chromasens
Imaging for Professionals

Hardware - Software Interface

(HSI)

allPixa camera

HSI - Level: **1.50**

Document revision: **03**

0. Change History:

Date	Version	Description	Firmware version of implementation
	R1.0	Initial Version based on former document	
	R1.1	allPIXA updated to camera firmware revision P1.4x	
	R1.11	Reading of external trigger signals extended (TAG_STATE_EXT_INPUT 0x245) Correction of some parameter ranges	
	R1.12	Meaning of external trigger signals corrected (TAG_STATE_EXT_INPUT 0x245)	
		Switch off internal odd/ even control added (TAG_SET_INTERNAL_OE_CONTROL 0x2C0)	SVN 0042
		Range for RGB line distance expanded at allPIXApro (TAG_SET_RGB_LINEDISTANCE 0x319)	SVN 0046
		Extended modes for camera link interface at allPIXApro (TAG_SET_CAMERALINK_INTERFACE 0x3A1)	SVN 0047
		Product identifier implemented (TAG_SET_PRODUCT_ID 0x952)	SVN 0059
		LED flash control implemented at allPIXApro. Related TAGs: TAG_LED_FLASHCONTROL 0x400 TAG_LED_NUMBER_LINE_PATTERN 0x401 TAG_LED_SEQUENCETIME 0x402 TAG_LED_DRIVERSYNCHRONISATION 0x403 TAG_LED_PATTERN_DELAY 0x404 TAG_FLASH_TIME_PATTERN1 0x410 TAG_FLASH_TIME_PATTERN2 0x411 TAG_FLASH_TIME_PATTERN3 0x412 TAG_FLASH_TIME_PATTERN4 0x413	SVN 0059
	R1.20	Selection of active channels for internal white control implemented (TAG_SET_ACTIVE_CHANNELS 0x277) Commands DA and UA implemented for user application data to camera flash memory	SVN 0068
	R1.21	Range for horizontal binning expanded by mode 7 -> 2/3 reduction (TAG_SET_BINNING 0x29A)	
	R.1.22	TAG_SET_VSYLENGTH (0x231) may be extended to 1 Mio. lines, therefore the parameter is extended to FORMAT_LONG TAG_SET_SUPPRESSED_LINES (30E hex) no longer supported with allPIXApro Instead TAG_VERT_SCAN_LINE_REDUCTION_PATTERN_LENGTH (298 H) and TAG_VERT_SCAN_LINE_PATTERN (299 H) are used TAG_GET_EFFECTIVE_SCANLINE_LENGTH (0x2AA)	SVN 0079

		implemented allPIXApro: TAG_SET_CAMERALINK_INTERFACE (0x3A1) extended by BASE 3T_8Bit Mono	
		TAG_SET_GAIN_STOP_VARIANCE (0x2bd) and TAG_GET_WHITEREF_VARIANCE (0x2be) implemented	SVN 0080
	R.1.30	TAG_GLOBAL_MASTER_SLAVE_CONFIG = 31AH new TAG_LED_FLASH_FRAME_CONTROL (405 H) and TAG_LED_FLASH_LINE_MODE (406 H) new TAG_SET_SCANDIR (23A H) extended to SHORT TAG_SET_BINNING = 29A H: 2/3 reduction implemented	SVN 0081
		Parameter for internal light barrier implemented (3D0 - 3D5 H)	SVN 0082
		New order UI to get image data from camera	SVN 0083
		TAG_GET_CONTRAST_SUM (0x2BF) implemented	SVN 0084
		WHITE_CALIB_VALUES (25A H) and TAG_GET_WHITE_CALIB_VALUES (25B H) new	SVN 0088
	R. 1.40	TAG_SUPPRESSLINES_ENABLE (2C1 H) TAG_SUPPRESSLINES_MODE (2C2 H)	SVN 0104
		TAG_SET_VSYLENGTH (0x231): minimum Value = 8	SVN 0114
		TAG_PATTERN_TIME_1 (420 H) TAG_PATTERN_TIME_2 (421 H) TAG_PATTERN_TIME_3 (422 H) TAG_PATTERN_TIME_4 (423 H) returned in pk response	SVN 0115
		Definition of TAG_PACKET_VERIFY (259 H) added	
		TAG_GET_MIN_INT_TIME (CC9 H) TAG_GET_MIN_LINE_PERIOD (CCA H) TAG_GET_MAX_INT_TIME (CCD H) returned in pk response	SVN0142
	R 1.50	Description of AP added	SVN0153
		TAG_GET_SCANDIR (2C3 H)	SVN0154
		TAG_PATTERN_1_ADDGAIN = 414 H TAG_PATTERN_2_ADDGAIN = 415 H TAG_PATTERN_3_ADDGAIN = 416 H TAG_PATTERN_4_ADDGAIN = 417 H	SVN0159
		TAG_CHECK_TAPADJUST (2C8 H)	SVN0174

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1. Introduction

1.1 Purpose

This document defines the HSI data dictionary for Chromasens cameras of allPixa family.

It refers to camera package release P1.40

1.2 Scope

This document describes the structure of the HSI commands (also called HSI Order) It describes the several commands and the response returning from the camera.

1.3 Terms and abbreviations

Abbreviation	
HSI	Hardware Software Interface
TAG	Parameter structure for HSI commands

1.4 General HSI structures

1.4.1 General statement on commands

The structure of a command with no specific information, i.e. a command that consists only of the header and the checksum, is shown below. For reasons of economy the structure of such a minimum Command is not repeated throughout this document but is explained only once in the following:

15 8	7 0	
X	**Y**	0 Name
Low word length		2 Length
High word length		4 Length
reserved	reserved	6
reserved	reserved	8
Checksum		10 Check sum

Name: = ‘X’ ‘Y’ — The name field contains an abbreviation of the Command name consisting of two **upper-case ASCII characters**. The first character resides in the high byte.

Length: — The Length field consists of 2 words and is a 32 bit unsigned integer that states the length (word count) of the data following on the Receiver word and including the Checksum word.
For the minimum Command the length value is 1 if no data words are included to the Command (Low word length = 0001 H).

Check sum — This field contains the modulo 2^{16} sum of all words of the Command, except for the check sum word.

Remarks
All reserved bytes of a command or response must be set to zero.

Commands that contain additional information the data is follow by reserved words before the checksum. The length field is adapted appropriate.

1.4.2 General statement on responses

Since, generally, each Command must be answered by a response even if there are no specific response data, there is a minimum response consisting only of the header and the checksum. This response serves only as an acknowledgement of a preceding Command. For reasons of economy the structure of a minimum response is not repeated throughout this document but is explained only once in the following:

15 8	7 0	
x	**y**	0 Name
Low word length		2 Length
High word length		4 Length
Sender		6 Sender
reserved	reserved	8
Checksum		10 Check sum

Name: = ‘x’ ‘y’

The Name field of a response echoes the 2 character name of the corresponding Command, but is written **in lower-case characters**. (Command names consist of 2 upper-case characters.) The first character resides in the high byte.

Length

The Length field consists of 2 words and is a 32 bit unsigned integer that states the length (word count) of the response data following on the Receiver word and including the Checksum word.
For the minimum response the Length value is 1 (Low word length = 0001 H).

Sender

This field contains the name of the camera-board, which has transmitted the response message
= xxxx H: Board identifier (2 ASCII characters)
= ‘K1’ Camera board KAx No.1
= ‘K2’ Camera board KAx No.2
= ‘K3’ Camera board KAx No.3
= ‘K4’ Camera board KAx No.4

This is used in systems with more than one Camera board. By default (in single camera systems) the camera has the ID “K1”

Checksum

This field contains the modulo 2^{16} sum of all words of the response, except for the check sum word.

2. Tag structure

2.1 General

A tag is a data block which contains certain information defined by the tag header.
Tags are structured into 16-bit words and have the following general structure:

Bit	15 … 13	12 … 0	
	Format	TAG-ID	Word 0
	Length		Word 1
	Data word 1		Word 2
	...		
	...		
	Data word n		Word n

Meaning of the terms:

Format:	Identifies the data format. There are 5 different formats (see below).
TAG-ID:	The tag identifier states which type of data is contained in the data words.
Length:	If a length field exists, it contains the number of the subsequent data words.
Data word n:	Data of the tag with the actual information.

The following tag formats exist:

2.2 BIN format

Bit	15 … 13	12 … 0	
	Format	TAG-ID	Word 0

Format = 000 (bin) : The Boolean value of the tag is ´0´
Format = 001 (bin) : The Boolean value of the tag is ´1´

This binary tag consumes one (16-bit) word. Its Boolean value, either 0 or 1, is determined by the last bit of the format field (bit 2 [13]).

2.3 Short format

Bit	15 … 13	12 … 0	
	Format	TAG-ID	Word 0
	Data word		Word 1

Format = 010 (bin)

The information is contained in the 16-bit word following on the tag header. Obviously, all tags with no more than 16 bit of information can be implemented as Short format tags.

2.4 Long format

Bit	15 … 13	12 … 0	
	Format	TAG-ID	Word 0
	Data part low word (Bit 15 .. 0)		Word 1
	Data part high word (Bit 16 .. 31)		Word 2

Format = 011 (bin)

The information is contained in the 32-bit dword following on the tag header.

2.5 VAR format

Bit 15 – 13	12 – 0	
Format	TAG-ID	Word 0
Length		Word 1
Data word 1		Word 2
...		
...		
Data word n		Word n

Format = 100 (bin)

The VAR format is defined for tags of variable data length. The length values 0 or 1 are also permissible.

2.6 CONT format

Bit 15 – 13	12 – 0	
Format	TAG-ID	Word 0
Length		Word 1
TAG 1		
...		
...		
TAG n		

Format = 101 (bin)

This tag is named a container tag. The data part summarizes several, logically associated tags. The individual tags in the data part of the container tag can themselves in turn be container tags. Thus, nested containers can be built.

Example:

Bit 15 – 13	12 – 0	
101(cont)	TAG-ID	0 Header of the tag
Length = 8		1
000(bin)	TAG-ID	2 TAG of the BIN format
010(bin)	TAG-ID	3 TAG of the Short format
Data word		4
100(var)	TAG-ID	5 TAG of the VAR format
Length = 3		6
1. Data word		7
2. Data word		8
3. Data word		9

3. BL: Clear Error States

BL clears errors with following internal actions:

- Clear internal error memory
- Clear error state at external display (if exists)
- Clears error outputs (if exists)

3.1 Format of Command BL

The **BL** Command has no specific data (see 1.4.1 General statement on commands)

3.2 Format of the Response bl

The **bl** response has no specific data (see 1.4.2. General statement on responses).

4. DE: Download End

This command is used together with the PA Command. It signalizes the download of PA Commands are completed.

4.1 Format of the Command DE

The **DE** Command has no specific data (see 1.4.1 General statement on commands)

4.2 Format of the Response de

The **de** response has no specific data (see 1.4.2. General statement on responses).

5. DR: Download Reset

The DR Command is used to reset the camera software.

5.1 Format of the Command DR

The **DR** Command has no specific data (see 1.4.1 General statement on commands)

5.2 Format of response

Because of the internal reset no Response is sent!

6. fe: General Error Message

The **fe** response is delivered as an error response after errors an internal fault was detected. The error code and the state information are contained in the response.

The fe response can be sent as response to any Command instead of expected response.

6.1 Format of the Response fe

15 8	7 0	
f	**e**	0 Name
Length low word		2 Length
High word length		4 Length
Sender		6 Sender
0	0	8
0	0I	10 see below
ECO	ECL	12 Error entry
0	ECE	14 see below
0	ERLEN	16 see below
ERINF1	ERINF0	18 see below
...	...	
...	...	
Check sum		Check sum

ECL = xx H: Error class

ECO = xx H: Error code

ECE = xx H: Error code extension

ERLEN = xx H: Length of the error information (byte count)
The maximum length of the error information is 128 bytes.

ERINFn = xx H: Error information (freely available for error information)
If the length field ERLEN contains an uneven value, so that the error information does not end at a word boundary, then the last word must be filled up with a 0 byte.

Note on the error classes

Error class 1: Class 1 errors (warning) can be reported as a fe response to all Commands.

Error class 2: Class 2 errors (indication of internal error) can be reported as fe response to all Commands.

Error class 3: Class 3 errors (parameter errors) can be reported as fe response only to parameter commands.

Error class 4: Class 4 errors (initializing error) can be reported as fe response to all Commands. The reasons for these errors are internal checks.

Error class 5: Class 5 errors (reportable HW or SW errors) can be reported as fe response to all Commands. Afterwards the device enters the error state.

ECE represents the last detected error.

If ERLEN is greater 0 then further errors are reported in the fe response in the following format:

15 8	7 0
ERROR	
Error class	
TAG causing the error (if available)	
Order causing the error (if available)	

Up to 10 further errors can be reported.

7. MK: Manage camera parameter

The Command is used to change parameter of camera.
If parameters are changed which are relevant to image processing inconsistent or corrupted image may occur.

7.1 Format of the Command MK

15 8	7 0	
M	**K**	0 Name
Low word length		2 Length
High word length		4 Length
reserved	reserved	6 Sender
reserved	reserved	8 Receiver
reserved		10 Data, see below
Parameters for camera in TAG format		12
Check sum		Check sum

The parameters are structured as tags.

Gain Control Tags

TAG_SET_GAIN	(1C0 H)
TAG_SET_POINT_WHITE_REFERENCE	(1C2 H)
TAG_SET_GAIN_WARN_LEVEL	(1C4 H)
TAG_SET_MINIMUM_GAIN_LEVEL	(1C5 H)
TAG_USE_WHITECONTROL	(200 H)
TAG_SET_HORIZONTAL_POSWREF_ABSOLUTE	(223 H)
TAG_SET_HORIZONTAL_WREF_LENGTH	(224 H)
TAG_SHOW_WHITEREF_BORDERS	(226 H)
TAG_USE_FASTINCREMENTAL_AT_WARMINGUP	(22F H)
TAG_SET_INITIAL_GAIN_LEVEL	(267 H)
TAG_UPDATA_INITIAL_GAIN	(268 H)
TAG_SET_WHITEREF_AVERAGE	(283 H)
TAG_SEL_WHITEREFPOS	(287 H)
TAG_SET_HORIZONTAL_WREF_START	(2A1 H)
TAG_SET_VERTICAL_WREF_START	(2A3 H)
TAG_SET_VERTICAL_WREF_LENGTH	(2A4 H)
TAG_SET_GAIN_STOPP_FACTOR	(2A5 H)
TAG_SET_WREF_VISIBLE_MODE	(2A6 H)
TAG_USE_HORIZONTAL_WREF_START_ABSOLUTE	(2A9 H)
TAG_SET_GAIN_STOP_VARIANCE	(2BDH)
TAG_SET_WHITECONTROL_MODE	(318 H)
TAG_SET_CDS_GAIN	(3A0 H)
TAG_SET_INTERNAL_OE_CONTROL	(2C0 H)

Reference Data Tags (Black and White)

TAG_USE_SHADING_CORRECTION	(22A H)
TAG_USE_BLACKLEVEL_CORRECTION	(22B H)
TAG_SEL_REFRENCEDATA_BLACK	(280 H)
TAG_SEL_REFERENCEDATA_WHITE	(281 H)

Image Processing Tags:

TAG_SET_TESTPATTERN_MODE	(222 H)
TAG_SET_AVERAGEMODE	(228 H)
TAG_SET_GAMMA_VALUE	(229 H)
TAG_USE_COLOR_CONVERSION	(22C H)

TAG_MIRROR_DATA_HOR	(246 H)
TAG_SET_BINNING	(29AH)
TAG_USE_KEYSTONECORRECTION	(2b8 H)
TAG_SET_KEYSTONECORRECTION	(2b9 H)
TAG_SEL_CCM	(2BB H)
TAG_SET_COLOR_WEIGHTS	(305 H)
TAG_VIDEOLEVEL_CORRECTION	(315 H)
TAG_USE_IP_FILTER_HOR	(316 H)
TAG_SET_TESTPATTERN_LEVEL	(323 H)

Video Output Interface:

TAG_SET_VIDEOOUT_MODE	(265 H)
TAG_SET_INSERT_MODE	(293H)
TAG_MUX_OUT_COLOR_SELECT	(295H)
TAG_R_B_CHANGE	(296 H)
TAG_COLUMN_INSERTMODE	(2B0 H)
TAG_SELECT_CL_SPEED	(2BCH)
TAG_SET_GREYOUTPUT_MODE	(322 H)
TAG_SET_CAMERALINK_INTERFACE	(3A1H)

Trilinear/OddEven sensor support tags:

TAG_SET_RGB_LINEDISTANCE	(319 H)
TAG_SET_SCANDIR	(23A H)

Sync signal Generation Control Tags:

TAG_SET_VSYSTART	(230 H)
TAG_SET_VSYLENGTH	(231 H)
TAG_SET_HSYSTART	(232 H) (obsolete with camera release P1.40)
TAG_SET_HSYLENGTH	(233H)
TAG_SET_INTEGRATION_TIME_IN_NS	(24A H)
TAG_SET_SCANCONDITION	(24B H)
TAG_SET_SCANPATTERN	(237 H)
TAG_SET_SCAN_READY	(23C H)
TAG_SET_MAX_NUMBER_SCANLINES	(271 H)
TAG_STOP_BY_MAX_NUMBER_SCANLINES	(272 H)
TAG_SET_VSY_OVERSIZE	(273 H)
TAG_VERT_SCAN_LINE_REDUCTION_PATTERN_LENGTH	(298H)
TAG_VERT_SCAN_LINE_PATTERN	(299H)
TAG_SET_BINNING	(29AH)
TAG_USE_LINEPERIOD	(2B6 H)
TAG_SET_LINEPERIOD	(2B7 H)
TAG_MASTER_SLAVE_CONFIGURATION	(317 H)
TAG_SET_SUPPRESSED_LINES	(30E H)

Encoder control:

TAG_SET_TRANSITIONS_PER_LINE	(238 H)
TAG_USE_EXTERNALSYNC	(23B H)
TAG_SYNCMODE_EXTENDED	(279 H)

Manage Settings:

TAG_BURN_SETTINGS	(240 H)
TAG_SET_ACTIVE_SETTING	(241 H)
TAG_SET_SETTING_STOREFLAG	(258 H)
TAG_GET_WHITE_CALIB_VALUES	(25A H)
TAG_SET_WHITE_CALIB_VALUES	(25B H)
TAG_SETTING_CLEAR	(2A7 H)

Other TAGs:

TAG_PHYS_AUFL_HOR	(243H)
TAG_PHYS_AUFL_VERT	(244H)
TAG_COMMENT	(247H)
TAG_SET_CAMERA_DESCRIPTION_TEXT	(264 H)
TAG_SET_PRIVATE_DATA	(266 H)
TAG_REGISTER_TO_SETTING	(29D H)
TAG_SET_TRUE_RES	(303 H)
TAG_SET_TRACE_MASK	(30F H)
TAG_GLOBAL_MASTER_SLAVE_CONFIG	(31A H)
TAG_SET_PRODUCT_ID	(952 H)

Manage the external IOs

TAG_SET_EXTERNAL_SIGNAL_ASSIGNMENT	(701 H)
TAG_SET_EXTERNAL_SIGNAL_ASSIGNMENT_REFRENCE	(702 H)

7.2 Current gain values of the camera

Set the current gain values for the video channels. Every channel is separate programmed. Change of these values is only possible if the white control is switched off.

TAG-ID: TAG_SET_GAIN = 1C0 H
Format: VAR
Data:

1st word:	Red odd gain value
2nd word:	Red even gain value
3rd word:	Green odd gain value
4th word:	Green even gain value
5th word:	Blue odd gain value
6th word:	Blue even gain value
7th word:	Rear red odd gain value
8th word:	Rear red even gain value
9th word:	Rear green odd gain value
10th word:	Rear green even gain value
11th word:	Rear blue odd gain value
12th word:	Rear blue even gain value

Values: 0 … 700
Default: 640

7.3 Desired level of the white reference

Set the target values for the area of white reference. Each channel value (RGB, Odd/ Even, front/rear tab) is set separate.

TAG-ID: TAG_SET_POINT_WHITE_REFERENCE = 1C2 H
Format: VAR
Data:

1st word:	Red odd camera value
2nd word:	Red even camera value
3rd word:	Green odd camera value
4th word:	Green even camera value
5th word:	Blue odd camera value
6th word:	Blue even camera value
7th word:	Rear red odd camera value
8th word:	Rear red even camera value
9th word:	Rear green odd camera value
10th word:	Rear green even camera value
11th word:	Rear blue odd camera value
12th word:	Rear blue even camera value

Values: 0 … 1023

Default: 640

7.4 Gain warn level

If calculated gain level exceeds the gain warn level then a “fe response” is generated after request by Command WR. Each channel value (RGB, Odd/ Even, front/rear tab) is set separate.

TAG-ID: TAG_SET_GAIN_WARN_LEVEL = 1C4 H
Format: VAR
Data:
- 1st word: Red odd camera value
- 2nd word: Red even camera value
- 3rd word: Green odd camera value
- 4th word: Green even camera value
- 5th word: Blue odd camera value
- 6th word: Blue even camera value
- 7th word: Rear red odd camera value
- 8th word: Rear red even camera value
- 9th word: Rear green odd camera value
- 10th word: Rear green even camera value
- 11th word: Rear blue odd camera value
- 12th word: Rear blue even camera value

Values: 0 … 700
Default: 640

7.5 Minimum Gain Level

Values are limits that can be used in processing of WR- order to ensure minimum gain values within adjustment process. Each channel value (RGB, Odd/ Even, front/rear tab) is set separate.

TAG-ID: TAG_SET_MINIMUM_GAIN_LEVEL = 1C5H
Format: VAR
Data:
- 1st word: Red odd camera value
- 2nd word: Red even camera value
- 3rd word: Green odd camera value
- 4th word: Green even camera value
- 5th word: Blue odd camera value
- 6th word: Blue even camera value
- 7th word: Rear red odd camera value
- 8th word: Rear red even camera value
- 9th word: Rear green odd camera value
- 10th word: Rear green even camera value
- 11th word: Rear blue odd camera value
- 12th word: Rear blue even camera value

Values: 0 … 700
Default: 0

7.6 Switch White Control On/Off

Tag for enable or disable the white control function

TAG-ID: TAG_USE_WHITECONTROL = 200 H
Format: Bin
Data:
0 : White Control off
1 : White Control on

Default:

7.7 Set test pattern

This tag enables/disables the test pattern mode and selects the type of test pattern. If test pattern is activated synthetic test data is sent as image data instead of video data from camera sensor.

TAG-ID: TAG_SET_TESTPATTERN_MODE = 222 H

Format: Short

Data: 0 : No pattern
1 : Grey ramp in CCD-Direction
2 : Grey ramp in transport direction
3: ramp 0..1023 internal on green Channel
value set by TAG_SET_TESTPATTERN_VALUE (323H) on red and blue channel
4: Sequence of different test patterns and live image
5: change video level at every pixel

Default: 0: No pattern

7.8 Set first pixel of the white reference area absolute

This tag describes the position for the white reference in scan line direction.
Pixel position defined with TAG_SET_HORIZONTAL_POSWREF_ABSOLUTE is meant absolute beginning with first pixel of the camera sensor.

Pixel position can also be defined relative to actual active image window with TAG_SET_HORIZONTAL_WREF_START (2A1 H).
If TAG_USE_HORIZONTAL_WREF_START_ABSOLUTE (2A9H) is set then absolute position is used.

TAG-ID: TAG_SET_HORIZONTAL_POSWREF_ABSOLUTE = 223 H

Format: Short
Data: 0 to line length of the sensor

Default: 0

7.9 Set number of pixel for white reference area

This tag defines the number of pixel / columns for the white reference area in scan line direction.

TAG-ID: TAG_SET_HORIZONTAL_WREF_LENGTH =224H

Format: SHORT

Data: Number of pixels or columns used for white reference area .Only even values were supported.
0 … 1022

Default values: 20

7.10 Check White adjustment

With TAG_USE_CHECKWHITE internal white balancing is started.

State of adjustment must be polled with comman “SZ”. Value of KaZustand represents the current state of the process.
After having finished adjustment TAG_USE_CHECKWHITE is set to 0.

TAG-ID: TAG_USE_CHECKWHITE = 225 H

Format: BIN

Data: 0: no white adjustment is active
1: white adjustment is active

Default: 0:

7.11 Show the borders of white reference area in video data

This tag enables/ disables the function to show the borders of the white reference in the image.
Hints: To see borders in the video data the start and end positions must be within the active scan window.
The visible mode must be disabled by collecting images for offset and shading correction.

TAG_ID: TAG_SHOW_WHITE_REF_BORDERS =226H

Format: SHORT

Data: 1: Position of white reference borders in video data visible
0: Position of white reference borders in video date not visible

Default: 0

7.12 Set Average Mode

To get a better picture quality it is useful to average successive lines. But this slows the speed of the camera.
If average mode is set to n lines the speed has to be reduced to 1/n to keep the image ratio.

TAG-ID: TAG_SET_AVERAGEMODE = 228 H

Format: SHORT

Data: 0: No Average
n: Average scan line with (n + 1) Lines

Range: 0 … 15

Default: 0: No Average

7.13 Set Gamma

Gamma modifies the input values in all color channels: out_value = round (255 (normalized in_value $^{1/Gamma}$)

TAG-ID: TAG_SET_GAMMAVALUE = 229 H

Format: Short

Data: 0: gamma correction not used
1 … 25: set gamma in range value divided by 10 (0.1 ... 2.5)

Default: 0: gamma correction not used

7.14 Select Shading correction on/off

This tag enables / disables the shading correction. If enabled the stored shading reference data are loaded for correction.
With TAG_SEL_REFERENCEDATA_WHITE (281 H) the white reference data set is selected.

TAG-ID: TAG_USE_SHADINGCORRECTION = 22A H

Format: Bin

Data: 0: Shading correction disabled
1: Shading correction enabled

Default: 0: Shading correction disabled

7.15 Select Black level correction on/off

This tag enables the black level correction (Offset correction). If enabled the stored black level reference

data are loaded to correct the black level.
With TAG_SEL_REFERENCEDATA_BLACK (280 H) the black reference data set is selected.

TAG-ID: TAG_USE_BLACKLEVELCORRECTION = 22B H

Format: Bin

Data: 0: Black level correction disabled
1: Black level correction enabled

Default: 0: Black level correction disabled

7.16 Usage of color conversion on/off

This tag enables/ disables the color conversion function. Method and color conversion data are supported by order DD.

TAG-ID: TAG_USE_COLOR_CONVERSION = 22C H

Format: Bin

Data: 0: Color Conversion disabled
1: Color Conversion enabled

Default: 0: Color Conversion disabled

7.17 Use fast incremental gain control at Warming up

At white balancing with order WR the camera tries to adjust gain values to reach given target white level as fast as possible. To avoid visibility of gain steps in captured images the adjustment of gain value can be set to incremental mode.
If this mode is selected and function white balancing is requested the white reference average function is suppressed.

TAG-ID: TAG_USE_FASTINCREMENTAL_AT_WARMINGUP =22F H

Format: Bin

Data: 0: Normal behavior of gain control
1: Only incremental gain control mode in state “Warming Up” is allowed

Default: 0: Normal behavior of gain control

7.18 First valid scan line within an image

This tag defines the value of the first valid scan line within an image after a trigger event.

If a camera is in slave mode the value defines an offset to the first valid scan line position of the master camera.

TAG-ID: TAG_SET_VSYSTART = 230 H

Format: SHORT

Data: First valid scan line in range 0 to 32767

Default: 300

7.19 Set number of scan lines within an image

This tag defines the number of scan lines within an image. If scan condition mode 2

(TAG_SET_SCANCONDITON) is selected this function is not active.

TAG-ID: TAG_SET_VSYLENGTH = 231 H

Format: SHORT

Data: 1. word: number of scan lines

Range: 1 .. 65535

Default: 2704

At allPIXA cameras with appropriate firmware packet the value range of the parameter was extended. For this the format of the TAG is changed to FORMAT_LONG.

Format: LONG

Data: 1. DWORD: number of scan lines

Range: 1 .. 1048575

Default: 2704

7.20 Set first valid Pixel within a scan line

This tag defines the first valid pixel in image in scan line direction.

TAG-ID: TAG_SET_HSYSTART = 232 H (obsolete with camera release P1.40 and higher)

Format: SHORT

Data: 1. word: first valid pixel

Range: 0 … length of sensor / 2

Default: 0

7.21 Set length of a scan line

This tag defines the value of the image width in scan line direction.

TAG-ID: TAG_SET_HSYLENGTH = 233H

Format: SHORT

Data: 1. word: number of pixel within a scan line

Range: 2 … length of sensor

Default: 5000

7.22 Scan pattern

With this tag the triggering synchronization with external signals like light barriers is configured.

TAG-ID: TAG_SET_SCANPATTERN = 237 H

Format: VAR

Data: Data for Start Scan Control

Bit	15 … 0	
	ScanPattern Mask	Word 0
	ScanPattern 0	Word 1
	ScanPattern 1	
	ScanPattern 2	
	ScanPattern 3	Word 4

Mask: With one bit out of bits 0 .. 3 set to “1” a trigger input signal is selected.

With bits 0 .. 3 of the pattern words the polarity of the trigger signal is configured.

Example:

- LB1 is trigger signal
- rising edge
- only start trigger is used.

Bit	15 … 3 2 1 0	
ScanPattern Mask	0 0 **1** 0	Word 0
ScanPattern 0	0 0 **0** 0	Word 1
ScanPattern 1	0 0 **0** 0	
ScanPattern 2	0 0 **1** 0	
ScanPattern 3	0 0 **1** 0	Word 4

Bit 2^1 of mask selects LB1.
Sequence of 0-0-1-1 at bit 2^1 in pattern 0..3 corresponds to a rising edge of the signal.

If TAG_SET_SCANCONDITON (24B H) is set to start and stop condition then pattern 0 and 1 defines the start condition and pattern 2 and 3 the stop condition.

7.23 Linetrigger reduction factor

The selected factor with this tag is used to reduce the transport resolution in linetrigger and encoder mode. The factor is the reciprocal of the inserted value in the range from 1 to 256.

TAG-ID: TAG_SET_TRANSITIONS_PER_LINE (238 H)

Format: SHORT

Data: 1: No reduction is used
2 … 256: value for line reduction factor (1/value)

Default: 0: No reduction is used

7.24 Set scan direction

This tag selects the sequence of color lines of the tri-linear CCD-Sensor (RGB or BGR). The sequence needs to be changed by changing the scan direction.
TAG_SET_SCANDIR determines the direction of the RGB line shift done in the camera.

If external synchronization mode is selected (TAG_USE_EXTERNAL_SYNC = 1) the camera detects the scan direction by the incremental encoder. In this mode the tag is used to determine the meaning of encoder signal.

TAG-ID: TAG_SET_SCANDIR = 23A H

Format: Bin

Data: 0: red line first / incremental encoder signal not inverted

1: blue line first/ incremental encoder signal inverted

Default: 0: red line first / incremental encoder signal not inverted

allPIXApro with Firmware P2.22:

Format: SHORT

Data: 0: red line first
1: blue line first
2: ScanDir is determined by external IO pin (pin is set by IO config)
3: ScanDir is determined by encoder direction

Default: 0: red line first

7.25 Mode of horizontal synchronization

With this tag encode / line trigger mode of the camera is enabled.

The parameters for the encoder are set with TAG_SYNCMODE_EXTENDED (279 H).

TAG-ID: TAG_USE_EXTERNAL_SYNC = 23B H

Format: Bin

Data: 0: scan line is free running with parameter integration time / line period
1: scan line synchronization with external signal (encoder)

Default: 0

7.26 Start Scan Mode

This tag enables/ disables the scan line generation.

TAG-ID: TAG_SET_SCAN_READY = 23C H

Format: Bin

Data: 0: Generation of image line is disabled
1: Generation of images line is enabled

Default: 1

7.27 Store setting in non-volatile memory

With this tag the current configuration of the camera is stored in the selected slot of Setting to the non-volatile memory.

TAG-ID: TAG_BURN_SETTINGS = 240 H

Format: SHORT

Data: 1..19: Selected setting number to store configuration

With all other values the tag is ignored

7.28 Activate stored setting in camera

This tag activates a stored setting data set out of the non-volatile memory in the camera.
Selected setting must be stored with TAG_BURN_SETTING.

TAG-ID: TAG_SET_ACTIVE_SETTING = 241 H

Format: SHORT

Data: 0: default factory values

1 - 19: number of setting to configure camera

With all other values the tag is ignored

7.29 Physical resolution in transport direction

The value is used to calculate the parameters for the encoder.

TAG-ID: TAG_PHYS_AUFL_VERT = 244 H

Format: LONG

Data: 0 … FFFFFFF H, unit is 1/1000 dpi

Default: 400000 (1/1000 dpi)

7.30 Mirror scan line

This tag enables/ disables the function to mirror the data output of the scan line horizontally.

TAG-ID: TAG_MIRROR_DATA_HOR = 246H

Format: Bin

Data: 0: don't mirror data
1: mirror data

Default: 0: don't mirror data

7.31 Comment for Setting

With this tag a comment of maximum 128Byte (ASCII character) can be added to a setting.

Hint: TAG 240H is used to store the complete setting with the comment to the non-volatile memory.

TAG-ID: TAG_COMMENT = 247 H

Format: VAR

Data: Text for Comment (ASCII characters)
Maximum Length = 128 Bytes
End of text is marked with string end byte = 0

Default: No comment

7.32 Set Integration time in ns

This tag defines the value of integration time for the CCD sensor in ns.

TAG-ID: TAG_SET_INTEGRATION_TIME_IN_NS = 24A H

Format: long

Data: Integration value in ns
minimum integration time depends on camera speed and sensor length
max.: 12ms

Default: 100.000

7.33 Set Scan Condition

This tag selects the type of scan condition. The selected scan condition is configured with additional tags.
The start and stop conditions are set by TAG_SET_SCANPATTERN.
With TAG_SET_VSYSTART the start offset for frame start behind the start condition is set.
With TAG_SET_VSY_OVERSIZE the number of scan lines behind the stop condition end is set.

TAG-ID: TAG_SET_SCANCONDITON = 24b H

Format: SHORT

Data: 0: Do not use Scan Conditions (Free running)
1: Use Start condition defined
2: Use Start and Stop condition

Default: 0: Do not use Scan Conditions (Free running)

7.34 Set special register values in camera (use only for development)

With this tag camera internal register can be set directly. The range of functionality for this tag depends on the HW type.

Hint: Values sent with TAG_SET_REGISTER (250H) are not stored in the camera. If storing is needed use Tag 29D H.

TAG-ID: TAG_SET_REGISTER = 250 H

Format: VAR

Data: Register address and register data

Bit

15	0	
Address 1 relative to FPGA_A		Word 1
Data word 1 to write in Register		Word 2
Address 2 relative to FPGA_A		
Data word 2 to write in Register		
…		
….		Word n

7.35 Indicate Setting for Store

This flag indicates the actual setting to be stored previously in non-volatile memory.
When requesting the camera which settings are stored only setting with “stored” flag are set to be active in response tag TAG_GET_USED_SETTINGS (257 H).

TAG_ID: TAG_SET_SETTING_STOREFLAG = 258 H

Format: BIN

Data: 1: indicates that the function “Save all Settings” should include this Setting.
0: else

Default: 0

7.36 Set white calibration parameter to setting

This tag writes / copies all actual parameters which are relevant for white level calibration to a stored setting.

TAG-ID: TAG_SET_WHITE_CALIB_VALUES = 25A H

Format: SHORT

Data: 1 - 19: number of setting from where the parameter should be written to.
With all other values the tag is ignored

7.37 Read white calibration parameter from setting

This tag reads all parameters which are relevant for white level calibration from a stored setting. Together with TAG_SET_WHITE_CALIB_VALUES state of white calibration can be copied from one setting to another.

When reading the calibrated parameters the new values are also activated.

TAG-ID: TAG_GET_WHITE_CALIB_VALUES = 25B H

Format: SHORT

Data: 1 - 19: number of setting to where the parameter should be written
With all other values the tag is ignored

7.38 Set description text for the camera

With this tag a camera specific description can be stored in the camera.

Hint: The text is not setting specific.

TAG-ID: TAG_SET_CAMERA_DESCRIPTION_TEXT = 264 H

Format: VAR

Data: Text for Comment (ASCII)
Maximum length = 256 Bytes
End of text must marked with a byte with value x00

7.39 Set private data

With this tag 16 words of customer data can be stored in the camera. The content or meaning is arbitrary and not checked by the camera.

TAG-ID: TAG_SET_PRIVATE_DATA = 266 H

Format: VAR

Data: User data
Maximum length = 16 Words

The data is not setting specific and is always stored after receiving.

7.40 Set initial gain level

This tag sets the startup gain values for the camera. These values are also loaded when activating a setting with TAG_SET_ACTIVE_SETTING (241 H).

TAG-ID: TAG_SET_INITIAL_GAIN_LEVEL = 267 H

Format: VAR

Data:
1st word: Red odd camera value
2nd word: Red even camera value
3rd word: Green odd camera value
4th word: Green even camera value

5th word: Blue odd camera value
6th word: Blue even camera value
7th word: Rear red odd camera value
8th word: Rear red even camera value
9th word: Rear green odd camera value
10th word: Rear green even camera value
11th word: Rear blue odd camera value
12th word: Rear blue even camera value

Values: 0 H – 3FF H (16 bit unsigned)

7.41 Update initial gain level

With this tag the initial gain values are updated with the actual gain values. The actual gain values are changed by internal gain control. This tag is meant to store a leveled operation point to the startup values of the setting.

TAG-ID: TAG_UPDATA_INITIAL_GAIN = 268 H

Format: Bin

Data: 1: initial values are updated

Default: 0

7.42 Set maximum number of scan lines

Set the maximum number of scan lines generated after start scan condition is true. With this Tag it is possible to limit the necessary size of memory for the image.
With TAG_STOP_BY_MAX_NUMBER_SCANLINES the mode for further operation at reaching maximum number is determined.

TAG-ID: TAG_SET_MAX_NUMBER_SCANLINES = 271 H

Format: Short
Data: Maximum number of scan lines

Default: 0

7.43 Stop at max number of scan lines

With tag the mode for further operation after reaching maximum number of scan lines is determined.

TAG-ID: TAG_STOP_BY_MAX_NUMBER_SCANLINES = 272 H

Format: Bin

Data: 0: Scan Process continues after over size detection
1: An error message is generated

Default: 0

7.44 Set additional paper length

When automatic detection of image length is active (TAG_SET_SCANCONDITION = 2) with this TAG the number of lines **after** end of trigger signal is determined.

TAG-ID: TAG_SET_VSY_OVERSIZE = 273 H

Format: Short

Data: Length of paper oversize in number of lines

Default: 0

7.45 Set active channels for white control

With this TAG internal white control of the available image channels can be selected or omitted.
With 0 in the appropriate bit of a channel it is skipped from internal white control. This might be useful if you have illuminations with different color and white level calibration is done for each color separately. If i.e. red illumination is used all other color channel will rise into upper limit at white calibration if white control for these channels is not omitted.

TAG-ID: TAG_SET_ACTIVE_CHANNELS = 277 H
Format: SHORT
Data: xxxxxxxxxxx1 (bin): Channel 1 is used (red channel odd)
xxxxxxxxxx1x (bin): Channel 2 is used (red channel even)
xxxxxxxxx1xx (bin): Channel 3 is used (green channel odd)
xxxxxxxx1xxx (bin): Channel 4 is used (green channel even)
xxxxxxx1xxxx (bin): Channel 5 is used (blue channel odd)
xxxxxx1xxxxx (bin): Channel 6 is used (blue channel even)

All bits set to 0 is invalid than internal hardware default is used.

At allPIXA camera the behavior of the even channels are copied from odd channels because the odd and even channels of one color are controlled simultaneously.

allPIXA cameras are based on tapped sensor hardware. Front and rear tab behavior is controlled by white reference position mode parameter.

7.46 Encoder parameter

This Tag configures the parameter of the encoder. Using encoder mode adapts camera speed to varying scan speeds in transport direction.

TAG-ID: TAG_ SYNCMODE_EXTENDED = 279 H

Format: VAR

Bit

15 0		
Encoder resolution in nm / step	(low word) (high word)	Word 1 Word 2
Number of values for averaging		Word 3
Modes		Word 4
reserved		Word 5
Number of Encoder Channels		Word 6

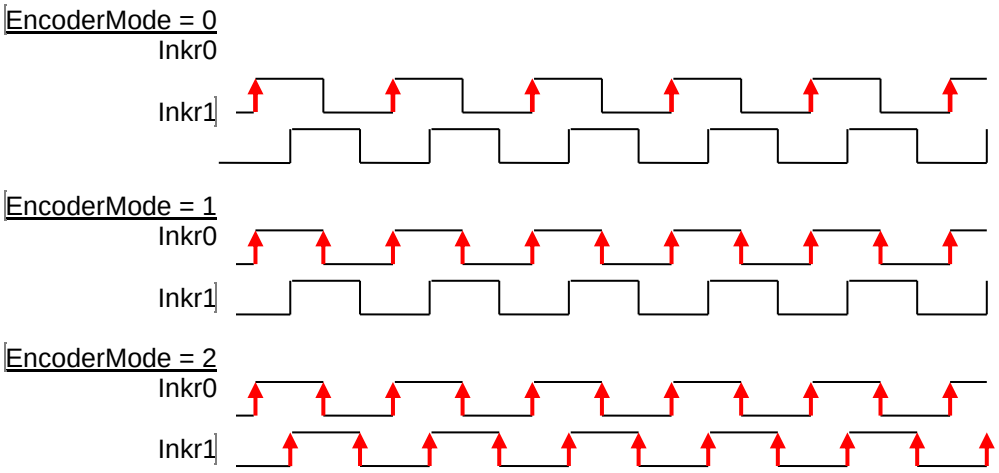
Number of values for averaging:

0: No average
1: average with 2 values
2: average with 4 values
3: average with 8 values
4: average with 16 values
5: average with 32 values
6: average with 64 values

Modes:
0: encoder mode inactive
1: Continues update using average
5: Line Trigger Mode

Number of Encoder Channels:
0: encoder resolution is distance between the positive edges

1: 1 Channel Encoder (2 edges per step)
2: 2 Channel Encoder (4 edges per step)



Note:

Because most available industrial encoders have jitter between rising and falling edges of each channel and also have jitter between the two channels best results are with using “Number of Encoder Channels” = 0.

7.47 Select reference data set for black level correction

This tag selected the reference data set for black level correction. The data set must be stored before with order DS.

TAG_ID: TAG_SEL_REFRENCEDATA_BLACK (280 H)

Format: Short

Data:
0: Black Reference data set 1 is used
1: Black Reference data set 2 is used
2: Black Reference data set 3 is used (camera P1.40 and higher)
3: Black Reference data set 4 is used

Default: 0

7.48 Select reference data set for white level correction

This tag selected the reference data set for shading correction. The data set must be stored before with order DS.

TAG_ID: TAG_SEL_REFRENCEDATA_WHITE (281 H)

Format: Short

Data:
0: White Reference data set 1 is used
1: White Reference data set 2 is used
2: Black Reference data set 3 is used (camera P1.40 and higher)
3: Black Reference data set 4 is used

Default: 0

7.49 Set number of white reference samples for average

If scan light is overlaid with flicker effects or the amount of noise is high than it is useful to average subsequent white reference data samples before the data are used to calculate new gain values.
Using this average mode slows the speed of gain control. But this is only significant if the light can change

rapid.

TAG_ID: TAG_SET_WHITEREF_AVERAGE (283 H)
Format: Short

Data: 0 : No average is done
1 : 2 Samples are used
2 : 4 Samples are used
3 : 8 Samples are used
4 : 16 Samples are used
5 : 32 Samples are used

Default: 0

7.50 Select mode for white reference

This tag determines at which position the reference data for gain control a captured.

TAG-ID: TAG_SEL_WHITEREFPOS (287 H)

Format: Short

Data: 0 : Front tab data is used for gain control, Rear channels follows (slave rear)
1 : Rear tab data is used for gain control, front channels follow (slave front)
2 : Front and Rear TAP data are controlled independently
3 : Automatic master detection. If white reference position is located in front TAP than front is master. If white reference position is located in rear TAP than rear is master.

In case of 0, 1 or 3 the difference of initial gain values between corresponding front and rear channels is build and added to gain of the following side (= slave side). If initial gain is set to zero the same gain values are used for the slave side.

Default: 0

7.51 Select insert information to video data

This TAG defines the debug and test data which is inserted to video data stream. The debug data overwrites image data values of the image.

TAG-ID: TAG_SET_INSERT_MODE (293 H) (allPixa with packet 1.3 and higher)

Format: Short

Data: Bit encoded, see table below

Bit No	Name	Position in image	Data length	Hint
0	FirstLine_InfoBlock	First line Pixel No. 0 bis 22	23 Px	Refer bellow
1	LastLine_TestRamp	Complete last line	Complete line	Start value: 128
2	LastLine_IMG_ChkSum	Middle of the last line	2 Pixel for each Tap	Refer bellow
3	EachLine_Infoblock	Each line Pixel No. 1 to 8	8 Pixel	Refer bellow
4:5	EachLine_GreyValSum OrContrast	Each line Pixel No. 10 to 15	6 Pixel	0: Inactive 1: EachLine_GreyValSum 2: Inactive 3: EachLine_ContrastVal
6..15	*Reserved*	--	--	*For future use*

Bit No 0: first line info block

Pixel line	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	n-1
0		SerialNumber					ImgCnt		IntTime			LineTime			EnClks				Error	TimeStamp				Video

Bit No 1: Last line test ramp

Pixel line	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	n-1
…	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid
…	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid
…	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid
…	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid	Vid
LastLine	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	…	m

Bit No 2: Last line image check sum

Pixel line	0	1	2	…	n-3	n-2	n-1
…	Vid	Vid	Vid	…	Vid		
LastLine R	Vid	Vid	Vid	…	Vid	ChkSumRed(15:8)	ChkSumRed(17:0)
LastLine G	Vid	Vid	Vid	…	Vid	ChkSumGreen(15:8)	ChkSumGreen(17:0)
LastLine B	Vid	Vid	Vid	…	Vid	ChkSumBlue(15:8)	ChkSumBlue(17:0)

Bit 3-5: Each line Info block

Pixel	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
value	**Infoblock**										**GreyValSum or ContrastValue**							
R	xFF	Error Reg	Speed 2High Line Time (19:16)	Enc Clks (23:16)	Next LTPos Int (15:8)	Time Stamp (23:16)	Max Val Front (7:0)	Max Val Rear (7:0)	Res (vid)	xFF	Red Front (23:16)	Green Front (23:16)	Blue Front (23:16)	Red Rear (23:16)	Green Rear (23:16)	Blue Rear (23:16)	xFF	Vid
G	x00	Line CNT (15:8)	Line Time (15:8)	Enc Clks (15:8)	Next LTPos Int (7:0)	Time Stamp (15:8)	Max Val Front (7:0)	Max Val Rear (7:0)	Res (Vid)	x00	Red Front (15:8)	Green Front (15:8)	Blue Front (15:8)	Red Rear (15:8)	Green Rear (15:8)	Blue Rear (15:8)	x00	Vid
B	X00	Line CNT (7:0)	Line Time (7:0)	Enc Clks (7:0)	Next LTPos Fract (7:0)	Time Stamp (7:0)	Max Val Front (7:0)	Max Val Rear (7:0)	Res (vid)	X00	Red Front (7:0)	Green Front (7:0)	Blue Front (7:0)	Red Rear (7:0)	Green Rear (7:0)	Blue Rear (7:0)	X00	Vid

Note:

Type and position of information for each line is specified with TAG_COLUMN_INSERTMODE (2B0 H)

7.52 Color channel for MuxOutCol

With this TAG image color can be configured for the RGB channels at the output to camera link cable.

TAG-ID: TAG_MUX_OUT_COLOR_SELECT = 295H

Format: SHORT

Data: Selects the color channel for the Output MUX.

Bits 5:4	Output Channel 1	Bits 3:2	Output Channel 2	Bits 1:0	Output Channel 3
0 (Default)	Red	0 (Default)	Green	0 (Default)	Blue
1	Red	1	Red	1	Red
2	Green	2	Green	2	Green
3	Blue	3	Blue	3	Blue

7.53 Change Red / Blue color channel

With this tag red and blue color channel are exchanged at the output to CameraLink.

TAG-ID: TAG_R_B_CHANGE = 296H

Format: BIN

Data: 0: keep red and blue order
1: Exchange red and blue channel

7.54 Enable camera link high speed

This Tag enables a higher transfer clock on the camera link interface for increasing data rate. Refer to Camera Link specification regarding cable length and transfer clock.

TAG-ID: TAG_ENABLE_CL_HIGHSPEED (297H)

Format: BIN

Data: 0 = Camera Link frequency 72,86 MHz (Standard speed)
1 = Camera Link frequency 85 MHz (High speed)

Default: 0

*1) Hint: KA8-allPixa supported within packet1.2 and lower. For packet 1.3 and higher refer to tag 0x2BC!

7.55 Length of pattern for vertical reduction

TAG-ID: TAG_VERT_SCAN_LINE_REDUCTION_PATTERN_LENGTH (298H)

Format: SHORT

Data: 0: reduction is inactive
1 … 8: length of the reduction pattern

Set the reduction of resolution in transport direction. The value of this tag determines the length of the used ring shift register. See TAG_VERT_SCAN_LINE_PATTERN

7.56 Pattern for vertical reduction

TAG-ID: TAG_VERT_SCAN_LINE_PATTERN (299H)

Format: SHORT

Data: Bit pattern for reduction of resolution in transport direction.

Example:
For a 4 of 8 blanking (4/8th of the original transport resolution) the length (Tag 298H) is set to 8 and the lower 8 bits of the reduction pattern is set to the desired pattern consisting of 4 ones and 4 zeros.

With reduction pattern = 169 = 0xa9 = 10101001 (bin)

Line 0, 3, 5 and 7 are transferred, line 1,2,4,6, are suppressed out of a block of 8 consecutive lines

7.57 Horizontal binning

This tag enables horizontal pixel reduction. Several neighbored pixel are averaged to one single pixel which is output.

TAG-ID: TAG_SET_BINNING = 29A H

Format: SHORT

Values 0: binning is off

Value	Reduction
0	1/1 (no reduction)
1	1/2
2	1/4
3	1/8
4	1/16
5	2/3 (allPIXApro P2.22 and higher)

Note:
HsyLength is corrected to multiple of binning factor.

7.58 Set register parameter to setting

Values sent with this tag can be stored to the actual active setting.

TAG-ID: TAG_ REGISTER_TO_SETTING = 29D H

Format: VAR

Data: Address und Data for Register

Bit

15 0	
Address 1	Word 1
Data word 1 to write in Register with Address 1	Word 2
Address 2	Word 3
Data word 2 to write in Register with Address 2	Word 4
Address 3	Word 5
Data word 3 to write in Register with Address 3	Word 6
Address 4	Word 7
Data word 4 to write in Register with Address 4	Word 8

Not used entries must be set to 0.

7.59 Set first pixel of white reference area relative to image window

This tag defines the position for the white reference in scan line direction relative to the actual image window; that means relative to TAG_SET_HSYSTART (232H)

TAG-ID: TAG_SET_HORIZONTAL_WREF_START =2A1H

Format: Short

Data: Position of first Pixel or Column for white reference
Position 0 is the first pixel of the active scan window defined by TAG_SET_HSYSTART.
Negative values in 2' complement are used to position the window left of the active scan window.

Default values: 0

7.60 Set first scan line of white reference area in transport direction

This tag defines the first scan line used for white reference area in transport direction.

Position = 0 is the first scan line after start of the active scan window defined by TAG_SET_VSYSTART.

Negative values in 2' complement are used to set the position before of the active scan window.
The first possible line is the line captured after frame trigger defined by TAG_SET_SCANPATTERN.

Therefore the maximum negative value can be equal to value set by TAG_SET_VSYSTART.

TAG-ID: TAG_SET_VERTICAL_WREF_START =2A3H

Format: SHORT

Data: Line start position of white reference area relative to TAG_SET_VSYSTART.
-(TAG_SET_VSYSTART) …. (TAG_SET_VSYLENGTH)

Default value: 0

7.61 Set number of lines for white reference area

This tag defines the number of lines used for white reference area in transport direction.

TAG-ID: TAG_SET_VERTICAL_WREF_LENGTH = 2A4 H

Format: SHORT

Data: 2..1022; Only even values are supported!

Default: 2

7.62 Set value for stop gain control

If video level of white references tropes below a certain factor the automatic gain control can be stopped. This operation mode is activated by Bit 4 of TAG_SET_WHITECONTROL_MODE (318 H).

This tag sets the value to disable gain control if the current channel values for the white reference different to the mean of all set point white values (1C2H).

The threshold for disable gain control is defined by:
Sum of all actual channel values < (value / 1024) * mean of all set point white values

Example:
All desired value for white reference (1C2 H) are set to 800
TAG_SET_GAIN_STOP_FACTOR = 512
If sum of all actual white references tropes below (**512** / 1024) * 800 = **400,** then automatic gain control is disabled.

TAG-ID: TAG_SET_GAIN_STOP_FACTOR = 2A5H

Format: Short

Data: 0 … 1000

7.63 Set White Reference visible mode

This tag selects the type of visibility of the borders of the white reference area. The borders are visible if TAG_SHOW_WHITEREF_BORDERS (226H) is set.

Note:
The visible mode should be disabled for capturing images for offset and shading correction.

TAG-ID: TAG_SET_WREF_VISIBLE_MODE = 2A6H

Format: Short

Data: 0: Show Borders of White Reference Area
2: Show Border Lines of White Reference Area

Default: 0: Show Borders of White Reference Area

7.64 Clear Setting content

With this tag the selected setting of the camera is erased in the non-volatile memory.

TAG-ID: TAG_ SETTING_CLEAR = 2A7 H

Format: SHORT

Data: 1 - 19: Number of selected setting to clear

With all other values the tag is ignored

7.65 Use absolute position of white reference in CCD direction

This tag determines if first pixel of white reference position is defined absolute or relative to scan window.

TAG-ID: TAG_USE_HORIZONTAL_WREF_START_ABSOLUTE =2A9H

Format: BIN

Data: 1: first pixel of position for white reference is defined absolute with TAG_SET_HORIZONTAL_POSWREF_ABSOLUTE (223H).
0: first pixel for position of white reference is defined relative to the active scan window with TAG_SET_HORIZONTAL_WREF_START (2A1H).

Default values: 0

7.66 Select position for insert information

TAG determines if information for first or / and last line is inserted to image.
The kind of information for first and last line is determined with TAG_SET_INSERT_MODE (293 H).

TAG-ID: TAG_COLUMN_INSERTMODE (2B0 H)
Format: Short

Data: Bit encoded, see description below

0: Information data inserted to the first pixel of scanline
1: Information data inserted to the last pixel of scanline
2: Information data inserted to the first and last pixel of scanline
All other values invalid

Default: 0:

7.67 Enable Line period at free run (Shutter Mode at Free run)

This Tag enables/ disables the functional shutter mode. The value for the line period is set with TAG_SET_LINEPERIOD = 2B7 H.

If the integration time is out of range corresponding to the line scan time an error message is provided and the tag will not be processed.

TAG-ID: TAG_USE_LINEPERIOD = 2B6 H

Format: Short

Data: 0: Disable shutter mode at free run
1 … 65535: Enable shutter mode at free run

Default: 0: Disable shutter mode at free run

7.68 Set Line period at free run (Shutter Mode at free run)

This Tag set the time for the scan line period. The line period is used together with the integration time (TAG_SET_INTEGRATION_TIME_IN_NS = 24A H). If the integration time is out of range corresponding to the line scan time an error message is provided and the tag will not be processed.

TAG-ID: TAG_ SET_LINEPERIOD = 2B7 H

Format: long

Data: Time for line period in ns

Range: Min value > Integration time in ns (Tag x24A)
Max value < 12337000

Default: 0

7.69 Enable Keystone correction

This Tag enables/ disables the keystone correction function. The parameter for the keystone correction are set with the Tag “TAG_SET_KEYSTONECORRECTION = 2B9 H”. If the parameters are invalid an error message is provided and the tag will not be processed.

TAG-ID: TAG_USE_KEYSTONECORRECTION = 2B8 H

Format: Short

Data: 0 : Disable keystone correction
1..65535 : Enable keystone correction

Default: 0 : Disable keystone correction

7.70 Parameters for Keystone correction

This Tag configures the parameter of the keystone correction. The first parameter is the shift for the correction on the edge of the image in Pixel. The sign of the value defines the correction for the red channel. Positive values for zoom in and negative values for zoom out (for the blue channel vice versa).
The second parameter defines the position of the zero crossing. For the common keystone correction the position is in the middle of the image (scan line length/2). For special use (e.g. simple TCA correction) the position can be shifted starting from the center up to the edge of the image.

TAG-ID: TAG_SET_KEYSTONECORRECTION = 2B9 H

Format: VAR

Data:

15 0	
Pixel shift for correction	Word 1
Position of zero crossing	Word 2

Pixel shift for correction (Word 1):
- Format is short
- Data range from +40 to -40 [Pixel/10]
- All other values invalid
- Default value is 0

Position of zero crossing, offset starting from center (Word 2):
- Data range from 1 to value of scan line length/2 [Pixel]
- All other values are invalid
- Default is [value of scan line length/2]

7.71 Select data set for color conversion method

This tag is used to select the CCM data set. Four different sets can be stored in the non-volatile memory of the camera. For transfer to camera command DD is used.

TAG_ID: TAG_SEL_CCM (2BB H)

Format: Short

Data: 0: CCM data set 0 is used
1: CCM data set 1 is used
2: CCM data set 2 is used
3: CCM data set 3 is used

Default: 0: CCM data set 0 is used

7.72 Select the camera link transfer speed

This Tag enables a higher transfer clock on the camera link interface for increasing data rate. Refer to Camera Link specification regarding cable length and transfer clock. Check environment and application for selection. The “Reduced speed” is used for long cable application.

TAG-ID: TAG_SELECT_CL_SPEED (2BC H)

Format: Short

Data: 0 = Camera Link frequency 72,86 MHz (Standard speed)
1 = Camera Link frequency 85 MHz (High speed)
2 = Camera Link frequency 63,75 MHz (Reduced speed)
All other values invalid

Default: 0

Note:
allPIXA supported with packet 1.3 and higher. For packet 1.2 and lower old tag 0x297 is used.

7.73 Set value for stop gain control by variance

This tag set the value to disable gain control if the variance of white reference area is above a threshold. The variance values of all channels are calculated and the maximum is used to compare with the stop variance condition.

TAG-ID: TAG_SET_GAIN_STOP_VARIANCE = 2BDH

Format: SHORT

Data: Maximum variance value of all channels from white reference area
Variance is the variance of the 10 bit values divided by 4

An undistorted white area should have a value below 500.

This mode of operation is activated by Bit 6 of TAG_SET_WHITECONTROL_MODE (318 H).

7.74 Set internal odd / even control

This TAG sets the mode of the internal odd / even control.

TAG-ID: TAG_SET_INTERNAL_OE_CONTROL = 2C0 H

Format: Short

Data: 0: automatic mode, internal odd / even control starts periodically
1: internal odd / even control is switched off

Default: 0

Note:
Value of TAG_SET_INTERNAL_OE_CONTROL becomes valid at once after received from the camera. But the value is not stored non-volatile.
After startup or reset of the camera TAG_SET_INTERNAL_OE_CONTROL is set to default value = 0.

7.75 Enable suppression of reverse lines

With TAG_SUPPRESSLINES_ENABLE the camera suppresses scan lines which are captured in wrong scan direction. Therefore a 2 channel encoder must be installed to determine the scan direction.

TAG-ID: TAG_SUPPRESSLINES_ENABLE = 2C1 H

Format: Bin

Data: 0: suppression of scan lines is disabled
1: suppression of scan lines is enabled

Default: 0

7.76 Mode of line suppression

With TAG_SUPPRESSLINES_MODE the direction of scan lines can be set to be suppressed. TAG_SUPPRESSLINES_ENABLE must be set to enable this function

TAG-ID: TAG_SUPPRESSLINES_MODE = 2C2 H

Format: SHORT

Data: 0: lines are suppressed in negative direction
1: lines are suppressed in positive direction

Default: 0:

7.77 Check Tap adjustment

With TAG_CHECK_TAPADJUST internal tap balancing is started.

State of adjustment must be polled with comman “SZ”. Value of KaZustand represents the current state of the process.
After having finished adjustment TAG_CHECK_TAPADJUST is set to 0.

TAG-ID: TAG_CHECK_TAPADJUST = 2C8 H

Format: SHORT

Data: 0: no tap adjustment is done
1: tap adjustment is active

Default: 0:

7.78 Set weights for the color channels

TAG-ID: TAG_SET_COLOR_WEIGHTS = 305 H
Format: VAR

Data:

Bit

15	0	
Weight for Red Channel		Word 1
Weight for Green Channel		Word 2
Weight for Blue Channel		Word 3

The weights has to be multiplied with factor 100

Example:
For weight 0.6 the needed value is 60

For Grey or Interleave output the sum of the weights should be 100.

Default: Red=30
Green = 59
Blue = 11

See also: TAG_SET_GREYOUTPUT_MODE (322 H)

7.79 Set reduction mode in transport direction

With this TAG image is reduced in vertical direction by suppressing scan lines.

TAG-ID: TAG_SET_SUPPRESSED_LINES = 30E H
Format: SHORT

Data: number of suppressed lines
Range: 0 … 255

Default: 0

The resulting reduction factor is: 1 + number of suppressed lines

7.80 Set trace mask

With this tag the information internally traced in the camera is specified.

Note: High amount of internal tracing data will decrease micro controller performance. Do only use for test purpose.

TAG-ID: TAG_SET_TRACE_MASK = 0x30F
Format: SHORT

Data: Bitmap for the selection of different trace items

Bit 0	General debug information
Bit 1	Communication transport layer
Bit 2	Communication transport layer details
Bit 3	reserved
Bit 4	State Trace White- and Led Control
Bit 5	internal states
Bit 6	image
Bit 7	environment values
Bit 8 .. 15	reserved

Default: 0

7.81 Modify Video level with brightness and contrast control

With this tag brightness and contrast level are changed by additional offset and gain parameters.

TAG-ID: TAG_VIDEOLEVEL_CORRECTION = 315 H
Format: VAR

Data:

Change brightness and contrast level by additional offset and gain parameters

Bit	15 0	
	Mode	Word 1
	Additional Offset Red	Word 2
	Additional Offset Green	Word 3
	Additional Offset Blue	Word 4
	Additional Gain Factor Red	Word 5
	Additional Gain Factor Green	Word 6
	Additional Gain Factor Blue	Word 7

Mode: 0: Do not use this features
1: Use Offset and Gain Correction

Additional Offset *color:*
VideoOut = VideoIn + Additional Offset
Range: - 255… 255 (in 10 bit Video Range)
Default: 0

Additional Gain Factor *color*:
VideoOut = VideoIn * Additional Gain Factor /1000
Range: 0 … 2000
Default: 1000

7.82 Master-Slave-Control

Several cameras can be connected to Master/Slave mode. By this master camera serves line valid und frame valid for the slave cameras.
With this tag it is configured how the camera determines to be master or slave.

TAG-ID: TAG_MASTER_SLAVE_CONFIGURATION = 317 H

Format: SHORT

Data: Refer description bellow

value	Mode	Meaning
0	NoMasterSlave (Default)	Camera is master, master / slave interface is inactive, signals are tri-state
1	Master Mode 0	Camera is master, master / slave interface is active (output)
2	Slave Mode 0	Camera is slave, master / slave interface is active (input)
3	AutoSelect Mode 0	Input nSelMaster determines master or slave 0: KA is master 1: KA is slave Default via Pull-Up, avoid short circuit at M/S interface

7.83 Set white Control mode

Parameter sets the mode of white control.

TAG-ID: TAG_SET_WHITECONTROL_MODE =318H
Format: SHORT

Data: Bit 0: Gain Control using area range mode defined with the following tags:

TAG_SET_HORIZONTAL_POSWREF_ABSOLUTE	(223 H)
TAG_SET_HORIZONTAL_WREF_LENGTH	(224 H)
TAG_SET_WHITEREF_AVERAGE	(283 H)
TAG_SEL_WHITEREFPOS	(287 H)
TAG_SET_HORIZONTAL_WREF_START	(2A1 H)
TAG_SET_VERTICAL_WREF_LENGTH	(2A4 H)

Bit 1: reserved
Bit 2: reserved
Bit 3: Use sync mode/ Taking references is synchronized with area scan. Additional the following TAGs are used for position of reference area in vertical direction:

TAG_SET_VERTICAL_WREF_START	(2A3 H)

Bit 4: stop gain control if the current level is below a defined factor.
The value for factor is set by TAG_SET_GAIN_STOP_FACTOR (2A5H).

Bit 5: Internal use, set to ‘0’

Bit 6: stop gain control if the variance inside the defined white reference area is above a defined value. The value threshold is set by TAG_SET_GAIN_STOP_VARIANCE (2BDH)

Bit 7 ...15: Currently not used set 0

Default: 0

7.84 RGB line distance between the color lines of a tri-linear sensor

Number of line shifts to compensate the geometric distance between the color lines of a tri-linear sensor. Sub-line shift is available.

TAG-ID: TAG_SET_RGB_LINEDISTANCE = 319 H
Format: Short

Data: Distance in units of 1/1024 line distances for delay red to green and blue green

Range
allPIXA: 0 … 4096 (sensor length greater than 4096 pixel)
0 … 6144 (sensor length less than 4096 pixel)

allPIXApro: 0 … 6144 (sensor length greater than 4096 pixel)
0 … 8192 (sensor length less than 4096 pixel)

Example:
Shift of 4 lines: 4 * 1024 = 4096

Shift of 1,5 lines: 1,5 * 1024 = 1536

7.85 Set grey video out mode

TAG-ID: TAG_SET_GREYOUTPUT_MODE (322 H)
Format: SHORT

Data	
0	Disabled (normal RGB Output), CL-Dual Base

1	2*8 bit grey according camera link specification on first CL-port
2	2*10 bit grey according camera link specification on first CL-port
3	2*12 bit grey according camera link specification on first CL-port
4	reserved
5	reserved
6	2*8 bit grey according camera link specification on both CL-ports at CL-Dual-Base
7	2*10 bit grey according camera link specification on both CL-ports at CL-Dual-Base
8	2*12 bit grey according camera link specification on both CL-ports at CL-Dual-Base
else	reserved

The weight for color to grey conversion is defined by TAG_SET_COLOR_WEIGHTS (305 H).

7.86 Global Master-Slave Configuration

With this tag the information internally traced in the camera is specified.

Note: High amount of internal tracing data will decrease micro controller performance. Do only use for test purpose.

TAG-ID: TAG_GLOBAL_MASTER_SLAVE_CONFIG = 31AH

Format: Short

Data: Refer description bellow

Default: 0

value	Mode	Meaning
0	No global configuration	Camera uses parameter from setting content.
1	Master Mode	Camera is master, master / slave interface is active (output)
2	Slave Mode	Camera is slave, master / slave interface is active (input)
3	AutoSelect Mode	Input nSelMaster determines master or slave 0: KA is master 1: KA is slave

Unlike TAG_MASTER_SLAVE_CONFIGURATION (317 H) the parameter TAG_GLOBAL_MASTER_SLAVE_CONFIG (31A H) is not part of each of the 20 settings in the camera.

TAG_GLOBAL_MASTER_SLAVE_CONFIG (31A H) is a global value which determines the Master-Slave behavior. This Parameter overwrites Master-Slave configuration out of the selected setting.

7.87 Set value for test pattern

The value is used to set the static output of some test patterns in combination with TAG_SET_TESTPATTERN_MODE (222 H).

TAG-ID: TAG_SET_TESTPATTERN_LEVEL = 323H

Data: 0 … 1023

Default: 0

7.88 Set Gain in the pre amplifier stage

Set the CDS Gain value in amplifier of ADC (analog digital converter)

TAG-ID: TAG_SET_CDS_GAIN = 3A0H

Format: VAR

Data:
1st word: Red CDS gain value
2nd word: Green CDS gain value
3rd word: Blue CDS gain value
4th word: Rear red CDS gain value
5th word: Rear green CDS value
6th word: Rear blue CDS value

Values:
0: - 3 dB
1: 0 dB
2: +3dB
3: +6 dB
All other values ignored

Default: 0

7.89 Select Type of Camera Link Interface

With this tag the type of camera link is selected.

TAG-ID: TAG_SET_CAMERALINK_INTERFACE = 3A1 H

Format: SHORT

Values:
0= Camera Link Base 1Tx24Bit (1X1 for color output)
2Tx8Bit, 2Tx10Bit or 2Tx12Bit (2XE for mono output with the color camera)

1= CameraLink Medium 2Tx24Bit (2XE)

2= CameraLink Medium 2Tx24Bit (1X2) Raw **(only supported with allPIXAPro)**
(4Tx8Bit (1X4) ,(only supported PIXAPro-Mono)

3= CameraLink Full64_8Tx8Bit (1X8 raw, RGB with 8 color planes per camera link clock,
(only supported with allPIXAPro)
(1X8, only supported PIXAPro-Mono)

4= CameraLink Full80_8Tx10Bit (1X8 raw, RGB with 8 color planes per camera link clock,
(only supported with allPIXAPro)

5= CameraLink Full80_10Tx8Bit (1X10 raw, RGB with 10 color planes per camera link clock, **(only supported with allPIXAPro)**

6= CameraLink Base_3Tx8Bit

(only supported with allPIXAPro with firmware P2.22)

All other values invalid

Default 0= Camera Link Base

7.90 Parameter for internal light barrier

The allPIXApro camera is able to start image frame automatically depending on the brightness level of actual scanline. If a given ROI of the actual scanline rises over or falls below a defined level an edge of the internal light barrier function is detected.

TAG-ID: **TAG_INTERNALLB_ROI_START** = 3D0 H
Format: SHORT

Data: Defines position of ROI were the camera catches the brightness level for edge detection. The position is set a absolute position inside the complete visible area of the camera.

TAG-ID: **TAG_INTERNALLB_ROI_LENGTH** = 3D1 H
Format: SHORT

Data:
0: length of ROI is 32 Pixel
1: length of ROI is 64 Pixel
2: length of ROI is 128 Pixel
3: length of ROI is 256 Pixel

Default: 0

TAG-ID: **TAG_INTERNALLB_COLOR_SELECT** = 3D2 H
Format: SHORT

Data:
0: all colors are relevant for edge detection
1: red colors are relevant for edge detection
2: green colors are relevant for edge detection
3: blue colors are relevant for edge detection

Default: 0

TAG-ID: **TAG_INTERNALLB_ROI_VISIBLE** = 3D3 H
Format: SHORT

Data:
0: ROI and scan line of rising or falling edge are **not** marked in image
1: ROI and scan line of rising or falling edge are marked in image

Default: 0

TAG-ID: **TAG_INTERNALLB_RISINGEDGE_LEVEL** = 3D4 H
Format: SHORT

Data: 0… 254: switching level for rising edge

TAG-ID: **TAG_INTERNALLB_FALLINGEDGE_LEVEL** = 3D5 H
Format: SHORT

Data: 0… 253: switching level for falling edge, must be smaller than rising level

7.91 LED flash control

This TAG enables LED flash control inside the camera. With LED flash control active the camera supports IO trigger signals for LED controllers. The Trigger signals are synchronous to camera internal scan line triggering.

(only supported with allPIXApro)

TAG-ID: TAG_LED_FLASHCONTROL = 400 H

Format: SHORT

Data: 0: flash control is off
1: standard mode, 1 scan line is generated per valid flash signal pattern

Default: 0

7.92 LED flash control configuration

If flash control is enabled count and duration of the available trigger signals must be defined with following TAGs.

These TAGs defines the count and duration of the available trigger signals for LED flash controllers are defined.

The camera delivers up to 4 control signals to trigger external LED illuminations. The signals are available at connector X5 of the allPixaPro housing.

Name and location of the available trigger signals:

Name	Location
Flash Channel 1	X5 pin 4
Flash Channel 2	X5 pin 12
Flash Channel 3	X5 pin 6
Flash Channel 4	X5 pin 8

Up to 4 pattern can be defined for each output. Every pattern value gives the active time of the output signal. The value is given in nanoseconds.
0 -> means output is inactive at actual pattern.
Maximum value is 2,3 milliseconds

Valid pattern should start with pattern 1. After the count of valid pattern the sequence is restarted.

For every valid pattern 1 scan line is captured.

The output signals can be selected arbitrarily. But they may not be determined for other functions in IO configuration setup (see TAG_SET_EXTERNAL_SIGNAL_ASSIGNMENT (701 H)) at the same time.

For optimized synchronization of the camera and the LED controller the allPixa is capable to deliver a clock signal for the LED driver electronics at pin 14 of connector X5.
This TAG defines the number of pattern to be used in a sequence

TAG-ID: **TAG_LED_NUMBER_LINE_PATTERN** = 401 H

Format: SHORT
Data: 1 … 4
Gives the number of pattern to be used in the sequence. The sequence starts with pattern 1.
0: will disable led flash control

TAG-ID: **TAG_LED_FLASH_SEQUENCETIME** = 402 H

Format: long

Data: 0 …. 9.200.000

Gives the time for the sequence of all valid pattern in nanoseconds.
If all 4 pattern are used the maximum sequence time is 4 * 2,3 ms = 9,2ms

The sum of all valid pattern may not exceed sequence time.

If camera is triggered by external input (LineTrigger or Encoder) the frequency of the trigger signal may not be faster than the sum all active pattern.

TAG-ID: **TAG_LED_DRIVERSYNCHRONISATION** = 403 H

Format: SHORT
Data: 0 …. 1

0: LED driver synchronization is off.
1: 885 kHz clock is delivered at X5 pin 14

TAG-ID: 404 H (Reserved)

TAG-ID: **TAG_LED_FLASH_FRAME_CONTROL** = 405 H

Format: SHORT

Data: 0: flash output signals are driven continuously
1: flash output signals are only driven while image frame is active

Default: 0

TAG-ID: **TAG_LED_FLASH_LINE_MODE** = 406 H

Format: SHORT

Data: 0: scan line speed is optimized pattern length
1: scan line speed is fixed to given sequence time
every “(sequence time) / (number of pattern)” micro seconds is a new pattern started

Default: 0

If flash control is enabled count and duration of the available trigger signals must be defined with following TAGs.

TAG-ID: TAG_FLASH_TIME_PATTERN1 = 410 H
TAG-ID: TAG_FLASH_TIME_PATTERN2 = 411 H
TAG-ID: TAG_FLASH_TIME_PATTERN3 = 412 H
TAG-ID: TAG_FLASH_TIME_PATTERN4 = 413 H

Format: VAR
Data: word [8]

Data word	Name	description
0 (low word)	Pattern X active time for Out1	0 … 2.300.000 Active time of LED trigger output signal given in nanoseconds.
1 (high word)		
2	Pattern X active time for Out2	
3		

4	Pattern X active time for Out3	0 = signal is inactive for actual pattern in sequence maximum value: -> 2,3 ms The resulting time for a pattern is determined by the greatest value set for a pattern.
5		
6	Pattern X active time for Out4	
7		

Outputs with all 4 pattern time set to 0 are invalid and are not used.

Note:
Due to maximum speed of the camera sensor and due to maximum line frequency for the CameraLink interface there is a minimum time which is necessary for internal scan line generation and transmitting. This minimum time depends on the length of the sensor (number of pixel), CameraLink Mode (base, medium, full, …) and CamerLink frequency (max. 85 MHz or smaller).

If a pattern time is smaller than this minimum scan line time, than the start of the next pattern is delayed until minimum scan line time is elapsed. The duration time of the flash trigger signal is not changed.

The resulting duration of each pattern is given with Tags (see pk response):

TAG_PATTERN_TIME_1 = 420 H
TAG_PATTERN_TIME_2 = 421 H
TAG_PATTERN_TIME_3 = 422 H
TAG_PATTERN_TIME_4 = 423 H

For each pattern an additional gain factor can be defined.
If saturation of sensor may occur in some scan regions active flash duration can be reduced. This will avoid saturation but also reduced signal of not saturated areas. This can be compensated with an additional gain stage in the camera.

TAG_PATTERN_1_ADDGAIN = 414 H
TAG_PATTERN_2_ADDGAIN = 415 H
TAG_PATTERN_3_ADDGAIN = 416 H
TAG_PATTERN_4_ADDGAIN = 417 H

Format: SHORT

Data: additional gain for appropriate pattern.
0x1000 represents gain factor 1.0. Digit lower 0x1000 define the decimal places with 1 / 4096 per digit.

Values: 0 … 0x4000

Default: 0x1000 → 1.0

7.93 Set External Signal Assignment

This Tag is used for the IO configuration. For easy configuration use the IO Configurator in the CST software tool.
(For allPIXA user, refer to the allPIXA user manual).

TAG-ID: TAG_SET_ EXTERNAL_SIGNAL_ASSIGNMENT = 701 H

Format: VAR

Data: List of Assignments to configuration description in Order DV

Define the assignment

Bit	15

0	
Function Index 1 Selector 1 …	Word 1 Word 2 …
… Function Index n Selector n	… Word 59 Word 60

Function Index: ASCII Character: A.. ..Z or AA.. ..ZZ for output functions
a.. ..z or aa.. ..zz for input functions
aA.. ..zZ for bidir functions

At function indices with one digit the ASCII character must be set in the low byte of the corresponding WORD. The high byte must be set to 0.

Example: “a” -> 0x0061

At function indices with two digit the first ASCII character must be set to the low, the second character to the high byte of the corresponding WORD.

Example: “Ab” -> 0x6241

Input selector: Binary value 0 … 255

Maximum number of entries is 30. Unused entries must be set to 0. A 0 entry in function index is used to mark the end of list.

Because the pk-response has a static format the list is longer as the number of used entries.

Assign an input port selected with “Input Selector “ to function defined by “Function Index”

Table of assigned input function indices:

LS0	“a”		
LS1	“b”		
LS2	“c”		
LS3	“d”		
Fast start	“e”		
Inkr0	“f”		
Inkr1	“g”		
nLineSync	“h”		
nFrameSync	“i”		
Autoselect	“j”		
Format impulse Count	“k”		
Format impulse Reset	“l”		
GP_IO_IN0	“m”		
GP_IO_IN1	“n”		
GP_IO_IN2	“o”		
GP_IO_IN3	“p”		
GP_IO_IN4	“q”		
GP_IO_IN5	“r”		
GP_IO_IN6	“s”		
GP_IO_IN7	“t”		

(for internal use)	“v”		

Table of assigned output function indices:

VSY-Signal	A	
HSY-Signal	B	
LED-PWM	C	
RS232_Activate	D	
SEL_GP_IO_OUT0	E	Select IO Pin
SEL_GP_IO_OUT1	F	Select IO Pin
SEL_GP_IO_OUT2	G	Select IO Pin
SEL_GP_IO_OUT3	H	Select IO Pin
SEL_GP_IO_OUT4	I	Select IO Pin
SEL_GP_IO_OUT5	J	Select IO Pin
SEL_GP_IO_OUT6	K	Select IO Pin
SEL_GP_IO_OUT7	L	Select IO Pin
FUNC_GP_IO_OUT0	M	Select Function for GP_IO
FUNC_GP_IO_OUT1	N	Select Function for GP_IO
FUNC_GP_IO_OUT2	O	Select Function for GP_IO
FUNC_GP_IO_OUT3	P	Select Function for GP_IO
FUNC_GP_IO_OUT4	Q	Select Function for GP_IO
FUNC_GP_IO_OUT5	R	Select Function for GP_IO
FUNC_GP_IO_OUT6	S	Select Function for GP_IO
FUNC_GP_IO_OUT7	T	Select Function for GP_IO

Table of assigned bi-directional function indices:

MS-Interface	Aa	2 Wire Master-Slave-Interface
SMC	Bb	4 Wire SMC Interface

7.94 Use an assignment table from another setting

Every setting data set stored in the non-volatile memory carries its own assignment table. If the assignment table of another setting should be used the reference setting number is defined with this TAG. Then the assignment table of the referenced setting is used.

TAG-ID: TAG_SET_EXTERNAL_SIGNAL_ASSIGNMENT_REFERENCE = 702 H

Format: SHORT

Data: Reference Setting Number
0: Use setting table of current setting
1 … 19: Use setting table of another setting

Reference settings are only settings with does not itself references to other settings.

7.95 Set product ID

TAG defines a null terminated string which set a product identifier for the camera system.

TAG-ID: TAG_SET_PRODUCT_ID = 952 H

Format: VAR

Data: Zero terminated String with Product Identifier
Maximum length = 20 Words

The data is not setting specific and is always stored after receiving.

7.96 Format of the Response mk

15 8	7 0	
m	**k**	0 Name
Low word length		2 Length
High word length		4 Length
Sender		6 Sender
Reserved	reserved	8 Receiver
1. Data word from read register		
....		
n. Data word from read register		
Checksum		10 Check sum

The **mk** response contains only data if a read-register-offset is send in Command MK.

8. MS: Maintenance Sensors

The Command MS return the status of the camera sensors and the status of external inputs.

15 8	7 0	
M	**S**	0 Name
Low word length		2 Length
High word length		4 Length
Reserved	Reserved	6 Sender
Reserved	Reserved	8 Receiver
reserved		10
REQUEST_CONTAINER (optional)		12
Check sum		Check sum

REQUEST_CONTAINER: Certain TAG_IDs

Using this filed a certain container can requested.
List of supported Containers:

- TAG_ENVIRONMENT_VALUES = 292H

The parameters are structured as tags.

8.1 Format of the Response ms

15 8	7 0	
m	**s**	0 Name
Low word length		2 Length
High word length		4 Length
Sender		6 Sender
Reserved	Reserved	8 Receiver
TAG 1		
..		
TAG n		
Checksum		10 Check sum

The **ms** response parameters are structured as tags.

TAGs for ms response

8.2 Environment Values

TAG-ID: TAG_ENVIRONMENT_VALUES =292H

Format: CONT

It can contain following TAGs:

TAG-ID: TAG_HWMONITOR_VOLTAGE _VANALOG1 (370H)
Format: SHORT
Data Internal voltage 1 in mV

TAG-ID: TAG_HWMONITOR_VOLTAGE _VANALOG2 (371H)
Format: SHORT
Data Internal voltage 2 in mV

TAG-ID: TAG_HWMONITOR_VOLTAGE_VCORE (372H)

Format: SHORT
Data Internal voltage 3 in mV

TAG-ID: TAG_HWMONITOR_VOLTAGE _SUPPLY1 (373H)
Format: SHORT
Data Internal voltage 4 in mV

TAG-ID: TAG_HWMONITOR_VOLTAGE _SUPPLY2 (374H)
Format: SHORT
Data Internal voltage 5 in mV

TAG-ID: TAG_HWMONITOR_VOLTAGE _SUPPLY_CCD (376H)
Format: SHORT
Data Internal voltage 6 in mV

TAG-ID: TAG_HWMONITOR_VOLTAGE _IN (377H)
Format: SHORT
Data External in voltage in mV

TAG_HWMONITOR_TEMPERATURE_BOARD (381H)
Format: SHORT
Data Temperature of internal board °C

TAG_HWMONITOR_TEMPERATURE_SENS (382H)
Format: SHORT
Data Temperature of sensor °C

8.3 Common values

Free TAGs (not part of a Container TAGs):

TAG_STATE_EXT_INPUT	= 245 H	(see Command PK)
TAG_ACTUAL_WHITE_REFERENCE	= 1C3 H	(see Command PK)
TAG_GET_SYNCINTEGRATION_TIME	= 290 H	
TAG_IMAGECOUNTER	= 291 H	
TAG_BETRIEBSZUSTAND	= 103 H	(see Command PK)
TAG_SET_GAIN	= 1C0 H	(see Command MK)
TAG_ERROR	= 1CA H	(see Command PK)
TAG_STATUS	= 1CB H	(see Command PK)
TAG_GET_MASTERSLAVE_MODE	= 2B5 H	
TAG_GET_WHITEREF_VARIANCE	= 2BE H	
TAG_GET_CONTRAST_SUM	= 2BF H	
TAG_GET_SCANDIR	= 2C3 H	
TAG_GET_EXTERNAL_SIGNALS_A	= 392 H	(see Command PK)
TAG_GET_TRANSPORT_SPEED	= 393 H	

Integration time in Nanoseconds

TAG-ID: TAG_GET_SYNCINTEGRATION_TIME =290 H
Format: LONG
Data: Time per line in Nanoseconds

The integration time calculated from external sync source in variable encoder mode is returned.
If this mode is not used the returned value is 0.

Actual internal image counter

TAG-ID: TAG_IMAGECOUNTER = 291 H

Format: SHORT

Data: actual value of internal image counter

Get Current Master/Slave Mode

TAG_ID: TAG_GET_MASTERSLAVE_MODE (2B5 H)

Format: Short

0: No Master Slave Mode is defined
1: Camera is Master
2: Camera is Slave

Get Variance in White Reference Area

TAG_ID: TAG_GET_WHITEREF_VARIANCE (2BE)

Format: Short

The Variance in the defined white reference area in all channels is calculated and the maximum value is reported.

Get actual contrast sum of image line (only allPIXApro with firmware >= P2.22

TAG_ID: TAG_GET_CONTRAST_SUM (2BF)

Format: VAR
Data:
1st word: contrast sum red front tab
2nd word: contrast sum green front tab
3rd word: contrast sum blue front tab
4th word: contrast sum red rear tab
5th word: contrast sum green rear tab
6th word: contrast sum blue rear tab

Get Current ScanDir

TAG_ID: TAG_GET_SCANDIR (2C3 H)

Format: SHORT

0: current scan direction is forward
1: current scan direction is backward

Current transport speed

TAG-ID: TAG_GET_TRANSPORT_SPEED (393 H)
Format: SHORT

Data: transport speed in mm/sec

special values are:
0xfffd: no data available
0xfffe: Speed too low
0xffff: Speed too high (only detectable using dynamic speed adaptation mode)

Shows current speed mode as a feature of dynamic speed adaptation mode

The transport speed is calculated from external sync source in variable encoder mode.
For calculation the TAG_PHYS_AUFL_VERT (244H) is used and must set right.

If this mode is not used the returned value is 0.

9. MR: Take Reference

The MR Command is used to create a white or black level reference internally. This reference data are stored in non volatile memory.
With the black level reference data the camera board corrects the offset failure. With the white reference data the shading effect is corrected.
Before sending the command all image processing functions must be disabled (e.g. using of Tag x91b). Also the scan condition for the reference must be set (free run/ encoder mode).

After sending the command to the camera the data are collected internally depending on the scan condition. Within the command the type of reference (Offset/ Shading) is selected and also the Id for the data set.

A time out value ensures that the command is aborted in case of missing scan condition.

Format of the Command MR

15 8 7 0

M	**R**	0 Name
Low word length		2 Length
High word length		4 Length
reserved	reserved	6 Sender
reserved	reserved	8 Receiver
Reserved		10
ABGLTYP		12 see below
TYPEREF		14 see below
UseSettingNo		16 see below
RefNo		18 see below
Time Out		20 see below
Check sum		22 Check sum

ABGLTYP = 0 (Reserved, not used for allPixa)

TYPEREF = Select type of reference
0 Create black level reference
1 Create white level reference
All other values invalid

UseSettingNo= =0 (Reserved, not used for KA8)

RefNo = ID number for Data Set
0 Data set No.1
1 Data set No.2
2 Data set No.3
3 Data set No.4
All other values invalid

Time Out = Time out value in seconds, Maximum time for processing the command. After reaching the Time Out value the command is aborted with an error message.
0..65565 value in [sec]

Format of the Response mr

The **mr** response has no specific data (see 1.4.2. General statement on responses).

10. WR: Check White Control Status

The WR Command is used to check the current white balance status.

The white status is ok when three successive times the control error is smaller than a predefined value and the gain value does not exceed the set gain warn level. If white status is not ok a fe-response is generated.

Format of the Command WR

15 8	7 0	
W	**R**	0 Name
Low word length		2 Length
High word length		4 Length
Reserved	Reserved	6 Sender
Reserved	Reserved	8 Receiver
reserved		10
WhiteOkCriteria		(12) optional , see Extended WR
Check sum		12(14) Check sum

Extended format of the Command WR

An additional parameter in the WR command can be used to adjust the sensitivity of the detection of the controlled state. A **WhiteOkCriteria** of 3 causes the WR command to wait for 3 control cycles without adjusting gain like the standard WR command. A value of one requires just one cycle without controlling.

Four error conditions are possible and reported in a fe-response

1. The desired output values could not be reached (Timeout) (error code = 0xF7)
2. The maximum warning level is reached (error code = 0xF6)
3. The minimum gain level is exceeded (error code = 0x41)

Format of the Response wr

The **wr** response has no specific data (see 1.4.2. General statement on responses).

11. TA: Tap Adjustment

The TA Command is used to adjust the sensor tab border.

If tab adjustment failed a fe-response is generated.

11.1 Format of the Command TA

15 8	7 0	
T	**A**	0 Name
Low word length		2 Length
High word length		4 Length
Reserved	Reserved	6 Sender
Reserved	Reserved	8 Receiver
		10
Check sum		12 Check sum

Four error conditions are possible and reported in a fe-response

1. Timeout (error code = 0x6E)
2. other adjustment error (error code = 0x6F)

11.2 Format of the Response ta

The **ta** response has no specific data (see 1.4.2. General statement on responses).

12. PA: Parameters for all Units

The PA Command is used for setting the essential operating modes. The Command is distributed within the device to all units of the device.

The actual parameters are structured as tags.

Note:

Indeed, the number of PA Commands is not limited, but it is also permissible to pack many parameters into one PA Command, whereby, nevertheless, the maximum allowable length of the Command must be taken into account.

12.1 Format of the Command PA

15 8	7 0	
P	**A**	0 Name
Low word length		2 Length
High word length		4 Length
reserved	reserved	6 Sender
reserved	reserved	8 Receiver
TAG 1		
...		
...		
TAG n		
Check sum		Check sum

The total length of the PA Command is limited to maximum **2048** bytes. If the parameters to be loaded exceed this limit, then they must be distributed over several PA Commands. The individual tags may be distributed arbitrarily over several PA Commands, but tags are indivisible, i.e. any tag must be completely contained in one PA Command.

12.2 Format of the Response pa

The **pa** response has no specific data (see 1.4.2. General statement on responses).

12.3 PA Tags and Parameter (TAG-IDs)

Set camera to capture reference data images

TAG-ID TAG_SHC_SELECTION (91B H)

Format: SHORT

Data: 1st word: selection of SHC data
Values:
0 = capturing no SHC data image
1 = black level keep setting scan condition
2 = black level without scan condition (static)
3 = white level SHC keep setting scan condition
4 = white level SHC without scan condition (static)

Default: 0

Note

With this TAG the camera board is initialized to capture an image for calculating shading reference data. Several parameters are set to specific values depending on the selected mode (refer tables below). After the shading procedure it is necessary to reload the setting to come back to the common scan condition.

This Tag can be sent within normal operation without any effect and is activated after receiving the “DE Command”.

Value 1..4			
Tag		Value	Hint
TAG_USE_COLOR_CONVERSION	0x22c	false	No color conversion
TAG_SET_GAMMAVALUE	0x229	10	No gamma correction
TAG_MIRROR_DATA_HOR	0x246	false	No mirror
TAG_USE_IP_FILTER_HOR	0x316	false	No filter
TAG_VIDEOLEVEL_CORRECTION	0x315	0	No dimming of brightness and contrast
TAG_SET_INSERTMODE	0x293	0	No Insert mode
TAG_SHOW_WHITE_REF_BORDERS	0x226	0	Disable display of white reference window
TAG_ USE_KEYSTONECORRECTION	0x2b8	0	Disable display keystone correction (camera release P1.40 and higher)
TAG_INTERNALLB_ROI_VISIBLE	0x3d3	0	Disable display LB-ROI (KA8: SVN 0082)

Value 1 Black level with current setting scan condition			
Tag		Value	Hint
TAG_USE_BLACKLEVEL_CORRECTION	0x22b	false	Disable offset correction
TAG_USE_SHADING_CORRECTION	0x22a	false	Disable shading correction
TAG_USE_LINEARISATION_TABLE	0x397	false	No linearisation table
TAG_USE_WHITECONTROL	0x200	false	Disable white control because light should be off (camera release P1.40 and higher)

Value 2 Black level without current setting scan condition			
Tag		Value	Hint
TAG_USE_SCANCONDITION	0x236	false	Disable scan condition
TAG_USE_BLACKLEVEL_CORRECTION	0x22b	false	Disable offset correction
TAG_USE_SHADING_CORRECTION	0x22a	false	Disable shading correction
TAG_USE_LINEARISATION_TABLE	0x397	false	No linearization table
TAG_USE_WHITECONTROL	0x200	false	Disable white control because light should be off (camera release P1.40 and higher)

Value 3 White level SHC with current setting scan condition			
Tag		Value	Hint
TAG_USE_SHADING_CORRECTION	0x22a	false	Disable shading correction
TAG_USE_BLACKLEVEL_CORRECTION	0x22b	true	Use offset correction

Value 4 White level SHC without current setting scan condition			
Tag		Value	Hint
TAG_USE_SHADING_CORRECTION	0x22a	false	Disable shading correction
TAG_USE_SCANCONDITION	0x236	false	Disable scan condition
TAG_USE_BLACKLEVEL_CORRECTION	0x22b	true	Use offset correction

13. PK: Configuration Test

The configuration of the device is enquired with the Command PK. The response contains information on board hardware and versions of loaded software and load ware.

13.1 Format of the Command PK

If **PK** Command has no specific data (see General Statement on Commands) all TAGs defined below are responded.

The content of same specific TAGs can requested with sending the TAG ID in the first data field (see at the bottom of this paragraph).

13.2 Format of the Response pk

15 8	7 0	
p	**k**	0 Name
Low word length		2 Length
High word length		4 Length
Reserved	Reserved	6 Sender
Reserved	Reserved	8 Receiver
TAG1		10 see below
...		...
TAG n		
Check sum		Check sum

The tags of the pk response are container tags. They contain different kind of information from the camera.

Most of the TAG values sent with command MK to the camera are responded to Order PK

Definition of the Container TAGs for the Configuration Message

Container for configuration of the camera board

TAG-ID: TAG_KA4_2_KONFIG = 201 H (allPixa)
Format: CONT
Data: Tags for the configuration of the camera

Values:
TAG_BETRIEBSZUSTAND (103 H)
TAG_KONF_FIRMWARE (107 H)
TAG_KONF_PROGRAM_TEXT (109 H), optional
TAG_KONF_HW (210 H)
TAG_KONF_LOGIC_KA4 (211 H)
TAG_HSI_LEVEL (213 H)
TAG_CONF_HW2 (214)
TAG_LOGIC_DESCR_TEXT (255 H), optional
TAG_GET_USED_SETTINGS (257 H)
TAG_ PACKET_VERIFY (259 H)

Container for setting information

Additional to the parameters which are part of the internal setting the following information is responded to command PK.

TAG-ID: TAG_KA4_2_SETTING = 209 H (setting of allPixa)
Format: CONT
Data: Tags for detailed information of the camera board settings

Values: additional to TAG's defined in Command MK the following TAG's are received with response pk:

TAG_ACTUAL_WHITE_REFERENCE (1C3 H)
TAG_ERROR (1CA H)
TAG_STATUS (1CB H)
TAG_SENSOR_TYPE (212H)
TAG_STATE_EXT_INPUT (245 H)
TAG_COMMENT_LOADED_FILTER (249 H)
TAG_SET_CAMERA_DESCRIPTION_TEXT (264 H) (see order "MK")
TAG_SET_SERIALNUMBER_PART1 (262 H)
TAG_SET_SERIALNUMBER_PART2 (263 H)
TAG_GET_MININTTIME (274 H)
TAG_SET_ACTIVE_CHANNELS (277 H) (see order "MK")
TAG_GET_EFFECTIVE_SCANLINE_LENGTH (2AA H)
TAG_GET_EXTERNAL_SIGNALS_A (392 H)
TAG_GET_FIRST_ACTIVE_PIXEL (394 H)
TAG_GET_LAST_ACTIVE_PIXEL (395 H)
TAG_GET_MAXIMUM_TRANSPORT_SPEED (396 H)
TAG_LINEARIZATION_TABLE_DESCRIPTION (398 H)
TAG_PATTERN_TIME_1 (420 H)
TAG_PATTERN_TIME_2 (421 H)
TAG_PATTERN_TIME_3 (422 H)
TAG_PATTERN_TIME_4 (423 H)

Camera Operating state (input for container tag)

TAG-ID: TAG_BETRIEBSZUSTAND = 103 H
Format: SHORT
Data: 1st word: Operating state
Values:
0 H: Device is defective
1 H: Device is ready
2 H: Device is warming up
3 H: (reserved)
4 H: (reserved)

Firmware configuration of a PCB-board (input for container tag)

TAG-ID: TAG_KONF_FIRMWARE = 107 H
Format: VAR

Data:
1st word: Program version of the firmware
2nd word: Build of the firmware
3rd word: type of the firmware (optional, depends upon the board)

Values:
1st word - 2nd word: 0 H - FFFF H (16 bit unsigned)
3rd word: Type
0: Released program
1: Special program
2: Test program
3: Locked program, only for development

Optional text for information about a program, firmware, or software (input for container tag)

TAG-ID: TAG_KONF_PROGRAM_TEXT = 109 H
Format: VAR

Data: up to 20 words: Additional text for information about a program
(up to 40 byte, ASCII characters).

Values: ASCII characters:
Value range: 20 H - 7F H (96 character classes)

Note
The text in the data words is entered as a character string.

Actual values of the white level reference (input for container tag)

TAG-ID: TAG_ACTUAL_WHITE_REFERENCE = 1C3 H
Format: VAR

Data:
1st word: Red odd gain value
2nd word: Red even gain value
3rd word: Green odd gain value
4th word: Green even gain value
5th word: Blue odd gain value
6th word: Blue even gain value
7th word: Rear red odd gain value
8th word: Rear red even gain value
9th word: Rear green odd gain value
10th word: Rear green even gain value
11th word: Rear blue odd gain value
12th word: Rear blue even gain value

Error status for the camera electronics (input for container tag)

TAG-ID: TAG_ERROR = 1CA H
Format: SHORT

Data: 0 H – FFFF H (16 bit unsigned)

Status for the camera electronics (input for container tag)

TAG-ID: TAG_STATUS = 1CB H
Format: Word

Data: Internal control states

Values: Bit 0-3: main control
Bit 4-7: gain control

Bit 12-15: disable white control reason

Hardware configuration of board (obsolete format)

TAG-ID: TAG_KONF_HW = 210 H
Format: SHORT

Data: Version of board

Values: Bit 0-3: hardware revision board (DZ)
Bit 4-7: Version of Lattice - HW
Bit 8-11: type of hardware (allPixa = 7)

Loadware configuration of a camera board (input for container tag)

TAG-ID: TAG_KONF_LOGIC_KA4 = 211 H
Format: SHORT

Data: Version of Xilinx load data
Values: 0000 H – FFFF H

Supported Sensor Type

TAG-ID: TAG_SENSOR_TYPE = 212 H
Format: VAR

Bit

15	0	
Sensor-Id		Word 0
Byte 1	Byte 0	Data
Byte 39	Byte 38	Word 20

Sensor-Id: 0000 H - FFFF H
Data: Sensor description, up to 40 byte, ASCII characters, End of string is marked with 0
Values: ASCII characters:
Value range: 20 H - 7F H (96 character classes)

Note
The text in the data words is entered as a character string.

HSI – Level

TAG-ID: TAG_HSI_LEVEL = 213 H
Format: SHORT

Data:

Values: Bit 0-7: minor level
Bit 8-15: major level

Shows the supported HSI-Level corresponding to HSI description document

Usually the major level is increased if new functionality is supported and the minor level at small changes in functionality.

Hardware configuration of boards

TAG-ID: TAG_CONF_HW2 = 214 H
Format: VAR

Data: Versions

Values: Byte 0: version of board
Byte 1: type of camera (allPixa=7)
Byte 2: Version of Lattice - HW
Byte 3: Version of aux board

Status of external inputs used for scan condition

TAG-ID: TAG_STATE_EXT_INPUT = 245 H
Format: SHORT

Data:

bit 0: shows level of LB0 signal
bit 1: shows level of LB1 signal
bit 2: shows level of LBS2 signal
bit 3: shows level of LBS3 signal

bit 4: signal toggles on any edge of LB0 signal
bit 5: signal toggles on any edge of LB1 signal
bit 6: signal toggles on any edge of LB2 signal

	bit 7:	signal toggles on any edge of LB3 signal

(camera release P1.42 and higher)

bit 4:	signal toggles on every rising edge of LB0 signal
bit 5:	signal toggles on every rising edge of LB1 signal
bit 6:	signal toggles on every rising edge of LB2 signal
bit 7:	signal toggles on every rising edge of LB3 signal
bit 8:	shows level of encoder input signal Incr0
bit 9:	shows level of encoder input signal Incr1
Bit 12:	signal toggles on every valid edge of Incr0 signal
Bit 13:	signal toggles on any edge of Inkr0 or Incr1 signal

Note:
LBx and IncrX are logical IO function and must be mapped to specific input in the IO configuration matrix.

Description of loaded filter table

TAG-ID: TAG_COMMENT_LOADED_FILTER (249H)
Format: VAR

Data: 16 characters description text

Default: “No filter loaded”

Time per pixel

TAG-ID: TAG_GET_TIME_PERPIXEL = 253 H
Format: SHORT

Data: Time per pixel in resolution of 10 ps
Values: 0

The time per pixel is a hardware constant which depends from loaded FPGA design.

Description text for logic data, optional description text for FPGA version (input for container tag)

Tag-ID: TAG_LOGIC_DESCR_TEXT (255 H)
Format: VAR

Data: 30 characters version text

Used Settings

TAG-ID**:** TAG_GET_USED_SETTINGS (257 H)
Format: LONG

Data: A ‘1’ in the setting corresponded bit position indicates that the stetting should be stored with ATS Function “Save all settings”.

If for example the data value is 6 then Setting No 1 and Setting No 2 is stored in the camera.

This TAG returns values which are set with setting specific TAG: TAG_MARK_SETTING_FOR_STORE (258H)

Packet Verify ID

TAG-ID: TAG_ PACKET_VERIFY = 259 H
Format: VAR

Data:
1st word: Packet ID
2nd – 21st: description text (40 characters)
22nd : signature difference
23rd - 25th: (internal use)

PaketID: ID to identify a defined set of program, FPGA, data files, tables etc. loaded with a specific order.

Description Text: Comment text with 0 as last value

SignatureDifference:
Difference between internal calculated checksum and stored packet checksum.
If complete set of firmware is stored in the camera ***Signature Difference*** is returned with 0. Else a loaded data file is not part of the packet.

Programmed serial number

TAG-ID**:** TAG_SET_SERIALNUMBER_PART1 = 262 H
TAG-ID**:** TAG_SET_SERIALNUMBER_PART2 = 263 H
Format: SHORT

Data: 0000-FFFF H

The first part of the serial number corresponds to the type of camera.
The second part is continuous number

Minimal possible integration time for used sensor

TAG-ID: TAG_GET_MININTTIME = 274 H
Format: SHORT

Data: Minimal Integration time in pixel units divided by 16

Effective scan line length

TAG-ID: TAG_GET_EFFECTIVE_SCANLINE_LENGTH = 2AA H
Format: SHORT

Data: value retrieves the effective number of pixel for each scan line which the camera tranferrs via Camera Link interface. The value depends on the defined scan line length and the given binning factor.

Status of additional external inputs

TAG-ID: TAG_GET_EXTERNAL_SIGNALS_A (392 H)
Format: SHORT

Data: returns state of digital external inputs

First useable Pixel

TAG-ID: TAG_GET_FIRST_ACTIVE_PIXEL (394 H)
Format: SHORT

Data: Count of first usable Pixel

This value includes necessary time delays for reading the CCD in pixels counts.

Last useable Pixel

TAG-ID: TAG_GET_LAST_ACTIVE_PIXEL (395 H)
Format: SHORT

Data: Count of last usable Pixel

This value includes necessary time delays for reading the CCD in pixels counts.

Maximum speed

TAG-ID: TAG_GET_MAXIMUM_TRANSPORT_SPEED (396 H)
Format: SHORT

Data: maximum speed in mm/s

This TAG returns the maximum possible speed for a given vertical resolution.

If supported in TAG_SET_CCD_PARAMETER (260 H), speed is calculated from parameter MinIntegrationtime otherwise data given by TAG_SET_INTEGRATIONTIME_IN_NS (24A H) is used as base.

Description Linearising Table

TAG-ID: TAG_LINEARIZATION_TABLE_DESCRIPTION (398 H)

Format: VAR
Data: 16 characters description text

Default: “No table load”

Resulting pattern time in flash mode

TAG-ID: TAG_PATTERN_TIME_1 (420 H)
TAG-ID: TAG_PATTERN_TIME_2 (421 H)
TAG-ID: TAG_PATTERN_TIME_3 (422 H)
TAG-ID: TAG_PATTERN_TIME_4 (423 H)
Format: LONG

Data: value retrieves the resulting time for each pattern in flash mode

Values: time is returned in nanoseconds

Minimum integration time

TAG-ID: TAG_GET_MIN_INT_TIME (CC9 H)
Format: LONG

Data: value retrieves the minimum integration time

Values: time is returned in nanoseconds

Minimum line period

TAG-ID: TAG_GET_MIN_LINE_PERIOD (CCA H)
Format: LONG

Data: value retrieves the minimum time for line period

Values: time is returned in nanoseconds

Maximum line period

TAG-ID: TAG_GET_MAX_INT_TIME (CCD H)
Format: LONG

Data: value retrieves the maximum integration time

Values: time is returned in nanoseconds

13.3 List of Tags which are specific to request

TAG_SET_CAMERA_DESCRIPTION_TEXT (264 H) (see order MK)
TAG_SET_PRIVATE_DATA (266 H) (see order MK)

14. RS: Request State

Request state of camera

14.1 Format of the Command RS

The **RS** Command has no specific data.

14.2 Format of the Response rs

15 8	7 0	
r	**s**	0 Name
Low word length		2 Length
High word length		4 Length
Reserved	reserved	6 Sender
Reserved	Reserved	8 Receiver
Reserved	camera state	10 see below
Check sum		12 Check sum

camera state:

KA_STAT_POWER_ON	0
KA_STAT_IDLE	1
KA_STAT_DOWNLOAD	2
KA_STAT_SCAN_IDLE	3
KA_STAT_READY_FOR_SCAN	4
KA_STAT_SCANNING	5
KA_STAT_POWER_SAVE	6

If an internal error occurred command RS is responded with error message “fe”.

15. SZ: Scan State

The command SZ retrieves the status of the scan process, and if a scan is finished the number of scanned lines

15.1 Format of the Command SZ

The SZ Command has no specific data.

15.2 Format of the Response sz

15 8	7 0	
s	**z**	0 Name
Low word length		2 Length
High word length		4 Length
Reserved	reserved	6 Sender
Reserved	Reserved	8 Receiver
ScanState		10 Data
WhiteControlState		12 Data
ScanLineNumLow		14 Data
ScanLineNumHigh		16 Data
KaZustand		18 Data
Check sum		20 Checksum

ScanStatus

IdleSteu	0x0000
WaitForVSyncStart	0x0001
WaitForVSyncEnd	0x0002
WaitForEndCheckWhite	0x0003
WaitForTrigger	0x0004
WaitForResStart	0x0005
WaitForResStop	0x0006

WhiteControlState

IdleReg	0x0000
WarteAufRefs	0x0001
WarteAufEndeRegDelay	0x0002
ProcessGain	0x0003

ScanLineNumLow Low word of the number of scanned lines
ScanLineNumHigh High word of the number of scanned lines
Remarks:
The number of scanned lines is valid only in State IDLE or READY_FOR_SCAN after a scan, not during a scan.

KaZustand

Defective	0x0000
Ready	0x0001
WarmingUp	0x0002
CheckWhiteTimeout	0x0003

16. DD: Download Digital Filters

With order DD digital filters are downloaded to camera and stored in non-volatile memory.

16.1 Format of the Command DD

15 8	7 0	
D	**D**	0 Name
Length low word		2 Length
High word length		4 Length
Reserved	reserved	6 Sender
Reserved	reserved	8 Receiver
FBGKENN		10 see below
TOD	TCD	12 Data, see below
FIKENN (low word)		14 see below
FIKENN (high word)		16 see below
MAG_NR (8 words) ...		18 see below
Version		34
DATA FIELD (see below)		
Check sum		Check sum

FBGKENN = xxxx H: Board identifier (2 ASCII characters)
= ‘K1’ Camera board KA1
= ‘K2’ Camera board KA2
= ‘K3’ Camera board KA3
= ‘K4’ Camera board KA4

TCD = xx H: Bit depth of Data
0 H: 10 bit Data

TOD = xx H: Type of Data

FIKENN = xx xxH Filter number (not necessary to use)

MAG_NR = 16 bytes: A short textual description of the filter to be loaded (ASCII string);

VERSION = xxxx H Current version of this structure is 2

DATA FIELD:

Command contains only Gamma correction tables

GAMMA_TABLE red channel	0
GAMMA_TABLE green channel	1024
GAMMA_TABLE blue channel	2048

GAMMA_TABLES:

The gamma tables for the color channels have 1024 entries with a width from one byte per entry.
The first value in the Table sets the output for the input value 00 and so far.

TOD = 01: Command contains Gamma correction tables and a color conversion table

GAMMA_TABLE red channel	0
GAMMA_TABLE green channel	1024
GAMMA_TABLE blue channel	2084
COLOR TABLE (262144 words) (this table is optional) ... or Color Matrix Data	

TOD= 03: Special format to load gamma tables at first initialization.
Start with word 32 follow 25 1k Tables with gamma values 0.1 – 2.5.
These tables are selectable with TAG_SET_GAMMAVALUE.

GAMMA_TABLE for select value = 1	0
….	1024
GAMMA_TABLE for select value = 25	24576

TOD = 14: Color Conversion Matrix

Offset Red	36
Offset Green	38
Offset Blue	40
C00int	42
C01int	44
C02int	46
C10int	48
C11int	50
C21int	52
C22int	54
C23int	56

COLOR_MATRIX:

Contains Offset Correction Data and a 10 bit 3 x 3 Color Conversion Matrix

$$\begin{pmatrix} Rout \\ Gout \\ Bout \end{pmatrix} = \begin{pmatrix} C00,\ C01,\ C02 \\ C10,\ C11,\ C12 \\ C20,\ C21,\ C22 \end{pmatrix} * \left(Rin + Offset_R, Gin + Offset_G, Bin + Offset_B \right)$$

Offset Values: - 255 … 255 take effect in 10 bit video range

Cxxint -511 … 511

Cxxint = Round (Cxx * 256)

Parameters are used if TAG_USE_COLOR_CONVERSION is true.

TOD =15: Input Linearization Table

Linearization table red odd channel	0
Linearization table green odd channel	1024
Linearization table blue odd channel	2048
Linearization table red even channel	3072
Linearization table green even channel	4096
Linearization table blue even channel	5120

Even tables are optional; if not available odd tables are used for odd and even channels.

Offset Red	36
Offset Green	38
Offset Blue	40
C00int	42
C01int	44
C02int	46
C10int	48
C11int	50
C21int	52
C22int	54
C23int	56

16.2 Format of the Response dd

The **dd** response has no specific data (see General Statement on Responses (see 1.4.2)).

17. DS: Download Reference data

The DS Command is used to load white or black level reference data in the camera board. This reference data is stored in non volatile RAM.

With the black level reference data the KAx board corrects the offset failure; with the white reference data the camera board corrects the shading effect.

This command is useful to load external calculated reference data in opposite to the Command MR which take reference data directly.

Up to four sets of reference data for black- and white level can be stored.

Maximum number of reference data: 10800 reference values

Format of the Command DS

15 8	7 0	
D	**S**	0 Name
Low word length		2 Length
High word length		4 Length
Reserved	Reserved	6 Sender
Reserved	Reserved	8 Receiver
reserved		10 see below
Version		12 see below
RefNo	ArtRef	14 see below
PositionFirstRefPixel		16 see below
CorrectionLength		18 see below
Reserved		20 see below
Dummy Data (14 Words black level reference data at version 1) (20 Words white level reference data at version 1) With version = 3 no dummy data is used.		22 see below
Reference data		
Check sum		

Version = 1 or 3 H Current Version of Header

ArtRef = 0 black level reference data
= 1 white level reference data

RefNo = 0 ... 3 Number of Dataset

Number of useable references depends on the revision of the camera

PositionFirstRefPixel = = 0000 H (obsolete)

CorrectionLength =xxxx H
Length of the given reference in number of pixel

Reserved must be to set 00H

Dummydata = xxxxH common to set 00H

Format of the Response ds

The **ds** response has no specific data (see 1.4.2)

18. DV: Download External IO Configuration Data

Format of the Command DV

15 … 8	7 … 0	
D	**V**	0 Name
Low word length		2 Length
High word length		4 Length
Reserved	Reserved	6 Sender
Reserved	Reserved	8 Receiver
Reserved		10 see below
Version		12 see below
Reserved1		14 see below
Reserved2		16 see below
Reserved 3		18 see below
Reserved 4		20 see below
Configuration Data in ASCII... (see below)		22 7998 (max)
Check sum		8000 (max)

Version = 0 Current version of order

Reserved = recommend to set to 0

Configuration Data in ASCII:

Configuration is stored in CSV format with semicolon separated data columns. The rows are separated by a “0x0D0A” sequence. After last row the sequence “0x0D0A” must follow.

Line No	
1	Head Line
2	Author and Creation date
3	Field description
4	
…	IO-Description fields see below

IO-Description fields

Field No	field content	Format	Max No signs	Example
1	external function name	ASCII-Text	20	Frame impulse
2	External pin name	ASCII-Text	5	X3 P2
3	internal signal name	ASCII-Text	10	CL_CC3
4	Board specific io pin	ASCII-Text	5	X10 Pin 1
5	Signal level	ASCII-Text	5	LVTTL
6	Internal Function name	ASCII-Text	10	LS0
7	Select	0 | 1 ASCII Sign	1	1
8	link to function	a … z | A … Z	2	A0
9	Bit no	ASCII chairs	2	
10	Register name	ASCII chairs	16	SelectEncoder

Select is set by TAG_SET_ EXTERNAL_SIGNAL_ASSIGNMENT.

Format of the Response dv

The dv response has no specific data (see 1.4.2)

19. UV: Upload External IO Configuration Data

The command UV read back data programmed with order DV to the camera.

The **UV** Command has no specific data.

Format of the Response uv

15 8	7 0	
u	**v**	0 Name
Low word length		2 Length
High word length		4 Length
Reserved	Reserved	6 Sender
Reserved	Reserved	8 Receiver
reserved		10 see below
Version		12 see below
Reserved1		14 see below
Reserved2		16 see below
Reserved 3		18 see below
Reserved 4		20 see below
Configuration Data in ASCII		22 7998 (max)
Check sum		8000 (max)

If no configuration data is available a uv response without specific data is returned. (see 1.4.2)

20. DA: Download application data

With this command the user application software may store a data block to flash memory of allPIXA camera. Because of necessary header and checksum according to HSI definition the real data area is limited to 65524 bytes.

The content of the data is not read or checked by the camera. Only length and checksum of the command is checked.

Format of the Command DA

15 8	7 0	
D	**A**	0 Name
Low word length		2 Length
High word length		4 Length
Reserved	Reserved	6 Sender
Reserved	Reserved	8 Receiver
User application data up to 65524 bytes		10
Check sum		

Format of the Response da

The da response has no specific data (see 1.4.2)

21. UA: Upload application data

With order UA user software application data stored with command DA before is sent to the host.

Format of the Command UA

The **UA** Command has no specific data.

Format of the Response ua

15 8	7 0	
u	**a**	0 Name
Low word length		2 Length
High word length		4 Length
Reserved	Reserved	6 Sender
Reserved	Reserved	8 Receiver
User application data up to 65524 bytes		10
Check sum		

22. UI: Upload image data

With order UI actual scan line data can be requested from camera

Format of the Command UI

The **UI** Command has no specific data.

Format of the Response ui

15 8	7 0	
u	**i**	0 Name
Low word length		2 Length
High word length		4 Length
Reserved	Reserved	6 Sender
Reserved	Reserved	8 Receiver
Actual scan line data in BMP format		10
Check sum		

23. AP: Adjust parameter (desired values for gain control)

Command starts internal adjustment of desired target values for gain control. The desired values are adjusted for each color (red, green and blue) separately. The gain target values are set to values which correspondents to the line maximum values set by AP-Parameter.

Before send this command it is necessary that the camera look on a white reference which has a minimum size as the used scan height. During AP processed this reference should be in a stable position.

For AP process it is necessary that the camera generate scan lines. If an encoder is used and it doesn't output signal edges because transport mechanism is not used, the encoder must be disabled. This could be done by sending an MK Order **with** TAG_USE_EXTERNALSYNC (23B H) = false.

At end of a successful AP-Process values set by TAGs

TAG_SET_POINT_WHITE_REFERENCE (1C2 H)
TAG_SET_INITIAL_GAIN_LEVEL (267 H)
TAG_SET_LED_START_DUTYCYCLE (311 H)

are determined and set in work space and stored in non-volatile memory of the active setting. Also in all settings of the same AP-group the these values are changed

During the AP-process several other TAGs Values are temporarily changed. Therefore it is necessary to reload the setting before next scan.

During AP these error conditions could be detected:

AP_TIMEOUT	0x55
AP_RETURN_ERR	0x57
AP_ILLUM_TOO_DARK	0x58
AP_ILLUM_TOO_BRIGHT	0x59
AP_WREF_TOO_DARK	0x5A
AP_GAIN_CORR_NARROW	0x5B
AP_BURN_SET_ERR	0x5C
AP_WREF_TOO_BRIGHT	0x5D
AP_BREF_TOO_HIGH	0x5E

If AP returns with timeout changes of the internal values remain valid. That means that gain, target values, ect. are nearer to adjusted state. Therefore AP can be repeated several time to come to desired state.

15 8	7 0		
A	**P**	0	Name
Low word length		2	Length
High word length		4	Length
reserved	Reserved	6	Sender
reserved	Reserved	8	Receiver
version		10	Data, see below
Timeout		12	
VidMaxRed		14	
VidMaxGreen		16	
VidMaxBlue		18	
EncoderMode		20	
ChangeSettings_POINT_WHITE_REFERENCE		22 24	
ChangeSettings_INIT_GAIN		26 28	
ChangeSettings LED_STARTDUTYCYCLE		30 32	
(reserved = 0)		34	Version 1 and further
(reserved = 0)		36	Version 1 and further
GainMinRed		38	Version 1 and further
GainMinGreen		40	Version 1 and further
GainMinBlue		42	Version 1 and further
GainMaxRed		44	Version 1 and further
GainMaxGreen		46	Version 1 and further
GainMaxBlue		48	Version 1 and further
Global_Config_Value		50	Version 1 and further
DesiredValueMaxRed		52	Version 2 and further
DesiredValueMaxGreen		54	Version 2 and further
DesiredValueMaxBlue		56	Version 2 and further
Check sum		58	

Parameter:

Version: 1 or 2 version of order

Timeout: Timeout for duration of process in seconds
0 -> default, 20 s timeout is used.

VidMaxRed: maximum video level of red color channel
VidMaxGreen: maximum video level of green color channel
VidMaxBlue: maximum video level of blue color channel
desired values of gain control are adjusted, that maximum video level of the 3 channels reach these values.
valid values: 1 – 1023
0 -> default, 800 is used

If image processing functions like offset correction are active or because of internal control mechanism, it may happen that maximum video level of 1023 is not possible. This must be clarified at specific camera system and arrangement.

EncoderMode: for adjustment process it is necessary that the camera generate scan lines. If an encoder is used and it doesn't output signal edges because transport mechanism is not used, the encoder must be disable for adjustment process.
0 -> no changes are made in internal encoder mode. If encoder is activated it has to output edge signals to ensure that the camera can generate scan lines
1 -> internal encoder mode is disabled for adjustment process

ChangeSettings POINT_WHITE_REFERENCE

This parameter indicates in which setting the parameter SET_POINT_WHITE_REFERENCE is updated to the value calculated out of the adjustment process. Every bit of the parameter corresponds to a setting number of the camera.
Bit 0: actual active setting is updated
Bit 1 … 19: corresponding setting 1 … 19 is updated

ChangeSettings INITIAL_GAIN

This parameter indicates in which setting the parameter SET_INITIAL_GAIN_LEVEL is updated to the value calculated out of the adjustment process. Every bit of the parameter corresponds to a setting number of the camera.
Bit 0: actual active setting is updated
Bit 1 … 19: corresponding setting 1 … 19 is updated

ChangeSettings LED_STARTDUTYCYCLE

This parameter indicates in which setting the intensity of the LED-Modules is updated to the value calculated out of the adjustment process. If adjustment of LED duty cycle is inactive the current duty cycle of the adjustment process is set in all selected settings.

Every bit of the parameter corresponds to a setting number of the camera.
Bit 0: actual active setting is updated
Bit 1 … 19: corresponding setting 1 … 19 is updated

GainMinRed: minimum gain value for adjustment process (red color channel)
GainMinGreen: minimum gain value for adjustment process (green color channel)
GainMinBlue: minimum gain value for adjustment process (blue color channel)
Minimum gain value which may be reached in adjustment process. If adjustment of LED duty cycle is active intensity is decreased if minimum gain is reached. Gain-Minimum should be higher than working value for TAG_SET_MINIMUM_GAIN_LEVEL (1C5)
Valid values: 1 – 1023
0 -> check for minimum gain values are disabled.

GainMaxRed: Maximum gain value for adjustment process (red color channel)
GainMaxGreen: Maximum gain value for adjustment process (green color channel)
GainMaxBlue: Maximum gain value for adjustment process (blue color channel)
Maximum gain value that may be reached in adjustment process. If adjustment of LED duty cycle is active intensity is increased if maximum gain is reached. Gain-Maximum should be less than working value for TAG_SET_GAIN_WARN_LEVEL (1C4 H).
Valid values: 1 – 1023
0 -> default, 1023 is used

Global_Config_Value:
configuration values for future use.

DesiredValueMaxRed: maximum desired value for white control of red color channel
DesiredValueMaxGreen: maximum desired value for white control of green color channel
DesiredValueMaxBlue: maximum desired value for white control of blue color channel
Video level reference region may reach these values.
Attention: Reference values coming from Hardware are usually black level corrected. By this they may not reach level of 1020. Then lower level for desired values must be used.
valid values: 1 – 1020
0 -> default, 1020 is used

It is important that internal parameter of the camera (setting) hold correct values for adjustment process. That means:

- Illumination must be active
- Following parameter must be inactive for adjustment process:
  - shading correction
  - Mirror data

- test pattern
- gamma
- use video correction
- use color correction
- if the position of the white reference is in the area of the visible scan line, than show WREF-borders must be inactive

To disable all these features a PA-Order with contains TAG_SHC_SELECTION (91B H) with value = 4 can be sent. .AP needs the same preparation as a shading reference scan. To process a PA-Order a following Order DE is needed.

Response ap is sent if process succeeded. Else fe response is sent which appropriate error code. After processing AP the last setting which has to be changed is loaded.

24. Appendix