



Intel® RealSense™ Product Family D400 Series

Specification Update

Revision 023

August 2020

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Revision History

| Document Number | Revision Number | Description | Revision Date |
|-----------------|-----------------|-------------------------------------|----------------|
| 337125 | 001 | Production Firmware 5.8.15 Release | February 2018 |
| | 002 | Production Firmware 5.9.2 Release | March 2018 |
| | 003 | Development Firmware 5.9.9 Release | April 2018 |
| | 004 | Development Firmware 5.9.11 Release | May 2018 |
| | 005 | Production Firmware 5.9.13 Release | June 2018 |
| | 006 | Development Firmware 5.9.14 | July 2018 |
| | 007 | Development Firmware 5.10.3 | August 2018 |
| | 008 | Production Firmware 5.10.6 | October 2018 |
| | 009 | Development Firmware 5.10.13 | November 2018 |
| | 010 | Production Firmware 5.11.1 | January 2019 |
| | 011 | Production Firmware 5.11.1.100 | February 2019 |
| | 012 | Development Firmware 5.11.4 | February 2019 |
| | 014 | Production Firmware 5.11.6.250 | June 2019 |
| | 015 | Development Firmware 5.11.11.100 | August 2019 |
| | 016 | Development Firmware 5.11.15.0 | September 2019 |
| | 017 | Development Firmware 5.12.0 | November 2019 |
| | 018 | Development Firmware 5.12.1 | December 2019 |
| | 019 | Development Firmware 5.12.2.100 | January 2020 |
| | 020 | Development Firmware 5.12.3.0 | February 2020 |
| | 021 | Development Firmware 5.12.5.0 | June 2020 |
| | 022 | Development Firmware 5.12.6.0 | July 2020 |
| | 023 | Production Firmware 05.12.07.100 | August 2020 |

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1 Preface

This document is an update to the specification contained in the [Affected Documents](#) table below. This document is a compilation of device and documentation errata, specification clarifications and changes. It is intended for hardware systems manufactures and software developers of applications, systems or tools.

Information types defined in Nomenclature are consolidated into the specification updates and are no longer published in other documents.

This document may also contain information that was not previously published.

1.1 Affected Documents

| Document Title | Location |
|---|---|
| Intel® RealSense™ D400 Series Product Family Datasheet | https://dev.intelrealsense.com/docs/intel-realsense-d400-series-product-family-datasheet |

1.2 Nomenclature

Errata are design defects or errors. These may cause behavior to deviate from published specifications. Hardware and software designed to be used with any given stepping must assume that all errata documented for that stepping are present on all devices.

Specification Changes are modifications to the current published specifications. These changes will be incorporated in any new release of the specifications.

Specification Clarifications describe a specification in greater detail or further highlight a specification's impact to a complex design situation. These clarifications will be incorporated in any new release of the specification.

Documentation Changes include typos, errors, or omissions from the current published specifications. These will be incorporated in any new release of the specification.

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2 Summary Table of Changes

The following tables indicate the errata, specification changes, specification clarifications, or documentation changes which apply to the Product Name product. Intel may fix some of the errata in a future stepping of the component and account for the other outstanding issues through documentation or specification changes as noted.

2.1 Codes Used in Summary Tables

Status

| | |
|-----------|---|
| Doc: | Document change or update will be implemented |
| Open: | In engineering assessment |
| Plan Fix: | This erratum may be fixed in a future firm of the product |
| Fixed: | This erratum has been previously fixed |
| No Fix: | There are no plans to fix this erratum |

Table 2-1. Errata Summary Table

| Number | Status | Errata |
|----------|--|--|
| DSO-7194 | Fixed in Windows 10* RS4 | Windows driver [mskssrv.sys] may crash with D400 series cameras in stress test condition |
| DSO-7755 | Fixed in Development Firmware 5.9.9 | Temporary stream hang observed on disabling Auto Exposure (AE) at 1280X720 resolution after any previous 90 FPS stream |
| DSO-7798 | Fixed in Production Firmware 5.9.2 | RGB at 60 FPS may not have the right exposure set when exposure is equal/less than -2 |
| DSO-7849 | Fixed in Development Firmware 5.9.9 | ROI based depth streaming immediately after change of IR projector power may result in a stream hang |
| DSO-7854 | Fixed in Production Firmware 5.9.13 | Depth Stream hang when system resumes from Sleep (S3) |
| DSO-7976 | Fixed in Production Firmware 5.9.2 | D400 Series camera is not recognized after reboot on Linux |
| DSO-8007 | Fixed in Windows Driver 5.160.1.5+ | Firmware updates via DFU fails when firmware update limit is reached |
| DSO-8328 | Fixed in Production Firmware 5.9.13 | Metadata attribute "Trigger" indicating Depth to Color synchronization may not have correct value |
| DSO-8461 | Not a RealSense bug (Requires Chrome* fix) | D400 Series Windows UWP driver does not work with Chrome browser |
| DSO-8467 | Fixed in LibRealSense2.10.1 | Left Imager UYVY format displays green image |

Summary Table of Changes

| Number | Status | Errata |
|----------------------|--|---|
| DSO-8538 | Fixed in Development Firmware 5.9.11 | Color correction parameters are not updated correctly |
| DSO-8565 | No Fix (expected as per current design) | Infrared speckles on color image from D415 and D435 cameras |
| DSO-6804 DSO-8681 | No Fix | D400 Series cameras intermittently enumerated as USB2 device on unplug/plug |
| DSO-9006 | Fixed in Development Firmware 5.9.11 | Frame rate does not change when manual exposure value is changed |
| DSO-9074 | Closed . This is USB2 Bandwidth related | Simultaneous streaming Depth, Imager and Color may result in data stream hang when camera is connected through USB2 |
| DSO-9094 | Fixed in Development Firmware 5.9.11 | Specific controls values missing in frames metadata |
| DSO-9153 | Fixed in Development Firmware 5.9.11 | D400 series camera fails to be recognized on system reboot when connected through USB3 |
| DSO-9224 | Fixed in Production Firmware 5.9.13 | IR Projector pattern flicker when streaming through USB2 connection |
| DSO-9228 | Fixed in Production Firmware 5.9.13 | D400 series camera disconnects on resume from system sleep when connected through USB2 |
| DSO-9240 | Fixed in Production Firmware 5.9.13 | D400 Series camera fails to be recognized on system reboot when connected through USB2 |
| DSO-9478 | Fixed in Production Firmware 5.10.6 | Image Flicker when Auto Exposure (AE) is enabled |
| DSO-9501 | Fixed in Windows 10* RS5 | Camera is not functional after HLK Sensor test when connected through USB2 |
| DSO-9546 | Fixed in Development Firmware 5.9.14 | IR projector pattern flicker when streaming at 1280X720, 4 FPS and connected through USB2 |
| DSO-9556 | Fixed in Development Firmware 5.10.3 | Camera stuck after streaming start-stop at Low FPS for few times |
| DSO-9645 | Fixed in Development Firmware 5.10.3 | Darker depth frame when changing depth exposure from [165760 - 165780] and connected through USB2 |
| DSO-10002 | Fixed in Development Firmware 5.10.3 | Calibration tables may get corrupted during power on and off cycles |
| DSO-10011 | No Fix | Auto Exposure (AE) for Color is not optimized for bright sunlight |
| DSO-10428 | Fixed in Development Firmware 5.11.4 | IR Image is black in Auto Exposure (AE) mode with sudden exposure to light |
| DSO-10431 | Fixed in Production Firmware 5.11.1 | IR image may flicker in outdoor sunlight when using Auto Exposure (AE) with default set point |
| DSO-10503 | Open | Low fill rate in outdoor environment using Auto Exposure (AE) |
| DSO-10603 | Fixed in Development Firmware 5.12.3.0 | Unable to set the Depth Exposure Time < 70 usec through USB2 |
| DSO-10777 | Fixed in LibRealSense | D435i - Buffer overflow on repeated start/stop |
| DSO-10674 | Fixed in LibRealSense | D435i - The first (cold) start of IMU sensors in LibRealSense on Linux takes ~4 sec |

Summary Table of Changes

| Number | Status | Errata |
|------------------------|---|---|
| DSO-10920 | Fixed in LibRealSense | First frames not received on metadata test |
| DSO-11041 | Fixed in LibRealSense | D435i – Unreasonably large accelerometer reading in Windows 10 |
| DSO-10591 | No Fix | In Multi Camera mode, sporadic and inconsistent frame drops and streaming halt |
| DSO-11040 | Fixed in Development Firmware 5.11.4 | D435 – Depth/IR corrupted image when streaming multi stream and RGB exposure is < -6 |
| DSO-11042 | Fixed in Development Firmware 5.11.11.100. LibRealSense 2.20.0 required. | D430 – RealSense Viewer errors out post reboot after using the “Hand” preset. |
| DSO-12586 | Fixed in Development Firmware 5.11.11.100 | D415, D435/D435i – RGB camera not available after FW Update process using DFU |
| DSO-12587 DSO-12814 | Fixed in Production Firmware 5.11.6.250 | D435i – Upgrading to FW version 5.11.6.200 causes corrupted calibration table. Note: Due to this issue this FW was removed. |
| DSO-10229 DSO-13386 | Fixed in Development Firmware 5.11.15.0 | Camera fail after start, stop of random profiles |
| DSO-13540 | Fixed in Development Firmware 5.11.15.0 | D415 – Intel® RealSense™ Self-Calibration doesn’t converge using D415 camera |
| DSO-13546 | Fixed in Development Firmware 5.12.0 | D435i – IMU frame drops |
| DSO-13554 | Fixed in Development Firmware 5.11.15.0 | D420 – Camera will stop working after FW update |
| DSO-12578 | Fixed in Development Firmware 5.12.3.0 | Device not recognized in device manager after machine reboot |
| DSO-14309 | Fixed in LibRealSense | Scale error after Tare calibration (Intel® RealSense™ Self-Calibration) was significantly degraded |
| DSO-14530 | Open | Frame drops when running on Ubuntu 18.04 with Kernel 5 |
| DSO-14525 | Open | D435i – Camera not released to idle state on Ubuntu 18.04 with Kernel 5 |
| DSO-14504 | Open | D435i – Frame drops in gyro stream on Windows |
| DSO-14517 | Fixed in Development Firmware 5.12.5.0 | 10 FPS not supported on Depth/IR 848x480 when connected through USB2 |
| DSO-14455 | Open | Frames stop arriving after few minutes on Windows 10 RS4 |
| DSO-13306 | Fixed in Development Firmware 5.12.5.0 | Frames stop arriving after few frames in Color/Depth stream due to unexpected halt on Windows 10 RS4 |
| DSO-14512 | Fixed in Development Firmware 5.12.6.0 | D435i – Failed to start IMU stream after resetting device |
| DSO-14526 | Fixed in Development Firmware 5.12.5.0 | D435i – Sending HW_reset immediately after stop streaming causes the camera to boot into invalid state |
| DSO-14558 | Fixed in Development Firmware 5.12.5.0 | Fails USB enumeration during PC restart |
| DSO-14499 | Open | Config error when stopping Color stream on Windows 10 RS4 |

Summary Table of Changes

| Number | Status | Errata |
|-----------|---|--|
| DSO-14349 | Fixed in LibRealSense | FW Update ID mismatch before and after entering DFU |
| DSO-14337 | Fixed in Development Firmware 5.12.5.0 | IR Frames stop arriving after several camera start/stop |
| DSO-14308 | Open | D415 - Self-Calibration/Tare fails to converge 20% of the time |
| DSO-14978 | Open | D455 - Depth/IR frame drops |

Table 2-2. Specification Changes

| Number | Specification Changes |
|------------------------|--|
| | Development Firmware v5.10.13 adds support for Intel® RealSense™ D435i camera. |
| | Firmware v5.9.2+ adds USB 2.0 support for Intel® RealSense™ D410, D415 and D435 cameras. The USB2.0 is supported for OS Linux and Windows*10 with Intel® RealSense™ SDK 2.10.4+ To ensure the best of quality of service, connection to a dedicated USB2 root port is desired. |
| DSO-9015 | Development firmware 5.11.15 allows a D4xx camera to run as an R200 via a JSON file. LibRealSense 2.20.0 or higher is required for this feature. |
| DSO-12258 | Development firmware 5.11.11.100 and LibrealSense 2.23.0 will bring improved depth linearity and absolute accuracy. Please see https://dev.intelrealsense.com/docs/white-paper-subpixel-linearity-improvement-for-intel-realsense-depth-cameras |
| DSO-12399 | Development Firmware 5.11.11.100 provides USB 2.0 support for D430 module. LibRealSense 2.21.0 or higher is required for this feature. |
| DSO-12266 DSO-12267 | Development Firmware 5.11.15.0 provides the ability for Self-Calibration (Intel® RealSense™ Self-Calibration) to improve depth noise/precision. Also provides the ability for Tare calibration (Intel® RealSense™ Self-Calibration) to improve absolute accuracy. LibRealSense 2.29.0 or higher is required for this feature on D400 series devices. |
| DSO-14282 | Development Firmware 5.12.3.0 provides additional USB2.0 formats for depth and IR streams. The available format for depth and IR 848x480 @ 6FPS, 10FPS. |
| DSO-12490 DSO-12281 | Development Firmware 5.12.5.0 provides single frame triggering feature called External Synchronization (GenLock) for D43x global shutter only cameras. The release also includes support for 256x144 @ 300FPS and 848x100 @ 300FPS formats for D43x cameras. |

Table 2-3. Specification Clarifications

| No. | Specification Clarifications |
|-----|--|
| | <p>Firmware releases are classified as "Production" and "Development" Firmware.</p> <p>Production Firmware – Firmware version recommended for Production builds integrating Intel® RealSense™D400 Series, Remote product update and Software development.</p> <p>Development Firmware – Firmware version recommended for software developers and may contain features that have not been fully validated by Intel. The development firmware is not recommended for production builds or remote product update.</p> |

Table 2-4. Documentation Changes

| No. | Documentation Changes |
|-----|--|
| | None for this revision of this specification update. |

Summary Table of Changes

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3 Errata

3.1 Open

| | |
|------------------------------------|---|
| DSO-6804 DSO-8681 | D400 Series camera intermittently enumerated as USB2 device on unplug/plug |
| Problem: | D400 Series camera intermittently enumerates as a USB 2.0 high speed device when the camera is plugged to a USB 3.1 Gen1 port. |
| Implication: | The issue is seen on Windows* and Linux*. The issue is not applicable when Host to Camera connection is Type-C (Host) to Type-C (Camera) |
| Workaround: | Plug in to Host (USB-Type A) after camera connection (Type-C) or alternately physical unplug-plug a camera with different insertion speeds. Issue more likely to occur on slow plug insertion into USB 3.1 Gen1 port. |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|--|
| DSO-10503 | Low fill rate in outdoor environment using Auto Exposure (AE) |
| Problem: | In outdoor light condition (at shaded area), the fill rate might be lower compared to older firmware versions. |
| Implication: | The failure is observed with Depth Camera D435 |
| Workaround: | None |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|---|
| DSO-14530 | Frame drops when running on Ubuntu 18.04 with Kernel 5 |
| Problem: | Start multiple streams (IR, Color, Gyro and Accelerometer), receive frame drops on streams. |
| Implication: | The failure is observed with Depth Camera D400 series |
| Workaround: | None |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|--|
| DSO-14525 | D435i – Camera not released to idle state on Ubuntu 18.04 with Kernel 5 |
| Problem: | D435i camera not going into idle state on Ubuntu 18.04 with Kernel 5. |
| Implication: | The failure is observed with Depth Camera D435i |
| Workaround: | None |
| Status: | Refer the <i>Summary Tables of Changes</i> |

Errata

| | |
|---------------------|---|
| DSO-14504 | D435i – Frame drops in gyro stream on Windows |
| Problem: | Start multiple streams (IR, Color, Gyro and Accelerometer), receive frame drops on gyro stream. |
| Implication: | The failure is observed with Depth Camera D435i |
| Workaround: | None |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|--|
| DSO-14455 | Frames stop arriving after few minutes on Windows 10 RS4 |
| Problem: | Start streams (Depth, IR, Color, Gyro and Accelerometer), frames stop arriving after a few minutes of streaming. |
| Implication: | The failure is observed with Depth Camera D400 series |
| Workaround: | None |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|--|
| DSO-14499 | Config error when stopping Color stream on Windows 10 RS4 |
| Problem: | With camera connected and RealSense Viewer open, starting Color stream (exposure min value), then changing exposure to max value and stopping Color stream causes error. |
| Implication: | The failure is observed with Depth Camera D400 series |
| Workaround: | Recovery can occur by restarting the Color stream |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|---|
| DSO-10591 | In Multi Camera mode, sporadic and inconsistent frame drops and streaming halt |
| Problem: | <p>When Multi-camera configured:</p> <ul style="list-style-type: none"> • Depth+Color VGAX30FPS • Start-stop streaming, 30 sec streaming duration <p>There is sporadic:</p> <ul style="list-style-type: none"> • High rate of frame drops received • Exception 'profile not found' received |
| Implication: | The failure is observed with Depth Camera D400 series |
| Workaround: | Application should be restarted in order to continue to work |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|--|
| DSO-14308 | D415 – Self-Calibration/Tare fails to converge 20% of the time |
| Problem: | During Self-Calibration and Tare process, the calibration fails to converge 20% of the time. |
| Implication: | The failure is observed with Depth Camera D415 |
| Workaround: | None |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|---|
| DSO-14978 | D455 – Depth/IR frame drops |
| Problem: | When setting depth and IR resolution 480x270 @ 5FPS, can take up to 8 sec before first frame arrives. |
| Implication: | The failure is observed with Depth Camera D455 |
| Workaround: | None |
| Status: | Refer the <i>Summary Tables of Changes</i> |

3.2 Fixed

| | |
|---------------------|---|
| DSO-7194 | Windows driver [mskssrv.sys] may crash with D400 Series camera in stress testing |
| Problem: | Windows driver crashes in start- stop streaming iterations. It may take hundreds of start – stop streaming iterations for failure to occur. |
| Implication: | D400 Series camera fails to be recognized in Windows Device Manager |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|--|
| DSO-7755 | Temporary stream hang observed on disabling Auto Exposure (AE) at 1280X720 resolution after any previous 90 FPS stream. |
| Problem: | Play any 90 FPS depth or left or right imager stream -> stop -> play 1280x720 resolution -> disable Auto Exposure (AE) -> the stream gets stuck for few seconds. |
| Implication: | Depth or left and right Imager streams are stuck for a few seconds |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|--|
| DSO-7798 | RGB at 60 FPS may not have the right exposure set when exposure is equal/less than -2 |
| Problem: | Manual exposure with value equal or less than -2 may not result in right exposure. |
| Implication: | Depth module D415 and Depth cameras D415 and D435 with RGB sensor are affected by this issue |
| Status: | Refer the <i>Summary Tables of Changes</i> |

Errata

| | |
|---------------------|--|
| DSO-7849 | ROI based depth streaming immediately after change of IR projector power may result in a stream hang |
| Problem: | Frames do not arrive after ROI (Region of Interest) is selected to start streaming immediately after a change is made to the IR projector power. |
| Implication: | No depth streaming |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|---|
| DSO-7854 | Depth Stream hang when system resumes from Sleep (S3) |
| Problem: | System resume from S3 does not resume depth streaming and requires application restart. |
| Implication: | Currently seen on Windows* only. |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|--|
| DSO-7976 | D400 series camera is not recognized after reboot on Linux |
| Problem: | Device does not appear in the device manager (lsusb) |
| Implication: | The frequency of the problem occurrence depends on specific Kernel version. It occurs more frequently on 4.4.0.x kernel versions and less frequently with 4.10.x kernel versions. Not seen on Windows* |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|--|
| DSO-8007 | Firmware updates via DFU Service fails when firmware update limit is reached |
| Problem: | D400 series firmware update engine will allow a return to a previous version or baseline version of firmware up to 20 times unless a higher version of firmware. DFU service as part of Windows Driver package updates camera firmware when camera connected has a firmware version different than expected. The DFU service fails to function when firmware update limit of 20 is reached. |
| Implication: | When the firmware update limit is reached, firmware update fails even if higher firmware version. DFU service is in Windows driver package only. |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|--|
| DSO-8328 | Metadata attribute "Trigger" indicating Depth to Color synchronization may not have correct value |
| Problem: | Trigger is a metadata field and its value indicates whether the depth and color streams are synced (1) or not (0). The value in this metadata field indicating synchronization may have the wrong value. |
| Implication: | D400 series cameras, D415 and D435 with color sensor |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|---|
| DSO-8461 | D400 Series Windows driver does not work with Chrome browser |
| Problem: | When Windows driver is installed on a Windows*10 system, chrome browser does not recognize D400 Series camera in chrome://settings/content/camera |
| Implication: | D400 series camera is recognized without Windows driver installed. |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|---|
| DSO-8467 | Left Imager UYVY format displays green image |
| Problem: | Streaming color out of left imager in UYVY format displays a green image |
| Implication: | RealSense Viewer displays a green image when UYVY format is selected for left imager stream |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|--|
| DSO-8538 | Color correction parameters are not updated correctly |
| Problem: | Color correction parameters update to default values |
| Implication: | This issue affects color from left imager in cameras D400, D410 & D415 |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|--|
| DSO-8565 | Infrared speckles on color image from D415 and D435 cameras |
| Problem: | Infrared speckles are seen on color image from D415 and D435 cameras when laser power is at maximum or closer to maximum value |
| Implication: | Infrared speckles reduces with distance and ambient lighting |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|---|
| DSO-9006 | Frame rate does not change when manual exposure value is changed |
| Problem: | Frame rate (FPS) may need to change based on the exposure value and in some cases the FPS may not change as expected. |
| Implication: | Issue observed with camera D430 and D435 |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|--|
| DSO-9074 | Simultaneous streaming Depth, Imager and Color may result in data stream hang when camera is connected through USB2 |
| Problem: | One or two streams hangs may hang when simultaneously streaming Depth, Imager and Color data when camera is connected through USB2 |
| Implication: | The issue is not observed when 1 or 2 data streams are simultaneously streaming. The issue is observed on Windows* and Linux* |
| Status: | Refer the <i>Summary Tables of Changes</i> |

Errata

| | |
|---------------------|---|
| DSO-9094 | Specific controls values missing in frames metadata |
| Problem: | Frames arrive without controls values in Metadata |
| Implication: | Missing metadata for valid frames. Issue observed in Linux* |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|---|
| DSO-9153 | D400 series camera fails to be recognized on system reboot when connected through USB3 |
| Problem: | D400 Series camera may fail to be recognized on system reboot when connected through USB3 |
| Implication: | The issue is observed on Windows*. Camera not recognized in Windows Device Manager |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|--|
| DSO-9224 | IR Projector pattern flicker when streaming through USB2 connection |
| Problem: | IR Projector pattern flicker maybe observed when camera is streaming through a USB2 connection |
| Implication: | The flicker may be observed after streaming for some time (~3 minutes) independent of resolution and frame rate. It is observed in D400 series cameras with IR projectors and on Windows* and Linux* |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|---|
| DSO-9228 | D400 series camera disconnects on resume from system sleep when connected through USB2 |
| Problem: | D400 series camera may disconnect on resume from system sleep when connected through USB2. |
| Implication: | Application such as Intel® RealSense Viewer streaming before entering system sleep fail to function on resume from sleep as the camera may fail to be recognized. The issue is only observed on Linux* OS |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|---|
| DSO-9240 | D400 Series camera fails to be recognized on system reboot when connected through USB2 |
| Problem: | D400 Series camera may fail to be recognized on system reboot when connected through USB2 |
| Implication: | The issue is observed on Windows* and Linux* |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|---|
| DSO-9478 | Image Flicker when Auto Exposure (AE) is enabled |
| Problem: | Image flicker may be observed under certain light conditions when Auto Exposure (AE) is enabled |
| Implication: | Image flicker seen on imager output streams may impact the depth stream |
| Status: | Refer the <i>Summary Tables of Changes</i> |

| | |
|---------------------|---|
| DSO-9546 | IR projector pattern flicker when streaming at 1280X720, 4 FPS and connected through USB2 |
| Problem: | IR projector pattern flicker may be observed when streaming at resolution 1280X720, 4 FPS and camera connected to a USB2 connection |
| Implication: | The issue is observed on Windows* and Linux* |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|--|
| DSO-9556 | Camera stuck after streaming start-stop at Low FPS for few times |
| Problem: | Camera depth streams at low frame rates may be stuck after start-stop streaming a few times |
| Implication: | The issue is observed for both, USB3 and USB2 camera connection and at 6FPS. Re-plugging the camera is required to be able to communicate with the camera again. |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|---|
| DSO-9645 | Darker depth frame when changing depth exposure from [165760 - 165780] and connected through USB2 |
| Problem: | Darker (holes) depth frames are observed when depth exposure is changed between 165760 and 165780 range of values |
| Implication: | When streaming depth / IR configuration with resolutions [480x270/640x480] and [6/15/30/60] fps and camera connected through USB2 |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|--|
| DSO-10002 | Calibration tables may get corrupted during power on and off cycles |
| Problem: | Power on/off cycles may cause calibration table to get corrupted |
| Implication: | Invalid depth stream |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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| DSO-10011 | Auto Exposure (AE) for Color is not optimized for bright sunlight |
| Problem: | Auto Exposure for Color is not optimized for bright sunlight. |

Errata

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| Implication: | Depth Cameras D415 and D435 support color through dedicated RGB sensor and are impacted by this issue. The cameras cannot be used for color in bright sunlight for use cases that require good AE based region of interest (ROI) |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|--|
| DSO-10428 | IR Image is black in Auto Exposure (AE) mode with sudden exposure to light |
| Problem: | When switching from no light to full outdoor sunlight in AE mode, IR image turns black |
| Implication: | The failure is observed with Depth Camera D415 |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|--|
| DSO-10431 | IR image may flicker in outdoor sunlight when using Auto Exposure (AE) with default set point |
| Problem: | IR image flickers in outdoor sunlight when using Auto Exposure with default AE set-point (1536) and higher |
| Implication: | The failure is observed with Depth Camera D435 |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|---|
| DSO-10674 | D435i – The first (cold) start of IMU sensors in LibRealSense on Linux takes ~4 sec |
| Problem: | Sending request to stream Accel/Gyro data results in 4 sec wait till the data starts to arrive. |
| Implication: | The failure is observed with Depth Camera D435i |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|---|
| DSO-10777 | D435i - Buffer overflow on repeated start/stop |
| Problem: | Cycling through start/stop with Depth+Gyro+Accelerator streams abruptly terminates with: Process finished with exit code 134 (interrupted by signal 6: SIGABRT) |
| Implication: | The failure is observed with Depth Camera D435i |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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| DSO-11040 | D435 – Depth/IR corrupted image when streaming multi stream and RGB exposure is < -6 |
| Problem: | Depth/IR corrupted image when streaming multi stream and RGB exposure is less than -6 |
| Implication: | The failure is observed with Depth Camera D435 |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|---|
| DSO-11041 | D435i – Unreasonably large accelerometer reading in Windows 10 |
| Problem: | Unreasonably large accelerometer reading in Windows 10 |
| Implication: | The failure is observed with Depth Camera D435i |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|---|
| DSO-11042 | D430 - RealSenseViewer crash after win10 PC reboot |
| Problem: | RealSense Viewer errors out post reboot after using the "Hand" preset |
| Implication: | The failure is observed with D415, -435, -430 |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|---|
| DSO-12586 | D415, D435/D435i – RGB camera not available after FW Update process using DFU |
| Problem: | Upgrade device using DFU after upgrade process is complete, RGB camera not available |
| Implication: | The failure is observed with D435/D435i and D415 |
| Workaround: | <p>Do not disconnect USB cable for 20+ secs after FW update process is complete. This allows the host system to enumerate the device properly.</p> <p>If device is experiencing this issue, please use the following steps to downgrade FW to recover</p> <p>Downgrade device FW to Development FW 5.11.4 using DFU tool (making sure to do not disconnect USB cable for 20+ secs after FW update is complete and device has been enumerated and detected by host platform)</p> |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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| DSO-12587 DSO-12814 | D435i – Upgrade to latest production FW causes corrupted calibration table |
| Problem: | Upgrade device to latest production FW causes corrupted calibration table |
| Implication: | The failure is observed with D435i |
| Workaround: | If the device has been upgraded to FW 5.11.6.200, run LibRealSense ver 2.23 (or higher), and it will correct the calibration table. Alternatively, downgrade FW to Development FW 5.10.13 and verify that the calibration table is OK. |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|--------------------------------|---|
| DSO-10229 DSO-13386 | Camera fail after start, stop of random profiles |
| Problem: | When trying to stream more than one camera stream (depth, infrared and color) in a random profile, the camera streams aborts. |
| Implication: | None |
| Workaround: | Disconnect and reconnect camera |

Errata

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| Status: | Refer the <i>Summary Tables of Changes</i> |
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| DSO-13540 | D415 – Intel® RealSense™ Self-Calibration doesn't converge using D415 camera |
| Problem: | When running Intel® RealSense™ Self-Calibration process via LibRealSense, the error "Calibration didn't converge! (EDGE_TO_CLOSE) please retry in different lighting conditions" is seen. |
| Implication: | The failure is observed with Depth Camera D415 |
| Workaround: | None |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|--|
| DSO-13554 | D420 – Camera will stop working after FW update |
| Problem: | When upgrading FW, the D420 stops working. |
| Implication: | The failure is observed with Depth Module D420 |
| Workaround: | If D420 is not experiencing issue, do not upgrade FW |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|---|
| DSO-13546 | D435i – IMU frame drops |
| Problem: | When depth, infrared, color, gyro and accel are streaming for a long period of time, frame drops (gyro and accel) are observed. |
| Implication: | The failure is observed with Depth Camera D435i |
| Workaround: | None |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|---|
| DSO-10920 | First frames not received on metadata test |
| Problem: | Metadata start frame on depth/IR/color stream began from 2 or 3 value, the expected value is 1. |
| Implication: | None |
| Workaround: | Ignore first frame of metadata |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|---|
| DSO-12578 | Device not recognized in device manager after machine reboot |
| Problem: | When rebooting system under Windows operating system, camera is not recognized by device manager. |
| Implication: | None |
| Workaround: | None |

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| Status: | Refer the <i>Summary Tables of Changes</i> |
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| DSO-14309 | Scale error after Tare calibration (Intel® RealSense™ Self-Calibration) was significantly degraded |
| Problem: | When using Tare calibration functionality, the scale error can be significantly degraded. |
| Implication: | None |
| Workaround: | None |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|--|
| DSO-9501 | Camera is not functional after HLK Sensor test when connected through USB2 |
| Problem: | Camera is not functional after HLK Sensor test when connected through USB2 (Windows HLK) |
| Implication: | The issue is observed on production units and not seen on pre-production samples. |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|--|
| DSO-10603 | Unable to set the Depth Exposure Time < 70 usec through USB2 |
| Problem: | When connected through USB2, setting Depth Exposure Time less than 70 usec will result in artifacts and over-exposed frames. |
| Implication: | The failure is observed with Depth Camera D400 series |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|---|
| DSO-14526 | D435i – Sending HW_reset immediately after stop streaming causes the camera to boot into invalid state |
| Problem: | Sending HW_reset immediately after stop streaming causes the camera to boot into invalid state. |
| Implication: | The failure is observed with Depth Camera D435i |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|---|
| DSO-14517 | 10 FPS not supported on Depth/IR 848x480 when connected through USB2 |
| Problem: | When connected through USB2, 10 FPS is not available on depth or IR streams under 848x480 resolution. |
| Implication: | The failure is observed with Depth Camera D400 series |
| Status: | Refer the <i>Summary Tables of Changes</i> |

Errata

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|---------------------|---|
| DSO-14337 | IR Frames stop arriving after several camera start/stop |
| Problem: | During several iterations of start of frame stream, collect frames and stop streaming, the IR frames stop arriving. |
| Implication: | The failure is observed with Depth Camera D400 series |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|---|
| DSO-13306 | Frames stop arriving after few frames in Color/Depth stream due to unexpected halt on Windows 10 RS4 |
| Problem: | Frames stop arriving after few frames in Color/Depth stream due to unexpected halt on Windows 10 RS4. |
| Implication: | The failure is observed with Depth Camera D400 series |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|--|
| DSO-14558 | Fails USB enumeration during PC restart |
| Problem: | Camera sometimes fails USB3.1 enumeration during PC restart. |
| Implication: | The failure is observed with Depth Camera D400 series |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|---|
| DSO-14512 | D435i – Failed to start IMU stream after resetting device |
| Problem: | IMU stream fails to start after camera reset command is sent to the device. |
| Implication: | The failure is observed with Depth Camera D435i |
| Status: | Refer the <i>Summary Tables of Changes</i> |

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|---------------------|---|
| DSO-14349 | FW Update ID mismatch before and after entering DFU |
| Problem: | Before and after entering DFU for FW Update, the FW Update ID shows mismatch. |
| Implication: | The failure is observed with Depth Camera D400 series |
| Status: | Refer the <i>Summary Tables of Changes</i> |

4 Appendix

4.1 Functional Specification

Table 4-1. Image Formats (USB 2.0)

| Format | Resolution | Frame Rate | Comment |
|------------------------------------|------------|------------|---|
| Z [16 bits] | 1280x720 | 6 | Depth |
| | 848x480 | 6,10 | |
| | 640x480 | 6,15,30 | |
| | 640x360 | 30 | |
| | 480x270 | 6,15,30,60 | |
| | 1280x720 | 15 | Compressed Depth |
| Y8 [8 bits] | 1280x720 | 6 | Luminance Stream from Left Imager |
| | 848x480 | 6,10 | |
| | 640x480 | 6,15,30 | |
| | 480x270 | 6,15,30,60 | |
| UYVY [16 bits] | 1280x720 | 6 | Color Stream from Left Imager (D410 & D415) |
| | 640x480 | 6,15,30 | |
| | 480x270 | 6,15,30,60 | |
| YUY2 [16 bits] | 1280x720 | 6, 15 | Color Stream from RGB camera (Camera D415 & D435/D435i) |
| | 640x480 | 6,15,30 | |
| | 424x240 | 6,15,30,60 | |
| Intel® RealSense™ Self-Calibration | 256x144 | 90 | Intel® RealSense™ Self-Calibration and Tare format |

NOTE:

Depth and Color are mapped as separated interfaces. Each one of the interfaces is working independent with the other interface (Virtual channel in MIPI and End Point in USB). Right infrared imager stream is supported for calibration purposes only.