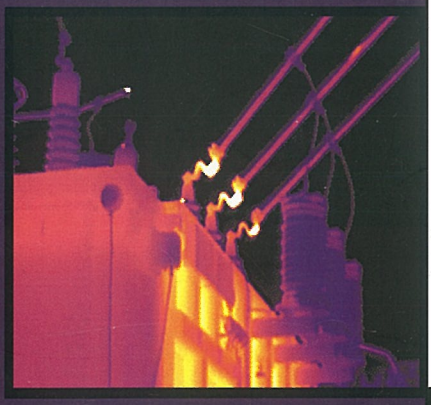
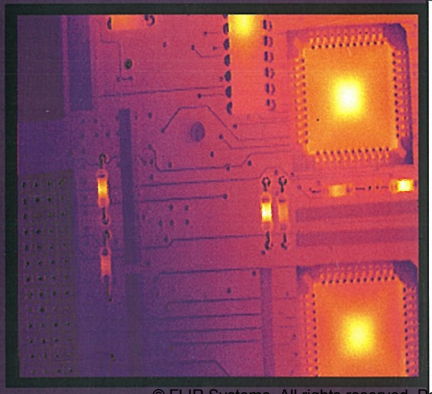
FSI
FLIR SYSTEMS™

Prism DS

Infrared Camera

Operator's Manual





The **Prism DS** camera does not contain any user serviceable parts, or calibration points. Always return the camera (or system components) to FLIR Systems, Inc. for any repair or system calibration that maybe required (see Chapter 8 of this manual for Service information).

OPERATING ENVIRONMENT

The recommended operating temperature (environmental ambient) for the **Prism DS** camera is -10 °C to 45 °C. Operation outside of the recommend temperature limits may cause damage to the equipment. Always protect your **Prism DS** system from moisture and temperatures (or temperature changes) that may cause condensation within the instruments.

OPERATING POSITION

The **Prism DS** camera can be operated in any position. However, always ensure that the ventilation ports are free of any obstructions.

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CHAPTER 1 GENERAL INFORMATION

SYSTEM INTRODUCTION

The FLIR Systems, Inc. **Prism DS** (**D**igital **S**torage) IR (**I**nfra**R**ed) Camera is used to detect emitted thermal energy in the medium wavelength (3.6 to 5 micron) spectral region, and then display a real-time image showing the relative intensity of this energy. In addition, the camera provides the operator with the ability to remotely measure the absolute temperature of a specific point on the target in one of three different temperature measurement configurations: (Running Crosspoint Temperature Display, Freeze Frame, or Peak Hold); and then display the measured temperature in either Fahrenheit or Celsius at the operator's discretion. In addition, the camera provides digital image storage of more than 30 images (with a 5MB PCMCIA card).

The camera offers exceptional image and temperature sensitivity due to its staring Focal Plane Array (FPA), and is contained in a truly portable package. The camera is easily adaptable to a wide variety of applications such as predictive/preventive maintenance, quality control, manufacturing process evaluation, and component or system failure analysis to name a few.

The **Prism DS** IR Camera is a self contained system that provides the operator with everything required to begin basic IR viewing and non-contact temperature measurements.

The Standard **Prism DS** System consists of:

- FPA IR Camera with Single Point temperature measurement and Digital Image Storage (B&W/NTSC color video output standard; B&W/PAL color video option is available);
- Viewfinder;
- Interconnect Cable;
- 25mm Lens, 17° x 13° Field-of-View;
- Safety Strap;
- Range Extension Filter (F05);
- Sealed Lead Calcium Rechargeable (LCR) Battery Belt;
- Battery Charger (120VAC, 16 Hour Charge);
- Carrying Case;
- Operation Manual.

Optional accessories that may be included, depending on the system options ordered are:

POWER ACCESSORIES:

- Battery Belt, Sealed LCR Rechargeable (3 hour);
- Battery Belt, Sealed LCR Rechargeable (6 hour);
- Battery Charger, LCR, 120V, 4 Hour;
- Battery Charger, LCR, 240V, 8 Hour;
- AC to DC Power Adapter, 120/240V (50/60Hz);
- DC Power Adapter (provides power from a 12V automotive source).

LENS:

- 8mm Lens, 53° x 41° Field-Of-View;
- 12.5mm Lens, 34° x 26° Field-Of-View;
- 50mm Lens, 8.5° x 6.5° Field-Of-View;
- 100mm Lens, 4° x 3° Field-Of-View.

VIDEO OPTIONS:

PAL VIDEO OUTPUT

PAL Video Output (converts the video output to PAL video standard). When this option is ordered, the 240VAC Battery Charger is substituted for the standard 120VAC Battery Charger which is supplied with NTSC systems. This option must be specified at the time the system is ordered.

Other video options include:

- Video GEN Lock input;
- 12 bit digital video interface.

VIDEO ACCESSORIES:

- 8mm VCR with LCD, NTSC Video;
- Post Processing Software:

  Full featured **AnalyzIR™ Analysis** and **Report Generator** (Windows™ based) software for detailed thermal analysis of the full screen image and support documentation.
- 8mm "Camcorder" with LCD, NTSC Video;
- Color Video Printer, NTSC Video;
- Visual Light Camera with Disk Storage, NTSC Output.

The **Prism DS** IR Camera is an extremely versatile and adaptable imaging system; new accessories and applications are constantly being developed.

"Windows" is a trademark of the Mircosoft Corporation.

For the latest options available or custom requirements, contact your local sales representative, or FLIR Systems, Inc. Customer Support at **(800) 322-3731**.

SYSTEM SPECIFICATIONS

DETECTOR:

Type:	Platinum Silicide (PtSi) IR CCD Array (320 x 244 pixels);
Spectral Range:	3.6µm to 5µm;
	NOTE: Standard internal sun filter improves system response by eliminating transmission below 3.6µm.
Cooling:	Mechanical, Split Stirling;
Operating Temp:	77°K;
MDT:	≤0.1° @30° C;
Spatial Resolution:	1.0 mrad (using 25mm lens).

RADIOMETRIC:

Temperature Range (no Filter):	-10° to 200° C (14° to 392° F)
(With supplied F05 Filter):	to 450° C
With optional Filters:	Up to 1,500° C (2732° F);
Accuracy:	±2° C or ±2% (which ever is greater).

OPTICS:

8mm:	53° x 41° (Optional);
12.5mm:	34° x 26° (Optional);
25mm:	17° x 13° Standard lens;
50mm:	8.5° x 6.5° (Optional);
100mm:	4° x 3° (Optional).
Focus Range:	12" (30cm) to infinity (∞) with 25mm lens.

POWER REQUIREMENTS:

Input Voltage:	12VDC (120/240VAC, 50/60Hz with external converter);
Input Current:	~2.9ADC (Nominal @ 23°C).

DISPLAY:

Video Outputs:	Black & White/Color NTSC, or Black & White/PAL (video format is set at the factory);
Image Update Range:	60 Hz (50 Hz for PAL);
Gray/Color Levels:	256 or 16 user selectable levels of thermal display;
Color Palettes:	Color (Pastel or High Contrast) or Monochrome, user selectable;
Display Type:	Viewfinder, external color/B&W display;
Infrared Dynamic Range:	12 bits;
Image Storage Capacity:	More than 30 images (5MB PCMCIA card. Image capacity is dependent on card memory.)

MECHANICAL:

Camera (Camera, Viewfinder, and 25mm Lens):

Weight:	~7 pounds (3.2 Kg);
Size:	8.75 x 5.0 x 5.5 inches (222 x 127 x 140 mm).

Battery Belt:

(6 Hour)

Weight:	Less than 9.5 pounds (4.3 Kg);
Size:	45 x 5.0 x 5.0 inches (1143 x 127 x 127 mm).

(3 Hour)

Weight:	Less than 6.5 pounds (3.0 Kg);
Size:	45 x 5.0 x 5.0 inches (1143 x 127 x 127 mm).

CHAPTER 2 RECEIVING, UNPACKING, AND INSTALLATION

RECEIVING

The **Prism DS** IR Imaging System is packed in high-density foam, within a high-impact ABS case for protection against damage in transit and storage.

Upon receipt of the system(s), check the shipping container for any damage which may have occurred during shipment. Immediately report any damage to the freight carrier who delivered the shipment, and to FLIR Systems Inc. Customer Support at **(800) 322-3731**.

UNPACKING

The shipment includes all the standard components needed for operation of the system. In addition, the shipment will include any options (or accessories) that have been ordered. Open all the containers and check the contents against the packing list and original order to insure that all of the items have been included.

Save all of the packing material, if service or camera upgrade is ever required, the system can then be placed in the original shipping containers for return.

SYSTEM COMPONENTS CHECKLIST

The following lists all standard system (B&W/ NTSC color video) components (in systems equipped with the B&W/PAL color video option, a 220VAC charger is substituted for the 120VAC shown below):

1 - Hand-held IR Camera;

1 - 25mm Lens with Cap /Cover;

1 - Viewfinder;

1 - Range Extension Filter (F05);

1 - Safety Strap;

1 - Battery Belt;

1 - Battery Charger (120VAC 50/60Hz input, 16 hour charge cycle);

1 - Interconnect Cable (Battery Belt to camera);

1 - Operator's Manual;

1 - Carrying/Storage Case.

The carrying case is made of durable ABS plastic and accommodates all of the standard accessories listed above. In addition, space is provided for storage of the following optional accessories:

2 - Filters;

1 - Lens;

SYSTEM INSTALLATION

The **Prism DS** IR Camera is designed to adapt to a wide variety of installation configurations. The following section provides general installation guidelines and directions.

For operators who wish to start IR imaging as quickly as possible, the "Basic System Start-Up" procedure is provided to help you begin using your **Prism DS** IR Camera as quickly and easily as possible.

Basic System Start-Up:

If operating from the Battery Belt, allow the Battery Belt to charge for sixteen hours using the standard charger, eight hours for the 220VAC input charger, or four hours if using the optional rapid charger prior to connecting the Battery Belt to the camera.

If you are operating using an optional AC/DC adapter, connect the adapter to the Break-Out Box (supplied with the AC/DC adapter), and then connect the camera to the Break-Out Box using the Interconnect Cable.

- Be sure that the power switch is in the "OFF" position and the camera lens cap is on.
- Connect the **Prism DS** IR Camera to the power source being used.

- Apply power to the camera by placing the power switch to the ON position. When power is first applied to the camera, the sound of the detector cooler can be heard and no video will be preset in the viewfinder (the sound produced by the cooler will decrease as the detector approaches its correct operating temperature; at this time video will also be presented).

- The camera takes less than eight minutes to cool the detector. Watch for video to appear in the viewfinder indicating that the detector has reached the correct temperature.

- Ensure that the lens cover is on. When video appears, momentarily press the switch labeled NUC.

- Remove the lens cover, focus (rotate the lens focus ring as required); the camera is now ready for basic IR imaging.

NOTE:

The radiometric features will default to:

MODE:	Running Crosspoint (Active) temperature measurement
UNITS:	Degrees Celsius
EMISSIVITY:	1.00
BACKGROUND:	23.0° C

For a detailed description of the camera controls see Chapter 3, "*SYSTEM CONTROLS*". Also, to insure that the temperature measurements are as accurate as possible, be sure to read Chapter 5, "*TEMPERATURE MEASUREMENT*".

Common Operating Configurations:

The following paragraphs describe some of the more common operating configurations for the **Prism DS** IR Camera.

If your configuration is not specifically described, information is provided outlining key system characteristics that may help you design your own custom install9ation.

Operation using the Battery Belt:

The simplest configuration uses only the IR Camera and no external monitor or recording device. Power is applied directly to the camera from the Battery Belt through the Interconnect Cable.

Operation using the Battery Belt and an external monitor:

Although not directly supported, an external monitor can also be used with the Battery Belt. A video connection is available on the belt that can be used to drive an external monitor, or VCR video input. No system control is provided at this output, as only the video signal is available. The video cable (and the input of the external equipment) should have a 75 Ohm impedance.

The video connector used at the Battery Belt is a male "phono" type. A commercially available female phono to female BNC adapter is required to use standard coax cabling.

Information on external monitor options can be obtained by contacting your local representative or FLIR Systems, Inc. Customer Service at **(800) 322-3731**.

Operation from external AC power:

The **Prism DS** IR Camera can be operated from external AC power using the AC/DC adapter option. The adapter allows operation using either 120 or 240VAC, 50/60 Hz input. Connection to the camera and the AC adapter is made using the Break-Out Box that is supplied with the adapter option.

Although the AC adapter is "universal" in that it allows operation from either 120 or 240VAC, input (AC line) adapters may be required depending on the local AC line standards.

Operation using external AC power and monitor:

The **Prism DS** IR Camera has the capacity to drive an optional external video monitor. Connection to the monitor is made using the Break-Out Box (supplied with the AC adapter) connection labeled "VIDEO". The connector is a standard BNC type, this allows the use of general purpose "off the shelf" coax cables which are easily obtained. It should be remembered however, that the **Prism DS** IR Camera is designed to operate into a standard 75 Ohm impedance; the cable used should be the proper impedance, and the length kept as short as possible for best performance.

Nearly all video monitors have an input termination that is switchable to either 75 Ohms or Hi-Z (high impedance). The monitor input impedance should be adjusted to the 75 Ohm value for proper termination.

Information on external monitor options can be obtained by contacting your sales representative, or FLIR Systems, Inc. Customer Support at **(800) 322-3731**.

Operation using the Battery Belt with a VCR:

Provisions have been made to allow for the remote operation of an optional external Video Cassette Recorder, or "Camcorder". The optional VCR available from FSI comes with its own AC adapter, battery pack, and battery charger. If this option has been purchased, see the instruction manual that is provided with the VCR to completely familiarize yourself with the system's operation and options.

When using the **Prism DS** IR Camera with the VCR option, the video and control cable connections are located on the Battery Belt (and must be connected before power is applied to the camera). When operated in this manner, the user is able to switch between the RECORD and PAUSE functions of the VCR from the camera by using the VCR PAUSE switch located on the camera.

Operation using external AC power and VCR/ "Camcorder":

When using the optional AC power adapter, it is possible to support the video input to a VCR if required, however, remote control of the VCR is not possible.

To use the optional FLIR Systems, Inc. supplied recorder while operating from AC power, a female BNC to female phono adapter is required at the Break-Out-Box to interface to the VCR video input.

When using a different VCR, the camera's video output is always obtained from the "VIDEO" connector on the Break-Out-Box, the type of connector used at the VCR video input will depend on the input configuration used by the manufacturer. In most cases, the video input will be a female phono connector.

Operation using external AC power, Monitor, and VCR:

It is possible to operate both an external monitor and VCR with the Prism DS IR Camera while operating from the AC power line. To accomplish this, the monitor and VCR are placed in series to provide the required 75 Ohm impedance to the camera's video driver.

Nearly all video cassette recorders have a fixed 75 Ohm input impedance, while most display monitors have an input termination that is switchable to either 75 Ohms or a high impedance ("Hi-Z") configuration. Also, most monitors provide both an "INPUT", and "OUTPUT", video connection. By placing the monitor's impedance adjustment to the high impedance position, and using the monitor's video output signal to drive the VCR video input, the signal is supplied to both devices while maintaining the required 75 Ohm termination.

Operation using automotive electrical power:

The Prism DS IR Camera may be operated from automotive electrical power by using the optional DC to DC adapter. Input power is obtained from the cigarette lighter, and connection to the camera is made using the Power Cord and the Break-Out Box (supplied with the adapter).

CAUTION:

The DC to DC adapter is designed to work with vehicles having a 12VDC, negative ground electrical system. Some vehicle systems operate with 24VDC, or positive grounds. Operation using any system other than 12VDC, negative ground, may result in damage to the camera.

Before using the DC to DC Adapter, verify the type of electrical system in use.

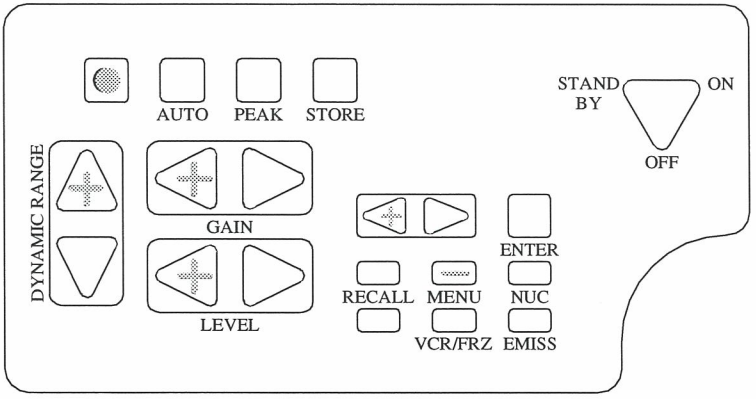
Most automotive electrical systems will rise to 13 or 14VDC when operating, this will not affect the operation of the camera.

If the automobile battery is in poor condition, or the electrical connections are corroded, the voltage supplied to the camera may drop below the required operating voltage when the automobile is not running. If this occurs, the camera will shut off. The vehicle battery and electrical connections (from the battery to the cigarette lighter) should be checked to find the source of the voltage drop.

CHAPTER 3 SYSTEM CONTROLS

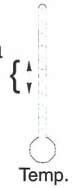
SYSTEM CONTROLS AND STATUS INDICATORS

The **Prism DS** Focal Plane Array IR Camera is designed to provide powerful thermal imaging features and performance, while maintaining a simple and user friendly feature activation and control system. Most of the cameras' controls are conveniently located on a single, easily accessible control panel.



Prism DS Controls

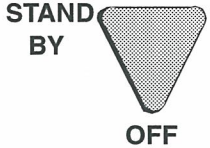
The camera controls and their function are quickly listed in the table below; a more comprehensive description of each control, and the various camera functions then follows.

CONTROL	FUNCTION
POWER • OFF • STAND BY • ON	All camera power is off, or turned off. Camera cooler operates but the video circuitry is off. Applies power to the camera. When turned on, the camera uses the "Power-Up" file to define the system.
LEVEL	Provides adjustment of the camera level offset (the viewed temperature span) when the camera is in the MANUAL (radiometric) operating mode, or when using the Isotherm display mode. 
GAIN	Provides adjustment of the camera gain (thermal sensitivity) when the camera is in the MANUAL and AUTO LEVEL (radiometric) operating modes, or when using the Isotherm display mode. 

CONTROL	FUNCTION
DYNAMIC RANGE	Adjusts the temperature response of the camera.
RANGE:	Approximate Response
• **"1"**:	-10 to 80° C (14 to 176° F)
• **"2"**:	60 to 200° C (140 to 392° F)
• **"3"**:	Special range for use with external filters to extend the temperature response up to 1500°C (2732° F)
AUTO	Used to select between the AUTO-IMAGE, MANUAL, and AUTO-LEVEL (radiometric) modes of operation.
• AUTO-IMAGE:	GAIN, LEVEL, and DYNAMIC RANGE settings are automatically selected for the thermal range of the viewed scene.
• MANUAL:	Allows the user to adjust the GAIN, LEVEL and DYNAMIC RANGE settings used by the camera.
• AUTO-LEVEL:	LEVEL and DYNAMIC RANGE settings used by the camera are automatically selected so the temperature of the point under the crosspoint is always located near the center of the color bar, the GAIN setting can be still be manually adjusted.

CONTROL	FUNCTION
PEAK	Places the camera into the Peak (temperature) Hold mode, or exits the Peak mode and returns to the Running Crosspoint measurement mode. This mode displays the highest temperature that passes under the crosspoint.
STORE	Stores the image to a memory card for future reference.
RECALL	Used to recall a stored image from the memory card.
MENU	Provides access to the various system menus.
NUC	**N**on-**U**niformity **C**orrection, provides correction for the different offset level characteristics of the individual detector elements.
EMISS (Emissivity)	Used with the "INC/DEC" switch to set the emissivity value.
ENTER	Used to make selections from the various system menus.
VCR/FRZ	Used to define the function of the push button switch (on the hand grip), either Freeze Frame trigger or VCR RECORD/PAUSE trigger can be selected.

ON, OFF, and STAND BY (Mode) SWITCH



The ON/OFF/STAND BY control is a three position switch that provides the operator with control of system power (ON and OFF), and the ability to place the camera into a "STAND BY" condition.

"ON":

When power is first applied to the camera several things happen. First, the unit begins to cool the IR detector. Because the detector must be cooled to approximately 77°K for proper operation, the video circuitry is automatically placed into a STAND BY mode where power is not applied to the video hardware until the detector is near the correct operating temperature (the camera takes less than eight minutes to cool the detector). Once the detector has been properly cooled, power is applied to the video hardware, and video will then appear in the viewfinder (or external monitor).

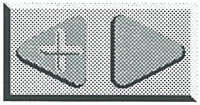
"STAND BY":

By placing the switch to the "STAND BY" position the camera is placed into the Stand By mode. While in the Stand By mode, the unit applies power only to the detector cooler; all video hardware is off. This allows the operator to keep the camera ready for immediate operation (following the system downloading of calibration tables) while conserving battery power.

To return to full operation from the Stand By mode, place the switch to the ON position. Active video will then be displayed after internal memory is loaded (it will take a few seconds before the video is actually presented).

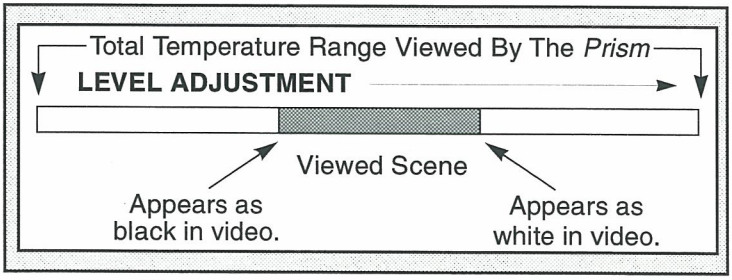
The camera can be placed into the Stand By mode at any time by placing the switch to the STAND BY position. However, it is important to remember that any image information (frozen images for example), or changes in the camera configuration will be lost when the camera is placed into the Stand By mode unless it is first saved. Also, the camera will use the information contained in the POWER-UP configuration file when the system is again activated, not the configuration that was present when the Stand By mode was entered.

LEVEL



LEVEL

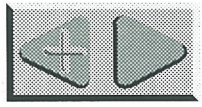
When the camera is placed in the MANUAL (radiometric) mode of operation (this is done by using the AUTO switch), or in the Isotherm display mode, the LEVEL control is used to position a selected span of temperatures relative to all the temperatures within the scene. Any objects having temperatures lower than the lower limit of the span are suppressed and displayed as black (when the camera is in the white-hot video mode), while objects with temperatures above the upper limit of the span are saturated and displayed as white.



In the factory default white-hot video mode, lower Level settings will allow the viewing of detail in brighter (hot) areas, while higher Level settings are needed to view detail in darker (cool) areas. If the overall difference in temperature is too great, adjustment of the GAIN control may also be required. Since most active applications will exhibit continually changing scene temperatures, minor adjustments of the LEVEL control (and to a lesser extent GAIN) should be anticipated when operating the unit in the MANUAL mode of operation.

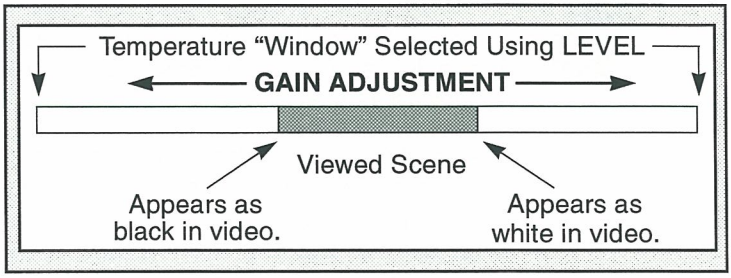
When the camera is in either of the automatic radiometric modes of operation (AUTO-LEVEL or AUTO-IMAGE), the LEVEL control is disabled and has no effect on the displayed video.

GAIN



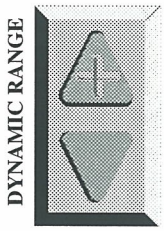
GAIN

When the camera is placed in the MANUAL mode of operation, or in the Isotherm display mode, the GAIN control sets the video sensitivity by limiting the span of temperatures to be displayed (black to white). Low Gain settings represent wide temperature spans, while higher Gain adjustments represent narrower spans.



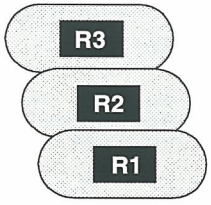
When the camera is placed in the AUTO-LEVEL mode, the GAIN control is still functional and can be used to adjust the scene characteristics, however, the control is deactivated in the AUTO-IMAGE mode.

DYNAMIC RANGE



The DYNAMIC RANGE switch allows the operator to optimize the camera's temperature response when the camera is in the MANUAL mode of operation. High Dynamic Range settings allow increased detail to be seen when observing hot targets (like a hot soldering iron for example).

The camera will automatically select the correct Dynamic Range (R1, R2, or R3 if a filter has already been entered) if the camera is placed in either the AUTO-LEVEL or AUTO- IMAGE modes of operation (the Dynamic Range switch is disabled). The "R3" range is especially designed to be used with external filters. A filter must be selected before the camera will enter this range.

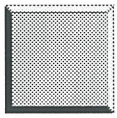


When the Dynamic Range icon is activated ("R#"), the Dynamic Range currently in use will appear in the video. R1 is the lowest (temperature) setting, while R2 is the maximum setting that can be used without external filters, and is used to view targets to approximately 200° C (392° F).

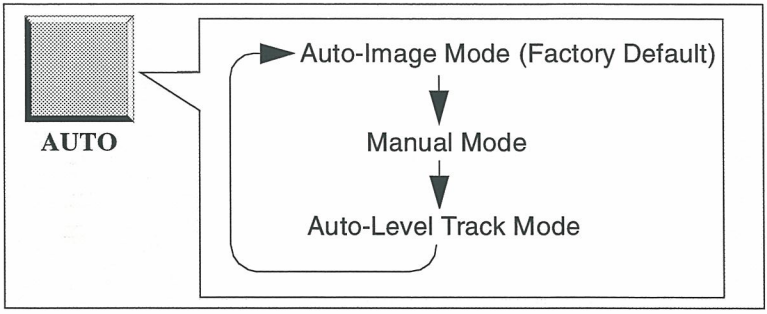
The "R3" Dynamic Range setting allows external filters to be used, extending the temperature measurement capacity of the camera to 1500° C (2732° F). The "FILTER" feature found in the "MAIN MENU" is used to enter (or identify) the filter being used. The correct filter must be

physically installed and selected (in the software) for accurate temperature measurements in any of the Dynamic Ranges.

AUTO



The AUTO button is used to change the radiometric operating mode of the camera. AUTO-IMAGE, MANUAL, or AUTO-LEVEL modes of operation are available. The factory default following power up is the Auto-Image operating mode. If the AUTO button is pressed the mode will change to the Manual mode, another depression will place the camera into the Auto-Level mode, and another depression will return the camera back to the Auto-Image mode.



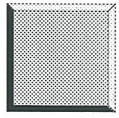
When the camera is in either the Auto-Image or Auto-Level mode of operation, selection of the correct Dynamic Range is performed automatically by the camera. If the temperature under the crosspoint is beyond the range of the camera (with no filter installed), "OVER" will appear in place of the temperature measurement. If this should happen, it will be necessary to place the camera into the Manual operating mode, change the Dynamic Range to "R3", and then install and select the correct filter before the measurement can be made.

Remember, not only does the filter need to be physically installed on the lens, it is also necessary to "install" the filter in the software FILTER feature.

When using filters, it is possible for the temperature under the crosspoint to be below the cameras' measurement capacity with a filter installed, in this case "UNDER" appears in place of the measurement. This indicates that the filter needs to be removed (both physically and from the system configuration), and the Dynamic Range changed from "R3" to one of the non-filter ranges.

When the camera is placed into the Manual mode, the operator has complete control over the Gain, Level, and Dynamic Range settings that control the system. Again, the camera will inform the operator if the temperature under the crosspoint is beyond the current ranges' capacity by displaying "OVER" in place of the temperature measurement. Or, if the temperature is below the selected range capacity, "UNDER" will appear in place of the temperature measurement. Selecting the correct Dynamic Range will regain the temperature measurement.

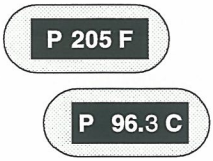
PEAK



PEAK

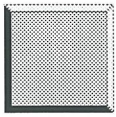
The PEAK button is used to change between the RUNNING CROSSPOINT, and the PEAK HOLD temperature measurement modes. The factory default following power up is the Running Crosspoint operating mode.

With the camera in the Running Crosspoint measurement mode, the temperature display is continuously updated as the crosspoint moves through the scene.



In the Peak Hold measurement mode, the temperature readout displays (and holds) the peak temperature encountered by the crosspoint. This measurement is held either until it is cleared (by exiting the Peak Hold mode), or until a greater temperature is encountered. When the camera is placed into the Peak Hold mode, a "P" is displayed in front of the temperature measurement to indicate the measurement mode.

STORE



STORE

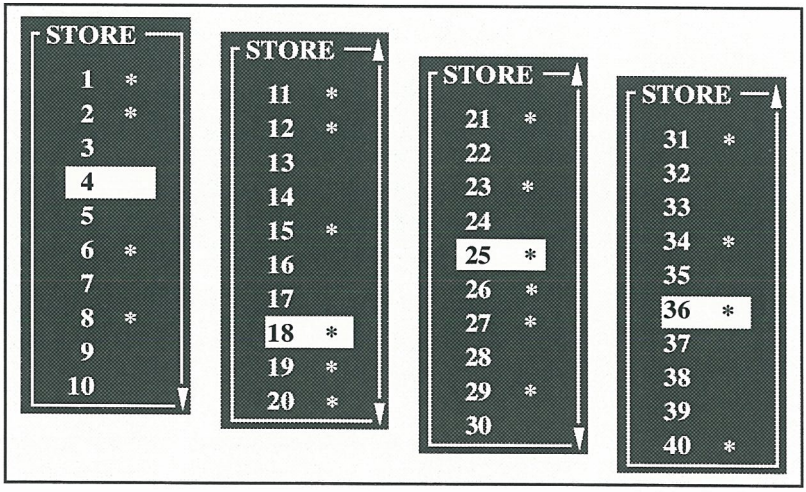
The STORE button allows the user to save an image to memory (PCMCIA card) for later inspection or analysis. The camera can store images in two "automatic" modes ("Auto-Locate" and "Auto-Over") and one manual storage mode. The automatic storage modes will immediately store an image to memory when the STORE button is pressed, the difference between the two is how memory is utilized.

In the Auto-Locate mode, the camera locates the first empty file location in memory, and then stores the file in that location. Locations that already contain files are skipped over so it's not possible to "lose" a valuable file by recording over it. The Auto-Over mode stores the image in the first memory location, and then moves to the second, third and so on, and will record over an image if one is already present (the camera will return to the first location each time that the camera is turned on). In the Manual mode, the user specifies the memory location where the image is to be stored.

It is possible to analyze saved images through the use of optional software (**AnalyzIR™**

Analysis). Using post analysis software, the user is given complete control over the image variables. The user can change the background temperature, target emissivity, and evaluate any pixel in the image to name a few of the features that are available to the operator. Please contact your local sales representative, or FLIR Systems, Inc. Customer Service at **(800) 322-3731** for information about post analysis software.

When the camera is in the Manual (image storage) mode and the STORE button pressed, the image is saved (in memory) and the STORE menu appears. The Store menu shows the labels that already contain an image by displaying an "*" next to the image file number. The files are presented in single "pages" of 10 images, and the highlighted bar is moved through the files by using the INC/DEC key. If the bar is moved to the bottom of the page, the next increment (+) will make the next file number appear. Likewise, if the highlighted bar is at the top of the page, the next decrement will move back one file location.



Move the highlighted bar to the file number you wish to use, and then press the ENTER button to store the image. If you attempt to store an image in a location that already contains an image, you will be asked to verify the procedure before the old file is deleted.

The "PROGRESS" icon is displayed as the image is saved.

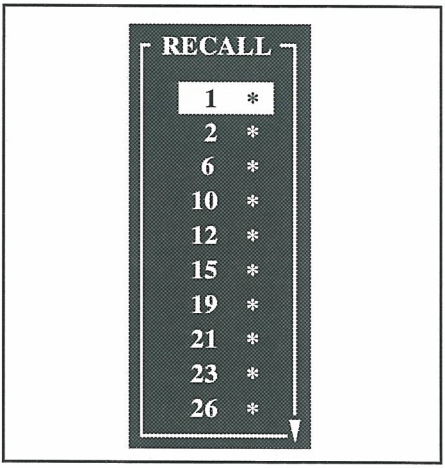
It is possible to save more than 30 files depending on the available memory. In any of the storage modes, the file number that will be used for the next image is shown in the file icon at the bottom of the display.

RECALL

The RECALL key allows the operator to recall a stored image from memory (PCMCIA card). This is not to be confused with the "REVIEW" feature which is activated from software.

RECALL

The recall process is started by pressing the RECALL button; at this time the system will display the RECALL file menu.



The menu shows the locations of the stored images with a "*"; only file locations that contain an image are shown. File selection is made by moving the highlighted bar over the desired file number and then pressing the ENTER button. The "PROGRESS" icon is displayed as the image is being loaded.

Once the file is loaded the RECALL icon is displayed, and the image will remain displayed until the VCR PAUSE/Freeze Frame trigger is pressed (recalled images are treated in a similar manner as frozen images). If you wish to exit the RECALL menu without displaying an image, press the MENU button.

MENU

MENU

The MENU button is utilized to gain access to the auxiliary functions of the camera which are controlled through software. When the MENU button is pressed the MAIN MENU will appear in the video display. This provides the operator access to the system features and sub-menus that are controlled through software. Pressing the MENU button again will exit the MAIN MENU, or "back out" one menu level if you have opened one of the sub-menus.

NUC (NON-UNIFORMITY CORRECTION)

NUC

The Focal Plane Array detector used by the **Prism DS** IR Camera consists of 320 x 244 detector elements, and each of the detector elements has a slightly different offset level characteristic. The NUC feature corrects the different element offset levels, giving the camera a constant video level for the viewed scene. The camera comes pre-loaded with a detector correction and gain table that covers the normal operating temperatures.

For applications that involve low contrast thermal imaging, the NUC function will provide you with an improved image.

It is recommend that the NUC function be used if there has been a large change in the environmental temperature (this also includes any increase in the camera temperature, as may result during extended periods of operation), if the observed object has radically changed (in temperature) since the camera was last "NUC'ed", if the Dynamic Range is changed, if the camera lens is changed, or if an optical filter is added or removed.

To use the NUC feature, a scene of constant and uniform temperature must be presented to the camera, preferably at a temperature similar to the scene that is to be viewed. For general viewing, place the lens cap on the lens and adjust the focus for infinity (this presents a broad, even temperature scene to the camera detector). The NUC button is then pressed and the NUC operation is performed.

The NUC procedure can be performed from any mode except Freeze Frame (this includes image recall procedures) and the Stand By mode.

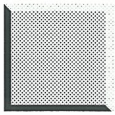
EMISS (Emissivity)

EMISS

The Emissivity value used in the temperature calculations can be set to any value between 0.05 and 1.00 (in 0.01 steps) by using the EMISS button. To adjust the emissivity value, press (and release) the EMISS button, the emissivity value in the video display will begin to flash, this indicates that the camera is ready to accept a new value. Use the INC/DEC switch to increment (or decrement) the emissivity value until the desired value is displayed. Press the ENTER button and the value will be accepted and used in the temperature calculations.

Note that the rate of change is at first slow, and then speeds up as the emissivity is adjusted. This allows you to quickly make radical changes in the emissivity value even if the settings differ greatly.

ENTER



ENTER

The ENTER button allows the operator to make selections from the various system menus.

VCR/FRZ

VCR/FRZ

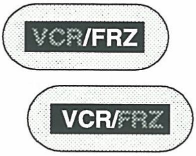
The VCR/FRZ switch (located on the side panel) is used to define the functionality of the push-button thumb control located on the right side cover marked "VCR PAUSE". In the factory default condition, the first depression of the thumb control places the camera into the Freeze Frame mode; the next depression returns the live IR image. The freeze frame feature allows you to "catch" a specific scene or event in time. If desired, the frozen frame can also be stored to PCMCIA cards for later analyses.

VCR PAUSE

When the optional video recorder is attached, pressing the VCR/FRZ switch changes the function of the thumb control from Freeze Frame trigger, to VCR control. The VCR PAUSE button can then be used to remotely activate and deactivate the PAUSE feature of the recorder.

Momentarily pressing the VCR PAUSE switch will remove the recorder from the PAUSE mode, place the recorder into the RECORD mode and allow the IR video to be recorded. "REC" will appear in the displayed video when recording (unless the icon is disabled).

Once the recorder is activated, pressing the switch again will place the recorder back into the PAUSE condition.



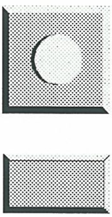
The current function of the thumb switch can be identified by observing the "VCR/FRZ" video icon, the currently assigned function is highlighted.

Additional presses of the VCR/FRZ switch will cycle between the two switch control modes.

INCREMENT/DECREMENT (INC/DEC)

The Increment/Decrement, or INC/DEC button is used to move "through" the menu selections, or position the flashing video cursor when making or defining the system configuration. It is also used to advance or decrease system settings such as the emissivity value, time and date or electronic zoom settings.

USER DEFINED CONTROLS



The control panel contains two user definable buttons; each of the buttons can be programmed to perform one of the following functions:

- VCR/Record
- Palette
- Isotherms
- No Function
- Recall Factory Configuration
- White Hot / Black Hot
- Electronic Zoom
- Background Temperature

To make identification easy, The surface of one of the keys contains an embossed character.

FOCUS

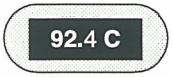
The camera is focused by manually rotating the lens focus ring as required to produce a clear image. The standard lens supplied with the system (25mm) can focus from 12 inches (30cm) to infinity.

STATUS INDICATORS

Video indicators have been incorporated into the **Prism DS**, IR Camera to inform the operator of the battery status, mode of operation, current system configuration, and vital system information such as available image memory. A brief description of the indicators is given below.

If the operator desires, any (or all) of the video indicators can be deleted from the display, with the exception of the low battery indication ("BATTERY"), the FLIR logo, the error detected indicator (a flashing "E"), and the "WAIT" icon.

TEMPERATURE MEASUREMENT/UNITS:



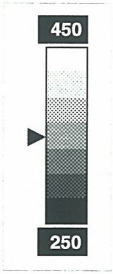
The temperature measurement made by the **Prism DS** is displayed in the lower right corner of the display (unless the feature has been deactivated). Temperature measurements up to 100° (either °C or °F) are shown to tenths of a degree, while those above are shown to the nearest degree.

The units, or system that the temperature is measured in is indicated by the letter following the measurement, "F" for Fahrenheit, and "C" for Celsius.

If the camera is in the MANUAL mode of operation, then the Dynamic Range that is being used is selected by the user. Each of the Dynamic Ranges measures a specific range of temperatures, if a measurement is attempted that is above the capability (or settings) of the currently selected range, "OVER" will appear in place of the temperature measurement prompting the user to change to the next higher

Dynamic Range setting. If a measurement is below the currently selected ranges' capacity, "UNDER" will appear in place of the temperature measurement prompting the user to change to the next lower Dynamic Range setting.

COLOR BAR:



The Color Bar provides the user with a variety of image/system related information. For example, it shows the scene high and low temperature points and the color (gray scale) representation between the two. The caret shows the temperature of the spot under the reticule relative to the rest of the image; the color bar also provides an indication whether White or Black-Hot video is active.

BATTERY:

The "BATTERY" indicator is displayed when the camera has approximately 10 minutes of operation left before a dead battery condition exist and the camera shuts down.

TIME:

Time is displayed using a 24 hour format, in the sequence:

HOURS:MINUTES:SECONDS

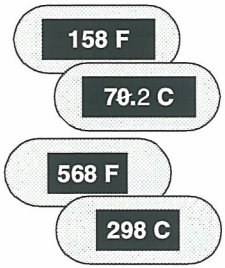
2:35 PM is shown as 14:35:00, while 2:35 AM is 02:35:00.

DATE:

The current date is displayed using the format day/month/year. For example, the date February 18, 1996 is displayed as 18 Feb 96.

SYSTEM MODES

TEMPERATURE MEASUREMENT MODES:

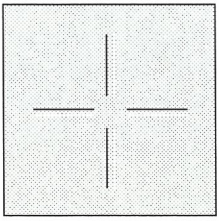


The **Prism DS** IR Camera is capable of measuring temperature in three different modes:

- Running Crosspoint, or Active temperature measurement;
- Freeze Frame measurement;
- Peak Hold measurement.

Running Crosspoint, or Active Temperature Measurement Mode:

In the Running Crosspoint or Active measurement mode, the temperature measurement of the area under the crosspoint is constantly updated. The displayed temperature will actively follow the temperature of the target area as it changes, or will reflect a constant and unchanging temperature for a stable target.

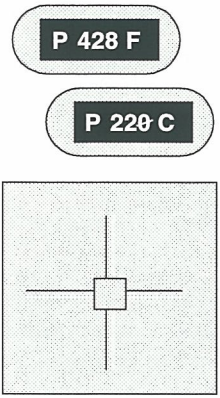


When the Running Crosspoint measurement mode is selected, only the measured temperature is shown in the temperature display; and the reticule consists of a "cross-hair" with an open target area.

This is the factory default measurement mode when power is first applied to the camera. With the camera in this measurement mode, pressing the PEAK switch once will retain the measurement and place the camera in to the Peak (temperature) Hold measurement mode.

Peak (temperature) Hold Measurement Mode:

The Peak Hold measurement mode is entered (from the Running Crosspoint mode) by depressing the PEAK button. To exit the mode, press the PEAK button again.



In the Peak Hold measurement mode only the peak, or highest temperature that passes under the reticule is displayed. This displayed temperature is retained until either a higher temperature is encountered, or until the camera is placed into a different temperature measuring mode.

When the camera is placed into this mode, a "P" (to indicate Peak) appears in front of the measured temperature, and the reticule contains a square target box in the center.

Freeze Frame Measurement Mode:

In the Freeze Fame measurement mode, the temperature (and the image) of the target at the moment that the Freeze Frame trigger is pressed is retained. This measurement is retained until the camera removed from the Freeze Frame mode by again pressing the Freeze Frame trigger.

When the camera is placed into this mode, the "FREEZE" icon will appear in the video.

AUTO TRACKING MODES:

The camera is capable of two "automatic" radiometric tracking modes:

- Auto-Image Tracking;
- Auto-Level Tracking.

Auto-Image Tracking:

The Auto-Image Tracking mode shows the scene high and low temperature extremes above and below the color bar; these values change dynamically as the scene changes. The crosspoint temperature is indicated by the "caret" sliding up and down the color bar. Gain, Level and Dynamic Range settings are automatically adjusted for the temperature range of the scene.

Auto-Level Tracking:

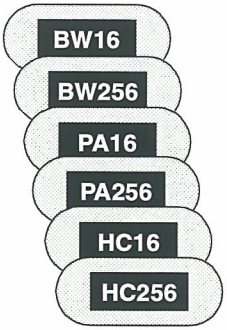
The Auto-Level Tracking mode produces an image where the item (temperature) under the crosspoint is always at the center of the color bar. Auto-Level achieves an automatic Level setting function while still allowing control of the Gain (temperature window) setting.

AUXILIARY VIDEO DISPLAYS:

"REC" is displayed (unless disabled) when the external Video Cassette Recorder is recording under camera control.

A flashing "E" is displayed if the processor detects a system error. A description of the fault can be obtained using the ERRORS feature located in the MAINTENANCE sub-menu.

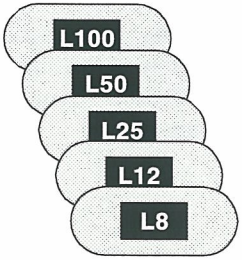
The "WAIT" icon indicates that the temperature measurement has not yet achieved the rated system accuracy. This may be due to an inadequate warm-up period, a large change in the ambient temperature, a change in the emissivity value, background temperature, lens, or filter settings. When the system stabilizes, the icon will disappear. This icon can not be user disabled.



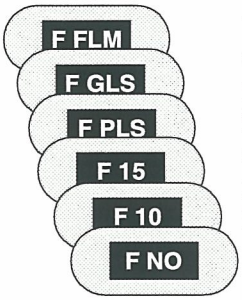
When selecting the PALETTE to be used, the currently active Palette appears flashing in the video display. Use the INC/DEC button to change between the different palette selections. The user can select a **B**lack/**W**hite or one of two color palettes (**PA**stel and **H**igh **C**ontrast). Each of the palettes can be displayed in either 16 or 256 colors or steps of gray scale. When the desired Palette is displayed, press ENTER to exit the selection process.

The BG (Background Temperature) can be set to any value from -10° to 1500°C (14° to 2732°F) and is used to increase the accuracy of the temperature calculations. The Background Temperature is displayed in the same units (°C or °F) as the main temperature readout.

The software based image REVIEW mode is active.



The currently selected (in the software LENS) feature) camera lens. It is important to remember that the camera does not have feedback between the installed lens and the software selected lens. It is up to the operator to make sure that the lens in use and the installed lens match.

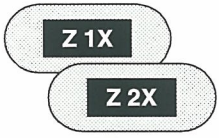


The currently selected filter (as selected in the software FILTER feature) in use. It is important to remember that the camera does not have feedback between the installed filter and the software selected filter. It is up to the operator to make sure that the filter in use and the installed filter match.

The flashing "BATTERY" icon will appear when there is approximately 10 minutes of operation left before the camera shuts down.

The currently selected units of measurement, "C" for Celsius and "F" for Fahrenheit

The current level of image Averaging, or "smoothing" in use.



When selecting the level of electronic Zoom, the Zoom icon shows the current level of image magnification, or Zoom. The Zoom icon is only displayed when selecting the Zoom level.

When the Isotherm display mode is active, the Isotherm (temperature set points) are displayed.

CHAPTER 4 SYSTEM OPERATION

BATTERIES

When the system is first received, or has been stored for a extended period of time, the batteries should be charged.

The batteries supplied with the **Prism DS**, IR Camera utilize a Lead Calcium Rechargeable (LCR) technology. Given proper care, they are capable of providing the user with exceptionally high performance. Unlike conventional rechargeable Nickel Cadmium cells ("Ni-Cads"), LCR cells will retain most of their charge even when in storage. A new, fully charged battery, will retain approximately 91% of its charge after three months, 82% after six months, and 64% of the charge after twelve months (when stored at 25°C). Additionally, LCR cells do not exhibit a charge "memory" that forces the use of specialized charge/discharge procedures.

Three different battery chargers are available for use with the **Prism DS**, IR Camera. The standard charger (the charger normally supplied with the system), will charge a fully discharged Battery Belt (standard 6 hour belt) in approximately sixteen hours; an optional rapid charge unit is available and is capable of

charging a discharged Battery Belt in approximately four hours. Both of these units operate using standard 120VAC, 50/60Hz input. An optional charger is also available to allow battery charging using 220VAC, 50/60Hz input; this charger provides an eight hour charging cycle.

Maximum battery life is obtained when using the standard battery charger, and the sixteen hour charge cycle (assuming a fully discharged battery). A fully charged standard Battery Belt will provide the operator with approximately six hours of operation at normal room temperatures. The operating time of the camera, when using battery power, decreases when the camera is operated at elevated temperatures. This is due to the additional power used by the detector cooler as it works to keep the detector at the correct operating temperature.

The life of the battery is primarily determined by the charging cycle used. Approximately 500 charge/discharge cycles can be expected when using the standard charger and a sixteen hour charge cycle, this decreases to approximately 100 charge cycles when using the fast charge (four hour) system.

If the operating time of the camera is known, it is possible to "proportionally" charge the batteries to shorten the charging time if required. For example, if the camera has been used for three hours (one-half of the normal six hour operating time), the charging cycle can be reduced to eight hours using the standard charger (one-half of the normal sixteen hour cycle), or, two hours if the fast charger is used (one-half of the four hour cycle). This is assuming that the camera has been operating at room temperature.

If you are familiar with the operating time of the camera when it is being used in an elevated temperature application, it is possible to customize the charge cycle to match the discharge curve as describe above.

NOTE:

Do not leave, or store the Battery Belt in a discharged state. This can cause permanent damage to the batteries, decreasing both battery life and performance. It is recommended that the Battery Belt be recharged as soon as possible following discharging.

CAUTION

As with all batteries, the cells should not be stored at elevated temperatures, and because of the low internal impedance, never short-circuit a Battery Belt.

Never use a battery charger that is not specifically designed to charge the LCR Battery Belt. This can result in decreased cell life, a Battery Belt that never obtains a full charge, or damage to the Battery Belt and possibly the charger.

CHARGING THE BATTERIES

Charging the Battery Belt is a simple procedure: merely disconnect the Battery Belt if it is connected to the camera, and attach it to the charger.

If the standard charger is used, allow sixteen hours for the batteries to obtain a full charge; if the 240VAC charger is used, allow eight hours; and if the rapid charger is used, allow four hours.

The charging time given above is for a fully discharged Battery Belt, if the state of the battery charge is unknown, allow the batteries to charge for a full charge cycle, the batteries are not damaged by extended or prolonged charging cycles.

OPERATING FROM BATTERIES

With the camera power switch in the OFF position, attach a charged Battery Belt to the camera using the coiled power cable. Remove the lens cap and place the power switch to the ON position. At this time, the cooler motor can be heard and no video will be present at the viewfinder. Cooling the detector will take less than eight minutes; and once cool, the sound produced by the cooler will decrease as it "throttles-back". Active video will then be presented in the viewfinder.

When the camera is first powered up, the factory default settings are:

- Running Crosspoint measurement mode;
- Celsius temperature measurements;
- Auto-Imaging mode (automatic Gain, Level, and Dynamic Range adjustments);
- White-Hot display;
- Pastel Color Palette (256 levels of display);
- Emissivity is set to 1.00;
- Background Temperature is 23° C;
- All video overlays are displayed (ON).

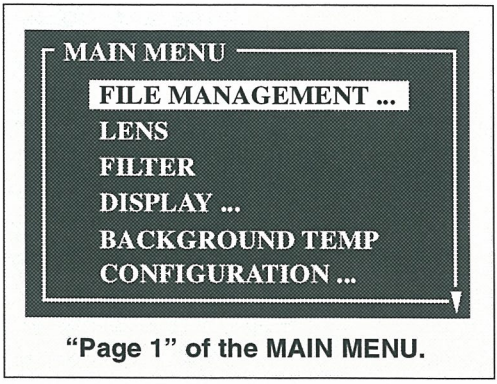
While looking through the viewfinder, adjust the focus (by rotating the lens) until a clear image is obtained.

At this time, the NUC function can be used to optimize the image uniformity and camera sensitivity.

If the Battery Belt is fully charged and the camera is operated at room temperature, approximately six hours of operation can be expected before a low battery warning (flashing "BATTERY" in the video) is displayed.

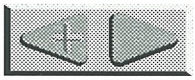
SYSTEM MENUS

A variety of system features are available through a series of software menus. Access to the menus is obtained by pressing the MENU button located on the side switch panel. The first menu to appear is the "MAIN MENU"; it is from this "two page" menu that the user obtains access to the various sub-menus that are used to control the user selectable feature set, and define the system configuration.



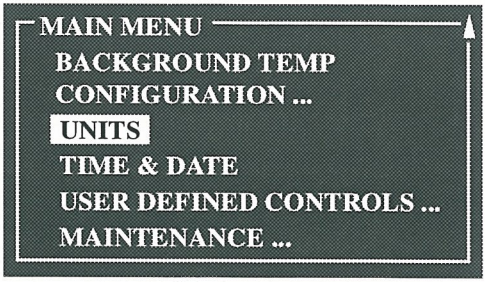
"Page 1" of the MAIN MENU.

Note the small arrow at the bottom of the menu, this signifies that additional information is available by scrolling the highlighted bar down (the arrow is also used in the other menus when additional selections or information is available).



The "highlighted bar" is used to move through the menus, and to identify selections. The bar is moved by using the INC/DEC (Increment/ Decrement) control, it's the smaller unlabeled switch marked with a "+".

To move to "Page 2" of the MAIN MENU, move the highlighted bar to the bottom of the page, the next advance will "enter" the second page (or, from the top of page one, move the bar "up" one place). Note that the arrow now points "up" to the previous page.



"Page 2" of the MAIN MENU.

To select a sub-menu or feature, move the highlighted bar over the desired selection using the INC/DEC switch, and then press the ENTER button. To exit the menu, press the MENU button again. Any changes that have been made from the MAIN MENU (or any of the sub-menus) will be implemented upon exiting the MAIN MENU.

Some menu items act directly on the screen display without "opening" a new menu. These features include:

- LENS, FILTER, BACKGROUND TEMP, UNITS, and TIME & DATE.

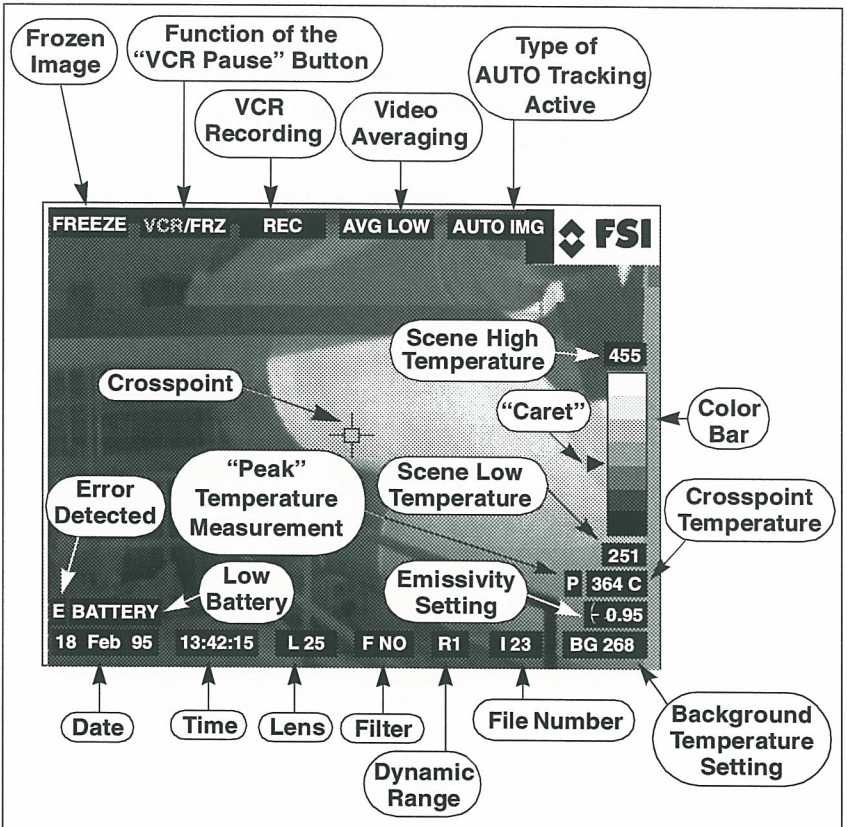
Those menu items which open a new menu can be identified by the "..." following the menu label. These include:

- FILE MANAGEMENT, DISPLAY, CONFIGURATION, USER DEFINED CONTROLS, and MAINTENANCE.

The highlighted bar is moved through the menus using the INC/DEC switch, and menu selections are made using the ENTER button. To exit a sub-menu, press the MENU button to "back out" to the previous menu. Pressing the MENU button while in the MAIN MENU will exit the menu, implement any changes made, and return to live video.

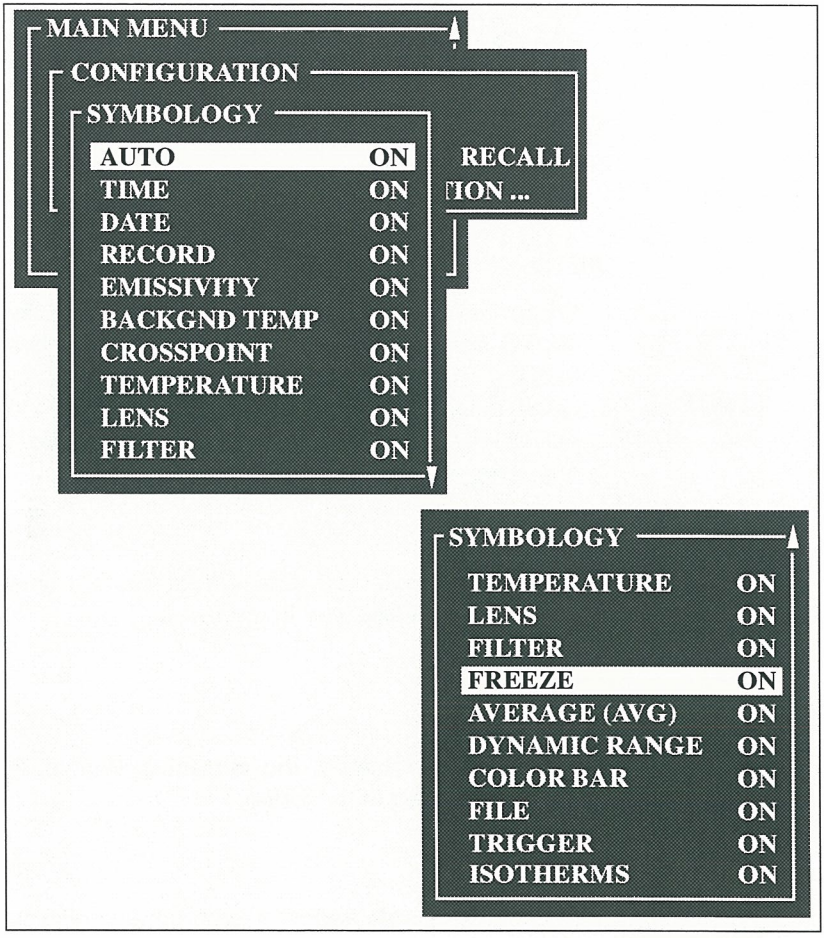
VIDEO OVERLAY ADJUSTMENTS

If the operator desires, the camera has the capacity to display various information, such as battery status, date, time, or the current operating mode (temperature measurement, file storage, and image display) within the active video.



Prism DS (*D*igital *S*torage) Camera Video Overlays

The selection of the video overlays being displayed is controlled from the SYMBOLOGY sub-menu. Access to this menu is obtained by moving the highlighted bar over the "CONFIGURATION" label located on Page 2 of the MAIN MENU and then pressing the ENTER button.

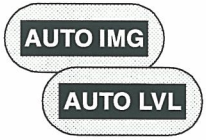


From this menu, the various icons within the video display can be turned on and off.

This allows the operator to see more of the video image, and display only the information pertinent to the subject being imaged.

Use the INC/DEC button to move through the menu selections. With the highlighted bar over the icon to be displayed (or turned-off) press the ENTER button. The INC/DEC button can now be used to toggle between ON and OFF. When the icon display setting is correct, press the ENTER button again and the selection will be accepted; additional changes can now be made if necessary. When "ON" is selected, the icon will be displayed; "OFF" will suppress the icon from the video display.

AUTO:



When ON is selected, the camera will display "AUTO IMG" when the Auto-Image temperature tracking mode is active, or "AUTO LVL" if Auto-Level temperature tracking is active. With the AUTO icon on, there will be no icon displayed if the Manual tracking mode is selected.

TIME:

When ON is selected, the current system time setting will be displayed in the video.

DATE:

When ON is selected, the current system date will be displayed in the video.

REC (Record):

When ON is selected, the camera will display "REC" when the optional VCR is recording under camera control.

EMISSIVITY:

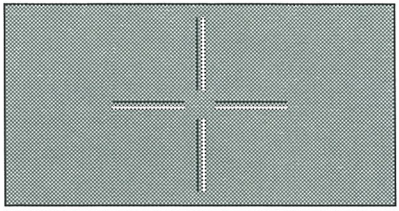
When activated (ON), the currently selected emissivity value is displayed.

BACKGND TEMP (Background Temperature):

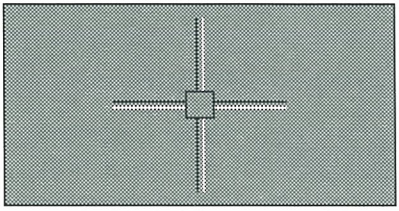
The currently entered background temperature is displayed when activated (ON). If no background temperature has been entered, the camera will use 23° C as the default background temperature value.

CROSSPOINT:

When activated (ON), the crosspoint is displayed in the video. The appearance of the crosspoint will depend on the temperature measurement mode selected. While in the Running Crosspoint measurement mode, the crosspoint appears as shown below.

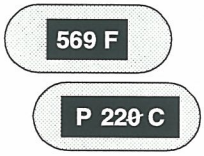


The Peak Temperature Hold measurement mode uses the same crosspoint but contains a square target box (this gives a visual indication of the currently active measurement mode).



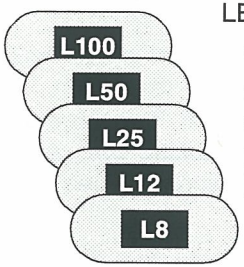
By observing the characteristics of the crosspoint, the user can instantly tell which measurement mode has been selected.

TEMPERATURE:



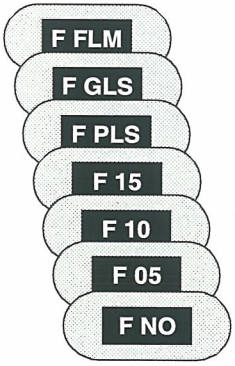
When activated (ON), the current temperature measurement is displayed. When the camera is in the Peak Temperature Hold measurement mode a "P" is placed in front of the measurement.

LENS:



When activated, the currently selected lens is displayed. The correct lens must be installed and selected (using the "LENS" feature) for accurate measurements. You can only select lens that have been installed with a valid calibration table.

FILTER:

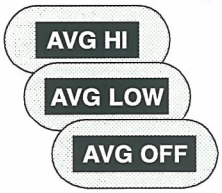


When activated, the currently selected filter is displayed in the viewer. External filters allow the usable temperature range to be extended, or help correct for conditions that may make observation difficult. Only filters for which a valid calibration table exist will be presented for selection.

FREEZE:

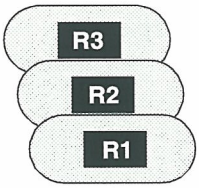
When activated, the Freeze Frame icon is displayed in the video display when the camera is placed into the Freeze Frame mode.

AVERAGE (AVG):



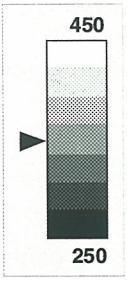
The camera has the capacity to digitally process and enhance the image; two levels of digital "filtering" (Low and High) are available to the user.

DYNAMIC RANGE:



When the Dynamic Range icon is activated (ON), the setting of the Dynamic Range ("R#") will appear in the video. "R1" is the lowest (temperature) setting, while "R2" is the maximum setting that can be used without external filters (and is used to make measurements up to 200° C). Dynamic Range "R3" is used to extend the range of the camera to 1500° C (2732° F) through the use of external filters. The correct filter must be selected and installed for accurate temperature measurements when using the "R3" Dynamic Range.

COLOR BAR:

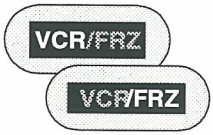


When the Color Bar is activated (ON), the Color Bar appears at the right center of the video display. The Color Bar provides an indication of the currently selected palette (16 levels of B/W or color, 256 levels of B/W or color), whether the video is "white" or "black" hot, and the high and low scene temperatures (or settings). The "caret" indicates where the measured crosspoint temperature is relative to the high and low limits.

FILE:

The FILE icon shows the user the file number that will be assigned to the next stored image.

TRIGGER:



The TRIGGER icon shows the currently assigned function of the "VCR PAUSE" thumb switch. The current function of the push button will appear bold, or in highlighted video.

ISOTHERMS:

When the Isotherm display mode is active, the high and low temperature set points are displayed in the image. Selecting OFF will remove the set points from the display.

When the symbology is set as desired, the menu can be exited by again pressing the MENU button. This will return to the CONFIGURATION menu; each depression of the MENU button will "back out" to the previous menu.

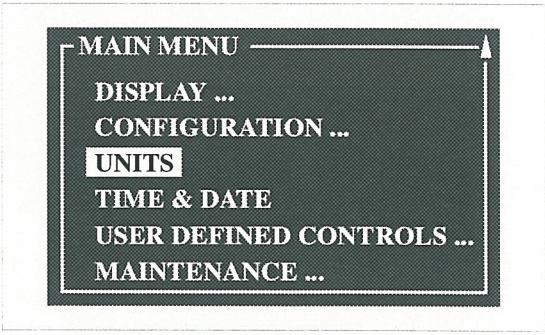
Additional changes can be made by selecting a new menu, or normal camera operation resumed by "exiting" from the MAIN MENU. To exit the MAIN MENU, press the MENU button again.

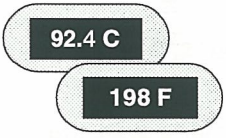
DEFINING THE SYSTEM

Many of the system features can be configured to the users needs, for example, temperature can be presented in either Celsius or Fahrenheit units of measurement. The following will help you understand the various options available to you, and help you to define the best system configuration for your application.

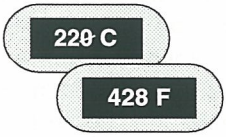
UNITS Feature:

The Units feature allows the user to select the units of temperature measurement (Celsius or Fahrenheit); and is found on Page 2 of the MAIN MENU.





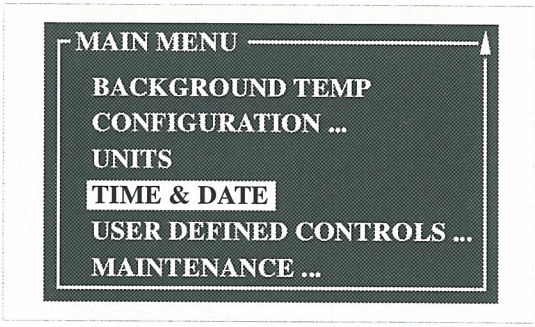
To enter the UNITS feature, move the highlighted bar to "UNITS" and press the ENTER button. At this time the menu will disappear and the units symbol in the temperature display ("C" or "F") will begin to flash; use the INC/DEC button to change between Celsius (C) and Fahrenheit (F) units of measurement.



When the system is displaying the desired units of measurement, press the ENTER button to accept the setting and exit the UNITS feature. Temperature measurements below 100° (° C or ° F) are displayed to tenths of a degree, and to the degree on measurements 100° and above.

TIME & DATE Feature:

The TIME & DATE feature allows the system clock and calender to be set, and is found on Page 2 of the MAIN MENU.



Once the TIME & DATE feature is entered (by pressing ENTER with the TIME & DATE label highlighted), the menu will disappear and the system will prepare to set the date.

The date is displayed using the format:

DAY/MONTH/YEAR

For example, the date FEBRUARY 18, 1995 is displayed as 18 FEB 95.

The TIME & DATE feature starts with the first value in the date icon, which will begin to flash. The numerical date can then be changed by using the INC/DEC button. When the correct date is present, press the ENTER button to accept the date and move on to the month (will then begin to flash). Again, the month is adjusted by using the INC/DEC button, and accepted by pressing the enter button; once the month setting is entered the year will begin to flash which is then set the same way.

Following the setting of the year, it is now time to set the system clock; and the hours in the time display will flash.

The time is set using the same procedure that was used to set the date. Time is displayed using a 24 hour format in the sequence:

HOURS:MINUTES:SECONDS.

2:35 PM is shown as 14:35:00, while 2:35 AM is 02:35:00.

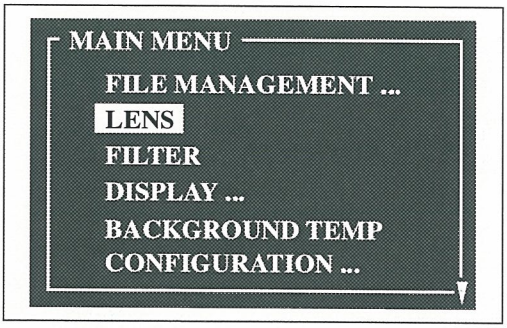
With the hours flashing, use the INC/DEC button to increment/decrement the setting; when "23" is reached the next displayed hour is "00" if the count is advancing. Likewise, the next display following "00" for a downward count will be "23". When the correct hours are displayed, depress the ENTER button and the system will accept the hours setting and move to the minutes for the next adjustment.

Minutes and seconds are set like the hours, again use the INC/DEC button to increase or decrease the count, and the ENTER button to accept the setting.

Following the setting of the seconds (pressing ENTER) the camera will exit the TIME & DATE feature. The TIME & DATE feature can also be exited at any time (and any changes that have been made accepted) by pressing the MENU button at any point of the setting sequence, this will exit the TIME & DATE feature and return to the MAIN MENU.

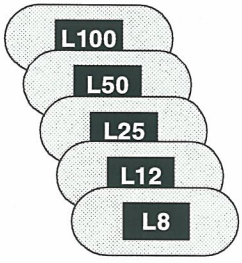
LENS Feature:

The "LENS" feature allows the user to define the lens currently being used.



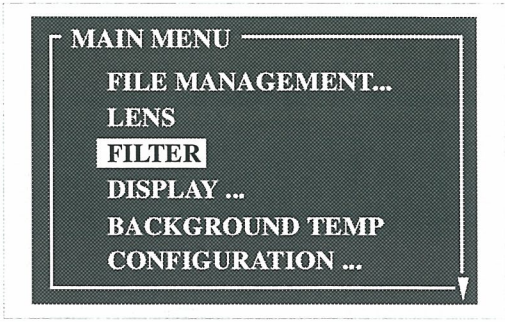
This is necessary because the camera must install a matching calibration table to be used in the temperature measurement calculations. The lens installed on the camera and the lens selected in the software menu must match if the temperature measurements are to be accurate. Only lens which have a valid calibration table will be presented for selection.

When the LENS feature is entered, the menu will disappear and the lens icon will begin to flash; the available selections can be viewed by using the INC/DEC button. Press the ENTER button to select the correct lens; at this time the lens selection feature is exited.

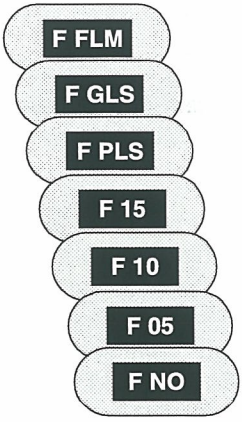


Standard lens selections include 8,12.5, 25, 50, and 100mm. Custom calibration using non-standard, or customer supplied lens may also be possible. Information on camera calibration options can be obtained by contacting your local representative or FLIR Systems, Inc. Customer Service at **(800) 322-3731**.

FILTER Feature:



Filters are used to extend the temperature measurement range, or enhance the image in certain applications. As with lenses, each filter must be used with a factory installed calibration table to correct for the filters' optical characteristics. The filter installed on the camera and the filter selected in the software menu must match if the temperature measurements are to be accurate. Only filters which have a valid calibration table will be presented for selection.

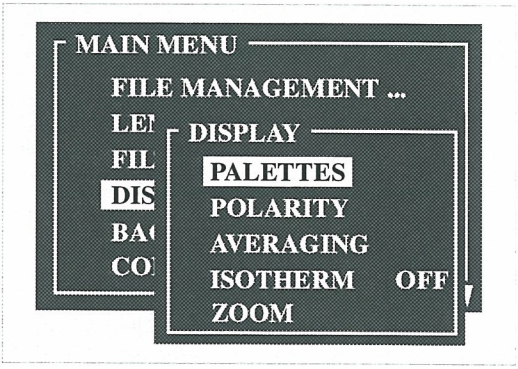


Filter selections available are F 05, F 10, F 15, F GLS (glass), F PLS (plastic), F FLM (flame), or, no filter installed (F NO). The F 05, F 10, and F 15 are high temperature filters designed to be used with the Dynamic Range setting "R3", and must be used for measurements above 250° C (482° F). Again, the correct lens and filter being used must be entered for correct temperature measurements.

Custom calibration using non-standard, or customer supplied filters may also be possible. Information on camera calibration options can be obtained by contacting your local representative or FLIR Systems, Inc. Customer Service at **(800) 322-3731**.

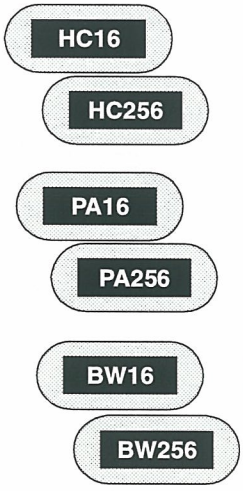
DISPLAY Menu:

The DISPLAY menu contains the features that control the appearance of the video display.



Features available include display Palettes, Polarity (White/Black-Hot), Averaging, Isotherm display and electronic Zoom.

PALETTES Feature:



The PALETTES feature allows the operator to select either a monochromatic, or one of two color (Pastel and High Contrast) video formats for the cameras' video output.

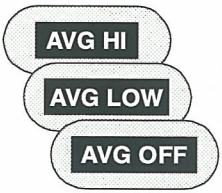
Although the camera is capable of color or black/white video output, only black/white is displayed by the viewfinder. Each of the palettes can be displayed in either 16 or 256 levels, or steps of color or gray scale. The mode currently selected can be identified by using the SYSTEM STATUS DISPLAY feature found in the MAINTENANCE menu (this will be cover later), or by activating the PALETTES feature. When the PALETTES feature is activated, the currently active palette appears in a flashing icon in the video. "HC16" is displayed for 16 levels of high contrast color

video, "HC256" for 256 levels of high contrast color video, "PA16" is displayed for a 16 level pastel color display, "PA256" for a display of 256 levels of pastel color video, "BW16" for a 16 level black/white gray scale, and "BW256" if a black/white 256 level gray scale is active. With the icon displayed, a different palette can be selected by using the INC/DEC button to move through the different palette selections. The video is changed as each icon is displayed (although this may not be apparent through the viewfinder). When the desired palette is displayed, press the ENTER button to make the selection and exit the Palettes feature.

POLARITY Feature:

The POLARITY feature allows the operator to select between White and Black-Hot video display. In the White-Hot video mode, hot objects are displayed as white, while the cool objects are displayed black. The Black-Hot mode reverses this, hot is black and cold is white (this will also reverse the color palette when color video is active). The user will learn to interpret imagery more quickly if most of his viewing time is spent gaining familiarity with only one polarity (white hot is recommended). At the viewers discretion, the opposite polarity may be selected to assist in scene discrimination. For instance, if it can not be determined whether an object in the scene is the target of interest, reversing the polarity might help the observer notice a cue. This, however, should only be considered as a secondary measure after the camera LEVEL and GAIN adjustments have been optimized.

AVERAGING Feature:

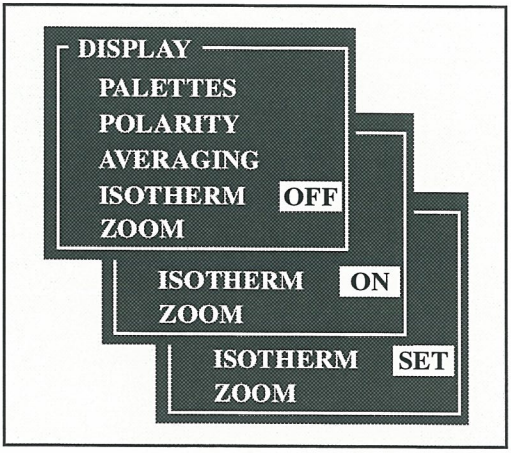


The camera has the capacity to digitally process and enhance the image; two levels of digital "filtering" (Low and High) or enhancement are available to the user.

When the AVERAGING feature is entered, the menu will disappear and the Average (AVG) icon will begin to flash, use the INC/DEC button to change between the different averaging settings. Note that the video image changes as you move between each of the selections. Press the ENTER button when the desired averaging is displayed; at this time the setting will be accepted, and the AVERAGE feature exited

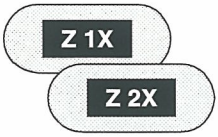
ISOTHERM Feature:

The Isotherm feature selects and displays a user-defined portion of the active thermal display range to emphasize subtle thermal detail, or eliminate certain portions of the image. The Isotherm feature allows you to turn the Isotherm display OFF/ON, and SET (define the upper and lower temperature points).



To activate the ISOTHERM feature, move the highlighted bar over the ISOTHERM feature and press the ENTER button. Use the INC/DEC button to select either ON or SET. Selecting SET will allow you to adjust the high and low set points. Use the LEVEL control to adjust the position of the thermal window, and the GAIN control to adjust the size of the window.

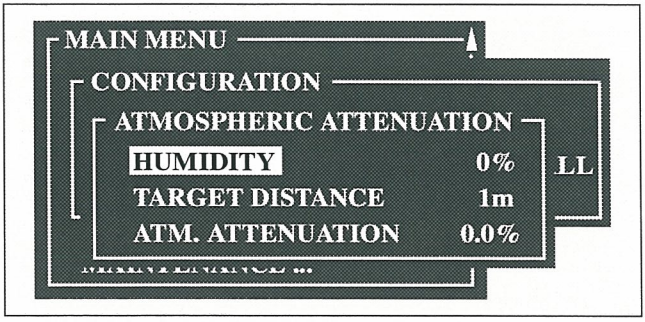
ZOOM Feature:



The Zoom feature provides an electronic 2:1 zoom ratio. Select the feature by moving the highlighted bar over the feature title and then press the ENTER key. The menu will disappear and the flashing Zoom icon will appear showing the current level of magnification. Use the INC/DEC button to switch between the two zoom settings (the image will change to reflect the zoom setting). Press ENTER to accept the setting and exit the feature.

ATMOSPHERIC ATTENUATION Sub-Menu:

The Atmospheric Attenuation sub-menu is a part of the CONFIGURATION menu found on "page 1" of the Main Menu.

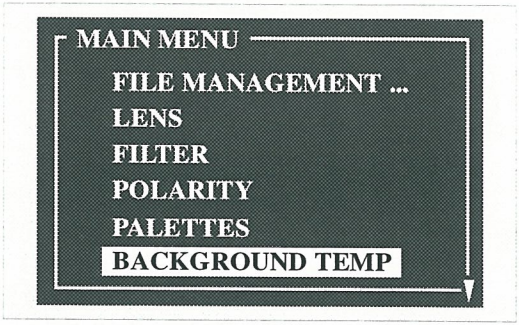


If extreme accuracy is required, losses resulting from humidity and target distance can be compensated for. Default values are:

Humidity:	0% (adjustable to 90%);
Target Distance:	1m (adjustable to 1000m);
Atm. attenuation:	0.0% (adjustable to 99%).

BACKGROUND TEMP Feature:

The **Prism DS** IR Camera allows the operator to specify the background temperature (the temperature of the non-focused energy being reflected off the subject).



This information is then used in the temperature calculations to increase the accuracy of the measurement by accounting for the possible errors due to reflections from the background source.

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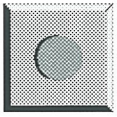
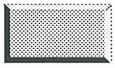
When the BACKGROUND TEMP feature is entered, the menu will disappear, and the background icon will begin to flash. Initially the background temperature setting will default to "23°C". In most applications the 23°C will give the best overall response. If you want to use this value, press the ENTER button and the setting will be accepted and the feature exited.

If you wish to change the background temperature, the setting can be adjusted to any value between -10 and 1500°C (14 to 2732° F) by using the INC/DEC button. Press the ENTER button when the desired background temperature is displayed; at this time the Background Temperature will be accepted, and the feature exited.

USER DEFINED CONTROLS Feature:





The camera has two switches (located on the side panel) which can be defined by the user to provide the following functions:

- VCR PAUSE/RECORD

  Provides camera control of the optional VCR RECORD/PAUSE functions.

- POLARITY

  Switches between the White and Black-Hot video modes.

- RECALL FACTORY CONFIGURATION

  Resets all of the camera options/settings to the factory default values.

- BACKGROUND TEMPERATURE

  Allows setting the Background Temperature value without going through the system menus.

- PALETTE

  Allows the video palette in use to be changed without going through the system menus.

- ISOTHERMS

  Provides access to the Isotherm display.

- ZOOM

  Allows access to the electronic Zoom. The zoom ratio is 2:1 .

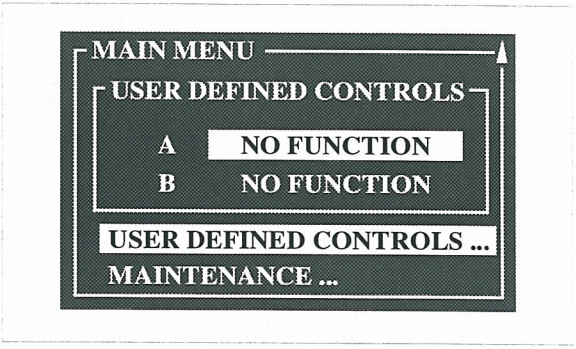
- NO FUNCTION

  The switch has no effect on the camera operation.

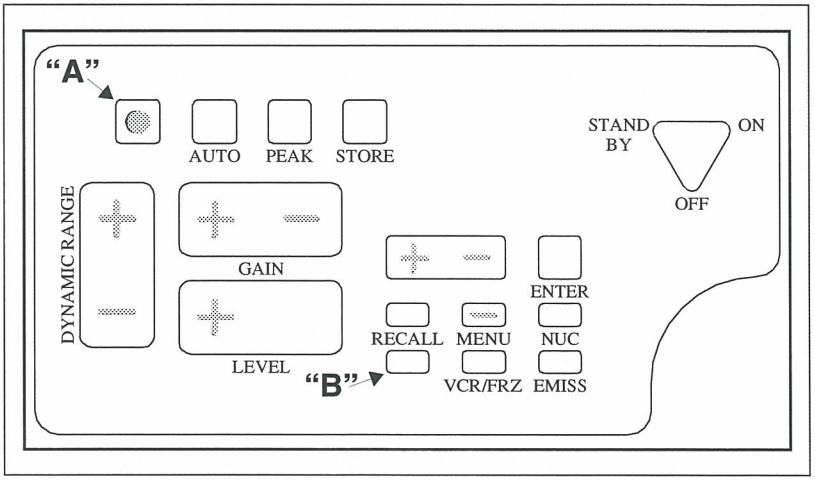
If you frequently use/change the above functions, it maybe advantageous to assign frequently used functions to one (or both) of the switch(s).

The currently assigned function(s) can be determined by using the SYSTEM STATUS DISPLAY feature found the MAINTENANCE menu (this will be cover later), or by activating the USER DEFINED CONTROLS feature.

The USER DEFINED CONTROLS feature is found on Page 2 of the MAIN MENU. To activate the feature, move the highlighted bar (using the INC/DEC button) over the feature title, and then press the ENTER button. The currently defined functions will be shown when the menu is displayed.



Use the INC/DEC button to move between the "A" and "B" switch selection; press the ENTER button when the desired switch is selected.



Use the INC/DEC button to move between the assignable functions; press the ENTER button when the desired function is displayed.

VCR PAUSE/FREEZE FRAME TRIGGER:

The VCR PAUSE button is located on the right side cover near the thumb grip. This switch is special in that it is capable of two different functions, but is not programmed from the system software menus.

The VCR PAUSE button is capable of performing two functions:

- When configured as a VCR control, it will switch an optional VCR between the RECORD and PAUSE modes when pressed.

- When configured as "FRZ" (Freeze Frame trigger), it will place the camera into (and out) of the Freeze Frame mode.

The functionality of the VCR PAUSE button is controlled from the VCR/FRZ button located on the side switch panel. The factory default for the VCR PAUSE button is Freeze Frame control, pressing the VCR PAUSE switch will place the camera into the Freeze Frame mode; the next depression returns the live IR image. The Freeze Frame feature allows you to "catch" a specific scene or event in time. If desired, the frozen frame can also be stored to memory for later analyses. To exit a "frozen" frame, press the VCR PAUSE button again.

Pressing the VCR/FRZ switch changes the function of the thumb control from Freeze Frame trigger, to VCR control. When the camera is equipped with the optional VCR, the VCR PAUSE button can then be used to remotely activate and deactivate the RECORD feature of the recorder.

Momentarily pressing the VCR PAUSE switch will remove the recorder from the PAUSE mode and place the recorder into the RECORD mode allowing the IR video to be recorded. "REC" will appear in the displayed video when recording (unless the icon is disabled).

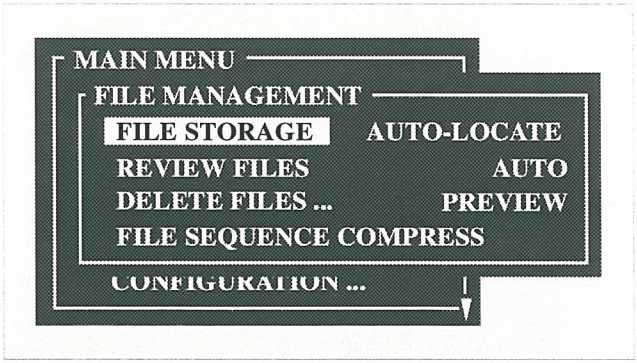
Once the recorder is activated, pressing the switch again will place the recorder back into the PAUSE condition.

The current function of the thumb switch can be identified by observing the "VCR/FRZ" video icon, the current function is highlighted.

Additional depressions of the VCR/FRZ switch will cycle between the two switch control functions.

IMAGE AND IMAGE FILE MANAGEMENT

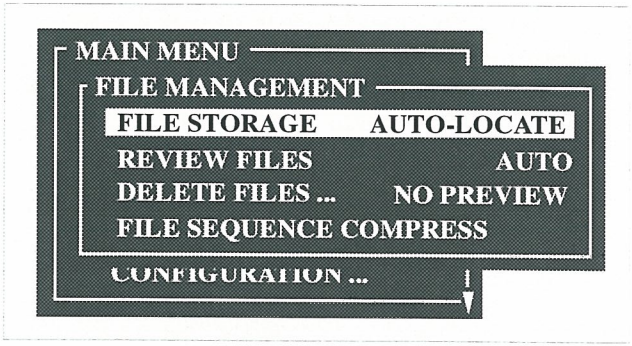
The **Prism DS** camera is capable of storing more than 30 images on a single 5 Meg PCMCIA card. File storage and recall procedures are controlled from the FILE MANAGEMENT menu found on Page 1 of the MAIN MENU.



Like the other menus the INC/DEC button is used to move through the selections, and the ENTER button is used to make menu selections. Pressing the MENU button again will exit the FILE MANAGEMENT menu (return to the MAIN MENU) and incorporate any changes that have been made.

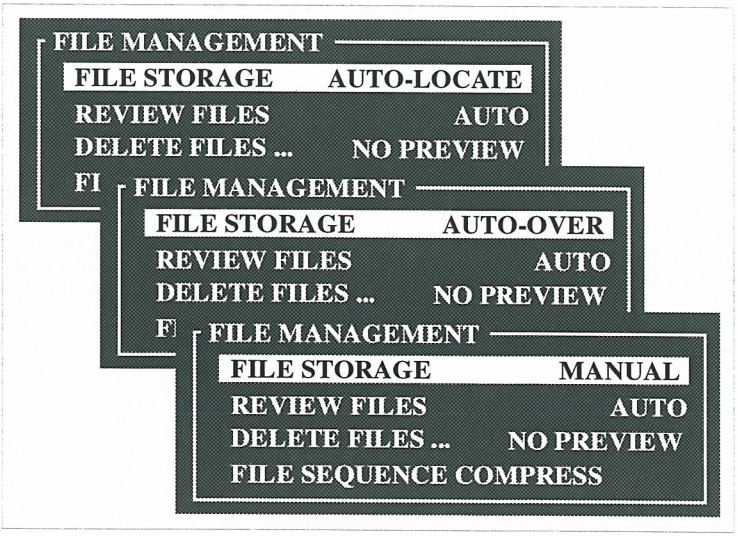
FILE STORAGE Menu:

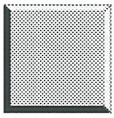
The FILE STORAGE menu allows you to select the method used when saving image files.



There are three modes available for the storage of image files:

- Auto-Locate;
- Auto-Over;
- Manual.





STORE

In any of the modes, an image is stored by pressing the STORE button. The "FILE" icon shows the file label (number) that will be assigned to the stored image (while in the automatic storage modes).

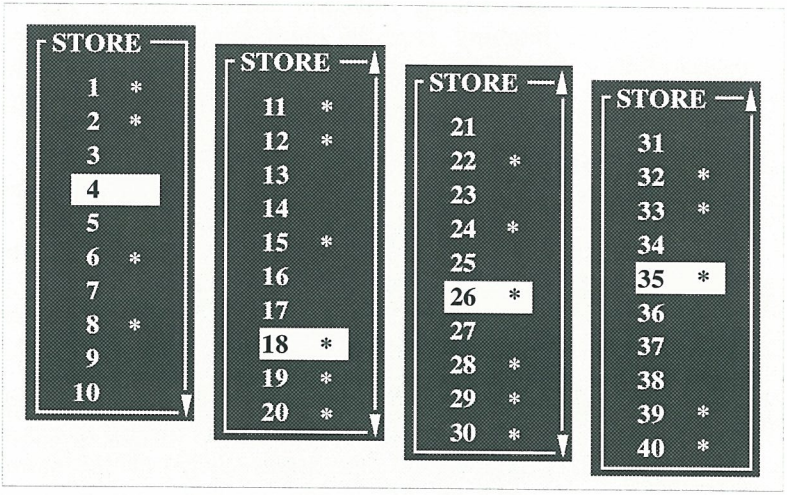
The most convenient file storage mode is AUTO-LOCATE. In this mode the files are stored starting in the first open file label, and then sequentially until the storage card is full. If a memory card is used that already contains image files, the first empty label is used, files already present are skipped over until the card is full.

When the card is full and out of memory space, the "STORAGE CARD FULL" icon will be presented. It will not be possible to store anymore images (in this mode) until some of the old files are deleted, written over, or a new memory card is installed.

In the AUTO-OVER mode, the image is stored in the first file label (even if an image is already present), and then sequentially until the storage card is full. Any image files that are contained on the card will be written over as the card memory is used. When a memory card is full, the "STORAGE CARD FULL" icon will be presented. It will not be possible to store anymore images (in this mode) until some of the old files are deleted, or a new memory card is installed. When this mode is selected it is important to remember that no warning is given as the files are over written. Also, each time that the camera is turned on the camera returns to the number 1 file location. You must remember that the camera will start at the first location on the card when it is first inserted, or each time that the camera is turned on, and will write over any files present as the images are stored.

In the MANUAL mode the user decides where the image file is to be stored. When the camera is in the MANUAL mode and the STORE button is pressed, the image becomes frozen and the STORE menu then appears in the video.

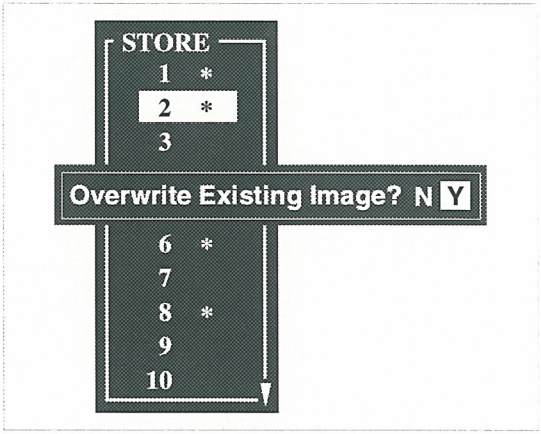
The STORE menu is presented in "Pages" of 10 image files.



The highlighted bar is moved through the menu by using the INC/DEC key. If the bar is moved to the bottom of the page, the next increment (+) will make the next image file number appear. Likewise, if the highlighted bar is at the top of the page, the next decrement will make the previous image file number appear.

Move the highlighted bar to the file number you wish to use, and then press the ENTER key to store the image.

If you attempt to store an image in a location that already contains an image, you will be asked to verify this before the old file is written over.



If ENTER is pressed the file is overwritten with the new image file, the INC/DEC button is used to toggle to N (No), pressing ENTER will abort the file writing process allowing you to select a different file number if you want to.

When the image is saved, the PROGRESS icon

is displayed as the file is being stored. Once the file is completely saved, active video will once again be displayed.

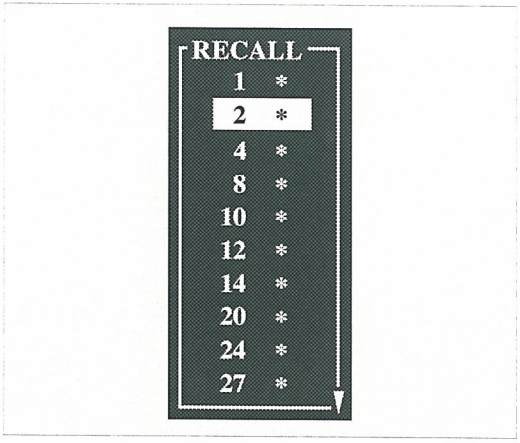
RECALLING AND VIEWING SAVED IMAGES

RECALL

Saved image files can be viewed by either "Recalling" (using the RECALL button) or 'Reviewing" (through software control). The main difference between the two viewing modes is that the Recall mode is generally used when it is desired to view only one image; the Review mode is used when all of the images in memory are to be viewed.

RECALLING IMAGES:

Image files can be quickly recalled by using the RECALL button located on the camera control panel. Pressing the RECALL button to view an image file will first make the RECALL menu appear.

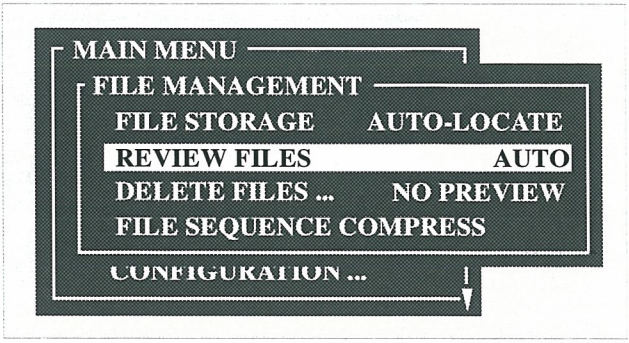


The menu shows where the image files are located. File locations containing a image file are identified by the "*" next to the file number (only locations containing an image are displayed).

The INC/DEC button is used to move the highlighted bar through the menu (when the bottom of the "page" is reached the next file location will appear). Pressing ENTER will display the selected image file. A displayed image is treated the same way as a Frozen image, to exit the displayed image use the Freeze Frame trigger (the same as if exiting a frozen frame). To exit the RECALL menu without viewing an image, press the MENU button.

REVIEW FILES:

Stored image files can also be retrieved or viewed by using the REVIEW FILES feature found in the FILE MANAGEMENT menu. "Reviewing" files allows you to see all of the files stored in memory. There are two different modes used to review image files, AUTO, and, MANUAL. To select or change the file review mode, move the highlighted bar over the Review File label located in the File Management menu, and then press the ENTER button. Use the INC/DEC button to toggle between AUTO and MANUAL. When the correct mode is shown, press the ENTER button to accept the selection.



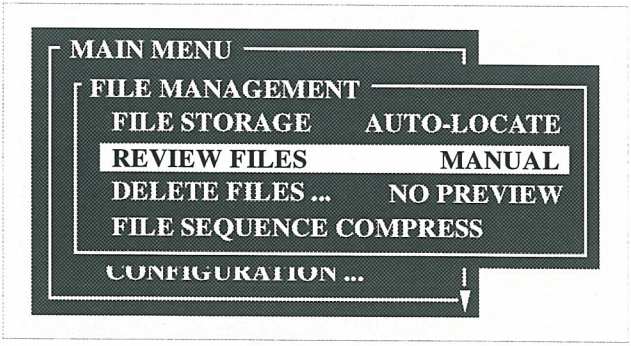
AUTO (Review File):

When the AUTO mode is selected, all of the files contained on a memory card are displayed in a kind of "slide show". Each of the files is presented (starting at the first file on the card) for approximately 4 seconds until all of the files have been presented. The file number (or label) is also presented, this makes it easy to find a particular file, or quickly review the contents of a card.

The files will be presented from the first image contained on the card through the last, and then exit the feature to live video. You can exit the image presentation at any time by pressing the Freeze Frame trigger (VCR PAUSE), the camera will then return to live video.

MANUAL (Review File):

When the REVIEW FILE, MANUAL mode is selected, the files contained on the memory card are displayed one at a time (starting at the first file on the card); the user decides how long each image is to be viewed. Each increment of the INC/DEC button will advance to the next file until all of the files have been presented. The file number (or label) is also presented.



To use the manual Review File feature, move the highlighted bar over the Review File, Manual label located on the File Management menu, and then press the ENTER button.

If you want to exit the image presentation at any time, press the Freeze Frame trigger (VCR PAUSE) to return to live video.

DELETING SAVED IMAGES

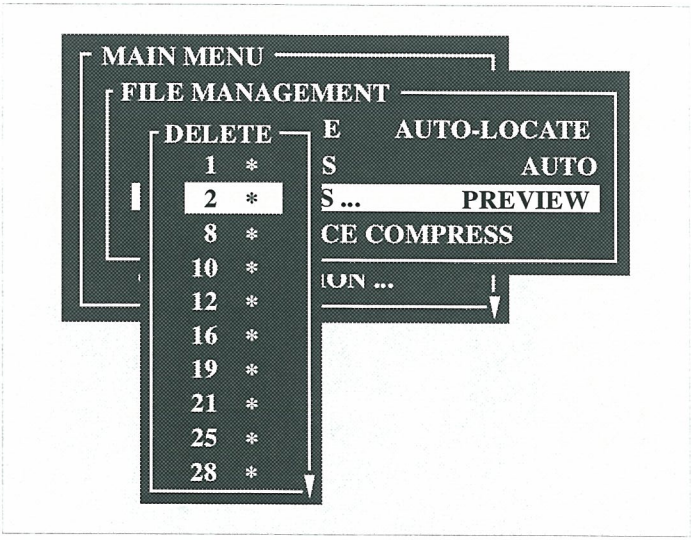
Two different modes are provided for the deletion of files, DELETE FILES (with) PREVIEW, and DELETE FILES (with) NO PREVIEW. The Delete Files, Preview mode allows you to see the file and verify the content before the deletion process. The Delete File, No Preview mode is used when you are absolutely sure that you know the contents of the files being deleted. To select or change the Delete Files mode, move the highlighted bar over the Delete Files label located in the File Management menu, and then press the ENTER button.

Use the INC/DEC button to toggle between PREVIEW and NO PREVIEW modes. When the desired mode is shown, press the ENTER button

to accept the selection and enter the Delete Files feature, or, if you only wish to specify the active delete mode, press the MENU button to exit the Delete Files feature.

PREVIEW (Delete):

The Delete File (with) Preview mode allows you to see a file before the delete process is performed. To use this mode, move the highlighted bar over the DELETE FILES menu with the "PREVIEW" mode selected, and again press the ENTER button (if NO PREVIEW is currently selected, use the INC/DEC button to change the delete mode and then press ENTER). At this time the DELETE menu will appear.

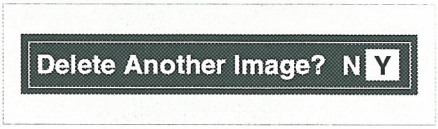


Use the INC/DEC button to move the highlighted bar over the file to be deleted and then press the ENTER button. The PROGRESS icon will be displayed as the file is loaded for presentation.

Once the file is loaded you will be asked to verify that the file is to be deleted.

If you decide that the file is to be deleted, press the ENTER button again. If you change your mind and decide that the file is not to be deleted, use INC/DEC button to select N (No), and then press the ENTER button.

If there are still more files contained in memory following the deletion (or, if you selected N), you will be asked if there are any more files to be deleted.



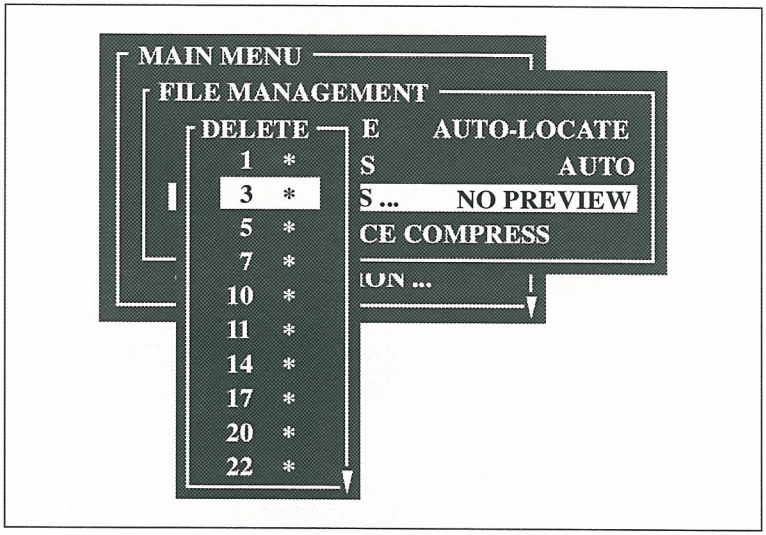
Selecting Y (Yes) will display the DELETE menu again allowing the next file to be selected, N will exit the Delete process and return to live video. The process will continue as long as there are files remaining to be deleted (or until you select N).

You can also exit the DELETE menu without deleting any files by pressing the MENU button, this will return you to the FILE MANAGEMENT menu.

NO PREVIEW (Delete):

The Delete Files (with) No Preview mode works much like the Preview mode only the files are not presented for review before the deletion process.

With DELETE FILES... NO PREVIEW displayed, press the ENTER button to make the DELETE menu appear.



Use the INC/DEC button to move the highlighted bar over the file to be deleted, and then press the ENTER button to delete the file. Once the file is deleted you will be asked if there are any more files to be deleted.

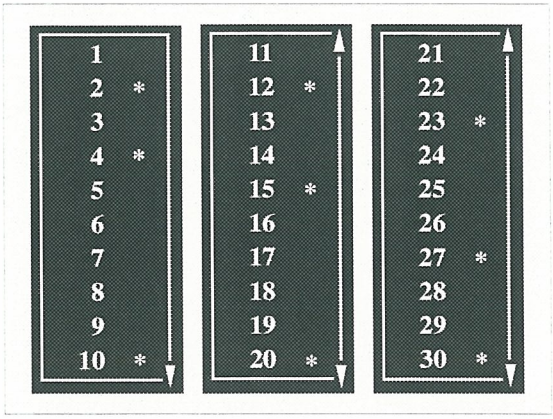
Selecting Y (Yes) will display the DELETE menu again allowing the next file to be selected, N will

exit the Delete process and return to live video. The process will continue as long as there are files remaining in memory to be deleted (or until you select N).

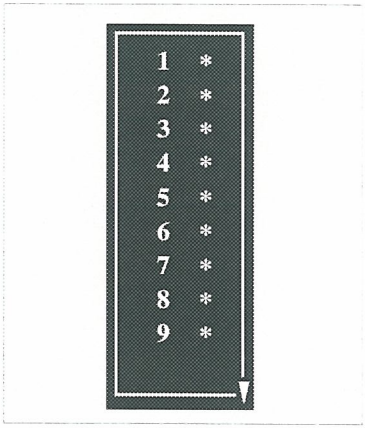
You can also exit the DELETE menu without deleting any files by pressing the MENU button, this will return you to the FILE MANAGEMENT menu.

FILE SEQUENCE COMPRESS

With the ability to store (and delete) files from any location on a PCMCIA card it is very possible for the contents to become "fragmented". For example, if locations 1,5,9, and 28 contain image files it becomes very easy to "loose" image 28 because it is located so far from the other files (it would be very easy over look it when reviewing the contents of the card). The FILE SEQUENCE COMPRESS feature is used to eliminate the "holes" in the file sequence. For example, suppose that images have been stored in locations 2, 4, 10, 12, 15, 20, 23, 27, and 30.



After the File Sequence Compress feature is used, the files are not scattered but sequential. The order of the files has not been changed, only the empty spaces between them removed.



To use the File Sequence Compress feature, move the highlighted bar over the File Sequence Compress feature (using the INC/DEC button) and then press the ENTER button.

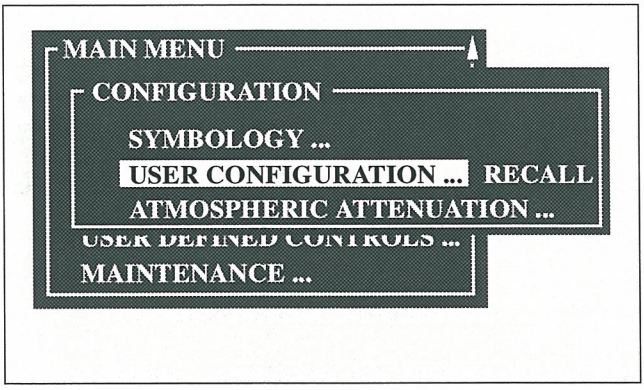
The file sequence compression is immediately performed.

SYSTEM CONFIGURATION MANAGEMENT

The **Prism DS** has the ability to save and recall user specified system configurations. This makes it possible to quickly change the camera settings to frequently used configurations, or to define the specific settings that the camera is to use when power is first applied.

USER CONFIGURATION Menu:

The USER CONFIGURATION sub-menu allows the user to recall and save desired system configurations; and is found in the CONFIGURATION menu located on Page 2 of the MAIN MENU.

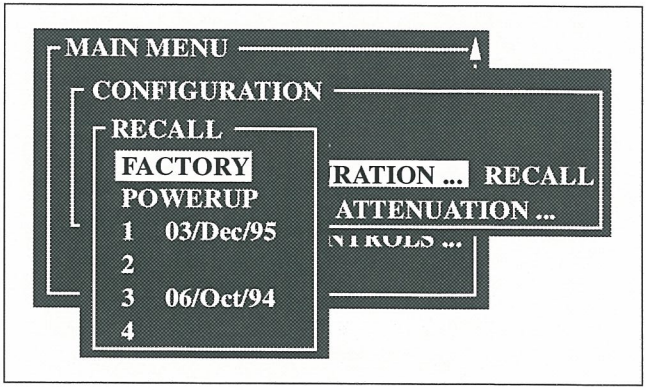


To enter the USER CONFIGURATION feature, move the highlighted bar over USER CONFIGURATION and press ENTER. Use the INC/DEC button to alternate between RECALL and STORE.

RECALL is used to retrieve a previously saved system configuration, and STORE is used if the

current camera configuration is to be saved for future recall. When the correct function is displayed, press the ENTER button to activate the menu.

RECALL (Configuration):



The RECALL menu allows the operator to recall six previously saved system configurations (four non-labeled (1-4), the FACTORY default settings, and the currently defined POWERUP configuration). When the camera is first received, the POWERUP setting is the same as the FACTORY configuration settings. Other selectable configurations are identified by the date code as they are saved.

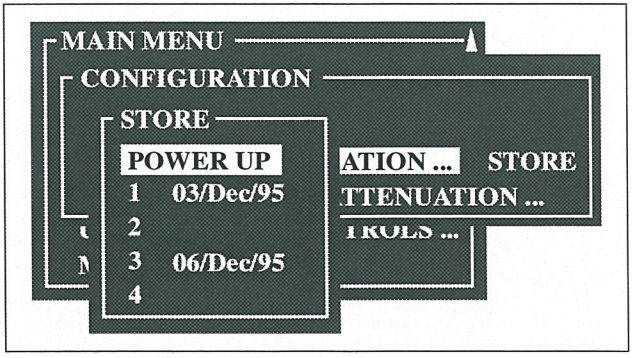
When the RECALL menu appears, the highlighted bar will indicate the currently active configuration. To recall a different configuration, move the highlighted bar over the configuration desired (use the INC/DEC button), and press the ENTER button. At this time the camera will load the new configuration and return to live video.

If FACTORY is selected, the camera will return to its' original factory programmed configuration. Power Up is the configuration settings used by the camera when power is first applied, and is the same as the FACTORY setting until a new configuration is defined by the user through the USER CONFIGURATION, STORE menu.

It is important to remember that any changes made in the camera configuration or video display settings are lost when the camera is powered-down unless they are first saved. When the camera is powered-on, the settings in the POWERUP file are used to define the cameras' configuration, not the camera settings when it was last powered-down.

STORE (Configuration):

The STORE menu allows the user to save five custom system configurations (four non-labeled, 1 through 4, and one that is used as the default power-up configuration).



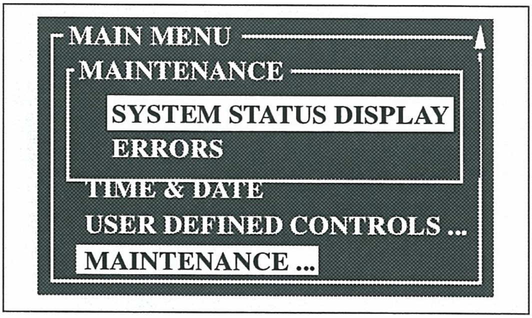
When the STORE menu appears, the highlighted bar will indicate the currently active configuration file. To save the present camera configuration,

move the highlighted bar over the configuration number that is to be identified with present configuration (use the INC/DEC button), and then press the ENTER button. At this time the camera will save the current configuration and return to live video. If the highlighted bar is placed over a previously saved file and the ENTER button pressed, the old configuration will be replaced with current system settings.

The "POWERUP" is a special file. The information contained in this file is used when the camera is first turned on and defines the cameras' initial characteristics. Moving the highlighted bar over the POWERUP label and then pressing ENTER will make the current camera settings the default values used whenever the camera is turned-on.

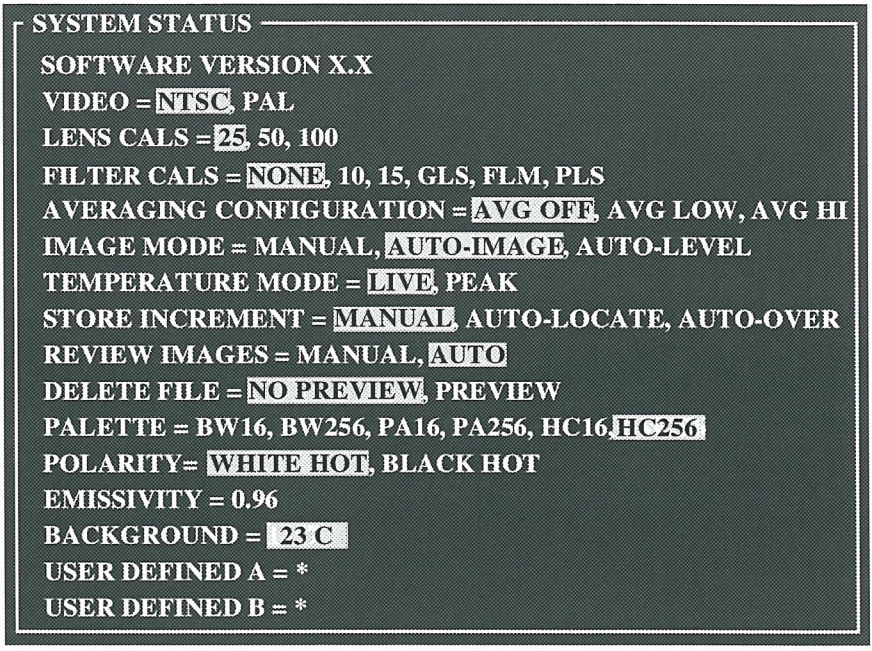
<u>MAINTENANCE Menu:</u>

The MAINTENANCE menu allows system parameters, such as the current configuration, or the results of system detected errors to be evaluated.



SYSTEM STATUS DISPLAY Feature:

The SYSTEM STATUS feature provides a display that shows all of the current camera settings. The System Status menu will only display the current settings, it is not possible to change any of the parameters from the display.

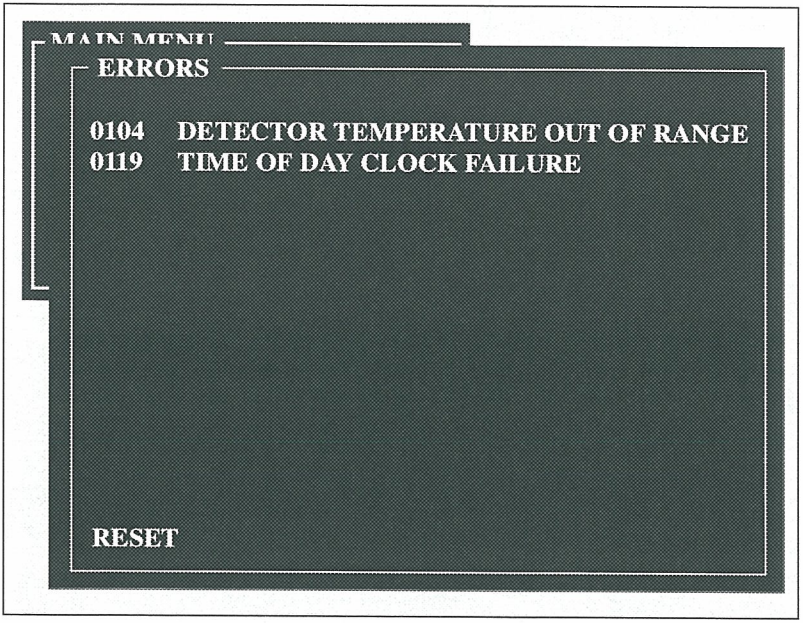


*** May be defined as: "VCR RECORD, WHITE HOT/BLACK HOT, RECALL FACTORY CONFIGURATION, BACKGROUND TEMPERATURE, PALETTE, ISOTHERM, ZOOM, or NO FUNCTION.**

Press the MENU button to exit the display.

ERRORS Feature:

The camera is capable of limited self diagnostics in the event of system failure. When a error has been detected by the system processor, the error icon ("E") will appear in the video display. A more complete description of the error can be obtained by using the ERROR feature.



The "Error Window" provides a description of the detected error. Although the camera contains no parts that the user can replace or calibrate, knowing the nature of the error will allow you to decide how severe the problem is. Some problems maybe temporal in nature and may correct themselves, for example, if the temperature of the detector goes temporarily out of the normal operating range an error will be

generated even if the temperature returns to the correct value. The RESET feature allows the operator to verify the error. **By pressing ENTER, the system will clear the Error Window (including the "E" icon on the active display)**, perform a system check and then report the results.

CHANGING THE LENS

The lenses are designed to be quickly and easily changed. To change from one lens to another, unscrew the lens from the camera and then screw the new lens in (be sure to not over tighten, it's only necessary to finger tighten the lens in place).

Always have a lens attached to the **Prism DS** Camera. This will keep dust and other contaminants from entering the system.

********** **CAUTION** **********

The lens elements are made of Zinc Selenide. Although this material is an excellent infrared transmitter, it is very soft and easily scratched. Use extreme care when cleaning the optical components.

Also, the lens are coated to protect them and improve their optical efficiency. This coating gives the lens a "frosted" appearance. Do not confuse this coating for contamination.

Always, protect your lenses by replacing the lens cap on the unused lenses (or on the camera lens when not in use); and store accessory lenses in the product carrying case to provide additional protection.

Enter the LENS feature and select and enter the new lens.

Following a change in the lens or filter selection, "WAIT" will appear over the temperature display until a new calibration table is generated. When lens or filter changes are made, it is also necessary to perform a "NUC" to correct for the new lens/filter characteristics.

USING THE OPTIONAL VCR

When using the optional VCR with the Battery Belt, it is possible to control the "RECORD" feature of the VCR from the viewer.

The VCR comes with its own AC power adapter, battery charger, and battery pack. Complete operating instructions and unit specifications are contained in the operator's manual supplied with the recorder. The manual also contains a list of options that are available to support the VCR.

Video and recorder control connections are located on the Battery Belt. The video connector on the belt is connected to the VCR video, and the control connection is made to the "REMOTE" terminal on the VCR (NOTE, a tape must be in the VCR, and the connections made before the camera is turned on).

The camera will automatically place the VCR to the RECORD/PAUSE state when the camera powers up, or when the VCR PAUSE button is pressed. Once the camera goes through its' cool-down procedure, pressing the VCR PAUSE button activates the recorder. "RECORD" will be seen in the video while recording if the icon is active. Pressing the button again places the recorder into the PAUSE mode.

Additional presses of the VCR PAUSE switch toggles the VCR between the RECORD and PAUSE modes of operation.

When using the optional AC adapter, video input to the VCR is obtained at the Break-Out Box (supplied with the adapter) "VIDEO" connector. Remote operation of the VCR is not supported when using AC power, the normal control switches on the VCR are used to enter the desired mode of operation.

OPERATING FROM THE AC POWER LINE

Operation using the AC power line is exactly like operation from the Battery Belt except the optional AC power adapter is used to supply the camera power. The AC adapter connects to the camera power cable using the Break-Out Box assembly (supplied with the AC adapter). Attach the cable assembly from the camera, and the connector from the AC adapter to the Break-Out Box. The AC adapter does not have an ON/OFF switch, operation is controlled using the ON/OFF switch located on the **Prism DS** IR camera, and by unplugging the adapter from the AC line.

The adapter is capable of operating from either a 120 or 240VAC, 50/60 Hz input, although an adapter may be required to interface with different line plug configurations.

OPERATING FROM AC POWER WITH AN EXTERNAL MONITOR AND/OR VCR

Operating with the AC adapter requires the use of the Break-Out Box, which offers several viewing options to the operator.

The video output from the camera is accessible at the Break-Out Box, and is capable of directly driving a 75 Ohm video load. Display monitors, video printers, and/or video cassette recorders, may be connected to this output. Nearly all video cassette recorders and video printers have a fixed 75 Ohm input impedance, while most display monitors have an input termination which is switchable to either 75 Ohms or a high impedance ("Hi-Z") configuration.

The connector available at the Break-Out Box is a standard BNC connector; this is the same type of connector that is used on most video monitors. Connection between the two devices is easily made using commercially available coax cables.

Interconnecting video cables should not be any longer than necessary, and should have a 75 Ohm impedance (standard coax meeting this requirement are RG-6, RG-11, and RG-59 type/ equivalents).

Connecting to a VCR may require a BNC to male "phono" adapter, as a female phono connector is the usual video input used by most VCR's. These are available from a number of sources, including FLIR Systems, Inc.

If required, both a monitor and VCR can be used provided some simple guidelines are followed. As previously stated, the camera video source requires a 75 Ohm impedance to operate correctly. Most video monitors have both an "INPUT" and "OUTPUT" connection. Place the impedance switch on the monitor to the high impedance setting; video from the camera is applied to the monitor "INPUT", while the "OUTPUT" connector is used to drive the VCR video input. By using the VCR to terminate the line, the correct 75 Ohm impedance is presented to the camera. If desired, an additional monitor(s) can be placed before the VCR as long as they are adjusted to the high input impedance setting.

This can also be done using multiple monitors (and no VCR), by making sure that the last device connected has the input impedance adjusted to 75 Ohms; and the all preceding units are switched to the high impedance setting. The user must remember that if the last device is disconnected, the preceding unit must be switched to terminate the line with 75 Ohms.

CHAPTER 5 TEMPERATURE MEASUREMENT

OVERVIEW

The **Prism DS** IR Camera allows the operator to make temperature measurements (with no physical contact) to a user specified area of interest located on the target. Although the camera is simple to operate, the user should be familiar with some of the basic concepts of Infrared Imaging in order to obtain the greatest accuracy and flexibility from the **Prism DS**, IR Camera. The following sections contain some of the fundamental theories that apply to IR Imaging and temperature measurement.

For those wishing to immediately begin thermal measurements, skip to section "MAKING TEMPERATURE MEASUREMENTS" in this chapter. However, the following paragraphs contain information that can directly affect the accuracy of the thermal measurements you make. At some point be sure to read the following sections.

INFRARED RADIATION

Infrared radiation is the part of the electromagnetic spectrum with a wavelength of

approximately 750 nanometers (0.75 microns or 7500 angstroms) to 30 microns (this "window" has been arbitrarily assigned and varies from source to source).

The infrared window can again be broken down to the following sub-bands (again, the limits will vary from one reference to another):

0.75 to 3 microns	Near Infrared;
3 to 6 microns	Middle Infrared;
6 to 15 microns	Far Infrared;
15 to 30 microns	Extreme Infrared.

All objects above absolute zero emit radiation; the wavelength of the emitted radiation is inversely proportional to the temperature, while the Radiant Flux (rate of transfer) is proportional. For example, as the element on a stove is heated, the first energy emitted is in the extreme IR region and is invisible to the eye. As the element heats, the wavelength of the emitted radiation shortens and can be detected as heat by our sense of touch (but is still invisible to the eye); as the temperature increases more, the wavelengths continue to shorten through the invisible Near IR region and finally includes radiation detectable by the eye, what that we call "visible light". If the temperature was allowed to increase without limits, the emitted radiation would continue to shorten and would include ultraviolet, and finally gamma rays (X-rays) of shorter and shorter wavelengths. The radiation emitted by an object is a result of the atoms "disposing" of the extra energy as they return to more stable states. The emitted radiation does not consist of a single wavelength, but is broad banded in nature, representing the different paths the atoms (and molecules) use as they return to more stable configurations.

HEAT TRANSFER

Radiation (heat) is transmitted in three different ways:

Conduction: The energy is transferred molecule to molecule (atom to atom) like heat flowing *through* a frying pan.

Convection: The thermal energy develops a current in the medium that helps to moves it along more rapidly than by simple conduction. This effect can be seen in the air currents that heat or cool a house. The currents help transfer the heat from the source (hotter) to the cooler parts of the house.

Radiation: The direct transfer of energy through electromagnetic radiation, like the transfer of visible light, and heat from the sun, no medium is required for the transfer.

Of the three, radiation is of the greatest interest to us. Radiation is characterized by two parameters: power, or radiant emittance (how much); and the wavelength (what kind, or type).

An object may react with radiation (heat) in three different ways:

Transmission: The radiation goes through the object with no reaction.

Reflection: The radiation bounces off the surface, and again, does not react with the object.

Absorption: The object absorbs the energy.

We can now explain how heat is transferred from the source, and how an object (target) will react to the transferred energy. The transfer however, is seldom by a single mode of transmission, and objects seldom react by a single mode of interaction. Instead, the transfer and reaction (of an object) to heat takes place using multiple modes of transfer and interaction. A glass window for example will transmit most of the visible sunlight that lands on it, but some is reflected (like the reflection of the sun from an on-coming automobile windshield), and some is absorbed (the glass becomes warm to the touch). A plain glass mirror will typically reflect 85% of the light while absorbing 10% (in the glass; the final 5% is actually absorbed by the aluminium coating used to produce the mirror). There is no perfect reflector, transmitter, or absorber of radiation.

EMISSIVITY

Objects can be classified by the way that they react to the incident radiation that falls on them. The way they react directly affects the methods that you will use to make your temperature measurements.

Blackbody: If an object absorbs all, and reflects none of the incident radiation that falls on it (at any wavelength), then it is called a Blackbody.

Graybody: If an object absorbs a portion, of the incident radiation that falls on it (at all wavelengths), then it is called a Graybody.

Selective Radiator: If an object absorbs varying portions of the incident radiation that falls on it (at different wavelengths), it is then called a Selective Radiator.

In the real world, there are no true blackbodies, although many objects come close to possessing the correct properties. For example, a dull piece of metal that is not polished (or, if it has a thin coating of rust) approximates a blackbody. A blackbody radiates across the entire infrared spectrum; an incandescent light bulb is a fairly good blackbody radiator. A fluorescent bulb on the other hand, emits only at certain wavelengths and is a poor blackbody radiator.

If all objects behaved as blackbodies, measuring their temperature would be as simple as measuring the IR energy emitted by the object and then using a look-up table to match the emitted energy to a specific temperature. But as we know, real objects are not blackbodies and only emit a portion of their energy as though they were. This *ratio* of actual emitted radiation to the theoretical emission (of a true blackbody at the same temperature) is called Emissivity. A blackbody has a emissivity of 1.0 (and by definition is a perfect emitter). Real world objects are never this efficient and possess emissivities less than this. A common red brick typically has a emissivity of around 0.93 and is a fairly good emitter in the IR spectrum, while the emissivity of the metal mercury is only 0.1 and is a poor emitter. If both materials were at the same temperature and the emitted IR radiation measured, the brick would emit 9.3 times the IR radiation that the mercury does. If the emissivity

of a object is not corrected for, the measured temperature can be greatly in error.

The emissivity of a material is not a fixed and absolute number, and is typically affected by several factors. For example:

Temperature:

Generally, as the temperature of a material rises, the emissivity value for that material also increases. However, the emissivity of a few materials decrease as the temperature increases (over a limited temperature span). Oxidized magnesium has an emissivity value of approximately 0.55 at 527°F (275°C); this changes to 0.20 at 1517°F (825°C).

NOTE:

Inaccuracies due to the emissivity figure is minimized at higher temperatures because:

- The radiation from the surface increases as the temperature of the surface increases (to the fourth power).
- The emissivity effect is directly proportional to the radiation.

Surface Texture:

A dull surface is produced by a material that absorbs a large portion of the light illuminating it; this produces a target that responds more like a blackbody. A smooth, polished surface generally has a low emissivity.

A polished piece of copper generally has a emissivity of 0.02 to 0.03, if the surface is matt, the emissivity is typically 0.22.

Surface Treatment:

Many commonly used materials receive surface treatments to help protect them. Aluminum for example, is commonly anodized. Bare aluminium has an emissivity of 0.02 to 0.09, anodized aluminium has a emissivity of 0.55 (when anodized using the chromic acid process).

Remember, surface treatments affect the texture and composition of a material. Rust can be considered a surface treatment of iron; sheet iron, (chemically iron, Fe) has a emissivity of 0.20. Once rusted, the surface becomes a mixture of iron oxides and hydrates (ferric oxide Fe_2O_3, and ferrous oxide FeO), the texture/composition changes and the emissivity becomes 0.65.

Oil is another common surface treatment that can affect the emissivity of the target. A nickel base may have a emissivity of 0.05; place a 0.001" coating of lubricating oil on the surface and the emissivity rises to 0.27; make the coating 0.002" thick and the emissivity changes to 0.46; a 0.005" coating will change the emissivity to 0.72.

It should be noted that radiation sensing instruments only measure the surface of an object. If the coating acts as an insulator, the measurement relates only to the surface of the coating, it may be necessary to scratch through the coating to obtain the temperature of the base material.

The exception to the surface only (measurement) rule is when the coating consist of an IR transmissive material. Two examples of this might be a machine part with a polyethylene plastic coating, or a printed circuit board coated with a thin plastic conformal coating.

The end result of this is, if the temperature of a target is to be measured accurately, the emissivity of the material that the object is made of (or coated with) must be known and corrected for. Know the materials that you are working with.

DETERMINING (OR CORRECTING FOR) AN UNKNOWN EMISSIVITY

If precise temperature measurements are required but the emissivity of the target is unknown, there are several techniques that can help you to determine the emissivity of the target and increase the measurement accuracy.

- Attach a thermometer or thermocouple to the target; measure the temperature. Adjust the emissivity setting of the **Prism DS**, IR Camera until the measured temperature is the same. Record the emissivity setting for future use.

  When using this method remember, attaching a thermocouple to an object will affect the object's temperature at the point of contact. Most subjects will contain enough mass to make this loss insignificant, however, if the object posses little mass (relative to the thermocouple) the thermocouple can act like a "heat sink" seriously affecting the actual temperature of the object.

- Place the target into an oven (of known accuracy); heat the object to a known temperature and adjust the emissivity setting until the measured temperature is correct.

  In a variation on the above technique, using an oven of unknown accuracy, heat the target along with a second target possessing a known emissivity (see below), using the camera (adjusted to the known emissivity) measure the temperature of the second target; view the primary target and adjust the emissivity until the primary target measures correctly.

  When using either technique, be sure and allow sufficient time for the target(s) to stabilize before making your measurements; record the emissivity setting for future use.

- If the temperature of the object cannot be calibrated (or directly measured), "adjust" the emissivity of the target to a known value. Where possible, you can obtain a surface of known emissivity by painting the surface (temperature and working conditions permitting). Coating the surface with a flatblack lacquer spray paint will provide you with a target possessing an emissivity of approximately 0.98. If it's not possible to paint the surface, a coating of "foot powder" (baby powder or talc) has an emissivity near 0.90, and masking tape is approximately 0.95.

  With the surface at a known emissivity, adjust the camera emissivity setting to the correct value. Temperature measurements can now be made.

ATMOSPHERIC ATTENUATION

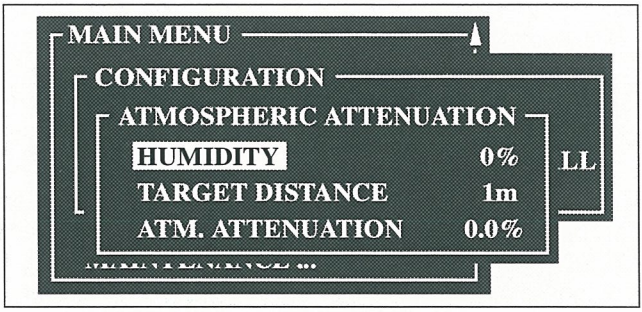
Atmospheric attenuation refers to the ability of the atmosphere (this includes atmospheric phenomenon such as clouds, rain, fog, "smog", etc.) to absorb some of the IR radiation that maybe of interest to us over a given path. For example, short wave ultraviolet light from the sun reacts with our skin to produce a suntan, or burn, if the exposure is extreme. On days when the atmosphere poorly transmits short wave UV (short wave UV is absorbed by water vapor, ozone (O_3), smog, and many types of chemical vapors, such as nitrogen and bromine compounds) you can spend most of the day in the sun without becoming burnt. On a day when the atmosphere is clear (or if you go above the absorbing materials, like skiing on a high mountain), your exposure must be limited because of the increased transmission.

Because our temperature measurements are made by measuring the IR radiation emitted by the target, it is important to limit the losses between the target and the camera. The greater the distance between the two, the greater the atmospheric absorption (and the greater the effect on the temperature measurement).

However, it is interesting to note that the atmosphere is especially transparent in two bands of the IR spectrum, specifically, from 3-5, and 8-14 microns. The **Prism DS** IR Camera utilizes the Middle IR (3-5 micron) region, this helps to minimize the losses due to atmospheric attenuation (absorption).

There is an other reason to limit the distance between the camera and the target. The further away that you are from an object, the smaller it becomes in the monitor. All instruments have a limiting resolution. As the size of the object approaches this resolution (becoming smaller in the monitor), the ability of the instrument to correctly distinguish its temperature (from the background) deteriorates. If possible, fill as much of the video frame as possible with the target.

The **Prism DS** IR camera allows you to compensate for some of the negative effects resulting from atmospheric absorption. The "ATMOSPHERIC ATTENUATION" sub-menu can be found in the CONFIGURATION feature on the first page of the MAIN MENU.



If you are working with targets located at extreme distances, you can enter the target distance and current humidity into the table and the camera will correct the temperature measurements to compensate for the ambient conditions. You can also use the table to "back calculate" and determine the atmospheric attenuation for a given distance/humidity condition. For example, if you set the humidity to 40% and the target distance to 150 meters, you will find that the atmospheric attenuation will be 22.4% under those conditions.

If you want, you can also enter an atmospheric attenuation value to see what effect it will have on the measurement. This entry will "over ride" the calculated value for a given set of distance and humidity settings.

TARGET AND BACKGROUND CONTRAST

Ideally, when viewing a target, the only data processed by the camera is the radiation emitted by the target under observation. Unfortunately, the target will also reflect radiation from sources that are around it. The total radiation from a surface is a combination of emitted and reflected radiation (also remember that objects at higher temperatures emit more radiation, if this is presented to the camera through a reflection from the target surface, the temperature measurement made is of questionable value).

In most cases, the target will act enough like a blackbody so it will absorb the radiation landing on it. Only a very strong (much different from the target) source(s) of radiation will provide a significant contribution through reflection. The exception to this rule occurs with surfaces such as polished metals (which naturally have very low emissivities) and reflect radiation to a large degree.

The background temperature must be different enough to allow the camera to "see" it (for the **Prism DS**, this is amounts to about 0.1° C when at 30° C), but not so great that the target becomes lost, or reflections from the hotter background saturate the image.

BACKGROUND TEMPERATURE

Again, no natural object is a perfect emitter of infrared energy. The IR energy received by the camera is a combination of emitted and reflected energy. The **Prism DS** IR Camera allows the operator to specify the background temperature (the temperature of the non-focused energy being reflected off the subject). This information is then used in the target temperature calculations to increase the accuracy of the measurement by accounting for possible errors due to the reflections from the background source.

The emissivity setting allows the user to define the percentage of energy emitted; the background temperature allows the user to compensate for reflected energy.

ANGLE OF OBSERVATION AND FOCUS

When making a temperature measurement, try to observe the target straight on, most objects emit thermal radiation perpendicular to their surface. The amount of radiation decreases at smaller angles, and the possibility of reflections will increase at "grazing" angles. For example, water at a very shallow angle reflects greatly and may "look" like the trees along the shore line, or more commonly, like the sky above. If the water is looked at from a near perpendicular vantage point, the water has a very high emissivity, and hence it looks almost like a blackbody (at the temperature of the water).

The focus should be as "sharp" as possible for an accurate measurement. This allows the temperature crosspoint to contain only the information present in the desired area to be evaluated, not a blending of the energy contained in the surrounding surfaces.

MEASUREMENT MODES

Depending on the application, different aspects of an objects temperature may be of interest to the observer. Three different modes of temperature measurement are available to the observer, Running Crosspoint, Peak Temperature Hold, and Freeze Frame.

Most commonly, the observer is interested in an active, or "live" temperature measurement as the object is being scanned. With the camera in the Running Crosspoint mode the temperature measurement is continuously updated as the temperature beneath the center crosspoint changes (either as a result of the temperature of the object changing, or the different temperatures found on the objects surface as a result of scanning). This can be useful when performing a temperature survey of a target. For example, to determine the temperature distribution across the target.

Sometimes, only the highest temperature scanned is important. With the camera in the Peak Temperature Hold mode, the displayed temperature will change only when the temperature beneath the center reticule is greater than the temperature displayed. This can give the user the highest temperature found on the target (provided the user scans the full surface).

The final mode, Freeze Frame, allows the operator to select, or "freeze" a temperature measurement at a selected point in time. When activated (by pressing the "VCR PAUSE" button when it is defined as the freeze frame trigger), the scene (temperature) at that instant is retained and displayed until the Freeze trigger is again pressed.

MAKING TEMPERATURE MEASUREMENTS

When the system is first received and powered on, the camera will default to the Running Crosspoint measurement mode, assume a target emissivity of 1.00, the background temperature will be the current internal temperature of the camera (AMB), and give a Celsius temperature readout (remember, whenever the emissivity is 1.00 the object is a perfect blackbody. Therefore, the background temperature will have no effect on the temperature measurement, no matter what value is entered as the object absorbs 100% of the radiation falling on it). If you wish to make your temperature measurements using the Fahrenheit units of measurement, enter the UNITS feature and change the measurement units.

If the emissivity value is known (or a close approximation), enter the value by pressing the EMISS button, and then use the INC/DEC button to change the emissivity setting displayed. When the desired value is displayed, it can be entered by pressing the ENTER button.

If necessary, the Background Temperature can now be changed. Enter the MAIN MENU by pressing the MENU button; use the INC/DEC button to move the highlight bar over the "BACKGROUND TEMP" feature, and then press

ENTER. The Background temperature will begin to flash in the video display and can now be adjusted using the INC/DEC button. When the desired value is displayed, again press the ENTER button.

If the camera is in the Running Crosspoint measurement mode, place the crosspoint over the point to be measured, try to fill as much of the video frame as possible with the target, and make sure that the image is well focused for the most accurate measurements.

If you wish to make and "hold" (freeze frame) a measurement, be sure that the camera is in the Running Crosspoint measurement mode (there will not be a "P" in front of the temperature display). Place the crosspoint over the target; press the freeze frame trigger (VCR PAUSE) once, and the temperature and image will become frozen. The "FROZEN" icon will appear in video display to identify that the Freeze Frame mode has been entered. If the target is actively changing temperature, or the characteristics of the target at a specific moment in time is to be measured, observe the target carefully until the desired target parameters are observed before entering the Freeze Frame mode.

The Frozen Frame (temperature) will be displayed until the Freeze Frame trigger is again pressed. If another frozen measurement is to be made, you must return to the Running Crosspoint, or Peak Hold mode before the new measurement can be made.

To measure the highest temperature scanned on a target, place the camera into the Peak Temperature measurement mode. From the Running Crosspoint mode, press the PEAK

button once. A "P" will appear in front of the temperature display, and the center of the crosspoint will now contain a square box indicating that the Peak Temperature mode has been entered. As the target is scanned, the displayed temperature will only change if the crosspoint encounters a temperature greater than the displayed value (or if the camera is place into a different measurement mode). If another "peak temperature" survey is to be made, you must clear the presently displayed value by pressing the PEAK button twice (this will cycle the camera through the Running Crosspoint mode and return the camera to the Peak temperature mode). It is important to remember that the displayed temperature will only reflect the highest temperature that passed under the crosspoint and not necessarily the highest temperature on the target (unless the TOTAL surface of the target was scanned).

DYNAMIC RANGE AND MEASUREMENTS

To provide the most accurate temperature measurements possible, each Dynamic Range setting is designed to measure a specific span of temperatures (with some temperature over lap between the different ranges).

The first three ranges are "stand alone" with each measuring a higher temperature window than the previous range. If the camera is in the MANUAL radiometric measurement mode and the temperature of the target is above the current ranges' capacity, "OVER" will appear in place of the temperature measurement and the user should change to the next higher Dynamic Range setting until a measurement is obtained. If the temperature of the target is below the current

ranges' capacity, "UNDER" will appear in place of the temperature measurement and the Dynamic Range switch should be changed to the next lower setting until a temperature measurement is obtained. If the camera is in one of the automatic radiometric modes (Auto-Image or Auto-Level) the camera will automatically switch between Dynamic Ranges R1 and R2, but will not enter range R3 (which can only be entered from the MANUAL radiometric mode and requires external filters for operation, this is described below).

Dynamic Range R3 operates differently from the first three, it is designed to be used with external filters, and allows measurements of very hot targets. Also, it is only possible to enter the R3 range if a filter has been selected (from the FILTER menu).

The correct filter must be selected and installed (using the FILTERS feature) for the camera to make an accurate temperature measurement. If the camera is placed in Dynamic Range R3, and no filter is selected, the camera will recognize a fault condition and will not display a temperature measurement (thereby preventing an erroneous measurement). It is important to remember however, there is no feedback between the filter selected, and the actual filter in use (or, if there is even a filter present), it is up to the user to ensure that the filter is correctly selected and installed. Selection of the wrong filter will result in erroneous temperature measurements. Also, whenever changing any optic (lens or filter), be sure to perform a "NUC" to insure the highest quality image.

CHAPTER 6 SYSTEM OPTIONS

GENERAL OVERVIEW

The **Prism DS** IR Camera has many options and accessories available that provide the operator with extended system performance, flexibility, and convenience.

If your application requires an option or accessary not listed, accessories may be available from FLIR Systems, Inc. that can solve your application requirements. For the latest options available, contact your local representative, or FLIR Systems, Inc. Industrial Service at **(800) 322-3731**.

POWER ACCESSORIES

BATTERY BELTS (6 and 3 Hour):

An extra standard (6 Hour) Battery Belt will provide the user with more than twelve hours of total operating time, and will allow continued operation while one of the Battery Belts is being recharged.

A three hour Battery Belt is also available and is useful as a "back-up" power source.

LCR BATTERY CELL:

Although the batteries used in the Battery Belt will provide approximately 500 charge/discharge cycles when using the standard charger (assuming a sixteen hour charge cycle), they do possess a finite life and will eventually need to be replaced.

Battery cell replacement is indicated when a fully charged Battery Belt will no longer power the camera for the normal four hour operating period before requiring recharging.

The Battery Belt contains two LCR battery cells. It is recommended that both cell packs be replaced at the same time.

DC to DC ADAPTER:

In applications where the imaging system is operated from a vehicle, the DC to DC adapter allows the camera to be powered from the plug-in cigarette lighter. Connection to the camera is made using the coiled power cable and the Break-Out Box assembly (supplied with the DC/DC adapter).

CAUTION:

The DC to DC Adapter is designed to operate in vehicles using 12VDC, negative ground electrical systems. Damage to the camera may occur if operation is attempted in vehicles that operate using 24VDC or positive ground electrical systems.

AC LINE ADAPTER:

The AC adapter allows operation using AC power lines. This frees the operator from the time limitations placed on the camera when using a battery power source.

The AC adapter accepts an input of 120 to 240VAC, 50/60Hz. Connection to the camera is made using the coiled power cable and the Break-Out Box (supplied with the AC adapter).

BATTERY CHARGER (4 Hour):

This charger allows a fully discharged Battery Belt to be charged in approximately four hours. The charger operates with 120VAC 50/60Hz input.

It should be remembered however, that rapid charging of the batteries will shorten the life span (charge/discharge cycles) of the battery pack.

BATTERY CHARGER, 240VAC Input:

This charger allows charging of the Battery Belt using 240VAC 50/60Hz input. The charger will charge a fully discharged Battery Belt in approximately eight hours.

An AC input adapter may be required depending upon the local AC line standards.

LENS ACCESSORIES

8mm Lens:

Extra wide angle lens (53° x 41° Field-Of-View).

12.5mm Lens:

Wide angle lens (34° x 26° Field-Of-View).

50mm Lens:

Provides a 2X magnification over the standard 25mm lens (8.5° x 6.5° Field-Of-View).

100mm Lens:

Provides a 4X magnification over the standard 25mm lens (4° x 3° Field-Of-View).

VIDEO ACCESSORIES

PAL COLOR VIDEO:

Video output using the PAL color format is available to support operation in countries where PAL is the video standard used. This option must be installed by the factory, therefore it must be specified at the time the system is ordered. If it is decided to retrofit a B&W/NTSC color system to B&W/PAL color video (or to change a PAL system to NTSC), the camera must be returned to the factory. Please contact your local sales representative, or FLIR Systems, Inc. Customer Service at **(800) 322-3731** for a price quotation on this conversion.

When the PAL color option is requested, the standard 120VAC battery charger is replaced with the 240VAC charger.

8mm VIDEO CASSETTE RECORDER with LIQUID CRYSTAL DISPLAY, NTSC Video Format:

The VCR option provides the operator with the ability to record the camera IR image in systems using the standard B&W/NTSC video option (B&W/PAL video format is not supported by this VCR). When used with the Battery Belt, the operator can control the record/pause function of the VCR directly from the camera.

The VCR fits neatly into a pouch attached to the Battery Belt.

The VCR comes with its own battery pack, battery charger, AC line adapter, and operator's manual.

Please contact your local sales representative, or FLIR Systems, Inc. Customer Service at **(800) 322-3731** for information about 8mm PAL video recorders that are compatable with the camera's built-in VCR PAUSE control.

VIDEO PRINTER:

For applications requiring printed images, the Video Printer can provide a large (5.7 X 4.1 inch, or 140 X 100mm) monochrome or color printed output of the IR video in 35 seconds, or 30 seconds for a small (3.2 X 2.2 inch, or 79 X 57mm) printout.

The Printer will accept NTSC, or an RGB input. It can therefore be used with any video source that provides these inputs.

Please contact your local sales representative, or FLIR Systems, Inc. Customer Service at **(800) 322-3731** for information about video printers compatible with PAL video cameras.

VISUAL LIGHT CAMERA with DISK STORAGE:

For applications that also require a visible light picture, the Visual Light Camera provides a convenient method to back up, or augment the IR image in the visible spectrum. The camera can record up to 50 images on a standard 2 inch video floppy disk.

The camera provides a standard NTSC color output that can be connected to a VCR, video monitor, or video printer.

FILTERS

Optional filters are available to enhance the performance of the **Prism DS** IR Camera. Filters are used to pass specific bands of radiation to the camera, or extend the temperature range of the camera by uniformly attenuating the input radiation.

Contact your local representative, or FLIR Systems, Inc. Customer Service at **(800) 322-3731** to find if a filter is available to assist with your specific application.

CHAPTER 7 ROUTINE MAINTENANCE

GENERAL

The Prism DS IR Camera is designed to provide trouble free operation with minimal care and maintenance. The camera does not require routine calibration, lubrication, or internal adjustments. The only routine maintenance normally required is general cleaning of the unit and optics.

To maintain the guaranteed temperature measurement accuracy, it is recommended that the camera be calibrated once per year. The camera must be returned to FLIR Systems, Inc. for calibration.

CLEANING THE UNIT

Should the camera become dirty, it can easily be cleaned using a dry soft cloth, or a soft cloth lightly moistened with a mild detergent solution. Harsh solvents such as acetone should not be used.

Care should be taken to minimize the amount of fluids that the switches and controls are exposed to. Also, never clean the camera with the lens removed.

The same cleaning instructions also apply to the other items supplied with the Prism DS IR Camera, with the exception of the optics.

CLEANING THE LENS

Although dust or fingerprints rarely cause any noticeable loss of system performance, many substances can harm the coatings on the optics and should be removed.

********** **CAUTION** **********

The lens elements are made of Zinc Selenide. Although this material is an excellent infrared transmitter, it is very soft and easily scratched. Use extreme care when cleaning the optical components.

Also, the lens are coated to protect them and improve their optical efficiency. This coating gives the lens a "frosted" appearance. Do not confuse this coating for contamination.

Remove fingerprints, grease, dust, etc. by using a non-abrasive wipe such as clean facial tissue, or cheesecloth moistened with isopropyl alcohol. Rub as lightly as possible, and replace the facial tissue or cheesecloth wipes as they become soiled.

When not in use, always keep the protective cap on the lens; and store it in the Prism's carrying case for added protection.

STORAGE

When not in use, the carrying case provides an ideal storage container for the Prism DS IR Imaging system. If an extended storage period is anticipated, it is recommend that the camera and accessories be cleaned, and the batteries be fully charged before storage.

CHAPTER 8 SERVICE

OVERVIEW

The **Prism DS** IR Camera contains no user serviceable parts. All service and camera upgrades must be performed by returning the camera to FLIR Systems, Inc.

Before returning the camera for repair, please contact FLIR Systems, Inc. Industrial Service, phone **(800) 322-3731**, or FAX **(503) 968-1121** to acquire a return authorization number (R.A.#).

Once authorization is received, the camera must be packaged into the original shipping container and sent prepaid to:

FLIR Systems, Inc.
Industrial Service
16505 SW 72nd Avenue
Portland, Oregon 97224
USA

Attention: R.A#

Be sure to provide the following information when the camera is returned:

- Write the R.A.# on the outside and inside of the shipping container;
- A detailed description of the problem;
- The name of a person who can be contacted who is familiar with the camera's operation, and the problem.

No billable repair will be performed without a purchase order or letter of authorization. Written or verbal estimates will be supplied at customer request. For any warranty or service inquiries, call or refer all correspondence to:

Your local Sales Representative or Distributor:

-or-

FLIR Systems, Inc.
Customer Service Department
16505 S.W 72nd Avenue
Portland, Oregon 97224
USA

Telephone: **(800) 322-3731**
FAX: **(503) 684-3207**

CHAPTER 9 EMISSIVITY TABLES

INTRODUCTION

The following table provides typical emissivity values for a variety of materials. Remember, surface texture, temperature, corrosion (rust), or surface treatment (anodizing for example) can affect the emissivity value of a material, these values should only be used as a guide in establishing more precise values.

MATERIAL	TEMPERATURE °C	APPROXIMATE EMISSIVITY
METALS		
ALUMINUM		
Polished	100	0.09
Commercial sheet	100	0.09
Electrolytic chrome oxide	100	0.55
Lightly oxidized	25 - 600	0.10 - 0.20
Heavily oxidized	25 - 600	0.20 - 0.40
BRASS		
Mirror face	28	0.03
Oxidized	100 - 600	0.61 - 0.59

MATERIAL	TEMPERATURE °C	APPROXIMATE EMISSIVITY
CHROMIUM		
Polished	40 - 1090	0.08 - 0.26
COPPER		
Mirror face	100	0.03
Heavy oxidation	25	0.78
Cuprous oxide	800 - 1100	0.66 - 0.54
Molten copper	1080 - 1280	0.16 - 0.13
GOLD		
Mirror face	230 - 630	0.02
IRON		
Cast iron polished	200	0.21
Cast iron finished	20	0.44
Tempering iron polished	40 - 250	0.28
Steel casting polished	770 - 1040	0.52 - 0.56
Ground seal steel	945 - 1100	0.55 - 0.61
Oxidized surface:		
Completely rusted surface	20	0.70
Rolled sheet iron	22	0.66
Oxidized steel	100	0.74
Foundry iron (oxidized at 600°C)	198 - 600	0.64 - 0.78
Steel (oxidized at 600°C)	198 - 600	0.79
Electrolytic oxidized iron	125 - 500	0.78 - 0.82
Iron oxide	500 - 1200	0.85 - 0.89
Ingot	925 - 1120	0.87 - 0.95
Sheet iron	25	0.80

MATERIAL	TEMPERATURE °C	APPROXIMATE EMISSIVITY
LEAD		
Pure lead (non-oxidized)	125 - 225	0.06 - 0.08
Lightly oxidized	25 - 300	0.43
MAGNESIUM		
Oxidized	275 - 825	0.55 - 0.20
Oxidized	900 - 1670	0.20
MERCURY	0 - 100	0.09 - 0.12
NICKEL		
Electroplating - polished	25	0.05
Electroplating - not polished	20	0.11
Wire	185 - 1010	0.09 - 0.19
Plate (oxidized)	198 - 600	0.37 - 0.48
Nickel oxide	650 - 1255	0.59 - 0.86
ALLOYED NICKEL		
Chrome nickel	50 - 1040	0.64 - 0.76
Nichrome wire (bright)	50 - 1000	0.65 - 0.79
Nichrome wire (oxidized)	50 - 500	0.95 - 0.98
NIckel silver	100	0.14
SILVER		
Silver polished	100	0.01
STAINLESS STEEL		
18 - 8	25	0.16
304 (8 Cr, 18 Ni)	215 - 490	0.44 - 0.36
310 (25 Cr, 20 Ni)	215 - 520	0.90 - 0.97

MATERIAL	TEMPERATURE °C	APPROXIMATE EMISSIVITY
TIN		
Tin plate sheet on the market	100	0.07
Heavily oxidized	0 - 200	0.60
ZINC		
Oxidized at 400°C	400	0.11
Zincified sheet iron - bright	28	0.23
Gray oxide	25	0.11
Sheet zinc	100	0.05
PAINTS		
BLK LUSTER LACQUER (Sprayed rude iron)	26	0.88
BLACK LUSTER (Sprayed tin-plate sheet)	20	0.82
BLK OR WHT LACQUER	38 - 90	0.80 - 0.95
FLAT BLACK LACQUER	38 - 90	0.96 - 0.98
OIL PAINT (all colors)	100	0.92 - 0.96
RADIATOR PAINT		
White	100	0.79
Cream	100	0.77
Bleaching	100	0.84
LUSTER PAINT (all colors)		0.9
NON-LUSTER PAINT		0.95

MATERIAL	TEMPERATURE °C	APPROXIMATE EMISSIVITY
ORGANIC COMPOUNDS		
PAPER	0 - 100	0.80 - 0.95
PLASTER (rude lime)	10 - 85	0.91
PLASTIC (opacity, all colors)		0.95
CHINA (luster)	23	0.92
ROOFING PAPER	20	0.91
GUM		
Hard luster plate	25	0.94
Soft gray, rude-face	25	0.86
WATER	0 - 100	0.95 - 0.96
ICE		0.98
FROST		0.98
TEXTILE (all colors)		0.95
SILK		0.78
WOOL		0.78
SKIN		0.98
WOOD		0.78 - 0.94
CORTEX, LEAF		0.98

MATERIAL	TEMPERATURE °C	APPROXIMATE EMISSIVITY
CONSTRUCTION MATERIALS		
STONE		0.92
CONCRETE		0.94
CERAMIC	100 600	0.85 - 0.95 0.60 - 0.90
GRAVEL	38	0.28 - 0.44
PLASTER		0.93
STONE (plate)		0.92
ASBESTOS BOARD	25	0.96
ASBESTOS PAPER	38	0.93 - 0.94
MARBLE (Rough)	23	0.93
BRICK		
Red brick White brick White brick Silica brick	20 100 1000 1000	0.93 0.90 0.70 0.75 - 0.85
BRICK	1100	0.75
FIRE-BRICK	1100	0.75 - 0.80
CARBON (lamp black)	96 - 225	0.95
ENAMEL (white)	18	0.90
ASPHALT	0 - 200	0.85 - 0.93
GLASS (plane)	23	0.94
HEAT-RESISTANT GLASS	200 - 540	0.85 - 0.95
PLASTER	20	0.91
OAK	20	0.90

MATERIAL	TEMPERATURE °C	APPROXIMATE EMISSIVITY
ELECTRIC PARTS		
RESISTOR		
Carbon film		0.85
Insulated film		0.91 - 0.94
Metal film		0.88 - 0.90
Solid		0.80 - 0.93
Glass pipe		0.90
Coil type		0.87
Enamel finish		0.90
Enamel variable		0.83 - 0.95
CAPACITOR		
Ceramic (disk type)		0.90 - 0.94
Ceramic (cylinder type)		0.90
Film		0.90 - 0.93
Mica		0.94 - 0.95
Dipped mica		0.90 - 0.93
Glass		0.91 - 0.92
SEMICONDUCTOR		
Transistor (plastic)		0.80 - 0.90
Transistor (metal)		0.30 - 0.40
Diode		0.89 - 0.90
TRANS COIL		
Pulse trans		0.91 - 0.92
Peaking coil		0.91 - 0.92

MATERIAL	TEMPERATURE °C	APPROXIMATE EMISSIVITY
ELECTRONIC MATERIAL		
Epoxy glass board		0.86
Epoxy phenol board		0.80
Gold plated sheet copper		0.30
Solder plated copper		0.35
Tin plated lead wire		0.28
Holman copper wire		0.87 - 0.88
Steatite terminal		0.87

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