

# **Ti10, Ti25, TiR and TiR1**

Thermal Imagers

## Users Manual

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# Table of Contents

Title	Page
Introduction .....	1
Contacting Fluke .....	1
Safety Information.....	2
Unpacking the Imager .....	3
Charging the Battery.....	3
Turning the Imager On and Off.....	3
Features and Controls .....	3
Using the Menu .....	5
Changing the Displayed Language.....	5
Setting the Imager Clock .....	5
Setting the Date.....	6
Setting the Time.....	6
Focusing and Capturing an Image .....	6
Saving Imager Data .....	7
Adjusting the Thermal Image .....	7
Selecting a Palette .....	8
Setting the Range .....	8
Setting the Level (Manual).....	9
Setting the Temperature Span (Manual).....	9
Switching Between PIP and Full IR (Ti10 and TiR Only) .....	10
Setting IR Fusion <sup>®</sup> and PIP (Ti25 and TiR1 Only).....	10
Reviewing and Deleting Stored Images .....	10
Adding Voice Annotation to Saved Data (Ti25 and TiR1 Only) .....	11
Listening to Voice Annotations (Ti25 and TiR1 Only) .....	12
Changing the Temperature Units.....	12
Enabling/Disabling Spot Indicators (Ti25 and TiR1 Only).....	12
Making Accurate Temperature Measurements.....	12
Setting Emissivity (Ti25 and TiR1 only).....	13
Setting File Format .....	14
SmartView <sup>™</sup> Software.....	14

Changing the SD Card .....	15
Setting the Backlight.....	15
General Specifications .....	15
Detailed Specifications .....	17

# ***List of Tables***

<b>Table</b>	<b>Title</b>	<b>Page</b>
1.	Symbols .....	2
2.	Features and Controls .....	4

# ***List of Figures***

<b>Figure</b>	<b>Title</b>	<b>Page</b>
1.	Range and Span Settings .....	8



## ***Introduction***

The Fluke Ti10, Ti25, TiR, and TiR1 Thermal Imagers (hereafter “the Imager”) are handheld imaging cameras used for predictive maintenance, equipment troubleshooting, and verification. All four Imagers produce thermal and visual images on a 640 X 480 display. Thermal and visual images are displayed on the Imager LCD and can be saved to an SD Memory card. Transferring images to a PC is accomplished by removing the SD memory card and connecting it to a PC through the included card reader. SmartView™ software is included for image analysis and report generation from these saved images.

Both thermal and visual images can be presented simultaneously as a full fusion (thermal displayed over visual) image or as a Picture-In-Picture (PIP) image. The thermal image temperature range starts at -20 °C, and goes up to +100 °C for the TiR and TiR1, +250 °C for the Ti10 and +350 °C for the Ti25. The thermal image can be displayed using any one of a number of color palettes, depending on the model.

Imager power is supplied by a rechargeable Nickel Metal-Hydride battery. A full visual image (640 X 480) can be displayed and stored with each IR image.

In addition to the features mentioned above, the Ti25 and TiR1 provide voice recording for annotating saved images.

## ***Contacting Fluke***

To contact Fluke, call:

1-800-760-4523 in USA

1-800-363-5853 in Canada

+31-402-675-200 in Europe

+81-3-3434-0181 in Japan

+65-738-5655 in Singapore

+1-425-446-6888 from anywhere in the world

Or, visit Fluke’s Web site at [www.fluke.com](http://www.fluke.com)

To register your product, visit [register.fluke.com](http://register.fluke.com)

## Safety Information

Use the Imager only as specified in this manual. See Table 1 for a list of symbols used on the Imager and in this manual.

A **Warning** identifies hazardous conditions and actions that could cause bodily harm or death.

A **Caution** identifies conditions and actions that could damage the Imager or cause permanent loss of data.

### Warning

**To avoid a burn hazard, remember that highly reflective objects will result in lower than actual temperature measurements. See Emissivity information later in this manual for more information.**

**Do not use in a manner not specified in this manual or the protection provided by the equipment may be impaired.**

Table 1. Symbols

Symbol	Description	Symbol	Description
	Battery condition.		Battery charging.
	Conforms to requirements of European Union and European Free Trade Association.		Important information. See manual.
	Imager connected to battery charger.		Audio recording associated with the displayed image.
	On Off Symbol		Imager in sleep mode or audio paused.
	Do not dispose of this product as unsorted municipal waste. Go to Fluke's website for recycling information.		

## **Unpacking the Imager**

Carefully unpack the following items:

- Ti10, Ti25, TiR or TiR1 Imager
- AC Power Adapter/Charger
- Rugged Carrying Case
- SD Memory Card
- SD Card Reader
- Soft Transport Bag
- User Manuals (in various languages)
- SmartView™ Software
- Warranty Registration Card

## **Charging the Battery**

Before using the Imager for the first time, charge the battery for at least two hours. The Imager's battery condition is displayed in the upper-left corner of the display. When the last segment of the battery icon extinguishes, the Imager will shut down and will require recharging before operating again. To charge the Imager's battery:

1. Plug the ac input of the battery charger into an ac wall outlet.
2. Plug the battery charger's dc output into the Imagers ac adapter socket.

The optional Car Charger can also be used to recharge the Imager's battery.

While the battery is charging, the battery icon appears as  while the Imager is operating. With the Imager off,  appears in the display while connected to the battery charger.

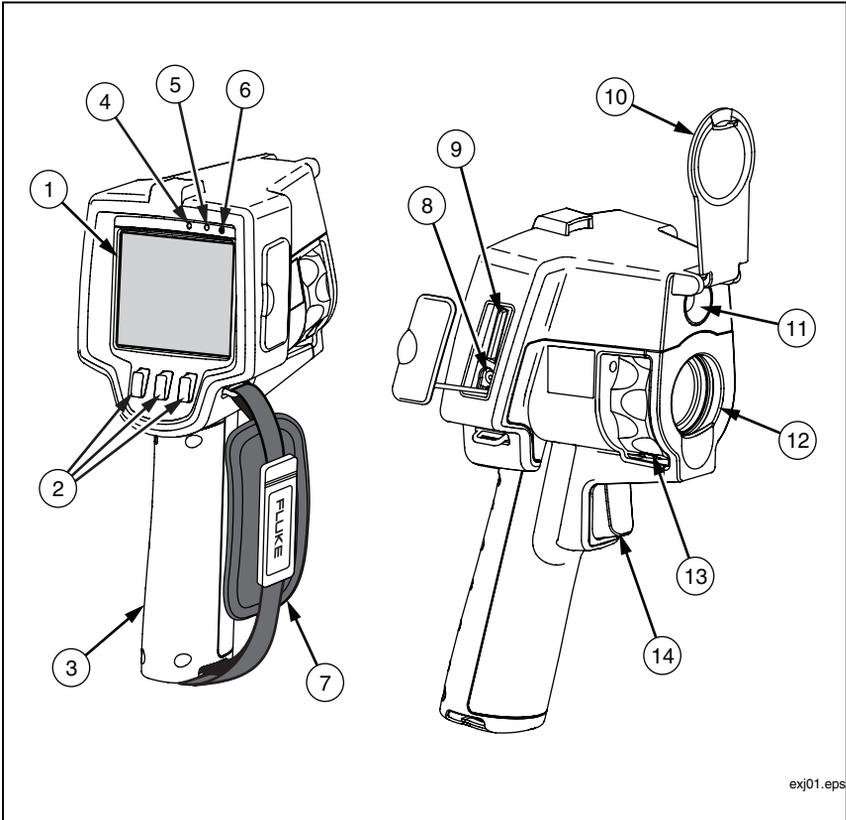
## **Turning the Imager On and Off**

To turn the Imager on or off, press the center softkey () for two seconds.

## **Features and Controls**

Imager features and controls are shown and described in Table 2.

**Table 2. Features and Controls**



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Item	Description
1	LCD Display
2	Function Softkeys (F1, F2, and F3)
3	Battery Cover
4	Speaker
5	Microphone
6	Auto backlight sensor
7	Hand strap
8	AC adapter/charger input terminal

**Table 2. Features and Controls (cont.)**

<b>Item</b>	<b>Description</b>
9	SD memory card compartment
10	Retractable Lens Cover
11	Visual camera
12	Thermal (IR) camera
13	Focus control
14	Trigger

## ***Using the Menu***

The menus, coupled with the three softkeys (F1, F2, and F3), provide access for setting features (date, time, language, units, backlight and spot temperatures), thermal image display, and saving and viewing stored images.

To bring up the menu, press F2. The text above each function softkey (F1, F2, and F3) corresponds to that softkey throughout all menu screens.

Press F2 to open and cycle through the menus.

The menu will disappear several seconds after the last press of a softkey.

## ***Changing the Displayed Language***

To change the display to present information in another language:

1. Press F2 until the F1 softkey label reads **Language**.
2. Press the softkey labeled **Language**.
3. Press the softkey labeled **Up** or **Down** to move the cursor to the desired language.
4. Press the softkey labeled **Back/Done** to set the units.

## ***Setting the Imager Clock***

The Imager has an internal real-time clock that holds the date and time of day.

## **Setting the Date**

To set the date:

1. Press **F1** until **Date** appears over the F1 softkey.
2. Press the softkey labeled **Date**.

The date can be displayed in one of two formats: **MM/DD/YY** or **DD/MM/YY**.

3. Press the softkey labeled with the desired date format.
4. Press the softkey labeled **Up** (**F1**) or **Down** (**F3**) to adjust the selected date element.
5. Press the softkey labeled **Next** to move to the next date element.
6. Press the softkey labeled **Done** when finished.

## **Setting the Time**

To set the time:

1. Press **F3** until **Time** appears over the F3 softkey.
2. Press the softkey labeled **Time**.

The Imager will display time in two different formats: 24 hour or 12 hour.

3. Press the softkey labeled with the desired format.
4. Press the softkey labeled **Up** (**F1**) or **Down** (**F3**) to adjust the selected time element.
5. Press the softkey labeled **Next** to move to the next time element.
6. Press softkey labeled **Done** when finished.

The 12 hour format has a selection for setting whether the time is AM or PM.

## **Focusing and Capturing an Image**

Point the Imager at the object or area of interest, focus by turning the focus control until the image displayed on the LCD is as clear as possible, and then press and release the trigger. The Imager displays the captured image and a menu. The TiR and Ti10 menu allows image storage. The TiR1 and Ti25 menu allow image storage, image setting adjustments, and recording of audio annotations. To cancel image storage and return to live viewing, press and release the trigger.

*Note*

*Minimum focus distance for thermal (IR) camera is 15 cm (approx. 6 inches). Minimum focus distance for visible (visual) light camera is 46 cm (approx. 18 inches).*

*Note*

*The Imager can save the image as a simple picture or as a radiometric image that allows further temperature analysis. To change the saved image format, see the “Setting File Format” section later in this manual.*

*Note*

*When IR-Fusion<sup>®</sup> is enabled, adjusting the IR focus control will align the IR and visible light images on the LCD display. When the IR image is properly focused, the images should be almost perfectly aligned. This functionality provides an easy method to get a good focus on the IR image. Because of image parallax and minimum focus specifications, the minimum distance for an aligned IR-Fusion<sup>®</sup> image is approximately 46 cm (18 inches).*

Pressing the softkey labeled **Settings** allows modification of image characteristics such as palette, picture-in-picture, and range. Refer to the appropriate setting section for operational details.

## **Saving Imager Data**

The Imager saves displayed data on an SD card placed into the camera. See the “Changing the SD Card” section for inserting and ejecting an SD card. The file format set on the Imager determines how the measured information is stored on the SD card. To store Imager data:

1. Point camera at the area of interest and pull the trigger to capture an image. This will freeze the image in the display and bring up the Image Capture menu.
2. Press the softkey labeled **Store**. If the SD card is in the Imager and there is enough room left on the card, the information is stored.

## **Adjusting the Thermal Image**

The Imager uses different colors or shades of gray to display the temperature gradient of the area within the Imager’s field of view. There are two adjustments for changing how the Imager displays the image: Palette and Range.

## **Selecting a Palette**

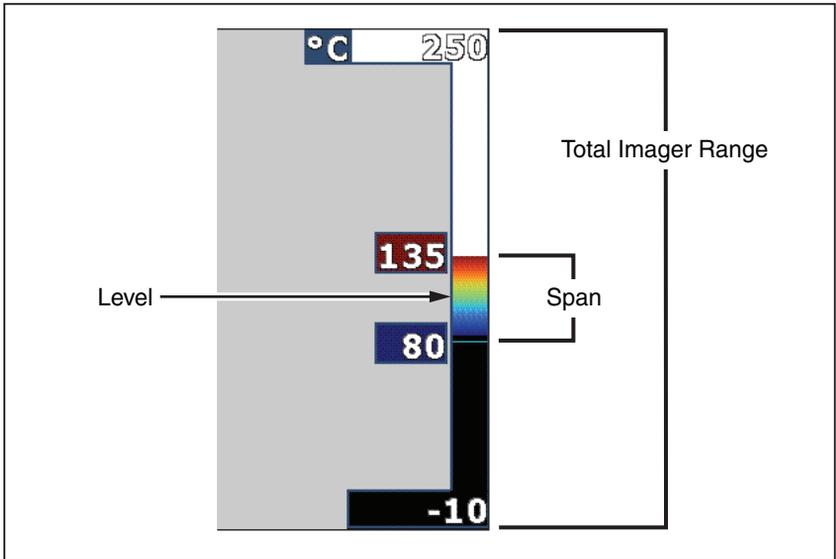
The palette menu provides different thermal viewing patterns. Grayscale, Blue-Red, High Contrast, and Ironbow are available in all four Imagers. The TiR1 and Ti25 add Amber and Hot Metal to the list. To select a palette:

1. Press  until **Palette** appears over .
2. Press the softkey labeled **Palette** to display the available palette options.
3. Press the softkey labeled **Up** or **Down** to move between the palette options.
4. Press the softkey labeled **Back/Done** to set the Imager to the selected palette.

## **Setting the Range**

Viewing temperature (level and span) is set either automatically or manually. To set the range, do the following:

1. Press  until **Range** appears over .
2. Press the softkey labeled **Range**.
3. Press the softkey labeled **Manual** to set the Imager to manual ranging and press the softkey labeled **Auto** to select auto ranging.



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**Figure 1. Range and Span Settings**

### **Setting the Level (Manual)**

When put into manual ranging, the level setting adjusts the thermal span within the total temperature range of the Imager. See Figure 1. To set the level:

1. After entering the manual range mode (See the “Setting the Range” section above), press the softkey labeled **Level**.
2. Press the softkey labeled **Up** to move the temperature span to higher temperatures or **Down** to move the span to lower temperatures.
3. Press the softkey labeled **Done** to set the Imager’s range level.

The scale along the right side of the display indicates the range.

### **Setting the Temperature Span (Manual)**

When put into manual ranging, the span setting adjusts the palette over a temperature range within the total range of the Imager. See Figure 1. To adjust the temperature span:

1. After entering the manual range mode (See the “Setting the Range” section above), press the softkey labeled **Span**.

2. Press the softkey labeled **Increase** to widen the temperature span or **Decrease** to narrow it.
3. Press the softkey labeled **Done** to set the Imager's range level.

## **Switching Between PIP and Full IR (Ti10 and TiR Only)**

The Imager can be set to display a full infrared image (Full IR) or an infrared image surrounded by a visual light image (Picture-in-Picture / PIP). To switch the Ti10 or TiR Imagers between a full infrared display and Picture-In-Picture (PIP) display:

1. Press **F2** until **Fusion** appears over **F3**.
2. Press the softkey labeled **Up** or **Down** to toggle the display between **PIP** and **Full IR**.
3. Press the softkey labeled **Back/Done** when finished.

## **Setting IR-Fusion® and PIP (Ti25 and TiR1 Only)**

Blending a visual image with a thermal image is called IR-Fusion®. The Imager is set to one of three different levels of blending. In addition to setting the visual to thermal blending, the IR-Fusion® menu is used to select between a full thermal image display, or a Picture-In-Picture (PIP) display. To set the IR-Fusion® level and PIP display:

1. Press **F2** until **IRFusion** appears over **F3**.
2. Press the softkey labeled **IRFusion** to reveal the IR-Fusion® menu.
3. Press the softkey labeled **Up** or **Down** to move between the six IR-Fusion® settings. The top three settings select a PIP display. The bottom three settings have full screen IR with different levels of visible blending.
4. Press the softkey labeled **Back/Done** when finished.

## **Reviewing and Deleting Stored Images**

To view stored images on the SD card,

1. Press **F2** until **Memory** appears over **F1**.
2. Press the softkey labeled **Memory** to reveal the review menu.
3. Press the softkey labeled **Review**.

4. Press the softkey labeled **Up** to display the previous image or **Down** to display the next stored image.

To delete a single Image from the SD card:

1. Perform the steps under viewing stored images above to bring the desired image to the display.
2. Press the softkey labeled **Select**.
3. Press the softkey labeled **Delete**.

To delete all the images from the SD card:

1. Press  to activate the menu.
2. Press the softkey labeled **Memory**.
3. Press the softkey labeled **All Images**.

## ***Adding Voice Annotation to Saved Data (Ti25 and TiR1 Only)***

Voice annotation can only be added to an image prior to storing it. After capturing an image, the Image Capture menu appears. To add a voice annotation to the image:

1. Press the softkey labeled **Audio**.
2. Press the softkey labeled **Record** to start the recording.
3. Speak into the Imager's microphone opening. Up to 60 seconds of audio can be recorded for each image.
4. When done recording, press the softkey labeled **Review** to listen to what was recorded. When an audio recording has been created for an image,  appears in the display while the image is displayed. To keep the audio annotation, proceed to the next step. Otherwise, press the softkey labeled **Append** or **Replace** to modify the recording before storing the image. Once stored, the audio annotation can only be reviewed and not modified.
5. Press the softkey labeled **Back** to return to the Audio menu.
6. Press the softkey labeled **Store** to store the measured data and audio annotation.

## ***Listening to Voice Annotations (Ti25 and TiR1 Only)***

To play the voice annotation already stored with an image on the SD card:

1. Perform the steps in the “Reviewing and Deleting Stored Images” section to bring the desired image to the Imager’s display.
2. Press the softkey labeled **Select**.
3. Press the softkey labeled **Audio**.
4. Press the softkey labeled **Review**.

The saved voice annotation will be replayed through the Imager’s speaker.

## ***Changing the Temperature Units***

The Imager will display temperature in Fahrenheit or Celsius. To change the temperature units:

1. Press  until **Units** is displayed over .
2. Press the softkey labeled **Units**.
3. Press  for Celsius or  for Fahrenheit.
4. Press the softkey labeled **Back/Done** to set the language.

## ***Enabling/Disabling Spot Indicators (Ti25 and TiR1 Only)***

To enable or disable the hot and cold spot indicators:

1. Press  until **Spot Temp** appears over .
2. Press the softkey labeled **Spot Temp**.
3. Press the softkey labeled **Off** to turn the hot spot indicators off or press the softkey labeled **On** to turn them on.
4. Press the softkey labeled **Back/Done** to accept the setting.

## ***Making Accurate Temperature Measurements***

All objects radiate infrared energy. The amount of energy radiated is based on two primary factors: the surface temperature of the object and the emissivity of

the object's surface. The Imager detects the infrared energy from an object and uses this information to estimate the temperature of the object. Most of the objects measured such as painted metal, wood, water, skin, and cloth are very efficient at radiating energy and it is easy to get very accurate measurements. For surfaces that are efficient at radiating energy (high emissivity), the emissivity factor is estimated to be 95% (or 0.95). This estimate works for most purposes. This simplification does not work however, on shiny surfaces or unpainted metals. These materials are not efficient at radiating energy and are classified as having low emissivity. To accurately measure materials with a low emissivity, an emissivity correction is necessary. The easiest correction method is to set the Imager to the proper emissivity value so the Imager automatically calculates the correct surface temperature. If the Imager uses a fixed emissivity value (meaning that it is set to one value and the user cannot adjust it), then the Imager's measurement must be multiplied by a value found in a look up table to get a more accurate estimate of the actual temperature.

The TiR1 and Ti25 have the ability to set emissivity by directly entering a value or using a table of built-in values. The TiR and Ti10 have emissivity that is permanently fixed at 0.95, which works well for most surfaces but can provide very inaccurate reading if used directly on a shiny metal surface.

A significant amount of information is available on emissivity. Further study of this topic is recommended to get the most accurate temperature measurements using the Imager.

## **Setting Emissivity (Ti25 and TiR1 only)**

Setting your Imager with correct emissivity values is critical to making accurate temperature measurements. To set the emissivity value:

1. Press  until **Emissivity** appears over .
2. Press the softkey labeled **Emissivity**.

At this point, emissivity can be set directly as a value or selected from a list of emissivity values for some common materials. To select from a list of common materials:

1. Press the softkey labeled **Table**.
2. Press the softkey labeled **Up** or Down to move between the materials in the list. The emissivity value for each material is shown on the screen as the selection moves between the different materials
3. Press the softkey labeled **Done** to select the highlighted material.

To set the emissivity value directly:

1. Press the softkey labeled **ε**.
2. Press the softkey labeled **Up** or **Down** to increment or decrement respectively the emissivity value displayed just above the softkey labels.
3. Press the softkey labeled **Done** to select the set value.

## **Setting File Format**

Data stored on the Imager's SD card can be saved in two different file formats: .bmp and .is2. This setting is saved and remains valid when the Imager is turned off and back on. It can always be changed prior to capturing images.

To change the file format:

1. Press **F6** until **File Format** appears over softkey F3.
2. Press the softkey labeled **File Format**.
3. Press **F1** to set the bitmap (.bmp) file format, or **F9** to set the infrared storage (.is2) file format.

The bitmap format only saves the image shown on the Imager's display. The ".is2" format is a proprietary file format that saves the radiometric data, fusion blend, palette, visual image, screen settings, and voice recording to annotate the stored image.

Bitmap (.bmp) images can be transferred to a PC and used immediately in non-proprietary software and electronic documents. Images in ".is2" format can be transferred to a PC for further analysis and report generation through Fluke SmartView™ software or non-Fluke software which is available from specially approved software vendors. Visit the Fluke web site or contact Fluke to find out about currently available software options.

## **SmartView™ Software**

SmartView™ software is supplied with the thermal imager. This software is specially designed for Fluke imagers and contains powerful functions to analyze images, organize data storage, and create professional reports. SmartView™ allows audio annotations to be reviewed on a PC. SmartView™ can be used to export IR and visible images as JPEG, BMP, GIF, TIFF, WMF, EXIF, or EMF formatted files.

## Changing the SD Card

To eject an SD card from the Imager, press in on the exposed edge of the SD card and then release. The card should pop partially out after releasing it. Carefully pull the card out of the slot.

### Note

*The SD Card can be inserted and removed while the Imager is in operation.*

To insert an SD card into the Imager, carefully slip the card into the slot with the card's label facing toward the LCD display. Push the card in until it catches.

## Setting the Backlight

The backlight can be set to Auto-sensing or Full-Bright. To set the backlight:

1. Press  until **Backlight** appears over .
2. Press the softkey labeled **Backlight**.
3. Press the softkey labeled **Auto** or **Full-Bright**.

### Note

*To extend battery life, Auto-Sensing automatically adjusts backlight brightness based on ambient light levels.*

## General Specifications

### Temperature

Operating.....	-10 °C to 50 °C (14 °F to 122 °F)
Storage.....	-20 °C to +50 °C (-4 °F to 122 °F) without batteries

**Relative Humidity**..... 10 to 90 % non-condensing

**Display**..... 640 x 480 color LCD, approx. 2" X 3"  
(Landscape orientation)  
with Backlight (selectable Bright or Auto)

### Controls and Adjustments

User selectable temperature scale (°C/°F)

Language selection

Time/Date set

Emissivity selection (Ti25 and TiR1 only)

User selectable Hot Spot and Cold Spot on the image (TiR1 and Ti25 only)

<b>Software</b> .....	SmartView™ full analysis and reporting software included
<b>Power</b>	
Battery .....	Rechargeable battery pack (included)
Battery Life.....	3 to 4 hours continuous use (assumes 50 % brightness of LCD)
Battery Charge Time .....	2 hours full charge with ac adapter or dc car charger
AC Operation/Charging .....	AC adapter/charger (110 – 220 Vac, 50/60 Hz). Charges battery while imager is operating. Universal ac mains adapters included.
Power Saving.....	Sleep Mode activated after 5 minutes of inactivity Automatic Power Off after 30 minutes of inactivity
<b>Safety Standards</b>	
CE Directive .....	IEC/EN 61010-1 2 <sup>nd</sup> Edition Pollution Degree 2
<b>Electromagnetic Compatibility</b>	
EMC Directive .....	EN61326-1
C Tick.....	IEC/EN 61326
US FCC .....	CFR 47, Part 15 Class A
<b>Vibration</b> .....	2 G, IEC 68-2-29
<b>Shock</b> .....	25 G, IEC 68-2-6
<b>Drop</b> .....	2 meter drop, all sides
<b>Size (H x W x L)</b> .....	10 in x 5 in x 6 in (25.4 cm x 12.7 cm x 15.2 cm)
<b>Weight</b> .....	1.1 kg (2.35 lb)
<b>Enclosure Rating</b> .....	IP54
<b>Warranty</b> .....	2 years
<b>Calibration Cycle</b> .....	2 years (assumes normal operation and normal aging)
<b>Supported Languages</b> .....	English, Italian, German, Spanish, French, Russian, Portuguese, Swedish, Turkish, Czech, Polish, Finnish, Simplified Chinese, Traditional Chinese, Korean, and Japanese

## **Detailed Specifications**

### **Temperature Measurements**

Temperature Range (not calibrated below -10 °C)

TiR and TiR1 .....	-20 °C to +100 °C
Ti10 .....	-20 °C to +250 °C
Ti25 .....	-20 °C to +350 °C

Accuracy

TiR and Ti10 .....	±5 °C or 5 % (whichever is greater)
TiR1 and Ti25 .....	±2 °C or 2 % (whichever is greater)

Measurement Modes ..... Smooth Auto-Scaling and Manual Scaling

On-screen Emissivity Correction ..... (Ti25 and TiR1 Only)

### **Imaging Performance**

Field of View ..... 23 ° x 17 °

Spatial Resolution (IFOV) ..... 2.5 mRad

Minimum Focus Distance

Thermal Lens.....	15 cm (approx. 6 in)
Visible (Visual) Light Lens.....	46 cm (approx. 18 in)

Focus ..... Manual

Image Frequency..... 9 Hz refresh rate

Detector Type ..... 160 X 120 Focal Plane Array,  
uncooled microbolometer

Infrared Lens Type..... 20 mm EFL, F/0.8 lens

Thermal Sensitivity (NETD)

Ti10 .....	≤0.2 °C at 30 °C (200 mK)
Ti25 .....	≤0.1 °C at 30 °C (100 mK)
TiR.....	≤0.1 °C at 30 °C (100 mK)
TiR1.....	≤0.07 °C at 30 °C (70 mK)

Infrared Spectral Band..... 7.5 μm to 14 μm

Visual Camera ..... 640 x 480 resolution

### **Image Presentation**

Palettes

TiR and Ti10 .....	Ironbow, Blue-Red, High Contrast, Grey
TiR1 and Ti25 .....	Ironbow, Blue-Red, High Contrast Amber, Hot Metal, Grey

Level and Span

Smooth Auto-Scaling and Manual Scaling of level and span
Minimum Span (in manual mode)

Ti10.....	5 °C
Ti25, TiR, and TiR1 .....	2.5 °C
Minimum span (in auto mode)	
Ti10.....	10 °C
Ti25, TiR, and TiR1 .....	5 °C

**IR-Fusion® Information**

Visual and IR Blending (Ti25 and TiR1 only)

Picture-In-Picture (PIP)

Ti10 and TiR .....100 % IR displayed in center 320 x 240 pixels

Ti25 and TiR1.....Three levels of on-screen IR blending displayed in center 320 x 240 pixels

Full Screen (PIP off)

Ti10 and TiR .....100 % IR displayed on 640 x 480 LCD

Ti25 and TiR1.....Three levels of on-screen IR blending displayed on 640 x 480 LCD

Ti25 and TiR1 allows user to adjust palette, alpha blend, level, span, PIP, and emissivity on a captured image before it is stored.

**Voice Annotation**.....60 seconds maximum recording time per image (TiR1 and Ti25 only)

**Image and Data Storage**

Storage Medium.....SD Memory Card (2 GB memory card will store at least 1200 fully radiometric (.is2) IR and linked visual images each with 60 seconds voice annotations or 3000 basic (.bmp) IR images)

File Formats.....Non-Radiometric (.bmp) or Fully-Radiometric (.is2)  
 No analysis software required for Non-Radiometric (.bmp) files

Export File Formats w/ SmartView® Software.....JPEG, JPG, JPE, JFIF, BMP, GIF, DIP, PNG, TIF, and TIFF