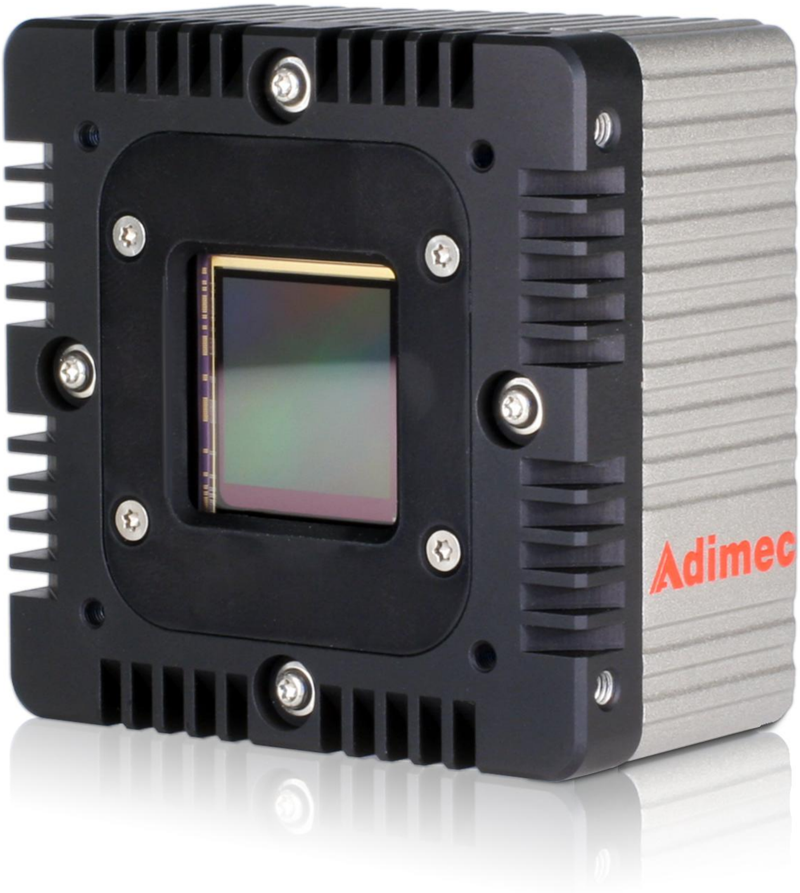
Manual

Rev. 0.1



Q-8V100 / S-25A30

Q-8V100m
Q-8V100c
S-25A30m
S-25A30c

About Adimec

Adimec is the leading supplier of high-performance digital camera modules and camera-lens assemblies for use in three market segments: machine vision, medical imaging, and applications for government purposes such as traffic and defense systems. In developing our products as a partner to major OEMs around the world, we utilize the synergy between these segments to shine in terms of image quality, speed, dynamic range and reliability.

Adimec is the only company in the market that weds the specific needs of its highly demanding customers to its technological inventiveness, generating vision solutions of exceptional quality. These industry-leading customer specials are the models for our standard products.
Thanks to this unique approach, Adimec's solutions add crucial competitive value to our customers' high-end systems and their applications, as they yield brilliant results to the users of those systems.

The Netherlands-based holding company has business offices in Europe, the United States, Japan, and Singapore. For more detailed information about Adimec and our products you can visit our website www.adimec.com or you can contact your local dealer or the business offices in your region:

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1. GENERAL INTRODUCTION

This document describes the electrical and software interface of the Quartz Q-8V100 and Sapphire S-25A30 cameras. Both are based on the ON Semi Vita25k sensor and available in monochrome or Bayer color.

The mechanical interface is specified in separate mechanical outline drawings.

1.1. Product Highlights

Global shutter
8 Mp acquisition at 100 fps (Q-8V100)
25 Mp acquisition at 30 fps (S-25A30)
Camera Link 10 tap interface

1.2. About this manual

This manual provides the necessary information for setting up, operating and troubleshooting the camera.
We strongly recommend reading this manual before you unpack or operate the camera.

The manual is applicable to the following models, color as well as monochrome, with Camera Link interface:
Q-8V100 (Quartz)
S-25A30 (Sapphire)

Unless stated differently, all information in this manual is applicable to all camera versions.

1.3. Standards

Camera Link – Specification of Camera Link Interface Standard for Digital Cameras and Frame Grabbers – Version 1.1 - January 2004.

1.4. Liability

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2. PRECAUTIONS

NOTE: It is advised to include the text of this chapter in the assembly documents of the system in
which the camera is used.
A CMOS sensor camera is a sensitive device. Please read the following precautions carefully before
you continue unpacking or operating the camera.

2.1. Safety precautions

2.1.1. General

It is advised to unpack and handle the camera in a clean, ESD protected working area.
It is advised to read the whole manual before using the camera.

2.1.2. Safety symbols

The following safety symbols are applicable to and indicated on the camera.

Symbol for “Conformité Européenne”

The exclamation mark within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the instrument.

2.2. Handling

2.2.1. General

In order to prevent damage to the camera and to keep the CMOS sensor clean, please take the following precautions.
Always keep the sensor cap in place, as long as no lens is attached.
Remove the lens cap just before the lens is screwed on the camera. It is advised to perform this operation in a clean room or clean bench.
Never touch the CMOS sensor surface. The cover glass is easily damaged and the CMOS sensor can be damaged by ESD (electrostatic discharge).

2.2.2. Cleaning of the CMOS sensor

Cleaning of a CMOS sensor is a rather difficult task. Depending on the aperture of the lens used, any dust particles with a size of 10μ and larger can show up in your image.
All cameras are checked for cleanliness in our factory before shipment. Proper handling instructions during system assembly can prevent the CMOS sensor from getting contaminated.

Should cleaning of the CMOS sensor be necessary follow the instruction below.

NOTE: that damage of the CMOS sensor due to scratches on the cover glass or electrostatic discharge (ESD) is not covered by warranty!
The correct working environment for cleaning is essential in order to ease cleaning and to prevent damage of the CMOS sensor.

Precautions:

- Take precautions to prevent ESD that can damage the CMOS sensor.
- Cleaning of the CMOS sensor, and assembly of the lens is preferably performed in a clean room or clean bench.Never try to clean the CMOS sensor at a relative humidity lower than 30 %. A relative humidity of 40 % or higher is preferred in order to minimize the chance of damage due to ESD.
- It is advisable to use an ionizer, in order to minimize the built-up of ESD.
- Be sure to clean the lensmount of the lens before assembly.
- Use non-fluffing Q-tips and Alcohol (or Hexane) for cleaning. De-ionized water may be necessary to remove ionic contaminants like salts.
- Any Q-tip should be used only once - you will otherwise move dirt from one place to another.
- Never dry rub the window. This may cause static charges or scratches that can destroy the CMOS sensor.

Cleaning instructions:

1. First try to remove the contamination by using clean, dry air. (Use an ultra-filtered, non-residue dust remover spray). Avoid blowing air into the screw thread of the lensmount, because this may cause contamination on the CMOS sensor due to loose particles and traces of oil or grease. If this step does not result in an acceptable result, continue with step 2.
2. Remove the lensmount by unscrewing the 4 crosshead screws that hold the lensmount.
3. Clean the inner screw thread of the lensmount using Alcohol or Hexane and a Q-tip.
4. Clean the CMOS sensor cover glass using Alcohol or Hexane and a Q-tip. Gently and carefully rub the window always in the same direction, e.g. top to down.
5. Install the lensmount back on the camera front. Maximum tightening force may not exceed 0.3 Nm.
6. Install a lens, power up the camera, set the lens at a small aperture (F16) and point the lens at a bright source. Adjust gain and integration time if necessary.
7. Check the image on the monitor for dark spots and stripes caused by contamination on the CMOS sensor cover glass. (Note that the image on the monitor should not saturate due to over-exposure - if necessary close the iris even further).
8. If the CMOS sensor is not clean, repeat steps 4 - 7 using a new Q-tip. After three unsuccessful tries, it is advised to wait a few minutes before a new attempt is made to clean the CMOS sensor. (The waiting time allows the electric charge that has been built up during cleaning to neutralize).

2.2.3. Cleaning of the camera

The camera shall NEVER be immersed in water or any other fluid. For cleaning, only use a light moist tissue.

2.2.4. Maintenance

No specific maintenance other than cleaning is applicable.

2.2.5. Repair and modification

Repair, modification and replacement of parts shall be done only by Adimec to maintain compliance
with the directive 89/336/EEC electromagnetic compatibility and directive 72/23/EEC low voltage directive and the international standards.

2.2.6. Peripheral equipment

For safety, use an external SELV qualified power supply. Maximum current 1 A.
For safety, peripheral equipment must either be double isolated or SELV qualified.

2.2.7. Mounting / Mechanical

Connectors
Take care during handling of the camera. The Camera Link connector and the power connector should not be damaged.
The maximum tightening torque for the Camera Link connector may not exceed 0.26 Nm.
Prevent the entry of foreign objects or dirt into the connectors, as this will result in unreliable operation or damage.

Mounting screws
Take notice of the maximum length of the screws that may be used for mounting of the camera. Using screws too long can cause damage to the camera. Maximum screw length: 5 mm.

3. INSTALLATION

In this chapter all three electrical interfaces as well as the mechanical and optical interface are described. If a lens and all interfaces are available, it is possible to refer to the quick start paragraph at the end of this chapter. The other paragraphs describe the interfaces in detail.

3.1. Electrical interface - power

Connector type: Hirose type HR10A-7R-6PB(74)
Mating connector: Hirose type HR10A-7P-6S(74)

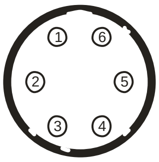


Figure 3.1: Pin type on camera

Pin number	Function
1, 2[1]	10-24 Vdc
3, 4	Not Connected
5, 6[1]	DC GND

[1] tied together inside of the camera

3.1.1. I/O connector

An input for external triggering of the camera as well as control of an external flash light is available at the I/O connector.
The input and output are fully programmable. For reference see paragraph [TBD].
The input and output are galvanic isolated from the internal camera electronics by means of an optocoupler (Vishay type SFH6156-2).

Connector type: Hirose type HR10A-7R-4PB(74)
Mating connector: Hirose type HR10A-7P-4S(74)

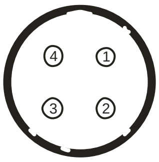


Figure 3.2: Socket type on camera

Pin number	Function
1	Trigger in
2	Flash strobe out
3	Trigger return
4	Flash strobe return

The delay from non-conductive to conductive state of the phototransistor is less than 1.5 µs.
The delay from conductive to non-conductive state of the phototransistor is less than 10 µs.
The recommended termination circuitry is drawn in Figure 3.3.

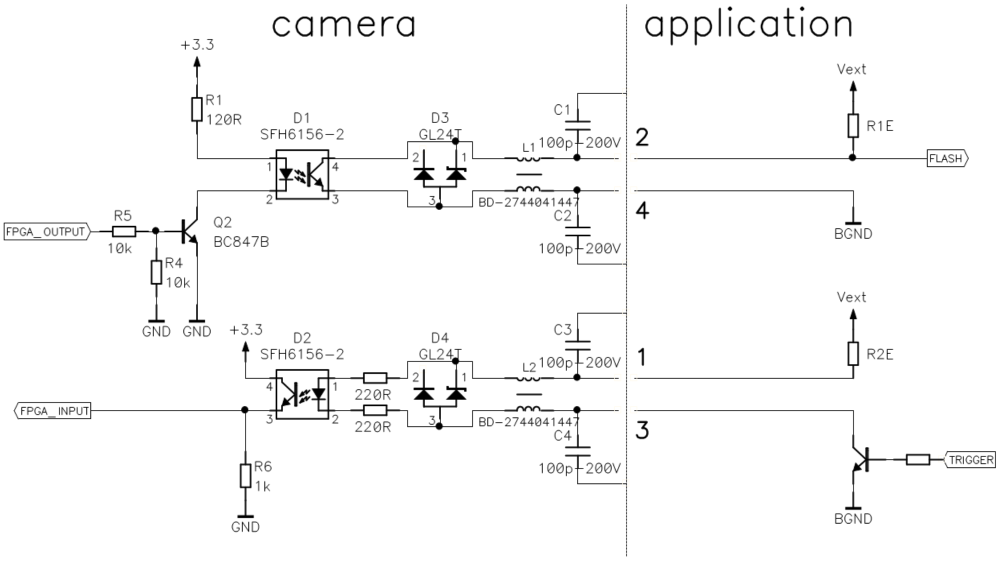


Figure 3.3: I/O-interface schematic

A current of 2.5 mA is recommended for the Flash strobe output. For the Trigger input, a current of 10 mA is recommended. These current recommendations translate to the recommended series resistor values in table 3.4.

Recommended series resistor (2.5 mA flash strobe; 10 mA trigger input):

Vext [V]	R1E [Ω]	R2E [Ω]
3.3	1000	Do not apply
5.0	2000	0
12	4700	470

3.2. Camera Link interface connector

The Camera Link interface is designed to connect the camera to a frame grabber in order to transfer video to the grabber as well as control data from the grabber to the camera. The maximum cable length is 10 meter, for a 85MHz interface however 5 meter is recommended.

For a description of the Camera Link interface please refer to the Camera Link specification.

NOTE: PoCL (Power over Camera Link) is not supported. When connecting the camera to a PoCLcompliant frame grabber, the PoCL-function must be disabled.

NOTE: The Q-8V100 and S-25A30 support only Camera Link 8 tap and 10 tap configuration. This requires two equivalent cables (i.e. of the same length and preferably the same brand and type number).

Interface connectors: 3M MDR 26-pins.
Standard Camera Link cables can be ordered at Adimec.

4. FUNCTIONAL CHARACTERISTICS

4.1. Overview

The Q-8V100 and the S-25A30 are direct pipeline cameras (acquisition and transmission are not decoupled through a memory).
They support various acquisition modes, basic processing functions, region of interest, defect pixel correction and some service and GPIO functionality.
The communication protocol and structure is described in Chapter 5; the commands for specific functionality are treated in Chapter 6.

4.2. Frame rates

The maximum speed of the camera at 8Mp ROI resolution is indicated in the table below.

Type	H (pix)	V (pix)	CL taps	CL f [MHz]	Max fps
Q-8V100	3320	2490	8	85	80
Q-8V100	3320	2490	10	85	100

Besides the number of CL taps, the speed depends on the resolution and camera link settings.
The exact equations in order to calculate speeds for other settings will be added later.

5. CONTROL OF THE CAMERA

The Quartz cameras are fully software controlled via the Camera Link serial channel using a simple ASCII based protocol.
It is possible to save settings as 'power-up default settings' in the camera.
A command line control application is available to interactively control the camera settings. Please contact your local Business Office to obtain a copy of the latest release.
Although this is an easy way of changing camera settings, it is also possible to communicate with the camera using self deployed software. Please refer to chapter 5.2 for the communication protocol.
Use chapter 6 as a detailed reference of the control commands.

5.1. Communication protocol

The camera is controlled by a host system connected to the Camera Link interface using the serial communication link of the Camera Link. Commands and resulting data are transferred between the host system and the camera by means of a communication protocol. The host system is the master in the communication link. All actions are initiated by the host system. The camera only replies to a message received from the host system.

5.1.1. Data link settings

The data link set tings that shall be used for communication with the camera are:

Baud rate	57600 baud
stop bit	1
data bit	8
parity	none
handshaking	none

5.1.2. Data flow characters

The communication protocol uses data flow control characters to identify a message and for acknowledgement.
The following data flow characters are defined:

CHAR	DEC	Description
NUL	0	NUL character, is ignored
STX	64	Start of message identifier
ETX	13	End of message identifier
ACK	6	Positive acknowledgement
NAK	21	Negative acknowledgement

5.1.3. Message Format

Command and data are packed in a message. A message starts with the STX character followed by the message content. The message ends with an ETX character. The characters allowed in the message content range from decimal 32 to 255.
Format: STX <message content> ETX

5.1.4. Message acknowledgement

After receiving a message, the camera responds with an acknowledgement character. This can be an ACK character (positive acknowledgement) or a NAK character (negative acknowledgement).
The ACK response is given when the received message was understood (the content of the message is not considered).
The NAK response is given when the received message was not understood, which may be the case when invalid characters are received as message content, or the message overruns the camera receiver buffer capacity.

5.1.5. Reply messages

When a message is sent to the camera that requires data to be transmitted back to the host system, this data is packed in a message and is sent to the host system after the positive acknowledgement (ACK) character. When the camera responds with a NAK character no data is send back to the host system.

5.1.6. Communication timing

The time between the successive characters making up a message is not limited. The camera however, when transmitting a message to the host system, has a time interval between successive characters of less than the time required for a single character to be transmitted.

5.1.7. Host system requirements

After transmitting a message to the camera, the host system must wait for the camera to reply with an ACK or NAK character. To prevent lock-up, the wait time for the response must be limited by a timeout period. After not receiving an ACK or NAK character after the time-out period has elapsed, the host system must consider the transmitted message as not being received.
The time-out time to be used for the camera should be at least 200 ms.
Under normal conditions, a NAK or no response from the camera results from damage of the transmitted characters due to noise or communication link hardware problems. In such case, the host system should transmit the message again. The number of repeated transmissions after a NAK response or no response must be limited by a retry count to prevent lock-up.
If the camera is still responding with a NAK character after the maximum number of retries of the transmitted message have been sent, the communications channel should be considered malfunctioning or too noisy.
When the maximum number of retries of the transmitted message has been reached and the camera is still not responding, the communication channel should be considered disconnected or the camera not being powered or malfunctioning.

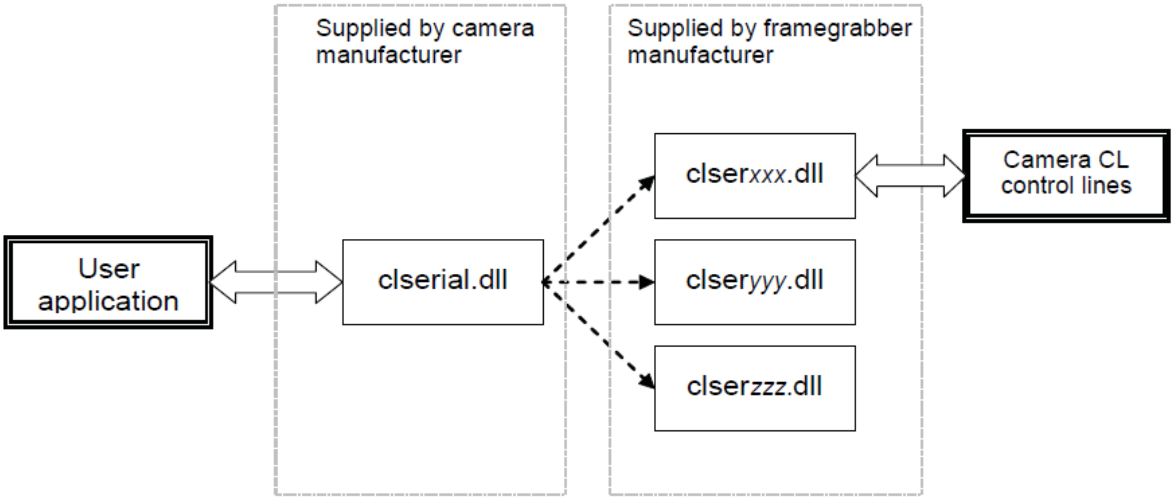
5.2. Camera Link interface standard

Without getting into detail on the Camera Link standard, this section discusses the mechanics of the serial communication channel.

Available Camera Link serial software enhancements in the form of Dynamic Link Library files will greatly simplify the setup of a communication channel.
Both camera manufacturers and frame grabber vendors have issued these DLL files which will provide standard C, API and native Visual Basic support, so that applications written in C or Visual Basic can communicate serially with Camera Link cameras.

5.2.1. Overview

The user application calls into the generic clserial.dll, which dynamically loads the.dll file(s) specific to the frame grabber(s) referred to by the application. It then routes all calls to that .dll file. The following diagram illustrates this sequence:



Features Provided by clserial.dll
Simultaneous, multi-port (including cross vendor) support
Support for binary or text based data transfers
Common API across vendors
Common error codes across vendors
Common error text across vendors
Strict, well defined behavior of all functions in specification
Openness to vendor specific error codes and text
Ability to enumerate ports on sytem
Inquireable/adjustable baud rate for ports
Win 32 support (open source for port to other platforms)
C/C++ support through import library
VisualBasic support through type library
Backwards compatibility with recommended specification of October 2000
Standard default communication settings for serial port

5.2.2. Mechanics of clserial.dll

When clserial.dll loads, it searches the operating system's system directory (for example, C:\windows\system or c:\winnt\system) for all files that use the naming convention clserxxx.dll (xxx is uniquely assigned to AIA member companies). Clserial.dll then dynamically loads those .dll files and queries each one for its manufacturer name and port names. This action produces a list of all possible ports.

The application can then select which port or ports it would like to communicate through. The required manufacturer specific .dll files will be loaded and clserial.dll will manage passing the application calls to the appropriate .dll for the application specified port.
Further details can be found in the Camera Link – Specification of Camera Link Interface Standard for Digital Cameras and Frame Grabbers – Version 1.1 - January 2004.

5.3. Camera Link ports assignment

Only Camera Link full configuration is available in this camera, in 8 or 10 taps.
The format is horizontally interleaved.

6. DETAILED FUNCTIONALITY & CONTROL DESCRIPTIONS

6.1. Camera Identification

The camera identification string can be queried by the following command:

Command Syntax:	ID?
Return message:	"Q-8V100x/CL S/N:yyyyyy "S-25A30x/CL S/N:yyyyyy

Here x indicates the type: "m" for monochrome or "c" for (bayer) color.

yyyyyy is the serial number of the camera.

The serial number can be queried individually by:

Command Syntax:	SN?
Return message:	"yyyyyy

Where yyyyyy is again the serial number.

Furthermore, the camera link Build State can be queried by:

Command Syntax:	BS?
Return message:	"x.xx;y.yy;z,zz

x.xx is the camera issue
y.yy is the micro controller firmware version
z.zz is the FPGA firmware version.

6.1.1. Internal temperature

Command Syntax: TM?

The internal temperature is returned in units of 1^0C.

6.2. Camera configuration sets

The factory default values of all settings are restored by:

Command Syntax: FD

In addition, user settings can be stored by:

Command Syntax: SC

The settings stored in the user set are loaded all at once by:

Command Syntax: LC

The camera can be rebooted by:

Command Syntax: YC

6.3. Modes of operation

The camera can be operated in one of 3 control modes or in continuous (free run) mode. The mode is set by:

Command Syntax: MOx
MO?

x	Mode
0	Continuous mode (free run) Camera is master; frame period and integration time fixed and configurable by commands.
1	Control mode Camera is slave; both frame period and integration time determined by trigger pulse (either Camera Link CC pulse or external trigger).
2	Sync Control mode Camera is slave; start and stop of integration determined by start of trigger (either Camera Link CC pulse or external trigger). The frame period equals the integration time.
3	Timed Trigger control mode Camera is slave; start of integration determined by start of trigger (either Camera Link CC pulse or external trigger). Integration time configurable by command.

6.3.1. Frame Period

In Continuous mode (MO0), the frame period is configurable by:

Command Syntax: FPx
FP?

x is the frame period in units of 1 μs, ranging to 100,000 maximum. The minimum depends on various settings but can always be found by FP0, after which the actual minimum can be queried by FP?.

6.3.2. Integration Time

In Continuous mode (MO0) and Timed Trigger control mode (MO3), the integration time is configurable by:

Command Syntax: ITx
IT?

x is the integration time in units of 1 μs, ranging from 1 to 100,000. The camera automatically clips to the maximum value for the set frame period.

6.3.3. Trigger input and polarity selection

In the control modes (MO1, MO2, MO3) the trigger can be either a Camera Link CC pulse or the external trigger. This is configurable by:

Command Syntax: CCEx;y
CCE?

x is the source:

x	Trigger source
0	CC1
1	CC2
2	CC3
3	CC4
4	External trigger

y is the trigger polarity:

y	Trigger source
0	normal (rising edge triggers start of integration)
1	Inverted (falling edge triggers start of integration)

6.4. Flash Strobe commands

The camera is equipped with strobe output signal on the I/O connector. The strobe can be switched on or off by means of the FSE command.

Command Syntax: FSEx
FSE?

With x=0, the flash strobe is disabled, with x=1 it is enabled.

6.4.1. Flash strobe polarity

The active state of the strobe output can be inverted to adapt to the application requirements.

Command Syntax: FSPx
FSP?

where x=1 for the normal polarity: in this polarity configuration the photo transistor at the camera output is conductive during the active state of the strobe.
If x=0 the strobe photo transistor is non-conductive during the active state of the strobe.

6.4.2. Output Mode setting

The strobe output can be operated in two different modes, which are set through the FSM command.

Command Syntax: FSMx
FSM?

x=0 for the automatic mode: The strobe will become active during the integration time (regardless operating mode MOx)
x=1 for the programmed mode; both delay time after start of integration as well as the duration of the active state is programmed.
Note that a flash strobe length that extends after the end of integration time is not possible. The camera will end the flash strobe automatically.

The timing can be programmed:

Command Syntax: FSTx;y
FST?

x is the delay between start of integration and the transition of the flash strobe to the active state. y is the length of the flash strobe active state. Both x and y are in units of 1 µs and range from 0 to 100,000.
Both are without the additional intrinsic response delay of the flash strobe which is mentioned in section 3.1.1.

6.5. Defect pixel correction

A defect correction is available that replaces a defect pixel by a weighted average of those its 4 adjacent pixels that are not defect. The neighbors are labeled N, S, E, and W in figure 6.1. Their weights are listed in table 6.1 for the possible situations.

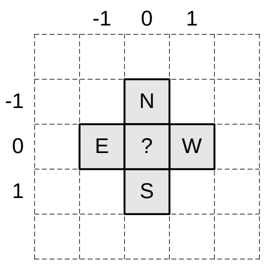


Figure 6.1: Surrounding of defect pixel

#	**Is defect:**				**Weight of adjacent pixel:**			
	N	S	E	W	kN	kS	kE	kW
0	0	0	0	0	1/4	1/4	1/4	1/4
1	0	0	0	1	1/4	1/4	1/2	0
2	0	0	1	0	1/4	1/4	0	1/2
4	0	1	0	0	1/2	0	1/4	1/4
8	1	0	0	0	0	1/2	1/4	1/4
3	0	0	1	1	1/2	1/2	0	0
5	0	1	0	1	1/2	0	1/2	0
6	0	1	1	0	1/2	0	0	1/2
9	1	0	0	1	0	1/2	1/2	0
10	1	0	1	0	0	1/2	0	1/2
12	1	1	0	0	0	0	1/2	1/2

7	0	1	1	1	1	0	0	0
11	1	0	1	1	0	1	0	0
13	1	1	0	1	0	0	1	0
14	1	1	1	0	0	0	0	1
15	1	1	1	1	Can't happen, do not replace pixel			

Table 6.1: Weights of N, S, E, W in determining the correction value for the defect pixel.
The defect pixel is enabled or disabled by:

Command Syntax: DPEx
DPE?

x=0 disables the defect pixel correction.
x=1 enables the defect pixel correction (default).

NOTE: the advanced defect pixel correction that is described above is not available in the first prototypes. Instead, in these cameras the defect pixel correction as in e.g. the Q-4A180 is used.

6.5.1. Addition and removal of defect pixels

The camera has a defect pixel map capacity of 1024 pixels.
The defect pixels at the time of camera production are stored as the factory default set.

Users can add defect pixels to the list by:

Command Syntax: DPx;y
DP?n

Where x and y are the origin (1, 1) base coordinates of the defect pixel.
The sytax DP?n returns the position of the n-th defect pixel in the list. DP?0 returns the number of defect pixels in the list.

Users can remove a defect pixel by;

Command Syntax: DPRx;y

Where x and y are the origin (1, 1) base coordinates of the defect pixel.

Alternatively, users can clear the entire defect list by:

Command Syntax: DPC

After either of the changes described in this subsection, the new (modified) defect list must be saved to non-volatile memory by:

Command Syntax: DPSC

Else, the modifications will be lost upon camera reboot.

6.5.2. Restoring factory default defect pixel list

The factory default defect list can be restored by:

Command Syntax: DPFD

6.5.3. Defect pixel test mode

Defect pixels can be visualized with a test mode.

Command Syntax: DPTx
DPT?

x	Test mode
0	Disable test mode
1	Show defect pixels as white in video
2	Show defect pixels as black in video
3	Show defect pixels as white in black image

6.6. Image data formatting

6.6.1. Black level and offset

In *monochrome* cameras, the black level is changed by:

Command Syntax: BLx
BL?

Here x is the black level from 0 to 1023 (defined in 10 bits).

In *color* cameras, instead of the black level the offset is configurable:

Command Syntax: OFSx
OFS?

Here x is the offset from 0 to 1023 (defined in 10 bits).

The difference between black level and offset is that the former scales along when gain is applied whereas the latter does not.

6.6.2. Digital fine gain

Command Syntax: GAx
GA?

Here x is the gain in steps of 0.01x, ranging from 100 to 400.

6.6.3. White balance (color only)

In color cameras, a gain per channel (R, G, B) is available.

Command Syntax: WBr;g;b
WB?

r, g and b are the gains per channel R, G and B in steps of 0.01x, ranging from 100 to 400.

6.6.4. Output look-up table

In the camera an output look-up table (OLUT) can be applied.
When the table is programmed in the camera, it can be enabled by:

Command Syntax: OLUTEx
OLUTE?

With x=0 the OLUT is disabled, with x=1 it is enabled.

The table can be programmed by the following sequence of commands:

Command Syntax: OLUTBGN
OLUTx_0
OLUTx_1
⋮
OLUTx_{1023}
OLUTEND

x_0 to x_{1023} are the values of the OLUT, each ranging from 0 to 1023.
If not 1024 OLUT values are entered, the OLUT will not be programmed.

Down scaling to 8 bit output is done after the OLUT stage.

An OLUT value can be queried by the command OLUT?i with i the index.

6.7. Output format and Camera Link settings

6.7.1. Region of interest

Within the sensor resolution of 5120x5120 a ROI may be applied.

Command Syntax: ROIx;y;w;h
ROI?

x and y are offset of the left top position of the ROI with respect to the left top origin of the sensor resolution (= 0,0).
w and h are the ROI width and height.
x, y, w and h are in pixels.

x must be a multiple of 2 and ranges from 0 to 5119.
y can be any value between 0 and 5088.

w must be a multiple by 2 and ranges from 32 to 5120.
h can be any value between 1 and 5120.

The minimum ROI size is (w x h) is 32 x 1.
The maximum ROI size is (w x h) is 5120 x 5120.

The sensor acquisition frame rate increases with decreasing ROI (see section 4.2).

6.7.2. Camera link settings (taps and Lval-gap)

Command Syntax: OFRMx;y
OFRM?

x is the number of camera link taps. For this camera that can be only 8 or 10.
y is the Lval-gap. This ranges from 2 to 1023.

In both 8 and 10 tap the output is interleaved.

The output resolution is always 8 bit.

The Fval gap is also configurable.

Command Syntax: FVALGAPx
FVALGAP?

Here x ranges from 2 to 1023.

6.7.3. Camera Link clock

Command Syntax: CLCx
CLC?

x is the Camera Link pixel clock frequency.
x=0: 66 MHz
x=1: 85 MHz

6.8. Service and Maintenance

6.8.1. Built-in test

The built-in test function (BIT) verifies critical camera functions and signals system critical errors when they arise. Some tests are run at camera start-up and others are continuously run.

The BIT result can be queried by:

Command Syntax: BIT?

In case of no failure, a 0 is returned. The returned values for various failures are listed below.

Code	Description
0	All tests passed; no error found
1	FPGA boot failed
2	FPGA not running
4	Configuration data corrupt
8	Setting data corrupt
128	Output look-up table data corrupt
256	Sensor data alignment error

6.8.2. Error diagnosis

Since the communication protocol does not check the message content, the error result of a command can be obtained by a separate command.

Command Syntax: ERR?

In case of no error, a 0 is returned. The returned values for various errors are listed below.

Code	Description
1	Last received command: not recognized.
2	Last received command: missing parameter(s)
3	Last received command: parameter syntax error
4	Last received command: too many parameters
5	Last received command: not enough parameters
7	One or more of the command parameters for the last received command is out of range.
8	Last received command: internal Adimec error
100	Loading of settings from non-volatile memory failed
101	Storing of settings to non-volatile memory failed
102	The defect pixel correction data can't be stored, because the defect pixel list is full
103	The defect pixel correction data can't be stored, because the defect pixel is already in the defect pixel list
120	LUT begin action not allowed; LUT transactions already pending
121	Adding LUT elements not allowed
122	Adding LUT elements stopped before complete LUT was filled
123	Adding more LUT entries than allowed
124	The current state does not allow the action

6.8.3. Cross hairs and test pattern

Cross hairs and test pattern are available in the camera for aligning the image and debugging the imaging pipeline.

Command Syntax: TPx
TP?

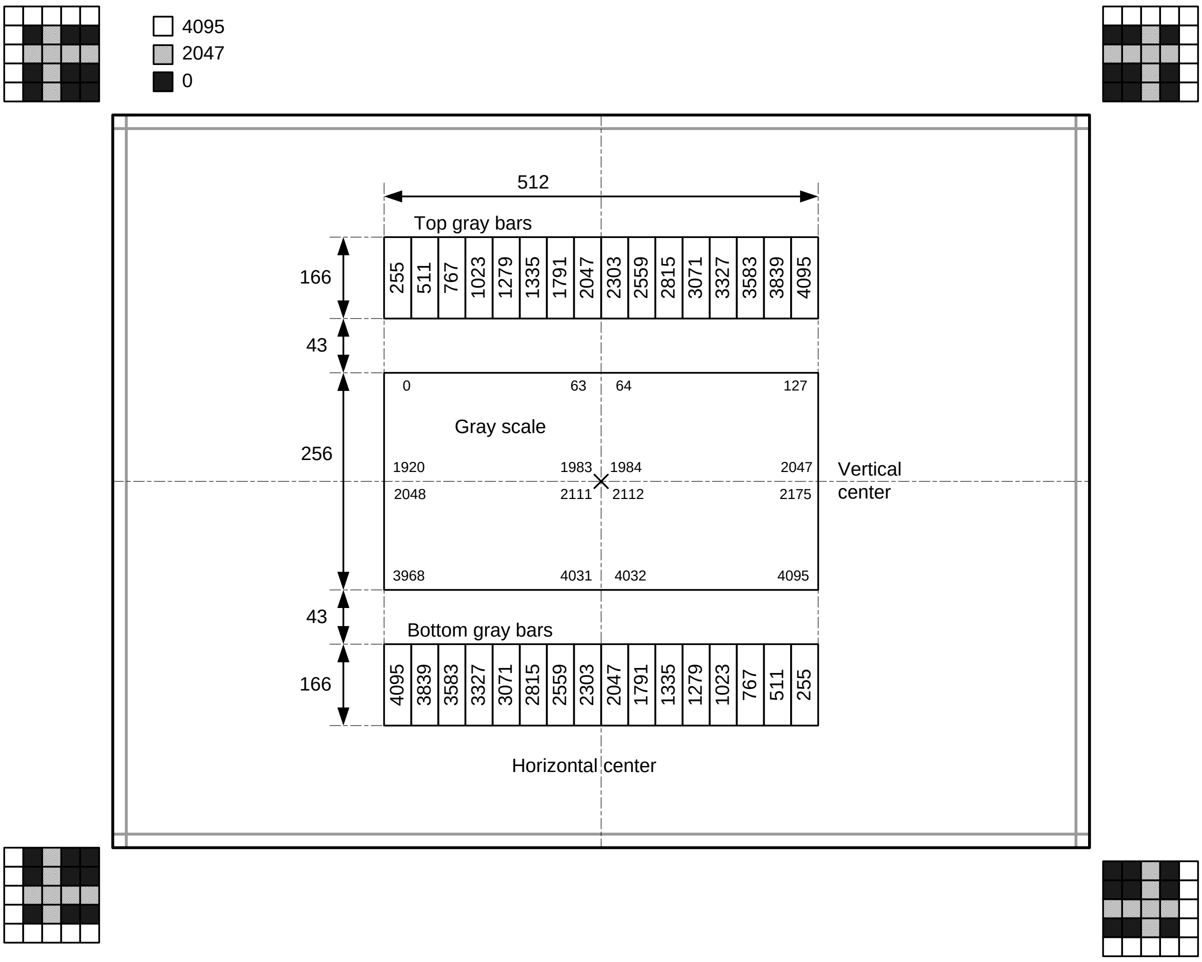
Where x is as follows:

x	setting
0	No test pattern. Normal image
1	Standard test pattern, see description below
2	Cross hair overlay

Standard test pattern

The test image is composed of a border pattern (white border of 255 and inner gray lines of 127 with 1 pixel spacing to the border pixels, a top gray bar running from 15 to 255 in steps of 16, a center gray scale of 128 x 32 rectangles of size 4 x 8 pixels running from left top 0 to right bottom 255 and a bottom gray bar running down from 255 to 15 in steps of 16. The remaining surface is 0 (black).
For color cameras, color patches are present on the side.

The test image is processed by the same video processing as the normal sensor video.



Cross hair overlay

The crosshair is composed of a vertical line 2 pixels wide, horizontally centered with reference to the output image and a horizontal line 2 pixels high vertically centered with reference to the output image.

The gray level of the crosshair pattern is fixed at 255.

6.8.4. Frame count and image tagging (not available in first prototypes)

In the camera a 32-bit frame counter is present. It is incremented after each frame being output. When at (2^{32}-1) it rolls over to 0.

The frame counter is reset to 0 after power up or camera re-boot.
In addition it can be reset by command:

Command Syntax: FCR

The frame counter can be read out at any time by:

Command Syntax: FCNR?

Also, the frame counter can be tagged onto the output image by the overlay command.

Command Syntax: OVLx
OVL?

x=0 disables image tagging.
x=1 enables image tagging.

Tagging replaces the top-left pixels of the output image by the image count data.
The insertion position of tag data is fixed and independent from other settings.

Tag data assignment is listed in the table below:

Pixel location (x,y)	Assignment
(0,0)	Frame counter bits 7:0
(1,0)	Frame counter bits 15:8
(2,0)	Frame counter bits 23:16
(3,0)	Frame counter bits 31:24