr>
<td>Depth – Std Dev</td>
<td>2.5mm @ 1m</td>
<td>VGA resolution, 95% reflectivity</td>
</tr>
<tr>
<td></td>
<td>15.5mm @ 9m</td>
<td></td>
</tr>
<tr>
<td>Exposure Time</td>
<td>&lt; 100ns per depth point</td>
<td>Robust against motion blur</td>
</tr>
<tr>
<td>Lighting Condition</td>
<td>&lt; 500 lux sunlight (0.4uW/cm²/nm)</td>
<td></td>
</tr>
</tbody>
</table>

3.4 Depth Start Point (Ground Zero Reference)

The depth start point or the ground zero reference can be described as the starting point or plane where depth = 0. For LiDAR camera (L515), this point is referenced from front of camera cover glass.
Table 3-6. LiDAR Depth Start Point

<table>
<thead>
<tr>
<th>LiDAR Camera</th>
<th>Camera Front Glass (Z')</th>
</tr>
</thead>
<tbody>
<tr>
<td>L515</td>
<td>-4.5mm</td>
</tr>
</tbody>
</table>

NOTES:

If depth measurement reference is front cover glass, then |Z'| should be added to measured value to determine Ground Truth.

This value can be read via Intel® RealSense™ SDK 2.0 APIs. Please see the latest SDK for reference.
3.4.1 Depth Origin X-Y Coordinates

The depth origin X-Y coordinates is the X-Y center of the IR Transmitter.

Figure 3-3. LiDAR Camera X-Y Depth Origin Reference

3.5 Image Formats and Color Camera Functions

Table 3-7. Image Formats

<table>
<thead>
<tr>
<th>Format</th>
<th>Resolution</th>
<th>Frame Rate (FPS)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>YUY2</td>
<td>1920x1080</td>
<td>6,15,30</td>
<td>Color Stream from RGB camera</td>
</tr>
<tr>
<td></td>
<td>1280x720</td>
<td>6,15,30,60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>960x540</td>
<td>6,15,30,60</td>
<td></td>
</tr>
</tbody>
</table>

NOTE:

Color camera frame rates are expressed as nominal. Effective frame rates can vary depending on the exposure settings of the camera. Camera settings that increase the exposure time can decrease the effective frame rate.

Table 3-8. Color Camera Controls

<table>
<thead>
<tr>
<th>Control</th>
<th>Description</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto-Exposure Mode</td>
<td>Automatically sets the exposure time and gain for the frame.</td>
<td>0x1</td>
<td>0x8</td>
</tr>
<tr>
<td>Manual Exposure Time</td>
<td>Sets the absolute exposure time when auto-</td>
<td>1</td>
<td>10000</td>
</tr>
</tbody>
</table>
### Functional Specification

<table>
<thead>
<tr>
<th>Control</th>
<th>Description</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brightness</td>
<td>Sets the amount of brightness applied when auto-exposure is enabled.</td>
<td>-64</td>
<td>64</td>
</tr>
<tr>
<td>Contrast</td>
<td>Sets the amount of contrast based on the brightness of the scene.</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Gain</td>
<td>Sets the amount of gain applied to the frame if auto-exposure is disabled.</td>
<td>0</td>
<td>4096</td>
</tr>
<tr>
<td>Hue</td>
<td>Sets the amount of hue adjustment applied to the frame.</td>
<td>-180</td>
<td>180</td>
</tr>
<tr>
<td>Saturation</td>
<td>Sets the amount of saturation adjustment applied to the frame.</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Sharpness</td>
<td>Sets the amount of sharpening adjustment applied to the frame.</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>White Balance Temperature Control</td>
<td>Sets the white balance when AWB is disabled.</td>
<td>2800</td>
<td>6500</td>
</tr>
<tr>
<td>White Balance Temperature Auto (AWB)</td>
<td>Enables or disables the AWB algorithm.</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Power Line Frequency</td>
<td>Specified based on the local power line frequency for flicker avoidance.</td>
<td>Disabled 50Hz/60Hz/Auto</td>
<td></td>
</tr>
<tr>
<td>Backlight Compensation</td>
<td>Sets a weighting amount based on brightness to the frame.</td>
<td>0</td>
<td>255</td>
</tr>
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### IMU Specification and Operating Modes

#### Table 3-9. Inertial Measurement Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>Bosch BMI085</td>
</tr>
<tr>
<td>Degrees of Freedom</td>
<td>6</td>
</tr>
<tr>
<td>Acceleration Range</td>
<td>±4g</td>
</tr>
<tr>
<td>Accelerometer Output Data Rate</td>
<td>100Hz/200Hz/400Hz</td>
</tr>
<tr>
<td>Gyroscope Range</td>
<td>±1000 Deg/s</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Gyroscope Output Data Rate</td>
<td>100Hz/200Hz/400Hz</td>
</tr>
<tr>
<td>Data Format</td>
<td>32b Float</td>
</tr>
</tbody>
</table>

Accelerometer and gyroscope data streams from the onboard IMU are available via Intel® RealSense™ SDK 2.0.

### 3.7 L515 Device Firmware Update (DFU)

The firmware contains the operation instructions. Upon runtime, Vision ASIC loads the firmware and programs the component registers. If the Vision ASIC is configured for update or recovery, the unlocked R/W region of the firmware can be changed.

#### 3.7.1 Update

During a firmware update, the firmware utility will issue a device firmware update command to the Vision ASIC. The Vision ASIC will then reset into firmware update mode. The firmware utility uses a single binary file to maintain the firmware image.

#### 3.7.1.1 Update Limits

The firmware update engine does not allow infinite update cycles between older and current versions of firmware. The engine will establish a baseline version of firmware based on the latest firmware version installed. The engine will allow a return to a previous version or baseline version of firmware up to 20 times. After the 20th update, the engine will only allow an update to a firmware revision higher than the baseline version.
4 Intel® RealSense™ LiDAR Camera L515 Hardware Specification

4.1 L515 Device Components

Table 4-1. Main components

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI085</td>
<td>Accelerometer and Gyroscope in a single package</td>
</tr>
<tr>
<td>OV2740</td>
<td>RGB image sensor</td>
</tr>
<tr>
<td>IR emitter</td>
<td>860nm IR laser</td>
</tr>
</tbody>
</table>

4.2 Color Camera Properties

Table 4-2. Color Camera Properties

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Camera Sensor Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color Image Signal Processor</td>
<td>Embedded*</td>
</tr>
<tr>
<td>Active Pixels</td>
<td>1920 X 1080</td>
</tr>
<tr>
<td>Sensor Aspect Ratio</td>
<td>16:9</td>
</tr>
<tr>
<td>Format</td>
<td>1/6”</td>
</tr>
<tr>
<td>F Number</td>
<td>2.0</td>
</tr>
<tr>
<td>Focal Length</td>
<td>1.88mm</td>
</tr>
<tr>
<td>Focus</td>
<td>Fixed</td>
</tr>
<tr>
<td>Shutter Type</td>
<td>Rolling Shutter</td>
</tr>
<tr>
<td>Signal Interface</td>
<td>MIPI CSI-2, 2X Lanes</td>
</tr>
<tr>
<td>Horizontal Field of View</td>
<td>69° +/-1°</td>
</tr>
<tr>
<td>Vertical Field of View</td>
<td>42° +/-1°</td>
</tr>
</tbody>
</table>

*arm This product uses Arm® Assertive Camera™ technology by Arm Limited.

4.3 Camera L515 Power Consumption

The Intel® RealSense™ LiDAR Camera L515 is powered through USB VBUS power connected to host platform via USB type-C connection. The same cable is used for data transfer.
Table 4-3. Power Requirements

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Nom</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCC Supply Voltage</td>
<td>4.5</td>
<td>5</td>
<td>5.5</td>
<td>V</td>
</tr>
</tbody>
</table>

Table 4-4. Power Consumption

<table>
<thead>
<tr>
<th>Model</th>
<th>Idle Power (W)</th>
<th>Normal Power (W)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Typical Usage Configuration (@ 25°C)</td>
<td></td>
</tr>
<tr>
<td>L515</td>
<td>0.8</td>
<td>3.0</td>
<td>Depth (VGA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.2</td>
<td>Depth (VGA) + RGB (1080p, 30FPS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.1</td>
<td>Depth (XGA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.3</td>
<td>Depth (XGA) + RGB (1080p, 30FPS)</td>
</tr>
</tbody>
</table>

4.4 Camera Interface

The interface to L515 is USB 3.0 Type-C. Standard USB3 cables with max over-mold size of 6.5mmx12mm are supported.
4.5 Camera L515 Storage and Operating Conditions

Table 4-5. Storage and Operating Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Condition</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage (Still Air), Not Operating</td>
<td>Sustained, Controlled (1)</td>
<td>0</td>
<td>50</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>Short Exposure (2)</td>
<td>-20</td>
<td>70</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>Humidity, Non-Condensing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating(3)(4)</td>
<td>Ambient temperature range when the device is streaming</td>
<td>0</td>
<td>30</td>
<td>°C</td>
</tr>
<tr>
<td>Skin Temperature @ 25°C Ambient(3)(4)</td>
<td>Camera housing temperature</td>
<td>N/A</td>
<td>50</td>
<td>°C</td>
</tr>
</tbody>
</table>

NOTE:

(1) Controlled conditions should be used for long term storage of product.

(2) Short exposure represents temporary max limits acceptable for transportation conditions.

(3) Under typical indoor air flow.

(4) Depth and RGB enabled simultaneously.

4.6 Material, Vendor and Device ID

4.6.1 Camera L515 Product Identifier and Material Code

Table 4-6. Product Identifier and Material Code

<table>
<thead>
<tr>
<th>Production</th>
<th>Product Material Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camera L515</td>
<td>999NGF</td>
</tr>
</tbody>
</table>

4.6.2 Vendor Identification (VID) and Device Identification (DID)

Table 4-7. Vendor ID and Device ID Table

<table>
<thead>
<tr>
<th>Depth Module/Depth Camera</th>
<th>Vendor ID</th>
<th>Device ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel® RealSense™ LiDAR Camera L515</td>
<td>8086</td>
<td>0x0B64</td>
</tr>
</tbody>
</table>
5 Software (SDK)

5.1 Intel® RealSense™ Software Development Kit 2.0

Intel® RealSense™ SDK 2.0 is a cross-platform library for working with Intel® RealSense™ LiDAR Camera L515. It is open source and available on https://www.intelrealsense.com/sdk-2/

The SDK at a minimum includes:

- **Intel® RealSense™ Viewer** - This application can be used view, record and playback depth streams, set camera configurations and other controls.
- **Depth Quality Tool** - This application can be used to test depth quality, including: distance to plane accuracy, Z accuracy, standard deviation of the Z accuracy and fill rate.
- **Debug Tools** - These command line tools gather data and generate logs to assist in debug of camera.
- **Code Examples** - Examples to demonstrate the use of SDK to include D400 Series camera code snippets into applications.
- **Wrappers** - Software wrappers supporting common programming languages and environments such as ROS, Python, Matlab, node.js, LabVIEW, OpenCV, PCL, .NET and more

Figure 5-1. RealSense Viewer – L515
6 Mechanical Specifications

6.1.1 Mechanical Dimensions

Table 6-1. Intel® RealSense™ LiDAR Camera L515 Mechanical Dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Nominal</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>61</td>
<td>mm</td>
</tr>
<tr>
<td>Height</td>
<td>26</td>
<td>mm</td>
</tr>
<tr>
<td>Weight</td>
<td>95</td>
<td>g</td>
</tr>
</tbody>
</table>

Figure 6-1. Intel® RealSense™ LiDAR Camera L515

When integrated into system, it is recommended that the L515 be secured via the two M3 mounting screw holes on the back of the product. The cooling vents need to remain unobstructed at all times.
6.2 **L515 Cover Material Cleaning Procedure**

1. Do not use any chemical or water on the camera cover material.
2. Remove dust and dirt as much as possible from the cover material with a lens blower brush.
3. Wipe with a dry, clean micro-fiber cloth.
7 Regulatory Ecology Compliance

7.1 System Laser Compliance

The Intel® RealSense™ LiDAR Camera L515 certification is transferable to the system and no system recertification is required. However, the following statements and labels must be included in the user manual of the end product.

7.1.1 Certification Statement

This product is classified as a Class 1 Laser Product under the EN/IEC 60825-1, Edition 3 (2014) internationally.

In the US, this product is in conformity with performance standards for laser products under 21 CFR 1040, except with respect to those characteristics authorized by Variance Number 2018-V-3042-0001 effective on August 28, 2018.

7.1.2 Explanatory Label

![CLASS 1 LASER PRODUCT EN/IEC 60825-1, 2014 (EU & other)]

This product is in conformity with performance standards for laser products under 21 CFR 1040, except with respect to those characteristics authorized by Variance Number 2018-V-3042-0001 effective on August 28, 2018.

7.1.3 Cautionary Statements

System integrators should refer to their respective regulatory and compliance owner to finalize regulatory requirements for a specific geography.
Caution - Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

- Do not power on the product if any external damage was observed.
- Do not attempt to open any portion of this laser product. There are no user serviceable parts.
- Invisible laser radiation when opened. Avoid direct exposure to beam.
- There are no service/maintenance, modification, or disassembly procedures for the stereo module and infrared projector. The system integrator must either notify Intel or return modules before any failure analysis is performed.
- Modification or service of the stereo module, specifically the infrared projector, may cause the emissions to exceed Class 1.
- Do not try to update camera firmware that is not officially released for specific camera module SKU and revision.

7.1.4 Embedded Laser Information

- Wavelength (0-50°C): 844-875nm
- Beam divergence (without collimation): (6x10) deg to (15-21) deg; parallel x perpendicular
- Pulse duration and repetition rate:
  - 1ns pulse duration
  - 500 MHz repetition
  - Rise/Fall time: 300ps
- Maximum power or energy output: 240mW

7.1.5 US FDA Accession Number

Table 7-1. U.S. FDA Accession Number

<table>
<thead>
<tr>
<th>Component</th>
<th>U.S. FDA accession numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel® RealSense™ LiDAR Camera L515</td>
<td>1820840</td>
</tr>
</tbody>
</table>

This accession number should be entered into Box B.1 of the Food and Drug Administration (FDA) 2877 Declaration for Imported Electronic Products Subject to Radiation Control Standards.
7.2 Regulatory Compliance

7.2.1 Manufacturer’s Information
Intel Corporation:
Attn: Corp. Quality
2200 Mission College Blvd,
Santa Clara, CA 95054-1549, USA

7.2.2 EU Single Place of Contact
Att. Corp Quality
Intel Deutschland GmbH
Am Campeon 10-12
Neubiberg, 85579 – Germany

7.3 Ecology Compliance

7.3.1 China RoHS Declaration

China RoHS Declaration

<table>
<thead>
<tr>
<th>部件名称 Component Name</th>
<th>有毒有害物质或元素 Hazardous Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>铅 Pb</td>
</tr>
<tr>
<td>相机 Camera</td>
<td>○</td>
</tr>
<tr>
<td>印刷电路板组件 Printed Board Assemblies</td>
<td>X</td>
</tr>
<tr>
<td>三角架 Tripod</td>
<td>○</td>
</tr>
<tr>
<td>电缆 Cable</td>
<td>○</td>
</tr>
</tbody>
</table>
### 7.3.2 Waste Electrical and Electronic Equipment (WEEE)

“In the EU, this symbol means that this product must not be disposed of with household waste. It is your responsibility to bring it to a designated collection point for the recycling of waste electrical and electronic equipment. For more information, contact the local waste collection center or your point of purchase of this product.”

---

| ○ | 表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572标准规定的限量要求以下。 |
| ○ | Indicates that this hazardous substance contained in all homogeneous materials of such component is within the limits specified in GB/T 26572. |
| × | 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572标准规定的限量要求。 |
| × | Indicates that the content of such hazardous substance in at least a homogeneous material of such component exceeds the limits specified in GB/T 26572. |

对销售之日的所售产品，本表显示我公司供应链的电子信息产品可能包含这些物质。注意：在所售产品中可能会也可能不会含有所有所列的部件。

This table shows where these substances may be found in the supply chain of our electronic information products, as of the date of sale of the enclosed product. Note that some of the component types listed above may or may not be a part of the enclosed product.

除非另外特别的标注，此标志为针对所涉及产品的环保使用期限标志。某些可更换的零部件可能会有一个不同的环保使用期限（例如：电池单元模块）。

此环保使用期限只适用于产品在产品手册中所规定的条件下工作。

The Environment-Friendly Use Period (EFUP) for all enclosed products and their parts are per the symbol shown here, unless otherwise marked. Certain field-replaceable parts may have a different EFUP (for example, battery modules) number. The Environment-Friendly Use Period is valid only when the product is operated under the conditions defined in the product manual.
Inside Intel® RealSense™ LiDAR Camera L515 product box you will find the L515 camera, a tripod and a USB3 cable.

Figure 8-1. L515 Product Box