Intel® RealSense™ Product Family D400 Series

Specification Update

Revision 039

February 2025

Document Number: 337125

Intel products described herein. You agree to grant Intel a non-exclusive, royalty-free license to any patent claim thereafter drafted which includes subject matter disclosed herein.

No license (express or implied, by estoppel or otherwise) to any intellectual property rights is granted by this document.

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer or learn more at intel.com.

Intel technologies may require enabled hardware, specific software, or services activation. Check with your system manufacturer or retailer.

The products described may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request.

Intel disclaims all express and implied warranties, including without limitation, the implied warranties of merchantability, fitness for a particular purpose, and non-infringement, as well as any warranty arising from course of performance, course of dealing, or usage in trade.

All information provided here is subject to change without notice. Contact your Intel representative to obtain the latest Intel product specifications and roadmaps.

Copies of documents which have an order number and are referenced in this document may be obtained by calling 1-800-548-4725 or visit www.intel.com/design/literature.htm.

Intel and the Intel logo, Intel RealSense, Core trademarks of Intel Corporation in the U.S. and/or other countries.

*Other names and brands may be claimed as the property of others.

Contents

Table

Revision History

Revision Number	Description	Revision Date	Comment
001	Firmware 5.8.15 Release	February 2018	
002	Firmware 5.9.2 Release	March 2018	
003	Firmware 5.9.9 Release	April 2018	
004	Firmware 5.9.11 Release	May 2018	
005	Firmware 5.9.13 Release	June 2018	
006	Firmware 5.9.14	July 2018	
007	Firmware 5.10.3	August 2018	
008	Firmware 5.10.6	October 2018	
009	Firmware 5.10.13	November 2018	
010	Firmware 5.11.1	January 2019	
011	Firmware 5.11.1.100	February 2019	
012	Firmware 5.11.4	February 2019	
014	Firmware 5.11.6.250	June 2019	
015	Firmware 5.11.11.100	August 2019	
016	Firmware 5.11.15.0	September 2019	
017	Firmware 5.12.0	November 2019	
018	Firmware 5.12.1	December 2019	
019	Firmware 5.12.2.100	January 2020	
020	Firmware 5.12.3.0	February 2020	
021	Firmware 5.12.5.0	June 2020	
022	Firmware 5.12.6.0	July 2020	
023	Firmware 05.12.07.100	August 2020	
024	Firmware 05.12.08.200	October 2020	
025	Firmware 05.12.09.00	November 2020	
026	Firmware 05.12.10.00	January 2021	
027	Firmware 05.12.11.00	February 2021	
028	Firmware 05.12.12.100	March 2021	
029	Firmware 05.12.13.50	May 2021	
030	Firmware 05.12.14.50	June 2021	
031	Firmware 05.12.15.50	October 2021	
032	Firmware 05.13.0.50	November 2021	

033	Firmware 05.14.0.0	December 2022	
034	Firmware 05.15.0.2	June 2023	
035, 036	Firmware 05.15.1.0	November 2023	
037	Firmware 05.16.0.1	April 2024	
038	Firmware 05.15.1.55	September 2024	Check "Table 2 2. Specification Changes"
039	Firmware 05.16.3.0	February 2025	Check "Table 2 2. Specification Changes"

§§

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™ Product family D400 Series 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.

§§

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
RSDSO-7194	**Fixed** in Windows 10* RS4	Windows driver [mskssrv.sys] may crash with D400 series cameras in stress test condition
RSDSO-7755	**Fixed** in Firmware 5.9.9	Temporary stream hang observed on disabling Auto Exposure (AE) at 1280X720 resolution after any previous 90 FPS stream
RSDSO-7798	**Fixed** in Firmware 5.9.2	RGB at 60 FPS may not have the right exposure set when exposure is equal/less than -2
RSDSO-7849	**Fixed** in Firmware 5.9.9	ROI based depth streaming immediately after change of IR projector power may result in a stream hang
RSDSO-7854	**Fixed** in Firmware 5.9.13	Depth Stream hang when system resumes from Sleep (S3)
RSDSO-7976	**Fixed** in Firmware 5.9.2	D400 Series camera is not recognized after reboot on Linux
RSDSO-8007	**Fixed** in Windows Driver DMFT_5.160.1.5+	Firmware updates via DFU fails when firmware update limit is reached
RSDSO-8328	**Fixed** in Firmware 5.9.13	Metadata attribute “Trigger” indicating Depth to Color synchronization may not have correct value
RSDSO-8461	Not a RealSense bug (Requires Chrome* fix)	D400 Series Windows UWP driver does not work with Chrome browser
RSDSO-8467	**Fixed** in LibRealSense2.10.1	Left Imager UYVY format displays green image

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

Summary Table of Changes

Number	Status	Errata
RSDSO-10674	**Fixed** in LibRealSense	D435i – The first (cold) start of IMU sensors in LibRealSense on Linux takes ~4 sec
RSDSO-10920	**Fixed** in LibRealSense	First frames not received on metadata test
RSDSO-11041	**Fixed** in LibRealSense	D435i – Unreasonably large accelerometer reading in Windows 10
RSDSO-10591	No Fix	In Multi Camera mode, sporadic and inconsistent frame drops and streaming halt
RSDSO-11040	**Fixed** in Firmware 5.11.4	D435 – Depth/IR corrupted image when streaming multi stream and RGB exposure is < -6
RSDSO-11042	**Fixed** in Firmware 5.11.11.100. LibRealSense 2.20.0 required.	D430 – RealSense Viewer errors out post reboot after using the "Hand' preset.
RSDSO-12586	**Fixed** in Firmware 5.11.11.100	D415, D435/D435i – RGB camera not available after FW Update process using DFU
RSDSO-12587 RSDSO-12814	**Fixed** in 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.
RSDSO-10229 RSDSO-13386	**Fixed** in Firmware 5.11.15.0	Camera fail after start, stop of random profiles
RSDSO-13540	**Fixed** in Firmware 5.11.15.0	D415 – Intel® RealSense™ Self-Calibration doesn't converge using D415 camera
RSDSO-13546	**Fixed** in Firmware 5.12.0	D435i – IMU frame drops
RSDSO-13554	**Fixed** in Firmware 5.11.15.0	D420 – Camera will stop working after FW update
RSDSO-12578	**Fixed** in Firmware 5.12.3.0	Device not recognized in device manager after machine reboot
RSDSO-14309	**Fixed** in LibRealSense	Scale error after Tare calibration (Intel® RealSense™ Self-Calibration) was significantly degraded
RSDSO-14530	**Fixed** in LibRealSense	Frame drops when running on Ubuntu 18.04 with Kernel 5
RSDSO-14525	**Fixed** in LibRealSense	D435i – Camera not released to idle state on Ubuntu 18.04 with Kernel 5
RSDSO-14504	Open	D435i – Frame drops in gyro stream on Windows
RSDSO-14517	**Fixed** in Firmware 5.12.5.0	10 FPS not supported on Depth/IR 848x480 when connected through USB2
RSDSO-14455	**Fixed** in Windows 10 RS5	Frames stop arriving after few minutes on Windows 10 RS4
RSDSO-13306	**Fixed** in Firmware 5.12.5.0	Frames stop arriving after few frames in Color/Depth stream due to unexpected halt on Windows 10 RS4
RSDSO-14512	**Fixed** in Firmware 5.12.6.0	D435i – Failed to start IMU stream after resetting device

Number	Status	Errata
RSDSO-14526	**Fixed** in Firmware 5.12.5.0	D435i – Sending HW_reset immediately after stop streaming causes the camera to boot into invalid state
RSDSO-14558	**Fixed** in Firmware 5.12.5.0	Fails USB enumeration during PC restart
RSDSO-14499	**Fixed** in Firmware 05.12.09.00	Config error when stopping Color stream on Windows 10 RS4
RSDSO-14349	**Fixed** in LibRealSense	FW Update ID mismatch before and after entering DFU
RSDSO-14337	**Fixed** in Firmware 5.12.5.0	IR Frames stop arriving after several camera start/stop
RSDSO-14308	No Fix	D415 - Self-Calibration/Tare fails to converge 20% of the time
RSDSO-14978	**Fixed** in Firmware 5.12.11.0	D455 – Depth/IR frame drops
RSDSO-16289	**Fixed** in Firmware 5.12.11.0	When laser emitter is enabled via Python, laser turns on and off continuously
RSDSO-16765	**Fixed** in Firmware 5.12.13.50	Frames not arrived with 300fps
RSDSO-17659	**Fixed** in Firmware 5.13.0.50	D415 Depth Image fails upon start/stop cycling
RSDSO-17393	**Fixed** in Firmware 5.13.0.50	Cannot Reset Auto Exp/Gain Limit back to default value 0
RSDSO-17183	**Fixed** in Firmware 5.13.0.50	D430 depth fill rate is not good with high accuracy preset under 640x480
RSDSO-16964	**Fixed** in Firmware 5.13.0.50	Emitter_on_off stops when RGB camera stops
RSDSO-17567	**Fixed** in Firmware 5.13.0.50	RealSense Viewer Crashes after Surface Pro 7+ sleep
RSDSO-18928	No Fix, Downgrade is not allowed	New D455 cameras can't downgrade FW to <= 5.12.15.50
RSDSO-17832	Open	D455 & D415: Focal Length on chip calibration does not work with USB2
RSDSO-14986	Open	D455/D457 HW timestamp delta is 4.8FPS and not 5FP
RSDSO-17488	Open	D405 High UV error when aspect ratio is different than 16/9 (HD)
RSDSO-19055	No Fix	D450 + D4 ASIC board with FW version 5.12.7.100 cannot be updated
RSDSO-19117	Open	D457 and D456 Aux cap pop up
RSDSO-19280	Open	Self-Calibration: 'NEW' button doesn't show the updated calibration on RealSense Viewer
RSDSO-19269	Open	D435 RGB enumeration failure after a few HW reset
RSDSO-19297	Open	D457 camera in recovery mode cannot be recognized by the Viewer
RSDSO-19114	Open	D45x Z-accuracy out of Spec at high temp
RSDSO-19017	Open	Up to 80% dropped frames in several builds of Windows 11
RSDSO-19674	Open	Corrupted depth and IR frames in various streaming scenarios

Summary Table of Changes

Number	Status	Errata
RSDSO-20056	Open	D421: Laser is flickering at low exposure values (<1ms)
RSDSO-19836	No Fix	D421: high-pitched sound heard when streaming depth with laser

Table 2-2. Specification Changes

Number	Specification Changes
	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.
RSDSO-9015	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.
RSDSO-12258	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
RSDSO-12399	Firmware 5.11.11.100 provides USB 2.0 support for D430 module. LibRealSense 2.21.0 or higher is required for this feature.
RSDSO-12266 RSDSO-12267	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.
RSDSO-14282	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.
RSDSO-12490 RSDSO-12281	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.
RSDSO-15547 RSDSO-15001 RSDSO-15606	Firmware 05.12.08.200 provides support for depth HDR. For the D455 camera, enable synthetic RGB from left imager and half disparity. **Note:** Firmware 05.12.08.200 includes a change in API, when using the emitter on/off feature use the latest LibRealSense 2.39.0 or newer with Firmware 05.12.08.200 or newer. Depth HDR requires the latest LibRealSense 2.39.0 or newer with Firmware 05.12.08.200 or newer.
RSDSO-17182	Firmware 5.12.15.50 adds 8FPS for depth+IR1+IR2@848x480 on D435/D430 over USB2
RSDSO-17315	Firmware 5.12.15.50 enables D400 Color AE Priority by default
RSDSO-17425	Firmware 5.12.15.50 adds support for unrectified calibration + RGB YUY2 for D405 required for OEM calibration
RSDSO-18691	D435f and D435if are detected as separate products and can be identified by the SDK and the Intel RealSense viewer starting Firmware 5.15.0.2 and SDK version 2.54.1, from production line.
RSDSO-18278	Firmware 5.15.0.2 adds APIs to enable enhanced Auto Exposure algorithm for D455
RSDSO-19116	Firmware 05.15.1.0 adds support for Manual Depth HDR for D457
RSDSO-19302	Firmware 05.16.0.1 adds ssupport for variable IMU gyro sensitivity on D455 and D435i. check further info here
FW version 05.15.1.55	Firmware version 05.15.1.55 is at production line for selected cameras and is equal to 05.15.1.0 functionality. Refer to PCN #830705-00

Number	Specification Changes
FW version 5.16.3.0	Support for a new camera Module D421 with FW ver 5.16.3.0. This FW was only validated on D421, is not available to download and comes pre-loaded on the D421 module.

Table 2-3. Specification Clarifications

No.	Specification Clarifications
	All Intel® RealSense™ camera or module firmware releases are stable releases to be used in any stage of end-user product development and production. The current cadence is approx. 2 months. Customers can take full advantage of the new features and resolved issues throughout all releases. Check this errata and release notes for the details.

Table 2-4. Documentation Changes

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

§§

3 Errata

3.1 Open

RSDSO-6804 RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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:	This issue is fixed in Windows 10 RS5
Status:	Refer the *Summary Tables of Changes*

RSDSO-10591	**In Multi Camera mode, sporadic and inconsistent frame drops and streaming halt**
Problem:	When Multi-camera configured: • Depth+Color VGAx30FPS • Start-stop streaming, 30 sec streaming duration There is sporadic: • 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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-17832	**D455 & D415: Focal Length on chip calibration does not work with USB2**
Problem:	When selecting Focal Length Calibration - there is no IR ROI preview which is required for adjusting the camera position so the target is inside yellow rectangle of both left & right images
Implication:	On Chip calibration cannot work in USB2 and therefore is blocked for D415 & D455
Workaround:	Switch to USB3
Status:	Refer the *Summary Tables of Changes*

RSDSO-14986	**D455/D457 HW timestamp delta is 4.8FPS and not 5FP**
Problem:	D455/D457 HW timestamp delta is 4.8FPS and not 5FPS
Implication:	The HW TS delta is often higher than expected (208ms - 218ms) while the expected HW TS delta between two sequential frames with 5 fps is 200ms
Workaround:	Change the FPS
Status:	Refer the *Summary Tables of Changes*

RSDSO-19055	D450 + D4 ASIC board with FW version 5.12.7.100 cannot be updated
Problem:	When connecting a D4 ASIC board V3 with FW version <=5.12.13.50 with a new D450 optical module it is not recognized and cannot be updated See PCN 119628-01
Implication:	Cannot build a functional D455 like camera
Workaround:	Connect a different optical module: D410, D415 or D430 and update the FW to a version >= 5.13.0.50.
Status:	Refer the Summary Tables of Changes

RSDSO-19117	D457 and D456 Aux cap pop up after humidity and temperature stress test
Problem:	After 700 hours of humidity (90%) and temperature (60°) stress test, a few units had the aux cap pop up. There are no reports of this issue occurring with the products under normal operating conditions
Implication:	The unit is not closed and won't meet the IP65 rating
Workaround:	Close the cap
Status:	Refer the Summary Tables of Changes

RSDSO-19280	Self-Calibration: 'NEW' button doesn't show the updated calibration on RealSense Viewer
Problem:	When running Self calibration: On Chip , Tare or Focal calibration types and then toggling between the NEW / ORIGIN buttons (Before initiating 'APPLY NEW' or 'DISMISS'), the updated calibration isn't shown
Implication:	No impact on the self-calibration quality
Workaround:	None
Status:	Refer the Summary Tables of Changes

RSDSO-19269	D435 RGB enumeration failure after a few HW reset
Problem:	When sending a few consequent HW reset commands from the Viewer (or even just physically disconnect/connect the device), sometimes the RGB sensor doesn't enumerate properly. This issue is reproduced with D435 only
Implication:	The RGB sensor cannot stream from the viewer, though it exists in the device manager
Workaround:	Close and re-open the Viewer, or wait for 0.5 sec and re-enumerate the RGB sensor
Status:	Refer the Summary Tables of Changes

RSDSO-19114	D45x Z-accuracy out of Spec at high temp
Problem:	D45x cameras don't meet the Z-accuracy spec at 50°C case temperature as found in a 3-temperature qualification test (0°C, 25°C, 50°C)
Implication:	The Z-accuracy and hence depth quality, doesn't meet the KPI
Workaround:	Run self-calibration when the temperature is high or wait for the camera to cool down.
Status:	Refer the Summary Tables of Changes

RSDSO-19017	Up to 80% dropped frames in several builds of Windows 11
Problem:	When streaming at any frame rate and resolution with Windows 11 (KB5035853 OS Builds 22621.3296 and 22631.3296), high frame drop is experienced
Implication:	There's 50% probability to get up to 80% dropped frames
Workaround:	Switch to Windows 10 RS5 or Win 11 KB5030219 (OS Build 22621.2283) where there are no frame drops
Status:	Refer the Summary Tables of Changes

RSDSO-19674	Corrupted depth and IR frames in start stop scenario
Problem:	In random streaming scenarios the depth and IR frames are corrupted. This can occur after start/stop, or streaming of Depth, IR and RGB, when the projector can be turned On or Off.
Implication:	When the projector is Off the frames are black. When the projector is On, the upper part of the depth is corrupted, and the bottom part is black.
Workaround:	Stop and restart the stream
Status:	Refer the Summary Tables of Changes

RSDSO-20056	D421: Laser is flickering at low exposure values (<1ms)
Problem:	Laser flickering with AE (due to exposure values < 900us) with D421 module
Implication:	These exposure values are easily reached at minZ range
Workaround:	Work in manual fixed exposure >1msec
Status:	Refer the Summary Tables of Changes

RSDSO-19836	D421: high-pitched sound heard when streaming depth with laser
Problem:	High-pitched sound heard when streaming depth with laser using D421 module
Implication:	No impact on performance or reliability
Workaround:	Turn laser off, or just ignore the sound
Status:	Refer the Summary Tables of Changes

3.2 Fixed

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-10011	**Auto Exposure (AE) for Color is not optimized for bright sunlight**
Problem:	Auto Exposure for Color is not optimized for bright sunlight.
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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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:	Do not disconnect USB cable for 20+ secs after FW update process is complete. This allows the host system to enumerate the device properly. If device is experiencing this issue, please use the following steps to downgrade FW to recover Downgrade device FW to 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
Status:	Refer the *Summary Tables of Changes*

RSDSO-12587 **RSDSO-12814**	**D435i – Upgrade to latest Major FW causes corrupted calibration table**
Problem:	Upgrade device to latest Major 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 FW 5.10.13 and verify that the calibration table is OK.
Status:	Refer the *Summary Tables of Changes*

RSDSO-10229 **RSDSO-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
Status:	Refer the *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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
Status:	Refer the *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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
Status:	Refer the *Summary Tables of Changes*

RSDSO-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
Status:	Refer the *Summary Tables of Changes*

RSDSO-16289	**When laser emitter is enabled via Python, laser turns on and off continuously**
Problem:	When setting laser emitter to enabled in Python, laser turns on and off continuously.
Implication:	The failure is observed with Depth Camera D400 series
Status:	Refer the *Summary Tables of Changes*

RSDSO-16765	**Frames not arrived with 300fps**
Problem:	When setting depth 256x144 @ 300FPS, frames not arrived.
Implication:	The failure is observed with Depth Camera D400 Series

Status:	Refer the *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-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 *Summary Tables of Changes*

RSDSO-18928	**New D455 cameras can't downgrade FW to <= 5.12.15.50**
Problem:	See PCN 119628-01
Implication:	Any attempt to downgrade the firmware to version 5.12.13.50 and lower will lock the camera. Downgrades to other firmware versions will cause the camera to enter a Device Firmware Update mode, which still allows for the firmware version to be updated.
Workaround:	The firmware version of the cameras and modules with the new sensors can be updated to version number 5.13.0.50/5.13.0.55 or higher.
Status:	Refer the *Summary Tables of Changes*

RSDSO-19297	**D457 camera in recovery mode cannot be recognized by the Viewer**
Problem:	Start updating the FW in the D457 camera and interrupt the process so the camera enters recovery mode. In this mode the RealSense Viewer cannot detect the camera.
Implication:	The camera's FW cannot be updated and return to active mode
Workaround:	Copy the FW image to the host and copy it to the camera via command line
Status:	Refer the Summary Tables of Changes

RSDSO-17488	**D405 High UV error when aspect ratio is different than 16/9 (HD)**
Problem:	When streaming high resolution color at aspect ratio different than 16/9 there are high number of UV mapping pixel errors
Implication:	Significant degradation of more than ~15 pixel when using resolution with aspect ratio of 4/3 (VGA) in D405

Workaround:	Use 16/9 aspect ratio
Status:	Refer the *Summary Tables of Changes*