See the possibilities

User's Manual

RM/TM-6740CL
RMC/TMC-6740CL

Digital Monochrome/Color
Progressive Scan, Interline-Transfer CL Camera

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Disclaimer

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Warranty

Please contact your factory representative for details about the warranty.

Certifications

CE Compliance

The RM/TM-6740CL series of cameras has been certified to conform to the requirements of Council Directive 89/336/EC for electromagnetic compatibility and to comply with the following European Standards:

EMCEN55022: 1998 + A1: 2000 CLASS A
EN55024: 1998 + A1: 2001

All JAI Inc. products bearing the CE mark have been declared to be in conformance with the applicable EEC Council Directives. However, certain factory-installed options or customer-requested modifications may compromise electromagnetic compatibility and affect CE compliance. Please note that the use of interconnect cables that are not properly grounded and shielded may affect CE compliance.

Contact the JAI Inc. Applications Engineering Department for further information regarding CE compliance.

FCC

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference, in which case the user will be required to correct the interference at his own expense.

WARNING

Changes or modifications to this unit not expressly approved by the party responsible for FCC compliance could void the user's authority to operate the equipment.

RM/TM-6740CL Series Operation Manual

JAI Inc.
625 River Oaks Parkway
San Jose, CA 95134
Tel:(408) 383-0300
Tel:(800) 445-5444
Fax:(408) 383-0301
www.jai.com

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1 Hardware Introduction

1.1 Product Description

The JAI RM-6740CL series consists of high-speed progressive scan CCD cameras with Dual-Tap output, available in RoHS and non-RoHs versions with both monochrome and Bayer color models offered (RM-6740CL, TM-6740CL, RMC-6740CL, TMC-6740CL)[1]. The interline-type CCD permits full vertical and horizontal resolution of very high speed shutter images and applications. The electronic shutter, which has speeds to 1/64,000 sec., can be reset asynchronously by external pulse control. The frame rate for a full image is 200 fps, with partial scan and binning modes of up to 3205 fps. A 4:3 ratio imager format with uniform square pixels provides superior image definition in any orientation. On-chip micro lenses provide increased sensitivity.

The RM-6740CL has a full dynamic range control function, which can be set at externally selectable look-up table (LUT) knee slopes to convert 10-bit input to 8-bit output, thereby optimizing the CCD's full dynamic range in the normal output signal range. As a Dual-Tap camera, the RM-6740CL has dual-channel auto-black level balancing (except in horizontal partial scanning modes) and semi-auto-gain balancing functions. The camera has a Dual-Tap, 10-bit/8-bit Camera Link output (see Figure 1 "CL (Camera Link) System Configuration" on page 10). All the key functions are controlled via a Camera Link serial communication interface.

Applications for the RM-6740CL include machine vision, medical imaging, intelligent transportation systems, high-definition graphics, on-line inspection, gauging, character reading, archiving, and high-security surveillance.

1.2 Features

- Miniaturized and lightweight

  The printed circuit boards in the RM-6740CL have been arranged based on a new design philosophy. This creates modular electronics for the camera, giving it flexibility. In addition, the use of miniature solid-state components results in a compact, lightweight camera that is 50.8mm x 50.8mm x 74mm in dimensions, and weighs only 162 grams.

- Imager

  The RM-6740CL uses a Dual-Tap progressive-scan interline transfer CCD (KAI-0340) that has the following features:

  - Resolution of 640 x 480 active pixels for excellent image quality
  - 7.4 x 7.4 µm square pixels for precise dimensional measurement
  - High-speed electronic shutter capability for high dynamic resolution of moving objects that eliminates the need for a mechanical shutter.
  - Progressive-scan CCD eliminates interlace deterioration of image and increases ease of computer interface.
  - High sensitivity and low noise at fast scanning. The CCD has an excellent S/N ratio at the default setting that is greater than 50dB.
  - The CCD has built-in microlenses for increased quantum efficiency.

[1] The RM-67400CL series consists of the TM-6740CL, RM-6740CL (monochrome) and the TMC-6740CL and RMC-6740CL (color). Unless otherwise noted, all information contained in this manual is relevant to all models.

- Electronic shutter

  The RM-6740CL has a substrate drain-type shutter mechanism which provides superb pictures at various speeds without smearing. For more information, please see Section 3.3, “Electronic Shutter”.

- Asynchronous reset

  The RM-6740CL captures async reset images and provides single-shot video output with single FDV. This makes it simpler for an ordinary frame grabber to capture the async reset images. The RM-6740CL’s asynchronous reset is flexible and accepts external horizontal drive (HD) for phase locking. When the VINIT (5V) pulse is applied to CC1, it resets the camera's scanning and purging of the CCD.

  The RM-6740CL has three modes to control the asynchronous reset and shutter speed:

  – Async, no shutter. The video signal and FDV are reset by external VINIT.
  – Internal shutter speed control. The speed control varies from 1/250 to 1/64,000 sec. The video signal and FDV starts with internal V reset timing related to shutter speed.
  – External VINIT with pulse width. The duration between pulse edges controls the shutter speed externally.

- Output

  The RM-6740CL has Dual-Tap 10-bit/8-bit Camera Link output. The analog output is 714 mVp-p composite video (75 ohms) on all models.

- Dual-Channel Auto Black Level Balancing and Semi-Auto Gain Balancing

  The RM-6740CL, as a Dual-Tap output camera, has auto black level balancing and semi-auto gain balancing functions.

- Integration

  The RM-6740CL is capable of capturing high-resolution integration images. Its CCD imager can be exposed for longer than the normal scan timing of 1/200 sec. This integration feature provides extra sensitivity for applications in dark environments. The progressive scan imager permits a full frame of resolution in non-interlace format. Integration is achieved by applying INTEG signal to CC2 control of Camera Link or by feeding VINIT pulse width control up to 1 sec of the pulse width in async pulse width control mode for the frames to be integrated.

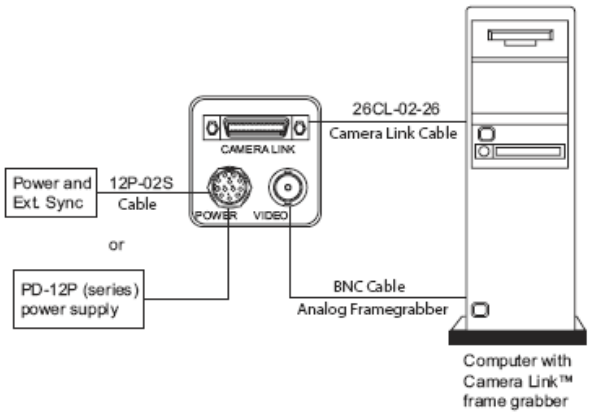
- Warranty

  Please contact your factory representative for details about the warranty.

1.3 System Configuration

Figure 1 below presents a typical system configuration for the Camera Link version.

Figure 1. CL (Camera Link) System Configuration



2 Installation

The following instructions are provided to help you to set up your camera quickly and easily. We suggest that you read through these instructions before you unpack and set up your camera system.

2.1 Getting Started

2.1.1 Unpacking Instructions

We recommend that you save the original packing cartons for the cameras and accessories in case you need to return or exchange an item.

We also recommend that you bench-test any equipment being sent to another location for field installation to assure that everything is fully operational as a system.

2.1.2 Components List

Please begin by checking your order against the Components List shown below to assure that you have received everything as ordered, and that nothing has been overlooked in the packing materials. If any item is missing, please contact your JAI Inc. representative immediately.

- RM-6740CL camera
- Camera-specific data sheet
- Camera-appropriate operation manual (if online)
- Dual-Tap AccuPiXEL camera-control software

2.1.3 Accessories and Options

Following is a list of additional accessories and options that may be required for your application. Please check with your JAI Inc. representative before you install your camera to determine what you might need.

- PD-12U series power supply
- 12P-02S power cable
- 26CL-02-26 Camera Link cable
- TP-20 Tripod Mounting Kit (for dimensions go to: www.jai.com/EN/CameraSolutions/Products/Accessories/Pages/Home.aspx)

2.2 Camera Setup

2.2.1 Heat Dissipation

The RM-6740CL is a compact 640 by 480 camera. Since all the electronics have been packed in a compact package, the outer case of the camera can become hot due to heat dissipation. For optimal performance, JAI recommends using a cooling fan to set up a positive air flow around the camera and following the precautions below.

- Mount the camera on a large heat sink (camera bracket) made out of heat-conductive material like aluminum.
- Make sure the flow of heat from the camera case to the bracket is not blocked by a non-conductive material like plastic.
- Make sure the camera has enough open space around it to facilitate the free flow of air.

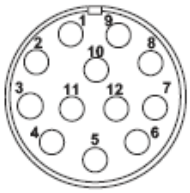
2.2.2 Connector Pin Configurations

2.2.2.1 12-Pin Connector

The RM-6740CL has a 12-pin Hirose connector for power input and signal integration. Pin #1 is Ground and pin #2 is +12V DC. The pin-out table is shown below.

Table 1 12-Pin Connector

Pin	Description	Pin	Description
1	GND	7	NC/VD in*
2	+12V DC	8	Strobe
3	GND (analog)	9	NC/HD in*
4	Video out	10	NC
5	GND (digital)	11	NC/Integration Control*
6	NC/VINIT in*	12	NC



*. Option 25-2 TTL inputs on 12-pin

2.2.2.2 Digital I/O Connector

The RM-6740CL has a 26-pin connector on the rear panel to output Camera Link data. The connector pin-out is shown in Table 2.

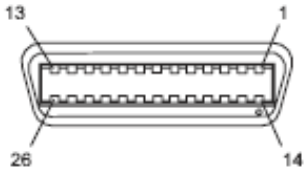


Table 2 Connector and Pin-Out Configurations

Camera Link Connector					
Pin #	**Description**	**I/O**	**Pin #**	**Description**	**I/O**
1	GND		14	GND	
2	Tx OUT 0-	Out	15	Tx OUT 0+	Out
3	Tx OUT 1-	Out	16	Tx OUT 1+	Out
4	Tx OUT 2-	Out	17	Tx OUT 2+	Out
5	Tx CLK OUT -	Out	18	Tx CLK OUT+	Out
6	Tx OUT 3-	Out	19	Tx OUT 3+	Out
7	SerTC+	In/RXD+	20	SerTC-	In/RXD-
8	SerTFG-	Out/TXD-	21	SerTFG+	Out/TXD+
9	CC1-	In/VINIT-	22	CC1+	In/VINIT+
10	CC2+	In/INTEG+	23	CC2-	In/INTEG-
11	CC3-	In/EX_HD-	24	CC3+	EX_HD+
12	CC4+	In/EX_VD+	25	CC4-	EX_VD-
13	GND		26	GND	

Note: SerTC: Serial To Camera
SerTFG: Serial to Frame Grabber

2.2.2.3 Analog Output Connector

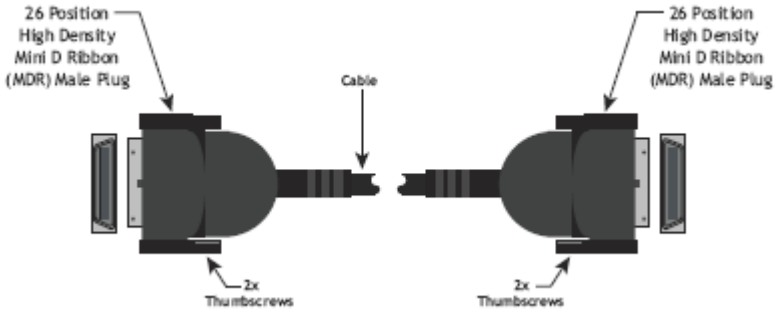
The RM-6740CL has a BNC connector on the rear panel to output analog video signal (80 MHz). Analog output is available to drive auto-iris lenses and for troubleshooting.

Note: This analog signal is not an RS-170 (television format) signal that can be connected to a standard CCTV monitor.

2.2.3 Camera Link Cable

The 26CL-02-26 cable assembly has been standardized as the Camera Link cable. This cable has a 26-pin connector on both ends. This is a straight-through cable and the pin-out configuration is shown in Table 2. Contact JAI Inc. for cable lengths other than 2 meters.

Figure 2. 3M Camera Link Cable



Note: For CL versions, serial communication for camera control is done via the Camera Link connector on the rear panel of the camera.

2.2.4 Power Supplies and Power Cable Setup

2.2.4.1 Power Supplies

The RM-6740CL camera requires 12V DC power that is obtained through the 12-pin connector located on the rear panel of the camera. JAI power supplies feature a 122-240VAC / 12VDC 1.2A universal voltage power supply. JAI Inc. recommends the following power supplies:

PD-12UU	PD12UU (No 12-pin Hirose)	US Plug
PD-12UUP	PD-12UU with12-pin connector	US plug
PD-12UE	PD-12UU (No 12-pin Hirose)	European plug
PD-12UEP	PD-12UU with 12-pin connector	European plug

For users providing power through the 12-pin connector, the PD-12P, PD-12UEP and PD-12UUP power supplies are available with the 12-pin mating connector already attached to the leads from the power supply. The PD-12UU and PD-12UE power supplies can be connected to the JAI power cable via a terminal strip or directly.

When wiring the PD-12UU and PD-12UE power supplies directly, please note the following:

- The lead ends must be twisted together and tin-soldered for strength and electrical continuity.
- Shrink tubing or a similar insulator should be used to prevent exposed leads from touching and shorting.
- The +12V lead is marked with a red stripe or white lettering; be sure not to reverse the leads.
- All connections must be properly insulated to prevent shorting.

2.2.4.2 JAI Power Cables

If you are using JAI power cables such as the 12P-02S, please refer to the 12-pin connector pin-out table below. The cable pin-out diagram is shown in Figure 3 below. The color-coded leads use Gray for Ground and Yellow for +12V.

Figure 3. 12P-02S Interface Cable (optional)

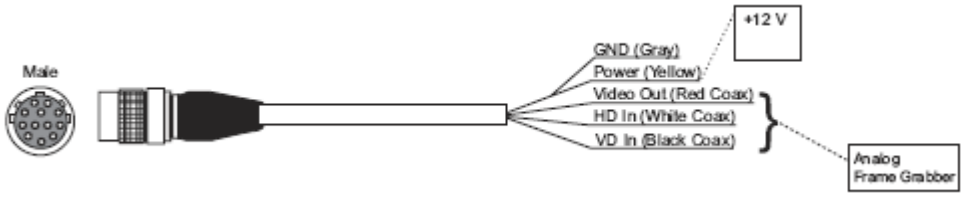


Table 3 12P-02S Cable

12P-02S Interface Cable					
Pin#	**Lead Color**	**Function**	**Pin#**	**Lead Color**	**Function**
1	Gray	GND	7	Black coax	VD Input
2	Yellow	+12V DC	8	White coax shield	Strobe Output
3	Red coax shield	AGND	9	White coax	HD Input*
4	Red coax	Video Out	10	Brown	N/C
5	Orange coax shield	DGND	11	Blue	Integration*
6	Orange coax	VINIT Input*	12	Black coax shield	N/C

*. Optional OP25-2 TTL inputs on 12-pin connector

Note: Make sure that the unused leads are not touching and that there is no possibility that exposed wires could cause the leads to short.

2.2.4.3 Building Your Own Power Cable

Refer to the 12-pin connector pin-out in Figure 3. Connect the Ground lead to pin #1, and the +12V DC lead to pin #2 of the 12-pin connector. Power must be DC-regulated, and of sufficient current to properly power the camera.

2.2.4.4 Attaching the Power Cable to the Connector

The 12-pin connector is keyed and will only fit in one orientation. Follow these directions to properly attach the power cable to the camera connector:

1. Rotate the connector while applying slight pressure until the keyways line up.
2. Press the connector into place until firmly seated.
3. Plug the power cord into the 100V AC socket. This will power the camera up.

Note: If using a power supply other than the standard PD-12U Series from JAI, certain characteristics are required of the power supply and the wiring in order to properly power the camera. The camera requires 12V immediately upon start-up; no slow ramps. Once power is applied, the power supply must be able to support a 2A to 2.5A in-rush current for approximately 200µs to prevent the voltage at the camera from dropping below the 10.8V minimum required. Dropping below this will result in the camera's internal power supply lowering its impedance in an attempt to draw more current. Since no more current will be available, the voltage at the camera will drop instead. This will result in a steady-state hang-up which will damage the camera's power supply and cause the camera to cease operating or to operate in an unstable manner.

2.2.5 Attaching the Analog Video Output

When connecting the RM-6740CL to an analog frame grabber, use the BNC connector on the rear panel of the camera. The input of devices connected to the analog output should be balanced for 75 ohms termination. The multi-conductor cable 12P-02S from JAI can be used to transmit analog video, power, sync. signals, and serial communication. The mini coaxial leads in JAI multi-conductor cables are designed for short runs of no longer than 10 feet.

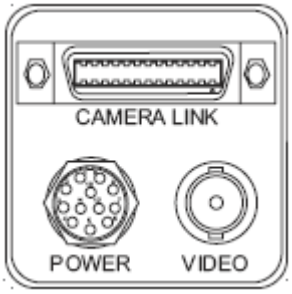
Note: Make sure that no extraneous wires are visible which could cause a short.

Note: Analog output clock frequency is 80MHz. Check the frame grabber manual to verify compatibility.

2.2.6 Attaching the Camera Lens

The RM-6740CL camera accepts 1/3" or larger format size C-mount lenses. To attach the C-mount lens[2] to the camera, carefully engage the threads and rotate the lens clockwise until it firmly seats on the mounting ring. Do not force the lens if it does not seat properly. Please note that some lenses with extremely long flangebacks may exceed the mounting depth of the camera.

2.3 Camera Rear Panel



2.3.1 Digital I/O Connector (Camera Link)

Refer to Section 2.2.2.2 for information on digital output connectors.

2.3.2 Analog Output Connector

The camera has a BNC connector on the rear panel to output analog video signal.

2.3.3 Power and External Sync Connector

Refer to Section 2.2.2.1 for information on the power and external sync connectors.

[2] C-mount to F-mount and C-mount to K-mount adapters are available for larger format lenses (35mm). Check with local photography dealers for these lens adapters.

3 Functions and Operation

3.1 Progressive Scanning

The RM-6740CL uses a state-of-the-art progressive scanning interline transfer CCD which scans all lines sequentially from top to bottom at one frame rate. Like a non-interlace computer screen, it generates a stable, crisp image without alternating lines and provides full vertical TV resolution of 480 lines. Due to the RM-6740CL's extremely high frame rate, it will not synchronize to most monitors.

The interline transfer architecture is also important to generate simultaneous shuttering. This is different from full frame transfer architecture which requires a mechanical shutter or strobe light in order to freeze the object motion.

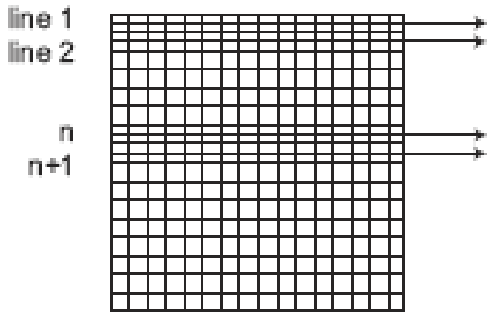
The RM-6740CL outputs the progressive-scanned image with an electronic shutter in thirty-six different formats. See Table 4 for more information.

- Progressive-scanning digital and analog output
  The CCD signal goes through A/D converters 10-bit in, 10-bit/8-bit out. The digital output is available via the Camera Link connector.

  The analog output is the same as 75 ohms, 714mV format available from BNC and 12-pin connector.

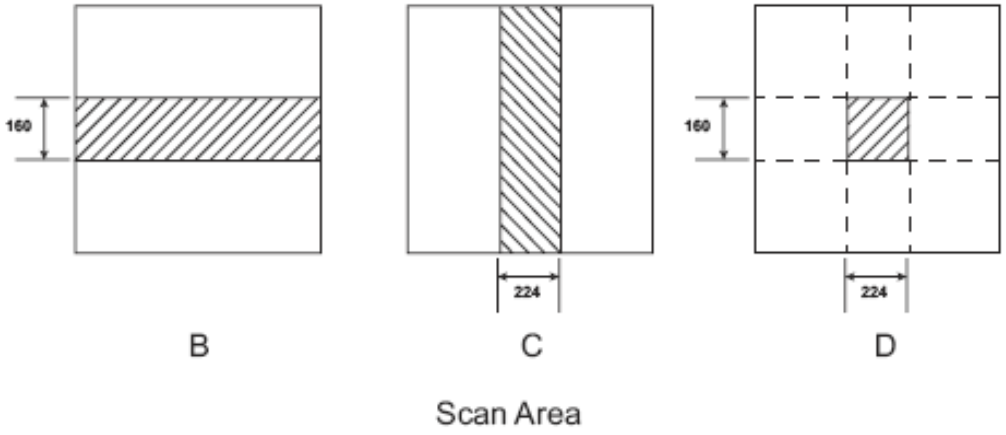
- Full Progressive Scan
  Normal scanning mode the RM-6740CL is for 640 x 480 pixels. The standard speed with dual-channel output is 200 frame/sec at the pixel clock of 40 MHz. The progressive scan reads every line from top to bottom and all lines are exposed with a single electronic shutter.

Figure 4. Full Progressive Scan Mode (A)



- Partial Scan Mode
  By selection, the camera has three partial scan modes: centered 160 lines, centered 224 columns, and centered 224 x 160 area. In partial scan mode B of Figure 5, the partial scan frame rate is 540 fps. Mode C is 500 fps, and D is 1250 fps.

Figure 5. Partial Scan Mode (B, C, and D)



- Binning Mode
  The RM-6740CL series has horizontal and vertical binning. By selection, the camera has 1x2, 1x4, 2x1, 2x2, 2x4, 4x1, 4x2, and 4x4 binning.

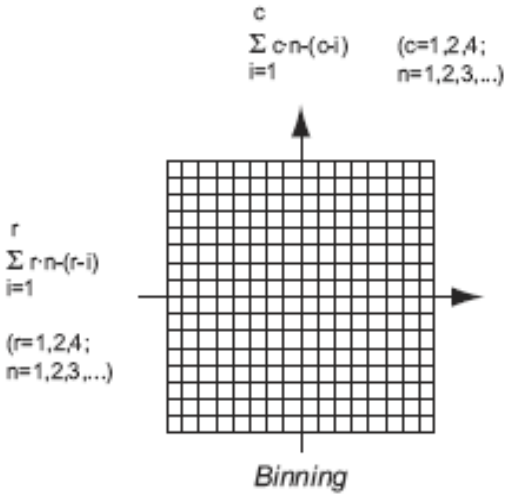


Table 4 RM-6740CL Scan Mode

Scan Mode		Active Pixels	Vertical Frequency (Hz)	Horizontal Frequency (KHz)	Output Clock	
Binning	Scan Area				Digital (MHz)	Analog (MHz)
No binning	A	640x480	200	100	40	80
	B	640x160	540	100		
	C	224x480	00	250		
	D	224x160	1250	250		
1x2	A	640x240	400	100		
	B	640x80	1000	100		
	C	224x240	1000	250		
	D	224x80	2315	250		
1x4	A	640x120	712	100		
	B	640x40	1596	100		
	C	224x120	1602	250		
	D	224x40	3205	250		
2x1	A	320x480	200	100	20	40
	B	320x160	540	100		
	C	112x480	500	250		
	D	112x160	1250	250		
2x2	A	320x240	400	100		
	B	320x80	1000	100		
	C	112x240	1000	250		
	D	112x80	2315	250		
2x4	A	320x120	712	100		
	B	320x40	1596	100		
	C	112x120	1602	250		
	D	112x40	3205	250		
4x1	A	160x480	200	92.59	10	20
	B	160x160	540	92.59		
	C	56x480	500	208.33		
	D	56x160	1250	208.33		
4x2	A	160x240	400	92.59		
	B	160x80	1000	92.59		
	C	56x240	1000	208.33		
	D	56x80	2315	208.33		
4x4	A	160x120	712	92.59		
	B	160x40	1596	92.59		
	C	56x120	1602	208.33		
	D	56x40	3205	208.33		

3.2 Electronic Shutter

The RM-6740CL has a substrate drain-type shutter mechanism which provides a superb picture at various speeds without smearing. A built-in manual shutter speed control selects the electronic shutter rate.

Table 5 Electronic Shutter Speeds

Shutter Speed Number	Manual	Async.
0	1/frame rate	Async No Shutter
1	1/250 sec	1/64,000 sec
2	1/500 sec	1/32,000 sec
3	1/1,000 sec	1/16,000 sec
4	1/2,000 sec	1/8,000 sec
5	1/4,000 sec	1/4,000 sec
6	1/8,000 sec	1/2,000 sec
7	1/16,000 sec	1/1,000 sec
8	1/32,000 sec	1/500 sec
9	1/64,000 sec	PWC (pulse width control)

With VINIT high (CC1), the CCD keeps discharging. With an active low pulse to VINIT, the camera resets and purges the charge momentarily. Then it starts integrating for the period of shutter control set by either an external pulse width or internal shutter control. Progressive scanning permits a full 480 lines of vertical resolution, as compared to an interlaced CCD camera which captures only half the vertical lines per shutter.

3.3 Integration

The CCD imager of the RM-6740CL can be exposed for longer than the normal scan timing of 1/200 sec. This integration feature provides extra sensitivity for dark-environment applications. The progressive-scan imager permits a full frame of resolution in non-interlace format. Integration is achieved by controlling CC2 Camera Control line through the Camera Link cable to low (GND) or providing pulse-width control up to 1 sec. Please refer to Table 1 in Section 2.2.2 for pin-out information on the 12-pin connector.

3.4 External Sync and Pixel Locking

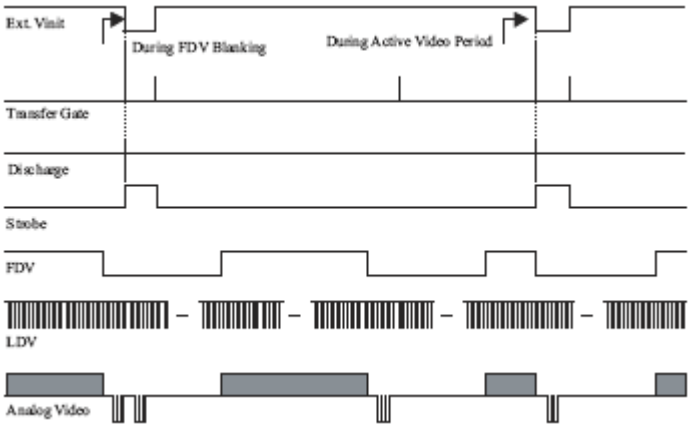
The RM-6740CL accepts an external sync of standard HD and VD on CC3 and CC4 of the Camera Link connector for general locking to an external source. The frequency requirement is shown in Table 4. The tolerance is ±2% horizontal frequency.

3.5 Asynchronous Reset

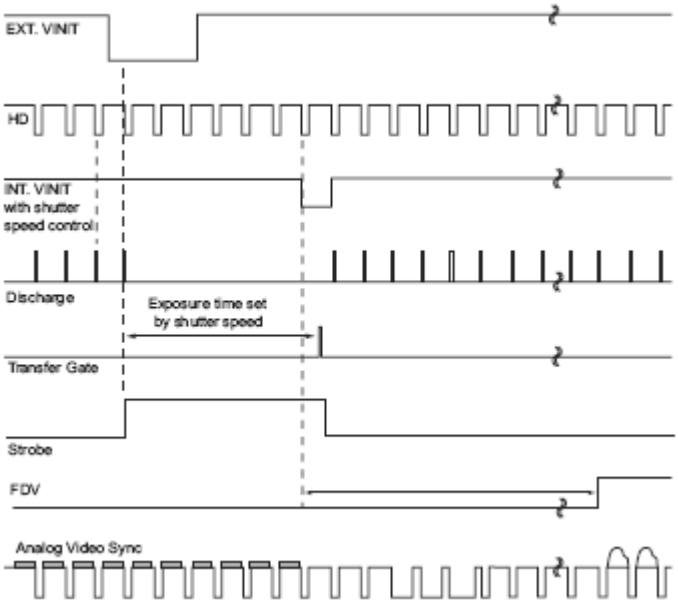
The RM-6740CL camera includes three modes to control the asynchronous reset and shutter speed:

- Async No Shutter
- Internal Shutter Speed Control
- External VINIT with Pulse Width (No-Delay Shutter) and ROI

3.5.1 Async No Shutter



3.5.2 Internal Shutter Speed Control

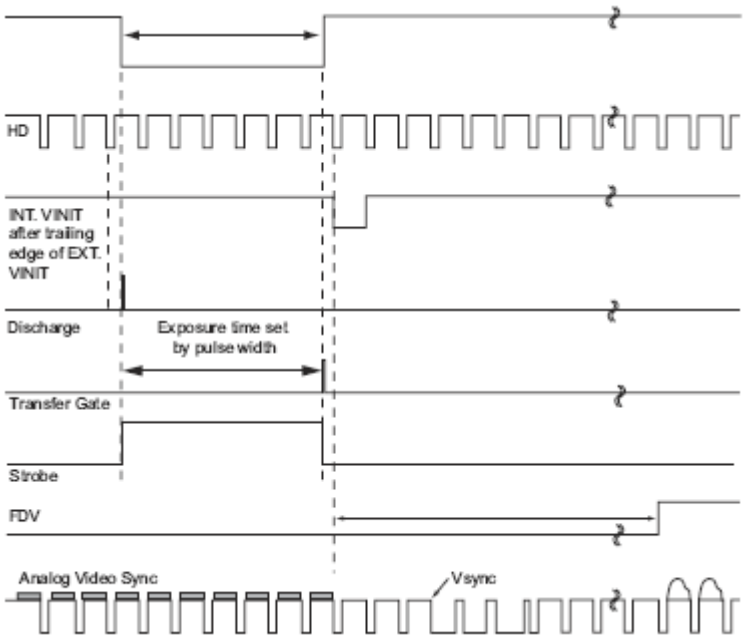


The camera operates the reset and shutter in the same way as the external pulse width control mode. When the external VINIT pulse is applied, internal VINIT is latched to HD and the internal VINIT is delayed to set up the shutter speed period. The shutter speed is controlled by communication software from “1” to “8.” Video output timing starts right after the internal VINIT and single shots. FDV is output at the internal VINIT timing.

3.5.3 External VINIT With Pulse Width (No-Delay Shutter) and ROI (Read-out Inhibit)

For multiple-camera applications such as 2D or 3D measurement and multi-angle inspection, simultaneous image capturing at exact shutter timing for all cameras is a critical requirement. The RM-6740CL’s asynchronous pulse-width control mode provides no-delay shutter as standard. Regardless of the internal pulse timing, the camera discharges at the VINIT leading edge and transfers charges at the trailing edge of the pulse. Even though each camera runs with slightly different H and data clock timing, the image capturing is exactly simultaneous.

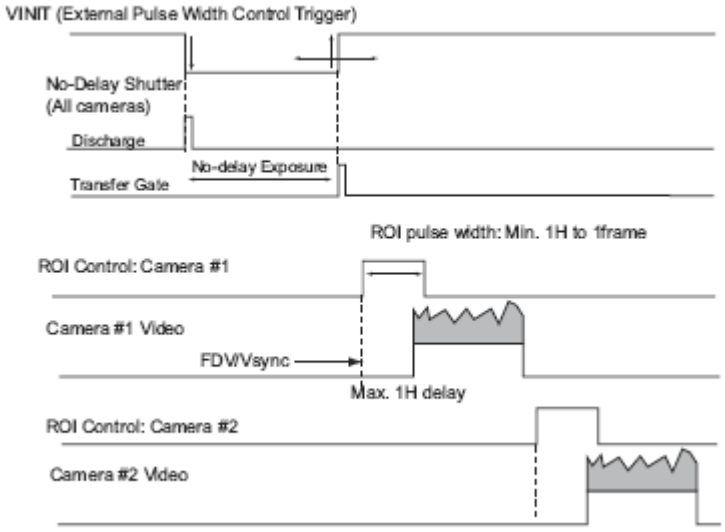
Figure 6. No-Delay Shutter



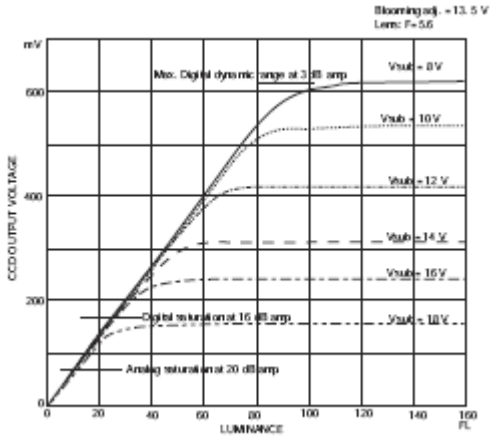
The RM-6740CL camera also has read-out-inhibit control (ROI) to control the vertical clock start (Async Shutter #9). When ROI is low, V-clock is stopped and the transferred charges remain in the vertical shift registers, which work like CCD memory. When the ROI is high, it clocks out the CCD data. This helps a single frame grabber process multiple images in pipeline processing (sequential process).

Note: When the ROI function is not used, make sure that the INTEG/ROI CC2 input is kept logic high during Async. pulse width control mode.

Figure 7. Read-Out Inhibit



3.6 Dynamic Range Control



The typical interline transfer CCD has fixed noise levels based on dark current (thermal or KT noise), pattern noise, and the operating clock speed. In general, the level of the 20 MHz pixel clock CCD at room temperature is around 20 to 50 electrons. The maximum capacity of CCD charges is limited by the well capacity at saturation. The range is limited by the structure and the pixel size.

The RM-6740CL uses a CCD with 7.4 µm x 7.4 µm pixels and a two-phase vertical shift register structure. The well capacity is 20,000 electrons. The theoretical dynamic range is 20,000:30 = 666:1 (56 dB).

A typical CCD camera does not use the full dynamic range due to the nominal gain and the output specification such as RS-170. The typical CCD camera's gain is set at 16 to 22 dB and the RS-170 video level is 714 mV. Using 20 dB gain for the calculation, CCD output is limited to 714/10 = 71.4 mV. Since the CCD's saturation voltage is 400 mV to 500 mV, it uses less than 1/5 of the full dynamic range.

Machine vision and outdoor applications, cannot afford to miss image information behind the saturation, which is why the dynamic range adaptation is critical.

3.6.1 Programmable Look-Up Table (LUT) and Knee Control

The RM-6740CL has a built-in LUT (look-up table) for dynamic range control.

At a specific gain setting, the offset (minimum level.... dark point) and A/D reference top voltage (maximum level... saturation point) are set to 10-bit A/D input so that the full dynamic range of the CCD is utilized at 10-bit references as the input and the LUT output is converted into 8-bit to adjust the gamma correction.

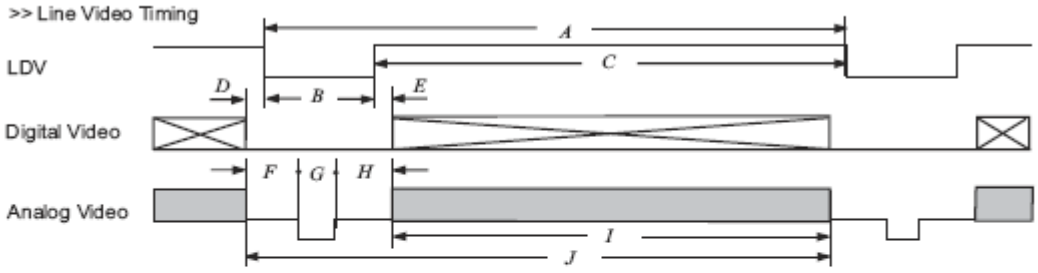
The look-up table has two knee points (variable gamma selection) that allow the 10-bit input to be segmented into three regions. The look-up table selection can be made by knee curve direct input.

3.7 Camera Timing Charts

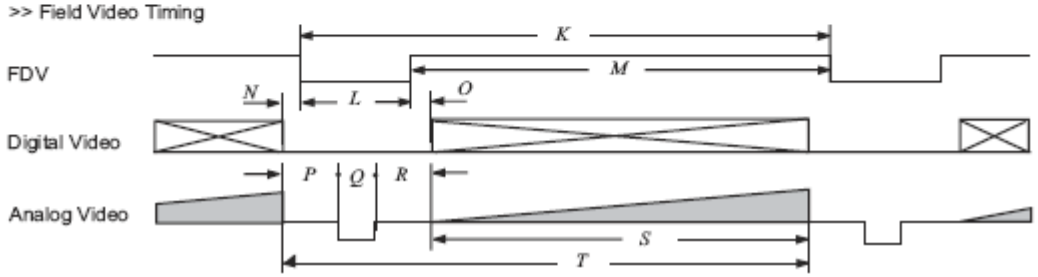
Refer to Tables 6-10 for timing values that can be applied to the variables in the following timing charts.

1. Video Output

>> Line Video Timing

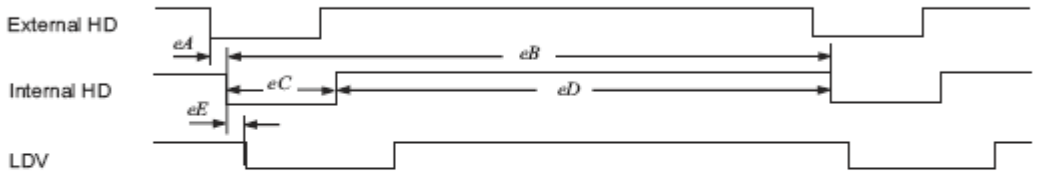


>> Field Video Timing

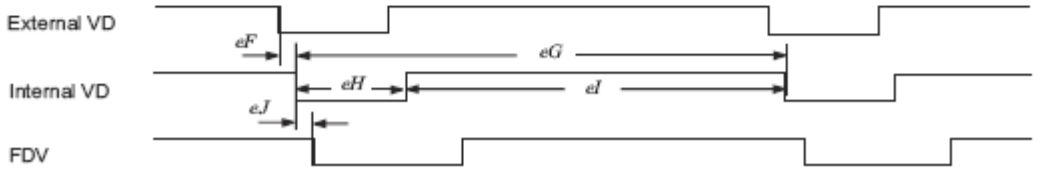


2. External HD Locking & Exteranl VD Reset

>> External HD Locking

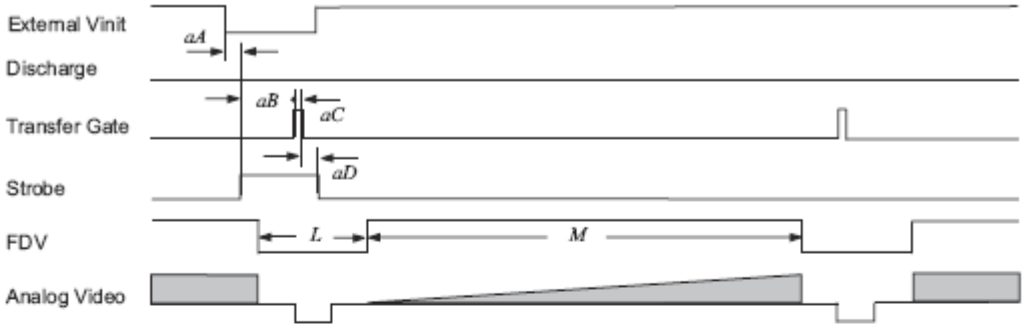


>> External VD Reset

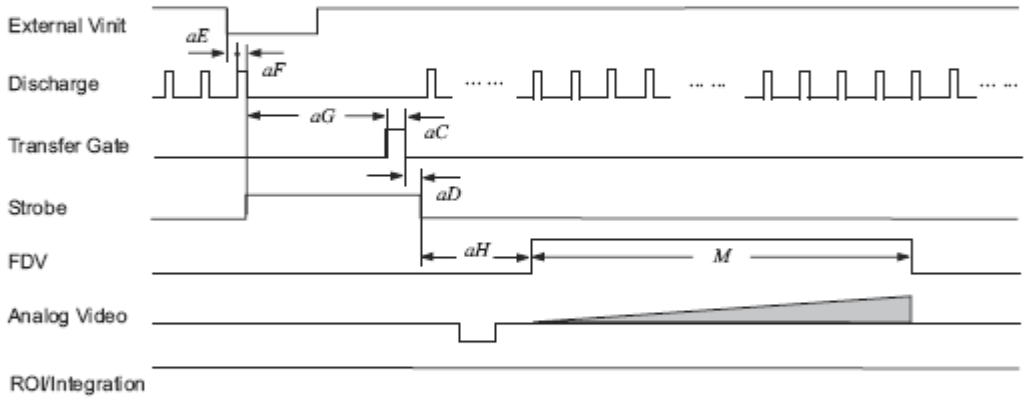


3. Async Reset

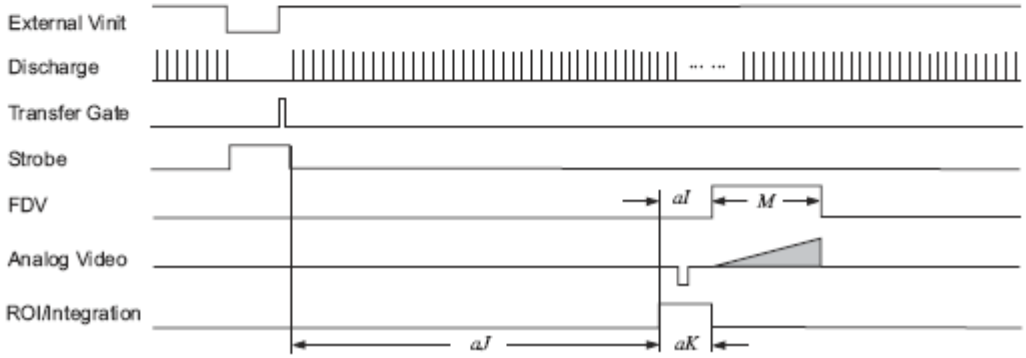
>> Async No Shutter (async shutter 0)



>> Async Normal Shutter (async shutter 1-8) & Async No-delay Shutter (async shutter 9)



>> Read-Out Inhibit (ROI, async shutter 9)



4. Video Output Order

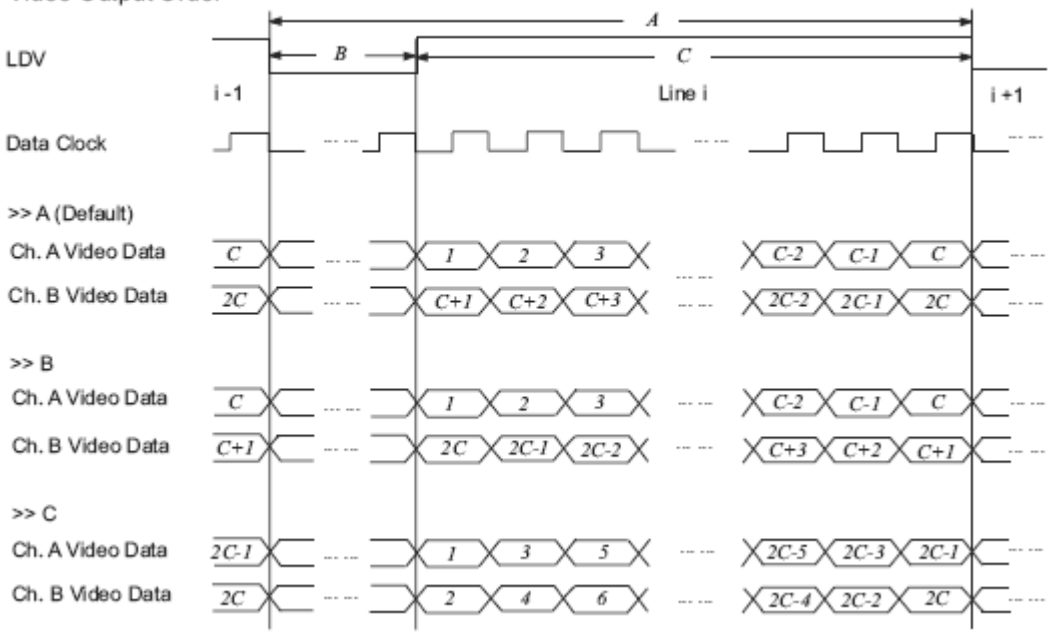


Table 6 Video Output (A to J)

Scan Mode		Output		Horizontal (Pixels)							
Binning	Scan Area			Digital			Analog				
		Digital	Analog	A	B	C	F*	G	H	I	J
No binning	A	40Mhz 25ns	80Mhz 12.5ns	400	80	320	58	16	86	640	800
	B			400	80	320				640	800
	C			160	48	112				224	320
	D			160	48	112				224	320
1x2	A			400	80	320				640	800
	B			400	80	320				640	800
	C			160	48	112				224	320
	D			160	48	112				224	320
1x4	A			432	112	320				640	864
	B			432	112	320				640	864
	C			192	80	112				224	384
	D			192	80	112				224	384
2x1	A	20MHz 50ns	40MHz 25ns	200	40	160	20	8	52	320	400
	B			200	40	160	20		52	320	400
	C			80	24	56	22		50	112	160
	D			80	24	56	22		50	112	160
2x2	A			200	40	180	20		52	320	400
	B			200	40	180	20		52	320	400
	C			80	24	56	22		50	112	160
	D			80	24	56	22		50	112	160
2x4	A			216	56	160	20		52	320	432
	B			216	56	160	20		52	320	432
	C			96	40	56	22		50	112	192
	D			96	40	56	22		50	112	192
4x1	A	10MHz 100ns	20MHz 50ns	100	20	80	10	4	26	160	200
	B			100	20	80				160	200
	C			40	12	28				56	80
	D			40	12	28				56	80
4x2	A			100	20	80				160	200
	B			100	20	80				160	200
	C			40	12	28				56	80
	D			40	12	28				56	80
4x4	A			108	28	80				160	216
	B			108	28	80				160	216
	C			48	20	28				56	96
	D			48	20	28				56	96

*. D, E=0 pixels.

Table 7 Video Output (K to T)

Scan Mode		Output		Vertical (Pixels)						
				Digital			Analog			
Binning	Scan Area	Digital	Analog	K	L	M*	P†	R	S	T
No binning	A	40Mhz 25ns	80Mhz 125ns	500	20	480	3	14	480	500
	B			185	25	160	9	13	160	185
	C			500	20	480	3	14	480	500
	D			200	40	160	9	28	160	200
1x2	A			250	10	240	3	4	240	250
	B			100	20	80	6	11	80	100
	C			250	10	240	3	4	240	250
	D			108	28	80	4	21	80	108
1x4	A			130	10	120	3	4	120	130
	B			58	18	40	5	10	40	58
	C			130	10	120	3	4	120	130
	D			65	25	40	4	18	40	65
2x1	A	20MHz 50ns	40MHz 25ns	500	20	480	3	14	480	500
	B			185	25	160	9	13	160	185
	C			500	20	480	3	14	480	500
	D			200	40	160	9	28	160	200
2x2	A			250	10	240	3	4	240	250
	B			100	20	80	6	11	80	100
	C			250	10	240	3	4	240	250
	D			108	28	80	4	21	80	108
2x4	A			130	10	120	3	4	120	130
	B			58	18	40	5	10	40	58
	C			130	10	120	3	4	120	130
	D			65	25	40	4	18	40	65
4x1	A	10MHz 100ns	20MHz 50ns	500	20	480	3	14	480	500
	B			185	25	160	9	13	160	185
	C			500	20	480	3	14	480	500
	D			200	40	160	9	28	160	200
4x2	A			250	10	240	3	4	240	250
	B			100	20	80	6	11	80	100
	C			250	10	240	3	4	240	250
	D			108	28	80	4	21	80	108
4x4	A			130	10	120	3	4	120	130
	B			58	18	40	5	10	40	58
	C			130	10	120	3	4	120	130
	D			65	25	40	4	18	40	65

*. N, O=0 pixels.
†. Q=3 lines.

Table 8 External HD Locking and External VD Reset (eA to eE)

Scan Mode		Pixel Clock	Horizontal		External HD Locking Timing (Pixels)				
Binning	Scan Area		Freq. (kHz)	Time (?sec)	eA	eB	eC	eD	eE
No binning	A	40Mhz 25ns	100	10	<20ns.	400	32.	368	13
	B		100	10		400		368	
	C		250	4		160		128	
	D		250	4		160		128	
1x2	A		100	10		400		368	
	B		100	10		400		368	
	C		250	4		160		128	
	D		250	4		160		128	
1x4	A		92.6	10.8		432		400	
	B		92.6	10.8		432		400	
	C		208.3	4.8		192		160	
	D		208.3	4.8		192		160	
2x1	A	20MH z 50ns	100	10	<20ns	200	16	184	12
	B		100	10		200		184	12
	C		250	4		80		64	11
	D		250	4		80		64	11
2x2	A		100	10		200		184	12
	B		100	10		200		184	12
	C		250	4		80		64	11
	D		250	4		80		64	11
2x4	A		92.6	10.8		216		200	12
	B		92.6	10.8		216		200	12
	C		208.3	4.8		96		80	11
	D		208.3	4.8		96		80	11
4x1	A	10MH z 100ns	100	10	<20ns	100	16	84	15
	B		100	10		100		84	
	C		250	4		40		24	
	D		250	4		40		24	
4x2	A		100	10		100		84	
	B		100	10		100		84	
	C		250	4		40		24	
	D		250	4		40		24	
4x4	A		92.6	10.8		108		92	
	B		92.6	10.8		108		92	
	C		208.3	4.8		48		32	
	D		208.3	4.8		48		32	

Table 9 External HD Locking (eF to eJ)

Scan Mode		Pixel Clock	Vertical		Vertical VD Reset Timing (Lines)				
Binning	Scan Area		Freq. (kHz)	Time (?sec)	eF	eG	eH	eI	eJ
No binning	A	40Mhz 25ns	200	5000	<2	500	9	491	1
	B		540	1850		185		176	-5
	C		500	2000		500		491	1
	D		1250	800		200		191	-5
1x2	A		400	2500		250		241	1
	B		1000	1000		100		91	-2
	C		1000	1000		250		241	1
	D		2315	432		108		99	0
1x4	A		712	1404		130		121	1
	B		1596	626.4		58		49	-1
	C		1602	624		130		121	1
	D		3205	312		65		56	0
2x1	A	20MHz 50ns	200	5000	<20ns	500	9	491	1
	B		540	1850		185		176	-5
	C		500	2000		500		491	1
	D		1250	800		200		191	-5
2x2	A		400	2500		250		241	1
	B		1000	1000		100		91	-2
	C		1000	1000		250		241	1
	D		2315	432		108		99	0
2x4	A		712	1404		130		121	1
	B		1596	626.4		58		49	-1
	C		1602	624		130		121	1
	D		3205	312		65		56	0
4x1	A	10MHz 100ns	200	10	<20ns	500	9	491	1
	B		540	10		185		176	-5
	C		500	4		500		491	1
	D		1250	4		200		191	-5
4x2	A		400	10		250		241	1
	B		1000	10		100		91	-2
	C		1000	4		250		241	1
	D		2315	4		108		99	0
4x4	A		712	10.8		130		121	1
	B		1596	10.8		58		49	-1
	C		1602	4.8		130		121	1
	D		3205	4.8		65		56	0

Table 10 Async Reset

Scan Mode		Async Reset Timing								
Binning	Scan Area	aA (lines)	aB (µsec)	aC (µsec)	aD (µsec)	aE	aG (lines)	aH (lines) s1-8†	aH (lines) s9‡	aI (lines)*
No binning	A	>1 & <2	43.2	4.8	1.9	s1-8: >1 line	s1=1 s2=2 s3=5 s4=12 s5=24 s6=49 s7=99 s8=199 s9=PW	20	>aH (s8) & < aH (s8) + 1	>aH (s8) +1 & < aH(s8) + 2
	B		43.2	4.8	1.9			19		
	C		16.0	4.0	3.8			18		
	D		16.0	4.0	3.8			32		
1x2	A		43.2	4.8	1.9			10		
	B		43.2	4.8	1.9			17		
	C		16.0	4.0	3.8			8		
	D		16.0	4.0	3.8			25		
1x4	A		46.4	4.8	2.7			10		
	B		46.4	4.8	2.7			16		
	C		19.2	4.0	4.6			8		
	D		19.2	4.0	4.6			22		
2x1	A	>1 & <2	43.2	4.8	1.9	s1-8: >1 line	s1=1 s2=2 s3=5 s4=12 s5=24 s6=49 s7=99 s8=199 s9=PW	20	>aH (s8) & < aH (s8) + 1	>aH (s8) +1 & < aH(s8) + 2
	B		43.2	4.8	1.9			19		
	C		16.0	4.0	3.8			18		
	D		16.0	4.0	3.8			32		
2x2	A		43.2	4.8	1.9			10		
	B		43.2	4.8	1.9			17		
	C		16.0	4.0	3.8			8		
	D		16.0	4.0	3.8			25		
2x4	A		46.4	4.8	2.7			10		
	B		46.4	4.8	2.7			16		
	C		19.2	4.0	4.6			8		
	D		19.2	4.0	4.6			22		
4x1	A	>1 & <2	43.2	4.8	1.9	s1-8: >1 line	s1=1 s2=2 s3=5 s4=12 s5=24 s6=49 s7=99 s8=199 s9=PW	20	>aH (s8) & < aH (s8) + 1	>aH (s8) + 1 & < aH(s8) + 2
	B		43.2	4.8	1.9			19		
	C		16.0	4.0	3.8			18		
	D		16.0	4.0	3.8			32		
4x2	A		43.2	4.8	1.9			10		
	B		43.2	4.8	1.9			17		
	C		16.0	4.0	3.8			8		
	D		16.0	4.0	3.8			25		
4x4	A		46.4	4.8	2.7			10		
	B		46.4	4.8	2.7			16		
	C		19.2	4.0	4.6			8		
	D		19.2	4.0	4.6			22		

*. aJ < 1 sec (recommended value)
aK = > 1 line
†. s1-9 means async shutter 1-9.
PW means pulse width of external vinit.
‡. aE = s1-8 < 1 line. s9 <125 nsec.
aF = 500 nsec.

4 Control Software Installation and Use

4.1 Introduction

The RM-6740CL series cameras are Dual-Tap AccuPiXEL, high-resolution, progressive scan cameras with JAI-proprietary LUT control and other excellent features. The software for these cameras was developed to function as standard software for the entire Dual-Tap AccuPiXEL series, and can open either the RS-232 serial port (COM) or Camera Link. Camera Link users must physically install the Camera Link frame grabber board into the PC. They must also install the Camera Link API (Cam2Net) (clserXXX.dll) software. These cameras are specially designed to capture images in progressive scan (non-interlace) format, producing a full frame of electronic shutter images, as well as normal images.

The AccuPiXEL interface appears different, and has various capabilities, depending on the camera model the software is accessing.

4.2 Software Installation

Following are instructions to install the Dual-Tap AccuPiXEL series camera-control software on a PC.

4.2.1 Before Installing the Dual-Tap AccuPiXEL Series Camera-Control Software

Before installing the Dual-Tap AccuPiXEL series camera-control software, please note the following requirements.

- Dual Tap AccuPiXEL series camera control software is tested with Microsoft Windows 2000, and Windows XP operating systems.
- The software requires one available communication port that is not in conflict with other peripherals such as the mouse or modem.
- Installation of the software requires 2.4 MB of free space on the PC hard disk.

4.2.2 Installing the Software

To install the Dual-Tap AccuPiXEL series camera-control software, obtain the software from the JAI web site and run "Setup.exe." The installer will direct you to install the application code.

If dual tap software is already installed on your computer, uninstall the software using the steps in the Uninstall section.

Note: The link to the frame grabber must be configured after the new software installation. The program asks for the location.

1. To obtain the Dual Tap software visit the JAI Inc. web site at http://www.jai.com
2. Hover over the Camera Solutions label in the top menu bar and select "Support & downloads > Downloads" from the drop-down menus that appear underneath
3. Scroll through the list to locate any RM-6740CL series camera (list is organized by scan type and color)
4. In the Software download column (far right) click the Dual-Tap software listing

Note: The latest version of Dual-Tap AccuPiXEL software will be listed. This manual uses v2.6.0 in its examples. If a later version is downloaded, some of the screens may vary slightly from those shown in the manual.

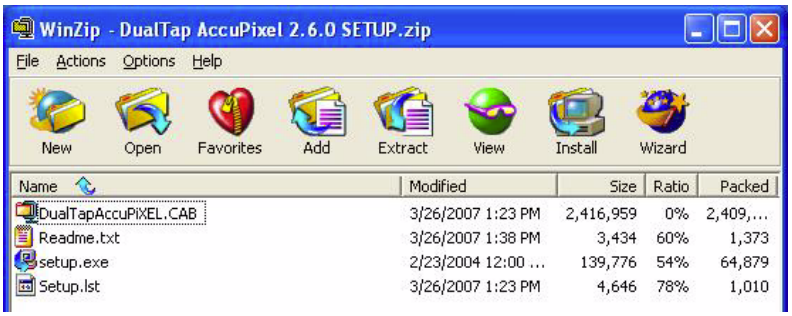
5. Select either *Open* or *Save* on the install dialog box

Note: The file is compressed, and uses the decompression program installed on your computer. WinZip is used in this example. Windows XP has an unzip capability as part of the operating system.

6. Open the file.

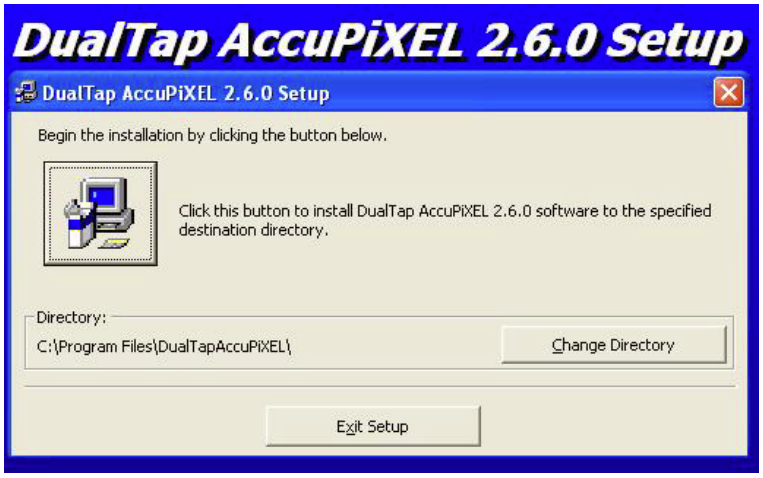
Note: It is not necessary to decompress the DualTapAccuPiXEL.CAB file

Figure 8. The Setup icon installs Dual Tap AccuPiXEL v 2.6.0



7. Follow the Setup instructions.

Figure 9. AccuPiXEL Setup screen



Note: Change the installation directory if desired.

Figure 10. Follow the installation directions

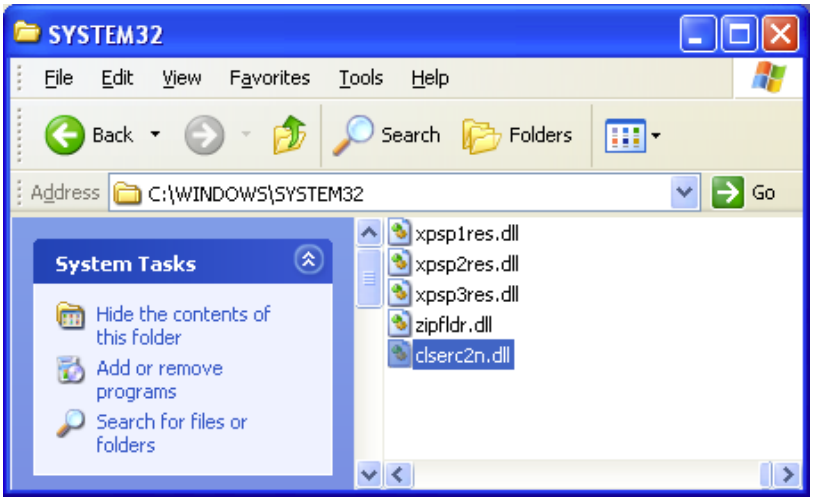
4.2.3 Installing the Camera Link API .dll (clserXXX.dll)

To install the Camera Link control software with frame grabber software, please consult the frame grabber company or JAI Inc.

4.2.4 Running Dual Tap AccuPiXEL

Click Start=>All Programs=>DualTapAccuPiXEL=>DualTapAccuPiXEL to run the software

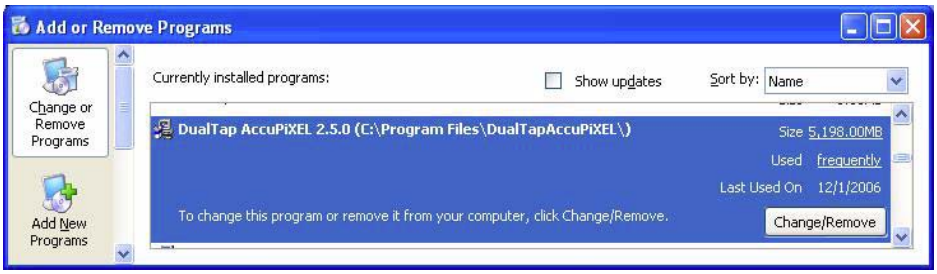
The Dual Tap software fails to start if the frame grabber .dll file (clserc2n.dll if you are using Cam2Net software) is missing. This may happen because the link to the .dll is lost when the previous version of dual tap software is uninstalled, or if a frame grabber has not been installed. If JAI Cam2Net software is being used and was installed with the default pathway, the screen grabber is located at C:\Windows\System32. If necessary use the Window Search feature to find the needed .dll file. Probably the most effective search is to look for the .dll extension. The screen grabber installation includes the essential .dll file.



4.2.5 Uninstalling the Software

Uninstall old versions of the Dual-Tap software before installing the new version. To uninstall the old version of the Dual-Tap AccuPiXEL series camera-control software from the control panel, follow the steps below. The newest version of the software can also be uninstalled in the same manner.

1. Open “Add or Remove Programs” in the control panel.
2. Select Dual-Tap AccuPiXEL software from the list of the installed software.
3. Click the “Change/Remove” button

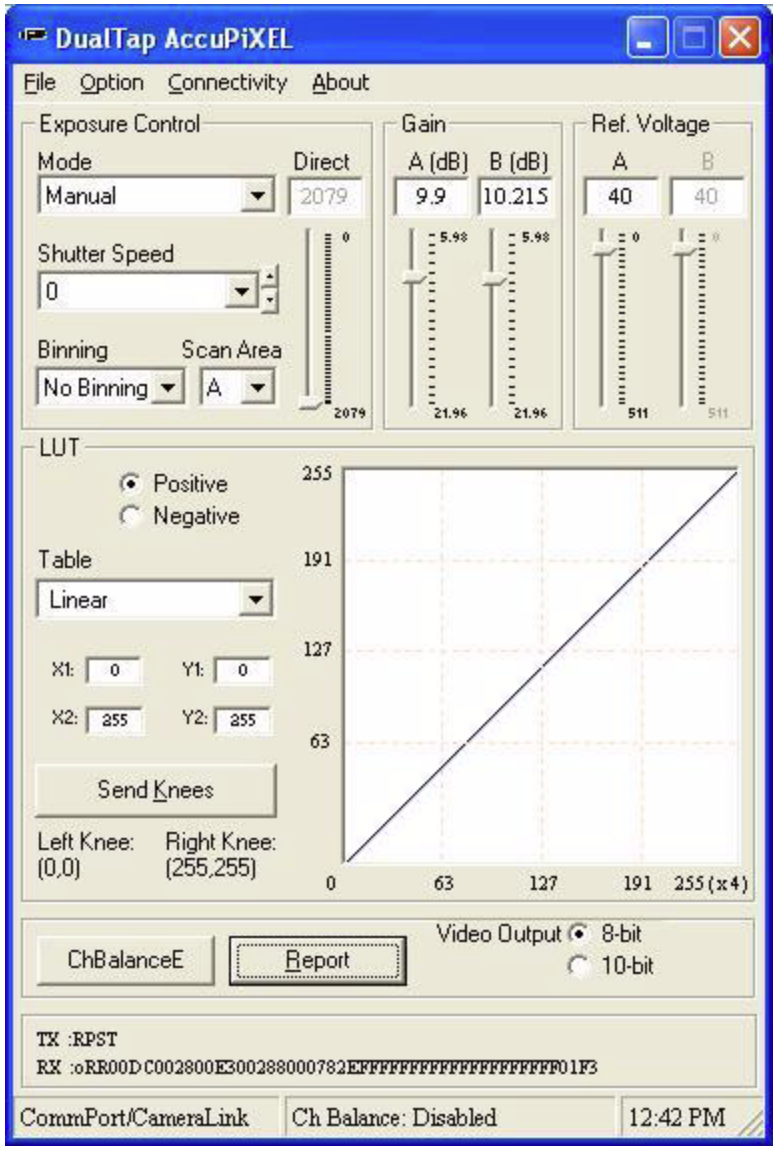


5 Graphical User Interface

5.1 GUI Features

The following is a list of camera functions that PC serial commands can control. The Dual-Tap AccuPiXEL series Camera Link cameras use differential serial communication through the Camera Link connector on the rear panel of the camera. Each camera displays the camera number at the top of the interface window. Since the following screens have been used in multiple manuals, the specific camera number has been removed.

- Exposure Control
  - Mode
  - Shutter Speed
  - Binning
  - Scan Area
  - Direct
- Gain Control
  - A (dB)
  - B (dB)
- Ref. Voltage
  - A
  - B
- LUT
  - Positive
  - Negative
  - Table
  - X1, X2, Y1, Y2
  - Send Knees
  - Graphic Knee Adjustment
- Channel Balance
- Report
  - TX, RX
- Video Depth
  - 8-bit
  - 10-bit
- Control Signals



5.2 Starting Dual-Tap AccuPiXEL Software

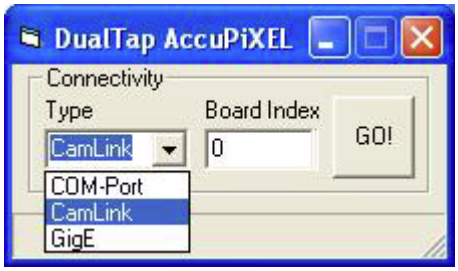
After installing the Dual-Tap AccuPiXEL software, start the program in Microsoft Windows XP by going to: Start->All Programs->DualTapAccuPiXEL 2.6.0. Click on DualTapAccuPiXEL 2.6.0.

Figure 11. Starting Dual-Tap AccuPiXEL from the desktop

5.3 Setting up the Camera Link software

When the software starts, a small window displays on the screen. Select CamLink to access the RM-6740CL camera. It is not possible to set up the CL camera using the COM-Port or GigE selection.

Figure 12. Initial Dual Tap AccuPiXEL screen.

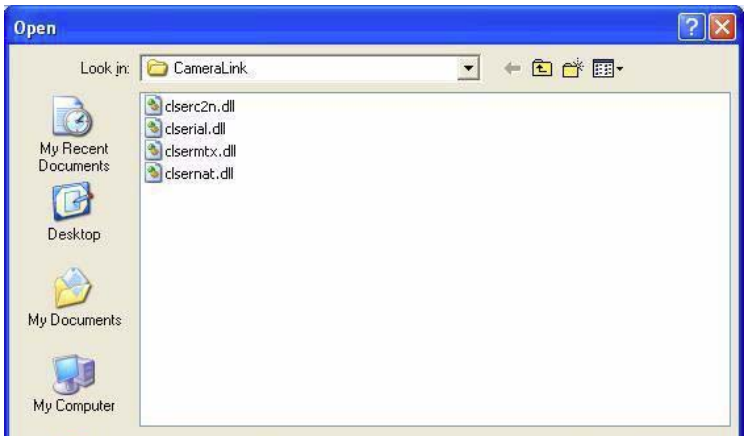


5.3.1 CamLink Mode

- When CamLink mode is selected, the camera searches for the driver to the frame grabber. Click the GO button. Choose the .dll for the desired frame grabber.

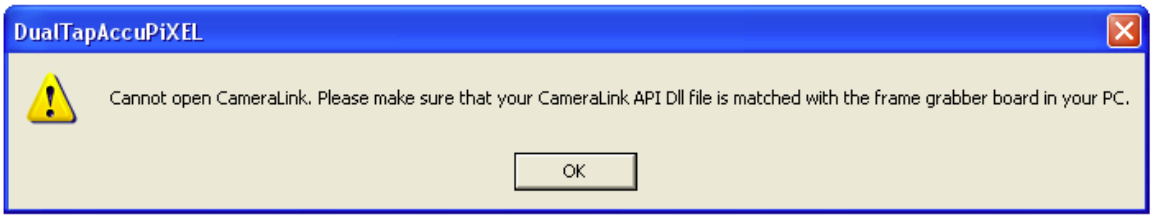
Note: The Dual-Tap AccuPiXEL software automatically opens the CameraLink directory if it is installed in the default location, since this where the .dll software is located.

Figure 13. Choose the desired frame grabber DLL



- If the frame grabber that corresponds to the dll is not present, an error message displays.

Figure 14. The error message if the .dll application is missing.



- Click Start=>All Programs=>DualTapAccuPiXEL=>DualTapAccuPiXEL to open the Dual Tap software.

5.3.2 GigE Mode

GigE mode provides an easily connectable, high-bandwidth imaging solution. Video data is sent as data packets over an industry-standard GigE network. Point-to-point (unswitched) transmission is up to 100 meters. With gigabit Ethernet switches, the transmission distance is virtually unlimited.

It is necessary to start the frame grabber software before the GigE mode recognizes the camera.

Note: If the Cam2Net frame grabber is used the GigE mode is not supported for the CL camera.

5.4 Operating The Control Software

5.4.1 Choose the CamLink mode

Choose the CamLink mode from the mode screen when the Dual-Tap AccuPiXEL camera control software starts. Click the GO button.

5.4.2 Check Current Camera Setting

Click the “Report” button to get the current camera setting from the camera.

Figure 15. The Report button provides camera setting information in the TX/RX frame.

5.4.3 Exposure Control

The exposure control allows you to select Manual or Asynchronous modes using the appropriate radio button.

5.4.3.1 Manual and Async

• Async mode opens and closes the shutter based on the camera settings until it is shut off or reset.

• Manual mode opens and closes the shutter based on manual or mechanical triggers.

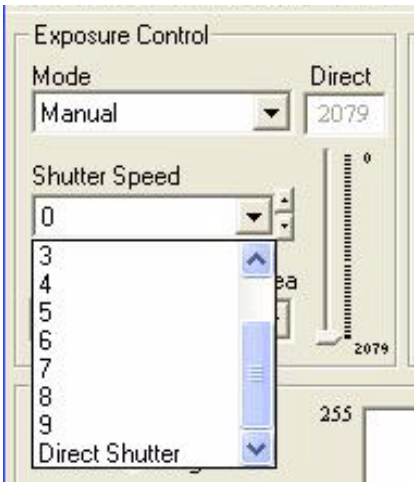
Figure 16. Manual and Async exposure control

5.4.3.2 Shutter Speed

The software offers 0-9 and Direct Shutter selections under Exposure Control when Manual is selected. Generally each shutter number is twice as fast as the previous shutter speed (so a setting of 3 would be twice as fast as 2, and half as fast as 4). For specific shutter speeds, see Table 5 in Section 3.2.

Manual shutter speed 0 is no shutter mode; Async shutter speed 0 is Async No Shutter mode; Async shutter speed 1~8 is Async normal shutter mode; Async shutter speed 9 is Async no delay shutter mode (pulse width control).

Figure 17. Exposure Control, Shutter Speed



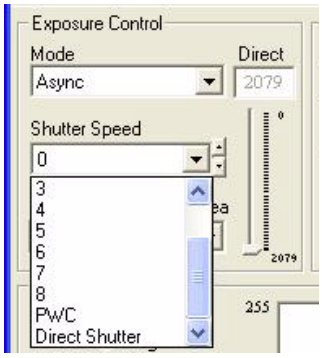
Direct Shutter

Manual mode makes Direct Shutter available. Using Direct Shutter allows the user to configure the exposure based on the number of lines. The direct slider becomes active to permit you to set the number of lines by using the slider or entering a number in the text box above the slider.

Pulse Width Control

PWC mode allows shutter control using an external trigger. The setting should be less than the combined exposure and trigger time for a single frame. All of the Exposure Control settings are available when the PWC shutter speed is selected. PWC is available only in Async mode.

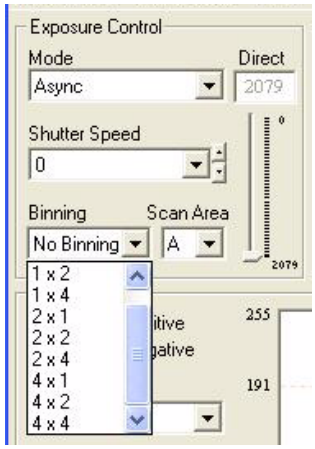
Figure 18. Select PWC from Shutter Speed in the Async mode.



Binning

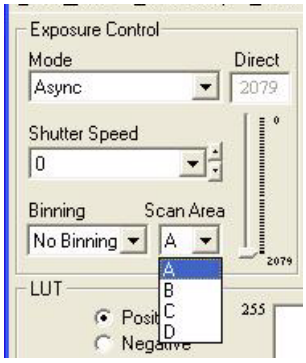
Binning is a process that combines the charge from adjacent pixels to create a single large pixel for higher quality video. Settings are available in the Exposure Control/Binning drop-down list box. Section 3.1 describes the binning options available for the RM-6740CL series. The interface for the binning options is shown below.

Figure 19. Use the binning drop-down list box to select a setting.



Scan Area

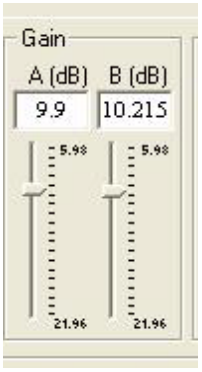
There are four pre-set scan areas available for the RM-6740CL, including full-scan and partial scan areas. Select a scan area using the drop-down list box. Preset scan areas have a letter designator. See section 3.1 for a description of the scan areas.



5.4.4 Gain Control

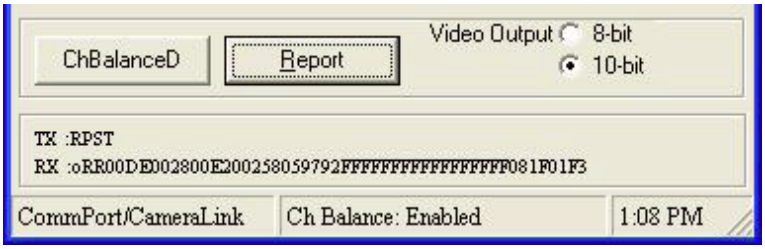
5.4.4.1 Gain

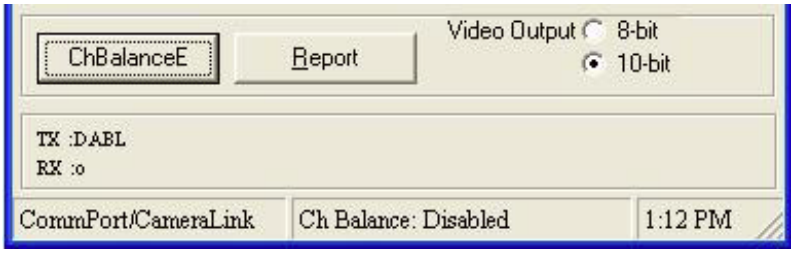
Gain refers to how and how much an electronic signal is amplified. The Gain Control box allows you to change the Gain value by moving the slider or entering the value directly into the text box.



5.4.4.2 Gain Auto Balancing Button

Click the “ChBalanceD” or “ChBalanceE” button to enable Gain Auto balancing. Once it is finished, the software will disable gain auto balancing automatically. The button changes from D to E, depending what channel was most recently balanced.

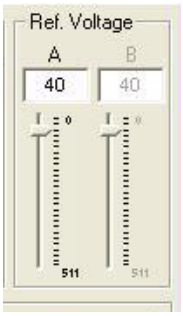




5.4.5 Ref. Voltage

Ref. Voltage is used to adjust the black level. Channel A voltage is the master, channel B is the slave. To change the value, move the slider or enter the value directly into the box. The camera automatically adjusts Channel B offset voltage, every other frame. The lower the number, the lower the black level. Most users attempt to adjust the black level so that any interference is just below the black level and does not become part of the final image. The camera should warm up for half an hour before adjusting reference voltage.

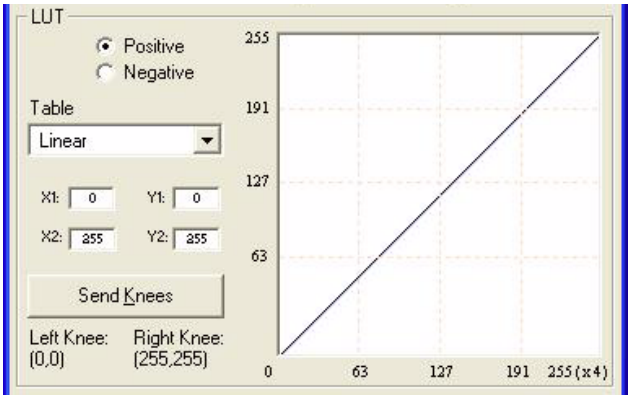
Figure 20. Ref. Voltage slider



5.4.6 LUT (Look-Up Table)

Use the radio buttons to select either a normal, “positive” image, or a reversed, “negative” image.

Figure 21. Positive or Negative image



The Knee Control box allows you to set your own knee values in the LUT.

5.4.6.1 LUT (Look-Up Table) Selection

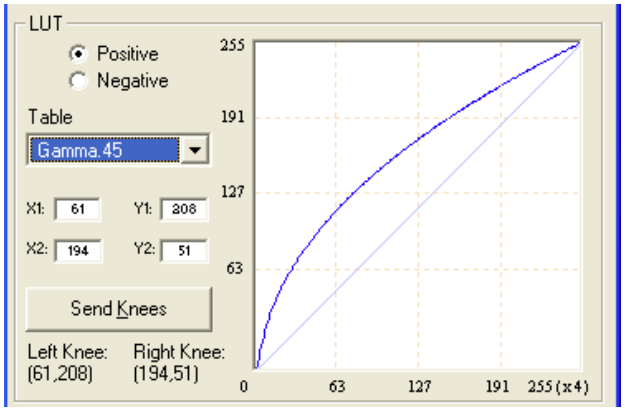
The LUT Selection box allows you to choose between linear or gamma 0.45 output.

Linear Selection

The Linear option gathers light in a proportional manner as shown in the preceding figure.

Gamma Selection

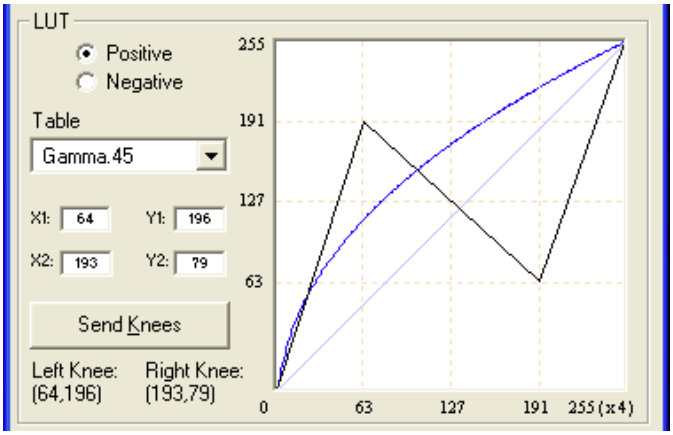
The Gamma.45 option is designed to cause the camera to gather light in a manner that produces a result very similar to what the human eye sees. The heavier curved blue line represents the Gamma.45 LUT adjustment.



Knees

The knee setting allows two adjustments in the light gathering configuration of the LUT to allow for corrected video as it is captured. It is possible to set knees on any of the drop down settings, although selecting the menu settings without adjusting the knees sends the defaults if the Send Knees button is clicked. You may enter X1, Y1, X2, Y2 values directly to adjust the knee curve, this is a useful way to copy the settings from another camera. When you have chosen the value you want and are ready to set this value to the camera, click the "Send Knees" button.

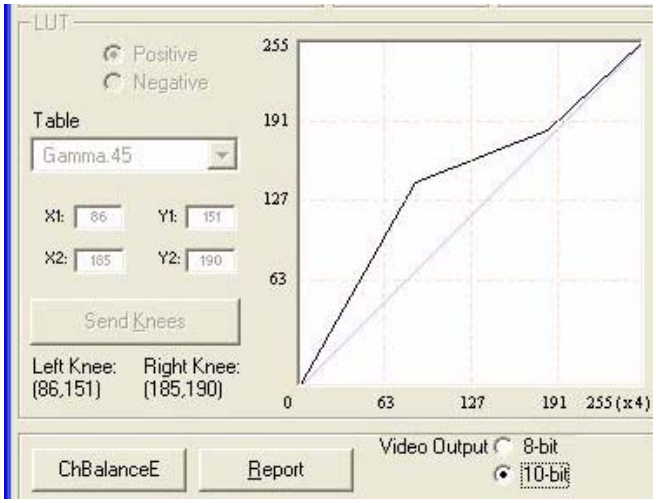
Figure 22. The knee setting does not activate until the Send Knees button is clicked



5.4.7 Video Depth

The RM-6740CL LUT can be used with 8-bit output. If 10-bit output is selected the LUT area becomes inactive, as shown in the following figure.

Figure 23. 10-bit video output deactivates the LUT frame.

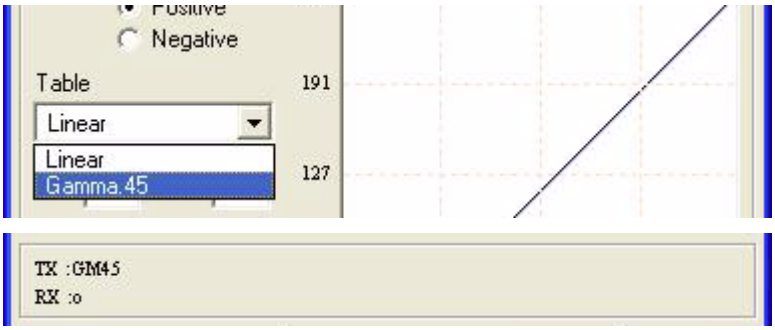


5.4.8 Report

5.4.8.1 Automatic Report

The report frame of the window often verifies recent actions without being prompted. An example of an action that is displayed without an inquiry (pressing the Report button) would be changing the camera to the Gamma.45 setting, or many of the other actions in the LUT table, such as setting a negative or positive image, or sending knees.

Figure 24. Automatic camera report



5.4.8.2 Report Button

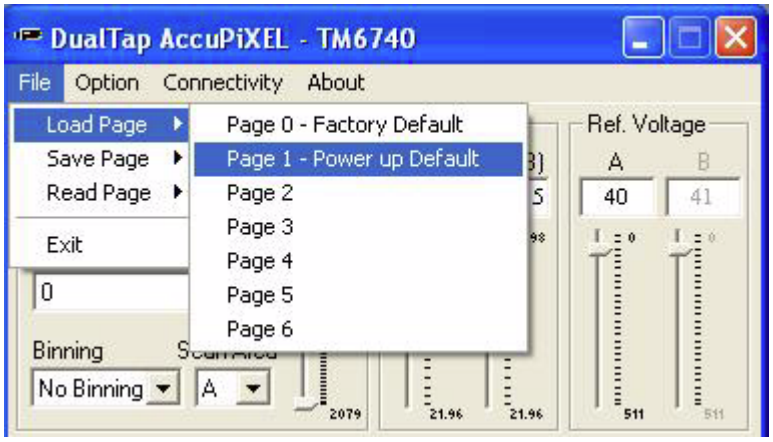
Press the Report button for a complete description of the current camera configuration. Use the "Description" column of the RM-6740CL Command List provided in Table 11, Section 6.1 to interpret the results.

5.5 Main Menu: "File"

5.5.1 Load and Save Page

Click on the File menu and choose Load Page to load a saved set of camera parameters. The Page 1 slot contains the power up default settings.

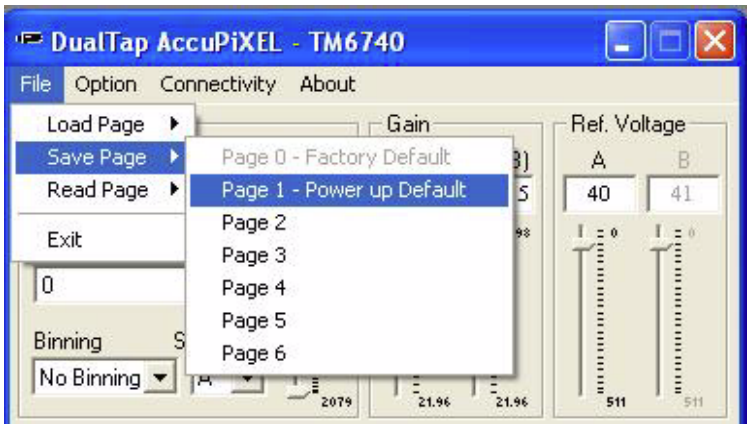
Figure 25. Load Page



5.5.2 Save Page

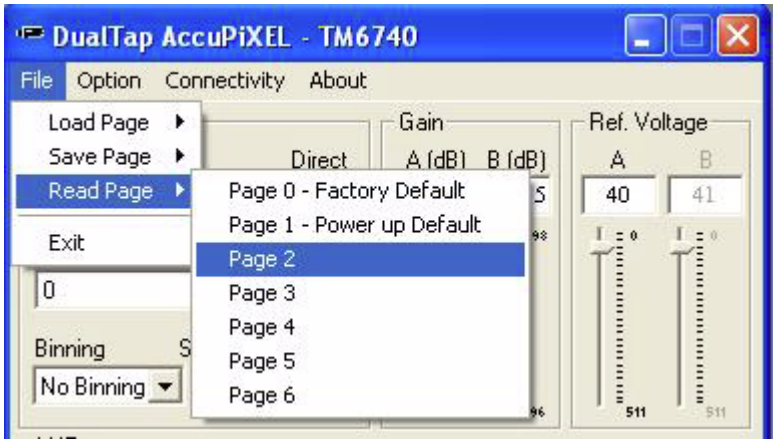
Click on the File menu and choose Save Page to change a saved set of camera parameters. The Page 0 slot is used to store factory default settings, and can not be overwritten without supplying a password. The Page 1 slot contains the power up default settings, and can be changed to allow different power up defaults. The remaining five pages can be used as desired to save configurations.

Figure 26. Save Page



5.5.3 Read Page

Click on the File menu and choose Read Page to read the EEPROM for a specific page. Using this command does not change the saved configuration.



5.6 Main Menu Option

Click on the “Option” menu and choose “Password” to gain access to load Page 0 of the camera parameters. Contact JAI Inc. at 1-800-445-5444 for password access. The password allows access to the EEPROM to rewrite factory default settings.

5.6.1.1 Test Pattern

From the main menu, select “Option” and click ‘Test Pattern” to view or disable the test pattern. This menu option is disabled if a monitor is not connected to the camera’s video output.

5.6.1.2 Pixel Output Order

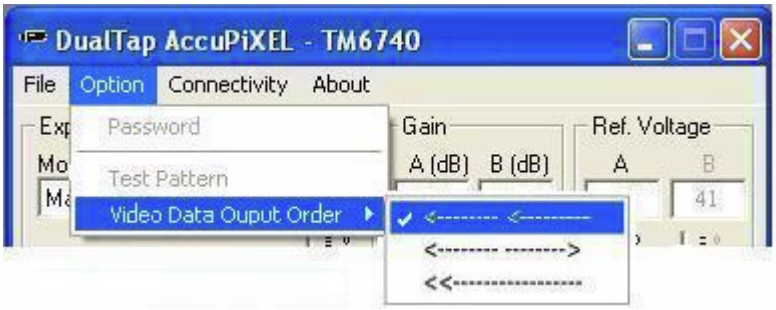
From the main menu, select “Option” and “Video Data Output Order” then choose “<--- <---” or “<--- - -->” or “<<------”

“<--- <---” = First video data are pixel no. 1 and no. 321.

“<--- --->” = First video data are pixel no. 1 and no. 640.

“<<------” = First video data are pixel no. 1 and no. 2.

Figure 27. Video output order



5.7 Main Menu “Connectivity”

Click on the “Connectivity” menu to view the buffer size. Some frame grabbers have a small buffer size and require a special communication algorithm. Use the “Receive Buffer Size” menu to set the buffer size. If you have trouble communicating with the camera, then select the “Receive buffer is small” option.

Figure 28. Buffer Size

5.8 Main Menu “About”

5.8.1.1 Camera Model

From the main menu, select “About” and click “Camera Model” to check the camera information. The details display in the information frame near the bottom of the window.

Figure 29. Camera Model

5.8.1.2 CPU Firmware Version

From the main menu, select “About” and click “CPU Firmware Version” to check the CPU firmware information.

Figure 30. CPU Firmware Version

5.8.1.3 About Control Software

From the main menu, select “About” and click “About Control Software” to check the software information.

Figure 31. Control Software Version

5.8.2 Exit

From the main menu, select “File,” and click “Exit” to exit the software.

6 Serial Communication Kit

6.1 RM-6740CL command list

The RM-6740CL camera can be controlled via RS-232 commands. The Start character is always ":" and the End character is always "cr" (return). For example, to set Asynchronous Pulse Width Mode, send the command "ASH=9<cr>" to the camera. The following table contains commands that can be used to control the camera.

Table 11 RM-6740CL Command List

Command	Parameters	End of Command	Ack Response	Description
Camera Control				
:VRA=	DDD	<cr>	:o<cr>	Set reference voltage for ch A (DDD = 000 - 1FF)
:VRB=	DDD	<cr>	:o<cr>	Set reference voltage for ch B (DDD = 000 - 1FF)
:MGA=	DDD	<cr>	:o<cr>	Set CDS gain for ch A (DDD = 042 - 1E8)
:MGB=	DDD	<cr>	:o<cr>	Set CDS gain for ch B (DDD = 042 - 1E8)
:VRA?	.	<cr>	:oVA[DDD]<cr>	Enquire reference voltage for ch A
:VRB?	.	<cr>	:oVB[DDD]<cr>	Enquire reference voltage for ch B
:MGA?	.	<cr>	:oGA[DDD]<cr>	Enquire CDS gain for ch A
:MGB?	.	<cr>	:oGB[DDD]<cr>	Enquire CDS gain for ch B
Test Pattern & Auto Balancing & Data Output Order				
:TPTN	N	<cr>	:o<cr>	Enable/Disable Test Pattern (N=1 Enable, N=0 Disable)
:EABL	.	<cr>	:o<cr>	Enable auto gain balance
:DABL	.	<cr>	:o<cr>	Disable auto gain balance
:ABL?	.	<cr>	:oAB[N]<cr>	Check if auto gain balance is enable (N=1 Enable, N=0 Disable)
:VDO	S	<cr>	:o<cr>	Video Data Output Order (s=A, B, C)
:DDP=	N	<cr>	:o<cr>	Set output data depth (N=0 8 bit, N=1 10 bit)
Shutter Control				
:MSH=	S	<cr>	:o<cr>	Set Manual Shutter (S= 0 - 9)
:DSH=	DDD	<cr>	:o<cr>	Set Direct Shutter (DDD=000 - XXX*)
:ASH=	S	<cr>	:o<cr>	Set Async Shutter (S= 0 - 9)
:SHR?	.	<cr>	:o[shtr]<cr>	Enquire current shutter mode and number
Lookup Table				
:GM45	.	<cr>	:o<cr>	Set gamma (.45) table
:LINR	.	<cr>	:o<cr>	Set linear table
:KNEE=	X1Y1X2Y2	<cr>	:o<cr>	Set knees (X1,Y1,X2,Y2 = 00 - FF)
:SLUT	N	<cr>	:o<cr>	Set positive knee or negative knee (0=positive, 1=negative)
:LUT?	.	<cr>	:o[lut]<cr>	Enquire current LUT setting

Command	Parameters	End of Command	Ack Response	Description
Memory Pages				
:WRPG	N	<cr>	:o<cr>	Write Page N (N = 0 - 6; Page 0 is factory setting and not allowed to change by customer)
:LDPG	N	<cr>	:o[settings]<cr>	Load Page N (N = 0 - 6)
:RDPG	N	<cr>	:o[settings]<cr>	Read (Report) Page N (N = 0 - 6)
:RPST	.	<cr>	:o[settings]<cr>	Report Current Overall Settings
Scan Mode				
:SMD	M	<cr>	:o<cr> S	et Mode (M = A,B,C,D)
:SMD?	.	<cr>	:oMD[mode]<cr>	Enquire current scan mode
:SMB=	N	<cr>	:o<cr>	Set Binning Mode (N=0~8)
Miscellaneous				
:CAM?	.	<cr>	[CamMode]	Enquire Camera Model
:VER?	.	<cr>	[version]	Enquire current version of firmware

*. Maximum size is equal to the maximum line number of each scan mode.

Note: If a command is not accepted for any reason, the camera will return a Nack response ":e<cr>".

Report Command : RPST<cr>

TS Return : 0 RR + "24 bytes" + <cr>

Table 12 18 Bytes Status Report

Byte 1, 2	MGA	.	Channel A Gain Control (H'042 - H'1E8)
Byte 3, 4	VRA	.	Channel A Offset Voltage (H'000 - H'1FF)
Byte 5, 6	MGB	.	Channel B Gain Control (H'042 - H'1E8)
Byte 7, 8	VRB	.	Channel B Offset Voltage (H'000 - H'1FF)
Byte 9	Function Flag 0		
	Bit 7	output pixel order 1	"00"=<-- "10"=<-- "01"=<--
	Bit 6	output pixel order 0	
	Bit 5	ScanMode5	"00" = horizontal no binning "10" = horizontal binning by 2 "01" = horizontal binning by 4
	Bit 4	ScanMode4	
	Bit 3	ScanMode3	"00" = vertical no binning "01" = vertical binning by 2 "10" = vertical binning by 4
	Bit 2	ScanMode2	
	Bit 1	ScanMode1	"00" = Scan area A "01"=Scan area B "10"=Scan area C "11"=Scan area D
	Bit 0	ScanMode0	
Byte 10	Function Flag 1		
	Bit 7	ShutterMode2	"000"=Manual Shutter "001"=Async Shutter "010"=Direct Shutter
	Bit 6	ShutterMode1	
	Bit 5	ShutterMode0	
	Bit 4	Output Data Depth 0=8 bit	0=8bit; 1=10bit

	Bit 3	ShutterSpeed3	“0000” - “1001” Shutter Speed 0 - 9
	Bit 2	ShutterSpeed2	
	Bit 1	ShutterSpeed1	
	Bit 0	ShutterSpeed0	
Byte 11	Function Flag 2		
	Bit 7	LUTSIGN	0=Positive LUT; 1=Negative LUT
	Bit 6		
	Bit 5		
	Bit 4		
	Bit 3		
	Bit 2	LUTTABLE2	“000”=Linear LUT “001”=Gamma.45 LUT “010”=Two Knee Table
	Bit 1	LUTTABLE1	
	Bit 0	LUTTABLE0	
Byte 12	Function Flag 3		
.	Bit 7	TESTPATTERN	0=Disable TP; 1=Enable TP
.	Bit 6	PASSWORD	0=Disable PW; 1=Enable PW
.	Bit 5		
.	Bit 4		
.	Bit 3		
.	Bit 2		
.	Bit 1		
.	Bit 0	AUTOBALANCING	0=Disable AB; 1=Enable AB
Byte 13			X1 (X1, Y1) Coordinate for Knee 1 Y1 (X1, Y1 = H’00 - H’FF)
Byte 14			
Byte 15			X2 (X2, Y2) Coordinate for Knee 1 Y2 (X2, Y2 = H’00 - H’FF)
Byte 16			
Byte 17	Reserved		
Byte 18	Reserved		
Byte 19	Reserved		
Byte 21, 22	Direct Shutter	.	H’000 - H’819
Byte 23, 24	Reserved	Total line number	H’040 - H’1F3

7 Troubleshooting

7.1 Problems and Solutions

Following are troubleshooting tips for common problems. In general, problems can easily be solved by following these instructions. If the following remedies fail to offer a solution to your problems, please contact a JAI Inc. representative.

7.1.1 Symptom: No Video

Remedies: Check that the following are properly connected and operational.

- Power supplies
- Power cables
- Main power source
- Shutter control
- Async mode
- Lens
- Digital output cable
- Analog video cable

7.1.2 Symptom: Dark Video

Remedies: Check that the following are properly connected and operational.

- Shutter selection
- Iris opening on the lens

7.1.3 Symptom: Non-Synchronized Video

Remedies: Check that the following are properly connected and operational.

- Proper mode output
- Framegrabber software camera selection

7.2 Information and Support Resources

For further information and support:

North American Technical Support

Phone: (408) 383-0300
Email: camerasupport.americas@jai.com

European Technical Support

Phone: +45 4457-8950
Email: camerasupport@jai.com

Japan/Asia Technical Support

Phone: +81 45 440 0154
Email: camerasupport@jai.com

Mail To: JAI, Inc.
ATTN: Video Applications
625 River Oaks Parkway
San Jose, CA 95134

8 Camera Specifications

8.1 Specifications

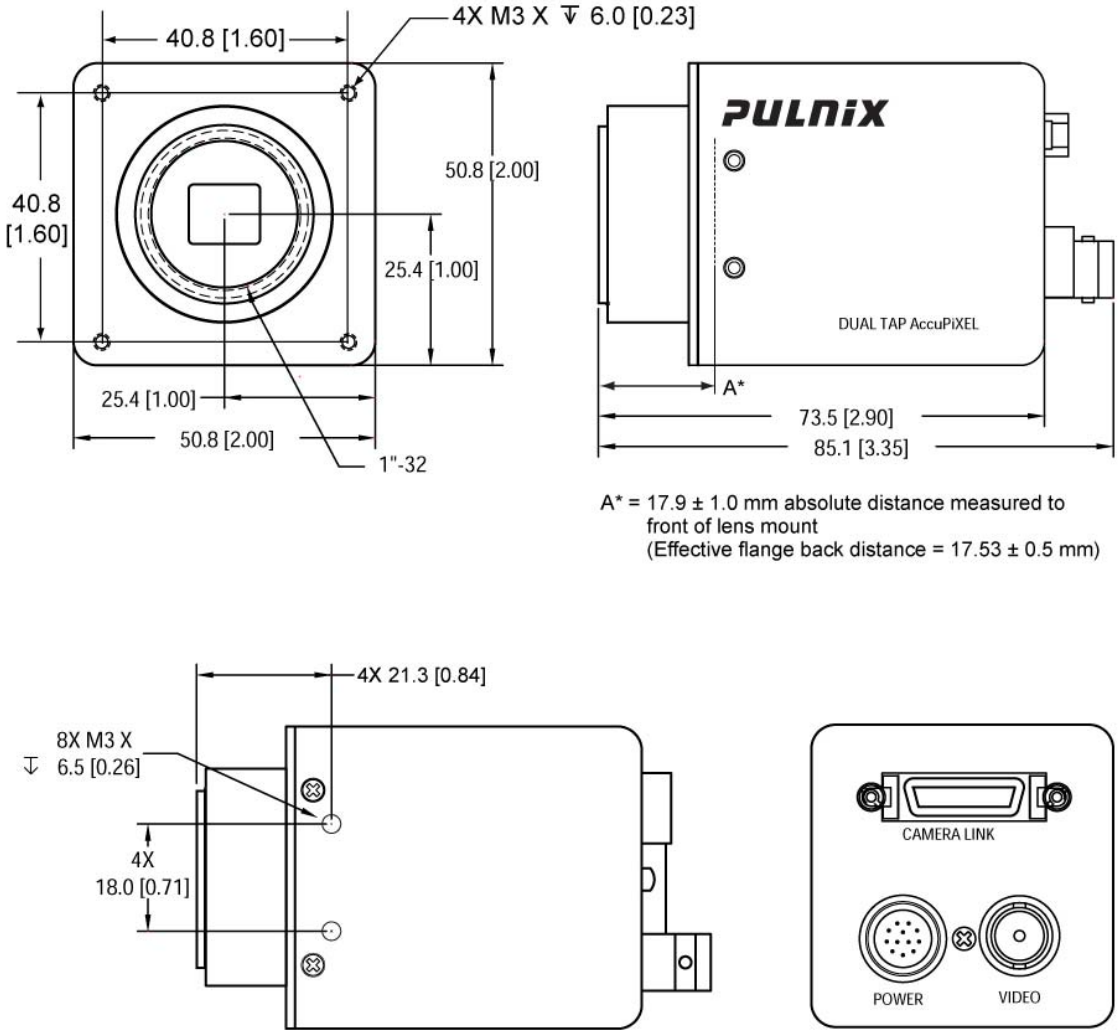
Table 13 RM-6740CL Camera Specifications Table

Feature	RM-6740CL
Imager	1/3" progressive scan interline transfer CCD (KAI-0340)
Active Area	4.74mm x 3.55mm
Active Pixels	640 (H) x 480 (V)
Cell Size	7.4µm x 7.4µm
Display Mode (Active Pixels)	640 (H) x 480 (V) @ 200 Hz (full image) 640 (H) x 160 (V) @ 540Hz (partial scan) 224 (H) x 480 (V) @ 500Hz (partial scan) 224 (H) x 160 (V) @ 1250Hz (partial scan) (1x2, 1x4, 2x1, 2x2, 2x4, 4x1, 4x2, 4x4 binning)
Sync	Internal/External auto switch HD/VD, 4.0 Vp-p impedance 4.7 K ohms VD=frame rates ±2%, non-interlace HD=horizontal frequency ±2%
Data Clock Output	40.00 MHz
Resolution	Digital:640 (H) x 480 (V), (Analog: over 480 TV lines (H) x 480 TV lines (V))
S/N Ratio	>50 dB
Min. Illumination Mono Color	1.4 lux, f=1.4 (no shutter) @ 200 fps 11.0 lux, f=1.4 (no shutter) @ 200 fps Sensitivity: 31µV/e-
Video Output	Analog: 714 mV, 75 ohms, (650 mV white clip) Digital output: 8-bit x 2 / 10-bit x 2 Camera Link
Gamma	Programmable LUT (1.0 std.)
Lens Mount	C-mount (use >1/3" format lenses or larger)
Power Requirement	12V DC, ± 10%, 270mA (typical at 25˚)
Operating Temp.	-10˚C to 50˚C*
Vibration	7 Grms (10Hz to 2000Hz) Random
Shock	70G, 11 ms, half-sine
Size (W x H x L)	50.8mm x 50.8mm x 85.1mm
Weight	162 grams, 5.7 oz (without tripod)
Optional Functions	OP 3-1, internal IR filter; OP 3-2, optical filter removal; OP 25-2, TTL signals on 12-pin connector; OP 21, glassless CCD imager; OP 21-QUV, UV CCD imager with quartz cover (mono models only)
Optional Accessories	
I/O CL cable	26CL-02-26 (2m), 26CL-05-26 (5m)
Power Cable	12P-02S
Power Supply	PD-12UUP series (includes power connector)
Tripod Mounting Kit	TP-20

*. Refer to Section 2.2.1 for information on camera heat dissipation. Image quality will degrade with increasing temperature.

8.1.1 RM-6740CL Physical Dimensions

Figure 32. FIGURE 8. Physical Dimensions



Caution: When mounting the camera to any fixture, do not use screws that extend more than 5 mm into the camera housing to avoid possible damage to the internal circuitry. For attaching the tripod mounting plate, only the supplied screws should be used.

8.1.2 Spectral Response

Figure 33. Monochrome Spectral Response

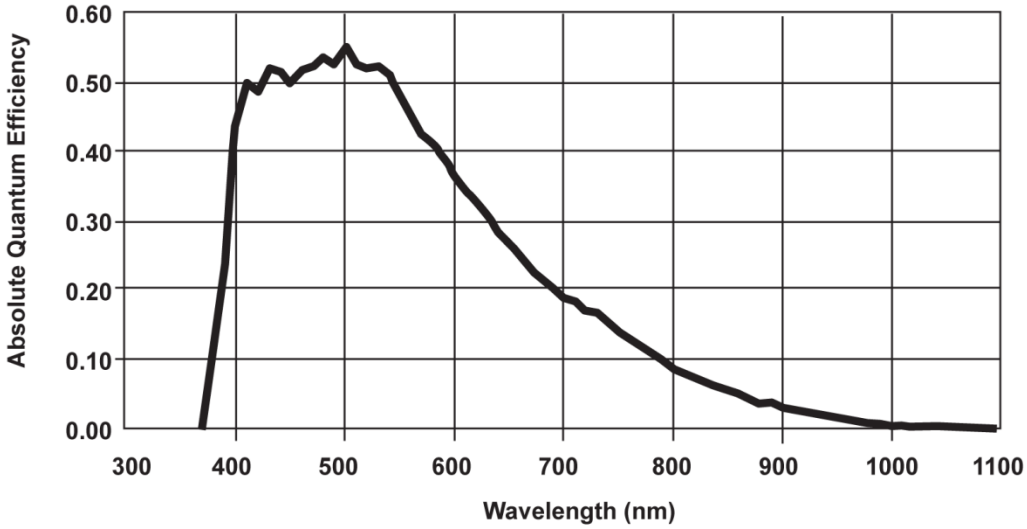
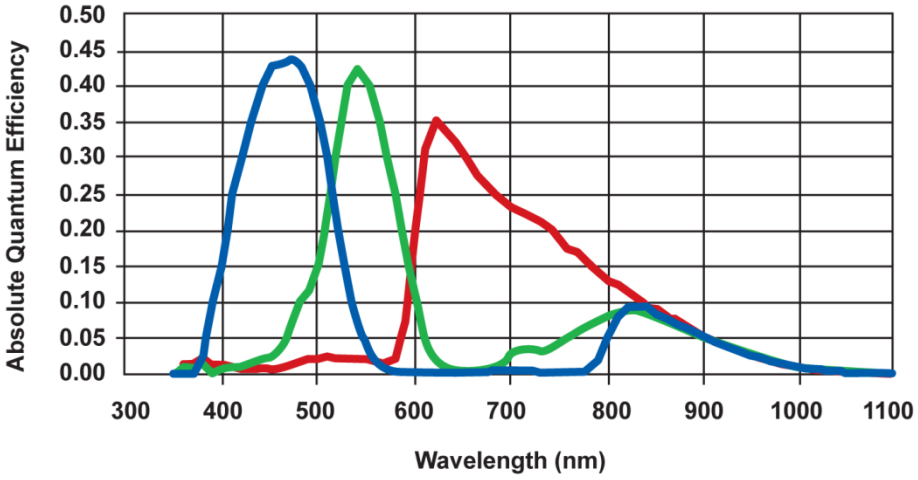


Figure 34. Color Spectral Response



Supplement

This applies to cameras in this manual that are RoHS compliant,which are noted by RM or RMC.

The following statement is related to the regulation on " Measures for the Administration of the control of Pollution by Electronic Information Products " , known as " China RoHS ". The table shows contained Hazardous Substances in this camera.

mark shows that the environment-friendly use period of contained Hazardous Substances is 15 years.

重要注意事项

有毒，有害物质或元素名称及含量表

根据中华人民共和国信息产业部『电子信息产品污染控制管理办法』，本产品《 有毒，有害物质或元素名称及含量表 》如下.

部件名称	有毒有害物质或元素					
	铅（Pb）	汞（Hg）	镉（Cd）	六价铬（Cr(Ⅵ)）	多溴联苯（PPB）	多溴二苯醚（PBDE）
外壳	×	○	○	○	○	○
光学滤色镜	×	○	×	○	○	○
…….	…….	…….	…….	…….	…….	…….

○：表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006规定的限量要求以下。
×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006规定的限量要求。
（企业可在此处、根据实际情况对上表中打“×”的技术原因进行进一步说明。）

环保使用期限

电子信息产品中含有的有毒有害物质或元素在正常使用的条件下不会发生外泄或突变、电子信息产品用户使用该电子信息产品不会对环境造成严重污染或对基人身、财产造成严重损害的期限。

数字「15」为期限15年。

Europe, Middle East & Africa
Phone +45 4457 8888
Fax +45 4491 3252

Asia Pacific
Phone +81 45 440 0154
Fax +81 45 440 0166

Americas
Phone (Toll-Free) 1 800 445-5444
Phone +1 408 383-0301

See the possibilities