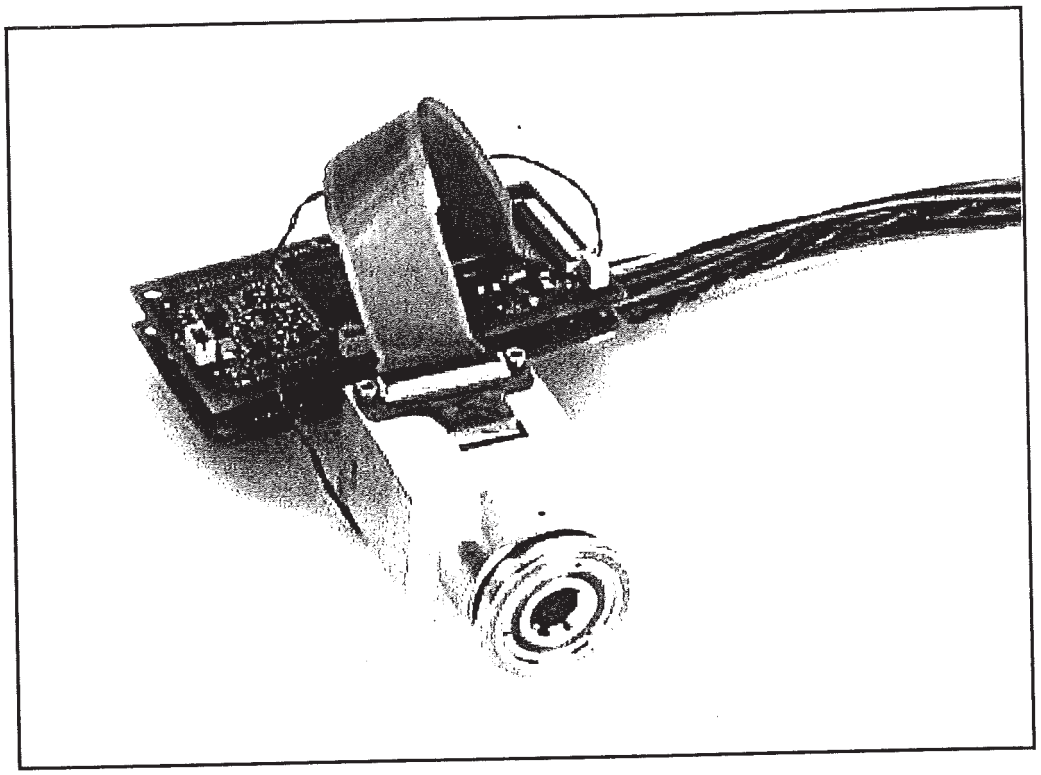
CONTROL*IR* 2000AS
SILICON CAMERA

QUICK REFERENCE USER'S GUIDE
(50^0 FOV, **Small** CCAs)

Drawing No. 3264684, Rev. –



Raytheon

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RAYTHEON CONTROL*IR* 2000AS SILICON CAMERA QUICK REFERENCE USER'S GUIDE

1 INTRODUCTION

This document provides a quick reference User's Guide for the Raytheon Control*IR* 2000AS Silicon Bolometer Camera (also referred to as 2000AS Silicon Bolometer Camera[1]), specifically the 4970750-01 (small CCAs, 50^0 FOV, threaded lens assembly) and 4970750-02 (small CCAs, 50^0 FOV, unthreaded lens assembly) model cameras. The 2000AS Silicon Bolometer Camera consists of an optics housing subassembly, an extension flex cable, an electronic CCA subassembly, and an interface cable. A copy of this technical User's Guide is provided with each production unit to aid in the system level operation of the camera product. For proper imaging, it is important to keep the matched set of the optics and electronics subassemblies together. Each detector and optics subassembly is calibrated at the factory, and then has its unique calibration coefficients stored in memory on its respective electronic CCAs. For any repairs or upgrades, the original set of electronics and optics should also be kept together. Additional technical support is available for these production units by contacting Raytheon Commercial Infrared Customer Service at (800)-990-3275. . An electronic version of this document can also be found on the RCI Website at www.raytheoninfrared.com (go to Products, OEM, 2000AS).

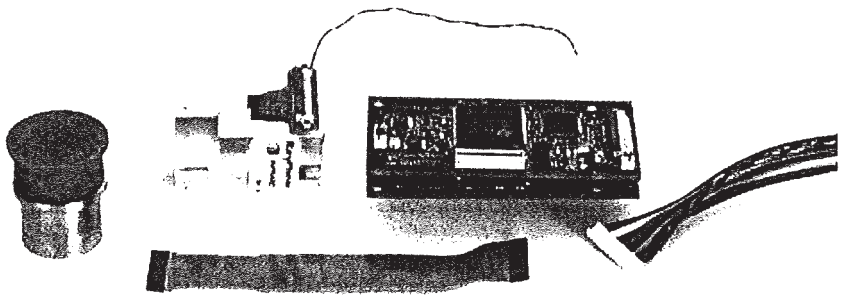

Figure 1. Control*IR* 2000AS Silicon Bolometer Camera with 50^0 FOV Lens (camera model 4970750-01) (Note: The optics pieces will be assembled and the focus fixed at the factory.)

[1]2000AS Silicon Bolometer is a trademark of Raytheon Commercial Infrared.

2 USER'S GUIDE

2.1 Electrical Interface

The electrical interface connections for model 4970750 cameras are through two connectors on the reformatter CCA: a 13-pin connector (J1) for most of the signals, and a 5-pin connector (J3) adequate for running a low-power LCD display. The supplied 12-inch long, 13-pin Interface Cable provides unterminated color-coded wires to allow easy connection to all the necessary inputs and outputs of the camera. Monochrome SMPTE-170M (NTSC compatible) video is available on both the 13-pin and 5-pin connectors and may be used simultaneously. The only inputs required are to one of the two power inputs (either 6-32Vdc to Power In or 2.5-4Vdc to Low Voltage In) and to Power Return. Other inputs to the camera include wires for manually activating the Touch-Up command and for reversing the video polarity. Additionally, regulated voltage outputs of +3.3, +3.4, and +5Vdc provide a limited amount of conditioned power for devices such as a low-power LCD. An RS-485 serial interface is also available on the 13-pin connector. Currently, this can only be used to install a user defined bitmap logo to be displayed alongside the Raytheon logo upon camera start-up.

2.1.1 13-Pin Connector

The 2000AS camera models 4970750-01 and -02 provide the same user-accessible functions as the existing camera models 4970745-01 and -02; however, several new features have been made available to the user. To use the new functions, a new cable is required to plug into the J1 connector on the reformatter CCA. This new Interface Cable (P/N 4970753) allows access to the existing functions using the same color coding scheme as for the 4970745 model cameras while new wire colors identify the new functions. Definitions for the new I/O interface are provided in **Table 1** and the following text.

Table 1. 13-pin (J1) Electrical Connector

Pin #	Function	Wire Color
1	Power In	Red
2	Power Return	Black
3	NA*	Yellow
4	RS-485 Data +	White
5	RS-485 Data -	Gray
6	Ground	Black
7	Touch-up	Green
8	Video Polarity	Brown
9	Low Voltage In	White/Red
10	Power Out	Orange
11	+3.4Vdc/+3.7Vdc Out	Violet
12	Video Return	Black
13	Video Out	Blue

*The Low Battery Command In is not enabled in the current standard software.

Power In – positive terminal of the higher-voltage external power source. Input voltage should be between 6 and 32Vdc—measured at the connector J3—, and the power source must be able to supply at least 1 Ampere for a short time upon turn-on. **WARNING: applying more than 34V will damage the 2000AS!** When 6 to 32Vdc power is applied, the low voltage input on pin 9 is locked out, preventing any inadvertent charging of batteries that may be connected to pin 9. The 2000AS internal circuitry is protected from inadvertent reversal of the polarity of the external power and over-current conditions.

Power Return – negative terminal for either of the user-supplied external power sources, and ground reference for the 2000AS electronic circuitry.

Low Battery Command In – The yellow wire, pin 3, is used in software versions that enable the low battery command. In such systems, when grounding the yellow wire (connecting it to either of the two black wires, pins 2 or 6), a command is sent to the 2000AS to display a low battery logo in the lower left corner of the displayed image. This pin is not enabled in the current standard software. This control can easily be removed or modified for interface at the OEM level, should a different interface be desired.

RS-485 Data+ - one of the two differential data lines that, along with a ground connection, is used for the RS-485 serial data port. The serial bus interface is primarily for RCI factory use but also made available to the User for loading an OEM unique logo (see sections 3 and 4).

RS-485 Data- - the second of the two differential data lines for the RS-485 serial data port.

Ground – ground available for a switch return and a serial port ground; identical to (and connected internally to) pin 2 on the Interface Connector (J1) and pin 5 on the LCD Interface (J3).

Touch-up – grounding the green wire (by connecting it to either of the two black wires, pins 2 or 6) causes the internal shutter to actuate and the camera to perform a "touch-up correction," improving the image for the present ambient temperature. Note that Touch-up is not a uniformity or calibration correction. All uniformity (NUC) and calibration coefficients that are factory loaded during calibration remain the same at Touch-up. Touch-up also activates automatically at time intervals set through the software version. This control can easily be removed or modified for interface at the OEM level, should a different interface be desired.

Video Polarity – grounding the brown wire (by connecting it to either of the two black wires, pins 2 or 6) changes the thermal image presentation from hotter objects appearing white to hotter objects appearing black; grounding pin 8 again returns the image to white hot. No symbology is provided for the user to indicate which polarity the camera is in, since it is normally intended to remain in white-hot polarity at the OEM level. This control can easily be removed or modified for interface at the OEM level, should a different interface be desired.

Low Voltage Input – positive terminal for a 3V-power source such as two AA alkaline batteries. Powering the camera from this pin requires an input voltage of approximately 2.5 to 4Vdc

for ideal operation. **WARNING: applying a voltage greater than 5V to this wire will damage the 2000AS!** Although power sources can be connected to both pin 1 and pin 9 simultaneously without damage, the 2000AS will default to the higher-voltage input applied to pin 1, locking out the low voltage source applied to pin 9.

Power Out – "Power In" on pin 1 is looped back out on this pin. The 2000AS provides a 40V, 1 Amp diode in series with this line to prevent damage from inadvertent polarity reversal of the external power source. Current drawn through this line by external circuitry must be no more than 0.5 Ampere, maximum.

+3.4Vdc/+3.7Vdc Out – a regulated (+/-2%) output voltage for use in external circuitry. The dc output voltage depends upon the input power source: approximately 3.4V is output with power at Power In and approximately 3.8V is delivered with power at Low Voltage In. The external load applied to this line must not exceed 250mA. The internal regulator is current limited. Care should be taken to keep RF energy from any external load from being conducted into this line.

Video Return – output video ground reference; not to be used for any other ground than video.

Video Out – an analog monochrome composite TV video output signal in an SMPTE-170M standard format (NTSC compatible) which is ac-coupled. For best performance, a 525 line monochrome display having 75 Ohm impedance (applied between Video Out on pin 13 and Video Return on pin 12) should be used. With 75 Ohm termination, the output video is a 1 Volt peak-to-peak signal.

2.1.2 LCD Interface 5-pin Connector

Another new feature is also incorporated into the new 2000AS Reformatter CCA for camera models 4970750-01 and -02. Connector J3 on the Reformatter CCA provides an interface designed to drive a small LCD display such as the Kopin 320Mono. However, the signals provided at the J3 interface are offered for any purpose as long as the guidelines in this document are respected. The J3 interface allows a second external video device to be directly connected to the 2000AS electronics, as well as providing a small amount of regulated dc power for use by external circuitry. The J3 connector requires a mating plug (p/n ZHR-5 by JST Connector) of the same series as the J1 Interface Connector (ZHR-13). J3 is located on the same end of the Reformatter CCA as the J1 Interface Connector, allowing the possibility of the cable bundle to J3 being common with that already going to J1. **Table 2** and the following text list the functions available through J3.

Table 2. LCD Interface 5-pin (J3) Connector

Pin #	Function	Recommended Wire Color
1	SMPTE-170M Video Out	Blue/White
2	SMPTE-170M Video Return	Black
3	Regulated +3.3Vdc Out	Violet/White
4	Regulated +5Vdc Out	Orange/White
5	Ground	Black

SMPTE-170M Video Out – a second 75 Ohm video output. This video output is dc-coupled, with blanking level set at ground potential; this is unlike the video output signal on Interface Connector J1's pin 13, which is ac-coupled. Both video outputs can be used simultaneously if desired.

SMPTE-170M Video Return – return for the video on pin 1; not to be used for any other ground than video; identical to pin 12 on the Interface Connector, J1.

Regulated +3.3Vdc Out - Regulated (approximately +/-1.5%), current-limited, dc supply. External load current can not exceed 50mA*. Care must be taken to keep external RF from entering this line. ***Note:** Simultaneously connecting loads to both the 3.3V and the 5V outputs is not reccomended

Regulated +5Vdc Out – Regulated (approximately +/-1.5%), current-limited, dc supply. External load current can not exceed 15mA*. Care must be taken to keep external RF from entering this line. ***Note:** Simultaneously connecting loads to both the 5V and the 3.3V outputs is not reccomended

Ground – power return for +3.3Vdc and +5Vdc; identical to (and connected internally to) pins 2 and 6 on the Interface Connector, J1.

2.2 Mechanical Interface

The photos in **Figures 2** and **3** show the germanium lens assembly, electronics CCAs, and connectors for the 2000AS Silicon Bolometer Camera, model 4970750-01.

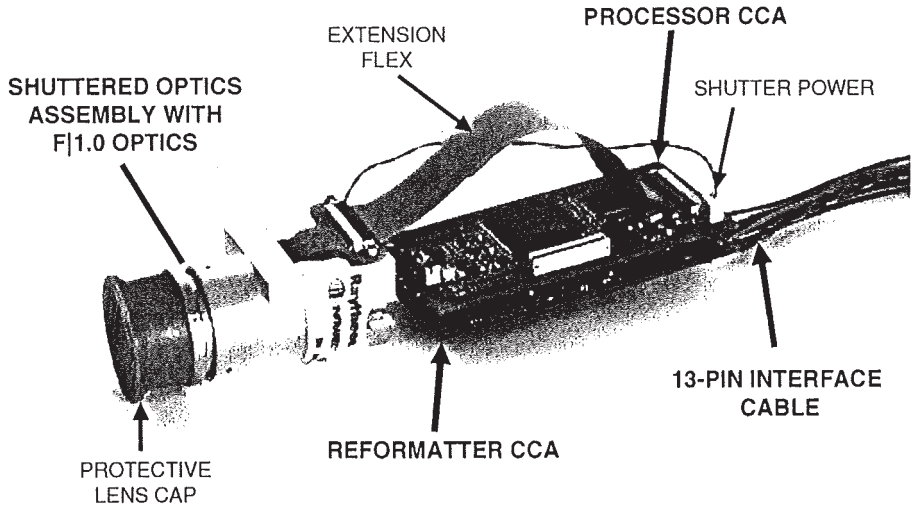

Figure 2. Assembled Control*IR* 2000AS Silicon Camera (50° FOV)

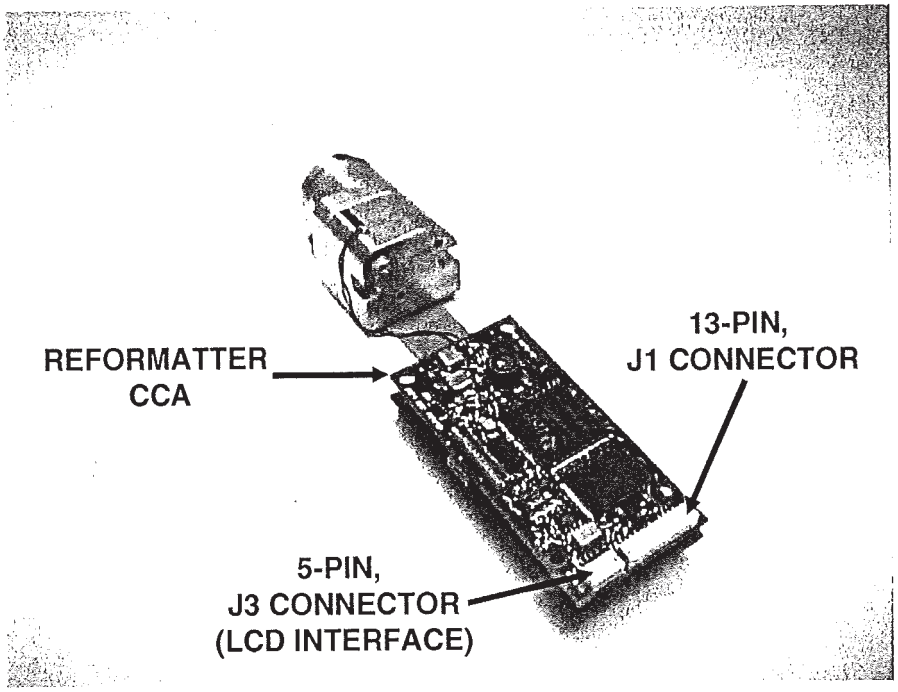

Figure 3. Interface Connectors on the Control*IR* 2000AS Silicon Camera (50° FOV)

Mechanical dimensional profile view drawings, showing front, top, side and bottom dimensions are shown in **Figure 4**. For electronic copies of the computer aided design drawings, defining detailed quantitative dimensions, contact Raytheon Commercial Infrared Customer Service at (800)-990-3275.

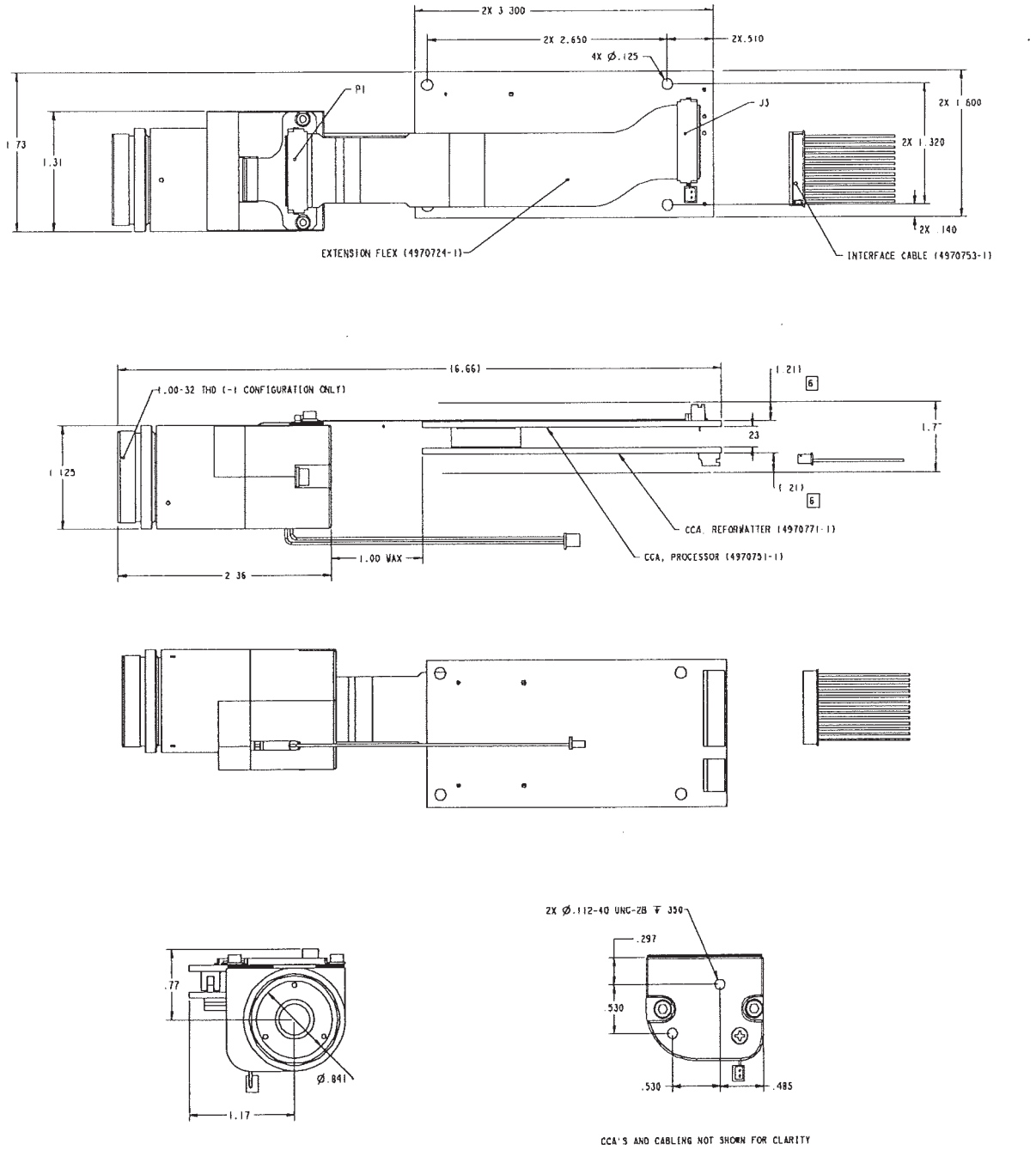

Figure 4. Control*IR* 2000AS Silicon Camera (50° FOV) Profile Views (dimensions are in inches)

2.3 Substituted Pixels & Operability

Pixel defects are a reality of today's high volume, low cost thermal imager manufacturing process. Pixel defects can occur individually or as contiguous clusters. Factory calibration automatically identifies most defective pixels so that they can be substituted with information from adjacent good pixels to produce an image that appears virtually free of defects. RCI has created an optimized balance of cost and yield, by assuring that less than 5% of the total viewed pixels shall be defective and that less than 5% of the center 36 by 48 pixels shall be defective. This defective pixel count includes substituted and unsubstituted (dead white or dead black, flashing, blinking or flickering). Additionally, 2000AS cameras are screened for any remaining defects to assure that all the pixels displayed in this center region are fully operable, being either good or substituted with good pixel data.

2.4 Operational Limitations

The power and environmental operational limitations for the Camera are shown in **Table 3**.

Table 3. Operational Limitations

Parameter	Requirement Description
Input Power Source	• into Power In: 6Vdc < Input Power < 32Vdc **(absolute maximum of <34 V or damage will occur!)** • into Low Voltage In: nominal 3Vdc **(absolute maximum of <5 V or damage will occur!)**
Temperature	• +0 to +60 °C, operating (< 2 °C change per minute) • -40 to +80 °C, storage
Vibration	• < 4.3 g's rms

This Amorphous Silicon camera is provided without an electrical, mechanical or environmental protective housing. This has been done to provide OEM end users maximum flexibility in mounting the individual components (optics assembly and circuit cards) in different configurations to support unique OEM developmental system integration needs. Good engineering judgement must be applied to this camera and subsystem components when integrating them into a housing with other electronic devices (LCD, controls, radio transmitter, etc.) to limit electromagnetic interference and provide thermal as well as mechanical protection.

Amorphous Silicon technology uses an isothermal principle that assumes that the FPA, housing and optics all change at the same temperature and at the same rate of change of temperature. Without a thermal electric cooler the a-Si detector temperature will change with time as the ambient temperature changes. When the detector temperature changes, each pixel's responsivity also changes. The 2000AS Bolometer compensates for this detector temperature change within the processor CCA's DSP via a closed loop control path limited by its rate of change. Limiting the rate at which the control loop can change limits how fast the temperature of the detector can change and have the DSP's adjustments keep up. Therefore, the detector housing must be insulated by the OEM end users to slow down and control both the ambient temperature and the rate of temperature change according to **Table 3**.

3 CUSTOM LOGO LOADING INSTRUCTIONS

The custom logo is programmed into flash memory using the RS-485 interface and the DOS program loadlogo.exe. The user defined steps are as detailed below:

Step 1: Connect the camera up to a PC using the wires RS-485+, RS-485-, and Ground along with a PC serial port to RS-485 adapter (eg. a model 485SD9RJ RS-485 to RS-232 Converter).

Step 2: Provide 6 to 32Vdc to the Power In pin (or 3Vdc to Low Voltage In).

Step 3: Enter the DOS command loadlogo "filename.bmp x y" containing the OEM logo of choice

where x =0 for 1 byte gray shades
=1 for 3 byte gray shades

and y =0 for the default Raytheon factory "Infrared Eye" logo only
=1 for the default OEM logo, making sure to not write over the RCI "Infrared eye" logo

Step 4: Make sure that the input file "filename.bmp x y" resides in the same P.C. directory as loadlogo.exe. The *.bmp file must contain exactly 120 rows and 160 columns.

Step 5: Execute loadlogo.exe.

Step 6: Power down the camera and disconnect the camera from the computer. Logo(s) loaded.

Note, the "Infrared Eye" is a branding trademark of Raytheon Commercial Infrared. Use of the "Infrared Eye" logo and any user-defined logo is covered by the User-Effectuated Agreement detailed in this document. Please call Raytheon for a no-cost copy of the Raytheon "loadlogo.exe" routine or for any other additional details, questions, comments or concerns.