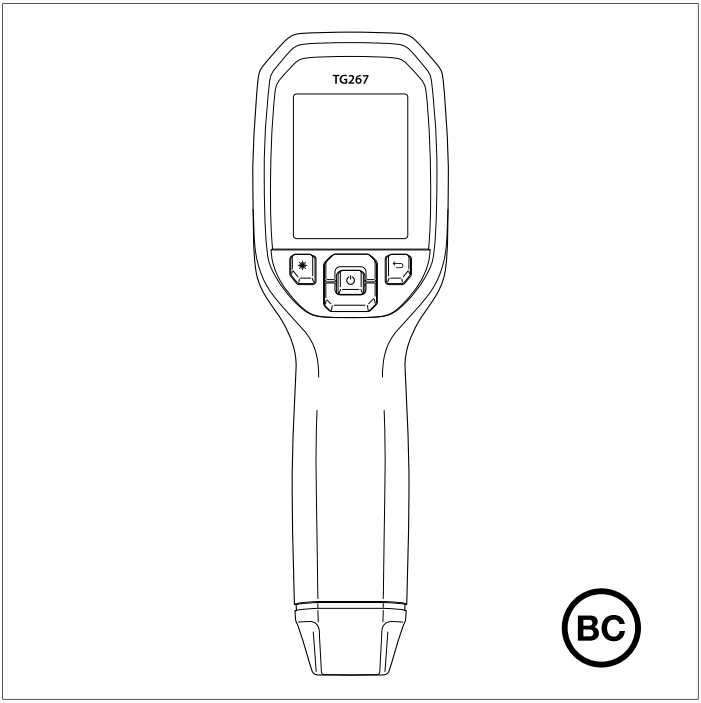
USER MANUAL
Automotive Diagnostic Thermal Camera

Models TG267 and TG297



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Automotive Diagnostic Thermal Camera

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1 Advisories

1.1 Copyright

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1.2 Quality Assurance

The Quality Management System under which these products are developed and manufactured has been certified in accordance with the ISO 9001 standard.

FLIR Systems is committed to a policy of continuous development; therefore, we reserve the right to make changes and improvements on any of the products without prior notice.

1.3 Documentation

To access the latest manuals and notifications, go to the Download tab at: https://support.flir.com. It only takes a few minutes to register online. In the download area you will also find the latest releases of manuals for our other products, as well as manuals for our historical and obsolete products.

1.4 Disposal of Electronic Waste

As with most electronic products, this equipment must be disposed of in an environmentally friendly way, and in accordance with existing regulations for electronic waste. Please contact your FLIR Systems representative for more details.

2 Introduction

The FLIR TG267 and TG297 are Automotive Diagnostic Thermal Cameras which combine non-contact temperature measurement and thermal imaging into one troubleshooting tool to help you quickly find the source of heat-related problems and spot potential faults when performing automotive maintenance and repair.

The FLIR TG267 adds Type-K thermocouple contact temperature measurements.

The FLIR TG297 offers a high temperature range to 1886°F (1080°C).

Visit https://support.flir.com/prodreg to register your instrument and to extend the standard one-year warranty to the 2-10 Year Warranty.

Features

- See beyond the limitations of single-spot IR thermometers with a 160 x 120 pixel true thermal imager (Lepton® microbolometer with integrated shutter)
- Visible spectrum 2M pixel digital camera
- Adjustable MSX® (Multi-Spectral Dynamic Imaging) adds key details from the visible spectrum camera to the IR image to help you diagnose problems
- 3 presets and 1 custom emissivity setting
- LED Work light
- Laser pointer and cross-hair display for easy targeting of measurement spot
- Type-K thermocouple contact measurements (TG267)
- High temperature lever switch (TG297) engages high temperature mode
- 4 GB internal memory for storing captured images
- USB–C connectivity for image transfer and charging
- Bluetooth® real-time remote temperature monitoring and camera image transmission to mobile devices
- Easy to read 320 x 240 2.4” TFT color LCD display
- Intuitive programming menu system translated in more than 21 languages
- IP54 enclosure (with top flap closed) protects from dirt, dust, and oil
- Rechargeable lithium battery
- Auto power off (APO), user adjustable
- Accessory mounting for tripods, extender poles, etc.

3 Safety

3.1 Safety Warnings and Cautions

WARNING

⚠This symbol, adjacent to another symbol indicates the user must refer to the manual for further information.

WARNING

The instrument's IP54 rating is only in affect when the top flap (covering the USB-C and Thermocouple jacks) is completely sealed. Do not operate the instrument with the flap open, except for charging, PC interface, or Type-K thermocouple use.

CAUTION

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

CAUTION

Use extreme caution when the Laser pointer is on.

CAUTION

Do not point the Laser beam toward anyone's eye or allow the beam to strike the eye from a reflective surface.

CAUTION

Do not use the Laser near explosive gases or in other potentially explosive areas.

CAUTION

Refer to the CAUTION statement label (shown below) for critical safety information.

4 Description

4.1 Product Description

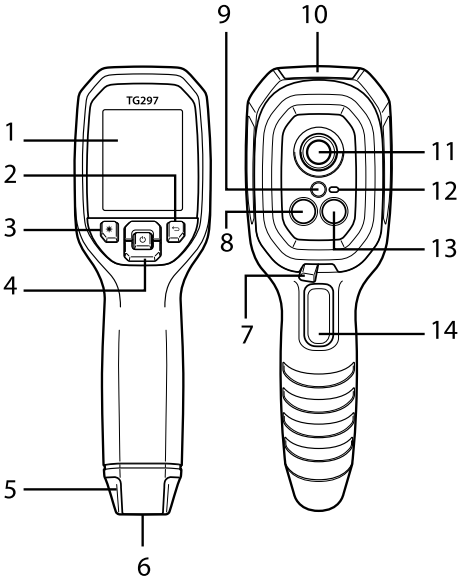


Figure 4.1 Imaging IR Thermometer Description (TG297 pictured)

1. Display area
2. Return button (to back up in the menu system)
3. Laser pointer button
4. Up/Down Navigation buttons and Power button (long press)/Menu button (short press)
5. Lanyard post
6. Accessory mount
7. High temperature lever switch (TG297)
8. 160 x 120 pixel Lepton® IR camera
9. Laser pointer with circular target-spot assist
10. USB-C and Thermocouple jack compartment
11. Spot thermal sensor
12. Work light (LED)
13. 2M pixel visible spectrum camera
14. Image capture trigger (also used to exit the menu system)

4.2 Control Button Descriptions

	Long press to power ON or OFF Short press to access the menu system
	Return button. Back out to previous screen in menus
	Press to scroll upward in the menus
	Press to scroll downward in the menus
	Press to activate the Laser pointer
TRIGGER	Pull trigger to capture camera image Pull trigger to exit the menu system

4.3 Display Description

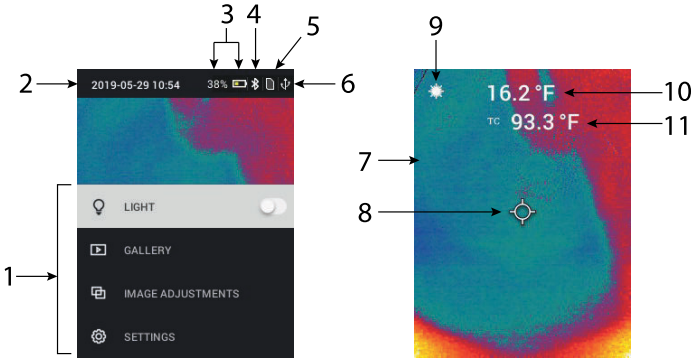


Figure 4.2 Display Description

1. Menu area
2. Date and time
3. Battery status indicators
4. Bluetooth® active
5. Image storage space status indicator
6. USB connection active

7. Camera image area
8. Center spot cross-hairs
9. Laser Pointer active
10. Center spot temperature measurement
11. Thermocouple measurement (TG267)

5 Operation

5.1 Camera Power

Power is supplied by a rechargeable lithium battery. Long press the power button (center) to switch the camera ON or OFF. If the camera does not power ON, charge the battery by connecting to an AC wall charger using the supplied USB-C cable. The USB-C jack is located in the top compartment. Do not use the camera while it is charging. When the top flap is closed, the camera is rated IP54 for encapsulation. See Section 9.2, *Battery Considerations and Service*, for more information.

The camera has an Auto Power OFF (APO) utility that switches it OFF automatically if no buttons are pressed for the duration of the selected APO time. Use the menu system (under *Device Settings*) To set the APO timer. See Section 6, *Programming Menu System*, for more information.

5.2 IR Camera and Thermometer

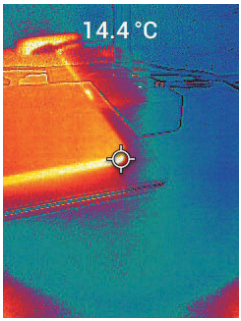


Figure 5.1 Combined Thermal and Visible Image (MSX®)

1. Long press the power button to switch the camera ON.
2. If not already selected, choose the Thermal plus Visible Image mode in the menu system (under *Image Adjustments/Image Mode*). You can adjust the MSX® (Multi-Spectral Dynamic Imaging) alignment in the *Image Mode* area of the menu.
3. Point the camera toward the test area and scan as desired. View the camera image on the display.
4. Use the cross-hair icon to target a spot. If the cross-hairs are not shown, enable the center spot in the menu system (under *Measurement*).

5. Press the Laser pointer button to switch ON the Laser pointer. The Laser pointer has a circular spot indicating the area that is being monitored for temperature. See the Laser pointer image example below in **Figure 5.2**. If the Laser beam does not appear when the button is pressed, enable it in the menu system (under *Device Settings*).
6. The temperature reading on the display represents the measurement of the targeted spot. See **Figure 5–1**.
7. The distance-to-spot ratio is 24:1 (TG267) or 30:1 (TG297) and the minimum target distance is 10.2 in. (26 cm).
8. To measure higher than 752°F (400°C) on the TG297 use the High Temperature Switch, see Section 5.3 below.
9. If a measurement is out of range, the display will show '**OL**'.
10. To adjust the Emissivity, use the menu system (under *Measurement*).
11. To change the display color palette, use the menu system (under *Image Adjustments/Colors*).

Figure 5.2 Laser pointer with temperature measurement spot

5.3 High Temperature Switch (TG297)

1. To access the high temperature mode of the TG297, slide the lever to the right (to expose the red color code).
2. The lever is located directly below the lens area and above the image capture trigger.
3. When engaged, the high end of the temperature range (>752°F [400°C]) is accessible.

5.4 Type-K Thermocouple Measurements (TG267)

WARNING

Note the temperature range limit printed on the thermocouple connector (or verify the range with the manufacturer). The supplied probe cannot be used to measure temperature through the entire display range listed in the specification section of this manual; measuring temperature beyond the range printed on the thermocouple connector can damage the probe and the TG267. If the thermocouple does not include a range label, please contact FLIR technical support.

WARNING

To avoid electrical shock, do not use this instrument when working near voltages > 24V AC/DC. Do not allow the thermocouple to touch live circuitry.

WARNING

To avoid damage and burns, do not make temperature measurements in microwave ovens.

CAUTION

Repeated flexing can break the thermocouple leads. To prolong lead life, avoid sharp bends, especially near the connector.

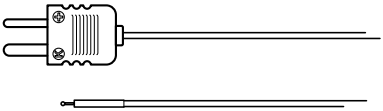


Figure 5.3 Supplied Type-K Thermocouple

Figure 5.4 Thermocouple temperature readout (33.7°C, in this example)

1. If necessary, enable the thermocouple mode in the menu system (under *Measurement*). The thermocouple is enabled when the '**TC**' label is shown on the display.
2. Connect a Type-K thermocouple sub-miniature plug (see **Figure 5.3**) to the jack in the top compartment.
3. Touch the thermocouple probe tip to the surface under test or hold it in air. Read the temperature value on the display next to the '**TC**' label, see **Figure 5–4**.
4. Go to *General Settings* in the menu system to select °C or °F temperature units.

5. If the thermocouple is not connected when the Type-K mode is selected, the display will show dashes in place of a reading. If the measurement is out of range, the display will show '**OL**'.
6. To find the optimum emissivity setting for a given surface, take an IR temperature measurement and then take a Type-K measurement. Adjust the emissivity until the IR measurement value equals the Type-K measurement value. Now the emissivity is optimized. Emissivity can be set in the menu system (under *Measurement*).

5.5 Visible Spectrum Camera

Figure 5.5 Visible Spectrum Digital Camera Image

1. Long press the power button to switch the camera ON.
2. Select the Visible Image mode in the menu system (under *Image Adjustments/Image Mode*).
3. Point the camera toward the test area and scan as desired.
4. View the image on the display, see **Figure 5–5**. Pull the image capture trigger to save an image. Refer to Section 5.6, *Capturing and Working with Images*, (next) for more information.

5.6 Capturing and Working with Images

1. To capture a camera image, pull and release the trigger. Note that an image cannot be saved if a USB cable is connected.
2. After a successful capture, a display confirmation will briefly appear showing the filename for the image.
3. The image is now stored in the internal memory.

4. To send/view/delete images, access the *Gallery* mode in the main menu. In the Gallery, scroll through the stored images with the arrows and open an image with the MENU button. Once an image is opened, press MENU again to see the SEND/CANCEL/DELETE/DELETE ALL IMAGES menu. Select the SEND command to transmit an image, via Bluetooth®, to a paired mobile device. Select the DELETE or DELETE ALL IMAGES command to erase the selected image or all of the stored images. Press CANCEL to return to the previous screen.
5. You can send images to a mobile device using Bluetooth® (see Section 7, *Bluetooth*®) or you can transfer images to your PC by connecting to a PC using the supplied USB-C cable. The USB jack is located at the top compartment. Once connected to the PC you can use the camera as you would any external storage device.

Note: *Device is not 100% compatible with Mac OS, please do not format its internal memory via Mac OS.*

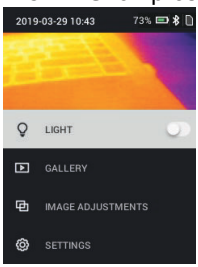
6 Programming Menu System

6.1 Menu System Basics

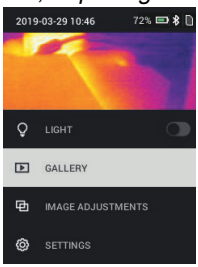
Short press the MENU button to access the menu system. Use the MENU button to switch settings ON or OFF, use the Return button to move to the previous screen, and use the arrows to scroll. The MENU button is used in some cases to confirm settings. Use the trigger to exit the menu system.

6.2 Main Menu

- **LIGHT**: Short press MENU to switch the Work light ON or OFF.

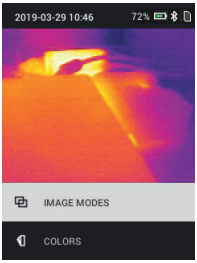


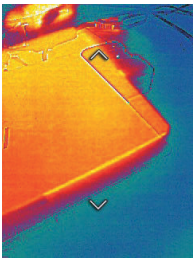
- **GALLERY**: Press MENU to access the stored images. Use the arrow buttons to scroll through the stored images and use the MENU button to open an image. Press MENU at an opened image to see the SEND/CANCEL/DELETE/DELETE ALL IMAGES menu. Select SEND to transmit the selected image to a mobile device (see Section 7, *Bluetooth*® and Section 5.6, *Capturing and Working with Images*, for more information).



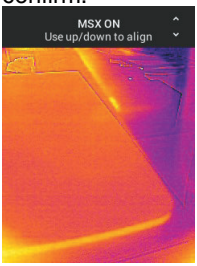
- **IMAGE ADJUSTMENTS**: Press MENU to access IMAGE MODES (including MSX® alignment) and COLORS, see below:

1. Image Modes: Press MENU at IMAGE MODES and use the arrow buttons to select VISIBLE IMAGE or THERMAL PLUS VISIBLE IMAGE (MSX®).

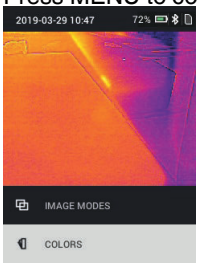


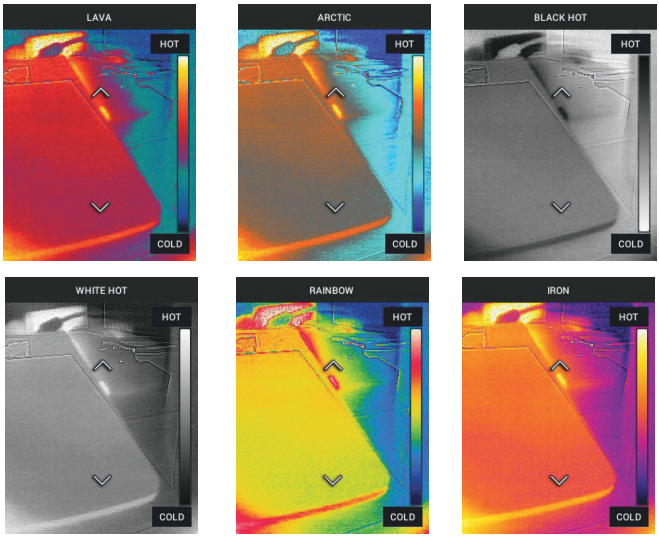


2. MSX® Alignment: While at the Image Mode menu you can adjust the MSX® alignment so that the thermal image and the visible image are aligned accurately. While viewing the THERMAL PLUS VISIBLE IMAGE screen in the menu, press MENU to access the MSX® adjustment screen and then use the arrow buttons to adjust the alignment. Press MENU to confirm.



3. Colors: Press MENU at the Colors menu and use the arrow buttons to select a color palette: Iron, Rainbow, White hot, Black hot, Arctic, or Lava. Press MENU to confirm selection.



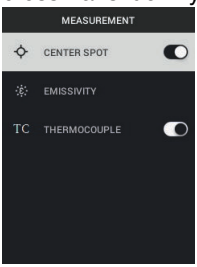


- **SETTINGS**: Press MENU to access the Settings sub-menu (see below):

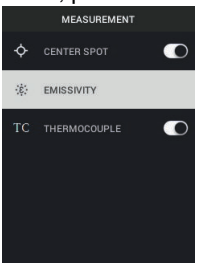
6.3 Settings Sub-Menu

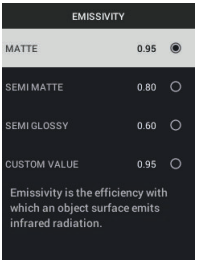
- **MEASUREMENT**

1. Center Spot: Press MENU to enable/disable the display cross-hairs. The cross-hairs identify the spot that is being measured for temperature.

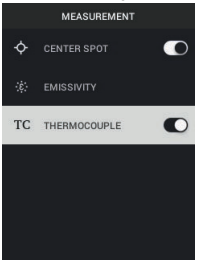


2. Emissivity: Press MENU to open the Emissivity adjustment utility. Use the arrows to scroll through the presets (0.95, 0.80, and 0.60) and use the MENU button to select a preset. Choose the Custom Value utility (last selection on the list) to select a specific emissivity value. At the Custom Value setting, press MENU and then use the arrows to select the emissivity value; press MENU to confirm.



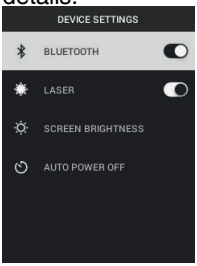


3. Thermocouple: Press MENU to toggle the Thermocouple mode ON/OFF (TG267 only).

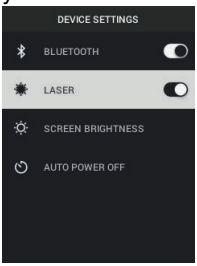


- **DEVICE SETTINGS**

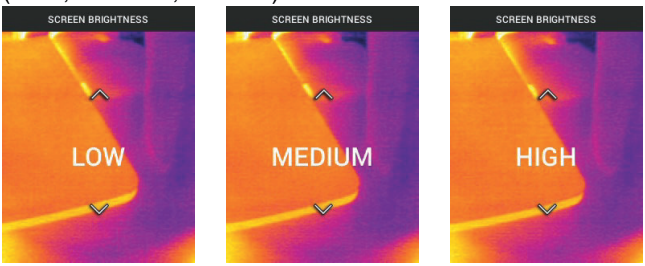
1. Bluetooth®: Press MENU to switch Bluetooth® ON or OFF. See Section 7, *Bluetooth®*, and Section 5.6, *Capturing and Working with Images*, for details.



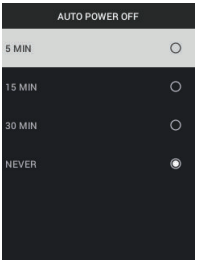
2. Laser: Press MENU to enable/disable the Laser pointer. When enabled, you can use the Laser pointer button to switch ON the Laser pointer.



3. Screen brightness: Use the arrows to select the desired display intensity (LOW, MEDIUM, or HIGH).

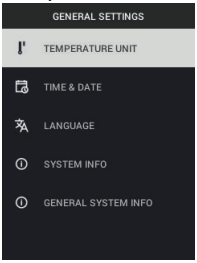


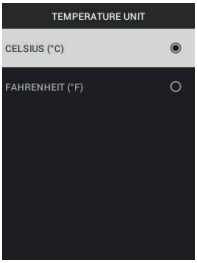
4. Auto Power OFF (APO): Use the arrows to scroll and MENU to select the desired APO time (5/15/30 minutes). Set to ‘Never’ to disable APO.



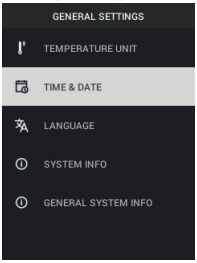
- **GENERAL SETTING**S

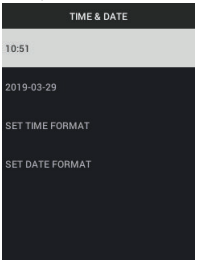
1. Temperature Unit: Use the arrows and the MENU button to select °C or °F.



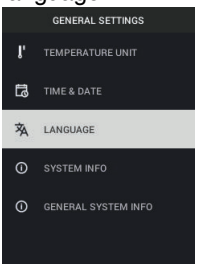


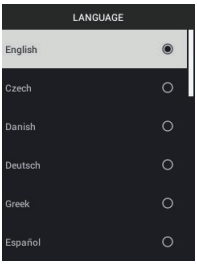
2. Time & Date: Use the arrows to scroll and the MENU button to set the Time, Date, Time Format, and Date Format.



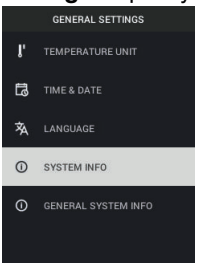


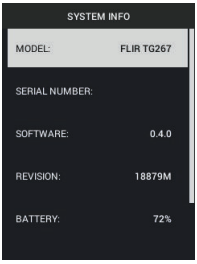
3. Language: Use the arrows to scroll and the MENU button to select a language.

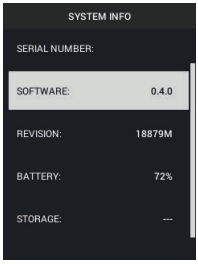




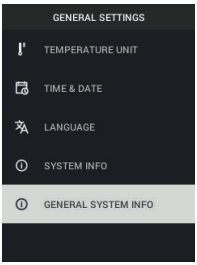
4. System Info: Scroll to desired topic: **Model** Number, **Serial Number**, **Software** Level, **Revision**, **Battery** status (%), and remaining Internal **Storage** Capacity.



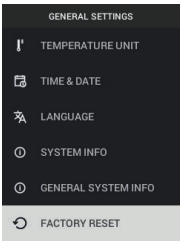


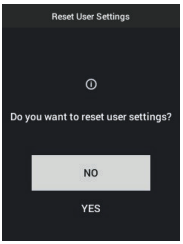


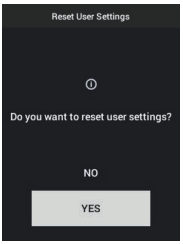
- **GENERAL SYSTEM INFO**: Press MENU to view compliance information.

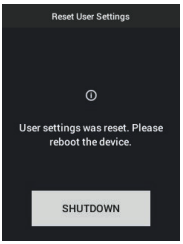


- **FACTORY RESET**: Follow the prompts to reset the User Settings back to Factory Default status.


GENERAL SETTINGS
TEMPERATURE UNIT
TIME & DATE
LANGUAGE
SYSTEM INFO
GENERAL SYSTEM INFO
FACTORY RESET


Reset User Settings
Do you want to reset user settings?
NO
YES


Reset User Settings
Do you want to reset user settings?
NO
YES


Reset User Settings
User settings was reset. Please reboot the device.
SHUTDOWN

7 Bluetooth® Communication and FLIR Tools™

To connect to a mobile device running the FLIR Tools™ Mobile App, turn on the mobile device and start the FLIR Tools™ Mobile App (download the mobile App from the Google Play™ store, the Apple App store, or here: https://www.flir.com/products/flir-tools-app/). Select INSTRUMENTS from the drop-down menu in the App and search for the model number of your camera (the camera must be ON). Tap in the App to connect. When connected to a device running the App, the camera (using the METERLiNK® protocol) continually sends readings for live display on the remote device. You can also send captured images to your mobile device (see Section 5.6, *Capturing and Working with Images*).

7.1 FCC Compliance

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.

2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna.

2. Increase the separation between the equipment and receiver.

3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

4. Consult the dealer or an experienced radio/TV technician for help.

WARNING

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

8 Field Firmware Updates

The camera includes a USB-C port in the top compartment. The USB port allows you to update the System firmware by first downloading an update file from the FLIR website and then transferring the file to the camera via USB. Connect to a PC using a USB-C cable. Firmware updates are available from https://support.flir.com.

NOTE

This camera is not 100% compatible with USB-C to USB-C cables. Use only USB-C to USB-A cables. The supplied cable is USB-C to USB-A type.

To update the firmware, you will need:

- Access to the website where the update file is located: https://support.flir.com
- The camera to be updated
- The update file. Refer to the steps in the next section:

8.1 System Firmware Update

1. Visit https://support.flir.com to obtain a firmware update file.
2. Select the 'Downloads' tab and then select 'Instrument Firmware' (Test and Measurement) from the drop-down menu.
3. Select your camera model from the second drop-down menu.
4. Select and download the firmware update file to the PC.
5. With the camera **ON** connect it to the PC via a USB-C cable (the USB-C port is located in the top compartment).
6. Copy the firmware update file to the camera's root directory.
7. Disconnect the USB cable from the PC and from the camera.
8. Follow the camera's display prompts to complete the update.

9 Maintenance

9.1 Cleaning

Wipe the housing with a damp cloth as needed. Do not use abrasives or solvents. Clean the lenses with a high-quality lens cleaner.

9.2 Battery Considerations and Service

The rechargeable lithium battery is not user-serviceable. Please contact FLIR support for service instructions: https://support.flir.com.

For best results, charge the battery immediately after seeing a low battery indication using the supplied USB-C cable (with an AC wall charger, not supplied). If the battery is allowed to fully drain, allow 2~3 hours before the charging display appears after connecting to an AC charger. a full charge (100%) requires 6 hours, a charge to 90% power requires 4 hours. Charging through a PC USB port is not recommended.

If the camera is not going to be used for an extended period (> 3 months), it should be charged to 70% then stored at room temperature and recharged every 6 months. Failure to do so may result in a battery that cannot be recharged and that therefore will require service.

9.3 Reset the Camera

If the camera display freezes or if the camera in any way stops operating normally, press and hold the up and down buttons for at least 10 seconds. Release the buttons when the camera switches OFF. After the device switches OFF, switch it back ON again to resume use. No data will be lost by resetting the camera. If problems persist, contact FLIR for support.

10 Specifications

10.1 Imaging and Optical Specifications

IR resolution	160 x 120 pixels
Digital image enhancement	Included
Thermal Sensitivity /NETD	< 70 mK
Field of View (FOV)	57° x 44°
Minimum focus distance	0.89 ft. (0.3 m)
Distance-to-Spot ratio	30:1
Dual range operation (TG297)	Range 1: < 752°F (400°C) Range 2: > 752°F (400°C) For Range 2, the high temperature lever must be engaged
Focus	Fixed
Image frequency	8.7 Hz

10.2 Detector Specifications

Focal plane array /Spectral response range	Uncooled microbolometer /7.5 ~ 14 µm
Detector pitch	12 µm

10.3 Image Presentation Specifications

Display resolution	320 x 240 pixels
Screen size	2.4 in. (portrait)
Viewing angle	80°
Color depth	24 bit
Aspect ratio	4:3
Display type	TFT technology
Image adjustment	Automatic
Image modes	• Thermal MSX® (Multi-Spectral Dynamic Imaging) • Visible Spectrum

10.4 Measurement Specifications

Object temperature range	TG267: –13 ~ +716°F (–25 ~ +380°C) TG297: –13 ~ +1886°F (–25 ~ +1030°C)
Accuracy at ambient temperature: 15 ~ 35°C (59 ~95°F)	-13°F ~ 32°F (-25°C to 0°C): ± 7.0°F (3.0°C)
	32°F ~ 122°F (0°C ~ 50°C): ± 5.0°F or ± 2.5% (±2.5°C or ± 2.5%) whichever is greater
	122°F ~ 212°F (50°C ~ 100°C): ± 3.0°F or ± 1.5% (± 1.5°C or ± 1.5%) whichever is greater
	213°F ~ 932°F (100°C ~ 500°C): ± 6.0°F or ± 2.5% (± 2.5°C or ± 2.5%) whichever is greater
	933°F ~ 1022°F (500°C ~ 550°C): ± 7.0°F or ± 3.0% (± 3.0°C or ± 3.0%) whichever is greater
IR Temperature resolution	0.2°F (0.1°C)
Reading repeatability	± 1 % of reading or ± 2°F (1°C), whichever is greater
Response time	150 ms
IR thermometer measurement	Continuous scanning
Minimum measurement distance	0.85 ft. (0.26 m)

10.5 Measurement Analysis Specifications

Spot meter	Center spot (cross-hairs); Programmable ON/OFF
Color display palettes	Iron, Rainbow, White-hot, Black-hot, Arctic, and Lava

10.6 Type-K specifications (TG267 only)

Type-K Temperature range of camera	-22°F ~ 734°F (-30.0°C ~ +390.0°C)[1]
Over- and under- range indication	**OL** or **—OL** display (dashes display if thermocouple is not connected)
Type-K Temperature Resolution	0.1°F (0.1°C)

Type-K Temperature Accuracy	± (1% of reading + 5.4°F [3°C])
Maximum voltage at Type-K input	60V DC or 24V AC rms

1. Note that this is the temperature range of the camera NOT the range for the supplied thermocouple. Please do not exceed the specified range printed on the thermocouple label. To measure higher or lower than the range of the supplied thermocouple, please use a Type-K thermocouple rated for the desired range. Contact FLIR for additional information

10.7 Configuration Specifications

Set-up commands	Local adaptation of units, language, date and time formats
Emissivity adjustment	3 presets plus a custom adjustment utility (0.1 ~ 0.99)
Languages	Czech, Danish, Dutch, English, Finnish, French, German, Greek, Hungarian, Italian, Japanese, Korean, Norwegian, Polish, Portuguese, Russian, simplified Chinese, Spanish, Swedish, traditional Chinese, Turkish
Firmware upgrades	User manageable (instructions included in this user manual)

10.8 Image Storage Specifications

Storage media	eMMC 4G
Image storage capacity	50k images
Image file format	JPEG with spot temperature meta-data tag

10.9 Digital Camera Specifications

Resolution	2M pixels
Focus	Fixed
Field of View (FOV)	71° x 56° (adapts to IR lens)

10.10 Flashlight Specifications

Flashlight type	Bright LED
LED CCT	6500° K
LED CRI	70
Beam angle	± 20°

Rated power	0.5 W
Light output	100 Lumens

10.11 Laser Pointer Specifications

Laser type	DOE (Diffractive optical elements)
Laser function	Indicates the size of the measurement area (circular target)
Laser class	Class I

10.12 Data Communication and Interface Specifications

Interfaces	USB 2.0 and Bluetooth®
USB	USB Type-C for data transfer and battery charging Not 100% compatible with USB-C to USB-C cables. Use only a USB-C to USB-A cable.
USB standard	USB 2.0 High Speed
Bluetooth®	BLE (Bluetooth® Low Energy)

10.13 Rechargeable Battery Specifications

Battery type	Rechargeable Lithium ion
Battery voltage	3.7 V
Battery operating time	5 hours scanning (medium brightness setting) 4.5 hours with Laser ON (medium brightness setting)
Battery charge life	30 days minimum
Charging system	Battery is charged inside the camera
Charging time	4 hours to 90% and 6 hours to 100%
Power management	APO adjustable 5/15/30 minutes. Can be disabled.

10.14 Environmental Specifications

Altitude	6562 ft. (2000 m)
Pollution degree	2

Operating temperature	14 ~ 113℉ (-10 ~ 45℃)
Storage temperature	-22 ~ 131℉ (-30 ~ 55℃)
Humidity (operating and storage)	0 ~ 90% Relative Humidity (RH) 32 ~ 98.6℉ (0 ~ 37℃) 0 ~ 65% RH 98.6 ~ 113℉ (37 ~ 45℃) 0 ~ 45% RH 113 ~ 131℉ (45 ~ 55℃)
EMC	EN 61000–6–3 EN 61000–6–2 FCC 47 CFR Part 15 Class B
Magnetic fields	EN 61000–4–8 Class 3
Radio spectrum	ETSI EN 300 328 FCC Part 15.249 RSS-247 Issue 2 EN 301 489–1:2011 EN 301 489–17:2009
Encapsulation	IP 54 (IEC 60529)
Shock	25 g (IEC 60068–2–27)
Vibration	2 g (IEC 60068–2–6)
Drop	Designed for 6.56 ft. (2 m)
Safety	CE/CB/EN61010/UL
Environmental safety	REACH Regulation EC 1907/2006 RoHS 2 Directive 2011/65/EC WEEE Directive 2012/19/EC JIS C 6802:2011 laser directive IEC 60825–1 class I laser directive FDA laser directive
Humidity requirements	IEC 60068–2–30 for operation and storage

10.15 Physical Specifications

Weight	13.9 oz. (0.39 kg)
Size (L x W x H)	8.3 x 2.5 x 3.2 in. (210 x 64 x 81 mm)
Accessory mount	UNC ¼”-20

10.16 Included Equipment

Standard equipment	Camera, USB-C cable, printed Quick Start Guide, Lanyard, Carry Pouch

11 Appendices

11.1 Emissivity Factors for Common Materials

Material	Emissivity	Material	Emissivity
Asphalt	0.90 ~ 0.98	Cloth (black)	0.98
Concrete	0.94	Skin (human)	0.98
Cement	0.96	Leather	0.75 ~ 0.80
Sand	0.90	Charcoal (powder)	0.96
Soil	0.92 ~ 0.96	Lacquer	0.80 ~ 0.95
Water	0.92 ~ 0.96	Lacquer (matt)	0.97
Ice	0.96 ~ 0.98	Rubber (black)	0.94
Snow	0.83	Plastic	0.85 ~ 0.95
Glass	0.90 ~ 0.95	Timber	0.90
Ceramic	0.90 ~ 0.94	Paper	0.70 ~ 0.94
Marble	0.94	Chromium Oxides	0.81
Plaster	0.80 ~ 0.90	Copper Oxides	0.78
Mortar	0.89 ~ 0.91	Iron Oxides	0.78 to 0.82
Brick	0.93 ~ 0.96	Textiles	0.90

11.2 IR Energy and Imaging Overview

A thermal imager generates an image based on temperature differences. In a thermal image the hottest item in the scene appears as white and the coldest item as black, and all other items are represented as a gray scale value between white and black. It may take some time to get used to the thermal imagery. Having a basic understanding of the differences between thermal and daylight cameras can help with getting the best performance from the camera.

One difference between thermal and daylight cameras has to do with where the energy comes from to create an image. When viewing an image with an ordinary camera, there must be some source of visible light (something hot, such as the sun or lights) that reflects off the objects in the scene to the camera. The same is true with human eyesight; what people see is based on reflected light energy. On the other hand, the thermal imager detects energy that is directly radiated from objects in the scene. Therefore, hot objects such as parts on an engines and exhaust pipes appear white, while the sky,

puddles of water and other cold objects appear dark (or cool). Scenes with familiar objects will be easy to interpret with some experience.

Infrared energy is part of a complete range of radiation called the electromagnetic spectrum. The electromagnetic spectrum includes gamma rays, X-rays, ultraviolet, visible, infrared, microwaves (RADAR), and radio waves. The only difference is their wavelength or frequency. All these forms of radiation travel at the speed of light. Infrared radiation lies between the visible and RADAR range of the electromagnetic spectrum. The primary source of infrared radiation is heat, or thermal radiation. Any object which has a temperature radiates in the infrared range of the electromagnetic spectrum. Even objects that are very cold, such as an ice cube, emit infrared. When an object is not quite hot enough to radiate visible light, it will emit most of its energy in the infrared. For example, hot charcoal may not give off light, but it does emit infrared radiation, which we feel as heat. The warmer the object, the more infrared radiation it emits.

Infrared imaging devices produce an image of invisible infrared or ‘heat’ radiation that is unseen by the human eye. There are no colors or ‘shades’ of gray in infrared, only varying intensities of radiated energy. The infrared imager converts this energy into an image that we can interpret. The Infrared Training Center (ITC) offers training (including online training) and certification in all aspects of thermography: https://www.infraredtraining.com.

12 2–10 Extended Warranty

To activate the extended 2–10 warranty, please register your product within 60 days of purchase. Otherwise, the standard one-year warranty will be in affect from date of purchase. The 2–10 warranty covers parts and labor for the camera for 2 years and coverage of the detector for 10 years. Register your product at https://customer.flir.com/prodreg.

13 Customer Support

Repair, Calibration, and Technical Support: https://support.flir.com.

13.1 Corporate Headquarters

FLIR Systems, Inc.

27700 SW Parkway Avenue

Wilsonville, OR 97070, USA

Website
http://www.flir.com

Customer support
http://support.flir.com

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