Changelog for gen4 Devices

Release v1.10.4

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Overview

This file contains the continuously updated changlog for the heliotis gen4 product generation.

1 Version 1.10.4

Release Date:	5.9.2025
diaphus:	1.10.2
heliService:	1.10.4
updateTool:	1.4.3
FPGA Firmware:	e089e2dx
heliDriver D3:	1.9

1.1 Bug Fixes and Improvements

- Improve Ethernet stability. Prevent network slowdown. *(15#19)*
- Fix UserSet migration. To avoid any UserSet migration issues, do a direct upgrade to version 1.10.4 from previous versions. (Skip version 1.10.3) *(5#258)*
- Add write lock during acquisition for the `TransferQueueMaxBlockCount` feature. *(19#75)*
- Fix firmware version read of WLI8Htr module. *(5#256)*
- Fix `LateralResolution` calculation. *(5#252)*
- Add ***warning*** to the heliService log if a frame start or recording start trigger is missed. *(5#254)*
- Fix maintenance tool startup issues in upgrade scenario. *(15#18)*

2 Version 1.10.3

Release Date:	30.5.2025
diaphus:	1.10.2
heliService:	1.10.3
updateTool:	1.4.3
FPGA Firmware:	e089e2dx
heliDriver D3:	1.9

Note: Reduced Transfer Data Rate

Starting from release ***1.10.3*** the transfer data rate is reduced by approx. 15% for data transmission from the camera to the host PC.

In `Scan3dExtractionMethod = AcceleratedCenterOfMass(IQCorrection)` this results in ***3-5ms*** longer cycle time.

For `Scan3dExtractionMethod = centerOfMass(IQCorrection), ImprovedCenterOfMass, HighPrecision` and `rawExtSimpMax` the cycle times is extended by ***3-5ms*** per transmitted frame configured by `ExtSimpMaxHWin`.

For `Scan3dExtractionMethod = rawIQ` and `rawAmp` the cycle time is increased by ~2ms per transmitted frame.

Note: Time critical applications can enable the newly introduced ***software pipelining*** to achieve a better cycle time (see **Overview of new Features**).

2.1 Overview of new Features

- Implementation of multiple frame buffers on the device. Allows to acquire new data during the transmission of the previous measurement. Configuration is possible with `TransferSelector` and `TransferQueueMaxBlockCount`. *(5#208, 5#209, 5#210, 5#211, 19#73)*

2.2 Bug Fixes and Improvements

- Fix the `DeviceReset` sequence: Now the features `FieldbusIntDataValue` and `FieldbusFloatDataValue` are reset as well. *(5#234)*
- Increase minimum value for `ExtSimpMaxHWin` from *0* to *1 (5#240, 19#69)*
- Expose the heliDriver D3 Heater-Module Firmware version also through the feature `HeliDriverModuleFirmwareVersion`. *(5#241)*
- Fix the `LineMode` and `LineSource` configuration for digital outputs on the LIA Module. *(5#239)*
- Fix the default configuration for acquired frames in Lock-In Camera mode. *(5#237)*
- Fix features invalidation information for `FileAccessControl` features. *(19#71)*
- Fix and clarify feature description. *(19#70)*
- Improve the initialization sequence of firmware updates and its post steps. *(15#15, 15#16)*
- Improve S4H readout noise in special (external reference) case. *(50#14)*
- Update Linux distribution to Rockhopper 2.1.0 and kernel 6.6. *(15#13, 15#14)*
- Improve sequence when the Ethernet connection is closed during data transfer. *(5#249)*
- Improvement of device reset sequence. *(5#238, 78#34)*
- *FPGA:* No time out exceptions for FilteredLastMax depending on Amplitude values anymore. *(78#33)*
- *FPGA:* Fixed Z-Tag values for maxima that are found near frame0. *(78#35)*
- *FPGA:* Providing streaming header information in static header. *(78#37)*
- *FPGA:* Improved frequency synthesis for external reference. *(78#38)*
- *FPGA:* Save handling of resets during writing of data to the shared memory. *(78#42)*
- *Examples:* Improve camera configuration in all examples for S4M case. *(31#4)*
- *Examples:* Improve Lock-In Camera examples and fix FPN correction. *(31#8)*
- *Examples:* Fix Python requirement file and use current version of Harvesters. *(31#9)*
- *Documentation:* Add documentation for some internal used features (Visibility = Invisible). Allows to document dynamic feature limits. *(23#14, 19#68, 19#67)*
- *Documentation:* Update *Event And Status Diagram*. *(23#13)*

3 Version 1.10.2

Release Date:	23.9.2024
diaphus:	1.10.1
heliService:	1.10.2
updateTool:	1.4.3
FPGA Firmware:	24052302 (1MS4), 24052401 (2MS4), 24052401 (1MS4M), 24052402 (2MS4M)
heliDriver D3:	1.9

3.1 Bug Fixes and Improvements

- Acceleration of Feature Read/Write. As well as, accelerate the measurement sequence. *(5#228)*
- Reduce delay in ***FrameActive*** and ***RecodingActive*** signal and status. *(5#223, 5#227)*
- Change Featuer `FieldbusIntDataValue` from unsinged to signed integer. *(5#232, 5#230)*
- Improve motion sequence and remove the risk of missed trigger in long (de)AccelerationRamp. *(5#231)*
- Improve Homing Sequence for MA3 stages. This fix was part of the patch 1.10.1-1 and 1.10.1-2 *(7#11)*
- Fix heliDriver update sequence in combination with partial assembly PI board *(58#4)*

4 Version 1.10.1

Release Date:	7.6.2024
diaphus:	1.10.1
heliService:	1.10.1
updateTool:	1.4.3
FPGA Firmware:	24052302 (1MS4), 24052401 (2MS4), 24052401 (1MS4M), 24052402 (2MS4M)
heliDriver D3:	1.9

4.1 Overview of new Features

- Expose LowLevel interface to heliDriver D3 registers. *(19#50)*
- Addition of further sequencers for R&D modes *(15#11)*

4.2 Bug Fixes and Improvements

- Fix Access Mode of Fieldbus features. *(5#229)*
- Add correct entries in `FieldbusType` feature. *(19#65)*
- Return an error when misconfiguring the features `FPNCorrectionNFrames`, `TriggerDivider` or `TriggerMultiplier`. *(5#218)*
- Fix external reference. *(5#224)*
- Include hardware configuration in Log Files *(5#222)*
- Remove internal features from the nodemap. *(5#221, 19#63)*
- *FPGA:* Adopted Memory readout for S4M versions. Ascan readout time for S4M = Ascan readout time for S4H. *(78#30)*
- *FPGA:* Fixed firstMax Amplitude behaviour for surfaces that are separated more that 64 frames. *(78#29)*
- *FPGA:* Fixed lastMax feature (was not working properly, Measurement could lead to timeouts)
- *FPGA:* Optimized readout speed for dualMem version by 30%
- *FPGA:* Added Memory CalibrationSuccess signal to the reset sequence.
- *Documentation:* Add ***AccessMode*** information to all features. *(23#11)*
- *Documentation:* Add ***Writable in Acquisition Mode*** information to all features. *(23#8)*
- *Documentation:* Fix page breakes across long tables. *(23#9)*
- *C4Hdl:* Improve object destruction and fix issue when closing and reopening an interface and/or device. *(9#23, 9#30)*

- *C4Hdl:* Implement error message in C API as thread_local variable. *(9#35)**
- *C4Hdl:* Add support for Python 3.12, remove support for deprecated Python 3.5. *(9#36)*

5 Version 1.10.0

Release Date:	22.3.2024
diaphus:	1.10.0
heliService:	1.10.0
updateTool:	1.4.3
FPGA Firmware:	24030601 (1MS4), 24030501 (2MS4), 24030602 (1MS4M), 24030603 (2MS4M)
heliDriver D3:	1.9

5.1 Overview of new Features

- Implement `TargetVerticalSpreading`, `ActualVerticalSpreading` and `LockInTargetBlankDurationNPeriod`, `LockInActualBlankDurationNPeriod` to control when the demodulation is active along the frame. *(5#169)*
- Specify the position of heliInspect H8 internal stage to the range from *+5.0mm* to ~ *-35.0mm* device instance independently. This requires a stage calibration (moCalib). * Note: Downgrade to older version could change the absolut position.* *(212#1, 5#192)*
- Add feature `SensorName` which exposes the sensor name. *(19#57)*
- Add support for heliDriver D3 Fieldbus interface. The new available features are in the category `FieldbusControl`. They are: `FieldbusType`, `FieldbusIntDataSelector`, `FieldbusIntDataValue`, `FieldbusIntDataMode`, `FieldbusFloatDataSelector`, `FieldbusFloatDataValue`, `FieldbusFloatDataMode`, `FieldbusBoolSelector`, `FieldbusBoolMode`, `FieldbusBoolSource` and `FieldbusBoolStatus` *(19#33, 5#177, 5#179)*
- Provide ***Device Description*** files for PLC and example project using the Fieldbus features. *(10#15)*
- Upgrade to GenTL 1.6. Expose buffer part information. *(14#31, 14#35)*
- Support of new heliDriver D3 Module ***RTIO LVDS*** *(5#199)*
- Support for External Reference Source on heliSens S4M. This was also part of patch 1.9.2-1 *(50#6)*
- Support for new B4 Processing Boards B4.2.0 and B4M.2.0 *(32#7)*
- Support for new Power and Interface Boards V1.4 partial assembly *(32#9)*
- New debug and logging interface. The feature `LogLevel` has less entries and is now based on a selector `LogSelector`. ***Note: User application already using the old LogLevel feature require an update.*** *(5#191)*
- Transfer the new logging information as `*.tar.gz` through GenICam file access. Add ***Log*** to the `FileSelector`. *(5#195)*
- *updateTool:* Get access to the device Log file through the File Manager dialog. *(11#19)*
- *C4Utility:* Add ***Technical Notes*** and ***heliCam C4 User Manual*** to the installation directory. *(9#13)*

5.2 Bug Fixes and Improvements

- Inputs FI2, FI3 and RTIO6, RTIO7 are not available for `FrameStartTrigger`. They are now removed from the enumeration list. *(19#41)*
- Fix functionality for *RecordingStartTrigger* coming from RTIO4 or DIO*. *(5#198)*
- Handle *RecordingStartTrigger* on RTIO6 correctly. *(5#215)*
- Rename `SignalGenerationMode` to `SignalGenerationModulationMode`. *Note: The old feature stays hidden for backward compatibility but is Deprecated and will be removed in further major release. (19#58)*
- Define maximum values of `AcquisitionBurstFrameCount` based on the Sensor Type. *(19#61)*
- Define maximum values of `ScanSpeed` based on the Stage Type. *(19#59, 193#1)*
- Return the correct value in the feature `SensorHeight`. *(5#217)*
- Fix and define the value range for `LockInTargetReferenceFrequency` based on the sensor type. *(19#55, 19#62, 5#196, 5#197, 5#205)*
- Increase minimum value of `ScanRange` to 0.01 *(19#54)*
- Increase minimum value of `SignalGeneratorOffset` to 1.0 *(5#206)*
- Increase maximum length for error messages of feature access. They are usaly returned through exceptions *(19#35)*
- Increase maximum number of available `ChunkZTagValue` to 1998 *(19#43)*
- Fix the maximum value for `ChunkZTagSelector` to `ChunkZTagCount - 1` *(5#173)*
- Change type of `OpticControllerSerialNumber` to a string, according to the GenICam definition. *(5#207)*
- Small changes in features meta data (Namespace, Visibility) to fulfill the GenICam definitions. Impacted features are `OpticControl`, `OpticControllerSelector`, `OpticControllerSerialNumber`, `OpticControllerFirmwareVersion`, `NumericalAperture`, `Magnification`. *(19#56)*
- Change nominal wavelength of Red LED Type 2 from 640nm to 650nm. *(32#10)*
- Change default `ScanPosition` to the stage's center position. *(5#200)*
- Return more error information in heliDriver D3 specific errors. *(5#201)*
- Fix artifacts in rawIQ and rawAmp mode of the dual-memory firmware. This fix was part of the patch 1.9.2-2 *(78#15)*
- Fix output configuration of RTIO2 *(78#8, 78#28)*
- Fix and return correct `LineStatus` information for RTIO2, RTIO3, RTIO6 and RTIO7 *(78#14)*
- Fix LineInverter configuration for RTIO6 and RTIO7. *(78#23)*
- Remove first and second frame masking in rawIQ mode. *(78#18)*
- Fix a small z offset bias. This fix was part of patch 1.9.2-2 *(78#24)*
- When lock-in reference is external and `LockInReferenceFrequencyScaler` isn't *MultiplyBy4*: Demodulate only as long external reference signal transitions are detected (previously kept synthesizing reference even when signal was not provided) *(78#26)*
- Fix Row Shift on heliSens S4M. This fix was part of patch 1.9.2-1 *(50#5)*
- Fix small reference frequency deviation when using internal reference frequency. *(50#12)*
- Improve demodulation frequency accuracy when reference source is internal. Inacuracy is now limited to approximately 1% in the worst case (highest frequency). It was up to a few % in the worst case previously. *(50#4)*
- Improve internal sensor configuration and fix few rounding issues. *(5#216)*

- Provide full external reference frequency tracking fidelity with `LockInCoupling = AC`. Previously tracking errors (frame-to-frame phase jumps) occured in AC mode when using maximum `LockInSensitivity` and low `ExpectedFrequencyDeviation`. *(50#13)*
- Fix motion implementation for gen4 devices without motion control and update stage status information. *(5#219, 8#1)*
- Fix error in second statge initialization of Xenax stage with Xvi 75V8 controller. *(27#8)*
- Fix type on Xenax specific feature and rename XenaxReplay to `XenaxReply`. *Note: The old feature stays hidden for backward compatibility but is Deprecated and will be removed in further major release. (27#7)*
- Use the LED Type installed on the device for postprocessing in ***clupea*** library. *(14#36, 14#39)*
- Add support for LED Type 3 in clupea *(1#2)*
- ***updateTool:*** Remove unused UserSet verification. It is handled on the device since version 1.8.0. *(11#6)*
- ***Examples:*** Update and expand Python examples for heliCam C4. *(31#3)*
- ***Examples:*** Update simple Python examples for heliInspect H8. *(31#7)*
- ***Examples:*** Add readme how to setup Python environment. *(31#6)*
- ***Examples:*** Update HALCON example and define producer name to accelerate the `open_framegrabber` command. *(29#1)*
- ***Examples:*** Add MATLAB example based on the C4Hdl library for heliCam C4. *(9#31)*
- ***Examples:*** Add Matrox Design Assistant examples for heliInspect H8 and H9.

5.3 Known Behavioral Changes

- ***Reflectance*** values are reduced by approx. 6% when using `Scan3dExtractionMethod = ImprovedCenterOfMass` or `HighPrecision`.
- Camera configuration time is a little longer compared to release 1.9.2.
- `WavelengthCorrection` must be recalculated when configuring a static value to `WavelengthCorrection` and a ***Red LED Type 2*** is installed.
- `LogLevel` interface has changed. See ***Overview of new Features*** above.

6 Version 1.9.2

Release Date:	19.6.2023
diaphus:	1.9.2
heliService:	1.9.2
updateTool:	1.4.2
FPGA Firmware:	23060801 (1MS4), 23060802 (2MS4), 23060803 (1MS4M), 23060804 (2MS4M)
heliDriver D3:	1.8

6.1 Overview of new Features

- Expose the heliDriver D3 module firmware version through the new feature `HeliDriverModuleFirmwareVersion[HeliDriverModuleSelector]` *(19#37)*
- Expose the feature `SignalGeneratorPhaseShift` to configure a phase shift in the SignalGenerator if it in *Pulsed Mode (19#28)*
- Add instance specific motor interpolator configuration *(32#3)*
- Add full support (incl. update mechanism) for new stage types MA3 and MA4 *(7#9, 15#10)*

6.2 Bug Fixes and Improvements

- Clear `Scan3dCoordinateScale` cache when `OpticType` feature is written *(19#52)*
- Expose `DeviceModelName` correctly *(5#183)*
- Expose `DeviceFamilyName` according to new heliotis naming convention *(5#184)*
- Fix swapped *FI2* and *FI3* configuration for LIA module *(19#39)*
- Fix `LineMode` feature for DIOs on LIA module *(5#185)*
- Fix input events for *DIO 10-17* on LIA module *(5#186)*
- Fix implementation of `SignalGeneratorTriggerSource` and `SignalGeneratorTriggerDelay` features *(5#172)*
- Limits of `SignalGeneratorAmplitude` feature in the range of *1.0% - 100.0% (5#189, 19#53)*
- Limits of `LockInTargetReferenceFrequency` feature in the range of *304Hz - 136kHz (19#45)*
- Limits of `LightBrightness` feature in the range of *1.0% - 100.0% (19#36, 14#30)*
- Set allowed minimum value of `ScanSpeed` feature to 0.1mm/s. *(19#44)*
- Make the `LightCurrentRating` feature writeable for TriLED outputs *(19#49)*
- Change `LockInReferenceTimeShift` and `TriggerDelay` implementation and make it functional *(19#51, 78#7)*
- Improve Xenax stage communication stability *(27#6)*
- Fix Xenax stage status information *(27#4)*
- Fix smart stage initialization for Xenax controllers *(27#5)*
- Automated correction of misconfigured D3 firmware *(15#9)*
- Update to heliDriver D3 1.8 firmware *(5#187*)*
- Fix DIO inverter configuration *(51#10)*
- Fix error when no LED is connected *(51#13)*
- *D3:* Fix functionality of `SignalGeneratorTriggerDelay`
- Fix increased surface noise when `Scan3dExtractionMethod = AcceleratedCenterOfMass` or `AcceleratedCenterOfMassIQCorrection` *(78#17)*
- Fix reset during recording active *(78#12)*
- Block `DeviceReset` command in acquisition mode *(5#194)*
- *Documentation:* Add unit information in the feature description *(19#38)*
- *Documentation:* Add deprecated warning in feature description *(23#6)*
- *Documentation:* Correction of smaller typos in the feature description and changelog *(19#47, 19#48, 10#10, 23#7)*

- *Python Example:* Using current Harvesters version 1.4.0 *(31#2)*
- *CVB Example:* Add examples for Common Vision Blox *(37#1)*
- *updateTool:* Remove unused reboot button in update window *(11#17, 11#14)*
- *updateTool:* Add links to the documentation and updates in the help menu *(11#12, 11#13)*

7 Version 1.9.1

Release Date:	27.1.2023
diaphus:	1.9.1
heliService:	1.9.1
updateTool:	1.4.1
FPGA Firmware:	22122202 (1MS4), 23010401 (2MS4), 22122203 (1MS4M), 23010402 (2MS4M)
heliDriver D3:	1.6

Note: C4Hdl library

With release *1.9.1* the Python Bindings are available for all active Python versions according to the Python Release Cycle (https://devguide.python.org/versions/). The binaries are include in C4Utility installation directory *./C4Utility/c4hdl/win64-x64/python/bin*

The lowest supported .NET Frameworks for the CLR bindings are based on the Microsoft .NET Framework Lifecycle Policy (https://learn.microsoft.com/en-us/lifecycle/products/microsoft-net-framework)

7.1 Overview of new Features

- Add support for heliDriver D3 LIA module as well as its SignalGenerator. SignalGenerator Features are: `SignalGeneratorFrequency`, `SignalGeneratorAmplitude`, `SignalGeneratorOffset`, `SignalGeneratorMode` *(5#114, 5#156, 5#167)*
- Implement external Reference signal for LockInCam applications. *(5#160)*
- The Reference signal could be mapped to digital output *RTIO2* and *RTIO3* (see enumeration list in `LineSource` feature description). *(5#161)*
- A new feature `OpticType` is available. A write access to this feature loads a predefined and best guess for the configuration of the features: `Magnification`, `NummericalAperture`, `WavelengthCorrection`, `TargetVerticalSpacing`. Additional information are available in the feature description. *(19#32, 5#131)*

7.2 Bug Fixes and Improvements

- Reduce the minimum supported `ScanRange` (or number of Recording Frames down to 4 in volume mode). *(5#162, 5#163)*
- Increase maximal supported `ScanRange` (or number of Recording Frames up to 1348 in surface mode). *(5#162)*
- Improve Illumination current calibration sequence. *(5#158)*
- Tolerated Frequency deviation of external Reference Signal is now tolerated within the bounds set with `LockInExpectedFrequencyDeviation`. *(5#170)*
- External Reference signal scaling is corrected so that the configuration of `LockInReferenceFrequencyScaler = Off` match with the applied demodulation reference signal. *(5#159, 5#168)*

- The prerelease feature name `AcquisitionBurstFrameCountPreview` is renamed to `AcquisitionBurstFrameCount` and the feature behavior is fixed. *(5#149, 5#157)*
- Improve the `StageInit` command (reliability when executing while H8 internal stage is at lower positions). *(5#154)*
- Define limits (minimum and maximum values) for position and range features. The limits are based on the Hardware and UserLimits. *(5#144, 5#166, 19#30)*
- `LockInReferenceFrequencyScaler` value `DevideBy2` is fixed. *(5#151)*
- Control of Digital IO *Line0 - Line3* was broken in release 1.9.0. This is fixed. *(5#147)*
- *SignalGenerator* feature family is now usable (access mode was NI). *(5#146)*
- Handle unplugging or disabling of network interface correctly *(14#32, 9#25)*
- *C4Hdl:* Implement and Support GenICam AccessMode *Not Implemented (NI) (9#24)*
- *C4Hdl:* Use .NET Framework 4.6.2
- *FPGA:* Full featured support for S4M sensor.

8 Version 1.9.0

Release Date:	16.9.2022
diaphus:	1.9.0
heliService:	1.9.0
updateTool:	1.4.1
FPGA Firmware:	22082307 (1MS4), 22082401 (2MS4), 22082306 (1MS4M), 22082402 (2MS4M)
heliDriver D3:	1.1

8.1 Overview of new Features

- Add new `DeviceOperationMode` to select how the camera is used (e.g. as 3D measurement system or as 2D LockInCam). Based on the `DeviceOperationMode` different configuration features are available.
- Remove the `ConfigurationStyle` feature and split its content to `DeviceOperationMode` and `LowLevelMode` features. *(19#21)*
- Implement LockInCam features (available in `DeviceOperationMode=LockInCam`). The new features available in the `LockInControl` category: `LockInTargetReferenceFrequency`, `LockInActualReferenceFrequency`, `LockInExpectedFrequencyDeviation`, `LockInTargetTimeConstantNPeriods`, `LockInActualTimeConstantNPeriods`, `LockInReferenceSourceType`, `LockInReferenceSourceSignal`, `LockInReferenceTimeShift`, `LockInReferenceFrequencyScaler`, `LockInCoupling`, `LockInSensitivity` as well as `AcquisitionBurstFrameCountPreview` and `TriggerSelector=Reference`. The whole mode is in beta mode and features changes of the configuration style will be possible. *(5#105)*
- Add support for the configuration of *RTIO2, RTIO3, RTIO6, RTIO7, FI2, FI3* and *SwCtrlVdd5*. They are available dependent on the hardware configuration. *(5#106)*
- Add features `Scan3dCoordinateScale`, `Scan3dCoordinateOffset` and `Scan3dOutputMode` to scale and move the 3D surface in x,y and z (`Scan3dCoordinateSelector`). *(5#97, 5#129)*
- Define a hardware configuration for horizontal or vertical mounting and configure the stage control parameters according to the configuration *(5#132)*
- Add support for additional H8 stage types *-MA3-* and *-MA4-*. *(32#2)*

8.2 Bug Fixes and Improvements

- Support for S4M sensor with optimized reference voltages, sequencer. *(5#112, 5#115, 5#139)*
- Correct offset of 1 in `PeakDetectionFilterWidth` feature *(5#124)*
- Recalculate `ActualVerticalSpacing` when changing `BackgroundSuppression` feature. *(5#116)*
- Fix the selection of `StageStatus=Initialized` and return the correct status in `StageStatus` *(5#117)*
- Fix move issue with heavy loaded Xenax stages *(5#121)*
- Fix the chunk information `ChunkScan3dDistanceUnit` and match it with `Scan3dDistanceUnit` configuration. *(5#96)*
- Remove cache for `HeliDriverStatus` feature. *(19#26)*
- ***updateTool:*** correct handling of updates (*.ipkg) when the file name contains special characters.
- ***updateTool:*** small operation improvement in hardware configuration window *(11#10)*
- fix re-initialization sequence in H8 motion. *(7#7)*

9 Version 1.8.0

Release Date:	15.4.2022
diaphus:	1.8.0
heliService:	1.8.0
updateTool:	1.4.0
FPGA Firmware:	22030201 (1MS4), 22030103 (2MS4)
heliDriver D3:	1.0

Note: Important Note

Starting with the release ***1.8.0***, a new fail safe memory layout is introduced. Future updates are released as whole image package (*.ipkg) and, alternatively, as a whole SD card image (*.img).

A detailed upgrade instruction is shown in chapter *Upgrade and Downgrade Information* and the sequence to upgrade to ***1.8.0*** is part of its sub-chapter *Upgrade from Version <1.8.0 to Version >=1.8.0*

A downgrade to previous versions is only possible by rewriting the SD card with image ***b4brdImg_20190719V03.img***. (see chapter *Upgrade and Downgrade Information*)

9.1 Overview of new Features

- FPGA Firmware selection (***single-memory*** or ***dual-memory***) based on camera hardware configuration (via updateTool)
- Add image based camera firmware update via *.ipkg file.
- Add additional information to the Chunk data: **ChunkTimestamp** and **ChunkFrameID** *(5#94)*
- Add Low-Level feature to enable Test and Fill Pixels *(19#20)*
- UserSets version (up/down-grades) are handled directly on the camera when the files are exchanged. No manual verification step is required. *(5#102, 32#0)*
- Add Adaptive Vision examples *(10#5)*
- ***C4Hdl:*** Add MATLAB example script

- *updateTool:* Linux support
- *updateTool:* Add dialog for Hardware Configuration
- *updateTool:* Add support for new camera firmware update (ipkg)
- *internal:* Support for S4MEmu *(5#38)*

9.2 Bug Fixes and Improvements

- Fix default configuration of Scan3dExtractionMethod. *(14#28)*
- Update feature description and meta information. *(19#16, 19#17, 19#19, 19#22)*
- Increase maximum motion speed for Xenax with 1um encoder. *(19#18)*
- Adjust default values of **OpticControl** features. Disable optic heater by default. *(5#83)*
- Features **NumericalAperture** and **Magnification** now depend on **OpticControllerSelector**. *(5#91)*
- Fix trigger configuration of **RecordingStart = Off** and **Software**. *(5#85)*
- Buffering new TargetPosition when it is written during a measurement sequence and apply it as soon as possible. *(5#103)*
- Removing cache from **Timestamp** feature. *(5#100)* Mark Sequencer relevant features as invalid when a new sequencerSet is loaded. *(5#86)*
- Fix x-y scaling in plots of Python examples.
- Improve Sensor configuration sequence. *(5#90)*
- Give write access independent of the Configuration Style for **ExtractionControl** features as well as for **AccelerationRamp**. *(19#21)*
- *C4Hdl:* Add additional error information when an internal exception is thrown. *(#18)*
- *C4Hdl:* Fix typo in C4FeatureInfo method name and rename getAccsessMode to `getAccessMode`. *(#19)*
- *C4Hdl:* Rework of `getEnumEntryList()` method and return only available enumeration entries. *(#20)*
- *diaphus:* Accelerate computer based post-processing algorithm. *(#23)*
- *updateTool:* Handle fast clicks on *"Update Device List"* button. *(#4)*
- *updateTool:* Validate gateway configuration and create a warning pop-up when the network is misconfigured. *(#5)*
- *C4Utility:* Installer selects all examples by default. *(10#7)*
- *C4Utility:* Reigster a QuietUninstallString in the Windows registry. *(10#6)*

10 Upgrade and Downgrade Information

This section assist you for up- or downgrading the camera firmware.

Note: It is recommended to use always the latest firmware version for best product stability and performance.

10.1 Upgrade from Version >=1.8.0 to Version >1.8.0

- Install the target C4Utility on your host machine. (`C4Utility-1.X.Y-win64.exe` or `C4Utility-1.X.Y-Linux.sh`)
- Start the *updateTool* and scan for devices. ("*Update Device List*" button)
- Select your device from the list and push the "*Update Device*" button.
- Select the image package `update_1.X.Y.ipkg` in the pop up browser window.
- Optionally check the log output in the dialog.
- The device reboots after the update, is ready to use and you may close the dialog.

10.2 Upgrade from Version <1.8.0 to Version >=1.8.0

- Install the target C4Utility on your host machine. (`C4Utility-1.X.Y-win64.exe` or `C4Utility-1.X.Y-Linux.sh`)
- Start the *updateTool* and scan for devices. ("*Update Device List*" button)
- Select your device from the list and push the "*Update Device*" button.
- Select the update package `update_1.8.0.upkg` in the new window.
- Optionally check the log output in the dialog and *Close* it if it asked for in the output message. (Don't use the *Reboot* button)
- The next step of the upgrade is installed in a silent mode and take around 15 minutes. **Don't power off the device during this upgrade sequence for the next 15 minutes!** At the end of the update installation, the illumination flashes two times and the device can be detected in the updateTool. (Version 1.8.0 is installed)
- After this procedure it's possible to upgrade to newer software according the description in *Upgrade from Version >=1.8.0 to Version >1.8.0*

10.3 Downgrade from Version >1.8.0 to Version >=1.8.0

- The downgrade sequence is identical to the upgrade sequence described in *Upgrade from Version >=1.8.0 to Version >1.8.0*.

10.4 Downgrade from Version >=1.8.0 to Version <1.8.0

- Downgrading to version below 1.8.0 requires a SD card rewrite. Download the image `b4brdImg_20190719V03.img` from our webpage.
- Power Down the device, extract the SD card from the device and insert it into your PC's card reader. Flush the image on it. (e.g. by using the Tool *balenaEtcher* on Windows or `dd` on Linux)
- Insert the SD card into the device and start it.
- Install the target C4Utility on your host machine.
- Start the *updateTool* and scan for devices. ("*Update Device List*" button)
- Select your device from the list and push the "*Update Device*" button.
- Select the target update package `*.upkg`.
- Optionally check the log output in the dialog and *Reboot* the device if it asked for in the output message.

Hint: see also the section *Additional Hints*.

10.5 Downgrade from Version <1.8.0 to Version <1.8.0

- Start the *updateTool* and scan for devices. ("*Update Device List*" button)
- Select your device from the list and push the "*Update Device*" button.
- Select the update package `update_1.X.Y.upkg` in the new window.
- Optionally check the log output in the dialog and reboot the device.
- Install the target C4Utility on your host machine. (`C4Utility-1.X.Y-win64.exe` or `C4Utility-1.X.Y-Linux.sh`)

Hint: see also the section *Additional Hints*.

10.6 Additional Hints

Version 1.5.0 and 1.5.1: It is not recommended to use this versions! For applications requiring a version 1.5.x it is recommended to use 1.5.2.

Downgrade to Versions <= 1.4.1: For a downgrade to versions <= 1.4.1 install `update_1.4.1-2.upkg`, reboot the camera and install the target version.

Upgrade from Versions < 1.3.3 to Version >= 1.3.3: Manual uninstallation of C4Utility is required