AXSYS TECHNOLOGIES

*Thermal Imaging Solutions Since 1976*

# Operator's Manual

# Axsys

# Mid-Wave Cooled

# Thermal Camera Modules

| Model | Part Numbers |
|---|---|
| 50/250 Thermal Camera Module (f/4) | 23083/23083M |
| Tri-field of View Thermal Camera Module (f/4) | 23048 |
| Continuous Zoom Thermal Camera Module (f/4) | 23086 |

GSA

*MAN23048 Rev. –*


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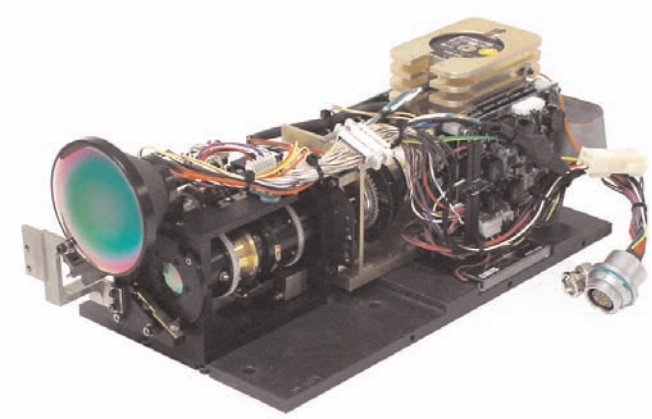
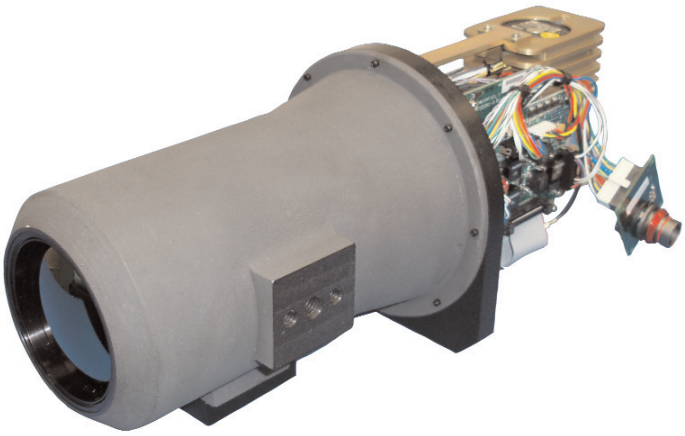
# Axsys Mid-Wave Thermal Cameras



*Tri-Field Module*



*50/250 Module*

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# Warnings and Limitations

The user should be thoroughly familiar with the camera system's proper orientation and limitations prior to use.

The actual service life of the equipment is dependent upon many factors, including the type of activities performed and the environmental conditions in which the equipment is used.

In the event of a malfunction, the camera system must be returned to Axsys IR Systems' repair facility for repair. There are no user-serviceable parts.

The camera system must be inspected and serviced by authorized personnel as specified by the manufacturer.

Repairs shall be performed only by Axsys IR Systems' certified personnel. Failure to comply voids the warranty.

Do not alter or modify the system. Never paint or label the system without manufacturer's written permission. Alteration or modification of the system voids the warranty and may cause the system to fail.

The camera system does not provide an image under water and does not permit objects to be seen through glass, water, or other shiny surfaces; these surfaces act as mirrors.

The thermal imaging system is sensitive to strong electromagnetic radiation (radio transmissions). Avoid strong radio transmissions close to the system; transmission may interrupt the system signal and interfere with normal operation.

Do *not* position the camera in such a way that the sun is within the field of view. Permanent damage to the sensor may occur.

# 1. Introduction

## 1.1 Scope

This manual is intended to provide the reader with an understanding of the basic operation and care of Axsys' mid-wave cooled thermal imaging modules, as listed in Table 1-1 below. It is not intended as a technical or service manual and does not discuss imager design or repair procedures. Please take the time to read this entire manual carefully before using the equipment.

**Table 1-1: Thermal Imaging Modules**

| Model Name | Part Number(s) | Lens Type | Effective Focal Lengths (mm) | F/# |
|---|---|---|---|---|
| *50/250 Module* | 23083/23083M | Dual Field of View | 50/250 | 4 |
| *Tri-Field Module* | 23048 | Tri-Field of View | 17/60/200 | 4 |
| *Continuous Zoom Module* | 23086 | Continuous Zoom | 50–350 | 4 |

## 1.2 System Overview

Axsys 3–5µm Cooled Camera Modules are designed as versatile thermal imaging systems. Using advanced Indium Antimonide (InSb) cooled mosaic focal plane array (FPA) technology, these systems provide excellent thermal resolution in total darkness or daylight conditions. Many automatic features make Axsys' systems easy to set up and operate, while the latest advances in technology keep the overall package size to a minimum.

Standard systems are available integrated with a number of different optics and can provide horizontal fields of view (FOVs) from 1.6 degrees to 31.5 degrees. The camera and lens systems are modular so that other fields of view can be accommodated on request.

Cameras accept either analog or digital communications and may be controlled remotely with a control box, a PC, or a hand held controller, or integrated into an existing system. See Sections 7 and 8 for information on various methods of control.

## 1.3 Technology Overview

In Axsys cooled camera modules, the sensing element is a cooled Indium Antimonide (InSb) infrared detector that is sensitive to energy in the Mid-Wave Infrared (MWIR) band from 1 to 5µm (microns). Operation is limited to selected bands within this range (generally 3.4 to 4.2µm). The focal plane array consists of 320 horizontal and 256 vertical detectors, or pixels, of which 320 x 240 are used to generate the video image. Each pixel is an Indium Antimonide element operating in photovoltaic mode. Thermal energy incident on a detector element creates a voltage proportional to infrared photons incident on the detector. These signals are read by the control; a viewable image is then made by mapping the signal output for each detector to an external display. Operation of this system's technology requires cooling of the InSb focal plane array; therefore an integral Stirling 0.5-watt cooler is used to maintain the appropriate temperature and optimize the performance of the sensor array.

# 2. Equipment: Standard Kit

If you did not order anything other than a Thermal Camera Module, your shipment may include the following:

- Thermal camera with integrated lens assembly.
- Interconnect cable (optional) that connects the camera on the connector side to your power and control equipment with flying leads: standard 18 or 22 pin interface, RS-232/422, 12 feet of cable length, connector on camera side.
- Waterproof re-usable shipping case (optional).
- CD including Axsys software (GUI) and User's Manual (this manual).

A representative standard kit is shown in Figure 2-1.

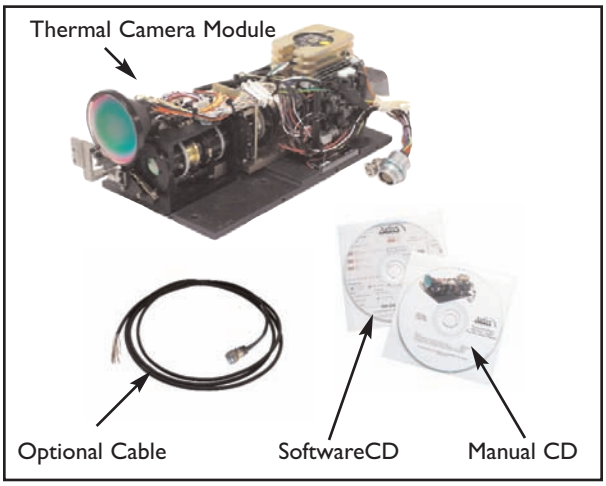


*Figure 2-1. Standard Cooled Camera Module Kit (Optional case not shown)*

Please unpack the shipment carefully.

**ESD CAUTION!**

Proper ESD precautions must be taken while integrating the camera module. Electrostatic discharge (ESD) may damage the unit. While unpacking and handling the unit, be sure that you do not touch the exposed boards.

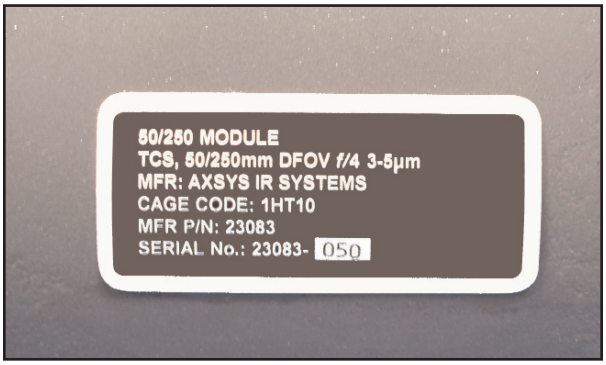


*Figure 2-2. Axsys Identification Plate*

When you have unpacked the system, inspect the components for any damage. If there appears to be any damage, or if your delivery does not include all the equipment you expect, please contact Axsys immediately:

**Contacting AXSYS IR Systems:**

- By Email: camerasupport@AXSYS.com
- By Phone: +1 (603)-898-1880
- By Fax: +1 (603)-898-3970

For your records, please make note of the unit's part and serial numbers, located on the identification plate (Figure 2-2), affixed to the camera.

# 3. Major Component Groups

Axsys Cooled Camera Modules include two major components. The first of these is the lens assembly, which houses the collection and focusing optics needed for imaging the thermal energy of a scene. The second is the camera assembly, where all of the image processing is done. The Module is designed to integrate with user-supplied external components, including a housing, an external power supply, and all necessary cabling, as well as any user interface equipment: video monitor, computer terminal, remote control, power supply, etc.

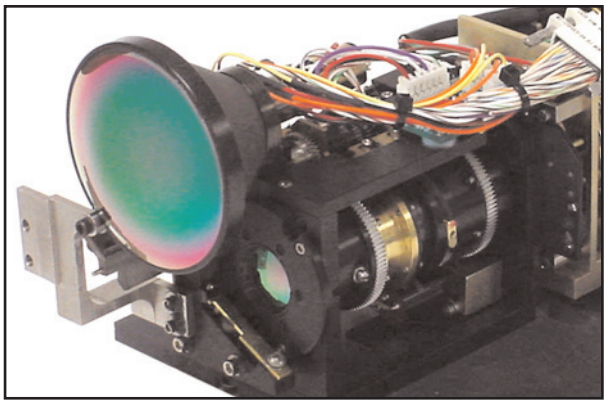

*Figure 3-1. Tri-field Lens Assembly*

## 3.1 Lens Assembly

Depending on the module selected, the camera lens configuration may be a dual field of view (DFOV), a tri-field of view (TFOV), or a continuous zoom (CZ).

Standard features for most lenses include:

- Highly efficient anti-reflective (AR) coatings on optical elements
- Wide operating temperature range for motors and drive electronics
- Field of View (FOV) change times typically less than 1.5 seconds, where applicable.

Figures 3-1 and 3-2 illustrate lens assemblies

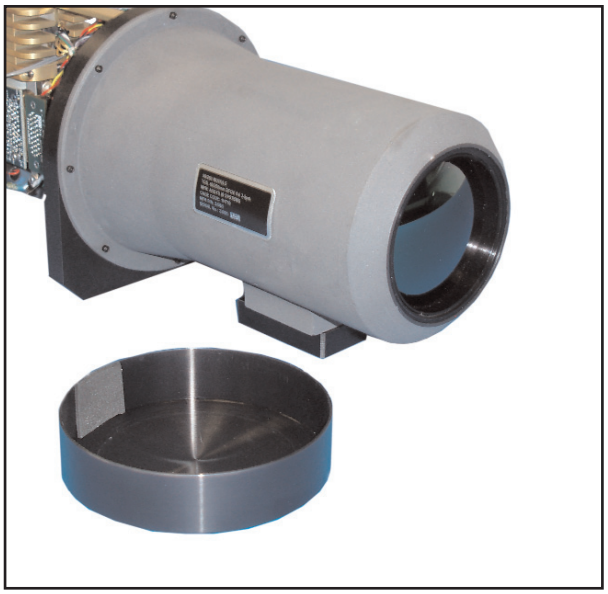

*Figure 3-2. 50/250 Lens Assembly with Lens Cap*

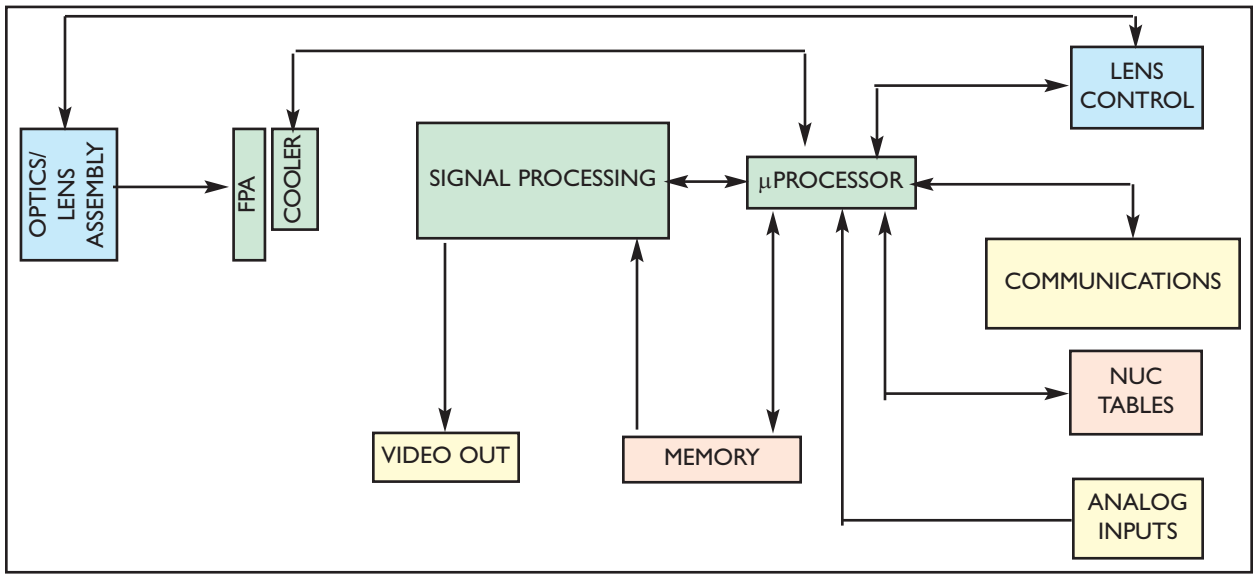


*Figure 3-3. System Block Diagram*

# 3.2 Camera Assembly

The camera assembly (Figure 3-4) includes a thermal imaging section, an internal power supply, and a communications/connector interface. The block diagram in Figure 3-3 depicts the relationship of these sections to each other as well as to the lens assembly.

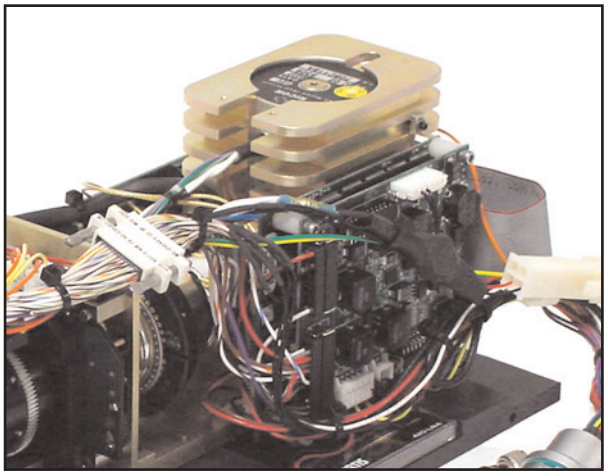

*Figure 3-4. Camera Assembly*

## 3.2.1 Thermal Imaging Section

The camera's thermal imaging section itself has several main components: The Focal Plane Array (FPA) detects the thermal energy from the scene, while a Stirling cooler maintains the FPA at a correct operating temperature. Output signals from the FPA are passed through signal processing electronics that prepare the image for display. A microprocessor and other housekeeping electronics control the system operation and communications with the outside world.

## 3.2.2 Internal Power Supplies

Internal power supplies convert the incoming DC voltage to the necessary voltages required by the camera and lens. On board power monitoring protects the system integrity in the case of a low voltage condition.

## 3.2.3 Connector Interface

The camera's system interface consists of two connectors that provide power input, serial communications, and analog control to the thermal imaging system, and video output from the camera to a monitor. Serial communications and power are transmitted through an 18 or 22-pin connector. Typically an analog video signal is sent via a BNC connector to produce video output; however, video is also available within the 22-pin connector. See Figure 3-5.

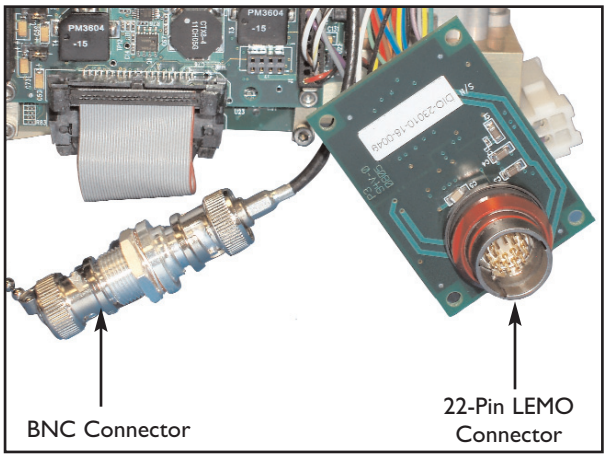


*Figure 3-5. System Interface 22-pin & BNC Connectors*

# 3.3 External Components

Axsys Cooled Camera Modules may be operated with certain external equipment: power supply, external controls, power/communications cable(s), video monitor, and standard video cable.

## 3.3.1 Required External Components

**Power Supply:** An external power supply is necessary to all cooled camera modules. Power requirements for specific models appear in Section 4.2.1.

**External Control:** All cooled camera modules require an external analog or digital control device in order to communicate commands to the camera. This function is sometimes combined in one component with the power supply. Commands may be given to the system by analog or digital methods; a number of configurations are possible. Basic control options are discussed in Section 3.3.2.

**Power/Communications Cable(s):** The optional camera interface cable supplies connections for power and analog and digital communication with the camera. For digital communication, RS-232 or RS-422 connections for protocols may be used. See Sections 4.2 and 4.3 for more information on cables and connections.

**Video Monitor and Video Cable:** To view the video output, a monitor with a BNC video input connector and a standard RG-59 video cable with 75-Ohm impedance are necessary if using the BNC video output. Alternatively, video signal can be accessed from the 22-pin cable interface, if the module is so equipped.

## 3.3.2 Control Component Options

Thermal Camera Modules are designed to be operable through integration into an existing analog or digital system; through a power supply to an analog handheld remote or digital connection to a PC; or by means of a digital control box/power supply.

### 3.3.2.1 Analog Control Option

The camera can be integrated into an analog control system. Section 7.1 provides a complete listing of signal requirements for analog inputs. Note that not all camera functions will be available if analog controls are used.

# 4. Installation

## 4.1 Unpacking the Module

The systems are shipped in anti-static protective packaging. Use care and proper ESD precautions while handling and integrating the systems.

**ESD CAUTION!**

Electrostatic discharge (ESD) may damage the unit. While unpacking and handling the unit, be sure that you do not touch the exposed boards.

## 4.1 Mounting/Integration Considerations

- Intended for integration into customer's systems, the thermal camera module is provided without all (or portions) of its protective enclosure. When the module has been integrated, the system should be mounted in a protective enclosure such that the module is not exposed to moisture. When completed, such an enclosure should be capable of being pressure sealed and will be expected to maintain a constant internal positive pressure of 2-5 PSI (14-34 kpa). It should also have an integrated port/valve that will allow the cavity to be purged (and pressurized) with dry nitrogen at periodic intervals.

- The customer-supplied enclosure must also be capable of allowing the camera module to function properly throughout its entire specified temperature range.

- Please consult the applicable drawings for your module for specific information on mounting the unit to its enclosure. The 50/250 module is provided with a partial enclosure and offers a choice of mounting holes (see Figure 4-1); the Tri-field & the Continuous Zoom Modules are shipped on mounting blocks with through-holes and/or tapped holes provided for ease of mounting.

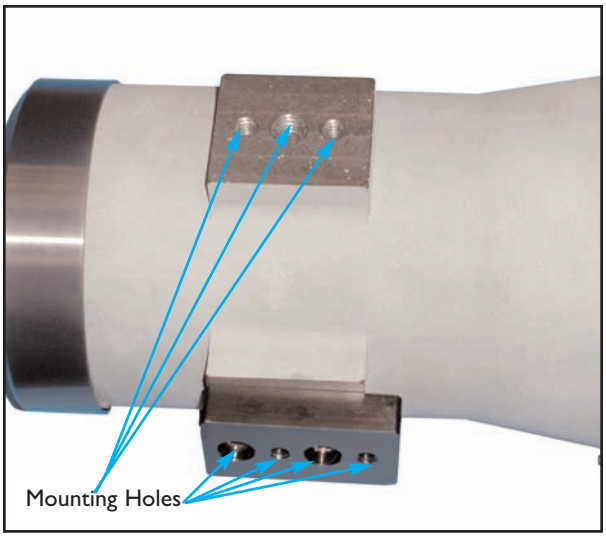


*Figure 4-1. Mounting Hole Choices on 50/250 Module*

# 4.2 Power Requirements

## 4.2.1 Camera Power Requirements

An external power source is required to provide the supply voltage. The power supply must be able to deliver 11-16 VDC with 2.5A peak current to the system. When operating with a nominal input voltage of 12 VDC, the camera will draw less than 18 watts of power at steady state at 25°C. Additional heater power consumption is given in Section 4.2.1.

**Table 4-1: Heater Power Requirements**

| Model Name | Part Number(s) | Voltage (V) | Current (Amps) | Wattage (W) |
|---|---|---|---|---|
| *50/250 Module* | 23083M | 12 | 0.88 | 10.6 |
| *Tri-Field Module* | 23048 | NA | NA | NA |
| *Continuous Zoom Module* | 23086 | NA | NA | NA |

## 4.2.2 Front Lens Heater Power Requirements

The 50/250 module incorporates a front lens heater with automatic thermostat. The thermostat is factory set to turn the heater on automatically at 5°C and turn the heater off at 8°C. This function is active as long as power is applied to the appropriate pins of the main connector as shown in the relevant installation drawing (located in the Appendix). The power consumption for the front lens heater of each system is listed in Table 4-1.

## 4.2.3 Use of the Optional Power/Communications Cable

A 12' power/communications cable using #25 AWG (American Wire Gauge) wire (Figure 4-2) is optional for Axsys cooled camera modules. If you are using that or a similar cable (with a resistance of 4.6 ohms per 100') with a 12VDC voltage supply, the maximum length for proper operation is 32'. If you wish to extend the length of the cable further than that, you should employ a heavier gauge wire or increase the voltage supply. For further information, consult a resistance chart or contact Axsys Customer Service.

# 4.3 Connections

Before a unit is turned on, all appropriate cables should be plugged in. Pin assignments are included with the installation drawing for each system. Copies of these drawings are included in the Appendix.

When plugging in the 18 or 22-pin cable (Figure 4-2) , ensure that the power supply is turned off. Never plug the main cable into the unit if the power supply is already turned on, as this may cause damage to sensitive electrical components.

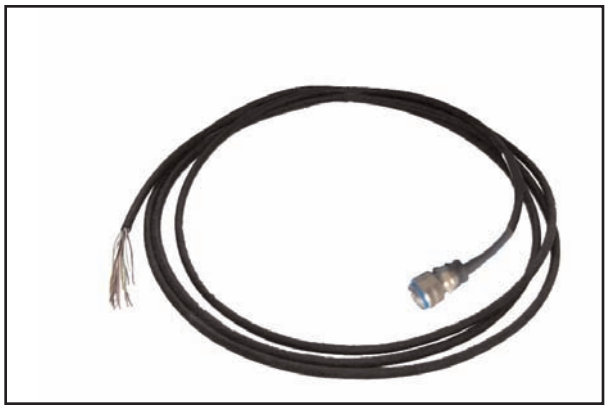

*Figure 4-2. Typical Cable with Flying Leads*

## 4.3.1 Multi-Pin Connector

The 18 or 22-pin connector, located at the rear of the camera, provides links for communications, power, analog control, and video. The connector is hermetically sealed, with a quick-disconnect feature.

### 4.3.1.1 18-Pin Connector, Fischer

*Optional cable, PN 22788-501-14*

To plug in the the cable ), line up the connector on the cable with the connector on the camera. Connectors are keyed and will only go together one way; there should be a red dot on each connector for alignment (Figure 4-3). Once they are aligned, insert the cable end into the connector on the camera. Apply pressure until you feel the two connectors lock together. Connect the other end of the cable to an appropriate power supply and control interface in accordance with Table 4-2.

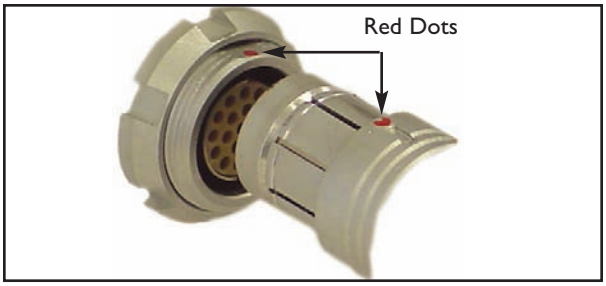


*Figure 4-3. To connect a Fischer 18-pin connector, align the two red dots.*

### 4.3.1.2 22-Pin Connector, LEMO

*Optional cable, PN 23020-501-12*

To plug in the cable (Figure 4-4), line up the connector on the cable with the connector on the camera. Connectors are keyed and will only go together one way. Once they are aligned, insert the cable end into the connector on the camera. Apply pressure until you feel the two connectors lock together. Connect the other end of the cable to an appropriate power supply and control interface in accordance with Table 4-3.

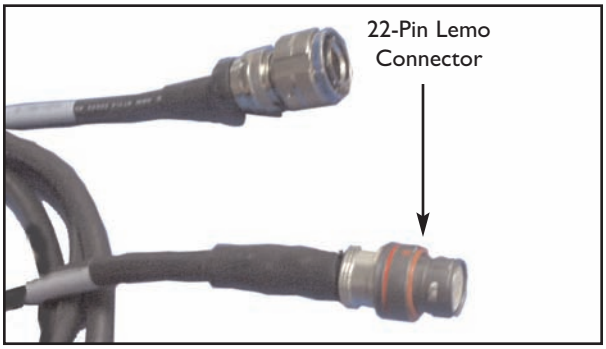


*Figure 4-4. To connect a LEMO 22-pin connector, align the connectors and press to lock connectors.*

### 4.3.1.3 22-Pin Connector, Amphenol

*PN 23034-501-12*

To plug in the cable (Figure 4-5), simply line up the connector on the cable with the connector on the imager. Connectors are keyed and will only go together one way. Once they are aligned, insert the cable end into the connector on the camera and turn the exterior ring clockwise until it stops. Connect the other end of the cable to an analog system, or to a power block, control box/power supply, or similar component according to the pin assignments defined in Table 4-2. Also see Figures 4-8 and 4-9; note that different cable PNs may apply for use with the PN 31239 Power Supply or other devices.

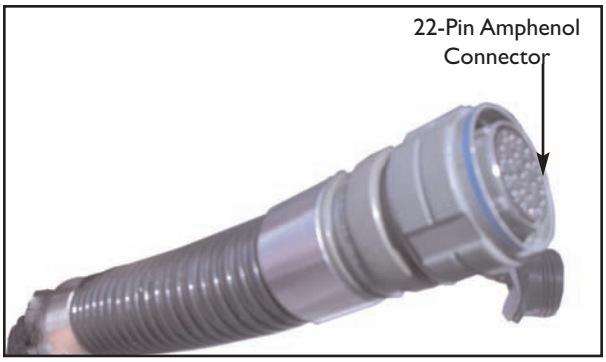


*Figure 4-5. Amphenol Twist-in 22-pin Connector*

### 4.3.1.4 Disconnecting the Connector

To disconnect a Fischer or LEMO cable from the camera, simply grasp the 18/22-pin connector body and pull straight backward. The connector should release with a minimal amount of force. NEVER try to disconnect the system by pulling on the cable. The connectors will not release if you do so, and damage to the contacts inside the connectors may result.

To disconnect an Amphenol cable from the camera, rotate the exterior ring counter-clockwise until it releases the cable from the camera.

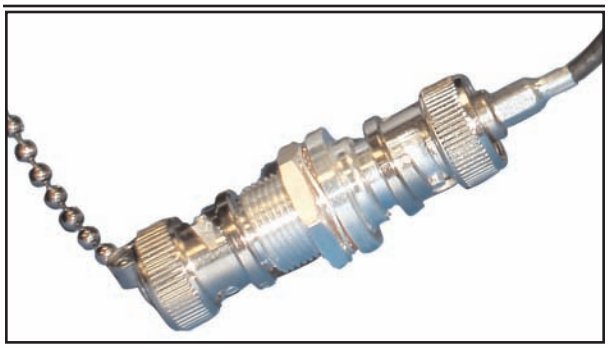

*Figure 4-6. BNC Connector (Dust Cap Attached) for Video Connection via RG-59 Cable*

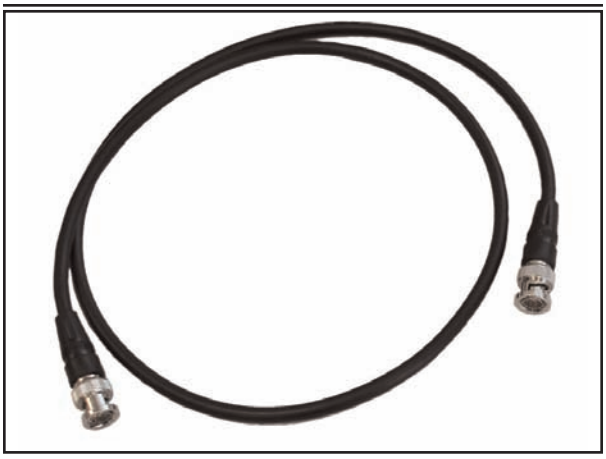

*Figure 4-7. RG-59 Video Cable.with BNC Connector*

## 4.3.3 Video Connector

To view the video output, a standard RG-59 cable with 75-Ohm impedance and a video monitor are needed. Attach the plug end of the video cable to the receptacle BNC connector on the back of the camera. To make the connection, unscrew the dust cap (if the camera is so equipped) from the the BNC on the camera. Slide the BNC plug on the end of the cable over the BNC receptacle on the camera and turn clockwise until the tabs on the camera connector latch into place. (See Figure 4-5.) Attach the other end of the cable to the monitor. Remember to replace the dust cap if the cable is disconnected.

Note that the analog video signal is also accessible from the 22-Pin Connector if the camera is so equipped. See the installation drawings in the Appendix for pin assignment information.

## 4.3.2 RS-232/RS-422 Connection

Connecting the camera to a host terminal system requires connecting either an RS-232 or an RS-422 communications cable connection between the terminal system and the camera module. If a control box is not being used, the system can also be connected directly to a host terminal by attaching the appropriate flying leads of the power/communications cable. See the installation drawings in the Appendix and/or cable information for details.

## 4.3.4 Connections to an Existing System

Connect the flying leads on the cable according to the pin assignments in Table 4-2. Also see Figures 4-7 and 4-8.

**Table 4-2:**
**Tri-Field or Continuous Zoom Modules**
**18-Pin Connector Pin Assignments**

| Pin | Function | Wire Colors for Connections to Provided Cable |
|---|---|---|
| 1 | CAMERA RXD | BLK |
| 2 | CAMERA TXD | BRN |
| 3 | COMM GND | RED |
| 4 | CABLE SHIELD | SHIELD |
| 5 | SPARE | ORG |
| 6 | HEATER V+ | YEL |
| 7 | HEATER V- | GRN |
| 8 | COOLER V+ | BLU |
| 9 | COOLER V- | VIO |
| 10 | CAMERA V+ | GRY |
| 11 | CAMERA V- | WHT |
| 12 | CONTROL BIT 2 | WHT/BLK |
| 13 | CONTROL BIT 3 | WHT/BRN |
| 14 | CONTROL BIT 4 | WHT/RED |
| 15 | CONTROL BIT 5 | WHT/ORG |
| 16 | CONTROL BIT 1 | WHT/YEL |
| 17 | CONTROL BIT 0 | WHT/GRN |
| 18 | BIT COM | WHT/BLU |

**Table 4-3:**
**50/250 Modules**
**22 Pin Connector Pin Assignments**

| 22 Pin | Function | Wire Colors for Connections to Provided Cable |
|---|---|---|
| 1 | CAMERA RXD | BLK |
| 2 | CAMERA TXD | BRN |
| 3 | COMM GND | RED |
| 4 | CABLE SHIELD | ORG |
| 5 | HEATER V+ | YEL |
| 6 | HEATER V- | GRN |
| 7 | CAMERA V+ | BLU |
| 8 | CAMERA V- | VIO |
| 9 | CONTROL BIT 2 | GRY |
| 10 | CONTROL BIT 3 | WHT |
| 11 | CONTROL BIT 4 | WHT/BLK |
| 12 | CONTROL BIT 5 | WHT/BRN |
| 13 | CONTROL BIT 1 | WHT/RED |
| 14 | CONTROL BIT 0 | WHT/ORG |
| 15 | RS-422 RX- | WHT/YEL |
| 16 | RS-422 RX+ | WHT/GRN |
| 17 | RS-422 TX- | WHT/BLU |
| 18 | RS-422TX+ | WHT/VIO |
| 19 | VIDEO | WHT/GRY |
| 20 | VIDEO RTN | WHT/BLK/BRN |
| 21 | VID POS | WHT/BLK/RED |
| 22 | VID NEG | WHT/BLK/ORG |

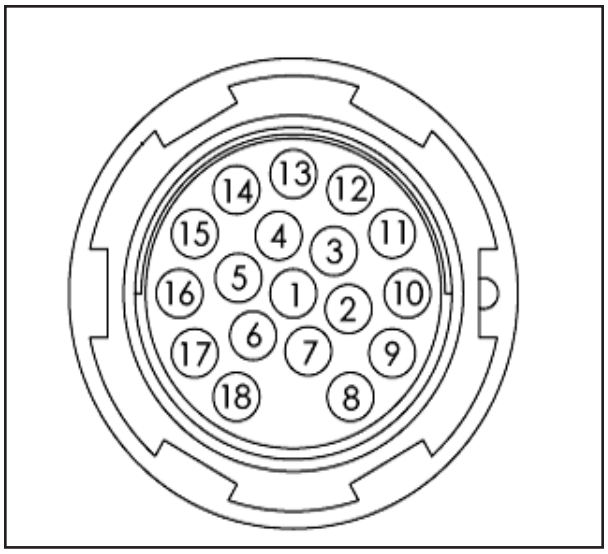


*Figure 4-8. Pin Assignments for 18-Pin Fischer Connector*

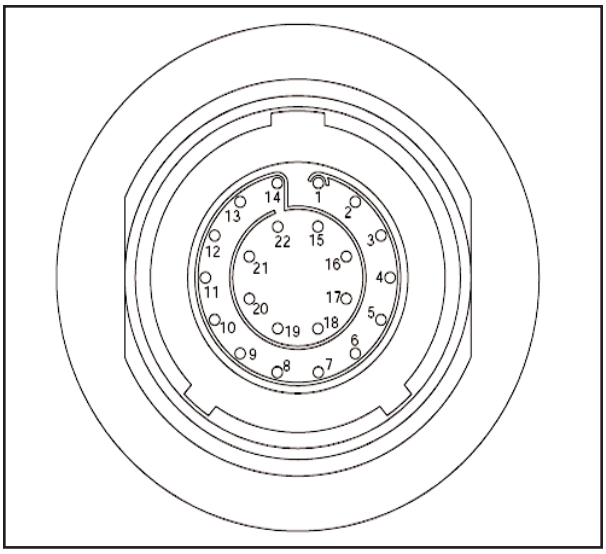


*Figure 4-9. Pin Assignments for 22-Pin LEMO Connector*

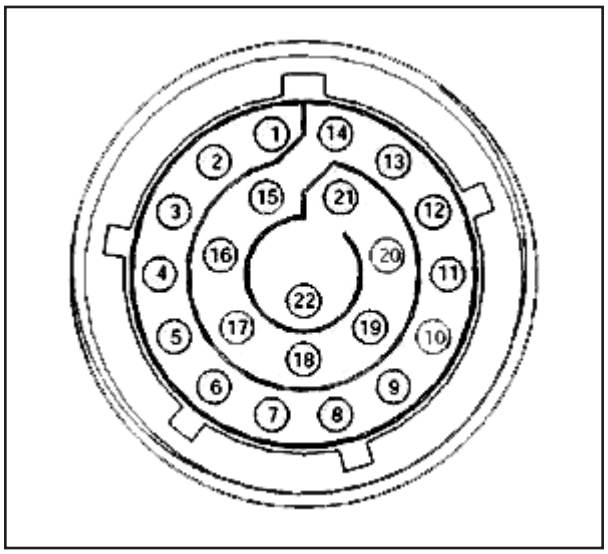


*Figure 4-10. Pin Assignments for 22-Pin Amphenol Connector*

# 5. Start-Up

Before turning on the system, make sure all connections are properly made. Verify that the power supply is an appropriately rated supply for both voltage and power output

## 5.2 Initialization

When the unit is turned on, the video output will be blank for several seconds while the unit is booting up. The Stirling cooler must stabilize the focal plane array at operating temperature before a quality image can be generated. This procedure takes approximately 7 minutes at 25°C, during which time a blank image or a company logo will be displayed on the video output. Note that the stabilization process may require more time in warm environments. After the cooler and FPA have reached a steady state temperature, the video will change to the actual camera image. See Figure 5-1 for an example. At this point the camera and lens are ready for operation.

*Figure 5-1. A Thermal Image Example*

# 6. Control Features

Axsys systems have been designed with ease of use in mind and will perform admirably in the majority of applications with the user adjustable settings left in their default modes. However a number of settings can be easily configured by the user for specific situations. The following section describes the more frequently used controls. For complete command descriptions and syntax information, see Section 7; for control via the Camera GUI see Section 8.

## 6.1 Gain and Offset Control

The settings of infrared cameras that most often need adjusting to acquire good images are the gain and offset (also sometimes referred to as contrast and brightness respectively). For this reason Axsys cameras feature an AUTOMATIC GAIN AND OFFSET CONTROL (AGC) that allows the user to acquire excellent imagery in a very simple hands-off manner.

### 6.1.1 Automatic Gain and Offset Control

The AUTOMATIC GAIN AND OFFSET CONTROLS are combined in the AGC feature, which will optimize the contrast and brightness of the viewed image. AGC ON is the camera's default condition and the state to which it reverts when powered up. Under most scene conditions, this mode provides high quality images. Prior to conversion to a video output, the camera automatically adjusts the gain and offset of the non-uniformity-corrected image. This operation is performed by means of histogram equalization and a corresponding look up table (LUT). The user can select different regions (ROIs) of the image for the AGC feature to use as reference criteria when making the automatic adjustments. See Figure 6-1 for an example of a thermal image at optimal configurations of gain and contrast. The AGC can be turned ON or OFF using any of the analog or digital control methods described in Sections 7 and 8.

### 6.1.2 Manual Gain and Offset Control

To enhance the image under specific circumstances, perhaps including very wet, cold, or low-contrast conditions, the user may prefer to adjust the video CONTRAST (gain) and BRIGHTNESS (offset) manually.

Moving the manual gain or offset controls (via RS-232 command, control box, etc.) will automatically place the system in manual mode; the gain or offset will increase or decrease in steps as the control is pressed.

- Increasing the gain will provide more contrast and bring out detail (blacks will be blacker, whites will be whiter).
- Conversely, decreasing the gain will produce less contrast (the entire scene will be more grey or neutral).
- Similarly, increasing the offset will provide more brightness (the entire scene will be lighter).
- Conversely, decreasing the offset will produce less brightness (the entire scene will be darker)

If the image appears to saturate or have little detail in the brightest regions, adjust the offset control downward to decrease the brightness. If the scene temperature drifts up or down it may be necessary either to make changes in the manual brightness setting or to return the system momentarily to AGC auto mode by using any of the analog or digital control methods described in Sections 7 and 8. The automatic AGC settings will override the manual settings and arrive at the best calculated setting. If the camera is then returned to manual mode, the automatically recalculated setting will be the starting point for manual gain and offset changes. Note: it is not necessary to press the AGC button to place the system in manual mode; simply actuating either the gain or the offset controls sets the system in manual mode.

The images following in Figures 6-2, 6-3, 6-4, and 6-5 have been adjusted to demonstrate the effects of brightness and contrast (offset & gain) adjustment. The live image result of manual gain and offset adjustment should be similar.

**NOTE**

- When the system is to be left unattended, turn AGC ON.
- If manual adjustments cause the scene to go all white or all black, turn AGC ON.

*Figure 6-1. A Thermal Camera Image with AGC ON*

*Figure 6-2. Original Thermal Camera Image with Brightness Adjusted Downward*

*Figure 6-3. Original Thermal Camera Image with Brightness Adjusted Upward*

*Figure 6-4. Original Thermal Camera Image with Contrast Adjusted Downward*

*Figure 6-5. Original Thermal Camera Image with Contrast Adjusted Upward*

## 6.2 Region of Interest Choice

The Region of Interest (ROI) can be one of eight areas of the image or FPA. Five of these areas are pre-defined at the factory. The user can define the remaining three if necessary. When the ROI is changed, a reticle box is temporarily overlaid on the output video to display the new ROI selection. The ROI can be changed using the the analog or digital methods described in Section 7. The five factory ROI presets are shown in Figures 6-6 through 6-10.

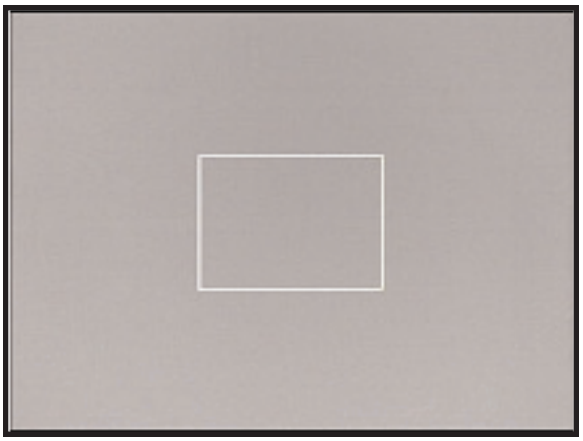

Figure 6-6. ROI 1

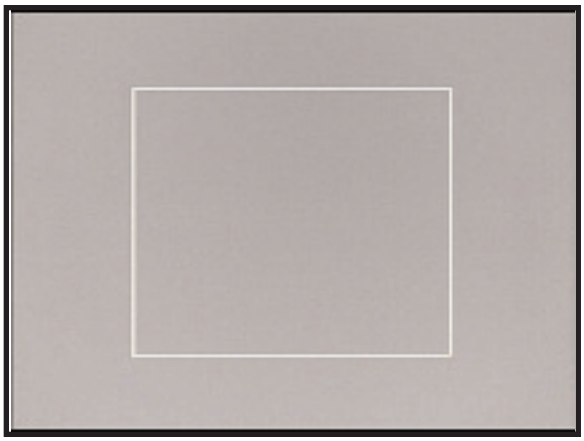

Figure 6-7. ROI 2

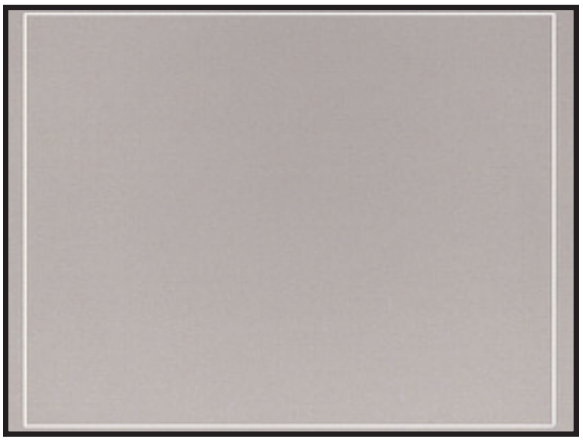

Figure 6-8. ROI 3

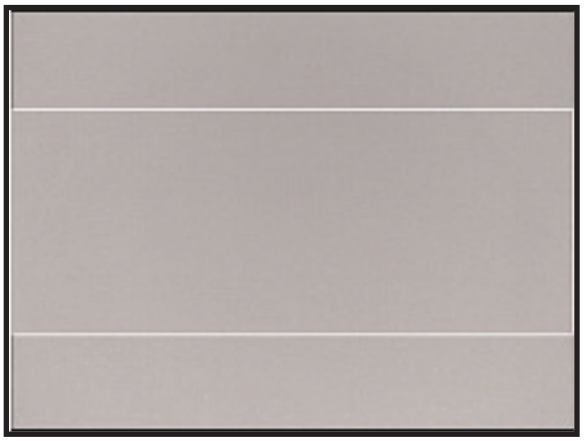

Figure 6-9. ROI 4

Figure 6-10. ROI 5

**Table 6.1: FPA Region Pixel Coordinates**

| Scroll Sequence | FPA Region Pixel Coordinates (upper left to lower right corners) |
|---|---|
| 1 | (107,81) to (211,157) |
| 2 | (69,43) to (249,195) |
| 3 | (14,6) to (304,232) |
| 4 | (0,55) to (319,183) |
| 5 | (15,79) to (303,239) |
| 6 | user defined |
| 7 | user defined |
| 8 | user defined |

Note: #3 includes nearly the entire FPA; the box drawn can be seen at the very edge of the screen.

# 6.3 Field of View Adjustment

Standard systems have a motorized FOV mechanism that allows the lens to be controlled from a remote location. The motorized lens assembly permits the user to switch between fields of view or adjust the zoom setting via any of the analog or digital control methods described in Section 7.

# 6.4 Focus Adjustment

All of Axsys' systems have motorized focus capability that enables the lens to be controlled from a remote location. Motorized lens assemblies allow the user to bring near or far objects into focus via any of the analog or digital control methods described in Section 7.

Note that if a multi-FOV or zoom lens assembly is being used, switching or zooming from one FOV to another may require a focus adjustment. For reference, generally the wide FOV (shorter focal length) will have a shorter minimum focus distance than the narrow FOV (longer focal length). That is, the WFOV will be able to focus on objects that are closer than the ones that can be brought into focus with the NFOV.

## 6.4.1 Autofocus

Most models have Axsys proprietary AUTOFOCUS capability. The AUTOFOCUS feature is designed to provide automatically the best focus on a given target scene. Note, however, that the success of the AUTOFOCUS function in finding the best focus is scene dependent. If one object is obscuring another sharply defined object, the AUTOFOCUS may not find the best focus.

AUTOFOCUS offers various functions, depending on the system condition in which it is used. Choosing AUTOFOCUS can initiate one of the following processes:

### 6.4.1.1 Continuous Autofocus

The CONTINUOUS AUTOFOCUS feature, when on, will constantly try to optimize the focus of the image. There are 5 modes of operation for CONTINUOUS AUTOFOCUS operation:

1. Variance
2. Sum-Modulus-Difference "SMD"
3. Tenengrad (aka Tenenbaum)
4. Laplacian
5. A combination of modes 1 and 3

A discussion of these modes of operation is outside the scope of this document; however, the performance of each mode is heavily scene dependent.

### 6.4.1.2 One Shot Autofocus

The ONE SHOT AUTOFOCUS feature initiates a reset of the camera's focus through a momentary return to automatic focus. When commanded, the camera will autofocus on the scene using mode 5 above and then disable its autofocus function until the next time a ONE SHOT AUTOFOCUS command is received. Most users prefer ONE SHOT AUTOFOCUS to the continuous mode.

### 6.4.2 Never Forget Focus

All multi-FOV models have Axsys' NEVER FORGET FOCUS activated. When this feature is functional, the last focus position for a particular field of view position is stored in memory. This capacity allows seamless switching between fields of view without the need to refocus on an object of interest. The feature, if available, may be turned ON or OFF using the serial commands described in Section 7 (FOCUSSERVO: command).

### 6.4.3 Non-Uniformity Correction

The NON-UNIFORMITY CORRECTION (NUC) feature activates a 1-point non-uniformity correction that quickly updates the offset correction coefficients for each pixel. The response of some pixels may drift over time or with changes in the environmental temperature. A 1-point update, using an internal shutter for reference surface, can be used to reset the correction of these pixels for optimum image quality. This function can be used at any time without any detrimental effect; the process is executed very rapidly.

## 6.5 Sensitivity Adjustment

The sensitivity adjustment feature allows the user to adjust the sensitivity to enhance the image if necessary by toggling the camera between normal and higher sensitivity settings. HIGH SENSITIVITY increases the sensitivity setting on the cooled detector. Note, however, that a high setting may produce excessive data, causing the image to become saturated if, for instance, the scene observed is very hot; in that case the sensitivity setting should be lowered.

When the thermal scene has extremely low contrast (when target temperatures are close to background temperatures) the image can be improved through the HIGH SENSITIVITY mode.
Examples of low contrast scenes:

- early evening desert conditions
- rainy conditions
- extremely cold conditions

If the scene has enough thermal content, this mode is *not* recommended; you will see the system saturate (display bright vertical columns). This is an indication to return to normal sensitivity mode. The HIGH SENSITIVITY function can be accessed through the Camera GUI or serial commands (SENSTOG: command).

## 6.6 Day Mode

DAY MODE provides an alternative way of viewing an image that is especially appropriate to hot dry scenes with high contrast, such as desert conditions, in which the image may otherwise have "clutter" (splotches of blacks and whites). The scene will automatically lower the contrast (tone down), bringing out objects that have been obscured in the clutter. The feature can be turned ON or OFF through the Camera GUI or by using any of the analog or digital control methods described in Sections 7 and 8.

## 6.7 Freeze Video

The FREEZE VIDEO feature freezes the current frame of the live video. The feature can be turned ON (freezing the frame) or OFF (restoring live video) through the Camera GUI or by using any of the analog or digital control methods described in Sections 7 and 8.

# 6.8 Polarity Choice and Color Palettes

Axsys systems allow the user to change the polarity of the output video. The available settings are WHITE HOT and BLACK HOT. In the WHITE HOT mode, objects in the scene that are higher in temperature will appear lighter or whiter, while colder objects will appear to be darker or blacker. The BLACK HOT mode reverses this presentation so that higher temperature objects will appear more black and low temperature objects will seem more white.

In additional to the white hot and black hot monochrome settings, seven color palettes are available for users wishing to view the thermal imagery in color. The monochrome and color palettes are listed below and illustrated in Figures 6-11 to 6-19:

1. White hot (grayscale)
2. Black hot (grayscale)
3. IronBow
4. Inverse IronBow
5. RainBow
6. Inverse RainBow
7. Oceana
8. Inverse Oceana
9. Sepia

You may find by experimentation that certain choices of polarity or palette settings increase the visibility of specific details in a given scene.

## Thermal Imager Color Palette Examples

Palettes will appear in the order of the illustrations.

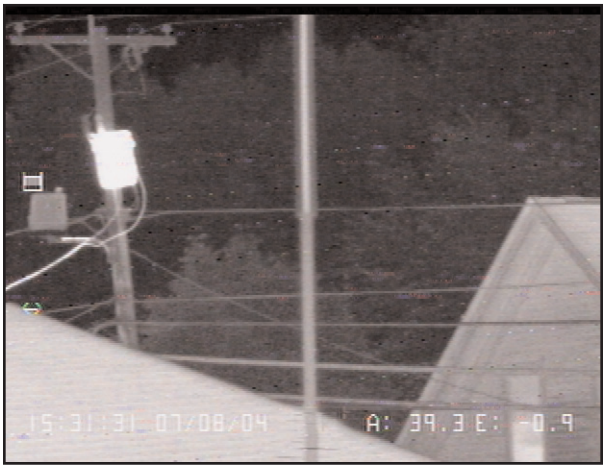

*Figure 6-11. Thermal Image Seen through White Hot Palette*


*Figure 6-12. Thermal Image Seen through Black Hot Palette*

*Figure 6-13. Thermal Image Seen through Ironbow Palette*

*Figure 6-14. Thermal Image Seen through Ironbow Inverse Palette*

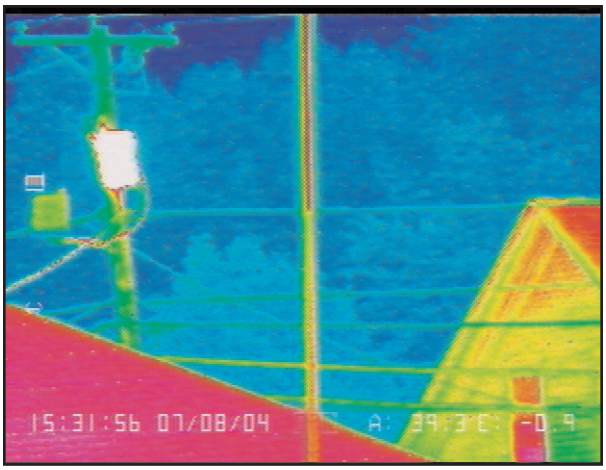


*Figure 6-15. Thermal Image Seen through Rainbow Palette*

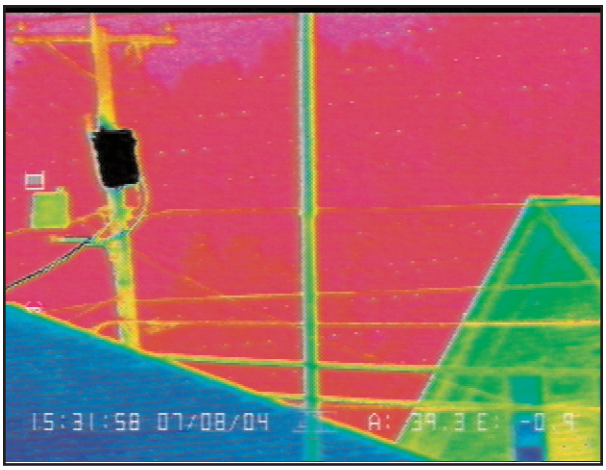


*Figure 6-16. Thermal Image Seen through Rainbow Inverse Palette*

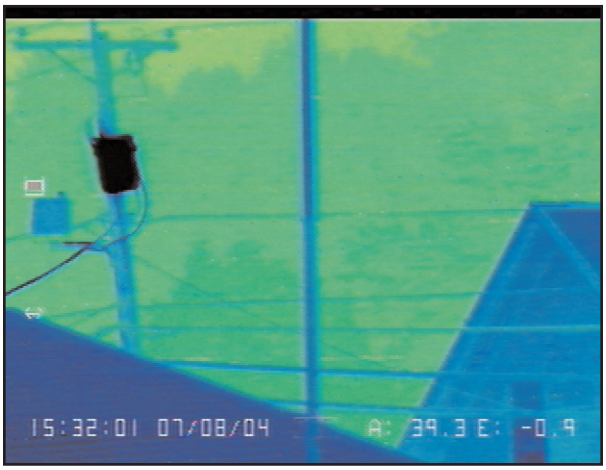


*Figure 6-17. Thermal Image Seen through Oceana Palette*

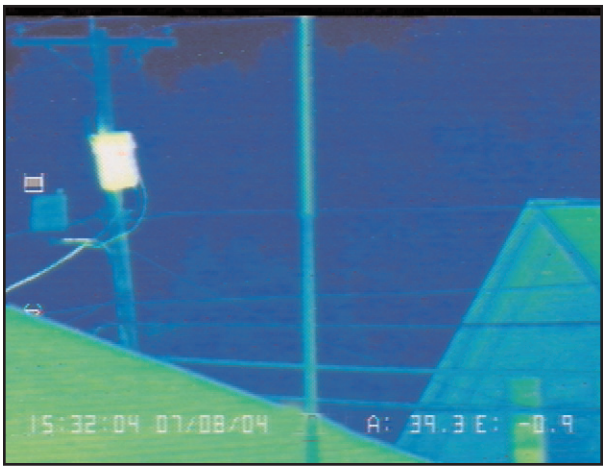


*Figure 6-18. Thermal Image Seen through Oceana Inverse Palette*

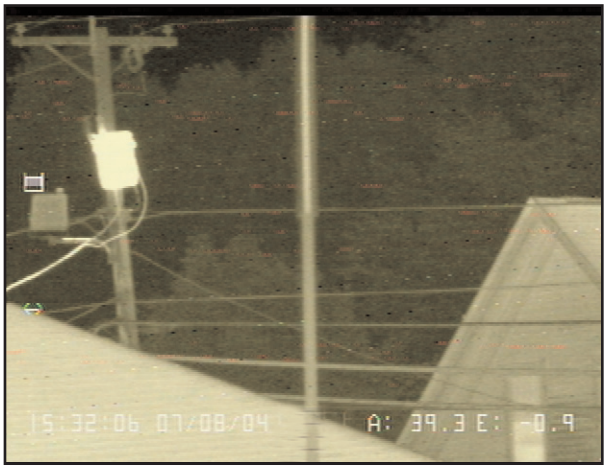


*Figure 6-19. Thermal Image Seen through Sepia Palette*

# 7. Methods of Control

Axsys' thermal imaging systems can be controlled by two distinct control methods: analog control or digital (serial) control, as described below.

## 7.1 Analog Control

Analog control signals to the system are in the form of relay closures. The commands are translated inside the unit into usable system commands. Operation of the systems with an analog controller enables the control of a limited set of camera and lens functions (see Table 7-1). If more sophisticated operation of the systems is required, serial communications have to be used (see Section 7.2.1).

### 7.1.1 Signal Levels

The analog relay closures require a ground contact to the camera on the appropriate pin. When a signal is not in use, the relay should be open, and the signal will float. Internal pull-ups keep the signals high inside the camera when they are not in use. Using a desired function requires a ground level to be applied as the input signal to the camera for that function. Applying a ground signal on the correct pin will cause the thermal imager to perform the appropriate response.

### 7.1.2 Function Assignments

Only some functions are available on systems operating with analog control inputs. For focus adjustments and field of view changes, as long as the signal is tied low, the focus will continue moving in the selected direction until the end of travel for the mechanism has been reached.

The following chart (Table 7-1) indicates each of the analog inputs.

**CAUTION:**

If more than 3.3V is applied to any input, damage may occur.

| Table 7-1: Table of Analog Inputs (Command Register Definitions) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Function** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** | **Decimal** |
| | 5 | 4 | 3 | 2 | 1 | 0 | |
| Nothing | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pol Norm | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Pol Inv | 0 | 0 | 0 | 0 | 1 | 0 | 2 |
| Focus Inf | 0 | 0 | 0 | 1 | 0 | 0 | 4 |
| Focus Near | 0 | 0 | 1 | 0 | 0 | 0 | 8 |
| FOV Wide | 0 | 1 | 0 | 0 | 0 | 0 | 16 |
| FOV Narrow | 1 | 0 | 0 | 0 | 0 | 0 | 32 |
| FOV Toggle | 0 | 0 | 0 | 0 | 1 | 1 | 3 |
| Pol Toggle | 0 | 1 | 0 | 0 | 0 | 1 | 17 |
| ROI Toggle | 0 | 1 | 0 | 0 | 1 | 0 | 18 |
| NUC[1] [sens.] Toggle [Inttime] | 0 | 1 | 0 | 0 | 1 | 1 | 19 |
| Freeze Toggle | 1 | 0 | 0 | 0 | 0 | 1 | 33 |
| Cal1 Start | 1 | 0 | 0 | 0 | 1 | 0 | 34 |
| AGC Toggle | 1 | 0 | 0 | 0 | 1 | 1 | 35 |
| MOC[2] Increment | 1 | 1 | 0 | 0 | 0 | 0 | 48 |
| MOC[2] Decrement | 1 | 1 | 0 | 0 | 0 | 1 | 49 |
| MGC[3] Increment | 1 | 1 | 0 | 0 | 1 | 0 | 50 |
| MGC[3] Decrement | 1 | 1 | 0 | 0 | 1 | 1 | 51 |
| Overlay Toggle | 0 | 0 | 0 | 1 | 0 | 1 | 5 |
| Reticle Toggle | 0 | 0 | 0 | 1 | 1 | 0 | 6 |
| Fine Focus Inf | 0 | 0 | 0 | 1 | 1 | 1 | 7 |
| Fine Focus Near | 0 | 0 | 1 | 0 | 0 | 1 | 9 |
| Zoom Out | 0 | 0 | 1 | 0 | 1 | 0 | 10 |
| Zoom In | 0 | 0 | 1 | 0 | 1 | 1 | 11 |
| AutoFocus Toggle | 0 | 0 | 1 | 1 | 0 | 0 | 12 |
| Sens Toggle | 0 | 0 | 1 | 1 | 0 | 1 | 13 |
| AGC Gain Increment | 0 | 0 | 1 | 1 | 1 | 0 | 14 |
| AGC Gain Decrement | 0 | 0 | 1 | 1 | 1 | 1 | 15 |
| Palette Toggle [PLT] | 0 | 1 | 0 | 1 | 0 | 0 | 20 |
| Image Capture [IC] | 0 | 1 | 0 | 1 | 0 | 1 | 21 |
| One Time Function [OTF] | 0 | 1 | 0 | 1 | 1 | 0 | 22 |
| Up Arrow | 0 | 1 | 0 | 1 | 1 | 1 | 23 |
| Down Arrow | 0 | 1 | 1 | 0 | 0 | 0 | 24 |
| Left Arrow | 0 | 1 | 1 | 0 | 0 | 1 | 25 |
| Right Arrow | 0 | 1 | 1 | 0 | 1 | 0 | 26 |
| OK Button | 0 | 1 | 1 | 0 | 1 | 1 | 27 |

[1]NUC=Non-Uniformity Correction [Table]
[2]MOC=Manual Offset Control
[3]MGC=Manual Gain Control

Note: A logic one (1) denotes a connection between Input X and Bit Common.

**Caution: If more than 3.3V is applied to any input, damage may occur.**

# 7.2 Digital Control

The digitally controlled system sends out serial commands directly to the camera from a control box or PC or to the camera from a PC via the Axsys Camera GUI (graphical user interface). All of the functionality of the lens and camera is available to a user employing the serial command method. For systems incorporating a PC, the Axsys Camera GUI provides an easy to use 'point and click' software interface that controls the thermal imaging system's properties via the serial commands. Axsys also offers a range of control boxes that enable partial to complete serial command control.

## 7.2.1 Serial Command Communication

The default standard for serial (digital) control utilizes RS-232 communications between the host and the unit. Unless otherwise specified, all units will be shipped with this protocol as the method of serial communications. The systems can also be configured for RS-422 communications if necessary, but this should be done at the factory, prior to shipping the unit. Please notify your Axsys representative at the time of purchase if RS-422 communications are required.

**NOTE:**

Cables must be plugged into the connector on the back of the camera for the system to communicate. Make sure power is off before plugging the cable in, as damage may result to sensitive electrical components otherwise.

## 7.2.2 Serial Communications Protocol

The thermal imager serial interface operates with the recommended host settings described in Table 7-2. Each camera is shipped with either the default setting, 9600, or to the baud rate specified by the customer at the time of purchase. The baud rate can be changed using the appropriate serial commands (BAUD:, UPDATE:). See Table 7-3 (Table of Serial Commands) for more information.

**NOTE:**

The serial input buffer is dynamic; it allows for backspacing of characters if a typing error occurs when the command is being entered.

**Table 7-2: Recommended Serial Port Parameters**

| | |
|---|---|
| Possible Baud Rates | 4800<br>9600– factory default<br>19200<br>38400<br>57600<br>115200 |
| Data bits | 8 |
| Parity | N |
| Stop bits | 1 |

### 7.2.2.1 RS-232 Protocol

To pass data between the host and a peripheral device, the RS-232 communications interface uses a 3-wire format: one transmit wire, one receive wire, and a ground wire. This format allows the communications cable to be plugged directly into most PCs with an available serial port. Note that if a shielded cable is to be used, the shield should be terminated at the host end of the cable. Refer to the IEEE standard for more information on RS-232 communications.

### 7.2.2.2 RS-422 Protocol

To pass data between the host and a peripheral device, the RS-422 communications interface uses a 4-wire, differential receive and transmit pair: It is recommended that the communications cable consist of two sets of twisted pairs, one for the differential receive, and one for the differential transmit. This format allows for longer cable lengths and better noise immunity. When differential signals are employed, the communications cable does not have to be shielded, but shielding is recommended if the system is to be used in a noisy environment. The shield should be terminated at the host end of the cable.

## 7.2.3 Command Format

The serial commands sent to the camera must adhere to the command format to be recognized. The general format for a serial command is the command string with an end of command marker, in this case a colon, followed by any necessary parameters, each separated by commas. If no parameters are needed, the command still requires the end of command marker, i.e. the colon. A serial command should be terminated with a carriage return, <CR>. The <Enter> key on some terminal emulators typically simulates a carriage return with line feed. If this is the case the "send a line feed with each line" option should be not checked.

Example 9-1 Sample Command with No Parameters

*To adjust the focus towards infinity, the following command is used:*

*FOCUSI:*

***Note:*** *no parameters are required for this command, so the parameter list is empty. However, the end of command marker, the colon, is still required.*

*Example 9-2 Sample Command with Parameters*

*This example shows how to change to Auto Shutter Interval to every 60 seconds:*

*INTERVAL:60*

*This time the parameter list contains the value 60, to indicate that 60 seconds is the desired interval period between automatic 1-point NUC (Non-Uniformity Correction) updates. This command may not be available in all systems.*

## 7.2.4 Serial Commands

### 7.2.4.1 Serial Input Commands

| | | Table 7-3: Serial Input Commands | | |
|---|---|---|---|---|
| | **Command** | **Description** | **In-put Req'd?** | **Para-meter Values** |
| | ADC?: | Displays in decimal the value of the specified AD channel. | yes | 0-7 |
| | AF: | Executes a single autofocus operation. | no | |
| | AGC: | Turns the Automatic Gain Control (AGC) off or on.<br>(No input toggles the Automatic Gain Control (AGC) state.<br>Inputting 0/1 turns AGC off (0)/on (1).) | optional | 0/1 |
| | AGC?: | Displays the off (0)/on (1) status of Automatic Gain Control. | no | |
| | AGCAVERAGE: | Sets the number of frames for the AGC running average in decimal. | yes | decimal |
| | AGCAVERAGE?: | Displays the number of frames for the AGC running average in decimal. | no | |
| | AGCFRAME: | Sets the number of frames between AGC calculations. | yes | 1-100 |
| | AGCFRAME?: | Displays the number of frames between AGC calculations in decimal. | no | |
| | AGCGAIN: | Sets the maximum gain level for linear AGC. | yes | 1-4094 |
| | AGCGAIN?: | Displays the maximum gain level for linear AGC. | no | |
| | AGCLOI: | Sets the level of interest for AGC for the current NUC. | yes | 1-4095 |
| | AGCLOI?: | Displays the level of interest for AGC for the current NUC. | no | |
| | AGCMODE: | Selects AGC mode:<br>0- Manual<br>1- Combination<br>2- Histogram Equalization<br>3- Linear<br>4- Histogram Full<br>5- Histogram Full Padded. | yes | 0-5 |
| | AGCMODE?: | Displays the gain control method for the current NUC. | no | |
| | AGCOFF: | Turns Automatic Gain Control off. | no | |
| | AGCON: | Turns Automatic Gain Control on. | no | |
| | AGCSHIFT: | Sets the number of bins to subtract from the offset in linear AGC. | yes | decimal |
| | AGCSHIFT?: | Displays the number of bins to subtract from the offset in linear AGC in deci-mal. | no | |
| | AGC-: | Decrements the AGC gain level used when AGC is enabled. | no | |
| | AGC+: | Increments the AGC gain level used when AGC is enabled. | no | |
| | AKILL: | Initiates Autokill, which automatically selects pixels to kill according to one of four methods. All four inputs are required.<br>Delta (Difference from mean that indicates bad pixel)= 0-4095<br>Gridsize (Size of grid to average)= 1-10<br>RightEdgeCols (# of right edge columns to ignore) = 0-319<br>SinglePix (Print stats for a single pixel. Enter Ø if not desired) 0-76799 | yes | D:0-4095<br>GS:1-10<br>REC:0-319<br>SP:0-76799 |

| | | | | |
|---|---|---|---|---|
| | AUTOCAL?: | Displays the off (0)/on (1) status of auto shutter calibration. | no | |
| | AUTOCALOFF: | Turns auto shutter calibration off. | no | |
| | AUTOCALON: | Turns auto shutter calibration on. | no | |
| | AUTOFOCUS: | Sets auto focus mode:<br>0=Disable<br>1=Variance<br>2=SMD<br>3=Tenenbaum<br>4=Laplacian<br>5=1+3. | yes | 0-5 |
| | AUTOFOCUS?: | Displays current auto focus mode:<br>0=Disable<br>1=Variance<br>2=SMD<br>3=Tenenbaum<br>4=Laplacian<br>5=1+3. | no | |
| | AUTOVRESET: | Turns auto vreset adjustment off (0)/on (1). | yes | 0/1 |
| | AUTOVRESET?: | Displays the off (0)/on (1) status of auto vreset adjustment. | no | |
| | BATTCHARGER: | Sets the battery charger state:<br>0 - disabled.<br>1 - enabled. | yes | 0/1 |
| | BATTCHARGER?: | Displays the battery charger state: 0 - disabled, 1 - enabled. | no | |
| | BATTPOWER: | Sets the power source:<br>0 - external source.<br>1 - battery. | yes | 0/1 |
| | BATTPOWER?: | Displays the power source. | no | |
| | BATTLEVEL: | Sets the 5 battery display thresholds in millivolts. Enter lowest to highest, separated by commas. | yes | 0 - 9999 |
| | BATTLEVEL?: | Displays the battery display thresholds in millivolts. | no | |
| | BATTTYPE?: | Displays whether a 2 or 3 terminal battery is in use. Use DEBUG_SSP for detailed results. | no | |
| | BAUD: | Sets the baud rate.<br>Supported rates are: 4800, 9600, 19200, 38400, 57600, 115200. | yes | see descript. |
| | BAUD?: | Displays the baud rate in decimal. | no | |
| | BAUD1: | Sets the baud rate on com 1.<br>Supported rates are: 4800, 9600, 19200, 38400, 57600, 115200. | yes | see descript. |
| | BAUD1?: | Displays the baud rate on com 1 in decimal. | no | |
| | BITPORT: | Uses external bit banging port: 0- No, 1- Yes. | yes | 0/1 |
| | BITPORT?: | Displays whether or not external bit banging port is in use. | no | |
| | BRICON?: | Displays the current brightness and contrast settings [0-4095] in either Auto or Manual Gain Control mode. | no | |

| | | | | |
|---|---|---|---|---|
| | CAL1: | Runs a shutter calibration; no save to flash. | optional | |
| | CAL1ERROR?: | Displays the acceptable % of deviation from the average value for limit check. | | |
| | CAL1FRAME: | Sets the number of frames to grab during a shutter calibration. | yes | |
| | CAL1FRAME?: | Displays the number of frames to grab during a shutter calibration. | no | 1-16 |
| | CAL1S: | Runs a shutter calibration; saves it to flash. | no | |
| | CAL2: | Runs the CPO routine with the entered value followed by a two point calibration [hex]. | optional | none,<br>0 - FFFF |
| | CAL2GAIN?: | Displays the maximum gain level for the two point calibration, per NUC. | no | |
| | CALPARAMS?: | Displays the parameters used during the CPO and two point calibration. | no | |
| | CAP: | Captures a still and saves it to flash. | no | |
| | COLOR: | Turns the color mode off (0)/on (1). | yes | 0/1 |
| | COLOR?: | Displays the off (0)/on (1) status of the color mode. | no | |
| | COLORBAR: | Turns the color bar test pattern off (0)/on (1). | yes | 0/1 |
| | COLORBURST: | Sets the colorburst value: off (0)/on (1). | yes | 0/1 |
| | COLORBURST?: | Displays the off (0)/on (1) status of the colorburst setting. | no | |
| | COMMODE: | Sets COM3 mode: 0 - RS-422, 1- RS-232.<br>Change takes effect after reboot. | yes | 0/1 |
| | COMMODE?: | Displays COM3 mode. 0- RS-422, 1- RS-232. | no | |
| | COMPASS: | Sets Compass configuration:<br>0/1 - Not present/Compass installed.<br>2/3 - Displays heading/Hides heading.<br>4 - Displays heading on terminal.<br>5 - Displays default pallet.<br>6 - Displays pallet 1.<br>7 - Displays pallet 2. | yes | 0-7 |
| | CURSOR: | Toggles the cursor display off (0)/on (1). | yes | 0/1 |
| | CURSOR?: | Displays the off (0)/on (1) status of the cursor display. | no | |
| | CURSORCOLOR: | Sets the color of the cursor: 0 - white, 1 - black. | yes | 0/1 |
| * | DAYMODE: | Sets Daymode operation: 0 - disable, 1 - enable. | yes | 0/1 |
| * | DAYMODE?: | Displays the Daymode setting: 0 -disabled, 1 - enabled. | no | |

* *Only Available in Axsys Mid-Wave Thermal Camera Systems using InSb cooled sensors.*

| | | | | |
|---|---|---|---|---|
| | DETECTOR?: | Displays the detector type. | no | |
| | DIAG: | Toggles the debug serial message display off (0)/on (1). | yes | 0/1 |
| | DIR: | Displays a listing of files on the flash memory. | no | |
| | DISPLAY: | Displays the entered (alphanumeric) text in the overlay buffer (enter text). | yes | see descript. |
| | DISPLAYMODE: | Sets the display mode.<br>0- Interlaced<br>1- Non-Interlaced. | yes | 0/1 |
| | DISPLAYMODE?: | Displays the display mode. | no | |
| | DOWNLOAD: | Downloads a file via 1kXmodem. Parameter is the local (alphanumeric) filename. | yes | see descript. |
| | DZOOM: | Enables Digital Zoom: 0- 1x, 1- 2x. | yes | 0/1 |
| † | EFL: | Moves the lens to the specified Effective Focal Length (enter length appropriate to range of camera in use). | yes | 100-500<br>*or*<br>50-350 |
| † | EFL?: | Displays the current Effective Focal Length. | no | |
| | FLIPH: | Activates (1)/Deactivates (0) a horizontal flip of the display. | yes | 0/1 |
| | FLIPH?: | Displays the off (0)/on (1) status of a horizontal flip of the display. | no | |
| | FLIPV: | Activates (1)/Deactivates (0) a vertical flip of the display. | yes | 0/1 |
| | FLIPV?: | Displays the off (0)/on (1) status of a vertical flip of the display. | no | |
| | FOCUSDURATION: | Sets the focus pulse duration in milliseconds. | yes | 1-255 |
| | FOCUSDURATION?: | Displays the focus pulse duration in milliseconds. | no | |
| | FOCUSPOS: | Sets the current FOV servo focus position (potentiometer) target value. | yes | 0 – 4095 |
| | FOCUSPOSM: | Sets the Medium FOV servo focus position (potentiometer) target value. (Value will be tested against the current "potmin/potmax" settings for the Medium FOV servo focus position.) | yes | 0-4095 |
| | FOCUSPOSN: | Sets the Narrow FOV servo focus position (potentiometer) target value. (Value will be tested against the current "potmin/potmax" settings for the Narrow FOV servo focus position.) | yes | 0-4095 |
| | FOCUSPOSW: | Sets the Wide FOV servo focus position (potentiometer) target value. (Value will be tested against the current "potmin/ potmax" settings for the Wide FOV servo focus position.) | yes | 0-4095 |
| | FOCUSPOS?: | Displays the servo focus position (potentiometer) target value:<br>0 - 4095(N)<br>0 - 4095(M)<br>0 - 4095(W). | no | |
| | FOCUSPOSA?: | Displays the current absolute servo focus position (potentiometer). | no | |

† *Only available in Continuous Zoom models.*

| | | | | |
|---|---|---|---|---|
| | FOCUSSERVO: | Sets the focus servo operation mode: 0 - disabled, 1 - enabled. | yes | 0/1 |
| | FOCUSSERVO?: | Displays the current focus servo ooperation mode | no | |
| | FOCUSI: | Focus towards infinity:<br>No input = 1 * focus duration.<br>Input of x > 1 = x * focus duration. | optional | decimal |
| | FOCUSINFINITY: | Focus towards infinity:<br>1- starts focus.<br>0- ends focus. | yes | 0/1 |
| | FOCUSN: | Sets Focus towards near:<br>No input = 1 * focus duration.<br>Input of x > 1 = x * focus duration. | optional | decimal |
| | FOCUSNEAR: | Initiates Focus towards near:<br>1 - starts focus.<br>0 - ends focus. | yes | 0-1 |
| | FOVDURATION: | Sets FOV pulse duration in milliseconds. | yes | 1-255 |
| | FOVDURATION?: | Displays the FOV pulse duration in milliseconds. | no | |
| | FOVSERVO: | Sets the FOV servo operation mode: 0 - disabled, 1 - enabled. | yes | 0/1 |
| | FOVSERVO?: | Displays the current FOV servo operation mode:<br>0 - disabled, 1 - enabled. | no | 0/1 |
| | FOVAXIS: | FOV axis present? 0 - No, 1 - Yes. | yes | 0/1 |
| | FOVAXIS?: | Displays whether or not an FOV axis is present. | no | |
| | FOVENABLE: | Re-enables the FOV after a timeout error. | no | |
| | FOVENABLE?: | Displays whether or not the FOV has been disabled. | no | |
| | FOVM: | Sets FOV to medium. For zoom systems (FieldPro), the lens is set to an effective focal length of 167mm. This command is only valid for Tri-FOV and zoom systems. | no | |
| | FOVN: | Sets FOV to narrow. For zoom systems (FieldPro), the lens is set to an effective focal length of 500mm. For Dual FOV and Tri FOV systems, the lens is set to the narrow FOV. | no | |
| † | FOVPRESETA: | Enters up to 10 FOV preset Effective Focal Length positions (comma separated) between the values of 100 - 500. This command affects zoom systems only. These positions will be appended to the end of the currently existing list. Enter FOV preset EFL to add (i.e., current list 100,150,175,400; FOVPRESTA:420,450; new list 100,150,175,400,420,450). The use of FOVPRESETS is recommended! | yes | 100-500;<br>EFL[1]…<br>EFL[10] |
| † | FOVPRESETS: | Enters up to 10 FOV preset Effective Focal Length positions (comma separated) between the values of 100 - 500. This command affects zoom systems only. Previously configured EFL positions will be lost. (I.e. FOVPRESETS: 100,150,175,400.) | yes | 100-500;<br>EFL[1]…<br>EFL[10] |
| | FOVPRESETS?: | Displays the FOV presets. | no | |
| | FOVTOGGLE: | Toggles the FOV position. For zoom systems (FieldPro), the lens scrolls through the EFL table set by the FOVPRESETA and/or FOVPRESETS commands. For Tri-FOV systems, the lens switches from wide to mid to narrow and back on consecutive toggle commands. For Dual FOV systems the lens toggles between the narrow and wide FOVs. | no | |
| | FOVW: | Sets FOV to wide. For zoom systems (FieldPro), the lens is set to an effective focal length of 100mm. For Dual FOV and Tri-FOV systems, the lens is set to the wide FOV. | no | |
| | FOV?: | Displays FOV position. | no | |

† *Only available in Continuous Zoom models.*

| | | | | |
|---|---|---|---|---|
| | FPACTL?: | Displays the FPA_CTL register setting [hex]. | no | |
| | FPACONST?: | Displays the FPA_CONST register setting [hex]. | no | |
| | FPAGAIN?: | Displays the value for the video mux in the FPA_CTL register.<br>1- hi gain<br>2- lo gain. | no | |
| | FPASCRH?: | Displays the FPA_SCR_H register setting [hex]. | no | |
| | FPASCRL?: | Displays the FPA_SCR_L register setting [hex]. | no | |
| | FPATEMP?: | Displays the FPA_TEMP register value [hex]. | no | |
| | FREEZE: | 0- Activates the 'live' display.<br>1- Freezes the video display. | optional | 0/1 |
| | HELP: | Displays a listing of available commands. | optional | |
| | HIGHLIGHT: | 0- Disables bad pixel highlighting.<br>1- Enables bad pixel highlighting. | yes | 0/1 |
| | HIGHLIGHT?: | Displays the status of bad pixel highlighting: 0- off, 1- on. | no | |
| | HISTBINHI: | Sets the end bin for calculating the histogram. | yes | 0-4095 |
| | HISTBINHI?: | Displays the end bin for calculating the histogram [0-4095]. | no | |
| | HISTBINLO: | Sets the start bin for calculating the histogram. | yes | 0-4095 |
| | HISTBINLO?: | Displays the start bin for calculating the histogram [0-4095]. | no | |
| | HISTBIN?: | Displays the range of bins used to calculate the histogram. | no | |
| | HISTWIDTH: | Sets the width of histogram data, in number of bins and per NUC, used to determine single or dual plateau method for AGC. | yes | decimal |
| | HISTWIDTH?: | Displays the width of histogram data, in number of bins and per NUC, used to determine single or dual plateau method for AGC. | no | |
| | ICONS: | 0- Disables the icon displays. 1- Enables the icon displays. | yes | 0/1 |
| | ICONS?: | Displays whether the icon displays are in use. 0- off, 1- on. | no | |
| | IMAGEOFF: | Clears a bitmap.<br>1- Temperature warning.<br>2- Low power warning.<br>3- Battery power level.<br>4- Transmitter<br>5- Flash write<br>6- AC adapter<br>7- NUC 1 indicator<br>8- Digital Zoom Indicator | yes | 1-7 |
| | IMAGEON: | Displays a bitmap.<br>1- Temperature warning.<br>2- Low power warning.<br>3- Battery power level.<br>4- Transmitter<br>5- Flash write<br>6- AC adapter<br>7- NUC 1 indicator<br>8- Digital Zoom Indicator | yes | 1-7 |
| | IMGDEL: | Entering 0-16 deletes a captured image from flash.<br>Entering 99 will delete all images on flash. | yes | 0-16,<br>99 |

| | | | | |
|---|---|---|---|---|
| | INTERVAL: | Sets the interval in seconds for auto shutter 1-point NUC. | yes | 1-5439 |
| | INTERVAL?: | Displays the interval for auto shutter 1-point NUC. | no | |
| * | INTTIME: | Sets the integration time for the current NUC table. | yes | 4-313 |
| * | INTTIME?: | Displays the integration time for the current NUC table.The input is optional. If a value is specified it must be in the range 0 – 3, specifying for which NUC to display the INTIME. | optional | 0 – 3 |
| | ISC: | Closes the ice shutter on models so equipped. | no | |
| | ISO: | Opens the ice shutter on models so equipped. | no | |
| | LEVELL: | Sets the count of pixels outside the lower threshold that would instigate a switch of NUC tables. | yes | decimal |
| | LEVELL?: | Displays the count of pixels outside the lower threshold that would instigate a switch of NUC tables. | no | |
| | LEVELU: | Sets the count of pixels outside the upper threshold that would instigate a switch of NUC tables. | yes | decimal |
| | LEVELU?: | Displays the count of pixels outside the upper threshold that would instigate a switch of NUC tables. | no | |
| | LEVEL?: | Displays the upper and lower count of pixel settings for NUC switching. | no | |
| | LOGO: | 0- Clears the logo display.<br>1- Displays the logo. | yes | 0/1 |
| | LOGO?: | Displays 1 if logo is displayed, 0 if logo is not displayed. | no | |
| | LUT?: | Displays the active LUT (Lookup Table). | no | |
| | MEAN: | Displays the averaged pixel values for n(1-16) number of frames.<br>If no input is specified, a single frame average is displayed. | optional | none,<br>1-16 |
| | MEMTEST: | Initiates a memory test: 0- All Banks, 1- SDRAM 0, 2- SDRAM 1, 3- SSRAM. | yes | 0-3 |

* *Only Available in Axsys Mid-Wave Thermal Camera Systems using InSb cooled sensors.*

| | | | | |
|---|---|---|---|---|
| | MAN?: | Displays the contrast (gain) and offset levels used when AGC is disabled. | no | |
| | MGC: | Sets, in decimal, the gain level used when AGC disabled. Higher value means higher gain. | yes | 0-4095 |
| | MGC-: | Decrements by one level the gain level used when AGC is disabled. | no | |
| | MGC+: | Increments by one level the gain level used when AGC is disabled. | no | |
| | MOC: | Sets, in decimal, the offset level used when AGC is disabled. | yes | 0-4095 |
| | MOC-: | Decrements by one level the offset level used when AGC is disabled. | no | |
| | MOC+: | Increments by one level the offset level used when AGC is disabled. | no | |
| | MODEL: | Sets model for camera. | yes | 0-9/a-s |
| | MODEL?: | Displays the current camera configuration. | no | |
| | NRED: | Sets the noise reduction parameters:<br>Type - 0-2<br>N - 0-3 | yes | type:0-2<br>N:0-3 |
| | NRED?: | Displays the noise reduction parameters: Type, N. | no | |
| | NUC: | Sets the active NUC table. | optional | 0-2 |
| | NUC?: | Displays the active NUC table. | no | |
| | NUCCOPY: | Copies the current NUC files to the specified NUC files. | yes | 0-3 |
| | NUCDEFAULT: | Sets the default power up active NUC table. | yes | 0-2 |
| | NUCDEFAULT?: | Displays the default power up active NUC table. | no | |
| | NUCDELETE: | Deletes all calibration files for the specified NUC. | yes | 0-3 |
| | NUCLOAD: | If no parameter, loads the files for the active NUC from flash. Otherwise, loads the files for the specified NUC from flash. | optional | 0-3 |
| | NUCS?: | Displays the number of available NUC tables. | no | |
| | NUCSWITCH: | Activates (1)/Deactivates (0) NUC switching. | yes | 0/1 |
| | NUCSWITCH?: | Displays the off (0)/on (1) status of NUC switching. | no | |
| | PALETTE: | Selects the color palette to use when color mode is enabled:<br>White Hot Grayscale<br>Black Hot Grayscale<br>Ironbow<br>Ironbow Inverse<br>Rainbow<br>Rainbow Inverse<br>Oceana<br>Oceana Inverse<br>Sepia. | yes | 0-8 |
| | PALETTE?: | Displays the selected color palette. | no | |

| | | | |
|---|---|---|---|
| PLTTOG: | Cycles through available color palettes (see listing at "PALETTE"). | no | |
| PLAT: | Sets the AGC plateau used in the single plateau method [hex]. | yes | 0-fff |
| PLAT1: | Sets the first AGC plateau used in the dual plateau method [hex]. | yes | 0-fff |
| PLAT2: | Sets the second AGC plateau used in the dual plateau method [hex]. | yes | 0-fff |
| PLATS?: | Displays the current plateaus and switch points used for AGC [hex]. | no | |
| PLAT?: | Displays the AGC plateau used in the single plateau method [hex]. | no | |
| PLAT1?: | Displays the first AGC plateau used in the dual plateau method [hex]. | no | |
| PLAT2?: | Displays the second AGC plateau used in the dual plateau method. | no | |
| PLATSWITCH: | Sets the bin to switch plateau values when using the dual plateau method. | yes | decimal |
| PLATSWITCH?: | Displays the bin to switch plateau values when using the dual plateau method. | no | |
| POL?: | Displays the current polarity mode (normal or inverted). | no | |
| POLARITY: | No input toggles polarity.<br>0- Polarity white hot<br>1- Polarity black hot. | optional | none,<br>0/1 |
| POLINV: | Sets the display polarity to inverted mode (white cold, black hot). | no | |
| POLNORM: | Sets the display polarity to normal mode (white hot, black cold). | no | |
| PSENSOR?: | Displays the state of the pressure sensor. | no | |
| REGISTERS?: | Displays the StrongArm register settings. | optional | |
| REG?: | Displays the setting of a Xilinx register [register offset]. | no | |

| | | | | |
|---|---|---|---|---|
| | RETICLE: | Toggles the reticle display off (0)/on (1). | yes | 0/1 |
| | RETICLE?: | Displays the off (0)/on (1) status of the reticle display. | no | |
| | RETICLESAVE: | Saves the current position and style of the reticle display. | no | |
| | RETICLETYPE: | Selects the reticle style. | yes | 1-3 |
| | RETICLETYPE?: | Displays the current reticle style. | no | |
| | ROI: | No input steps through the available regions.<br>Inputting 1-8 sets the regions of interest, from center of screen.<br>1- 1/4 screen<br>2- 1/2 screen<br>3- 3/4 screen<br>4- entire screen<br>5-8 user-defined areas. | yes | 1-8 |
| | ROI?: | Displays the current region of interest, originating from center of screen.<br>1- 1/4 screen<br>2- 1/2 screen<br>3- 3/4 screen<br>4- entire screen<br>5-8 user defined areas. | no | |
| | ROIDEFAULT: | Sets the default power up region of interest. | yes | 1-8 |
| | ROIDEFAULT?: | Displays the default power up region of interest. | no | |
| | ROISET: | Sets the region of interest as specified by the image coordinates. Enter ROI coordinates (1-8), X1,Y1, X2,Y2.<br>x1,y1 = upper left hand corner of ROI.<br>x2,y2 = lower right hand corner of ROI. | yes | n=1-8<br>x=0-319<br>y=0-239 |
| | ROISET?: | Displays the coordinates for the specified region of interest. | yes | 1-8 |
| | SCALEHI: | Sets the average pixel value scale factor for the temperature range 25 to 60 degrees. | yes | 0.0-5.0 |
| | SCALEHI?: | Displays the average pixel value scale factor for the temperature range 25 to 60 degrees. | no | |
| | SCALELO: | Sets the average pixel value scale factor for the temperature range -20 to 25 degrees. | yes | 0.0-5.0 |
| | SCALELO?: | Displays the average pixel value scale factor for the temperature range -20 to 25 degrees. | no | |
| * | SENSTOG: | Selects the sensitivity (FPASCRH) setting.<br>No input toggles the sensitivity (FPASCRH) setting.<br>0 - sets mode to lo<br>1 - sets mode to hi. | optional | none,<br>0/1 |
| * | SENSTOG?: | Displays the current sensitivity (FPASCRH) setting. | no | |

* *Only available in Axsys Mid-Wave Cooled InSb Camera Systems.*

| | | | | |
|---|---|---|---|---|
| | SETMENU?: | Displays the active menu items for cadet. | no | |
| | SHOWTIME: | Disables (0) or enables (1) the on screen time display. | yes | 0/1 |
| | SHUTTER: | Disables (0) or enables (1) the shutter operation. | yes | 0/1 |
| | SHUTTER? | Displays the shutter operational setting (enabled/disabled). | no | |
| | SN?: | Displays the serial number for the completed camera assembly. | no | |
| | SC: | Closes the shutter. | no | |
| | SO: | Opens the shutter. | no | |
| | STATUS: | Displays the settings for video flips, AGC, and the video interrupt. | no | |
| | STATS?: | Displays the runtime statistics. | no | |
| | SYNCMODE?: | Displays the mode for the digital vertical sync. | no | |
| □ | TEMP?: | Displays the shutter temperature if there is a thermistor in use. | yes | |
| | THERMISTOR: | Sets the status of the thermistor.<br>0 - Thermistor not in use<br>1 - Thermistor in use. | yes | 0/1 |
| | THERMISTOR?: | Displays whether or not the thermistor is in use. | no | |
| | THL: | Sets the index into the histogram buffer indicating the lower trip point for NUC table switching. | yes | 0-4095 |
| | THL?: | Displays the index into the histogram buffer indicating the lower trip point for NUC table switching [0-4095]. | no | |

□ *Only available in Axsys Long-Wave Uncooled Camera Systems.*

| | | | | |
|---|---|---|---|---|
| | THU: | Sets the index into the histogram buffer indicating the upper trip point for NUC table switching. | yes | 0-4095 |
| | THU?: | Displays the index into the histogram buffer indicating the upper trip point for NUC table switching [0-4095]. | no | |
| | TH?: | Displays the upper and lower threshold settings. | no | |
| | TIME: | Sets the time and date [hh:mm:ss [am/pm] MM/dd/yy]. If the am/pm indicator is left out, the 24h mode is assumed. | yes | see descript. |
| | TIME?: | Displays the current time and date. | no | |
| | UPDATE: | Writes the current configuration to flash. | no | |
| | UPLOAD: | Uploads a file via 1kXmodem. Parameter is the local (alphanumeric) filename. | optional | see descript. |
| | VBIAS?: | Displays the VBIAS voltage level. | no | |
| | VERBOSE: | Activates (1)/Deactivates (0) verbose response mode. | yes | 0/1 |
| | VERBOSE?: | Displays the off (0)/on (1) status of verbose response mode. | no | |
| | VERSION?: | Displays the software and Xilinx version information. | no | |
| | VHI: | Sets the VHI voltage level. | yes | 0fff |
| | VHI?: | Displays the VHI voltage level. | no | |
| | VIDCTL0?: | Displays the VID_CTL0 value. | no | |
| | VIDCTL1?: | Displays the VID_CTL1 value. | no | |
| | VIDEOCOLUMN?: | Displays last column used for replacement during pixel killing. | no | |
| | VIDEOFORMAT: | Sets the video format. 0- 8 bit format, 1- 12 bit format. | yes | 0/1 |
| | VIDEOFORMAT?: | Displays the video format. | | |
| | VIDEOMODE: | Sets the video mode. 0- NTSC, 1- PAL. | yes | 0/1 |
| | VIDEOMODE?: | Displays the video mode. | no | |
| | VIDEOROW?: | Displays the last row used for replacement during pixel killing. | no | |
| | VIDEOSOURCE: | Sets video output source selection: 0 - IR, 1 - Aux. | yes | 0/1 |
| | VIDEOSOURCE?: | Displays the video output source selection: 0 - IR, 1 - Aux. | no | |
| | VLO: | Sets the VLO voltage level (hex). | yes | 0fff |
| | VLO?: | Displays the VHI voltage level. | no | |
| | VRESET: | Sets the VRESET voltage level. | yes | 0-0xfff |
| | VRESET?: | Displays the VRESET voltage level. | no | |
| | WIPER: | Sets the window wiper mode. (0 - turns wiper off, 1 - turns wiper on) | yes | 0/1 |
| † | ZOOMC: | Moves the zoom continuously until stopped. The first parameter specifies direction [1/2] NARROW/WIDE; the second parameter enables / disables the zoom [0/1]. | yes | 1/2(narrow/wide), 0/1(disable/enable) |
| † | ZOOMN: | Moves the zoom in the NARROW direction for the specified duration, 0-5000 milliseconds. | yes | 0-5000 |
| † | ZOOMW: | Moves the zoom in the WIDE direction for the specified duration, 0-5000 milliseconds. | yes | 0-5000 |

† *Only available in Continuous Zoom models.*

### 7.2.4.2 Serial Output Commands

**Table 7-4: Serial Output Commands**

| | Command | Verbose Response | Non Verbose Response |
|---|---|---|---|
| | ADC?: | ":ADC Channel [uint] = [uint]." | [uint] |
| | AF: | no response | |
| | AGC: | ":AGC on.<br>:AGC off." | [uint] |
| | AGC?: | ":AGC on.<br>:AGC off." | [uint] |
| | AGCAVERAGE: | ":AGC frames to average [uint]." | [uint] |
| | AGCAVERAGE?: | ":AGC frames to average [uint]." | [uint] |
| | AGCFRAME: | ":AGC frames: [uint]." | [uint] |
| | AGCFRAME?: | ":AGC frames: [uint]." | [uint] |
| | AGCGAIN: | ":Max gain level [uint]." | [uint] |
| | AGCGAIN?: | ":Max gain level [uint]." | [uint] |
| | AGCLOI: | ":AGC level of interest [uint]." | [uint] |
| | AGCLOI?: | ":AGC level of interest [uint]." | [uint] |
| | AGCMODE: | ":Manual mode.<br>:Combination mode.<br>:Histogram equalization mode.<br>:Linear mode.<br>:Full Histogram equalization mode.<br>:Full Histogram equalization mode with low contrast padding." | 0<br>1<br>2<br>3<br>4<br>5 |
| | AGCMODE?: | ":Manual mode.<br>:Combination mode.<br>:Histogram equalization mode.<br>:Linear mode.<br>:Full Histogram equalization mode.<br>:Full Histogram equalization mode with low contrast padding." | 0<br>1<br>2<br>3<br>4<br>5 |
| | AGCOFF: | ":OK." | :OK |
| | AGCON: | ":OK." | :OK |
| | AGCSHIFT: | ":Offset shift = [int]." | [int] |
| | AGCSHIFT?: | ":Offset shift = [int]." | [int] |
| | AGC-: | ":AGC gain:[uint]." | [uint] |
| | AGC+: | ":AGC gain:[uint]." | [uint] |
| | AKILL: | no response | |
| | AUTOCAL?: | ":Auto calibration is on.<br>:Auto calibration is off." | [uint] |
| | AUTOCALOFF: | ":OK." | :OK |
| | AUTOCALON: | ":Auto calibration is on." | 1 |

| | | | |
|---|---|---|---|
| | AUTOFOCUS: | ":Autofocus = 0 (Disabled).<br>:Autofocus = 1/6 (Grey Level Variance method).<br>:Autofocus = 2/7 (Sum-Modulus-Difference method).<br>:Autofocus = 3/8 (Tenenbaum Edge Detection method).<br>:Autofocus = 4/9 (Laplacian Edge Detection method).<br>:Autofocus = 5/10 (Variance+Tenenbaum Detection method)." | 0<br>1/6<br>2/7<br>3/8<br>4/9<br>5/10 |
| | AUTOFOCUS?: | ":Autofocus = 0 (Disabled).<br>:Autofocus = 1/6 (Grey Level Variance method).<br>:Autofocus = 2/7 (Sum-Modulus-Difference method).<br>:Autofocus = 3/8 (Tenenbaum Edge detection method).<br>:Autofocus = 4/9 (Laplacian Edge Detection method).<br>:Autofocus = 5/10 (Variance+Tenenbaum detection method)." | 0/<br>1/6<br>2/7<br>3/8<br>4/9<br>5/10 |
| | AUTOVRESET: | ":Auto Vreset off.<br>:Auto Vreset on." | 0/1 |
| | AUTOVRESET?: | ":Auto Vreset off.<br>:Auto Vreset on." | 0/1 |
| | BATTCHARGER: | ":Battery Charger now [uint] (disabled (0)/enabled (1))." | 0/1 |
| | BATTCHARGER?: | ":Battery Charger now [uint] (disabled (0)/enabled (1))." | 0/1 |
| | BATTPOWER: | ":External power source.<br>:Battery powered." | 0/1 |
| | BATTPOWER?: | ":External power source.<br>:Battery powered." | 0/1 |
| | BATTLEVEL: | ":Thresholds set to [uint], [uint], [uint], [uint], [uint]." | [uint],[u],[u],[u],[u] |
| | BATTLEVEL?: | ":Thresholds set to [uint], [uint], [uint], [uint], [uint]." | [uint],[u],[u],[u],[u] |
| | BATTTYPE?: | ":Terminals:3<br>:Terminals:2<br>:Model does not use batteries." | see verbose |
| | BAUD: | ":Switching baud rate to [long uint.]…" | see verbose |
| | BAUD?: | ":Baud rate set to [long uint.]." | [long uint.] |
| | BAUD1: | "Switching baud rate to [long uint.]…" | see verbose |
| | BAUD1?: | ":Baud rate set to [long uint.]." | [long uint.] |
| | BITPORT: | ":External port not in use.<br>:External port in use." | 0/1 |
| | BITPORT?: | ":External port not in use.<br>:External port in use." | 0/1 |
| | BRICON?: | ":Brightness: [int] Contrast: [int]." | [int]:[int] |
| | CAL1: | Success = No text | see verbose |
| | CAL1ERROR?: | ":Deviation = 0 %, pixel replacement off.<br>:Deviation = [uint] %." | [uint] |
| | CAL1FRAME: | ":Frames = [uint]." | [uint] |
| | CAL1FRAME?: | ":Frames = [uint]." | [uint] |

| | | | |
|---|---|---|---|
| | CAL1S: | ":Clean mode initialization complete.<br>:Failed pixel count total now: [uint]<br>:FLASH: File gain_*.bin exists, deleting...<br>:FLASH: Writing file gain_*.bin...<br>:FLASH: File off_*.bin exists, deleting...<br>:FLASH: Writing file off_*.bin...<br>:FLASH: File pixel_*.bin exists, deleting...<br>:FLASH: Writing file pixel_*.bin...<br>:FLASH: File cal_data.ini exists, deleting...<br>:FLASH: Writing file cal_data.ini..." | see verbose |
| | CAL2: | no response | |
| | CAL2GAIN?: | ":Max gain = [float]." | [float] |
| | CALPARAMS?: | *Displays:* Ram Data. Date/Time Stamp for NUC updates, Calibration Settings,& Calibration Results. See Figure 7-1 | see verbose |
| | CAP: | ":COMMAND_INVALID.<br>:Acquiring image…" | see verbose |
| | COLOR: | ":Color off.<br>:Color on." | 0/1 |
| | COLOR?: | ":Color off.<br>:Color on." | 0/1 |
| | COLORBAR: | ":Color test bars off.<br>:Color test bars on." | 0/1 |
| | COLORBURST: | ":Colorburst now: [int]." | [int] |
| | COLORBURST?: | ":Colorburst = [uint]." | [uint] |
| | COMMODE: | ":RS422<br>:RS232" | 0/1 |
| | COMMODE?: | ":RS422<br>:RS232" | 0/1 |
| | COMPASS?: | ":Compass not present.<br>:Compass is present." | 0/1 |
| | CURSOR: | ":Cursor display disabled.<br>:Cursor display enabled." | 0/1 |
| | CURSOR?: | ":Cursor display disabled.<br>:Cursor display enabled." | 0/1 |
| | CURSORCOLOR: | ":OK." | :OK |

```
> calparams?:

RAM Data:
        Unit Serial #:
Time\Date Stamp:
        NUC     Date            Time            Serial #

         0
         1
         2
Calibration Settings:
        NUC      CPO    VHi     VLo     VReset  Gain    Int Time

         0      0x400   0xffe   0x3b0   0x780   1.500      4
         1      0x400   0xf7e   0x430   0x780   1.500      4
         2      0x400   0xfc1   0x372   0x680   1.500      4
Calibration Results:
                Lo      Hi              Pixel
        NUC     Mean    Mean    Delta   Fails

         0      1025    1691     666     501
         1      1032    1653     621     507
         2         0       0       0       0
```

*Figure 7-1: Representative screen as displayed on entering "CALPARAMS?:" command..*

| | | | |
|---|---|---|---|
| * | DAYMODE: | no response | |
| * | DAYMODE?: | ":DayMode now (disabled (0)/enabled (1))." | 0/1 |
| | DETECTOR?: | ":Uncooled detector.<br>:Cooled detector." | 0/1 |
| | DIAG: | "ERROR 33030: PARAMETER MISSING<br><br>Diagnostic Codes:<br><br>DEBUG_OFF 0x0000<br>DEBUG_GENERIC 0x0001<br>DEBUG_AGC 0x0002<br>DEBUG_CAL1 0x0004<br>DEBUG_CAL2 0x0008<br>DEBUG_CODE 0x20000<br>DEBUG_COMM 0x0010<br>DEBUG_CPO 0x0020<br>DEBUG_CURSOR 0x0040<br>DEBUG_DSP 0x0080<br>DEBUG_FLAG1 0x80000<br>DEBUG_FLAG2 0x100000<br>DEBUG_FLASH 0x0100<br>DEBUG_FOV 0x40000<br>DEBUG_GPIO 0x0200<br>DEBUG_HEAT 0x0035<br>DEBUG_I2c 0x0400<br>DEBUG_LCD 0x0800<br>DEBUG_MEMORY 0x1000<br>DEBUG_NUC 0x2000<br>DEBUG_PIXEL 0x4000<br>DEBUG_SSP 0x8000<br>DEBUG_TEMP 0x10000<br>DEBUG_XMODEM 0x0038<br>DEBUG_OVERLAY 0x200000<br>DEBUG_GUI 0x400000<br>DEBUG_RTC 0x0050<br>DEBUG_BATT 0x800000" | see verbose |
| | DIR: | *Displays:* list of files in directory with data on bytes used, bytes available. See *Figure 7- 2.* | |
| | DISPLAY: | ":OK." | :OK |
| | DISPLAYMODE: | ":Interlaced.<br>:Non-Interlaced." | 0/1 |
| | DISPLAYMODE?: | ":Interlaced.<br>:Non-Interlaced." | 0/1 |
| | DOWNLOAD: | no response | |
| | DZOOM: | ":Not supported by this hardware.<br>:Digital Zoom 1x.<br>:Digital Zoom 2x." | see verbose |

* *Only available in Axsys Mid-Wave Cooled InSb Camera Systems.*

| | | | |
|---|---|---|---|
| † | EFL: | no response | |
| † | EFL?: | ":EFL = [uint]." | [uint] |
| | FLIPH: | ":Horizontal flip disabled.<br>:Horizontal flip enabled." | 0/1 |
| | FLIPH?: | ":Horizontal flip disabled.<br>:Horizontal flip enabled." | 0/1 |
| | FLIPV: | ":Vertical flip disabled."<br>:Vertical flip enabled." | 0/1 |
| | FLIPV?: | ":Vertical flip disabled."<br>:Vertical flip enabled." | 0/1 |
| | FOCUSDURATION: | ":Focus duration = [uint] milliseconds." | [uint] |
| | FOCUSDURA-TION?: | ":Focus duration = [uint] milliseconds." | [uint] |
| | FOCUSPOS: | no response | |
| | FOCUSPOSM: | no response | |
| | FOCUSPOSN: | no response | |
| | FOCUSPOSW: | no response | |
| | FOCUSPOS?: | ":Focus Position Wide: [int], Medium: [int.] Narrow: [int.]." | [int], [int], [ int] |
| | FOCUSPOSA?: | ":Absolute Focus Position: [int.]" | [int] |
| | FOCUSSERVO: | ":Focus Servo operation now (disabled (0)/enabled (1)).<br>:Focus Servo already enabled." | 0/1 |
| | FOCUSSERVO?: | ":Focus Servo operation is (disabled (0)/enabled (1))." | 0/1 |
| | FOCUSI: | no response | |
| | FOCUSINFINITY: | ":Focusing stopped.<br>:Focusing to infinity." | |
| | FOCUSN: | no response | |
| | FOCUSNEAR: | ":Focusing stopped.<br>:Focusing near." | |

† *Only available in Continuous Zoom models.*

```
> dir:


FLASH: Flash size is = 2883584.

File at index  00       333962 bytes is diop_ir.hex
File at index  01       526697 bytes is camera.exe
File at index  02          864 bytes is camera.ini
File at index  03           24 bytes is stats.dat
File at index  04       153600 bytes is logo.ycb
File at index  05          864 bytes is cam_old.ini
File at index  06           60 bytes is config.ini
File at index  07          352 bytes is cal_data.ini
File at index  08       153600 bytes is cpo_0.bin
File at index  09       153600 bytes is gain_0.bin
File at index  10       153600 bytes is off_0.bin
File at index  11       153600 bytes is pixel_0.bin

FLASH: Total used: 1630823, total remaining: 1252761.
```

*Figure 7-2: Representative screen as displayed on entering "DIR:" command.*

| | | | |
|---|---|---|---|
| | FOVDURATION: | ":FOV pulse duration = [uint] milliseconds." | [uint] |
| | FOVDURATION?: | ":FOV pulse duration = [uint] milliseconds." | [uint] |
| | FOVSERVO: | ":FOV Servo operation now (disabled (0)/enabled (1))." | 0/1 |
| | FOVSERVO?: | ":FOV Servo operation now (disabled (0)/enabled (1))." | 0/1 |
| | FOVAXIS: | ":FOV axis is not present.<br>:FOV axis present." | 0/1 |
| | FOVAXIS?: | ":FOV axis is not present.<br>:FOV axis present." | 0/1 |
| | FOVENABLE: | ":OK" | :OK |
| | FOVENABLE?: | ":FOV axis disabled.<br>:FOV is enabled." | 0/1 |
| | FOVM: | ":Command not valid<br>:FOV axis disabled.<br>:FOV already in medium.<br>:FOV moved to medium.<br>:FOV axis not available.<br>:FOV timed out." | Command not valid<br>0x0200<br>0x0010<br>0x0020<br>0x1000<br>0x2000 |
| | FOVN: | ":FOV axis disabled.<br>:FOV already in narrow.<br>:FOV moved to narrow.<br>:FOV axis not available.<br>:FOV timed out." | 0x0200<br>0x0010<br>0x0020<br>0x1000<br>0x2000 |
| † ◆ | FOVPRESETA: | "AddFOVPreset().<br>VALUE %d: OUT-OF-RANGE (100-500)/<br>AddFOVPreset: LIST-FULL" ◆ | see verbose |
| † ◆ | FOVPRESETS: | "SetFOVPreset().<br>VALUE [int]: OUT-OF-RANGE (100-500)/<br>FOVPresets:<br>[int] .....[int]." ◆ | "SetFOVPreset().<br>VALUE [int]: OUT-OF-RANGE (100-500)/<br>[int] .....[int]." |
| | FOVPRESETS?: | "FOV Presets: [int] [int] …[int10]." | see verbose |
| | FOVTOGGLE: | no response | |
| | FOVW: | ":FOV axis disabled.<br>:FOV already in wide.<br>:FOV moved to wide.<br>:FOV axis not available.<br>:FOV timed out." | 0x0200<br>0x0010<br>0x0020<br>0x1000<br>0x2000 |
| | FOV?: | ":EFL = [uint]<br>:FOV axis disabled.<br>:FOV axis is not present.<br>:FOV narrow.<br>:FOV wide.<br>:FOV medium.<br>:FOV is uninitialized." | [uint]<br>0x0200<br>0x1000<br>0x0001<br>0x0002<br>0x0003<br>0x8000 |
| | FPACTL?: | ":FPA_CTL = [hex]." | [uint] |
| | FPACONST?: | ":FPA_CONST = [hex]." | [uint] |

† *Only available in Continuous Zoom models.*

◆ *Appears on error condition.*

| | | | |
|---|---|---|---|
| | FPAGAIN?: | ":FPA gain mux = [uint]." | [uint] |
| | FPASCRH?: | ":FPA_SCR_H = [hex]." | [uint] |
| | FPASCRL?: | ":FPA_SCR_L = [hex]." | [uint] |
| | FPATEMP?: | ":FPA_TEMP = [hex]." | [uint] |
| | FREEZE: | ":Image Freeze already on.<br>:Freeze frame off<br>:Freeze frame on." | 0/1 |
| | HELP: | {Lists all available commands in 4 columns.} | see verbose |
| | HIGHLIGHT: | ":Bad pixel highlighting off.<br>:Bad pixel highlighting on." | 0/1 |
| | HIGHLIGHT?: | ":Bad pixel highlighting off.<br>:Bad pixel highlighting on." | 0/1 |
| | HISTBINHI: | ":Histogram bin hi = [uint]." | [uint] |
| | HISTBINHI?: | ":Histogram bin hi = [uint]." | [uint] |
| | HISTBINLO: | ":Histogram bin lo = [uint]." | [uint] |
| | HISTBINLO?: | ":Histogram bin lo = [uint]." | [uint] |
| | HISTBIN?: | ":Bins [uint] to [uint]." | see verbose |
| | HISTWIDTH: | ":Histogram width set to the limit of [uint].<br>:Histogram width = [uint]." | [uint] |
| | HISTWIDTH?: | ":Histogram width = [uint]." | [uint] |
| | ICONS: | ":Icon display is off.<br>:Icon display is on." | 0/1 |
| | ICONS?: | ":Icon display is off.<br>:Icon display is on." | 0/1 |
| | IMAGEOFF: | ":OK." | :OK |
| | IMAGEON: | ":OK." | :OK |
| | IMGDEL: | no response | |

| | | | |
|---|---|---|---|
| | INTERVAL: | ":One point interval: [uint] seconds." | [uint] |
| | INTERVAL?: | ":One point interval: [uint] seconds." | [uint] |
| * | INTTIME: | ":Integration time set to [uint]." | [uint] |
| * | INTTIME?: | ":Integration time set to [uint]." | [uint] |
| | ISC: | no response | |
| | ISO: | no response | |
| | LEVELL: | ":Lower switch level: [uint]." | [uint] |
| | LEVELL?: | ":Lower switch level: [uint]." | [uint] |
| | LEVELU: | ":Upper switch level: [uint]." | [uint] |
| | LEVELU?: | ":Upper switch level: [uint]." | [uint] |
| | LEVEL?: | ":Lower: [uint]. Upper: [uint]." | see verbose |
| | LOGO: | no response | |
| | LOGO?: | ":On/Off." | see verbose |
| | LUT?: | ":Active LUT is [uint]." | [uint] |
| | MEAN: | Displays: Pixel Hi, Lo, Average, and, Mid points. See Figure 7-3. | see verbose |
| | MEMTEST: | {Test results} | see verbose |
| | MAN?: | ":Offset: [uint].<br>:Gain: [uint]." | see verbose |
| | MGC: | ":Gain capped at: [uint].<br>:Gain set to: [uint]." | see verbose |
| | MGC-: | ":Gain set to: [uint]." | see verbose |
| | MGC+: | ":Gain set to: [uint]." | see verbose |
| | MOC: | ":Offset capped at: [uint].<br>:Offset set to: [uint]." | see verbose |
| | MOC-: | ":Offset set to: [uint]." | see verbose |
| | MOC+: | ":Offset set to: [uint]." | see verbose |

* *Only available in Axsys Mid-Wave Cooled InSb Camera Systems.*

```
> mean:
Pixel Hi: 1061 (0x425) Lo: 1040 (0x410) Avg: 1048 (0x418)
```

*Figure 7-3: Representative screen as displayed on entering "MEAN:" command.*

| | | | |
|---|---|---|---|
| | MODEL: | {This command reinitializes the camera.} | see verbose |
| | MODEL?: | {Model name.} | see verbose |
| | NRED: | ":NR now: [int] [int]." | [int],[int] |
| | NRED?: | ":NR now: [int] [int]." | [int],[int] |
| | NUC: | ":You are currently in pixel cleaning mode. You must exit this mode before switching NUC tables.<br>:Active NUC is [uint]." | see verbose/[uint] |
| | NUC?: | ":Active NUC is [uint]." | [uint] |
| | NUCCOPY: | ":OK." | :OK |
| | NUCDEFAULT: | ":Power up NUC set to [uint]." | [uint] |
| | NUCDEFAULT?: | ":Power up NUC set to [uint]." | [uint] |
| | NUCDELETE: | "Calibration files for NUC [uint] deleted." | |
| | NUCLOAD: | "You are currently in pixel cleaning mode. You must exit this mode before switching NUC tables.<br>:OK." | see verbose |
| | NUCS?: | ":There are [uint] NUCs available." | [uint] |
| | NUCSWITCH: | ":NUC switching off.<br>:NUC switching on." | 0/1 |
| | NUCSWITCH?: | ":NUC switching off.<br>:NUC switching on." | 0/1 |
| | PALETTE: | ":Active Color Palette = [uint].<br>(White Hot GrayScale)<br>(Black Hot GrayScale)<br>(IronBow)<br>(Inverse IronBow)<br>(RainBow)<br>(Inverse RainBow)<br>(Oceana)<br>(Inverse Oceana)<br>(Sepia)" | <br>0<br>1<br>2<br>3<br>4<br>5<br>6<br>7<br>8 |
| | PALETTE?: | ":Active Color Palette = [uint].<br>(White Hot GrayScale)<br>(Black Hot GrayScale)<br>(IronBow)<br>(Inverse IronBow)<br>(RainBow)<br>(Inverse RainBow)<br>(Oceana)<br>(Inverse Oceana)<br>(Sepia)" | <br>0<br>1<br>2<br>3<br>4<br>5<br>6<br>7<br>8 |

| | | | |
|---|---|---|---|
| | PLTTOG: | no response | |
| | PLAT: | ":Plateau = [hex]." | see verbose |
| | PLAT1: | ":Plateau 1 = [hex]." | [uint] |
| | PLAT2: | ":Plateau 2 = [hex]." | [uint] |
| | PLATS?: | ":Single plateau method:<br>Histogram width = [uint]<br>Plateau = %#04x<br>Dual plateau method:<br>Switch Bin = [uint]<br>Plateau 1 = %#04x<br>Plateau 2 = %#04x." | see verbose |
| | PLAT?: | ":Plateau = [hex]." | [uint] |
| | PLAT1?: | ":Plateau 1 = [hex.]" | [uint] |
| | PLAT2?: | ":Plateau 2 = [hex]." | [uint] |
| | PLATSWITCH: | ":Plateau switch point = [uint]." | [uint] |
| | PLATSWITCH?: | ":Plateau switch point = [uint]." | [uint] |
| | POL?: | ":Polarity inverted, black hot.<br>:Polarity normal, white hot." | -1/1 |
| | POLARITY: | ":Polarity inverted, black hot.<br>:Polarity normal, white hot.<br>:OK " | -1/1<br>:OK |
| | POLINV: | ":OK." | :OK |
| | POLNORM: | ":OK." | :OK |
| | PSENSOR?: | ":Pressure Sensor disabled.<br>:Pressure Sensor enabled." | 0/1 |
| | REGISTERS?: | {Register Dump.} | see verbose |
| | REG?: | "Add: [hex] = [hex]." | |

| | | | |
|---|---|---|---|
| | RETICLE: | ":Disable reticle display.<br>:Enable reticle display." | 0/1 |
| | RETICLE?: | ":Reticle display disabled.<br>:Reticle display enabled." | 0/1 |
| | RETICLESAVE: | no response | |
| | RETICLETYPE: | ":Reticle [uint] selected." | [uint] |
| | RETICLETYPE?: | ":Reticle [uint] selected." | [uint] |
| | ROI: | ":No valid ROI entries found.<br>:ROI = [uint]." | 0/[uint] |
| | ROI?: | ":ROI = [uint]." | [uint] |
| | ROIDEFAULT: | ":Power up region of interest set to [uint]." | [uint] |
| | ROIDEFAULT?: | ":Power up region of interest set to [uint]." | [uint] |
| | ROISET: | ":ROI [uint] = ([uint],[uint]) to ([uint],[uint])." | [uint],[uint],[uint],<br>[uint],[uint] |
| | ROISET?: | ":ROI [uint] = ([uint],[uint]) to ([uint],[uint])." | [uint],[uint],[uint],<br>[uint],[uint] |
| | SCALEHI: | ":Hi scale factor = [float]." | [float] |
| | SCALEHI?: | ":Hi scale factor = [float]." | [float] |
| | SCALELO: | ":Lo scale factor = [float]." | [float] |
| | SCALELO?: | ":Lo scale factor = [float]." | [float] |
| * | SENSTOG: | ":Sensitivity now: [int]." | |
| * | SENSTOG?: | ":Sensitivity now: [int]." | [int] |
| | SETMENU?: | ":ActiveMenuItems:[hex]" | see verbose |

* *Only available in Axsys Mid-Wave Cooled InSb Camera Systems.*

| | | | |
|---|---|---|---|
| | SHOWTIME: | ":Time Display is (disabled/enabled)." | 0/1 |
| | SHUTTER: | ":Shutter operation is now (disabled (0)/enabled (1))." | 0/1 |
| | SHUTTER?: | ":Shutter operation is now (disabled (0)/enabled (1))." | 0/1 |
| | SN?: | ":Serial Number:(serial number)." | [string] |
| | SC: | no response | |
| | SO: | no response | |
| | STATUS: | "Flip Hor: [uint].<br>Flip Ver: [uint].<br>Video Int: [uint].<br>Auto Cal: [uint].<br>AGC: [uint]." | see verbose |
| | STATS?: | {List of statistics.} | see verbose |
| | SYNCMODE?: | ":Sync Pulse<br>:Field Sync." | 0/1 |
| □ | TEMP?: | ":Current Temp:[float] Running Avg Temp:[float]." | see verbose |
| | THERMISTOR: | ":Thermistor not in use.<br>:Thermistor in use." | 0 -not in use<br>1 - in use |
| | THERMISTOR?: | ":Thermistor not in use.<br>:Thermistor in use." | 0 -not in use<br>1 - in use |
| | THL: | ":Lower threshold [uint]" | [uint] |
| | THL?: | ":Lower threshold [uint]" | [uint] |
| | THU: | ":Upper threshold [uint]" | [uint] |
| | THU?: | ":Upper threshold [uint]" | [uint] |

□ *Only available in Axsys Long-Wave Uncooled Camera Systems.*

| | | | |
|---|---|---|---|
| | TH?: | ":Lower: [uint] Upper: [uint]." | [uint], [uint] |
| | TIME: | ":Time and Date Set." | Time and Date Set |
| | TIME?: | ":h:m:s AM/PM m/d/y." | h:m:s AM/PM m/d/y |
| | UPDATE: | no response | |
| | UPLOAD: | no response | |
| | VBIAS?: | ":Vbias = [hex]." | [uint] |
| | VERBOSE: | ":Verbose mode now enabled." | 0 |
| | VERBOSE?: | ":Verbose mode enabled." | 0/1 |
| | VERSION?: | ":[VersionCode, VersionHex, BspVersion]." | see verbose |
| | VHI: | ":Vhi = [hex]." | [uint] |
| | VHI?: | ":Vhi = [Vhi(hex)]." | [uint] |
| | VIDCTL0?: | ":VID_CTL0 = [hex]." | [uint] |
| | VIDCTL1?: | ":VID_CTL1 = [hex]." | [uint] |
| | VIDEOCOLUMN?: | ":Last column set to [uint]." | [uint] |
| | VIDEOFORMAT: | "Video format now [0 (8 bit) / 1 (12 bit)." | 0/1 |
| | VIDEOFORMAT?: | "Video format now [0 (8 bit) / 1 (12 bit)." | [uint] |
| | VIDEOMODE: | ":NTSC/PAL" | 0/1 |
| | VIDEOMODE?: | ":NTSC/PAL" | 0/1 |
| | VIDEOROW?: | ":Last row set to [uint]." | [uint] |
| | VIDEOSOURCE: | ":Video source now [0/1] ["IR/AUX"]." | 0/1 |
| | VIDEOSOURCE?: | ":Video source now [0/1] ["IR/AUX"]." | 0/1 |
| | VLO: | ":Vlo = (hex)." | [uint] |
| | VLO?: | ":Vlo = (hex)." | [uint] |
| | VRESET: | ":Flash Vreset = (hex), Working Vreset = (hex)." | [uint] |
| | VRESET?: | ":Flash Vreset = (hex), Working Vreset = (hex)." | [uint] |
| | WIPER: | ":Wiper mode now [OFF/ON]" | 0/1 |
| † | ZOOMC: | "[int]" | "[int]" |
| † | ZOOMN: | no response | |
| † | ZOOMW: | no response | |

† *Only available in Continuous Zoom models.*

# 8. Digital Control Using the Axsys Camera GUI (Graphical User Interface)

Cameras can be controlled digitally through connection to a PC. The following paragraphs detail the installation of the software and the use of the GUI (Graphical User Interface).

## 8.1 Software Installation

Software enabling camera operation through a PC is shipped with the camera. Note that if the software is to be installed on a Windows 2000 or Windows XP system, Administrator rights will be needed for installation.

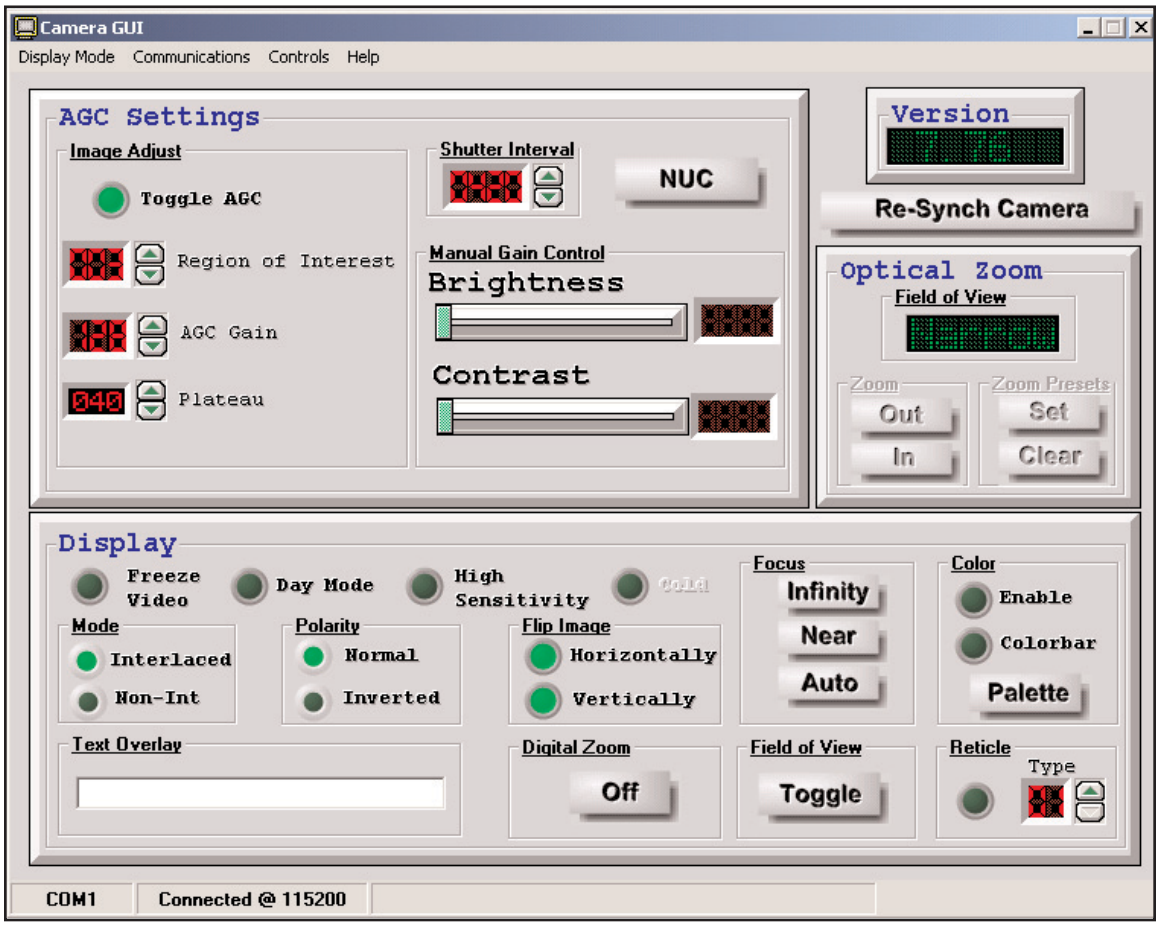


*Figure 8-1. Main Screen (Normal view mode)*

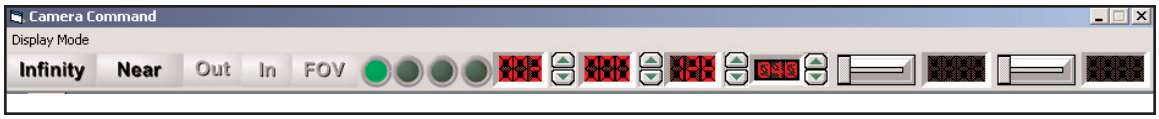


*Figure 8-2. Main Screen (Compact view mode)*

## 8.1.1 Installing the Software

**NOTE**

*On most machines the disk will auto run and start the Install Utility automatically.*
*If it does not, follow the procedure below.*

1. Insert the software CD (Figure 8-3) into the CD drive of the PC (typically drive D).
2. Using Windows Explorer, browse to the CD drive.
3. Double click on the Setup.exe application in the file list. The installation program will install the GUI.
4. Install the external communications cable into the camera and connect the DB9 connector to the COM1 port of the PC.
5. Open the standalone GUI from the Start/Programs menu.


*Figure 8-3. Software CD*

## 8.1.2 Initiating Communications with the Camera

To initiate communication with the camera immediately:

- Go to the Communications Menu:
- Select menu option: Communications-ComPorts->Com 1 or Com 2 (or other, depending on your hardware).
- Communication will be initiated, and initial settings of the camera will be displayed.

# 8.2 Using the GUI

When the software is first started, the main screen, seen in Figure 8-1, should come up immediately. The user can choose at any time to view the full screen (normal mode, Figure 8-1) or a reduced version (Compact Mode, Figure 8-2) providing only the key operating functions (compact mode). The Main Screen provides access to various camera settings as well as several pull-down menus.

**NOTE**

*Some controls have a tool tip.*
*To view the options, place the cursor over the control for a second and the tool tip, if available, should pop up.*

## 8.2.1 Pull-Down Menus

The GUI's four pull-down menus appear at the top of the screen.

### Display Mode

Allows the user to change the view from the Normal full display mode to a Compact display mode; not all functions are available in the Compact mode. See Figure 8-4.

### Communications

Allows the user to select among communication ports and baud rates.

#### Com Ports

By selecting Com Ports, the user may choose among the available communication ports in order to begin communication with the camera. After the camera is on and an image can be seen on the monitor, select the port through which camera communications are to be routed. (The software will determine and display the number of ports available.) See Figure 8-5.

- Select Communications -> Com Ports -> Com 1 or Com 2 (or other).

Doing so will initialize communications with the camera. Note that the status bar at the bottom of the screen will indicate when communications have been established. See Figure 8-15.

#### Options

By selecting Options, the user may choose among six available baud rates or check Auto Detect Baud Rate for automatic selection of the baud rate. See Figures 8-6 and 8-7.

- Select Communications -> Options -> Auto Detect (or other).

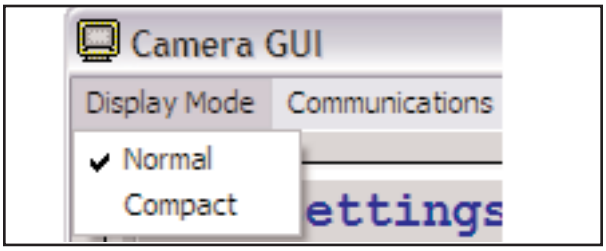


*Figure 8-4. Display Mode Menu*

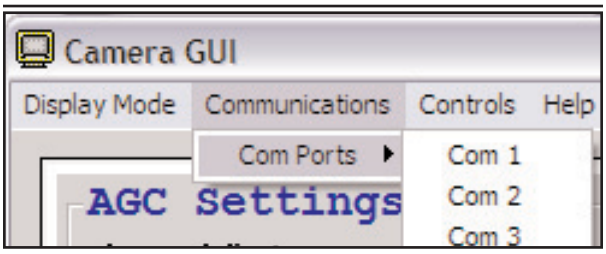


*Figure 8-5. Communications Menu, Com Ports Selected*

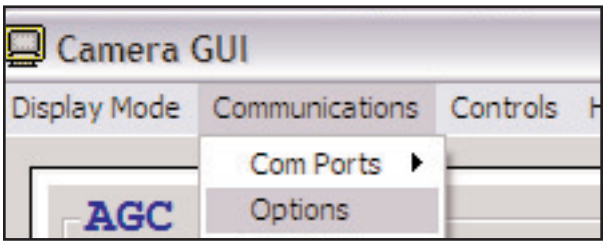


*Figure 8-6. Communications Menu, Options Selected*

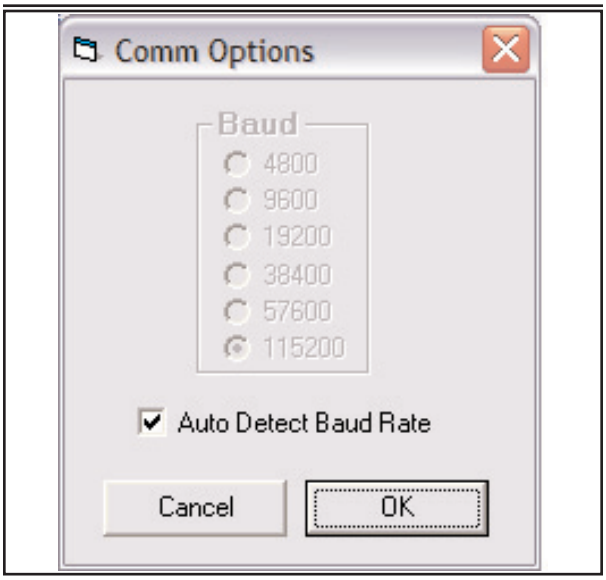


*Figure 8-7. Communications Menu, Options Selected*

### CONTROLS

Allows the user to access the Main Control Panel, the Pixel Substitution Panel, or the Terminal Window, or enables the Wiper on models so equipped. See Figure 8-8.

The Terminal Window allows serial commands to be entered and communicated directly to the camera (see Table of Serial Commands, Section 7.2.5.)

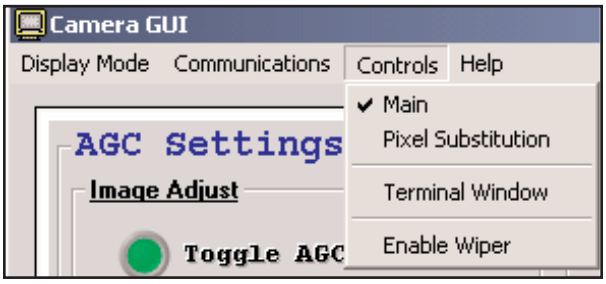


*Figure 8-8. Controls Menu*

### HELP

The HELP menu has two selections, an ABOUT selection and an OPERATION selection.

#### ABOUT CAMERA COMMAND

A screen that displays a dialog showing the current Camera GUI version. Press OK to return to the Main Screen. See Figure 8-9. Note: This screen may vary depending on the camera model.


*Figure 8-9. About Camera GUI Screen*

#### OPERATION

A screen that displays the following dialog: "Select com port to use from communications menu. Then wait for communications to be initialized." Press OK to return to the Main Screen. See Figure 8-10.


*Figure 8-10. Operation Screen*

## 8.2.2 AGC Settings Panel

The AGC (Automatic Gain Control**)** section of the display allows the user to control the gain and offset (contrast and brightness) of the viewed image. See Figure 8-11.

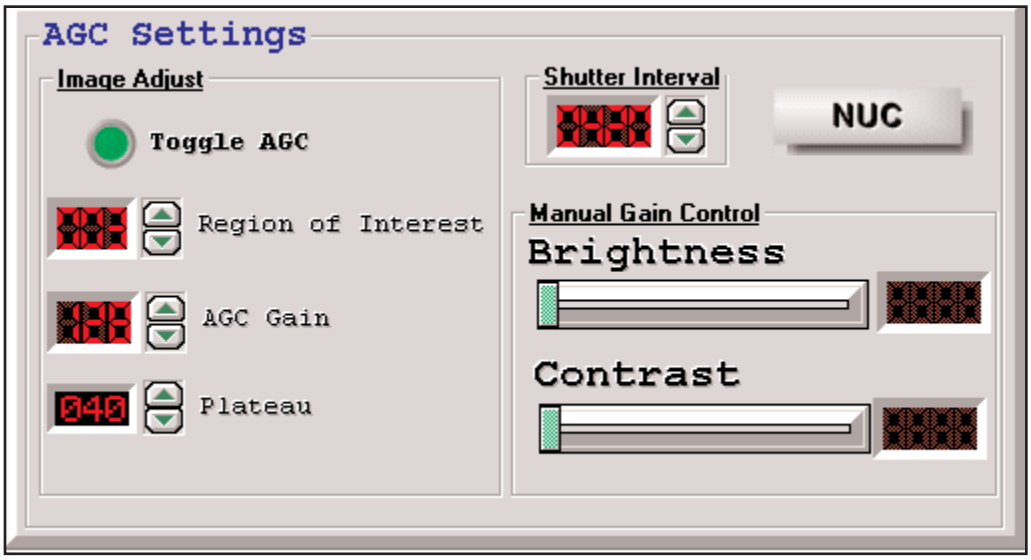


*Figure 8-11. AGC Settings Section of Main Screen*

### IMAGE ADJUST

#### TOGGLE AGC

Illuminated radio button that, when pressed, turns the automatic gain control feature ON or OFF to control the image manually. The button will turn bright green when the feature is ON, dark green when the feature is OFF.

#### REGION OF INTEREST

Vertical scroll arrows that allow the user to select among the available image subsections (regions) from which the automatic gain calculation is determined. The number of the selected region appears in the LED display to the left of the arrows. See the *Introduction, Set-Up, Installation* section of the manual for information on Regions of Interest (ROIs).

#### AGC GAIN

Vertical scroll arrows that allow the user to select the desired amount of digital gain (contrast), as shown in the LED display to the left of the arrows. AGC gain in this context is the minimum image histogram width that is used in the AGC calculation. Entering a higher gain value decreases image graininess for low contrast scenes at the expense of some contrast.

#### PLATEAU

Vertical scroll arrows that allow the user to select the plateau level, the increment value used when generating the AGC profile for the current image histogram. Default values are model dependent. Generally, a higher plateau value will decrease image contrast (gain). The selected level appears in the LED display to the left of the arrows.

**FYI:**
GAIN is equivalent to CONTRAST.
OFFSET is equivalent to BRIGHTNESS.

#### SHUTTER INTERVAL

(Scrolling Arrows & LED Display)
Vertical scrolling arrows that allow the user to select in seconds the desired time interval between one-point non-uniformity corrections (NUC). The number of seconds selected appears in the LED display to the left of the arrows.

### NUC

Button that, when pressed, sends to the camera the command "CAL1:," initiating a manual one-point non-uniformity correction (NUC) update. (A NON-UNIFORMITY CORRECTION compensates for innate nonuniformity in the response of each pixel in the sensor.)

#### MANUAL GAIN CONTROL

Sliders that allow the user to increase or decrease the desired amount of offset (brightness) or gain (contrast). Available only when the AGC toggle is OFF.

##### BRIGHTNESS

Moving the slider to the right increases the amount of brightness; moving the slider to the left decreases the amount of brightness.

##### CONTRAST

Moving the slider to the right increases the amount of contrast; moving the slider to the left decreases the amount of contrast.

## 8.2.3 Display Panel

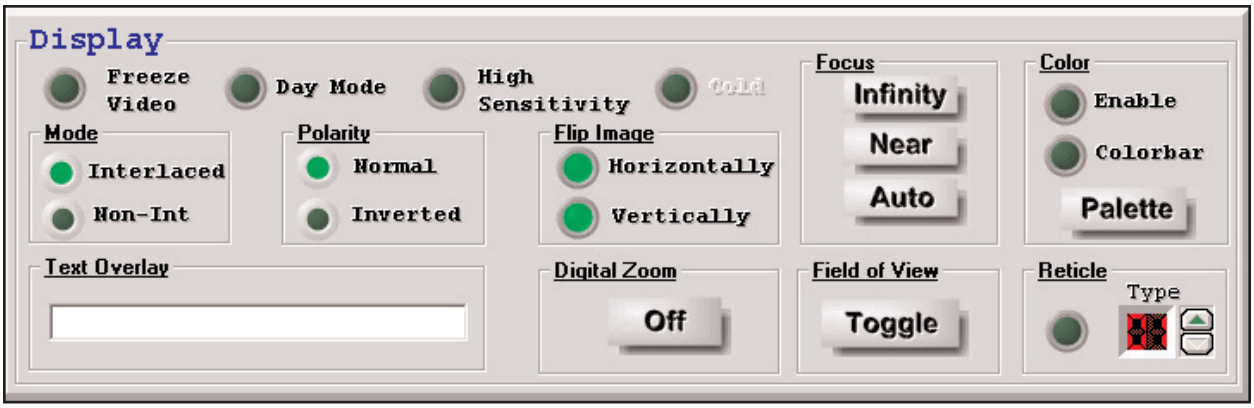


*Figure 8-12. Display Panel Section of Main Screen*

See Figure 8-12 for illustration of the following controls.

**FREEZE VIDEO**

Radio button that toggles the freeze video feature ON (freezing the current frame) or OFF (restoring live video).

**DAY MODE**

Radio button that toggles the contrast of the viewed image to a lower value (*cooled cameras only; disabled where inapplicable*).

**HIGH SENSITIVITY**

Radio button that toggles sensitivity setting to improve detail in poor visibility conditions (*cooled cameras only; disabled where inapplicable*).

**COLD**

Radio button that adjusts the camera to settings that will improve the quality of the image in cold environments (*uncooled cameras only; disabled where inapplicable*).

**FOCUS**

Buttons that continuously adjust the focus element(s) of the lens IN (towards near objects) or OUT (toward infinity). As long as either button is pressed, the focus group will continue moving in the appropriate direction, to the limit of the camera's capability.

**INFINITY**

Button that adjusts the focus element(s) towards the infinity focus of the lens.

**NEAR**

Button that adjusts the focus element(s) towards the near object distance of the lens.

**AUTO**

Button that initiates a ONE SHOT AUTOFOCUS on the current scene.

### COLOR

#### ENABLE

Radio button that toggles the viewed image between color and grayscale displays.

#### COLORBAR

Radio button that toggles the display of the colorbar ON or OFF.

#### PALETTE

Button that, when pressed, steps through the available image color palettes if color is enabled. The palette selection appears in the following order:

1. White hot (grayscale)
2. Black hot (grayscale)
3. IronBow
4. Inverse IronBow
5. RainBow
6. Inverse RainBow
7. Oceana
8. Inverse Oceana
9. Sepia

### MODE

Radio buttons that allow the user to select the signal mode in which the image is displayed on a monitor. Selection should be made based on the capability of the monitor in use. (Interlaced is standard for RS170/NTSC.)

#### INTERLACED

A display mode in which lines on the monitor screen are refreshed in a rapid A/B alternating pattern, sometimes causing a sensation that the viewed image flickers or pulses.

#### NON-INT[ERLACED]

A display mode in which lines on the monitor screen are refreshed in a rapid A-Z sequential pattern, providing a more steady image on a (higher capability) non-interlaced monitor.

### POLARITY

Radio buttons that, when pressed, allow the user to toggle the viewed image between normal and inverted polarities.

#### NORMAL

Displays the viewed image in normal WHITE HOT mode, in which objects in the scene that are higher in temperature will appear lighter or whiter, while colder objects will appear darker or blacker.

#### INVERTED

Displays the viewed image in inverted BLACK HOT mode, in which objects in the scene that are higher in temperature will appear darker or blacker, while colder objects will appear lighter or whiter.

### FLIP IMAGE

#### HORIZONTALLY

Flips the viewed image on the horizontal plane.

#### VERTICALLY

Flips the viewed image on the vertical plane.

#### TEXT OVERLAY

Modifiable field that allows the user to display a short string (≤ 40 characters) of text on the screen. To display information, type in the desired text and press the <Enter> key. To erase the screen text, delete the text and press the <Enter> key.

#### DIGITAL ZOOM

Button that, when pressed, toggles the digital zoom feature ON or OFF (only available on certain models).

#### FIELD OF VIEW

Button that, when pressed, toggles the camera among the available fields of view.

#### RETICLE

##### RETICLE BUTTON

Radio button that allows the user to toggle the reticle display on and off.

**TYPE** (SCROLLING ARROWS & LED DISPLAY)

Scrolling arrows that allow the user to select the desired reticle. The number of the selected reticle appears in the LED display to the left of the arrows.

## 8.2.4 Optical Zoom

#### FIELD OF VIEW

LED display indicating the current image magnification. See Figure 8-13.

- For Dual/Tri Field of View cameras, it displays the FOV: "Narrow," "Medium," or "Wide."
- For zoom lens cameras, it displays the current zoom ratio (e.g., from 1.0x to 7.0x; limits are dependent on the camera model).

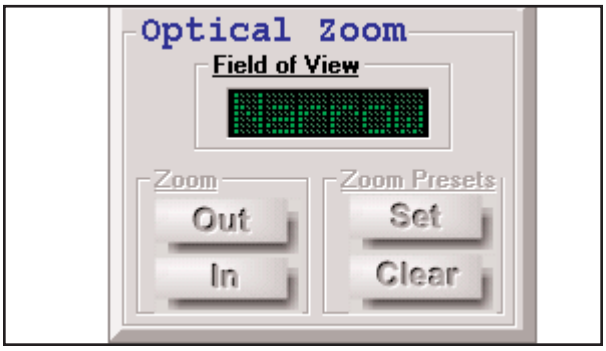


*Figure 8-13. Optical Zoom Panel*

#### ZOOM

##### OUT

For a continuous zoom lens, the OUT button zooms the camera's field of view OUT as long as the button is pressed, to the limit of the camera's ability.

##### IN

For a continuous zoom lens, the IN button zooms the camera's field of view IN as long as the button is pressed, to the limit of the camera's ability.

#### ZOOM PRESETS

##### SET

For a continuous zoom lens, the SET button sets and stores a Field of View setting using the current effective focal length (EFL). Up to ten presets may be stored. This list is the FOV sequence that is used by the FOV toggle button to scroll through FOV settings. The NEVER-FORGET-FOCUS feature is used at each FOV preset; that is, the system will refocus to the last focus position for each FOV preset.

##### CLEAR

For a continuous zoom lens, the CLEAR button clears the FOV preset list.

## 8.2.5 Additional Main Screen Displays

### VERSION

LED display indicating the version of the embedded camera control software currently in use. Note: this display does not refer to the GUI software. See Figure 8-14.

### RE-SYNCH CAMERA

Button that, when pressed, rereads the settings from the camera and displays them on the Main Screen. See Figure 8-14.


*Figure 8-14. Version and Re-Synch Displays*

### STATUS BAR

The status bar, located at the bottom of the GUI screen on all displays (see Figure 8-15) provides current information on:

- Port (Com 1, Com 2, Com 3, etc.)
- Connection (Connected / Not Connected)

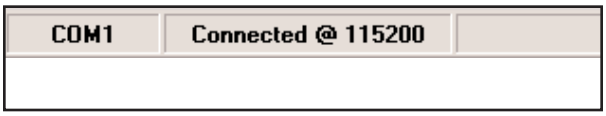


*Figure 8-15. Status Bar Section of Main Screen*

**NOTE**

The following buttons may be disabled depending on the model of the camera connected:

- DIGITAL ZOOM
- ZOOM
- FIELD OF VIEW
- FOCUS
- DAY MODE
- HIGH SENSITIVITY
- COLD MODE

# 9. Care and Maintenance

If any repair work is necessary, do not attempt to dismantle the unit without contacting Axsys first. Only Axsys should complete any repairs or modifications unless you are otherwise instructed. Unauthorized repair or modifications may result in damage to the instrument and/or cancellation of any warranty coverage that may apply.

## 9.2 Care and Cleaning of the Exterior Optical Surface

Care should be taken to avoid touching the optical surfaces of the lens or camera elements. Over time, acid left behind with fingerprints can be damaging to coatings and the optical substrates. If oil, water spots, or fingerprints form on the optical surfaces, GENTLY clean them using a mild, neutral soap diluted with distilled water (1 part soap to 100 parts water), followed by an isopropyl alcohol or acetone swab.

If dust collects on the optical surface, it can be removed gently, using an alcohol or acetone swab.

Note: It is important to avoid swabs that incorporate plastic stems, as some plastics will dissolve in acetone.

## 9.3 Other care instructions

**CAUTION!**

Do not allow any cleaning fluid to touch the internal parts of the module!

**NOTE:**

See Section 4.1 for expectations on intermittent purging with dry nitrogen.

# 10. Technical Support

The manufacturer can be contacted for technical support using the information below.

Contacting Axsys by Email: camerasupport@axsys.com
by Phone: +1 (603)-898-1880
by Fax: +1 (603)-898-3970

# 11. Troubleshooting

The following table provides suggestions for corrections to some easily solved problems. For more serious problems please contact Axsys Customer Service.

**Table 11.1 Troubleshooting Suggestions**

| Problem | Possible Cause | Solution |
|---|---|---|
| There is no power or power cuts out during operation. | • Power connection has become loose or unplugged. | • Check power connections and reconnect power cord. |
| Failed or faulty operation. | • Cable(s) incorrectly connected.<br><br>• Cable is damaged. | • Check cable connections and reconnect cables correctly.<br><br>• Replace with another cable of same type. |
| Power diminishes or cuts out. | • If original cable has been extended or replaced, cable length may be too great. See Section 4.2.2 for further explanation. | • Replace present cable with standard length cable. To use a longer cable, employ a heavier gauge wire or increase the voltage supply. |
| The camera no longer works. | • The camera has an unforeseen problem. | • Briefly disconnect AC power connection and then reconnect it and try again. |
| No thermal image appears. | • Lens cap(s) have not been removed.<br><br>• Video cable is loose or unplugged. | • Remove lens cap(s) from lenses.<br><br>• Check connection and try again. |
| Periodically it seems that the image freezes. | • Auto calibration routine is at work. Auto calibration requires less than 300 ms, which is hardly perceivable. This routine maintains system calibration to keep thermal image at its best appearance. | • None. This is standard procedure.<br><br>• Note: The Auto calibration function (AUTONUC) can be turned OFF. See Serial Commands, Section 7.2. |
| The image is lost when the camera has been operating for a period of time with AGC off. | • As the system changes temperature the AGC keeps the video in range. Once the AGC feature is turned off, this feature no longer operates. | • Turn on the AGC feature. |
| Communication with camera faulty or non-existent. | • Baud rate of camera may not equal that of host computer. | • Adjust baud rates to agree. (Consult manual for maximum baud rate for your camera.) Note: you may need to restart system after changing baud rates. |
| Image on boot-up (after logo disappears) is pixelated and oddly colorized. | • Camera Settings have been saved/updated with AGC OFF. | • Turn AGC ON. |

# 12. Specification Summary

## 12.1 General Camera Specifications

The specifications in Table 12-1 apply to all camera modules covered in this manual with the exceptions noted.

| **Table 12-1 General Camera Specifications** | |
|---|---|
| **Detector Type** | **InSb Mosaic Focal Plane Array 320x 256 elements, (320x240 used for video)** |
| *Pixel Pitch* | 30 x 30μm square pixels |
| *FPA fill factor* | ~ 90% |
| *Spectral Bandpass* | 3.4-4.2 typical |
| *Spectral Region* | 3-5μm |
| *Frame Rate* | 60 Hz NTSC, 50 Hz PAL |
| *Output Video Format* | CCIR601 NTSC or PAL-M |
| *Dynamic Range* | > 72dB |
| *Serial Communications* | RS-232 Default, RS-422 Optional |
| *Maximum Baud Rate* | 115200 bps |
| *Analog Control* | Up to 64 function analog interface |
| *Camera Controls* | Available on hand held pendant, rack mounted controller, or through a PC via an RS232/RS422 link |
| *Input Power* | 11-16 VDC /18 watts typical @ 25°C in steady state |
| *Cool Down Time* | ~ 7 min. @ 25° C |
| *NETD* | ≤ 40mK |
| *Detector MTBF* | ≥ 7500 hours |
| | |
| | |
| *Standard Features* | |
| *Focus* | Motorized focus |
| *Field of View switching* | Motorized Field of View switching or zoom (where applicable) |
| *Cooler* | Stirling 0.5 watt cooler |
| *Defroster* | Front element defroster (50/250 only) |
| | |

# 12.2 Individual Camera Specifications

The information in Table 12-2 is camera-specific.

**Table 12-2. Individual Module Specifications**

| Features & Characteristics | Tri-Field Module 17/60/200 | DFOV Module 50/250 | Continuous Zoom Module 50/350 |
|---|---|---|---|
| ***Part number*** | 23048 | 23083/23083M | 23086 |
| ***Effective Focal Lengths (mm)*** | 17/60/200 | 50/250 | 50 to 350 |
| ***F/#*** | f/4 | f/4 | f/4 |
| ***Field of view*** | | | |
| *Type* | Tri FOV | Dual FOV | Continuous Zoom |
| *WFOV* | 31.5° horizontal x 24.0° vertical @ 17mm | 11.0° horizontal x 8.2° vertical @ 50mm | 11.0° horizontal x 8.2° vertical @ 50mm |
| *MFOV* | 9.1° horizontal x 6.9°vertical @ 60mm | — | continuously to... |
| *NFOV* | 2.7° horiz x 2.1°vertical @ 200mm | 2.2° horizontal x 1.65°vertical @ 250mm | 1.6° horiz. x . 1.2° vertical @ 350mm |
| ***FOV Change time*** | < 1.5 sec. | < 1.5 sec. | NA |
| ***Serial Interface Connector*** | 18 pin connector | 22 pin connector | 18 pin connector |
| ***Heater Power Consumption*** | NA | 12 V DC 0.88 amps 10.6 watts | NA |
| ***Auto Thermostat on Heater*** | no | on at 5°C; off at 8°C | NA |
| ***Operating Temperature*** | -10°C to +60°C; | -20°C to +50°C | -10°C to +60°C |
| ***Storage Temperature*** | -40°C to +70°C | -40°C to +70°C | -40°C to +70°C |
| ***Mounting Plate*** | See Axsys DWG No. 23048 | See Axsys DWG No. .23083/23083M | See Axsys DWG No. 23086 |
| ***Length*** | 11.86" (30.1cm) | 13.76" (35.0cm) | 15.71" (39.9cm) |
| ***Weight*** | ~ 5.1 lbs. (2.31kg) | ~ 4.3 lbs. (1.95kg) | ~ 12.7 lbs. (5.78kg) |

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  - **NO WARRANTIES FOR THE SOFTWARE. The software is provided "as is" and with all faults. The entire risk as to satisfactory quality, performance, accuracy, and effort (including lack of due care or negligence) is with you. Also, there is no warranty against interference with your enjoyment of the software or against infringement. If you have received any warranties regarding the device or the software, those warranties do not originate from, and are not binding on, the company or its software suppliers.**

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- **Prohibition on Reverse Engineering, Decompilation, and Disassembly**. You may not reverse engineer, decompile, or disassemble the **software**, except and only to the extent that such activity is expressly permitted by applicable law or software license notwithstanding this limitation.

- **Software Transfer Allowed but with Restrictions**. You may permanently transfer rights under this EULA only as part of a permanent sale or transfer of the Device, and only if the recipient agrees to this EULA. If the **software** is an upgrade, any transfer must also include all prior versions of the **software**.

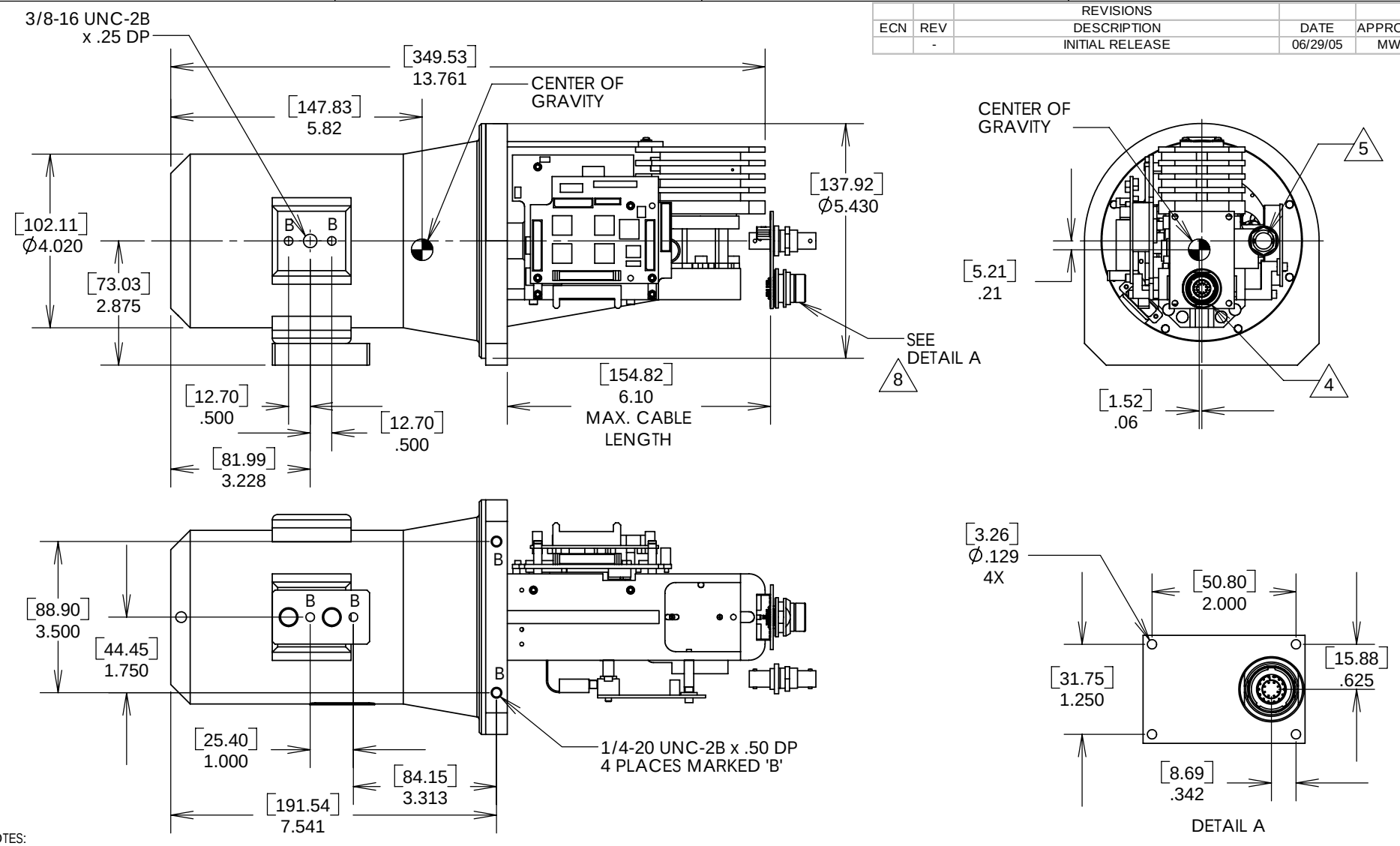
- **Export Restrictions**. Export of the **software** from the United States is regulated by United States law, the Export Administration Regulations of the U.S. Commerce Department Bureau of Industry and Security (BIS) or the U.S. Department of State. You agree to comply with such laws and regulations, and you are required to know what those laws and regulations are. You warrant and represent that neither the BIS nor any other U.S. federal agency has suspended, revoked, or denied your export privileges.

# Appendix A

# Drawings and Pin-Out Diagrams

Drawings and pinouts for the cameras discussed in this manual follow in order of part number.

| REVISIONS | | | | |
|---|---|---|---|---|
| ECN | REV | DESCRIPTION | DATE | APPROVED |
| | - | INITIAL RELEASE | 06/29/05 | MWH |




NOTES:

1. DIMENSIONS: INCHES [mm].
2. LENS CAP PROVIDED (NOT SHOWN).
3. LENS HEATER INCLUDED.
4. 22 PIN CONNECTOR:
   LEMO P/N HES.3F.322.XLDP OR EQUIV.
   (SEE SHEET 2 FOR PIN-OUT INFORMATION)
5. BNC CONNECTOR (WITH DUST CAP): VIDEO OUT
   STANDARD VIDEO FORMAT: NTSC; FOR PAL
   FORMAT OPTION, ADD "P" AFTER PART NUMBER
6. WEIGHT OF ASSEMBLY: APPROX 4.3lb [2.0 kg].
7. AXSYS EXTERNAL CABLE 23020-501-12 PROVIDED AS STANDARD.
8. CONNECTOR CARD TO BE MOUNTED TO CUSTOMER INTERFACE VIA FEATURES SHOWN IN DETAIL A. LOCATION OF CARD OPTIONAL.

THIRD ANGLE PROJECTION



UNLESS OTHERWISE SPECIFIED
DIMENSIONS: INCHES [mm]
TOLERANCES
ANGULAR: ±0.5°
LINEAR: .XX±.030 [.76]
.XXX±.010 [.25]
DIMENSIONS AFTER FINISH

MATERIAL --

FINISH --

DO NOT SCALE DRAWING

| APPROVALS | | DATE |
|---|---|---|
| DWN | M. HARBINSON | 6/29/05 |
| CHK | | |
| REL | | |
| QMR | | |
| MFG | | |

CONTRACT 12095

CAGE CODE 1HT10

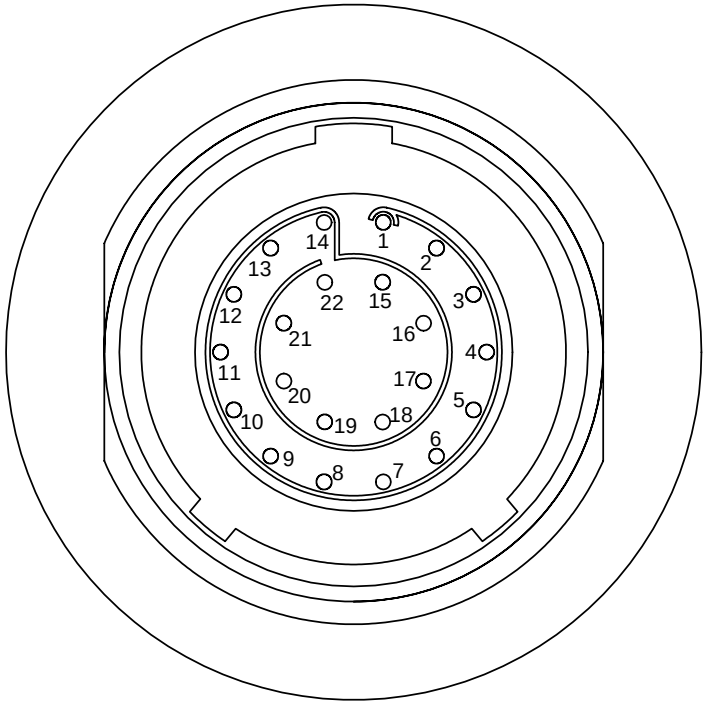
**DIOP** DIVERSIFIED OPTICAL PRODUCTS, INC.

TITLE
50/250mm DFOV *f*/4 3-5µm
THERMAL CAMERA MODULE

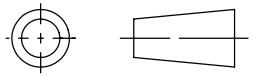
| SIZE | DWG. NO. | REV. |
|---|---|---|
| A | 23083 | - |

SCALE: N/A | APPROX. WEIGHT: 4.3 lb [2.0 kg] | SHEET 1 OF 2

| PIN | SIGNAL |
|---|---|
| 1 | CAMERA RXD |
| 2 | CAMERA TXD |
| 3 | COMM GND |
| 4 | CABLE SHIELD |
| 5 | HEATER V+ |
| 6 | HEATER V- |
| 7 | CAMERA V+ |
| 8 | CAMERA V- |
| 9 | CONTROL BIT 2 |
| 10 | CONTROL BIT 3 |
| 11 | CONTROL BIT 4 |
| 12 | CONTROL BIT 5 |
| 13 | CONTROL BIT 1 |
| 14 | CONTROL BIT 0 |
| 15 | RS-422 RX- |
| 16 | RS-422 RX+ |
| 17 | RS-422 TX- |
| 18 | RS-422 TX+ |
| 19 | Video |
| 20 | Video Rtn |
| 21 | Vid POS |
| 22 | Vid NEG |




THIRD ANGLE PROJECTION



**PROPRIETARY AND CONFIDENTIAL**

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UNLESS OTHERWISE SPECIFIED
DIMENSIONS: INCHES [mm]
TOLERANCES
ANGULAR: ±0.5°
LINEAR: .XX±.030 [.76]
.XXX±.010 [.25]
DIMENSIONS AFTER FINISH

MATERIAL --

FINISH --

DO NOT SCALE DRAWING

| APPROVALS | | DATE |
|---|---|---|
| DWN | M. HARBINSON | 6/27/05 |
| CHK | | |
| REL | | |
| QMR | | |
| MFG | | |

CONTRACT 12095

CAGE CODE 1HT10

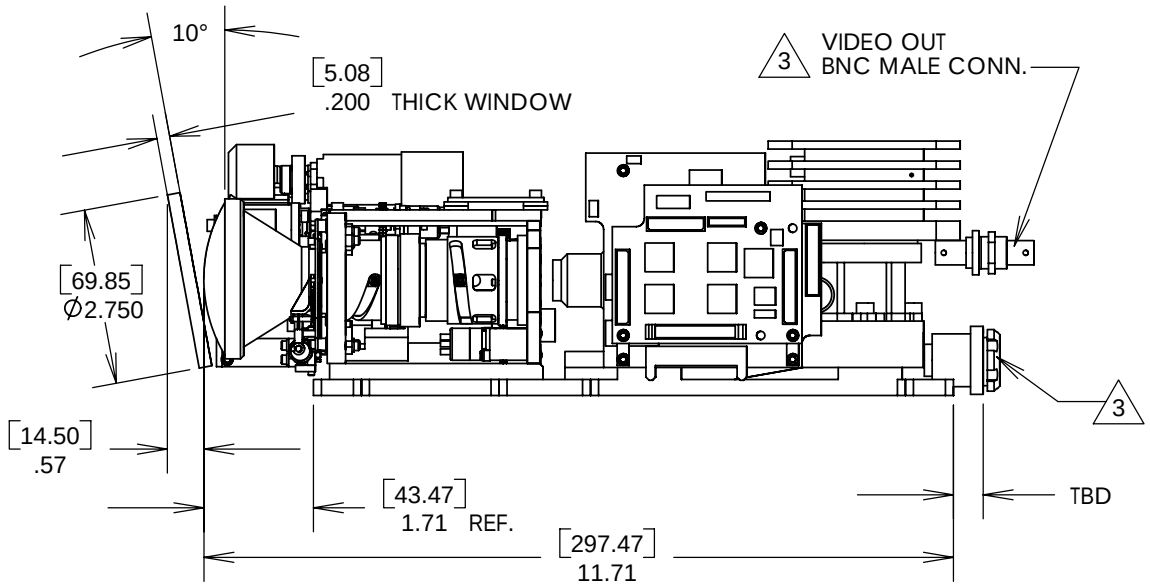
**DIOP** DIVERSIFIED OPTICAL PRODUCTS, INC.

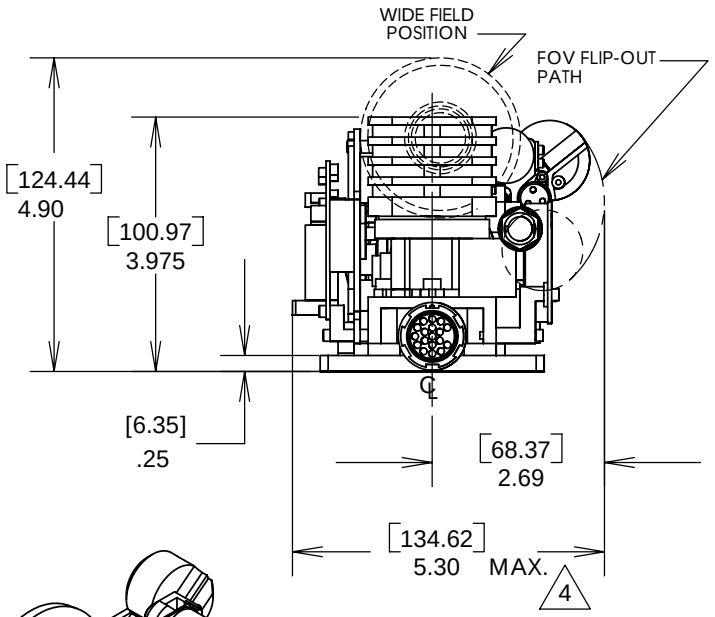
TITLE
50/250mm DFOV *f*/4 3-5µm
THERMAL CAMERA MODULE

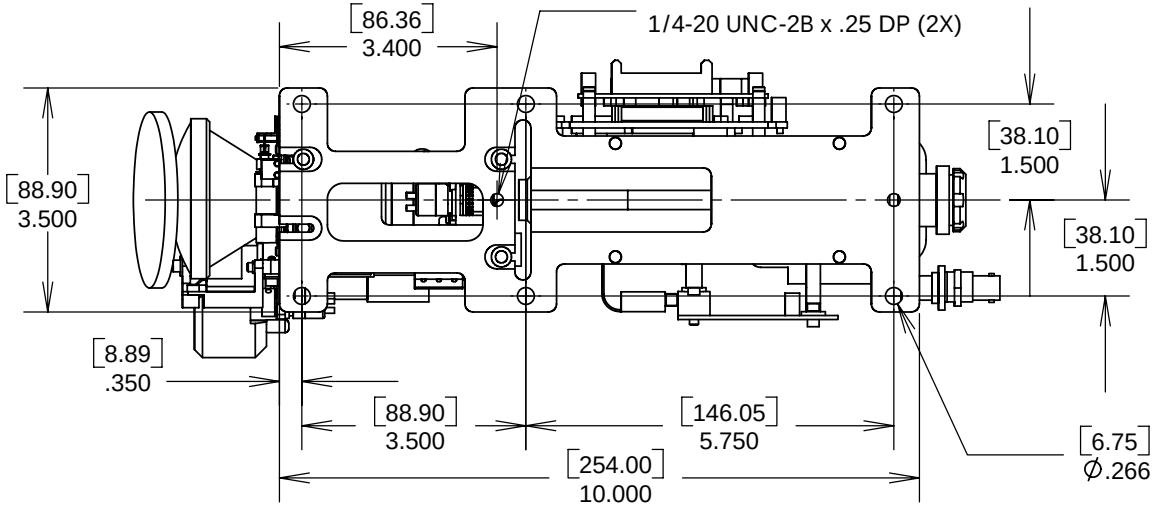
SIZE **A** | DWG. NO. 23083 | REV. -

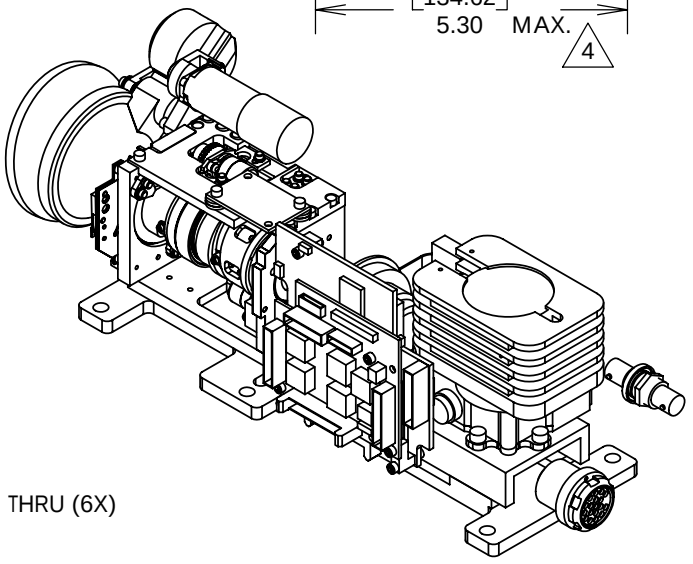
SCALE: N/A | APPROX. WEIGHT: N/A | SHEET 2 OF 2

| REVISIONS | | | | |
|---|---|---|---|---|
| ECN | REV | DESCRIPTION | DATE | APPROVED |
| | | | | |



NOTES:

1. DIMENSIONS: INCHES [MILLIMETERS]
2. ALL VIEWS SHOWN IN NARROW FIELD
3. 18-PIN CONNECTOR: FISCHER P/N DBPE105A038-8 SEE SHEET #2 FOR PIN-OUT. CABLE LENGTHS FROM CONNECTOR MOUNTING SURFACES TO BE DETERMINED
4. MAX. DIMENSION INCLUDES MATING CONNECTORS AND MIN. WIRE BEND RADII

THIRD ANGLE PROJECTION



UNLESS OTHERWISE SPECIFIED
DIMENSIONS: INCHES [mm]
TOLERANCES
ANGULAR: ±0.5°
LINEAR: .XX±.03 [.76]
.XXX±.015 [.38]
DIMENSIONS AFTER FINISH

MATERIAL --

FINISH --

DO NOT SCALE DRAWING

| APPROVALS | | DATE |
|---|---|---|
| DWN | C. BRANCATO | 06/21/05 |
| CHK | | |
| REL | | |
| QMR | | |
| MFG | | |

CONTRACT 12625

CAGE CODE 1HT10

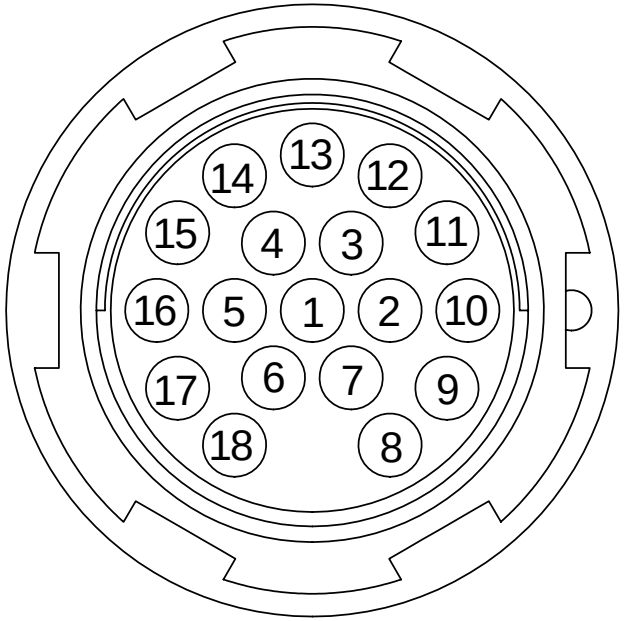
AXSYS TECHNOLOGIES

TITLE
TRI-FIELD 3-5µm CAMERA MODULE

| SIZE | DWG. NO. | REV. |
|---|---|---|
| A | 23048 | ER1 |

SCALE: 1/3 | APPROX. 5.1 lbs. WEIGHT: [2.32 kg] | SHEET 1 OF 2

| PIN | SIGNAL | PIN | SIGNAL |
|---|---|---|---|
| 1 | CAMERA RXD | 10 | CAMER V+ |
| 2 | CAMERA TXD | 11 | CAMERA V- |
| 3 | COMM GND | 12 | FOCUS INF |
| 4 | CABLE SHIELD | 13 | FOCUS NEAR |
| 5 | SPARE | 14 | WFOV |
| 6 | SPARE | 15 | NFOV |
| 7 | SPARE | 16 | POL INV |
| 8 | COOLER V+ | 17 | POL NORM |
| 9 | COOLER V- | 18 | BIT COM |




THIRD ANGLE PROJECTION



UNLESS OTHERWISE SPECIFIED
DIMENSIONS: INCHES [mm]
TOLERANCES
ANGULAR: ±0.5°
LINEAR: .XX±.03 [.76]
.XXX±.015 [.38]
DIMENSIONS AFTER FINISH

MATERIAL --

FINISH --

DO NOT SCALE DRAWING

| APPROVALS | | DATE |
|---|---|---|
| DWN | C. BRANCATO | 06/21/05 |
| CHK | | |
| REL | | |
| QMR | | |
| MFG | | |

CONTRACT 12625

CAGE CODE 1HT10

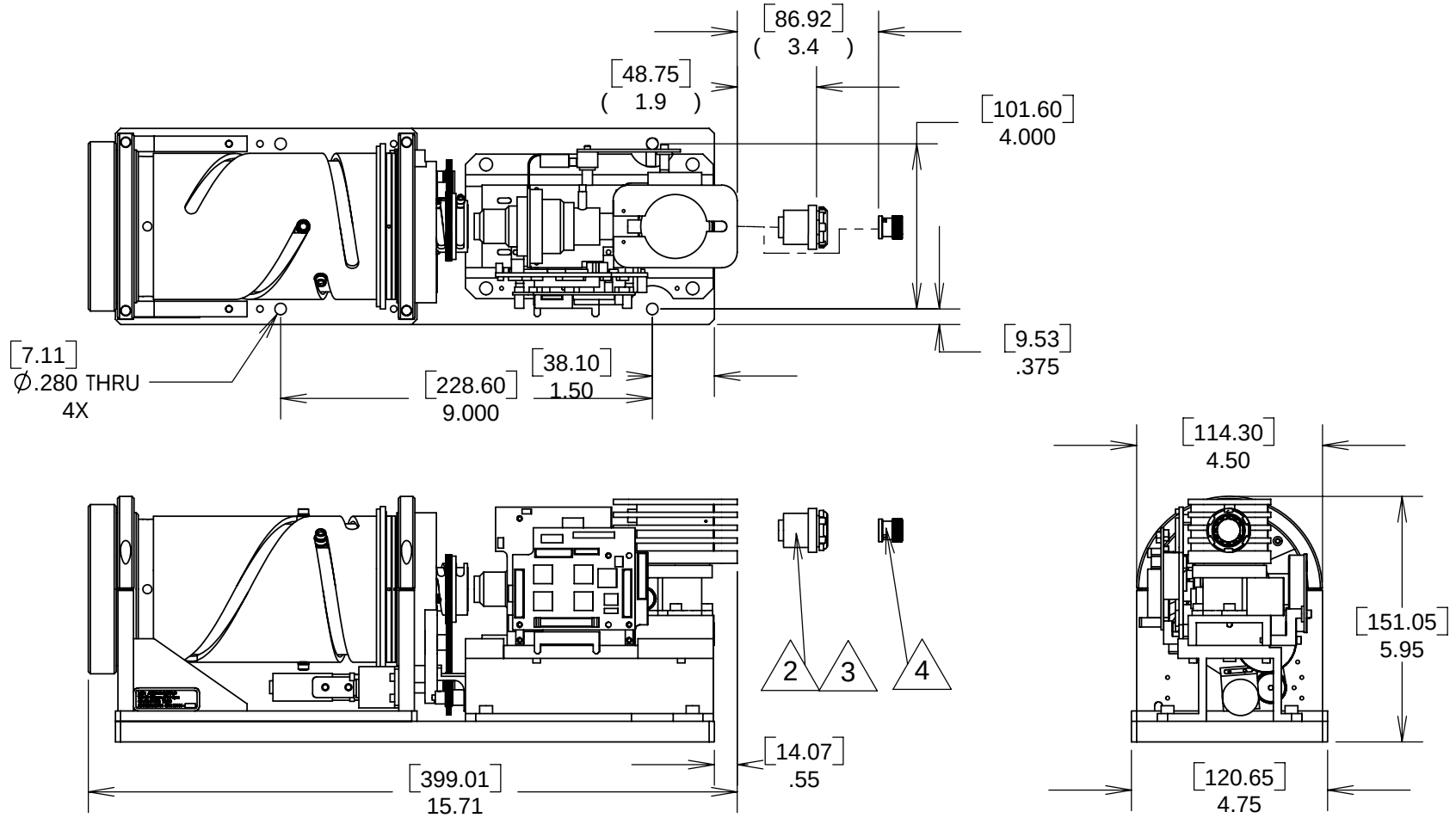
AXSYS TECHNOLOGIES

TITLE
TRI-FIELD 3-5µm CAMERA MODULE

SIZE A | DWG. NO. 23048 | REV. ER1

SCALE: 3/1 | APPROX. WEIGHT: N/A | SHEET 2 OF 2

| REVISIONS | | | | |
|---|---|---|---|---|
| ECN | REV | DESCRIPTION | DATE | APPROVED |
| | | | | |




NOTES:

1. DIMENSIONS: INCHES [mm]

2. 18-PIN CONNECTOR: FISCHER P/N DBPE105A038-8. (SEE SHEET 2 FOR CONNECTOR PIN-OUT). CABLE LENGTHS ARE APPROXIMATE.

3. 14' INTERFACE CABLE OPTIONAL (AXSYS P/N 22799-501)

4. BNC CONNECTOR (VIDEO OUT)

THIRD ANGLE PROJECTION



UNLESS OTHERWISE SPECIFIED
DIMENSIONS: INCHES [mm]
TOLERANCES
ANGULAR: ±1°
LINEAR: .XX±.020 [.25]
.XXX±.005 [.13]
DIMENSIONS AFTER FINISH

MATERIAL SEE NOTES

FINISH 63 OR BETTER

DO NOT SCALE DRAWING

| APPROVALS | | DATE |
|---|---|---|
| DWN | F. CONWAY | 10/21/05 |
| CHK | | |
| REL | | |
| QMR | | |
| MFG | | |

CONTRACT

CAGE CODE 1HT10

AXSYS TECHNOLOGIES

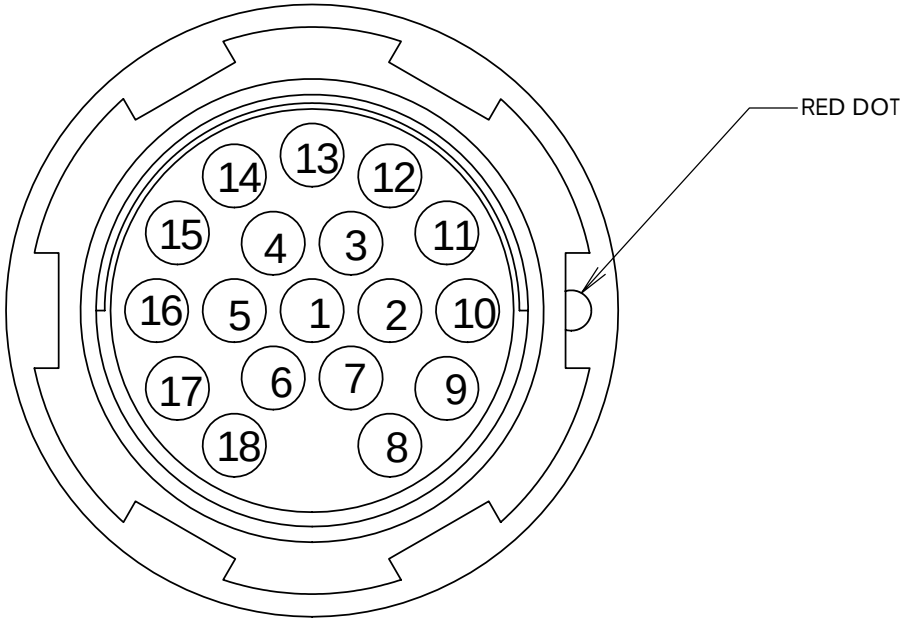
TITLE: TCS, 50-350mm *f*/4.0, 3-5µm

SIZE A | DWG. NO. 23086 | REV. ER

SCALE: 1:1 | WEIGHT: N/A | SHEET 1 OF 2

| REVISIONS | | | | |
|---|---|---|---|---|
| ECN | REV | DESCRIPTION | DATE | APPROVED |
| | | | | |

| PIN | SIGNAL | | PIN | SIGNAL |
|---|---|---|---|---|
| 1 | CAMERA RXD | | 10 | CAMERA V + |
| 2 | CAMERA TXD | | 11 | CAMERA V - |
| 3 | COMM GND | | 12 | FOCUS INF |
| 4 | CABLE SHIELD | | 13 | FOCUS NEAR |
| 5 | SPARE | | 14 | WFOV |
| 6 | HEATER V + | | 15 | NFOV |
| 7 | HEATER V - | | 16 | POL INV |
| 8 | COOLER V + | | 17 | POL NORM |
| 9 | COOLER V - | | 18 | BIT COM |




THIRD ANGLE PROJECTION



UNLESS OTHERWISE SPECIFIED
DIMENSIONS: INCHES [mm]
TOLERANCES
ANGULAR: ±1°
LINEAR: .XX±.020 [.25]
.XXX±.005 [.13]
DIMENSIONS AFTER FINISH

MATERIAL SEE NOTES

FINISH 63 OR BETTER

DO NOT SCALE DRAWING

| APPROVALS | | DATE |
|---|---|---|
| DWN | F. CONWAY | 10/21/05 |
| CHK | | |
| REL | | |
| QMR | | |
| MFG | | |

CONTRACT

CAGE CODE 1HT10

AXSYS TECHNOLOGIES

TITLE TCS, 50-350mm *f*/4.0, 3-5µm

SIZE A | DWG. NO. 23086 | REV. ER

SCALE: 2:1 | WEIGHT: N/A | SHEET 2 OF 2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+1 603 898 1880 • FAX: +1 603 898 3970 • http://www.axsys.com