



### General Description

The PULNiX TM-1010 is a very high resolution monochrome progressive scan camera with many features. The interline transfer CCD imager has a square imager format (1") with symmetrical pixels, resulting in consistent image definition in any orientation. The electronic shutter, which has speeds selectable to 1/16,000 sec., asynchronously resets by external pulse control. The TM-1010 has its own built-in frame store which can capture and output full-frame images in real time.

Specifically designed for low noise and high resolution image capturing, the single channel output produces outstanding shutter and integration characteristics. The scanning clock rate is adjustable to optimize noise relative to scanning speed.

This versatile camera is particularly easy to set up and use. Externally controlled gain and dynamic range adjustments offer added convenience when varying the imaging parameters of the CCD. All functions are remotely controllable via RS-232C communication. Special interface cables are available for connecting the TM-1010 directly to many existing commercial frame grabbers. 10-bit, RS-644 (LVDS) digital signal output permits interfacing with external image processing systems.

Applications for the TM-1010 include medical and scientific imaging, high definition graphics, on-line inspection, gauging, character reading, archiving, and long range image acquisition.

### Asynchronous Reset

The TM-1010's asynchronous reset is flexible and takes external horizontal drive (HD) for phase locking. CCD scanning and purging is reset by applying the VINIT pulse. There are three modes to control the asynchronous reset and shutter speed:

- 1. External VINIT with pulse width.** The duration between pulse edges controls the shutter speed (1/16,000 to 4 sec.).
- 2. Internal shutter speed with Fast mode.** The video signal has no delay from the reset timing. The shutter speed range is 1/2,000 to 1/16,000 sec.
- 3. Internal shutter speed with Slow mode.** The speed control can be varied from 1/125 to 1/1,000 sec., with a standard output of 15 fps. The video signal starts with internal V reset timing related to shutter speed. The built-in frame memory maintains the asynchronously captured full frame image until the next VINIT pulse comes in.

### Product Features

- Very high resolution 1" progressive scan interline transfer CCD imager (1024H x 1024V)
- 10-bit digital output for progressive scan (RS-644)
- 15 frame/sec. at 20 MHz clock speed, or selectable at 10 MHz or 5 MHz clock speed
- Full-frame shutter ...1/60 to 1/16,000 sec.
- Asynchronous reset with external shutter control
- Frame memory built-in for async image capture
- Full frame integration with uninterrupted video
- Excellent S/N (>60 dB at CDS)
- RS-232C external control for gain, A/D reference, dynamic range control

### Integration

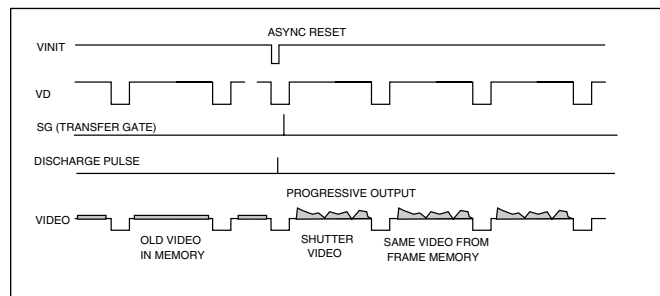
The CCD imager of the TM-1010 can be exposed longer than normal scan timing (1/15 sec.). Integration is achieved by controlling the #11 pin of the 12-pin connector to Low (GND) or by using VINIT pulse width control up to 10 sec. This integration feature provides high sensitivity for dark environment applications.

The internal frame memory provides continuous video output without interruption during the integration period. The progressive scanning CCD chip permits a full frame of resolution in non-interlace format. Designed for low noise, the integration mode and the slower clock scanning with 10-bit output make this camera suitable for a variety of applications.

### Electronic Shutter

The TM-1010 has a substrate drain shutter which allows a superb picture at various speeds without a smearing effect. Electronic shutter speeds of 1/60, 1/125, 1/250, 1/500, 1/1,000, 1/2,000, 1/4,000, 1/8,000, or 1/16,000 second are selectable via the built-in manual speed control.

With VINIT high (5V), the CCD keeps discharging. With a negative going pulse to VINIT, the camera resets and purges the charge momentarily. Then it starts integrating for the period set by either external pulse width or internal shutter control. Unlike conventional CCD cameras which allow only half lines per shutter, progressive scanning produces a full 1000 lines of vertical resolution per single shutter.



## Specifications

<b>Imager</b>	1" ( 9.1mm x 9.2mm ) progressive scanning interline transfer CCD
<b>Pixel</b>	1024 (H) x 1024 (V)
<b>Cell size</b>	9.0 μm x 9.0 μm
<b>Scanning</b>	1050 lines; 15 Hz
<b>Sync</b>	Internal/external auto switch HD/VD, 4.0 Vp-p impedance 4.7KΩ VD=15 Hz ±5%, non-interlace HD=15.734 kHz±3%
<b>Data clock output</b>	20.034 MHz (std), 10 and 5 MHz selectable
<b>Resolution</b>	Digital: 1008 (H) x 1018 (V)
<b>S/N ratio</b>	60dB at CDS
<b>Min. illumination</b>	1.0 lux, f=1.4 without IR cut filter (no shutter). Sensitivity: 10μV/e-
<b>Video output</b>	Digital 10-bit RS-644 output Analog 1.0 Vp-p composite video, 75Ω
<b>AGC</b>	OFF
<b>Gamma</b>	1.0
<b>Lens mount</b>	C-mount
<b>Power req.</b>	12V DC, 700 mA
<b>Operating temp.</b>	-10°C to 50°C
<b>Vibration &amp; shock</b>	Vibration: 7Grms (10 to 2000 Hz), Shock: 70G
<b>Size (W x H x L)</b>	51.2mm x 67.4mm x 151.2 mm (2.02" x 2.65" x 5.95")
<b>Weight</b>	463g w/o tripod mount (tripod mount is 60g)
<b>Auto iris connector</b>	None
<b>Functional options</b>	TBD
<b>Accessories</b>	DC-31 31-pin mating connector; 30DG-02-40 digital cable, CS-232 RS-232 cable & software
<b>Power cable</b>	12P-02S
<b>Power supply</b>	K25-12V or PD-12UE, PD-12UU, PD-12UUP, PD-12UEP

## Pin Configurations

### 31-Pin connector (MP211-031-113-4300)

Pin#	Description	I/O	Pin#	Description	I/O
1	CLK+	Out	17	CLK-	Out
2	LDV+	Out	18	LDV-	Out
3	FDV+	Out	19	FDV-	Out
4	GND		20	VINIT	In
5	EXT HD	In	21	INTEG	In
6	D0+	Out	22	D0-	Out
7	D1+	Out	23	D1-	Out
8	D2+	Out	24	D2-	Out
9	D3+	Out	25	D3-	Out
10	D4+	Out	26	D4-	Out
11	D5+	Out	27	D5-	Out
12	D6+	Out	28	D6-	Out
13	D7+	Out	29	D7-	Out
14	D8+	Out	30	D8-	Out
15	D9+	Out	31	D9-	Out
16	GND	Shield			

**Note:** CLK: data clock, LDV: Line data valid, FDV: Frame data valid, VINIT: async trigger, INTEG: integration control

### 6-Pin Connector RS-232C Communication

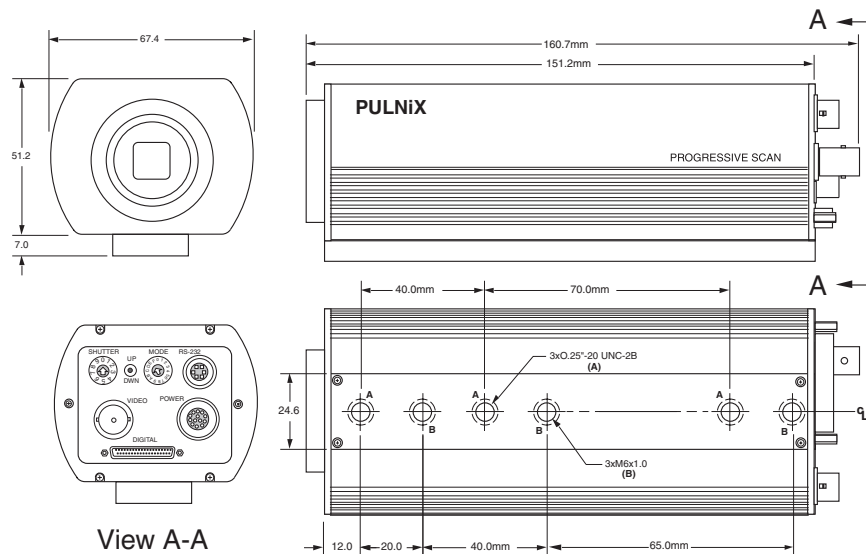
- 1 RXD
- 2 TXD
- 3 RTS
- 4 GND
- 5 GND
- 6 GND

Control and report functions

### 12-Pin Connector

- |         |             |
|---------|-------------|
| 1 GND   | 7 VD in     |
| 2 +12V  | 8 GND       |
| 3 GND   | 9 HD in     |
| 4 Video | 10 GND      |
| 5 GND   | 11 Int.cont |
| 6 VINIT | 12 GND      |

## Dimensions



### Mode control switch

- |     |   |                         |
|-----|---|-------------------------|
| 0   | Normal mode                             |                         |
| 1   | Gain control                            | up/down                 |
| 2   | Async/man shutter                       | up:manual,dwn:async     |
| 3-4 | Gain selection                          | up/down                 |
|     | (9dB - 28 dB)                           |                         |
| 5   | Clock selection                         | up/down                 |
|     | (20, 10, 5 MHz)                         |                         |
| 6   | A/D ref low                             | up/down                 |
| 7   | A/D ref high                            | up/down                 |
| 8   | Freeze (ENINT) enable                   | up:real time,dwn:freeze |
| 9   | Factory set recall                      |                         |
| A-F | User page storage (store user settings) |                         |

### Shutter Control Switch

	Manual	Async
0	no shutter	no shutter
1	1/60	1/16,000
2	1/125	1/8,000
3	1/250	1/4,000
4	1/500	1/2,000
5	1/1,000	1/1,000
6	1/2,000	1/500
7	1/4,000	1/250
8	1/8,000	1/125
9	1/16,000	Ext. pulse width

Covered by patent #6259478B1

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FILE #4312



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TM-1010

71-0018 Rev C