Hardware - Software Interface

(HSI)

allPIXA wave camera

Revision: 0.12

Change History:

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31.07.2017	R0.2	Removed tag 0x2BC removed TAG 232H, TAG 258H, TAG 277H, updated TAG_SET_CAMERALINK_INTERFACE = 3A1 H, updated TAG_MASTER_SLAVE_CONFIGURATION = 317 H removed TAG 702H	Raade
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16.11.2017	R0.4	-TAG_SET_BLACK_LEVEL_OFFSET = CC6H deleted -Marked chapter 7.63 and 7.66 as **(development use only!)** -Added TAG_XLC_SCAN_ASSIGN_NEW_DEVIC 1184H -Chapter 22.3 updated. -added chapter 22.2.6 Scan for new connected XLC devices and network join. -added chapter 21 UV: Upload External IO Configuration Data	Raade
27.11.2017	R0.5	-added chapter 7.75 Set grey video out mode -added chapter 7.76 Set weights for the colour channels -TAG_SET_INSERT_MODE (293 H) updated	Raade
06.12.2017	R0.6	-added new Board types for TypeOfBoard of command DL: Download Logic	Raade
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Date	Version	Description	Firmware version of implementation
08.08.2017	R0.2	RGB packet for deliveries	P_2_(50MHz)_008
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28.11.2017	R0.5	RGB packet for deliveries	>= P 3.005

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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 >=P3.005

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
reserved	reserved	8 Receiver
Version = 2	ZUHSI	10 see below
ECO	ECL	12 Error entry
ECE2		14 see below
reserved	ERLEN	16 see below
ERINF1	ERINF0	18 see below
...	...	
...	...	
Check sum		Check sum

ZUHSI = xx H: (not to be set by the camera)

ECL = xx H: Error class

ECO = xx H: Error code

ECE2 = xx H: 15 bit Error code extension, bit 15 must be 0

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.

ECE2 represents the last detected error.

The following block may be repeated for further errors detected in the camera

ECO	ECL
ECE2	
reserved	ERLEN
ERINF1	ERINF0
...	...
...	...

Note:
The complete error message fe may not exceed length of maximum 2048 byte include final checksum.

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_USE_WHITECONTROL	(200 H)
TAG_SET_HORIZONTAL_WREF_START_ABSOLUTE	(223 H)
TAG_SET_HORIZONTAL_WREF_LENGTH	(224 H)
TAG_SHOW_WHITEREF_BORDERS	(226 H)
TAG_SET_WHITEREF_AVERAGE	(283 H)
TAG_SET_VERTICAL_WREF_START	(2A3 H)
TAG_SET_VERTICAL_WREF_LENGTH	(2A4 H)
TAG_SET_WHITECONTROL_MODE	(318 H)
TAG_SET_WHITEB_CALIB_VALUES	(25A H)
TAG_GET_WHITEB_CALIB_VALUES	(25B H)
TAG_LINEAR_GAIN_COLOR_CLEAR	(1150 H)
TAG_LINEAR_GAIN_COLOR_RED	(1151 H)
TAG_LINEAR_GAIN_COLOR_GREEN	(1152 H)
TAG_LINEAR_GAIN_COLOR_BLUE	(1153 H)
TAG_CDS_GAIN_COLOR_CLEAR	(1020 H)
TAG_CDS_GAIN_COLOR_RED	(1021 H)
TAG_CDS_GAIN_COLOR_GREEN	(1022 H)
TAG_CDS_GAIN_COLOR_BLUE	(1023 H)
TAG_FULLWELLCAP_COLOR_CLEAR	(1040 H)
TAG_FULLWELLCAP_COLOR_RED	(1041 H)
TAG_FULLWELLCAP_COLOR_GREEN	(1042 H)
TAG_FULLWELLCAP_COLOR_BLUE	(1043 H)
TAG_WHITECTRL_TARGET_COLOR_CLEAR	(1080 H)
TAG_WHITECTRL_TARGET_COLOR_RED	(1081 H)
TAG_WHITECTRL_TARGET_COLOR_GREEN	(1082 H)
TAG_WHITECTRL_TARGET_COLOR_BLUE	(1083 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_GAMMA_VALUE	(229 H)
TAG_MIRROR_DATA_HOR	(246 H)
TAG_SET_TESTPATTERN_LEVEL	(323 H)
TAG_SET_TESTPATTERN_SENSOR_SIDE	(CC8 H)
TAG_BRIGHTCONTRAST_OFFSET_CLEAR	(1130 H)
TAG_BRIGHTCONTRAST_OFFSET_RED	(1131 H)
TAG_BRIGHTCONTRAST_OFFSET_GREEN	(1132 H)
TAG_BRIGHTCONTRAST_OFFSET_BLUE	(1133 H)
TAG_BRIGHTCONTRAST_GAIN_CLEAR	(1140 H)
TAG_BRIGHTCONTRAST_GAIN_RED	(1141 H)
TAG_BRIGHTCONTRAST_GAIN_GREEN	(1142 H)
TAG_BRIGHTCONTRAST_GAIN_BLUE	(1143 H)
TAG_BRIGHTCONTRAST_MODE	(CD2 H)

Video Output Interface:

TAG_SET_INSERT_MODE	(293H)
TAG_R_B_CHANGE	(296 H)
TAG_COLUMN_INSERTMODE	(2B0 H)
TAG_SET_CAMERALINK_INTERFACE	(3A1H)
TAG_SET_GREYOUTPUT_MODE	(322 H)
TAG_SET_COLOR_WEIGHTS	(305 H)

Trilinear/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_INTEGRATION_TIME_IN_NS	(24A H)
TAG_SET_CIS_LINEPERIOD_IN_NS	(CCB H)
TAG_SET_SCANCONDITION	(24B H)
TAG_SET_SCANPATTERN	(237 H)
TAG_SET_MAX_NUMBER_SCANLINES	(271 H)
TAG_STOP_BY_MAX_NUMBER_SCANLINES	(272 H)
TAG_SET_VSY_OVERSIZE	(273 H)
TAG_MASTER_SLAVE_CONFIGURATION	(317 H)
TAG_SET_SUPPRESSED_LINES	(30E H)
TAG_ROI_1	(1100 H)
TAG_ROI_2	(1101 H)
TAG_ROI_3	(1102 H)
TAG_ROI_4	(1103 H)
TAG_USE_ROI_1	(1120 H)
TAG_USE_ROI_2	(1121 H)
TAG_USE_ROI_3	(1122 H)
TAG_USE_ROI_4	(1123 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_SETTING_VERIFY	(27c H)
TAG_SETTING_CLEAR	(2A7 H)

Other TAGs:

TAG_PHYS_AUFL_VERT	(244H)
TAG_COMMENT	(247H)
TAG_ PACKET_VERIFY	(259 H)
TAG_REGISTER_TO_SETTING	(29D H)
TAG_SET_TRACE_MASK	(30F H)
TAG_SET_PRODUCT_ID	(952 H)
TAG_SET_COLOR_MODE	(CD1 H)
TAG_SELECT_LINE_EQ	(CCE H)
TAG_SET_OUTPUT_BIT_WINDOW	(CC7 H) (use only for development)
TAG_SET_CIS_MODE	(CC5 H) (use only for development)
TAG_SEL_CIS_QUANTIZ_DEPTH	(CC2 H) (use only for development)

Manage the external IOs

TAG_SET_EXTERNAL_SIGNAL_ASSIGNMENT	(701 H)

RS485 Light control

TAG_CONTAINER_LIGHTCONTROLLER_ID0	(1170 H)
TAG_CONTAINER_LIGHTCONTROLLER_ID1	(1171 H)
TAG_CONTAINER_LIGHTCONTROLLER_ID2	(1172 H)
	.
	.
	.
TAG_CONTAINER_LIGHTCONTROLLER_ID15	(117F H)

TAG_XLC_SERIAL_NUMBER	(1180H)
TAG_SET_XLC_LED_CURRENT	(1181H)
TAG_XLC_LIGHT_CONTROL	(1182H)
TAG_XLC_SEND_BROADCAST	(1183H)

TAG_SET_TRACE_IF	(1204 H)
TAG_SET_TDI_OPERATION_MODE	(1205 H)

7.2 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:

7.3 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

7.4 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.

TAG-ID: TAG_SET_HORIZONTAL_POSWREF_ABSOLUTE = 223 H

Format: Short
Data: 1 to line length of the sensor

Default: 1

7.5 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

7.6 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: BIN

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

Default: 0

7.7 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

7.8 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

7.9 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

7.10 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

7.11 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: LONG

Data: 1. DWORD: number of scan lines

Range: 1 .. 65535

Default: 1000

7.12 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.

7.13 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

7.14 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

7.15 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

7.16 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

7.17 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

7.18 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)

7.19 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

7.20 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

7.21 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

7.22 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)

7.23 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

7.24 Packet Verify ID

The complete Camera Firmware packet consists of several files programmed to the camera. This packet can be labelled together with a description with this tag. Critical files can be selected to calculate a signature to the packet. This signature is compared with the current files in the camera. This can be used to check the validity of the selected files.

TAG-ID: TAG_ PACKET_VERIFY = 259 H

Format: VAR

Data:

Bit

15 0	
PacketID	Word 1
Version	Word 2
Description Text (max. 40 ASCII character)	Word 3
…	
Signature	Word 23
MarkBits0 (selected data files)	Word 24
MarkBits1 (currently not used)	Word 25
PacketIDMinor	Word 26

PaketID: An arbitrary ID to identify a defined set of Firmware data, (e.g. FPGA program file, data files, tables etc. Loaded with a specific order).

Version: Version of TAG Definition, default 0

Description Text: Comment text in ASCII character (max.40Byte). The last character is a byte with value 0x00 to signalize End of text.

Signature: A unique number to identify a package. It is the sum of all the checksums for the selected data files.

MarkBits0: Mark the bit with '1' to select the files which were controlled. Refer to table with column Bit No. below. Files marked with value '0' were not selected.

BitNo	Art table	Load with Order	Used checksum
0	reserved		
1	Controller software	DP	HSI-Checksum
2	FPGA program file	DL	HSI-Checksum
3	Fallback controller software	DB	HSI-Checksum
4	Sensor configuration file	MK	Sum all TAG-Data TAGID without Format Bits
5	Control Data	DK	HSI-Checksum
6	Gamma Tables	DD (TOD=3)	HSI-Checksum
7	Spatial Filter	DF	special checksum for filter data
8	Color Filter	DD (TOD=14)	HSI-Checksum
9	2nd FPGA data	DL	HSI-Checksum
10	*reserved*		
11	*type 11 (for future use)*	-	-
12	*type 12 (for future use)*	-	-
13	*type 13 (for future use)*	-	-
14	*type 14 (for future use)*	-	-
15	*type 15 (for future use)*	-	-

MarkBits1: For future use, recommended to set 0

PacketIDMinor: Additional Parameter to name minor changes.

New with HSI 1.10

7.25 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 to where the parameters should be written.
With all other values the tag is ignored

7.26 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 from where the parameter should be read.
With all other values the tag is ignored

7.27 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

7.28 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

7.29 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

7.30 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

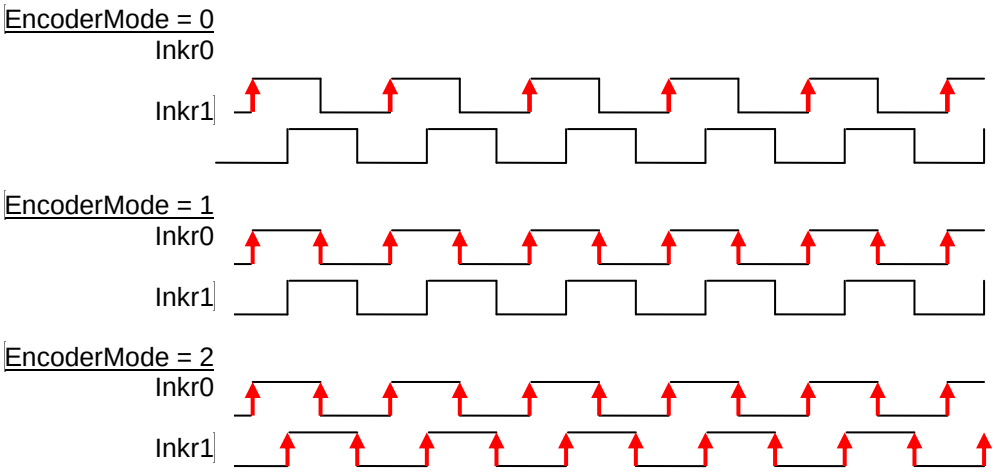
15	0	
Encoder resolution in nm / step	(low word)	Word 1
	(high word)	Word 2
Number of values for averaging		Word 3
Modes		Word 4
reserved		Word 5
Number of Encoder Channels		Word 6

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.

7.31 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

7.32 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.
It refers to camera package release >= P4.20

TAG-ID: TAG_SET_INSERT_MODE (293 H)

Format: Short

Data: Bit encoded, see table below

Bit No ActiveBit	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..7	*Reserved*	--	--	*For future use*

The lower byte contains the active bits with the information about the checkboxes activated in the Gui.

Note:

Type and position of information for each line is specified with TAG_COLUMN_INSERTMODE (2B0 H)
Not implemented in package release < = P4.20

7.33 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

7.34 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.

7.35 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

7.36 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

7.37 Set value for stop gain control

If video level of white references drops below or exceeds 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 values for the upper and lower thresholds to disable gain control if the current channel values for the white reference are different to the target reference values Tags 1080H -1083H

The lower threshold for disable gain control is defined by:
Current channel value <= (GainStopFactor / 1024) * Target Value

The upper threshold for disable gain control is defined by:
Current channel value >= (TargetValue - ((GainStopFactor / 1024) * Target Value)) + TargetValue

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

7.38 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

7.39 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).
Not implemented in package release < = P4.20!

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:

7.40 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	Reg edit information
Bit 4	State Trace White- and Led Control
Bit 5	internal states

Bit 6	Sensor information
Bit 7	environment values
Bit 8 .. 15	reserved

Default: 0

7.41 Master-Slave-Control

(Not implemented)

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

7.42 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_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 ...15: Currently not used set 0

Default: 0

7.43 Global Register Set 0

TAG-ID: TAG_GLOBAL_REGS_0 (31B H)

Format: VAR

Data:
1st word: Register address
2nd word: Register value
3rd word: Register address
4th word: Register value
5th word: ……

TAG_GLOBAL_REGS_0 are pairs of register addresses and register data value. The registers stored in this tag are written with the appropriate before initializing the Sensor.

Up to 100 pairs may be stored.

7.44 Global Register Set 1

TAG-ID: TAG_GLOBAL_REGS_1 (31C H)

Format: VAR

Data:
1st word: Register address
2nd word: Register value
3rd word: Register address
4th word: Register value
5th word: ……

TAG_GLOBAL_REGS_1 are pairs of register addresses and register data value. The registers stored in this tag are written with the appropriate values initializing the sensor is done.

Up to 500 pairs may be stored.

7.45 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
allPIXAWave: 0 … 3072 (Roi total length <= 10240 pixel)
0 … 2048 (Roi total length > 10240 pixel)

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

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

7.46 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

Format: Short

Data: 0 … 1023

Default: 0

7.47 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= CameraLink Base 1X 1Tx8b RGB (for color output)

1= CameraLink Medium 1X4 4Tx8b Mono (monochrome output 8 Bit)

2= CameraLink Medium 1X4 4Tx12b Mono (monochrome output 12 Bit)

3= CameraLink Medium 1X2 2Tx8b RGB (for color output 8Bit)

4=CameraLink Medium 1X 1Tx12b RGB (for color output 12Bit)

5=CameraLink Full64 1X8 8Tx8b Mono or RGB-Raw

6= CameraLink Full80 1X10 10Tx8b Mono or RGB-Raw

7 = CameraLink Full80 1X8 8Tx10b Mono or RGB-Raw

All other values invalid

Default 0= Camera Link Base

7.48 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

7.49 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.

7.50 Video output mode CIS

(Developer use) Shows the from the camera selected sensor operation mode.

TAG-ID: TAG_SET_VIDEOOUT_MODE_CIS = CC1 H

Format: SHORT

Data:
0 Grau-7,5K-8Bit -4T
1 Grau-15K-8Bit-2T
2 tbd.
3 tbd.
4 Grau-10K-12Bit -4T
5 Grau-15K-12Bit -2T

6 RGB-5K-12Bit -4T
7 RGB-5K-8Bit -4T
8 tbd.
9 RGB-15K-12Bit 1T
10 tbd.
.
.
13 tbd.

Values: 0 … 13

7.51 Select sensor quantization depth

This tag is used to select the sensor quantization depth.

TAG-ID: TAG_SEL_CIS_QUANTIZ_DEPTH = CC2 H

Format: SHORT

Data:
0 8Bit
1 12Bit

7.52 Set cis mode

(Developer use only) This Tag set the CIS to the Standard Mode, the Special pixel mode or in a ADC Test mode.

TAG-ID: TAG_SET_CIS_MODE = CC5H

Format: Short

Data:
0 : Standard Mode
1 : Special pixel mode
2 : ADC Test mode

Default: 0: Standard Mode

7.53 Output bit window for 8 bit mode

(Developer use)This tag selects the 8 bit output data range from the 12 bit sensor data if the camera is in an 8bit output mode.

TAG-ID: TAG_SET_OUTPUT_BIT_WINDOW= CC7H

Format: Short

Data: 0 : Bits 7:0
1 : Bits 8:1
2 : Bits 9:2
3 : Bits 10:3
4 : Bits 11:4

Default: 4: Bits 11:4

7.54 Set test pattern sensor side

(Developer use)This tag enables/disables the test pattern generator before the image processing path. It 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_SENSOR_SIDE= CC8H

Format: Short

Data: 0 : No pattern
1 : Grey ramp in x-direction
2 : Grey ramp in transport direction
3 : Grey ramp in x and y direction
4 : jump

Default: 0: No pattern

7.55 Min integration time in ns

This Tag is used to show in the UI the minimum integration time for a particular sensor operation mode.

TAG-ID: TAG_GET_MIN_INT_TIME = CC9 H

Format: long

Data: integration time in ns

Default: 1000ns

7.56 Min Line Period time in ns

This tag is used to show the min line period time which is depended by the integration time, roi length and the sensor operation mode.

TAG-ID: TAG_GET_MIN_LINE_PERIOD = CCA H

Format: long

Data: Time for minimum line period in ns

Range depended by the sensor operation mode, roi length, integration time.

7.57 Line Period time in ns

This Tag set the time for the scan line period of the cis.

TAG-ID: TAG_SET_CIS_LINEPERIOD_IN_NS = CCB H

Format: long

Data: Time for line period in ns

Range depended by the sensor operation mode, roi length, integration time.

7.58 Set the integration time of each CIS line in µs

This tag is used to set an individual integration for each line (colour) of the cis.
(development use only!)
TAG-ID: TAG_INT_TIME_PER_LINE = CCC H

Format: VAR

Data: unsigned long

Bit

15 0
intTimeClearSp
intTimeClearSp_HIGH
intTimeRedSp
intTimeRedSp_HIGH
intTimeClear
intTimeClear_HIGH
intTimeRed
intTimeRed_HIGH
intTimeGreen
intTimeGreen_HIGH
intTimeBlue
intTimeBlue_HIGH
intTimeGreenSp
intTimeGreenSp_HIGH
intTimeBlueSp
intTimeBlueSp_HIGH

7.59 Max integration time in µs

Tag is used to show the max integration time in µs which is depended by the line time and the sensor operation mode.

TAG-ID: TAG_GET_MAX_INT_TIME = CCD H

Format: long

Data: Line period in ns – 1500ns

Values: 0 …0xFFFFFFFF

7.60 Set line equalization

Set the line Equalization of the camera link output signal to match it to the used camera link cable.
(development use only!)

TAG-ID: TAG_SELECT_LINE_EQ = CCE H

Format: SHORT

Data:
0 off
1 low
2 medium
3 high

Values: 0 …3
Default: 0

7.61 Total ROI length

Shows the user for easier handling the frame grabber the total length of all regions of interest on the bv Bus.

TAG-ID: TAG_ROI_TOTAL_LENGTH = CCF H

Format: SHORT

Data: 1 – Max bv bus size (cleo 15360)

7.62 Tag set colour mode

This tag is used to set the colour mode of the allPIXA wave.
(Possible operating modes determined by sensorfile!)

TAG-ID: TAG_SET_COLOR_MODE = CD1 H

Format: SHORT

Data:
0 Grey
1 RGB
2 RGB+grey
.
.
FFFF H TBD.

7.63 Analog gain

Set the values for the analog gain for appropriate color. **(development use only!)**

TAG-ID:
TAG_ANALOG_GAIN_COLOR_CLEAR = 1000 H
TAG_ANALOG_GAIN_COLOR_RED = 1001 H
TAG_ANALOG_GAIN_COLOR_GREEN = 1002 H
TAG_ANALOG_GAIN_COLOR_BLUE = 1003H
TAG_ANALOG_GAIN_COLOR_05 = 1004 H
TAG_ANALOG_GAIN_COLOR_06 = 1005 H
TAG_ANALOG_GAIN_COLOR_07 = 1006 H
TAG_ANALOG_GAIN_COLOR_08 = 1007 H
TAG_ANALOG_GAIN_COLOR_09 = 1008 H
TAG_ANALOG_GAIN_COLOR_10 = 1009 H
TAG_ANALOG_GAIN_COLOR_11 = 100A H
TAG_ANALOG_GAIN_COLOR_12 = 100B H

Format: SHORT

Data: Analog gain for appropriate color

Values: 0 … 255
Default: 0

7.64 CDS gain

Set the values for the CDS gain for appropriate color.

TAG-ID:	TAG_CDS_GAIN_COLOR_CLEAR	= 1020 H
	TAG_CDS_GAIN_COLOR_RED	= 1021 H
	TAG_CDS_GAIN_COLOR_GREEN	= 1022 H
	TAG_CDS_GAIN_COLOR_BLUE	= 1023H
	TAG_CDS_GAIN_COLOR_05	= 1024 H
	TAG_CDS_GAIN_COLOR_06	= 1025 H
	TAG_CDS_GAIN_COLOR_07	= 1026 H
	TAG_CDS_GAIN_COLOR_08	= 1027 H
	TAG_CDS_GAIN_COLOR_09	= 1028 H
	TAG_CDS_GAIN_COLOR_10	= 1029 H
	TAG_CDS_GAIN_COLOR_11	= 102A H
	TAG_CDS_GAIN_COLOR_12	= 102B H

Format: SHORT

Data: 0: CDS = 1x
1: CDS = 2x

Values: 0 … 1

Default: 0

7.65 Sensitivity

Set the sensitivity mode for appropriate color.

TAG-ID:	TAG_FULLWELLCAP_COLOR_CLEAR	= 1040 H
	TAG_FULLWELLCAP_COLOR_RED	= 1041 H
	TAG_FULLWELLCAP_COLOR_GREEN	= 1042 H
	TAG_FULLWELLCAP_COLOR_BLUE	= 1043H
	TAG_FULLWELLCAP_COLOR_05	= 1044 H
	TAG_FULLWELLCAP_COLOR_06	= 1045 H
	TAG_FULLWELLCAP_COLOR_07	= 1046 H
	TAG_FULLWELLCAP_COLOR_08	= 1047 H
	TAG_FULLWELLCAP_COLOR_09	= 1048 H
	TAG_FULLWELLCAP_COLOR_10	= 1049 H
	TAG_FULLWELLCAP_COLOR_11	= 104A H
	TAG_FULLWELLCAP_COLOR_12	= 104B H

Format: SHORT

Data: 0: high dynamic
1: high sensitivity

Values: 0 … 1

Default: 0

7.66 Digital gain

Set the current values for the digital gain for each color. Every color is separate programmed. Change of these values is only possible if the white control is switched off. **(development use only!)**

TAG-ID:	TAG_DIGITAL_GAIN_COLOR_CLEAR	= 1060 H
	TAG_DIGITAL_GAIN_COLOR_RED	= 1061 H
	TAG_DIGITAL_GAIN_COLOR_GREEN	= 1062 H
	TAG_DIGITAL_GAIN_COLOR_BLUE	= 1063H
	TAG_DIGITAL_GAIN_COLOR_05	= 1064 H
	TAG_DIGITAL_GAIN_COLOR_06	= 1065 H
	TAG_DIGITAL_GAIN_COLOR_07	= 1066 H
	TAG_DIGITAL_GAIN_COLOR_08	= 1067 H
	TAG_DIGITAL_GAIN_COLOR_09	= 1068 H

TAG_DIGITAL_GAIN_COLOR_10	= 1069 H
TAG_DIGITAL_GAIN_COLOR_11	= 106A H
TAG_DIGITAL_GAIN_COLOR_12	= 106B H

Format: SHORT

Data: Digital gain for appropriate color.
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

7.67 Desired level of the white reference

Set the target / desired values for the area of white reference for the appropriate color.

TAG-ID:

TAG_WHITECTRL_TARGET_COLOR_CLEAR	= 1080 H
TAG_WHITECTRL_TARGET_COLOR_RED	= 1081 H
TAG_WHITECTRL_TARGET_COLOR_GREEN	= 1082 H
TAG_WHITECTRL_TARGET_COLOR_BLUE	= 1083H
TAG_WHITECTRL_TARGET_COLOR_05	= 1084 H
TAG_WHITECTRL_TARGET_COLOR_06	= 1085 H
TAG_WHITECTRL_TARGET_COLOR_07	= 1086 H
TAG_WHITECTRL_TARGET_COLOR_08	= 1087 H
TAG_WHITECTRL_TARGET_COLOR_09	= 1088 H
TAG_WHITECTRL_TARGET_COLOR_10	= 1089 H
TAG_WHITECTRL_TARGET_COLOR_11	= 108A H
TAG_WHITECTRL_TARGET_COLOR_12	= 108B H

Format: SHORT

Data: desired level of reference area which should be reached at white control process of the appropriate color.
Target value is given 4 times the desired grey level. 800 will lead to grey level of 200 (at 8Bit color channel).

Values: 0 … 1023

Default: 800

7.68 Actual level of the white reference

This Tag retrieves the actual level of the white reference areas for the appropriate color.

TAG-ID:

TAG_ACTUAL_WHITE_COLOR_CLEAR	= 10A0 H
TAG_ACTUAL_WHITE_COLOR_RED	= 10A1 H
TAG_ACTUAL_WHITE_COLOR_GREEN	= 10A2 H
TAG_ACTUAL_WHITE_COLOR_BLUE	= 10A3H
TAG_ACTUAL_WHITE_COLOR_05	= 10A4 H
TAG_ACTUAL_WHITE_COLOR_06	= 10A5 H
TAG_ACTUAL_WHITE_COLOR_07	= 10A6 H
TAG_ACTUAL_WHITE_COLOR_08	= 10A7 H
TAG_ACTUAL_WHITE_COLOR_09	= 10A8 H
TAG_ACTUAL_WHITE_COLOR_10	= 10A9 H
TAG_ACTUAL_WHITE_COLOR_11	= 10AA H
TAG_ACTUAL_WHITE_COLOR_12	= 10AB H

Format: SHORT

Data: Actual white level is given 4 times the real grey level at 8Bit color image.

Values: 0 … 1023

Default: -

7.69 Gain warning level

If calculated gain level exceeds the gain warn level then a “fe response” is generated after request by Command WR. Each channel value is set separate.

(Not implemented)

TAG-ID:	TAG_GAIN_WARN_LEVEL_CLEAR	= 10C0 H
	TAG_GAIN_WARN_LEVEL_RED	= 10C1 H
	TAG_GAIN_WARN_LEVEL_GREEN	= 10C2 H
	TAG_GAIN_WARN_LEVEL_BLUE	= 10C3 H
	TAG_GAIN_WARN_LEVEL_05	= 10C4 H
	TAG_GAIN_WARN_LEVEL_06	= 10C5 H
	TAG_GAIN_WARN_LEVEL_07	= 10C6 H
	TAG_GAIN_WARN_LEVEL_08	= 10C7 H
	TAG_GAIN_WARN_LEVEL_09	= 10C8 H
	TAG_GAIN_WARN_LEVEL_10	= 10C9 H
	TAG_GAIN_WARN_LEVEL_11	= 10CA H
	TAG_GAIN_WARN_LEVEL_12	= 10CB H

Format: SHORT

Data: gain warning level for the appropriate color.
Data range is same as digital gain.

Values: 0 … 0x4000

Default: 0x1000 → 1.0

7.70 Minimum Gain Level

Values are limits that can be used in processing of WR- order to ensure minimum gain values within adjustment process. Each color is set separate.

TAG-ID:	TAG_MINIMUM_GAIN_LEVEL_CLEAR	= 10E0 H
	TAG_MINIMUM_GAIN_LEVEL_RED	= 10E1 H
	TAG_MINIMUM_GAIN_LEVEL_GREEN	= 10E2 H
	TAG_MINIMUM_GAIN_LEVEL_BLUE	= 10E3H
	TAG_MINIMUM_GAIN_LEVEL_05	= 10E4 H
	TAG_MINIMUM_GAIN_LEVEL_06	= 10E5 H
	TAG_MINIMUM_GAIN_LEVEL_07	= 10E6 H
	TAG_MINIMUM_GAIN_LEVEL_08	= 10E7 H
	TAG_MINIMUM_GAIN_LEVEL_09	= 10E8 H
	TAG_MINIMUM_GAIN_LEVEL_10	= 10E9 H
	TAG_MINIMUM_GAIN_LEVEL_11	= 10EA H
	TAG_MINIMUM_GAIN_LEVEL_12	= 10EB H

Format: SHORT

Data: minimum gain level for the appropriate color.
Data range is same as digital gain.

Values: 0 … 0x4000

Default: 0x1000 → 1.0

7.71 Regions of Interest (ROI)

These tags are used to define region of interests (ROI).

TAG-ID: TAG_ROI_1 = 1100 H
TAG-ID: TAG_ROI_2 = 1101 H
TAG-ID: TAG_ROI_3 = 1102 H
TAG-ID: TAG_ROI_4 = 1103 H

Format: VAR
Data: word [4] (2 x DWORD)

Data word	Name	description
0 (low word)	Start of ROI	1 … 15456
1 (high word)		
2	Width of ROI	4 … 15456
3		

TAG-ID: TAG_USE_ROI_1 = 1120 H
TAG_USE_ROI_2 = 1121 H
TAG_USE_ROI_3 = 1122 H
TAG_USE_ROI_4 = 1123 H

Format: SHORT

Data: > 0 : appropriate ROI is active

7.72 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_BRIGHTCONTRAST_MODE = CD2 H

Format: SHORT

Data: 0 : brightness and contrast control is not active
1: brightness and contrast control is active

TAG-ID: TAG_BRIGHTCONTRAST_OFFSET_CLEAR = 1130 H
TAG_BRIGHTCONTRAST_OFFSET_RED = 1131 H
TAG_BRIGHTCONTRAST_OFFSET_GREEN = 1132 H
TAG_BRIGHTCONTRAST_OFFSET_BLUE = 1133 H
TAG_BRIGHTCONTRAST_OFFSET_05 = 1134 H
TAG_BRIGHTCONTRAST_OFFSET_06 = 1135 H
TAG_BRIGHTCONTRAST_OFFSET_07 = 1136 H
TAG_BRIGHTCONTRAST_OFFSET_08 = 1137 H
TAG_BRIGHTCONTRAST_OFFSET_09 = 1138 H
TAG_BRIGHTCONTRAST_OFFSET_10 = 1139 H
TAG_BRIGHTCONTRAST_OFFSET_11 = 113A H
TAG_BRIGHTCONTRAST_OFFSET_12 = 113B H

Format: SHORT

Data: VideoOut = VideoIn + Additional Offset
Range: -1023… 1023
Default: 0

TAG-ID:	TAG_BRIGHTCONTRAST_GAIN_CLEAR	= 1140 H
	TAG_BRIGHTCONTRAST_GAIN_RED	= 1141 H
	TAG_BRIGHTCONTRAST_GAIN_GREEN	= 1142 H
	TAG_BRIGHTCONTRAST_GAIN_BLUE	= 1143 H
	TAG_BRIGHTCONTRAST_GAIN_05	= 1144 H
	TAG_BRIGHTCONTRAST_GAIN_06	= 1145 H
	TAG_BRIGHTCONTRAST_GAIN_07	= 1146 H
	TAG_BRIGHTCONTRAST_GAIN_08	= 1147 H
	TAG_BRIGHTCONTRAST_GAIN_09	= 1148 H
	TAG_BRIGHTCONTRAST_GAIN_10	= 1149 H
	TAG_BRIGHTCONTRAST_GAIN_11	= 114A H
	TAG_BRIGHTCONTRAST_GAIN_12	= 114B H

Format: SHORT

Data: Brightness contrast control gain to set the contrast for appropriate color.
0x1000 represents gain factor 1.0. Digit lower 0x1000 define the decimal places with 1 / 4096 per digit.
Range: 0 ..8191d

7.73 Linear gain

Set the current values for the linear gain for each color. Every color is separate programmed.

TAG-ID:	TAG_LINEAR_GAIN_COLOR_CLEAR	= 1150 H
	TAG_LINEAR_GAIN_COLOR_RED	= 1151 H
	TAG_LINEAR_GAIN_COLOR_GREEN	= 1152 H
	TAG_LINEAR_GAIN_COLOR_BLUE	= 1153 H
	TAG_LINEAR_GAIN_COLOR_05	= 1154 H
	TAG_LINEAR_GAIN_COLOR_06	= 1155 H
	TAG_LINEAR_GAIN_COLOR_07	= 1156 H
	.	
	.	
	.	
	TAG_LINEAR_GAIN_COLOR_16	= 115F H

Format: UNSIGNED SHORT

Data: Linear gain factor for appropriate color.
1000 represents gain factor 1.0. Values lower 1000 define the decimal places with 1 / 1000 resolution.

Values: 0 … 50000

7.74 Adjust the CIS black level offset

Adjust the black level offset for the CIS in the CIS black level offset registers BLOReg 0x06 for the top lines (White and red) and bottom lines (green and blue).
(Development use only! for customer not accessible!)

TAG-ID: TAG_BLACK_LEVEL_OFFSET_TOP = 1160H

TAG_BLACK_LEVEL_OFFSET_BOTTOM = 1161H

Format: UNSIGNED SHORT

Data: Each Digital step adds 12mv to the Black level voltage, starting on 12mV.

Values: 0 … 0xFF

7.75 Set grey video out mode

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

Data	
0	Disabled (normal Output)
1	CameraLink Base 1X3 3Tx8b Mono
2	CameraLink Medium 1X4 4Tx8b Mono
3	CameraLink Medium 1X4 4Tx12b Mono

7.76 Set weights for the colour 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 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: 100

7.77 Destination of the trace output

With this TAG you can set the destination of trace information.
(Development use only!)

Attention, if the CL or RS232 interface is selected for the trace data output, this can disturb the HSI communication.

TAG-ID: TAG_SET_TRACE_IF = 1204 H

Format: SHORT

Data: 0 **default** stores the trace data internally to a circular buffer with the size of 2k!
1 Destination of the trace data is the RS232 interface!
2 Destination of the trace data is the CL interface!

7.78 Setting the TDI operating mode

This tag is used to set different weightings of each signal of the three sensor lines in the grey sum output signal of the camera in TDI operation.
The weightings of the sensor lines are given in the table below.
These modes of operation are only useful if the camera is equipped with a pure grey-line sensor.

TAG-ID: TAG_SET_TDI_OPERATION_MODE= 1205 H

Format: SHORT

Data:

HSI Value	TDI Operation Mode designation	Weighting of the three sensor lines
2	3-TDI	1/3 x Line1 + 1/3 x Line2 + 1/3 x Line3
1	2-TDI	1/2 x Line1+ 1/2 x Line2+ 0 Line3
0	1-TDI	1 x Line1+ 0 x Line2+ 0 x Line3

7.79 Enable Hardware DRC

This Tag is used to Enable the fast line by line Dark Ref clamping realized in the fpga logic.

TAG-ID: TAG_ENABLE_HARDWARE_DRC= 1206 H

Format: SHORT

Data: 0 -> SW DRC
1 -> HW DRC Fast DRC. Correction Values are calculated and set by the FPGA Logic.

7.80 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 (+1V8_CIS_ FPGA)

TAG-ID: TAG_HWMONITOR_VOLTAGE_VCORE (372H)
Format: SHORT
Data Internal voltage 3 in mV (+1V2_FPGA)

TAG-ID: TAG_HWMONITOR_VOLTAGE _SUPPLY1 (373H)
Format: SHORT

Data Internal voltage 4 in mV (+3V3_Vcc)

TAG-ID: TAG_HWMONITOR_VOLTAGE _SUPPLY2 (374H)
Format: SHORT
Data Internal voltage 5 in mV (+2V5_FPGA)

TAG-ID: TAG_HWMONITOR_VOLTAGE _SUPPLY_CCD (376H)
Format: SHORT
Data Internal voltage 6 in mV (+3V3_CIS)

TAG-ID: TAG_HWMONITOR_VOLTAGE _IN (377H)
Format: SHORT
Data External in voltage in mV (+24V_INT)

TAG_HWMONITOR_TEMPERATURE_POW (380H)
Format: SHORT
Data Temperature of Power board °C

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_GET_SYNCINTEGRATION_TIME	= 290 H	
TAG_IMAGECOUNTER	= 291 H	
TAG_GET_TRANSPORT_SPEED	= 393 H	
TAG_LINEAR_GAIN_COLOR_CLEAR	= 1150 H	
TAG_LINEAR_GAIN_COLOR_RED	= 1151 H	
TAG_LINEAR_GAIN_COLOR_GREEN	= 1152 H	
TAG_LINEAR_GAIN_COLOR_BLUE	= 1153 H	
TAG_ACTUAL_WHITE_COLOR_CLEAR	= 10A0 H	
TAG_ACTUAL_WHITE_COLOR_RED	= 10A1 H	
TAG_ACTUAL_WHITE_COLOR_GREEN	= 10A2 H	
TAG_ACTUAL_WHITE_COLOR_BLUE	= 10A3H	
TAG_OPERATING_STATE	= 103 H	
TAG_STATUS	= 1CB 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

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.

Linear gain

TAG-ID: TAG_LINEAR_GAIN_COLOR_X (1150 H - 1153 H)

Format: UNSIGNED SHORT

Data: Linear gain factor for appropriate color.
1000 represents gain factor 1.0. Values lower 1000 define the decimal places with 1 / 1000 resolution.

Values: 0 … 50000

Actual level of the white reference

TAG_ACTUAL_WHITE_COLOR_X (10A0 H - 10A3 H)

Format: SHORT

Data: Actual white level is given 4 times the real grey level at 8Bit color image.

Values: 0 … 1023

Camera Operating state (input for container tag)

TAG-ID: TAG_OPERATING_STATE = 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)

Status for the camera electronics (input for container tag)

TAG-ID: TAG_STATUS = 1CB H
Format: Word
Data: Internal control states

Bit

15 11	10 8	7 4	3 0
Disable White Control reasons	Reserved	Gain Control	Main Control

Single States:

Bit	**Disable White Control reasons**
11	Disabled by external signal (not supported currently)
12	White Control is disabled while light switched off by internal control
13	Control is disabled while light switched off by external command
14	Control is disabled while stop gain control condition set with TAG_SET_WHITECONTROL_MODE (318 H) is entered.
15	No actual references

See also TAG_GAINCONTROL_DISABLE_STATUS (325 H)

Last Changed: HSI 2.02

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**	
Low word length		0 Name 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. 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.

11.1 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.

11.2 Format of the Response pa

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

11.3 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_SET_GAMMAVALUE	0x229	10	No gamma correction
TAG_MIRROR_DATA_HOR	0x246	false	No mirror
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 P3.1 and higher)

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_WHITECONTROL	0x200	false	Disable white control because light should be off

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_WHITECONTROL	0x200	false	Disable white control because light should be off

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

12. 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.

12.1 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).

12.2 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_1_KONFIG = 200 H (allPixa)
Format: CONT
Data: Tags for the configuration of the camera

Values:

TAG_KONF_FIRMWARE (107 H)
TAG_KONF_PROGRAM_TEXT (109 H), optional
TAG_SENSOR_TYPE (212 H)
TAG_GET_MININTTIME (274)
TAG_KONF_LOGIC_KA4 (211 H)
TAG_HSI_LEVEL (213 H)
TAG_KONF_HW_KA4 (210 H)
TAG_CONF_HW2 (214)
TAG_LOGIC_DESCR_TEXT (255 H), optional

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_1_SETTING (208 H) (setting of allPixawave)
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_ERROR (1CA H)
TAG_SENSOR_TYPE (212H)
TAG_SET_SERIALNUMBER_PART1 (262 H)
TAG_SET_SERIALNUMBER_PART2 (263 H)
TAG_GET_FIRST_ACTIVE_PIXEL (394 H)
TAG_GET_LAST_ACTIVE_PIXEL (395 H)
TAG_GET_MAXIMUM_TRANSPORT_SPEED (396 H)

TAG_BLACK_LEVEL_OFFSET_TOP (1160 H)
TAG_BLACK_LEVEL_OFFSET_BOTTOM (1161 H)

TAG_ACTUAL_WHITE_COLOR_CLEAR (10A0 H)
TAG_ACTUAL_WHITE_COLOR_RED (10A1 H)
TAG_ACTUAL_WHITE_COLOR_GREEN (10A2 H)
TAG_ACTUAL_WHITE_COLOR_BLUE (10A3 H)

TAG_DIGITAL_GAIN_COLOR_CLEAR (1060 H)
TAG_DIGITAL_GAIN_COLOR_RED (1061 H)
TAG_DIGITAL_GAIN_COLOR_GREEN (1062 H)
TAG_DIGITAL_GAIN_COLOR_BLUE (1063 H)

TAG_ANALOG_GAIN_COLOR_CLEAR (1000 H)
TAG_ANALOG_GAIN_COLOR_RED (1001 H)
TAG_ANALOG_GAIN_COLOR_GREEN (1002 H)
TAG_ANALOG_GAIN_COLOR_BLUE (1003 H)

TAG_ROI_TOTAL_LENGTH (CCF H)
TAG_GET_MAX_INT_TIME (CCD H)
TAG_GET_MIN_LINE_PERIOD (CCA H)
TAG_GET_MIN_INT_TIME (CC9 H)
TAG_SET_VIDEOOUT_MODE_CIS (CC1 H) (use only for development)

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.

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 39	Byte 0 Byte 38	Data 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.

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 (Wave=8)
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 0
Not implemented in the allPIXAwave

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
Supported in: Ka5, Ka6, Ka7
Format: VAR
Data:

Bit

15 0	
PacketID	Word 1
Description Text (40 Chars)	Word 2
…	
SignatureDifference	Word 22
MarkBits0	Word 23
MarkBits1	Word 24
Calculated Signature	Word 25

PaketID: An arbitrary 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 Signature and set Signature. The internal value can get if
Signature is set to 0

MarkBits: see Description in Order MK

Calculated Signature: Useful do define the MK-Tag to set the Signature

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

Status of additional external inputs

TAG-ID: TAG_GET_EXTERNAL_SIGNALS_A (392 H)

Format: SHORT

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”

12.3 List of Tags which are specific to request

TAG_ PACKET_VERIFY (259 H)

13. RS: Request State

Request state of camera

13.1 Format of the Command RS

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

13.2 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”.

14. DD: Download Digital Filters

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

14.1 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	4096
GAMMA_TABLE blue channel	8192
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_LUT 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

TOD = 100: allows loading Look up tables independently

LUT Type identifier R,G,B,M,	0 LUT Type header info
Data of Gamma table	2

LUT Type	Identifier
R	0
G	1
B	2
C	3
Sn1	4
.	
.	
4711	TBD

14.2 Format of the Response dd

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

15. DL: Download Logic

Module	KA4	KA5	COSC	KA6/7	KA71	KA8
Supported	x	x	x	x	x	x

By means of the DL Command data for programmable hardware logic for Xilinx can be downloaded to I-KAx, where it is stored in non-volatile memory.

Format of the Command **DL**

15 8	7 0	
D	**L**	0 Name
Length low word		2 Length
High word length		4 Length
Reserved	reserved	6 Sender
Reserved	reserved	8 Receiver
FBGKENN		10 Board identifier
VersionOfHeader		12 see below
VersionOfData		14 see below
TypeOfBoard		16 see below
TimePerPixel		
SelectDestination		20 see below
CommentText (ASCII)(127 words)		22 see below
MinErzeugnisstand		
Reserved 1, Pixeltime LOW in 10 fs (10E-15)		86
Reserved 2, Pixeltime HIGH in 10 fs (10E-15)		88
Program data		90 see below
Check sum		Check sum

FBGKENN = xxxx H: Identifier of the selected board (2 ASCII characters)
= 'Kn' Camera board

VersionOfHeader = 0001H: Current Version of DL-Header
0002H: Extended version with pixel time as DWORD in Reserved 1, Reserved 2

VersionOfData =xxxx H: Current version of FPGA data

TypeOfBoard =xxxx H: Version of Camera Board for which data are suitable

= 0000 H: KA 40
= 0001 H: KA 41
= 0002 H: KA5
= 0003 H: COSC
= 0080 H: KA 89 (all types of KA89 Boards supported)
= 0081 H: supports only KA89 DZ1 Board
= 0082 H: supports only KA89 DZ2 Board **without** Booster Board
= 0083 H: supports only KA89 DZ2 Board with Booster
= 0084 H supports KA89 DZ2 Board with or without Booster Board

TimePerPixel =xxxx H: CCD shift time per pixel in resolution of 10 ps
0 if not needed

SelectDestination =xxxx H: Select device for data
= 0000 H: FPGAs on basis board, for allPIXAwave (KA89) RGB FPGA
= 0001 H: FPGA on FireWire board
= 0003 H: Alternative FPGA version (COSC), ZBT – Test
= 0004 H grey FPGA allPIXAwave (KA89)

TextForComment: ASCII text with comment
Max text length: 126 Byte + '0'
End of valid text must marked with byte value = 0

MinErzeugnisstand: 0 : Data is stored independent from "Erzeugnisstand (EZ)" of board
>0 : Data is only stored if the EZ value of the camera board is equal or higher than this value

Reserved1 = 0000 For future use, Pixeltime LOW
Reserved2 = 0000 For future use, Pixeltime HIGH

Data Program data for device to load over serial interface in the hardware device

Format of the Response **dl**

The **dl** response has no specific data 1.4.2

16. DP: Download Program Update

By means of the DP Command new programs can be downloaded to update-capable boards, where they are stored in non-volatile Flash EPROM.

Format of the Command **DP**

15 8	7 0	
D	**P**	0 Name
Length low word		2 Length
High word length		4 Length
Reserved	Reserved	6 Sender
Reserved	Reserved	8 Receiver
FBGKENN		10 Board identifier
Program data		12 Data
Checksum		Checksum

FBGKENN = xxxx H: Board identifier (2 ASCII characters)
= 'K1' Camera board KAx1
= 'K2' Camera board KAx2
= 'K3' Camera board KAx3
= 'K4' Camera board KAx4
= 'aP' allPIXA (board SC-CTRL8)

Version 2 of header (for allPIXA cameras):

D	**P**	0 Name
Length low word		2 Length
High word length		4 Length
Board type	Header version	6 Sender
SVN release of Software		8 Receiver
FBGKENN		10 Board identifier

Header version 2: parameter below are set with valid values

Board type Value is used to check if program fits to receiving hardware

0: No check is done
1: SC-CTRL8 with SC-KA8
2: SC-CTRL8 with SC-KA82
3: SC-KA822
0080 H: KA 89 (all types of KA89 Boards supported)
0081 H: supports only KA89 DZ1 Board
0082 H: supports only KA89 DZ2 Board **without** Booster Board
0083 H: supports only KA89 DZ2 Board with Booster
0084 H supports KA89 DZ2 Board with or without Booster Board

SVN relrease release number of software coming from subversion data base

Format of the Response **dp**

The **dp** response has no specific data (see ‘General Statement on Responses’).

A RESET of the device is necessary after the update.

Important note: If the device is switched off during programming, before the Flash EPROM is completely programmed, the fallback program goes active after reset.

17. DS: Download Reference data

(Not recommended for new designs!

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. DS: Download Reference data (Version 10)

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 allPIXA wave corrects the offset failure; with the white reference data the allPIXA wave corrects the shading effect.
Two sets of reference data for black- and white level can be stored.

Maximum number of reference data including header information per set is: 128kB.

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
FbgKenn		10 see below
Version = 10 (proposal)		12 see below
RefNo	ArtRef	14 see below
(reserved)		16 see below
(reserved)		18 see below
Number of Planes		20 see below
Plane-dataset 1 ...		22
Plane- dataset 2 ...		6+2 * correction length+22
...		
Plane- dataset n ...		(n-1)*(6+2 * correction length)+22
Check sum		

Plane data set structure:

Plane Type R,G,B,M,	0 plane header info
first valid ref pixel	2 plane header info
last valid ref pixel	4 plane header info
Refdata “Correction length” data words 16 bit left order	6 plane-ref data 2* Correction length+6

RefNo: 0 …1 for allPIXA wave
ArtRef: as before 0 = BREF, 1 = SHC

First valid ref pixel:
This value is 1 if the reference is calculated over the whole camera scan line length.
It locates the start pixel of the reference area of the camera scan line.

Last valid ref pixel:
Number of pixel per plane.
It locates the last pixel of the reference area of the camera scan line.

Number of Planes: Number of subsequent plane datasets.

Plane: Definition of the plane types see table below.

Plain Type	identifier
R	0
G	1
B	2
M	3
Sn1	4
.	
.	
4711	TBD

Note: If the camera works in TDI mode, it outputs a grey image. If plain type M references are sent to the camera in this mode, these are converted into R G B plain types and stored in the memory locations of these types. The reason for this is that the TDI operation of the camera is a slightly different RGB operation and therefore 3 references are needed for the shading and offset correction.

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

19. 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)

20. UD Upload Data

Module	KA4	KA5	COSC	KA6/7	KA71	KA8
Supported	-	-	-	-	-	x

Format of the Command UD

15 8	7 0	
U	**D**	0 Name
Low word length		2 Length
High word length		4 Length
Reserved	Reserved	6 Sender
Reserved	Reserved	8 Receiver
FbgKenn		10 see below
TOD	Reserved	12 see below
SETID		14 see bellow
Checksum		16 Checksum

FbgKenn = xxxx H: Identifier of the selected KA board (2 ASCII characters)

TOD = xxxx H: Type of data (corresponding to description of Order DD)

SETID = xxxxH CCM data set (0..3; all other values invalid)

Format of the response **ud**

15 8	7 0	
u	**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
SETID (low word)		14 see below
SETID (high word)		16 see below
MAG_NR (8 words) ...		18 see below
Version		34
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
Check sum		Check sum

Structure corresponding to comand DD (Download Digital Filter) TOD=14.

If no configuration data are available a fe response with failure code 0xBF “GENERAL_CCM_ERROR” is sent.

21. 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)

22. RS485 Interface for controlling XLC4 Light controllers

22.1 Introduction

Possibility to control up to 14 XLC Light controllers (preliminary) over RS485.
ID Range 2 to 15, ID 0 reserved for broadcast commands, ID 1 is service ID.
The camera can automatically assign an ID to the light control unit when it is connected to the RS485 bus with the service ID 1.

22.1.1 XLC RS485 Protocol (short introduction)

The XLC 4 Light controller is controlled by an ASCII Protocol.
`Camera command <STX>TE<ETX> XLC Response: <STX>te 29-25,30,31,31<ETX>`
In order to control several light controllers on a RS485 bus, the device in question must be addressed with a hash tag and it's ID (#F). This assumes the camera when the light controllers are connected to the RS485 interface of the camera.

For example we want to read out the temperatures of a XLC light controller with the ID 15.
`Camera command <STX>#F TE<ETX> XLC Response: <STX>*f te 29-25,30,31,31<ETX>`
`Camera command <STX>#F TE<ETX> XLC Response: <STX>te 29-25,30,31,31<ETX>`

Please restart the camera always if you connect a new XLC4 device to the camera otherwise it's not possible to control the XLC4 device over HSI!
Please note several devices may not have the same ID, a specific ID may only be assigned to one device at a time!

22.2 HSI communication

The TAGs for controlling the XLC4 light control unit over HSI are all a part of the MK command.

22.2.1 Container Tags

Since 14 XLCs can be addressed on the RS485 bus, a container tag is created for each XLC4 with their RS485 ID. These container tags then contain the tags for the actual control of the XLC 4 with the respective ID.

TAG_CONTAINER_LIGHTCONTROLLER_ID0 =1170 H Broadcast Tag to control all XLC light controllers which are active connected to the RS485 Bus

TAG_CONTAINER_LIGHTCONTROLLER_ID1 =1171 H Service Tag this tag is dedicated for service tasks.

These are the Tags to control specific XLC light controllers with their specific ID which are active connected to the RS485 Bus.
TAG_CONTAINER_LIGHTCONTROLLER_ID2 =1172 H we start with active XLCs
.
.
.
TAG_CONTAINER_LIGHTCONTROLLER_ID15 =117F H

Currently, the containers consist of the following Tags:
TAG_XLC_SERIAL_NUMBER =1180H
TAG_SET_XLC_LED_CURRENT =1181H
TAG_XLC_LIGHT_CONTROL =1182H

TAG_XLC_SEND_BROADCAST =1183H (only to use in conjunction with *TAG_CONTAINER_LIGHTCONTROLLER_ID0* to enable broadcast commands).

It's not necessary send a container always with all Tags inside it's also possible to put only used Tags into a container Tag.

22.2.2 TAG_XLC_SERIAL_NUMBER

TAG_XLC_SERIAL_NUMBER = 1180H
Format: LONG
Data: Seriennummer der XLC 4
Values: 0- 0xFFFFFFFF
Only PK response!

22.2.3 TAG_SET_XLC_LED_CURRENT

TAG_SET_XLC_LED_CURRENT =1181H
Format: VAR
Data: adjust the current of selected channels
Current: adjustable current mA 200 … 1800
Channel flag Bitmask which selects the channels of the XLC for which the current is to be set. Bit 0 channel A of the XLC and then ascending.

Channel Flag	
Bit	XLC channel
0	A
1	B
2	C
3	D

Bit 15 13 12 0

Format	TAG-ID
Length = 2	
current	
Channel Flag	

Word 0
Word 1
Word 2

22.2.4 TAG_ XLC _LIGHT_CONTROL

TAG_ XLC _LIGHT_CONTROL =1182H
Format: SHORT
Data: Bit coded, see table below. The light of the respective XLC channel can be switched on by setting the bit to 1 and switched off by setting the bit to zero.

Bit	XLC Kanal
0	A
1	B
2	C
3	D

22.2.5 Send a broadcast to set parameters for all connected light controllers

TAG_XLC_SEND_BROADCAST =1183H
Format: SHORT
Data: 1 Sends the data set in container ID 0 (1170 H) to all XLC4 light controllers.
0 Data from container ID 0 (1170 H) will be ignored.

Only available for container ID 0 (1170 H)
Sends the data set in the container for ID 0 (1170 H) to all XLC4 light controllers.

22.2.6 Scan for new connected XLC devices and network join

TAG_XLC_SCAN_ASSIGN_NEW_DEVICE 1184 H

Format: SHORT
Data: 0:does nothing.
1: scans for XLC4 devices which are connected to the RS485 Bus and joins them to the network. If a XLC4 device with the service ID 1 is detected it assigns the lowest free ID of the network to the device and joins it with the new ID to the RS485 network.

22.2.7 Composition and example for a container tag

Bit 15 13 12 0

Format	TAG-ID	
Length		Word 0
TAG 1		Word 1
...		
...		
TAG n		

Format = 101 (bin)

Exampel 1:
We want to set the current of channel A and B to 500mA and we want to switch on channels A and B of the XLC light controller with the ID 3.

B173 // (0xA000 | 0x1173) container tag for the XLC light controller with ID3 TAG 0x1173
0006 // word length of the container
9181 // (0x8000 | 0x1181) var Tag 0x1181 TAG_SET_XLC_LED_CURRENT
0002 // length of the Tag 0x1181
01F4 // current value (500mA)
0003 // Bitmask (0011bin) which selects the channels of the XLC for which the current is to be set.
5182 // (0x4000 | 0x1182) short Tag 0x1182 TAG_XLC_LIGHT_CONTROL
0003 // Bitmask (0011bin) which selects the channels which should be switched on or off.

In the line below you see the complete HSI command including the transport layer and check sums.
01 00 00 00 F1 1E 4B 4D 0A 00 00 00 00 00 00 00 32 4B 73 B1 06 00 81 91 02 00 F4 01 03 00 82 51 03 00 FF 2E 67

Exampel 2:
We want to switch on the channel A to D of all XLC4 light controller which are connected to the RS485 interface of the camera.
Solution we send a broadcast message with the broadcast container (ID0 container).

B170 // (0xA000 | 0x1170) container tag ID0 TAG 0x1170 for broadcast messages
0004 // word length of the container
5182 // (0x4000 | 0x1182) short Tag 0x1182 TAG_XLC_LIGHT_CONTROL
000F // Bitmask (1111bin) we switch on channels A – D of the XLC light controller.
5183 // TAG to enable the Broadcast Tag
0001 // Sends the data set in container ID 0 (1170 H) to all XLC4 light controllers

In the line below you see the complete HSI command including the transport layer and check sums.
01 00 00 00 F1 1A 4B 4D 08 00 00 00 00 00 00 00 32 4B 70 B1 04 00 82 51 0F 00 83 51 01 00 0E ED FF

Please restart the camera or use TAG_XLC_SCAN_ASSIGN_NEW_DEVICE for network join if you connect a XLC4 device to the camera otherwise it's not possible to control this XLC4 device by HSI! Please note several devices may not have the same ID, a specific ID may only be assigned to one

device at a time!

22.2.8 PK Response

With the PK response you get always the 14 container Tags 0x1172 to 0x117F for RS485 IDs 2 – 15. These container Tags are including the tag TAG_XLC_SERIAL_NUMBER 0x1180. If the Serial number of TAG_XLC_SERIAL_NUMBER is different from zero, it shows that a XLC device with this ID is connected to the RS485 Bus of the camera.

Bit 15 … 0	
Container Tag ID (0x1172 - 0x117F)	Word 1
Length of Container	Word 2
…	
Tag ID TAG_XLC_SERIAL_NUMBER	Word 3
Serial low	Word 4
Serial high	Word 5
Tag ID TAG_SET_XLC_LED_CURRENT	Word 6
Length of Tag TAG_SET_XLC_LED_CURRENT	Word 7
Led current	Word 8
Channel Flag	Word 9
Tag ID TAG_ XLC _LIGHT_CONTROL	Word 10
Channel Flag	Word 11

22.3 Automatic ID assignment

The camera is able to assign RS485 IDs to a XLC4 device automatically. This simplifies the handling of the XLC devices in a RS485 network for service or initial installation and it ensures that when a device is exchanged with the new device with the same position at the RS485 bus, the same ID is obtained again.
The XLC4 is supplied with ID one by default. ID one is the service ID. If the camera detects a XLC4 device with this ID at the RS485 bus, it will automatically assign the lowest free ID of the RS485 bus to this XLC4 device.
The process to use the automatic ID assignment of the camera for one or more XLC4 devices at the RS485 Bus is very easy.
At the startup the camera every times scans the RS485 Bus for connected and running XLC4 devices and joins them to the network.
If the camera detects in this phase a XLC4 device with the service ID1 it starts the automatic ID assignment for this device.
The automatic ID assignment can be carried out even if several devices are connected to the RS485 bus.
The only condition is that the XLC4 network subscribers are assigned with different IDs.
It has to be ensured that also with the automatic ID assignment always only one device with the service ID 1 is connected to the RS485 bus!
To assign an ID automatically to a device, connect the new device with the service ID1 to the RS485 Bus and start, restart (reset) the camera or send Tag TAG_XLC_SCAN_ASSIGN_NEW_DEVICE to the camera. After this procedure, you will get the device with the new assigned ID with the PK response. In this response you can identify the device via the serial number Tag (1180H) in the container Tags 1172 H – 117F H.
If you have to connect more than one new XLC4 devices to the RS485 bus please repeat the procedure.

Please Note it's also not possible to connect more than one device with the service ID 1 to the RS485 Bus!
If a network is set up with several XLC devices, the devices can all be connected to the RS485 bus if they have been preconfigured with the correct IDs.

If the XLC devices have not been preconfigured with an ID, i.e. all XLC devices still have the ID 1 configured, the ID can be assigned with the automatic ID assignment by the camera.
In this case, the devices must be connected to the camera's RS485 bus **one after the other, after having received their ID by the automatic ID assignment of the camera**.
In the case of the automatic ID assignment, the light controllers which have already been assigned an ID have to be properly connected to the RS485 bus!

23. Special function registers

Register address	Value	Function
8400 H	0 – FFFF H	Idle time until the next register call is enabled. (is used for processing the sensor file)
8700 H	0 – FFF H	Sets the dark ref clamping target value (DRC target value)
8710 H	0 – FFF H	Sets the black level init offset.
8720 H	0 – FFFF H	Sets the LVal offset (readout offset) of the CIS.
8740 H	0 - 1	1 disables the recalibration of the Black level offset registers (BLOReg) of the CIS.
8750 H	0 – FFFF H	Gradient Red
8751 H	0 – FFFF H	Offset Red
8752 H	0 – FFFF H	Gradient green
8753 H	0 – FFFF H	Offset green
8754 H	0 – FFFF H	gradient blue
8755 H	0 – FFFF H	Offset blue
875C	0 – 140 H	Difference Front Dark Refs to min Video (dark) red Channel
875D	0 – 140 H	Difference Front Dark Refs to min Video (dark) green Channel
875E	0 – 140 H	Difference Front Dark Refs to min Video (dark) blue Channel
8d10 H	0 – FFFF H	Sets the min Flash time for LED Flash control.

24. Appendix