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# TM-5LC

## Super Miniature Cylindrical CCD Camera

## Operation Manual




January 31, 2000

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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 is likely to 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.**

TM-5LC Operation Manual
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# TM-5LC Super-Miniature Cylindrical CCD Camera

## Operation Manual

# 1 INTRODUCTION

## 1.1 Product Description

The PULNiX TM-5LC is a miniature monochrome shutter camera with automatic electronic exposure control. Designed for self-contained miniature camera applications, the TM-5LC provides a robust and low-cost solution for replacing remote-head cameras. The TM-5LC has a built-in automatic shutter (electronic iris or electronic exposure control) to provide a wide dynamic range. The camera is designed for custom optics, and various types of lens mounts are available as an option. The TM-5LC is ideal for OEM applications, covert operation, robot vision, helmet cameras, pipe inspection, underwater cameras, microscopy, military applications, etc.

## 1.2 Features

- Electronic Shutter

  The TM-5LC has a built-in automatic shutter control (electronic iris or electronic exposure control) that varies from 1/60 sec to 1/10,000 sec, to provide a good image in illumination less than 0.5 lux to full daylight conditions.

- Miniaturized and Lightweight

  PULNiX designs all of its cameras using solid-state technology. This has enabled a high degree of miniaturization of housing and cables. The TM-5LC is comparable in size to a camera remote head and does not require an external control module. In addition, the availability of special mini Tamron lenses makes it possible to produce a compact, lightweight, robust and highly customized camera for a variety of specialized uses.

- High Sensitivity

  The TM-5LC series is one of the most low-light sensitive 1/4” CCD cameras available today. This is especially important when using the faster shutter speeds. The CCD detects images into the near

infrared. It requires only 1.0 lux of minimum illumination and 0.5 lux minimum illumination at maximum gain. In general, such a low light camera allows use of a higher lens F-value and provides greater depth of field and sharper images.

- High Resistance To Image Burning

  Since the CCD is highly resistant to image burning, the camera may be exposed to bright objects for a long period of time. It must be noted, however, that a “smear” phenomenon may occur when shooting a very bright object. An infrared cutoff filter is recommended to obtain a clear picture.

- High Resistance To Magnetic Field and Vibration/Mechanical Shock

  Due to its robust design, the CCD imager can withstand strong vibration and shock, and little or no noise will appear in the picture. Since the TM-5LC camera is not influenced by a magnetic field, it will produce stable images even when placed next to objects such as electronic furnaces, welding machines, or NMR scanners.

- Low Power Consumption

  Typical power consumption is only 1.5W. This makes the camera excellent for use with battery-operated systems.

- Optics

  The TM-5LC camera is designed for custom optics in OEM applications. The TM-5LC cylindrical enclosure has M14x0.5 threads that are compatible with Tamron lenses. Additionally, a C/CS-mount lens can be used with the optional adapter (part number 32-3663).

- Three-Year Warranty

  The CCD solid state image sensor allows the camera to maintain a superior performance level indefinitely while requiring virtually no maintenance. PULNiX backs all of the TM-Series cameras with a three-year warranty.

  **Warning: Opening the camera in any way will void this warranty.**

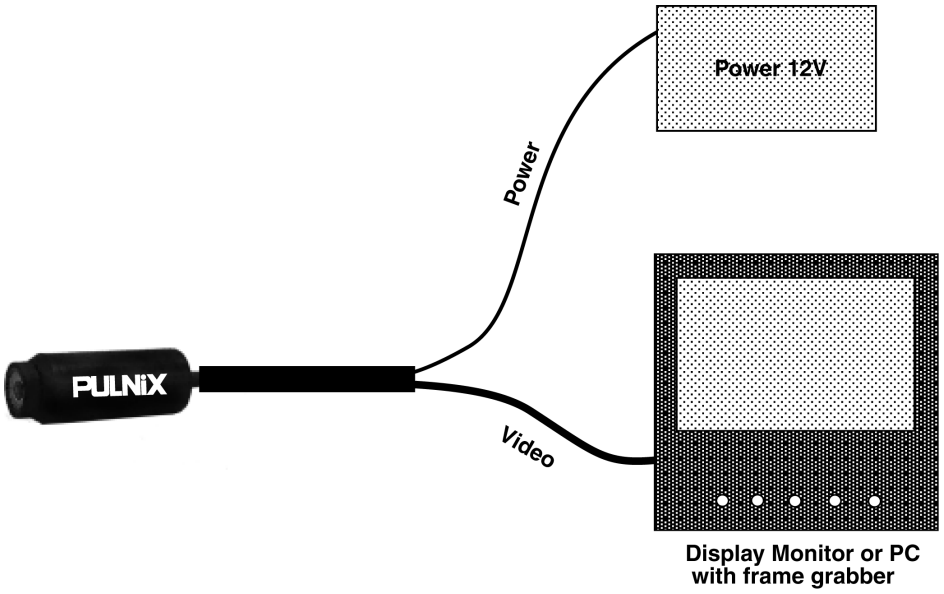
## 1.3 Functional Options

- AGC Off (On std.)
- Gamma 0.45 (1.0 std.)

## 1.4 TM-5LC System Configuration

Figure 1 (below) presents a typical system configuration in which a display monitor or a computer with grabber board is used.

**FIGURE 1.** **TM-5LC System Configuration**



# 2 INSTALLATION

The following instructions are provided to help you to set up your video camera system quickly and easily. It is suggested that you read through these instructions prior to unpacking and setting up your camera system.

## 2.1 Getting Started

### 2.1.1 Unpacking Instructions

It is recommended that the original packing cartons for the cameras and lenses be saved in case there is a need to return or exchange an item.

It is also recommended that any equipment being sent to another location for field installation be bench-tested 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 (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 PULNiX representative immediately.

- TM-5LC camera
- TM-5LC data sheet
- TM-5LC operation manual

### 2.1.3 Accessories

Following is a list of additional accessories or equipment that may be recommended or required for your particular application. Please check with your PULNiX representative prior to the installation of your video system to determine your exact needs.

- C/CS Mount adapter (part number 32-3663)
- M14X0.5 Tamron lens (model number 13F033 or 13F038)
- Power Supply

## 2.2 Camera Setup

### 2.2.1 Power Cable

The TM-5LC has a power cable with color-coded flying leads attached to the back of the camera (see Figure 3 in Appendix). The lead functions are as follows:

| Lead Color | Function |
|---|---|
| Yellow | +12V DC |
| Gray | GND |
| White Coax | Video Out |
| Black | GND |

### 2.2.2 Power Supply and Power Cable Setup

#### 2.2.2 (a) Power Supplies

PULNiX recommends the following power supplies:

| | | |
|---|---|---|
| K25-12 | 110V AC/12V DC | 2.1A power supply |
| P-15-12 | 220V AC/12V DC | 2.1A power supply |
| K50-12 | 110V AC/12V DC | 4.2A power supply |
| PD-12 | 110V AC/12V DC | 0.5A power supply |
| PD-12U | 90-220 AC/12V DC | 1.2A power supply |

#### 2.2.2 (b) PD-12 Power Supply

When wiring the PD-12 power supply 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.

#### 2.2.2 (c) “K” Series Power Supplies

The following procedure should be implemented to connect a “K” series power suply to the TM-5LC camera:

1. Attach the 110V line cord to the two terminals marked “AC”. Do not plug the cord into a 110V AC socket until later in the procedure.
2. Attach the gray and yellow leads of the power cable to the ground and 12V DC terminals, respectively. Be sure to replace the plastic terminal guard on the power supply at this time.

**Note:** The “K” series power supplies are designed primarily for OEM users who will be mounting the power supply inside a protective enclosure. For use in exposed situations, the PD-12 and PD-12U are recommended.

### 2.2.3 Attaching the Camera Lens

The TM-5LC camera accepts a specialized miniature 1/4" format size Tamron lens mount. To attach the Tamron lens 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.

### 2.2.4 Attaching the C/CS-Mount Adapter and Lens

An optional C/CS-mount adapter (part number 32-3663) can be used with the TM-5LC. Any C/CS-mount lens can be used on the TM-5LC with this adapter. In order to determine the position of the lens and the adapter, the following procedure should be implemented:

1. Attach the lens to the adapter.
2. Loosen the set screws on the adapter and slide it over the camera body.
3. Set the lens focus to infinity and point the camera at a distant object.
4. Slide the adapter up/down until the image is in focus.
5. Tighten the three set screws on the adapter.

### 2.2.5 Auto-Iris Lens Setup

The TM-5LC camera does not come equipped with auto-iris output. It is possible to use an auto-iris lens with full video input with the TM-5LC. The following procedure should be followed to connect an auto-iris lens to the TM-5LC.

1. Power down the camera before installing the auto-iris lens.

**Note:** Make sure that the power is removed from the camera before connecting or disconnecting the auto-iris lens. There is a small chance that damage could occur to the auto-iris lens by plugging or unplugging it while the camera is powered up.

2. Wire the video signal lead on the lens into the terminal 1 V peak to peak video output on the camera.
3. Point the camera at a light area and then quickly towards a dark area. If everything is working properly, the iris should adjust for light change.

### 2.2.6 Monitor Display Mode

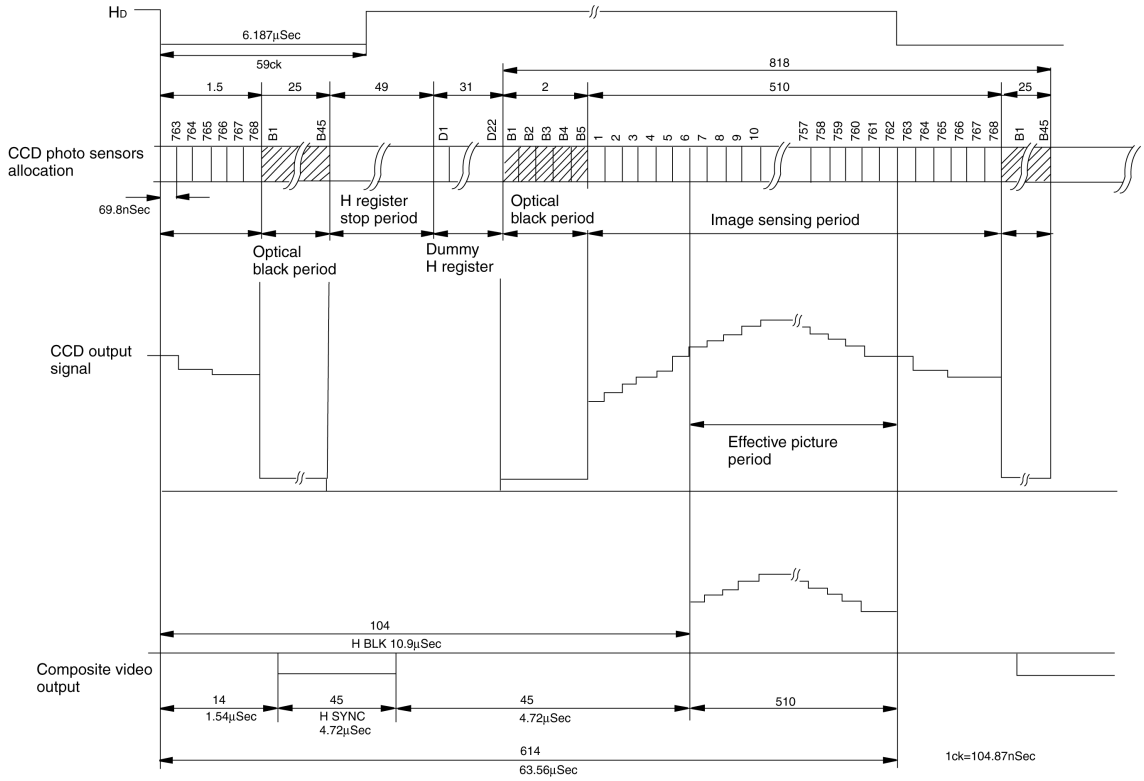
For monitoring real time video, connect the video output to an RS-170 video monitor or other device, as shown in Figure 1.

# 3 OPERATION

## 3.1 Modes of Operation

### 3.1.1 Timing

**FIGURE 2.** **TM-5LC Timing Chart**



# 4 TROUBLESHOOTING

## 4.1 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 PULNiX representative.

### 4.1.1 Symptom: No Video

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

- Power supplies
- Main power source
- Lens

### 4.1.2 Symptom: Dark Video

Remedy: Check that the iris opening on the lens is properly connected and operational.

### 4.1.3 Symptom: Non-synchronized Video

Remedy: Check that the frame grabber software camera selection is properly connected and operational.

## 4.2 Information and Support Resources

For further information and support:

| | |
|---|---|
| Phone: | (408) 747-0300 |
| | (800) 445.5444 |
| | (800) 3-PULNIX (24-hour message access) |
| Fax: | (408) 747-0660 |
| E-mail: | pulnixapps@aol.com |
| Mail: | PULNiX America Inc. |
| | Sales Department |
| | 1330 Orleans Drive |
| | Sunnyvale, CA 94089 |
| | ATTN: Video Applications |
| Web Site: | www.pulnix.com |

# 5 APPENDIX

## 5.1 Specifications

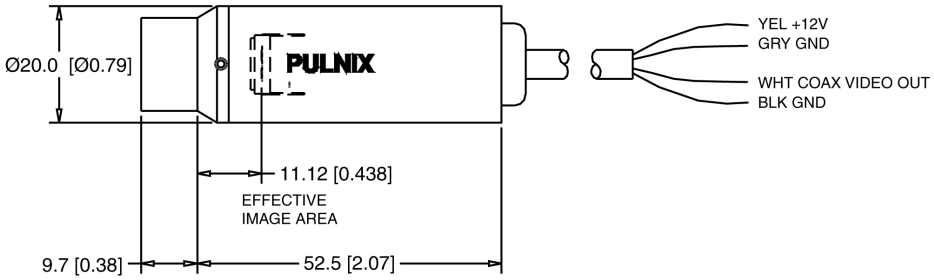
### 5.1.1 Product Specifications

**TABLE 1.** **TM-5LC Product Specifications Table**

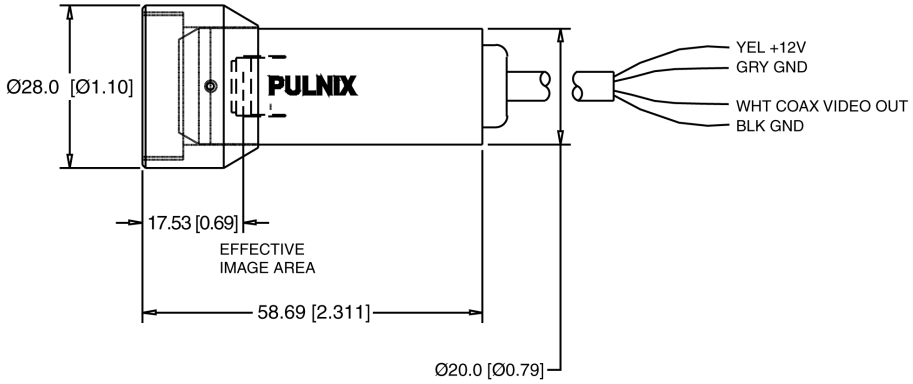
| Model | TM-5LC |
|---|---|
| **Imager** | 1/4" Interline transfer CCD |
| **Pixels** | 510 (H) x 492 (V) |
| **Cell size** | 7.15μm x5.55μm |
| **Scanning** | 525 lines @ 60Hz, 2:1 interlace |
| **Sync** | Internal, Hd=15.734 kHz, Vd=59.95 Hz |
| **TV resolution** | 400 (H) x 350(V) |
| **S/N Ratio** | 50dB minimum |
| **Min. illumination** | 0.5 lux (F=1.4) without IR cut filter |
| **Video output** | RS-170 Analog: 1.0 Vp-p composite video, 75Ω |
| **AGC** | ON/OFF (ON standard) |
| **Gamma** | 0.45 or 1.0 (1.0 standard) |
| **Lens mount** | M14X0.5 Tamron, C/CS Mount |
| **Power requirement** | 12V DC, 120mA |
| **Operating temp.** | -10°C to 50°C |
| **Shock** | 70G, 11 msec |
| **Random Vibration** | 7Grms/10-2000 Hz |
| **Size** | 20mm dia. x 52.5mm<br>0.78" dia. x 2.0" |
| **Weight** | 20.5g (without cable or lens) |
| **Power cable** | Flying leads, 24” length |
| **Auto iris connector** | None |
| **Power supply** | K25-12V or PD-12U |
| **Functional options** | None |
| **Accessories** | C/CS-mount adapter (32-3663) |
| | F3.3mm Mini Tamron lens (11-9002) |
| | F3.8mm Mini Tamron lens (11-2023) |

## 5.1.2 Physical Dimensions

**FIGURE 3.** **Physical Dimensions**



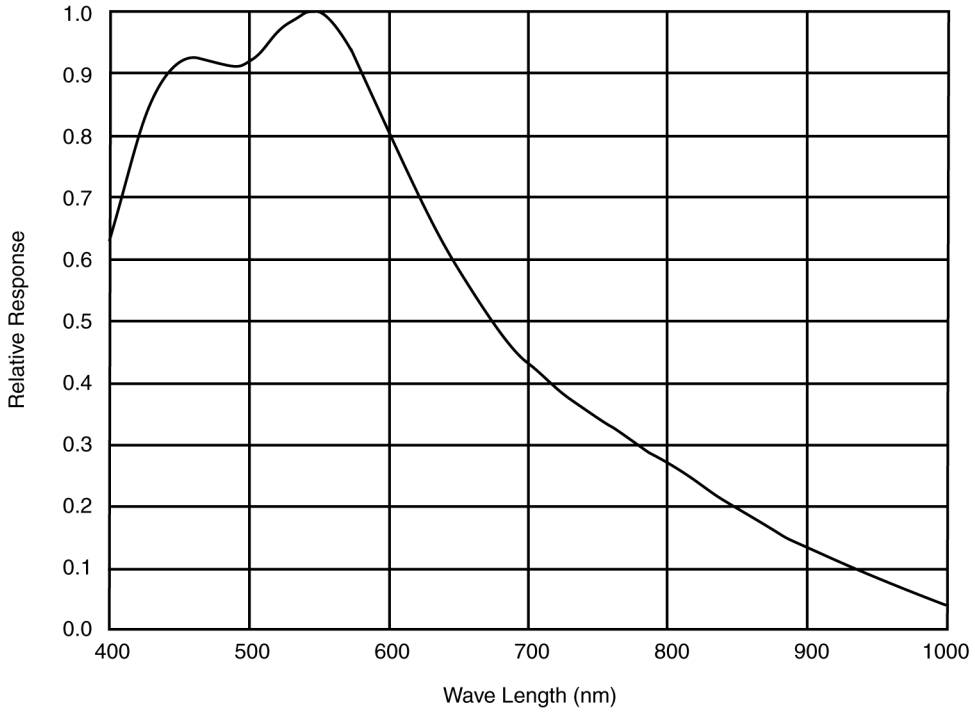

TM-5LC with M14X0.5 Tamron lens mount




TM-5LC with C/CS-mount adapter

## 5.2 Spectral Response

**FIGURE 4.** **Spectral Response**





## Industrial Products Division

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