

# PULNiX TM-6710

Progressive Scan High-Speed Shutter Camera

## Applications

- Motion analysis
- High-speed on-line inspection
- Gauging
- Character reading
- High-definition graphics
- Fast speed surveillance

## General Description

The PULNiX TM-6710 is a high-resolution monochrome camera with non-interlace quad speed scanning, 120 Hz format and partial scanning (200 and 100 lines) capabilities.

The signal is analog progressive scanning (484 lines). The full frame electronic shutter with asynchronous reset permits shutter speeds to 1/32,000 sec. The shutter function works in all scanning modes. Square pixels provide excellent image definition in all orientations.

Optional features include AGC enable, internal IR cut filter, gamma adjust to 0.45, and remoted imagers.

## LVDS Communication

A key feature of the TM-6710 is LVDS (Low Voltage Differential Signaling) communication. Due to the low voltage swing, this state-of-the-art technology reduces the amount of noise at high data transmission rates. Because the TM-6710 scans at a very fast 120 Hz, LVDS communication is essential in order to successfully transfer images.

## Asynchronous Reset

The TM-6710's asynchronous reset is flexible and takes external horizontal drive (HD) for phase locking (External HD=HD Output/2). When VINIT pulse is applied, it resets the camera's scanning and purges the CCD.

Three modes control the asynchronous reset and shutter speed. With Async shutter mode and external VINIT high (5V), the async mode is automatically selected and the signal readout is inhibited until the trigger pulse occurs. Without VINIT trigger, the output is black video.

1. External VINIT with controlled pulse width. The duration between pulse edges (5 volt TTL level) controls the shutter speed and integration period externally.

2. Internal shutter speed with Fast mode. The video signal capturing has no delay from the reset timing if the falling edges of VINIT and external HD are the same.



## Product Features

- High resolution 1/2" progressive scanning interline transfer CCD imager 648(H) x 484(V)
- Quad speed progressive scan - 120 Hz at full resolution or (partial scan at up to 300 Hz)
- 120 Hz, 60 Hz switchable
- Full frame shutter, 1/60 to 1/32,000 sec.
- Asynchronous reset with external shutter control
- 8-bit x 2 (or 8-bit x 1) RS-644 digital output and 120 Hz analog output
- RS-232 (or RS-644) Control for gain, A/D ref., shutter and mode selection with Win98/NT/2000/XP compatible software
- AGC on/off, gamma 1.0 or 0.45 (AGC off, gamma 1.0 standard)
- On chip micro-lens and low smear at fast shutter

---

Otherwise, there is a maximum HD delay before vertical scan resets.

3. Internal shutter speed with Slow mode. The shutter speed control can be selected from 1/250 to 1/2,000 sec. Since the exposure period is longer than the frame period, the data transfer is delayed to accommodate exposure.

## Integration

The CCD imager of the TM-6710 can be exposed longer than normal TV timing (1/60 sec.). This feature provides high sensitivity for dark-environment applications. Integration is achieved by controlling the pulse width of VINIT input up to a few seconds. The progressive scanning CCD chip in the TM-6710 produces a full frame of resolution, using a frame grabber to capture the one frame of integrated image in non-interlace format.

## Electronic Shutter

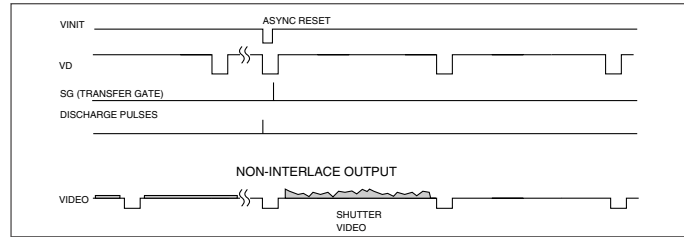
The TM-6710 has a substrate drain-type shutter mechanism which produces a superb picture at various speeds without smearing. The built-in manual shutter speed control selects the electronic shutter rate of 1/125, 1/250, 1/500, 1/1,000, 1/2,000, 1/4,000, 1/8,000, 1/16,000, or 1/32,000 sec. All shutter speeds are applied to partial scan, except slow speed at partial scanning. Progressive scanning allows a full 484 lines of vertical resolution per single shutter, unlike a conventional CCD camera at only 244 lines per shutter.

## Partial Scanning

By setting the mode switch on the back plate or sending the RS-232 command, the TM-6710 can have partial scanning of 200 and 100 lines (full resolution at narrower field of view and faster frame rate).

### Switch selection

Normal mode: F UP 120 Hz/60 Hz progressive scan  
 200 line scan: F DWN 236 Hz progressive scan  
 100 line scan: E UP 300 Hz progressive scan



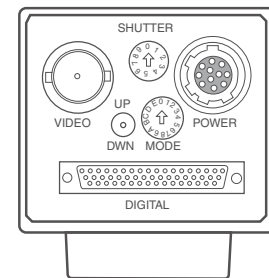
### Shutter Control Switch

Manual Shutter	Async Reset
0 no shutter 1/120	normal 1/120
1 1/250 128H	1H 1/32,000
2 1/500 64H	2H 1/16,000
3 1/1,000 32H	3H 1/12,000
4 1/2,000 16H	4H 1/8,000
5 1/4,000 8H	8H 1/4,000
6 1/8,000 4H	16H 1/2,000
7 1/12,000 3H	32H 1/1,000
8 1/16,000 2H	64H 1/500
9 1/32,000 1H	Shutter determined by pulse width (P.W.C.)

Async Reset Mode: Mode 0: normal mode; Mode 1-4: fast mode; Mode 5-8: slow mode; Mode 9: pulse width mode. At modes 1-9 the camera is at standby only, black video is output. One frame image will be output upon receiving an async reset pulse.

## Mode Control Switches

Mode Control Switch	Up/Down Switch
0 Normal mode	
1 Gain control (A/B) up/down - increase/decrease gain of Ch. A & Ch. B	
2 Gain (A/B) fine tune up/down - increase/decrease gain of Ch. A, while decrease/increase gain of Ch. B, at 5:1 ratio	
3 ChA Vref control up/down - increase/decrease A/D voltage reference of Ch. A	
4 ChB Vref control up/down - increase/decrease A/D voltage reference of Ch. B	
5 Gain selection up: 9dB down: 12dB	
6 Gain selection up: 18dB down: 22dB	
7 Clock selection up: 120Hz down: 60Hz	
8 Async / Manual shutter up: Manual down: Async	
9 Factory set recall up/down: recall only	
A Power up (recall or save) up: recall down: save	
B-C User page storage up: recall down: save (store user settings)	
D Direct Shutter up/down - increase/decrease manual shutter speed	
E Partial scan up: 100 lines down: Not Used	
F Partial scan up: normal scan down: 200 lines	



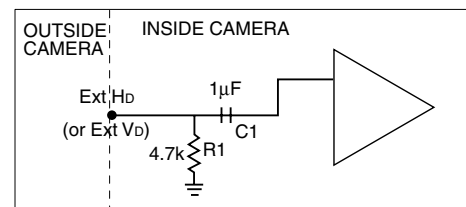
Rear Panel

## External Synchronization

The TM-6710 can accept external HD and VD for phase locking. The internal PLL will accept external HD and lock with the CCD's horizontal drive (HD). The CCD HD frequency is half of the analog video output HD.

Example: Ext. HD = 30.49 kHz; VD will be 120 Hz and Master Clock will be 50.90 mHz.

The internal sync generator will accept external VD to generate internal VD. The external VD frequency should be ±5% of the frame rate.



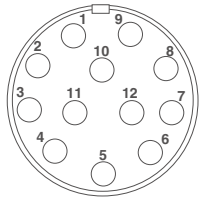
External Sync Input Schematic

$$\text{Ext. Hd} = \frac{\text{Analog Hsync Frequency}}{2}$$

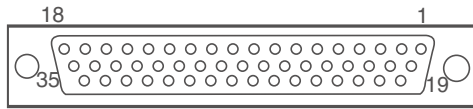
## Pin Configuration

### 12-Pin Connector

1	GND (power)	7	VD in
2	+12V	8	N/C
3	GND (analog)	9	HD in
4	Video out	10	RXD
5	GND (digital)	11	INTEG
6	VINIT in	12	TXD



12-Pin Connector



51-Pin Connector

### 51-Pin Connector

Pin#	Description	Pin#	Description	Pin#	Description
1	AO+	18	CLK+	35	CLK-
2	BO+	19	A0-	36	GND
3	A1+	20	B0-	37	VCC
4	B1+	21	A1-	38	VCC
5	A2+	22	B1-	39	EXT. HD
6	B2+	23	A2-	40	TXAO
7	A3+	24	B2-	41	LPULSE
8	B3+	25	A3-	42	RXAO
9	A4+	26	B3-	43	VINIT
10	B4+	27	A4-	44	INTEG
11	A5+	28	B4-	45	EXP+
12	B5+	29	A5-	46	EXP+
13	A6+	30	B5-	47	LDV-
14	B6+	31	A6-	48	LDV+
15	A7+	32	B6-	49	FDV-
16	B7+	33	A7-	50	FDV+
17	GND	34	B7-	51	GND

Note: CLK: data clock, LDV: Line data valid, FDV: Frame or field data valid, ENINT: Integration enable, LPULSE: Last pulse. (Note: The "B" channel is used for single-channel option). Output is RS-644 standard.

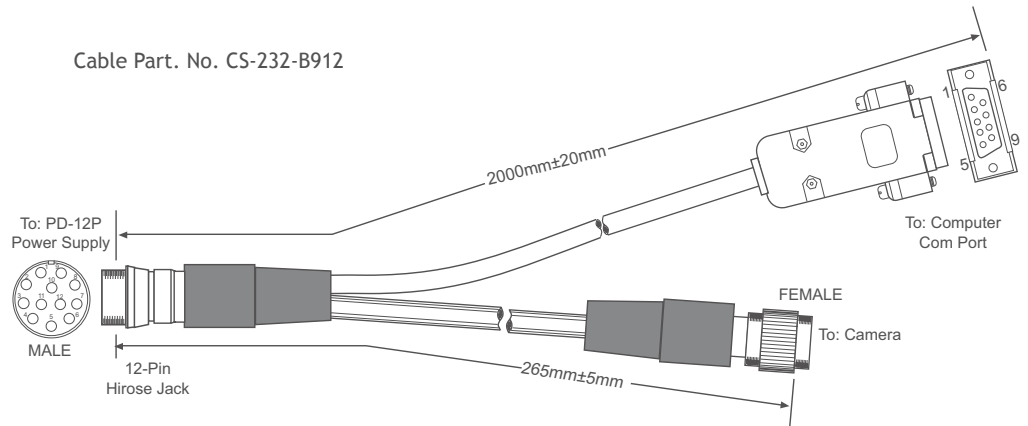
## Specifications

The TM-6710 mode selection can be accomplished remotely via RS-232C/RS-485 control (RS-485 communication control is available as an option). Windows 98, NT, 2000, XP control software, available from PULNiX, can be used for both RS-232 and RS-485 communications.

### 12-Pin Male Connector

Pin#	Description
1	GND
2	+12V
3	GND
4	Video Out
5	GND
6	VINIT
7	VD In
8	N/C
9	HD In
10	N/C
11	INTEG
12	N/C

Cable Part. No. CS-232-B912

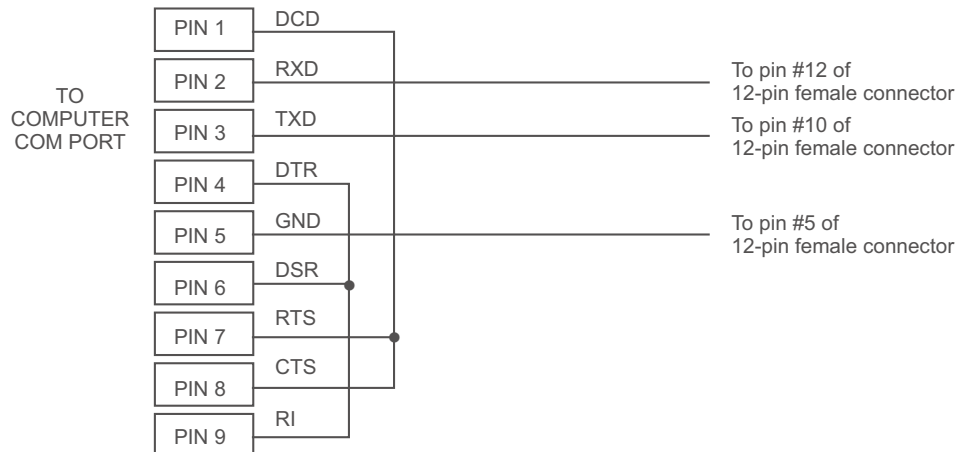


### 12-Pin Female Connector

Pin#	Description
1	GND
2	+12V
3	GND
4	Video Out
5	GND
6	VINIT
7	VD In
8	N/C
9	HD In
10	RXD
11	INTEG
12	TXD

### D-Sub 9-pin Connector

(ITEM 15-1007)

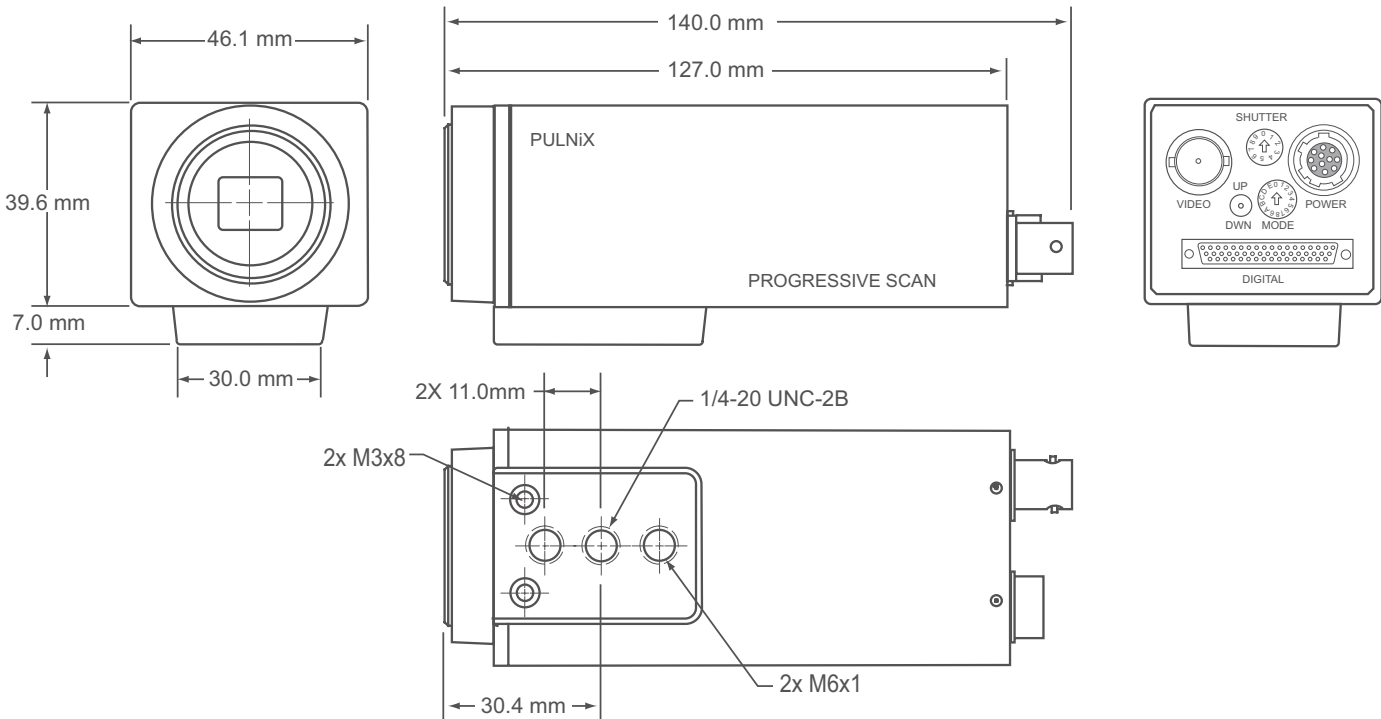


## SPECIFICATIONS

Imager	1/2" progressive scan interline transfer CCD
Active Area	5.8mm x 4.3mm
Active Pixel	648 (H) x 484 (V)
Cell Size	9.0 μm x 9.0 μm
Scan Modes (Active Pixels)	648 (H) x 484 (V) @ 120 Hz/60 Hz 648 (H) x 200 lines @ 236 Hz 648 (H) x 100 lines @ 300 Hz
Sync	HD= 30.49KHz ±5% (at 50.980MHz) Vertical async. reset. or VD=120Hz±5% HD=23.97KHz±5% (at 40.00MHz - optional) Vertical async. reset. or VD=96Hz±5% (opt.)
Data Clock Output	25.49 MHz (50.98MHz analog) or 20.03 MHz (40.06MHz analog)
TV Resolution	Analog: 500 pixels (H) x 484 lines (V)
S/N Ratio	45dB min. (AGC = off)
Min. Illumination	4 lux at normal speed (120 frame/sec)
Video Output	Analog: 1.0 Vp-p composite , 75Ω non-interlace Digital: Camera Link

AGC	OFF (AGC ON is a factory option)
Gamma	1.0 (Gamma 0.45 is a factory option)
Lens Mount	C-mount
Power Req.	12V DC, 700 mA
Operating Temp.	-10 °C to 50 °C
Vibration	7 Grms (10Hz x 2000Hz)
Shock	70G
Size (W x H x L)	46.1mm x 39.6mm x 140.0mm (1.81" x 1.56" x 5.51")
Weight	260 gr (9.2 oz)

MUST BE ORDERED SEPARATELY	
Optional Functions	AGC ON, Gamma 0.45
Optional Accessories	
Power Cable	12P-02S
Power Supply	PD-12UUP series
Digital Cable	50 DG-02
Camera Link Cable	26CL-02-26



Covered by patent #6259478B1

**JAI A-S, Denmark**  
Phone +45 4457 8888  
www.jai.com

**JAI UK Ltd., England**  
Phone: +44 189 582 1481  
www.jai.com

**JAI Corporation, Japan**  
Phone: +81 045 440 0154  
www.jai-corp.co.jp

**JAI PULNIX, Germany**  
Phone +49-(0) 60 55-93 79-10  
www.jaipulnix.com

**JAI PULNIX Inc., USA**  
1330 Orleans Drive  
Sunnyvale  
CA 94089  
USA

Phone +1 408-747-0300  
(toll-free) 1 800 445 5444  
Fax +1 408 747 0660  
www.jaipulnix.com