	<b>Subject:</b>	<b>Pulnix TMC1320-xxCL with mvTITAN-CL</b>	Created	Last change
			09.04.03	29.04.03
Application Note	Project:	Camera adaption	Version 1.1	

## Overview

Camera PULNIX TMC1320-15CL, with Bayer mosaic filter

### Running modes

Freerunning	<input checked="" type="checkbox"/>	
Restart/Reset	<input checked="" type="checkbox"/>	internal shutter time used
Ext. Synchronized	<input type="checkbox"/>	
Trigger Shutter	<input checked="" type="checkbox"/>	Trigger puls length defines integration time
Flash & Reset	<input type="checkbox"/>	

### Resolution

Horizontal	1300	pixel
Vertical	1024	pixel
Bits per Pixel	8	bpp
Binning	<input type="checkbox"/>	
Partial Scan	<input type="checkbox"/>	

### Timings

Pixel clock	20	MHz
Horizontal	15.734	kHz
Vertical	15	fps

### MATRIX VISION GmbH Frame Grabber

Typ	mvTITAN-CL Rev 1.03					
Line Enable by	camera	<input checked="" type="checkbox"/>	Frame Grabber	<input type="checkbox"/>	external	<input type="checkbox"/>
Frame Enable by	camera	<input checked="" type="checkbox"/>	Frame Grabber	<input type="checkbox"/>	external	<input type="checkbox"/>
Trigger by	external	<input type="checkbox"/>	Frame Grabber	<input checked="" type="checkbox"/>		
Flash by	camera	<input type="checkbox"/>	Frame Grabber	<input type="checkbox"/>	external	<input type="checkbox"/>

### Software

MVacquireControl	<input checked="" type="checkbox"/>	
mvIMPACT Go!	<input type="checkbox"/>	
Other	<input type="checkbox"/>	[e.g. LabView™, Halcon, etc.]

### Imprint

MATRIX VISION GmbH  
 Talstraße 16  
 D-71570 Oppenweiler  
 Author: Thomas Wimmer


This document requires the general knowledge of the usage and the technical data of the used frame grabber, camera and application.

Information in this document is subject to change without notice and does not represent a commitment on the part of MATRIX VISION GmbH.

Email: [info@matrix-vision.de](mailto:info@matrix-vision.de).

Copyright © 2003 MATRIX VISION GmbH all rights reserved

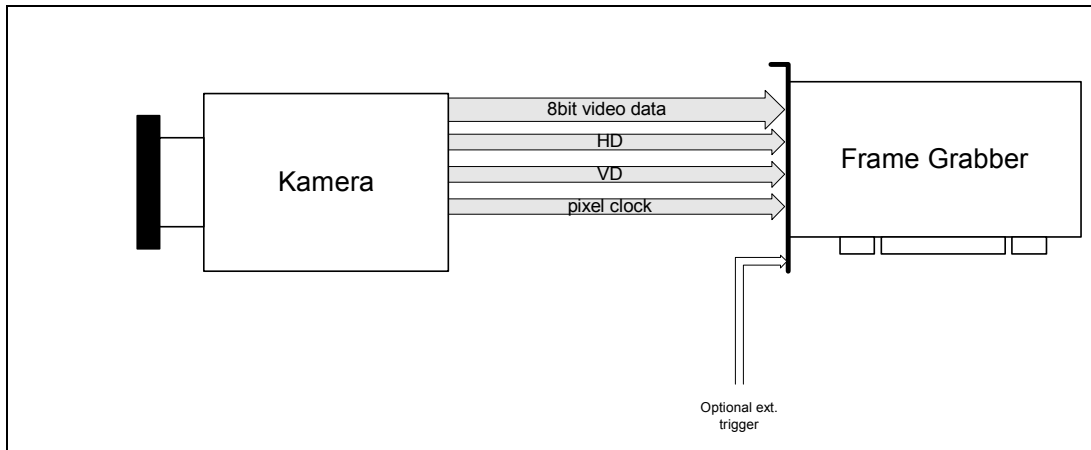
Windows95™, Windows98™, Windows98se™, WindowsNT4.0™, Windows2000™, WindowsXP™ are trademarks of Microsoft, Corp. All other trademarks are the property of their respective holders.

	<b>Subject:</b> Pulnix TMC1320-xxCL with mvTITAN-CL	Created	Last change
		09.04.03	29.04.03
Application Note	Project:	Camera adaption	Version 1.1

## Freerunning Mode

Camera runs with its own timing and output the 8 bit video signal, pixel clock, HD and VD on separate pins.

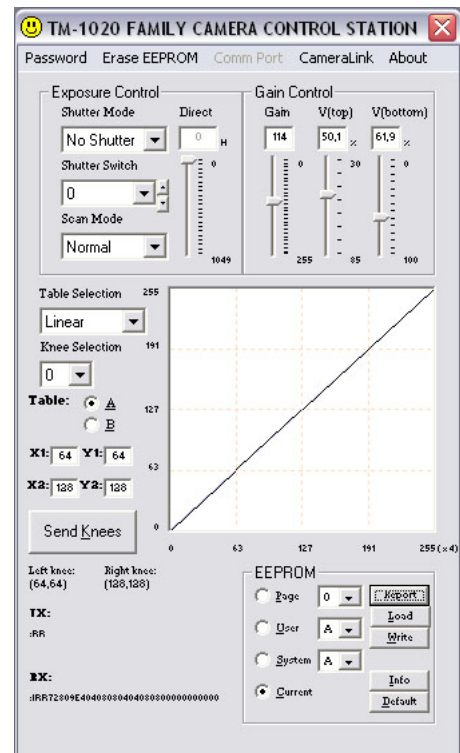
### Signal map




### Camera settings set by software

The pin CC2 of the CameraLink™ connection must be set to HIGH otherwise camera sends no image. To do this in MVacquireControl change to register *Signals* and modify the bitmask *Integration Off* to 'xxxxxxxxxxxxxxxx1x'. This bitmask is set automatically each time the mvTITAN-CL is opened after it was set once.

To control all other settings of the camera use control software *TM-1020 Family Camera Control System V3.2* provided by PULNIX. Control Software uses serial port 0 of CameraLink™ interface. After starting control software choose file *clsermv.dll* in `.. \windows \matrix` in menu item *CameraLink / Open*. Be sure the mvTITAN-CL is currently initialized otherwise no communication is possible.



	<b>Subject:</b>	<b>Pulnix TMC1320-xxCL with mvTITAN-CL</b>	Created	Last change
			09.04.03	29.04.03
Application Note	Project:	Camera adaption	Version 1.1	

### Pin connection

MDR 26 pin			MDR 26 pin	
Pin 1		inner Shield	Pin 26	
Pin 2		Tx Data 0-	Pin 25	
Pin 3		Tx Data 1-	Pin 24	
Pin 4		Tx Data 2-	Pin 23	
Pin 5		XCLK-	Pin 22	
Pin 6		Tx Data 3-	Pin 21	
Pin 7		SerTC+	Pin 20	
Pin 8		SerTFG-	Pin 19	
Pin 9		CC1-	Pin 18	
Pin 10		CC2+	Pin 17	
Pin 11		CC3-	Pin 16	
Pin 12		CC4+	Pin 15	
Pin 13		inner Shield	Pin 14	
Pin 14		inner Shield	Pin 13	
Pin 15		Tx Data 0+	Pin 12	
Pin 16		Tx Data 1+	Pin 11	
Pin 17		Tx Data 2+	Pin 10	
Pin 18		XCLK+	Pin 9	
Pin 19		Tx Data 3+	Pin 8	
Pin 20		SerTC-	Pin 7	
Pin 21		SerTFG+	Pin 6	
Pin 22		CC1+	Pin 5	
Pin 23		CC2-	Pin 4	
Pin 24		CC3+	Pin 3	
Pin 25		CC4-	Pin 2	
Pin 26		inner Shield	Pin 1	

Recommended cable for this mode from MATRIX VISION GmbH:

- KSCL 03.0, length 3 meters
- KSCL 05.0, length 5 meters
- KSCL 10.0, length 10 meters

### Optional External Trigger

Connect optional external trigger signal to J8 (8 pin Binder series 711) as follows:

Pin	Meaning	Connect to
4	Trigger-In + (Anode)	Trigger Signal
5	Trigger-In + (Cathode)	Trigger GND

For more details please take a look in the appendix of the mvTITAN-CL's manual.

### Camera definition


```

/* ----- TMC-1320 -----
DefCamType "TMC-1320" VM_DIG8 NONINTERLACED 50 15625 25000 PCLK_EXTERN
DefCamAcquireSetup "TMC-1320" VSCAN NOT_INV NEXT_FIELD
DefCamAnalogParam "TMC-1320" AC 1 0 0 1200
DefHorizontalUnit "TMC-1320" PIXEL
DefVerticalUnit "TMC-1320" LINES
DefCamHorizontalAcquire "TMC-1320" 0L 1300L 1
DefCamVerticalAcquire "TMC-1320" 1L 1024L 1

```

### Remarks

Camera sends 8 bit greyscale data. Because of the camera's Bayer mosaic filter this greyscale data must be calculated into a color image. This can be done with the mvTITAN-CL's *MosaicColor (Mvtitan)*

	<b>Subject:</b>	<b>Pulnix TMC1320-xxCL with mvTITAN-CL</b>	Created	Last change
			09.04.03	29.04.03
Application Note	Project:	Camera adaption	Version 1.1	

filter which calculates the color image in real time without any additional CPU load of the host PC. To activate this go to the MVacquireControl's register *Processing* and activate *MosaicColor (MVtitan)* in the list. White balance can be done with *Properties*.

Now you get colored images in live preview. It is possible that you get greyscale or bad images with *Snap*. In this case change the used videomode in the camera definition from


```
DefCamType "TMC-1320" VM_DIG8 NONINTERLACED 50 15625 25000 PCLK_EXTERN
```

```
to DefCamType "TMC-1320" VM_DIG32 NONINTERLACED 50 15625 25000 PCLK_EXTERN.
```

Now you will get 32bpp images in the memory.

Always be sure the DMA-Buffer is great enough to hold all the image data ( in color mode at least about 5.4 MB is needed).

If optional external trigger is used the mvTITAN-CL will acquire images after a trigger signal is recognized with the next VD the camera sends.

	<b>Subject:</b> Pulnix TMC1320-xxCL with mvTITAN-CL	Created	Last change
		09.04.03	29.04.03
Application Note	Project:	Camera adaption	Version 1.1

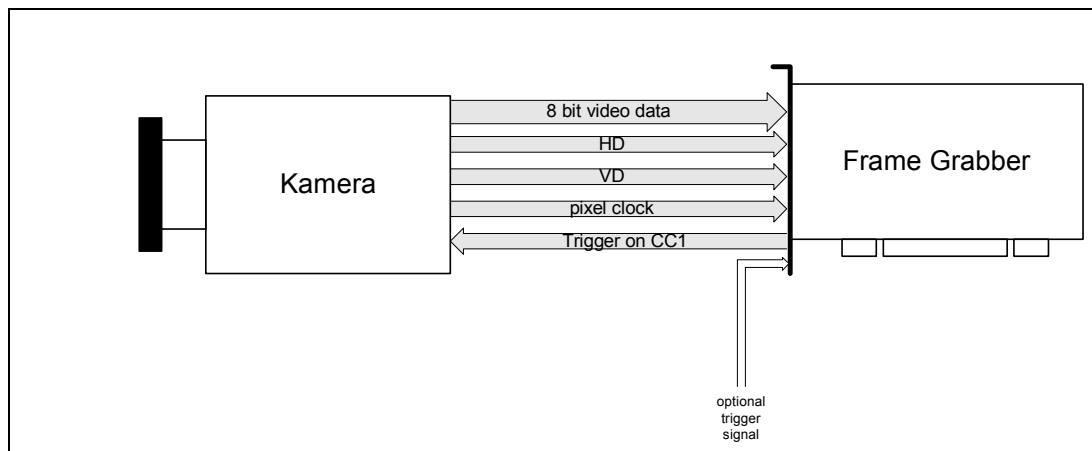
## Restart/Reset mode

In this mode the camera is reset by the frame grabber by use of digital output CC1 of the CameraLink™'s interface. The shutter time is set in the camera and is independent from the puls length of the trigger signal.

The camera sends 8 bit video data, pixel clock, HD and VD after the camera was reset to the frame grabber.

The mvTITAN-CL can generate the reset signal by its own or can pass an optional external trigger signal connected to the mvTITAN-CL to pin CC1.

### Signal map



### Camera settings set by software

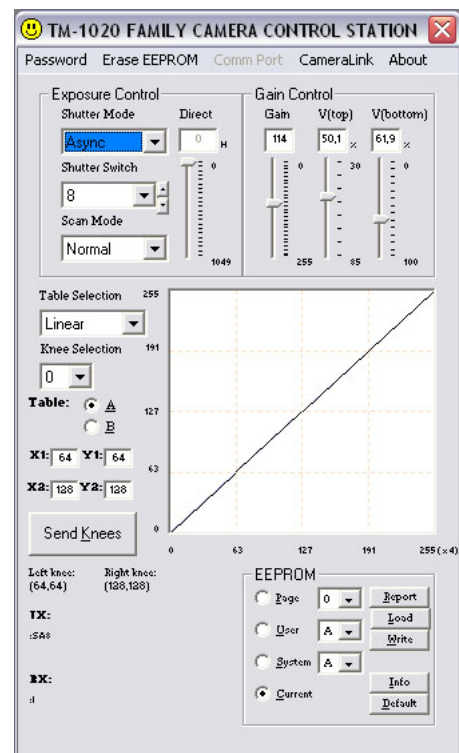
The pin CC2 of the CameraLink™ connection must be set to HIGH otherwise camera sends no image. To do this in MVacquireControl change to register *Signals* and modify the bitmask *Integration Off* to 'xxxxxxxxxxxxxxxx1x'. This bitmask ist set automatically each time the mvTITAN-CL is opened after it was set once.


To control all other settings of the camera use control software *TM-1020 Family Camera Control System V3.2* provided by PULNIX. Control Software uses serial port 0 of CameraLink™ interface. After starting control software choose file *clsermv.dll* in *..\\windows\\matrix* in menu item *CameraLink / Open*. Be sure the mvTITAN-CL is currently initialized otherwise no communication is possible.

Important settings in the control software:

Shutter Mode: set to *Async*

Shutter Switch: defines the shutter speed. But set this value neither to 0 nor to 9



	<b>Subject:</b>	<b>Pulnix TMC1320-xxCL with mvTITAN-CL</b>	Created	Last change
			09.04.03	29.04.03
Application Note	Project:	Camera adaption	Version 1.1	

### Pin connection

MDR 26 pin			MDR 26 pin	
Pin 1		inner Shield	Pin 26	
Pin 2		Tx Data 0-	Pin 25	
Pin 3		Tx Data 1-	Pin 24	
Pin 4		Tx Data 2-	Pin 23	
Pin 5		XCLK-	Pin 22	
Pin 6		Tx Data 3-	Pin 21	
Pin 7		SerTC+	Pin 20	
Pin 8		SerTFG-	Pin 19	
Pin 9		CC1-	Pin 18	
Pin 10		CC2+	Pin 17	
Pin 11		CC3-	Pin 16	
Pin 12		CC4+	Pin 15	
Pin 13		inner Shield	Pin 14	
Pin 14		inner Shield	Pin 13	
Pin 15		Tx Data 0+	Pin 12	
Pin 16		Tx Data 1+	Pin 11	
Pin 17		Tx Data 2+	Pin 10	
Pin 18		XCLK+	Pin 9	
Pin 19		Tx Data 3+	Pin 8	
Pin 20		SerTC-	Pin 7	
Pin 21		SerTFG+	Pin 6	
Pin 22		CC1+	Pin 5	
Pin 23		CC2-	Pin 4	
Pin 24		CC3+	Pin 3	
Pin 25		CC4-	Pin 2	
Pin 26		inner Shield	Pin 1	

Recommended cable for this mode from MATRIX VISION GmbH:

KSCL 03.0, length 3 meters

KSCL 05.0, length 5 meters

KSCL 10.0, length 10 meters

### Optional External Trigger

Connect optional external trigger signal to J8 (8 pin Binder series 711) as follows:

Pin	Meaning	Connect to
4	Trigger-In + (Anode)	Trigger Signal
5	Trigger-In + (Cathode)	Trigger GND


For more details please take a look in the appendix of the mvTITAN-CL's manual.

### Camera definition

```

/* ----- TMC-1320 -----
DefCamType "TMC-1320" VM_DIG8 NONINTERLACED 50 15625 25000 PCLK_EXTERN
DefCamAcquireSetup "TMC-1320" VSCAN NOT_INV NEXT_FIELD
DefCamAnalogParam "TMC-1320" AC 1 0 0 1200
DefHorizontalUnit "TMC-1320" PIXEL
DefVerticalUnit "TMC-1320" LINES
DefCamHorizontalAcquire "TMC-1320" 0L 1300L 1
DefCamVerticalAcquire "TMC-1320" 1L 1024L 1

```

	<b>Subject:</b> Pulnix TMC1320-xxCL with mvTITAN-CL	Created	Last change
		09.04.03	29.04.03
Application Note	Project:	Camera adaption	Version 1.1

## Setting up trigger signal

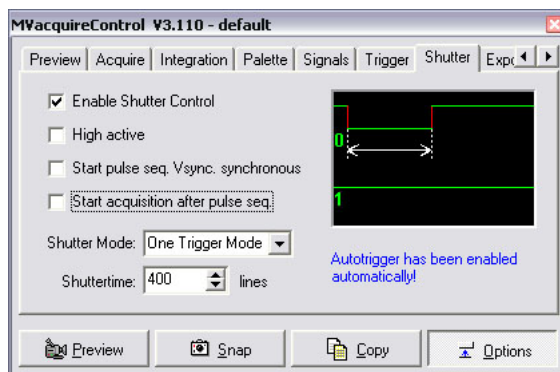
There are two methods to control the camera's trigger signal on CC1:

### 1. mvTITAN-CL generates the trigger signal

Using the MVacquireControl switch to register *Shutter*. Enable the Shutter Control and choose *One Trigger Mode*. In this case CC1 is automatically chosen for output.

The trigger signal must be active low. The shutter time is not relevant and has no effect on the reset behaviour of the camera.

For sending this signal periodically switch to register *Trigger* and activate *autotrigger*. The value *Autotrigger period* defines the frequency with which the signal is output.



Programming your own software you can either set this output manually by use of *mvWriteDigIO()* or you activate the automatically output by use of *mvDefPulsSep()* and *mvSetTriggerPeriod()* (more details about programming you can find in the mvTITAN-CL's manual).

### 2. external trigger signal is used and is passed to the camera

In this mode the trigger signal is first send to the mvTITAN-CL and is then passed through to the CC1 output of the CameraLink™ connector.

Here you have to use the Sync-In pins and not the Trigger-In pins to supply the external trigger signal to the mvTITAN-CL.

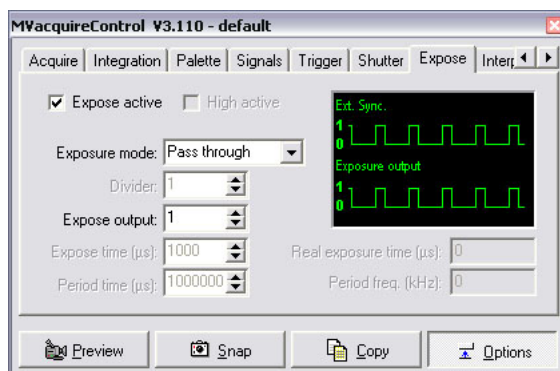
Connect external trigger signal to J8 (8 pin Binder series 711) as follows:


Pin	Meaning	Connect to
6	Sync-In + (Anode)	Trigger Signal
7	Sync-In - (Cathode)	Trigger GND

Using the MVacquireControl switch to register *Expose* and activate the expose output. Choose exposure mode *Pass through* and the output *I*.

Choose mode *Pass through inv.* if your external trigger signal is active high.

You can find more about the exposure mode and its programming in the manuals of MVacquireControl and mvTITAN-CL.



	<b>Subject:</b>	<b>Pulnix TMC1320-xxCL with mvTITAN-CL</b>	Created	Last change
			09.04.03	29.04.03
Application Note	Project:	Camera adaption	Version 1.1	

## Remarks

Camera sends 8 bit greyscale data. Because of the camera's Bayer mosaic filter this greyscale data must be calculated into a color image. This can be done with the mvTITAN-CL's *MosaicColor (MVtitan)* filter which calculates the color image in real time without any additional CPU load of the host PC. To activate this got to the MVacquireControl's register *Processing* and activate *MosaicColor (MVtitan)* in the list. White balance can be done with *Properties*.

Now you get colored images in live preview. It is possible that you get greyscale or bad images with *Snap*. In this case change the used videomode in the camera definition from

```
DefCamType          "TMC-1320" VM_DIG8 NONINTERLACED 50 15625 25000 PCLK_EXTERN
```


to

```
DefCamType          "TMC-1320" VM_DIG32 NONINTERLACED 50 15625 25000 PCLK_EXTERN.
```

Now you will get 32bpp images in the memory.

Always be sure the DMA-Buffer is great enough to hold all the image data ( in color mode at least about 5.4 MB is needed).



	<b>Subject:</b> <b>Pulnix TMC1320-xxCL with mvTITAN-CL</b>	Created	Last change
		09.04.03	29.04.03
Application Note	Project:	Camera adaption	Version 1.1

## Trigger Shutter Mode

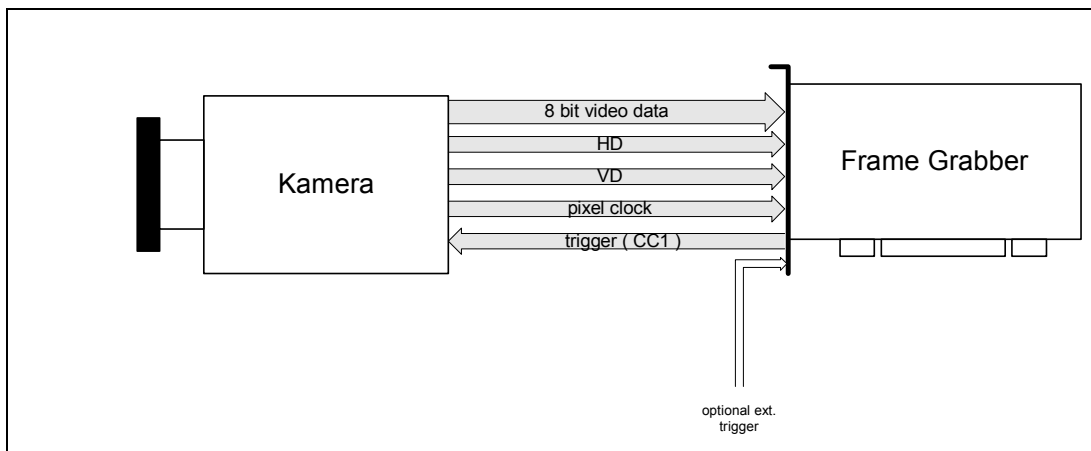
In contrast to Restart/Reset mode the puls length of the trigger signal defines the shutter time of the camera.

In this mode the camera is reset by the frame grabber by use of digital output CC1 of the CameraLink™'s interface.

The camera sends 8 bit video data, pixel clock, HD and VD after the camera was reset to the frame grabber.

The mvTITAN-CL can generate the reset signal by its own or can pass an optional external trigger signal connected to the mvTITAN-CL to pin CC1.

### Signal map



### Camera settings set by software

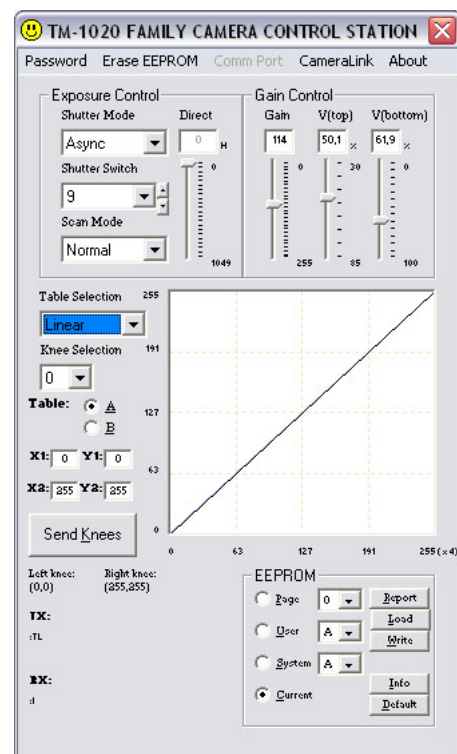
The pin CC2 of the CameraLink™ connection must be set to HIGH otherwise camera sends no image. To do this in MVacquireControl change to register *Signals* and modify the bitmask *Integration Off* to 'xxxxxxxxxxxxxxxx1x'. This bitmask ist set automatically each time the mvTITAN-CL is opened after it was set once.


To control all other settings of the camera use control software *TM-1020 Family Camera Control System V3.2* provided by PULNIX. Control Software uses serial port 0 of CameraLink™ interface. After starting control software choose file *clsermv.dll* in ..\windows\matrix in menu item *CameraLink / Open*. Be sure the mvTITAN-CL is currently initialized otherwise no communication is possible.

Important settings in the control software:

Shutter Mode: set to *Async*

Shutter Switch: set this value to *9*



	<b>Subject:</b>	<b>Pulnix TMC1320-xxCL with mvTITAN-CL</b>	Created	Last change
			09.04.03	29.04.03
Application Note	Project:	Camera adaption	Version 1.1	

### Pin connection

MDR 26 pin			MDR 26 pin	
Pin 1		inner Shield	Pin 26	
Pin 2		Tx Data 0-	Pin 25	
Pin 3		Tx Data 1-	Pin 24	
Pin 4		Tx Data 2-	Pin 23	
Pin 5		XCLK-	Pin 22	
Pin 6		Tx Data 3-	Pin 21	
Pin 7		SerTC+	Pin 20	
Pin 8		SerTFG-	Pin 19	
Pin 9		CC1-	Pin 18	
Pin 10		CC2+	Pin 17	
Pin 11		CC3-	Pin 16	
Pin 12		CC4+	Pin 15	
Pin 13		inner Shield	Pin 14	
Pin 14		inner Shield	Pin 13	
Pin 15		Tx Data 0+	Pin 12	
Pin 16		Tx Data 1+	Pin 11	
Pin 17		Tx Data 2+	Pin 10	
Pin 18		XCLK+	Pin 9	
Pin 19		Tx Data 3+	Pin 8	
Pin 20		SerTC-	Pin 7	
Pin 21		SerTFG+	Pin 6	
Pin 22		CC1+	Pin 5	
Pin 23		CC2-	Pin 4	
Pin 24		CC3+	Pin 3	
Pin 25		CC4-	Pin 2	
Pin 26		inner Shield	Pin 1	

Recommended cable for this mode from MATRIX VISION GmbH:

KSCL 03.0, length 3 meters

KSCL 05.0, length 5 meters

KSCL 10.0, length 10 meters

### Optional External Trigger

Connect optional external trigger signal to J8 (8 pin Binder series 711) as follows:

Pin	Meaning	Connect to
4	Trigger-In + (Anode)	Trigger Signal
5	Trigger-In + (Cathode)	Trigger GND


For more details please take a look in the appendix of the mvTITAN-CL's manual.

### Camera definition

```

/* ----- TMC-1320 -----
DefCamType "TMC-1320" VM_DIG8 NONINTERLACED 50 15625 25000 PCLK_EXTERN
DefCamAcquireSetup "TMC-1320" VSCAN NOT_INV NEXT_FIELD
DefCamAnalogParam "TMC-1320" AC 1 0 0 1200
DefHorizontalUnit "TMC-1320" PIXEL
DefVerticalUnit "TMC-1320" LINES
DefCamHorizontalAcquire "TMC-1320" 0L 1300L 1
DefCamVerticalAcquire "TMC-1320" 1L 1024L 1

```

	<b>Subject:</b> Pulnix TMC1320-xxCL with mvTITAN-CL	Created	Last change
		09.04.03	29.04.03
Application Note	Project:	Camera adaption	Version 1.1

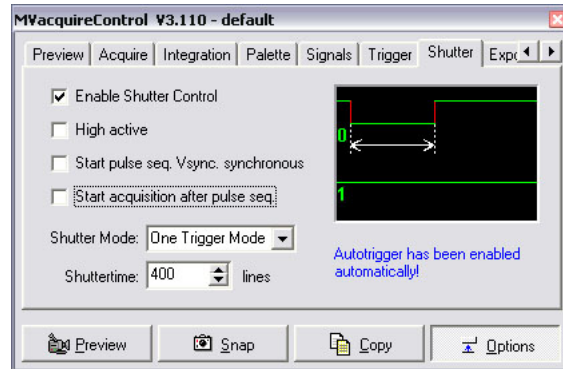
## Setting up trigger signal

There are two methods to control the camera's trigger signal on CC1:

### 1. mvTITAN-CL generates the trigger signal

Using the MVacquireControl switch to register *Shutter*. Enable the Shutter Control and choose *One Trigger Mode*. In this case CC1 is automatically chosen for output.

The trigger signal must be active low. The shutter time represents the shutter time used in the camera. So set this value to the correct time. With the mvTITAN-CL the shuttertime is given in microseconds and not in number of lines.



For sending this signal periodically switch to register *Trigger* and activate *autotrigger*. The value *Autotrigger period* defines the frequency with which the signal is output.

Programming your own software you can either set this output manually by use of *mvWriteDigIO()* or you activate the automatically output by use of *mvDefPulsSep()* and *mvSetTriggerPeriod()* (more details about programming you can find in the mvTITAN-CL's manual).

### 2. external trigger signal is used and is passed to the camera

In this mode the trigger signal is first send to the mvTITAN-CL and is then passed through to the CC1 output of the CameraLink™ connector.

Here you have to use the Sync-In pins and not the Trigger-In pins to supply the external trigger signal to the mvTITAN-CL.

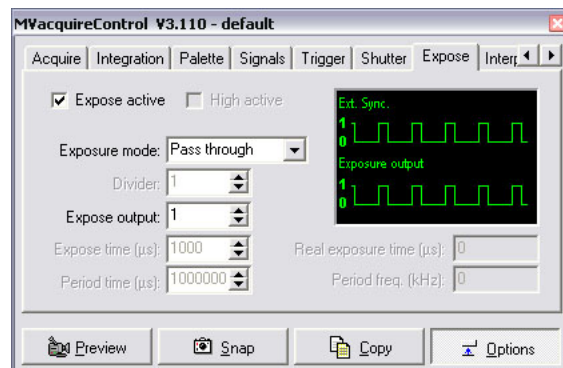
Connect external trigger signal to J8 (8 pin Binder series 711) as follows:


Pin	Meaning	Connect to
6	Sync-In + (Anode)	Trigger Signal
7	Sync-In - (Cathode)	Trigger GND

Using the MVacquireControl switch to register *Expose* and activate the expose output. Choose exposure mode *Pass through* and the output *I*.

Choose mode *Pass through inv.* if your external trigger signal is active high.

You can find more about the exposure mode and its programming in the manuals of MVacquireControl and mvTITAN-CL.



	<b>Subject:</b>	<b>Pulnix TMC1320-xxCL with mvTITAN-CL</b>	Created	Last change
			09.04.03	29.04.03
Application Note	Project:	Camera adaption	Version 1.1	

## Remarks

Camera sends 8 bit greyscale data. Because of the camera's Bayer mosaic filter this greyscale data must be calculated into a color image. This can be done with the mvTITAN-CL's *MosaicColor (Mvtitan)* filter which calculates the color image in real time without any additional CPU load of the host PC. To activate this got to the MVacquireControl's register *Processing* and activate *MosaicColor (Mvtitan)* in the list. White balance can be done with *Properties*.

Now you get colored images in live preview. It is possible that you get greyscale or bad images with *Snap*. In this case change the used videomode in the camera definition from


```
DefCamType          "TMC-1320" VM_DIG8 NONINTERLACED 50 15625 25000 PCLK_EXTERN
```

to

```
DefCamType          "TMC-1320" VM_DIG32 NONINTERLACED 50 15625 25000 PCLK_EXTERN.
```

Now you will get 32bpp images in the memory.

Always be sure the DMA-Buffer is great enough to hold all the image data ( in color mode at least about 5.4 MB is needed).

	<b>Subject:</b>	<b>Pulnix TMC1320-xxCL with mvTITAN-CL</b>	Created	Last change
			09.04.03	29.04.03
Application Note	Project:	Camera adaption	Version 1.1	

## Glossary and short cuts

Expression	Explanation
VD	Vertical drive, signal is sent to signalize next field (noninterlaced) or frame (interlaced). Also called Frame Enable, VSync or frame start signal.
HD	Horizontal drive, signal is sent to signalize next line. Also called Line Enable, HSync or line start signal.