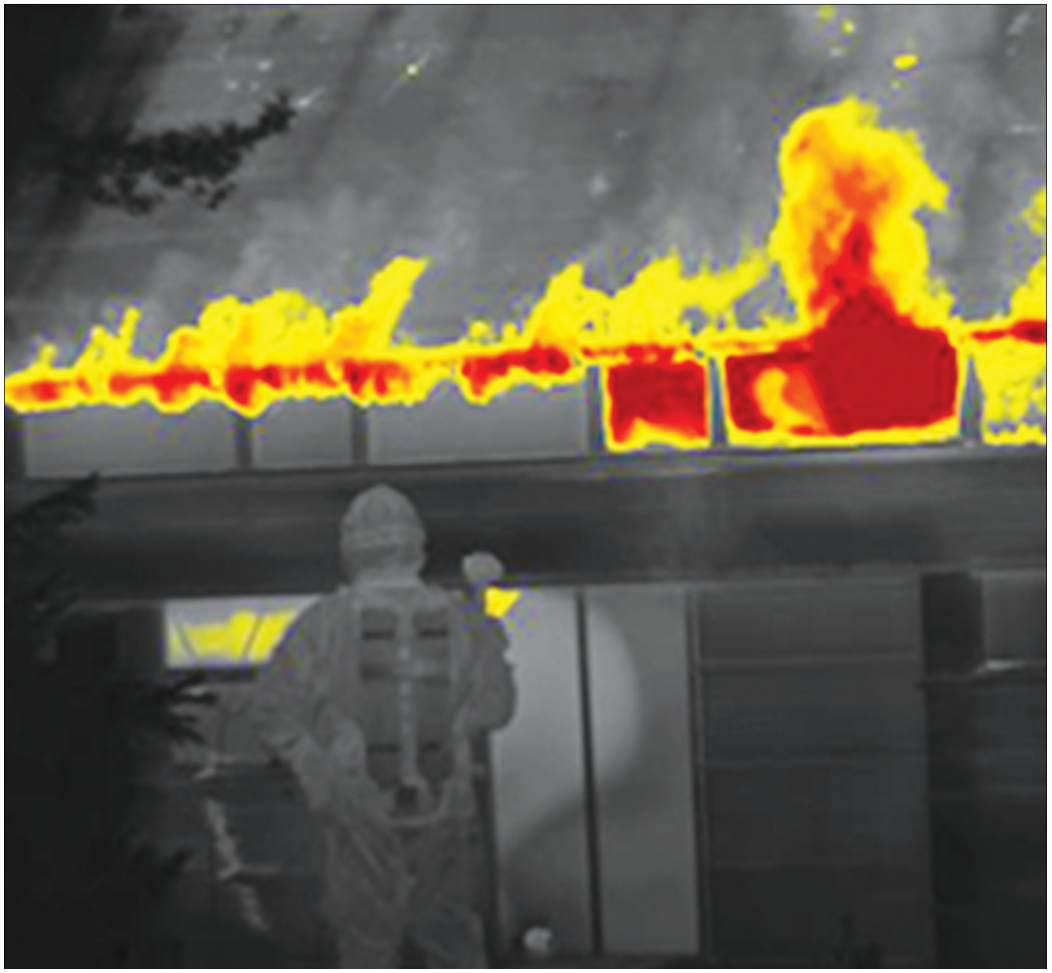
User's manual
FLIR K series



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1 Legal disclaimer

1.1 Legal disclaimer

All products manufactured by FLIR Systems are warranted against defective materials and workmanship for a period of one (1) year from the delivery date of the original purchase, provided such products have been under normal storage, use and service, and in accordance with FLIR Systems instruction.

Uncooled handheld infrared cameras manufactured by FLIR Systems are warranted against defective materials and workmanship for a period of two (2) years from the delivery date of the original purchase, provided such products have been under normal storage, use and service, and in accordance with FLIR Systems instruction, and provided that the camera has been registered within 60 days of original purchase.

Detectors for uncooled handheld infrared cameras manufactured by FLIR Systems are warranted against defective materials and workmanship for a period of ten (10) years from the delivery date of the original purchase, provided such products have been under normal storage, use and service, and in accordance with FLIR Systems instruction, and provided that the camera has been registered within 60 days of original purchase.

Products which are not manufactured by FLIR Systems but included in systems delivered by FLIR Systems to the original purchaser, carry the warranty, if any, of the particular supplier only. FLIR Systems has no responsibility whatsoever for such products.

The warranty extends only to the original purchaser and is not transferable. It is not applicable to any product which has been subjected to misuse, neglect, accident or abnormal conditions of operation. Expendable parts are excluded from the warranty.

In the case of a defect in a product covered by this warranty the product must not be further used in order to prevent additional damage. The purchaser shall promptly report any defect to FLIR Systems or this warranty will not apply.

FLIR Systems will, at its option, repair or replace any such defective product free of charge if, upon inspection, it proves to be defective in material or workmanship and provided that it is returned to FLIR Systems within the said one-year period.

FLIR Systems has no other obligation or liability for defects than those set forth above.

No other warranty is expressed or implied. FLIR Systems specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

FLIR Systems shall not be liable for any direct, indirect, special, incidental or consequential loss or damage, whether based on contract, tort or any other legal theory.

This warranty shall be governed by Swedish law.

Any dispute, controversy or claim arising out of or in connection with this warranty, shall be finally settled by arbitration in accordance with the Rules of the Arbitration Institute of the Stockholm Chamber of Commerce. The place of arbitration shall be Stockholm. The language to be used in the arbitral proceedings shall be English.

1.2 Usage statistics

FLIR Systems reserves the right to gather anonymous usage statistics to help maintain and improve the quality of our software and services.

1.3 Changes to registry

The registry entry HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Lsa\LmCompatibilityLevel will be automatically changed to level 2 if the FLIR Camera Monitor service detects a FLIR camera connected to the computer with a USB cable. The modification will only be executed if the camera device implements a remote network service that supports network logons.

1.4 U.S. Government Regulations

This product is subject to US Export Regulations. Please refer to exportquestions@flir.com with any questions.

1.5 Copyright

1.6 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.

1.7 Patents

One or several of the following patents and/or design patents may apply to the products and/or features. Additional pending patents and/or pending design patents may also apply.

000279476-0001; 000439161; 000499579-0001; 000653423; 000726344; 000859020; 001106306-0001; 001707738; 001707746; 001707787; 001776519; 001954074; 002021543; 002058180; 002249953; 1144833; 1182246; 1182620; 1285345; 1299699; 1325808; 1336775; 1391114; 1402918; 1404291; 1411581; 1415075; 1421497; 1458284; 1678485; 1732314; 2106017; 2381417; 3006596; 3006597; 466540; 483782; 484155; 4889913; 5177595; 60122153.2; 602004011681.5-08; 6707044; 68657; 7034300; 7110035; 7154093; 7157705; 7237946; 7312822; 7332716; 7336823; 7544944; 7667198; 7809258 B2; 7826736; 8,018,649 B2; 8,153,971; 8212210 B2; 8289372; 8354639 B2; 8384783; 8520970; 8565547; D540838; D549758; D579475; D584755; D599,392; D615,113; D664,580; D664,581; D665,004; D665,440; DI6702302-9; DI6903617-9; DI7002221-6; DI7002891-5; DI7002892-3; DI7005799-0; DM/057692; DM/061609; EP 2115696 B1; EP2315433; SE 0700240-5; US 8340414 B2; ZL01823221.3; ZL01823226.4; ZL02331553.9; ZL02331554.7; ZL200480034894.0; ZL200530120994.2; ZL200610088759.5; ZL200630130114.4; ZL200730151141.4; ZL200730339504.7; ZL200820105768.8; ZL200830128581.2; ZL200880105236.4; ZL200880105769.2; ZL200930190061.9; ZL201030176127.1; ZL201030176130.3; ZL201030176157.2; ZL201030595931.3; ZL201130442354.9; ZL201230471744.3; ZL201230620731.8

1.8 EULA Terms

- You have acquired a device (“INFRARED CAMERA”) that includes software licensed by FLIR Systems AB from Microsoft Licensing, GP or its affiliates (“MS”). Those installed software products of MS origin, as well as associated media, printed materials, and “online” or electronic documentation (“SOFTWARE”) are protected by international intellectual property laws and treaties. The SOFTWARE is licensed, not sold. All rights reserved.
- IF YOU DO NOT AGREE TO THIS END USER LICENSE AGREEMENT (“EULA”), DO NOT USE THE DEVICE OR COPY THE SOFTWARE. INSTEAD, PROMPTLY CONTACT FLIR Systems AB FOR INSTRUCTIONS ON RETURN OF THE UNUSED DEVICE(S) FOR A REFUND. **ANY USE OF THE SOFTWARE, INCLUDING BUT NOT LIMITED TO USE ON THE DEVICE, WILL CONSTITUTE YOUR AGREEMENT TO THIS EULA (OR RATIFICATION OF ANY PREVIOUS CONSENT).**
- **GRANT OF SOFTWARE LICENSE.** This EULA grants you the following license:
  - You may use the SOFTWARE only on the DEVICE.
  - **NOT FAULT TOLERANT.** THE SOFTWARE IS NOT FAULT TOLERANT. FLIR Systems AB HAS INDEPENDENTLY DETERMINED HOW TO USE THE SOFTWARE IN THE DEVICE, AND MS HAS RELIED UPON FLIR Systems AB TO CONDUCT SUFFICIENT TESTING TO DETERMINE THAT THE SOFTWARE IS SUITABLE FOR SUCH USE.
  - **NO WARRANTIES FOR THE SOFTWARE.** THE SOFTWARE is provided “AS IS” and with all faults. THE ENTIRE RISK AS TO SATISFACTORY QUALITY, PERFORMANCE, ACCURACY, AND EFFORT (INCLUDING LACK OF NEGLIGENCE) IS WITH YOU. ALSO, THERE IS NO WARRANTY AGAINST INTERFERENCE WITH YOUR ENJOYMENT OF THE SOFTWARE OR AGAINST INFRINGEMENT. **IF YOU HAVE RECEIVED ANY WARRANTIES REGARDING THE DEVICE OR THE SOFTWARE, THOSE WARRANTIES DO NOT ORIGINATE FROM, AND ARE NOT BINDING ON, MS.**
  - No Liability for Certain Damages. **EXCEPT AS PROHIBITED BY LAW, MS SHALL HAVE NO LIABILITY FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL OR INCIDENTAL DAMAGES ARISING FROM OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THE SOFTWARE. THIS LIMITATION SHALL APPLY EVEN IF ANY REMEDY FAILS OF ITS ESSENTIAL PURPOSE. IN NO EVENT SHALL MS BE LIABLE FOR ANY AMOUNT IN EXCESS OF U.S. TWO HUNDRED FIFTY DOLLARS (U.S.$250.00).**
  - **Limitations on Reverse Engineering, Decompilation, and Disassembly.** You may not reverse engineer, decompile, or disassemble the SOFTWARE, except and only to the extent that such activity is expressly permitted by applicable law notwithstanding this limitation.
  - **SOFTWARE TRANSFER ALLOWED BUT WITH RESTRICTIONS.** You may permanently transfer rights under this EULA only as part of a permanent sale or transfer of the Device, and only if the recipient agrees to this EULA. If the SOFTWARE is an upgrade, any transfer must also include all prior versions of the SOFTWARE.
  - **EXPORT RESTRICTIONS.** You acknowledge that SOFTWARE is subject to U.S. export jurisdiction. You agree to comply with all applicable international and national laws that apply to the SOFTWARE, including the U.S. Export Administration Regulations, as well as end-user, end-use and destination restrictions issued by U.S. and other governments. For additional information see http://www.microsoft.com/exporting/.

2 Safety information

WARNING

Applicability: Cameras with one or more batteries.

Do not disassemble or do a modification to the battery. The battery contains safety and protection devices which, if damage occurs, can cause the battery to become hot, or cause an explosion or an ignition.

WARNING

Applicability: Cameras with one or more batteries.

If there is a leak from the battery and you get the fluid in your eyes, do not rub your eyes. Flush well with water and immediately get medical care. The battery fluid can cause injury to your eyes if you do not do this.

WARNING

Applicability: Cameras with one or more batteries.

Do not continue to charge the battery if it does not become charged in the specified charging time. If you continue to charge the battery, it can become hot and cause an explosion or ignition. Injury to persons can occur.

WARNING

Applicability: Cameras with one or more batteries.

Only use the correct equipment to remove the electrical power from the battery. If you do not use the correct equipment, you can decrease the performance or the life cycle of the battery. If you do not use the correct equipment, an incorrect flow of current to the battery can occur. This can cause the battery to become hot, or cause an explosion. Injury to persons can occur.

WARNING

Make sure that you read all applicable MSDS (Material Safety Data Sheets) and warning labels on containers before you use a liquid. The liquids can be dangerous. Injury to persons can occur.

CAUTION

Do not point the infrared camera (with or without the lens cover) at strong energy sources, for example, devices that cause laser radiation, or the sun. This can have an unwanted effect on the accuracy of the camera. It can also cause damage to the detector in the camera.

CAUTION

Applicability: Cameras with one or more batteries.

Do not attach the batteries directly to a car's cigarette lighter socket, unless FLIR Systems supplies a specific adapter to connect the batteries to a cigarette lighter socket. Damage to the batteries can occur.

CAUTION

Applicability: Cameras with one or more batteries.

Do not connect the positive terminal and the negative terminal of the battery to each other with a metal object (such as wire). Damage to the batteries can occur.

CAUTION

Applicability: Cameras with one or more batteries.

Do not get water or salt water on the battery, or permit the battery to become wet. Damage to the batteries can occur.

CAUTION

Applicability: Cameras with one or more batteries.

Do not make holes in the battery with objects. Damage to the battery can occur.

CAUTION

Applicability: Cameras with one or more batteries.

Do not hit the battery with a hammer. Damage to the battery can occur.

CAUTION

Applicability: Cameras with one or more batteries.

Do not put your foot on the battery, hit it or cause shocks to it. Damage to the battery can occur.

CAUTION

Applicability: Cameras with one or more batteries.

Applicability: Cameras with one or more batteries.

Do not put the batteries in or near a fire, or into direct sunlight. When the battery becomes hot, the built-in safety equipment becomes energized and can stop the battery charging procedure. If the battery becomes hot, damage can occur to the safety equipment and this can cause more heat, damage or ignition of the battery.

CAUTION

Applicability: Cameras with one or more batteries.

Do not put the battery on a fire or increase the temperature of the battery with heat. Damage to the battery and injury to persons can occur.

CAUTION

Applicability: Cameras with one or more batteries.

Do not put the battery on or near fires, stoves, or other high-temperature locations. Damage to the battery and injury to persons can occur.

CAUTION

Applicability: Cameras with one or more batteries.

Do not solder directly onto the battery. Damage to the battery can occur.

CAUTION

Applicability: Cameras with one or more batteries.

Do not use the battery if, when you use, charge, or put the battery in storage, there is an unusual smell from the battery, the battery feels hot, changes color, changes shape, or is in an unusual condition. Speak with your sales office if one or more of these problems occurs. Damage to the battery and injury to persons can occur.

CAUTION

Applicability: Cameras with one or more batteries.

Only use a specified battery charger when you charge the battery. Damage to the battery can occur if you do not do this.

CAUTION

Applicability: Cameras with one or more batteries.

The temperature range through which you can charge the battery is ±0°C to +45°C (+32°F to +113°F), unless other information is specified in the user documentation or technical data. If you charge the battery at temperatures out of this range, it can cause the battery to become hot or to break. It can also decrease the performance or the life cycle of the battery.

CAUTION

Applicability: Cameras with one or more batteries.

The temperature range through which you can remove the electrical power from the battery is -15°C to +50°C (+5°F to +122°F), unless other information is specified in the user documentation or technical data. If you operate the battery out of this temperature range, it can decrease the performance or the life cycle of the battery.

CAUTION

Applicability: Cameras with one or more batteries.

When the battery is worn, apply insulation to the terminals with adhesive tape or equivalent materials before you discard it. Damage to the battery and injury to persons can occur if you do not do this.

CAUTION

Applicability: Cameras with one or more batteries.

Remove any water or moisture on the battery before you install it. Damage to the battery can occur if you do not do this.

CAUTION

Do not apply solvents or equivalent liquids to the camera, the cables, or other items. Damage to the battery and injury to persons can occur.

CAUTION

Be careful when you clean the infrared lens. The lens has an anti-reflective coating which is easily damaged. Damage to the infrared lens can occur.

CAUTION

Do not use too much force to clean the infrared lens. This can cause damage to the anti-reflective coating.

Note

The encapsulation rating is only applicable when all the openings on the camera are sealed with their correct covers, hatches, or caps. This includes the compartments for data storage, batteries, and connectors.

CAUTION

Do not change the standard fire-fighting procedures when you use a FLIR K series camera. The FLIR K series camera is not a replacement technology.

CAUTION

Do not use the FLIR K series camera without the correct training. If the persons that operate the camera do not have the correct training, an incorrect analysis of the infrared images can occur. Thus, incorrect decisions during the firefighting can be made.

The training must include:

- How a thermal camera operates and its limits
- How to interpret an image
- How to work safely with the camera

3 Notice to user

3.1 User-to-user forums

Exchange ideas, problems, and infrared solutions with fellow thermographers around the world in our user-to-user forums. To go to the forums, visit:

http://www.infraredtraining.com/community/boards/

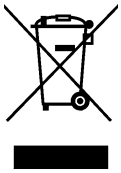
3.2 Calibration

We recommend that you send in the camera for calibration once a year. Contact your local sales office for instructions on where to send the camera.

3.3 Accuracy

For very accurate results, we recommend that you wait 5 minutes after you have started the camera before measuring a temperature.

3.4 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.

3.5 Training

To read about infrared training, visit:

- http://www.infraredtraining.com
- http://www.irtraining.com
- http://www.irtraining.eu

3.6 Documentation updates

Our manuals are updated several times per year, and we also issue product-critical notifications of changes on a regular basis.

To access the latest manuals and notifications, go to the Download tab at:

http://support.flir.com

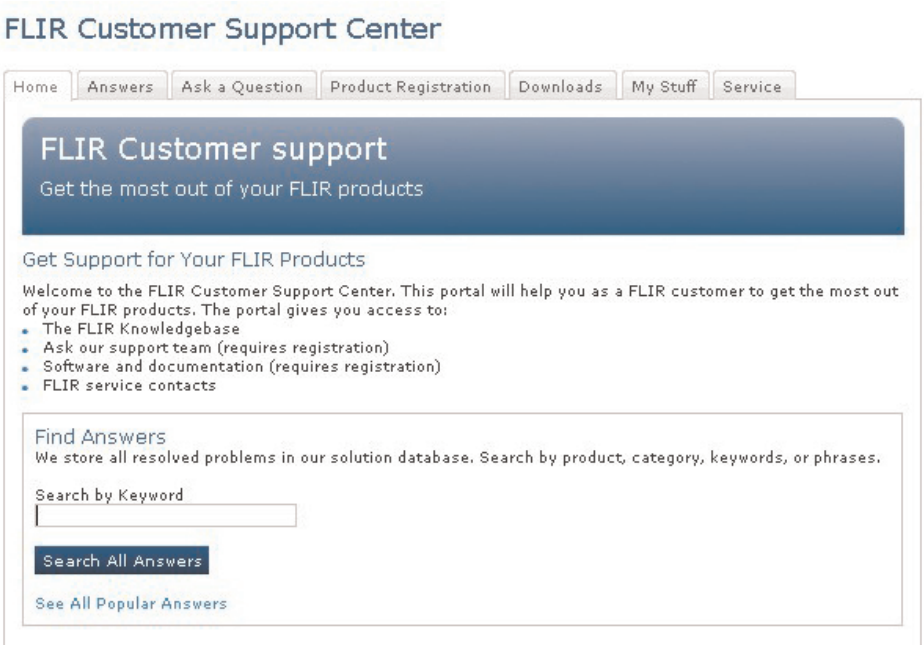
It only takes a few minutes to register online. In the download area you will also find the latest releases of manuals for our other products, as well as manuals for our historical and obsolete products.

3.7 Important note about this manual

FLIR Systems issues generic manuals that cover several cameras within a model line.

This means that this manual may contain descriptions and explanations that do not apply to your particular camera model.

4 Customer help



4.1 General

For customer help, visit:

http://support.flir.com

4.2 Submitting a question

To submit a question to the customer help team, you must be a registered user. It only takes a few minutes to register online. If you only want to search the knowledgebase for existing questions and answers, you do not need to be a registered user.

When you want to submit a question, make sure that you have the following information to hand:

- The camera model
- The camera serial number
- The communication protocol, or method, between the camera and your device (for example, HDMI, Ethernet, USB, or FireWire)
- Device type (PC/Mac/iPhone/iPad/Android device, etc.)
- Version of any programs from FLIR Systems
- Full name, publication number, and revision number of the manual

4.3 Downloads

On the customer help site you can also download the following:

- Firmware updates for your infrared camera.
- Program updates for your PC/Mac software.
- Freeware and evaluation versions of PC/Mac software.
- User documentation for current, obsolete, and historical products.
- Mechanical drawings (in *.dxf and *.pdf format).
- Cad data models (in *.stp format).
- Application stories.
- Technical datasheets.
- Product catalogs.

5 Important information about FLIR K series service

- Contact the service department before shipping the camera. Many problems can be resolved on the phone—if so, the camera does not need to be shipped.
- The camera must be thoroughly cleaned and decontaminated before shipping. No hazardous residues are allowed on cameras shipped to our service department. Such residues include—but are not limited to—chemical fire-extinguishing compounds, radioactivity, biohazardous materials, and residues from chemical fires.
- FLIR Systems reserves the right to charge the full cost for the decontamination of contaminated cameras that are shipped to our service department.

6 What is the FLIR K series?

Thank you for choosing aFLIR K series camera from FLIR Systems.

The FLIR K series is a robust and reliable infrared camera series designed to perform under extremely severe conditions. It has an intuitive interface with a design that makes it easy to control even with a gloved hand. The crisp and clear image helps you to navigate through smoke and to make quick and accurate decisions.

Main features:

- **Extremely affordable: a thermal imaging camera in every firefighting truck**. FLIR Systems markets more thermal imaging cameras than any other manufacturer. Thanks to economies of scale, FLIR Systems can market the FLIR K series at an extremely affordable price.
- **Robust and reliable**. The FLIR K series is designed to meet tough operating conditions. It can withstand a drop from 2 m (6.5′) onto a concrete floor, is water resistant to IP67, and is fully operating up to +85°C (+185°F).
- **Clear and crisp thermal images**. The maintenance-free uncooled microbolometer sensor produces clear and detail-rich images of 240 × 180 pixels (FLIR K40) or up to 320 × 240 pixels (FLIR K50). Thermal images are presented on a large, bright 4″ display, helping you to navigate and to make quick and accurate decisions.
- **Easy-to-use, and in a gloved firefighter's hand**. An intuitive and simple user interface allows you to focus on the job. The FLIR K series can be controlled by just three large buttons on top of the unit and one trigger. Ideal for a gloved firefighter's hand.
- **Produce simple reports in FLIR Tools**. Thermal images can be stored in the FLIR K series and later used to produce simple reports of what happened at the scene.

7 Quick start guide

Follow this procedure to get started right away:

1. Charge the battery for 4 hours before starting the camera for the first time, or until the blue battery condition LED glows continuously.
2. Push the On/off button to turn on the camera.
3. Aim the camera toward the object of interest.
4. Select a suitable camera mode by pushing the Mode button.
5. Pull the Save trigger to save an image.
6. Connect the camera to a computer, using the USB cable.
7. Do one of the following:
   - Move the image to the computer using a drag-and-drop operation.

     Note
     Moving an image using a drag-and-drop operation does not delete the image in the camera.

   - Move the image to the computer using FLIR Tools. A download card for FLIR Tools is included in the transport case. In FLIR Tools you can analyze the images and create PDF reports.

8 Parts lists

8.1 Scope of delivery

- Infrared camera.
- Battery (2).
- Battery charger.
- Hard transport case.
- Lanyard strap.
- Neck strap.
- Power supply.
- Printed documentation.
- Retractable lanyard.
- Tripod adapter.
- USB cable.
- User documentation CD-ROM.

Note
FLIR Systems reserves the right to discontinue models, parts or accessories, and other items, or to change specifications at any time without prior notice.

8.2 List of accessories and services

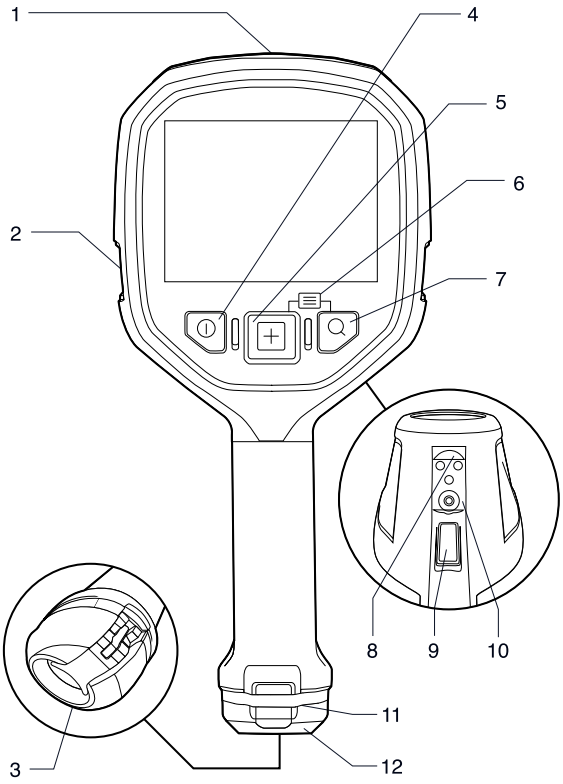
- 1910423 USB cable Std A to Mini-B.
- T127722 Retractable lanyard.
- T127724 Neck strap.
- T198125 Battery charger, including power supply with multi plugs.
- T198310 Battery.
- T198322 In-truck charger.
- T198416 Lanyard strap.
- T198441 Transport case.
- T198457 Tripod Adapter.
- T199844 One year extended warranty.

Note
FLIR Systems reserves the right to discontinue models, parts or accessories, and other items, or to change specifications at any time without prior notice.

9 System parts

9.1 Camera

9.1.1 Figure

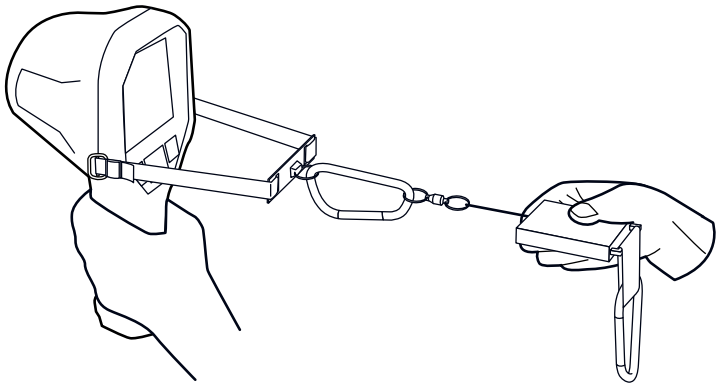


9.1.2 Explanation

1. USB Mini-B connector: Connect to a computer to download images using FLIR Tools.
2. Attachment point for lanyard strap/neck strap (left and right side).
3. Eccentric latch to secure the battery.
4. On/off button. This button has two functions:
   - Push the on/off button to turn on the camera.
   - Push and hold the on/off button for more than 3 seconds but less than 10 seconds to put the camera in standby mode. The camera then automatically turns off after 6 hours.
   - Push and hold the on/off button for more than 10 seconds to turn off the camera.
5. Mode button: Push repeatedly to select camera modes.
6. Access to setup menus and stored images: Push Mode + Zoom button.
7. Zoom button (zoom factor 2×).
8. Connectors for in-truck charger.
9. Save trigger.
10. Mount for tripod adapter.
11. Attachment point for retractable lanyard.
12. Battery.

9.2 Lanyard strap + retractable lanyard

9.2.1 Figure

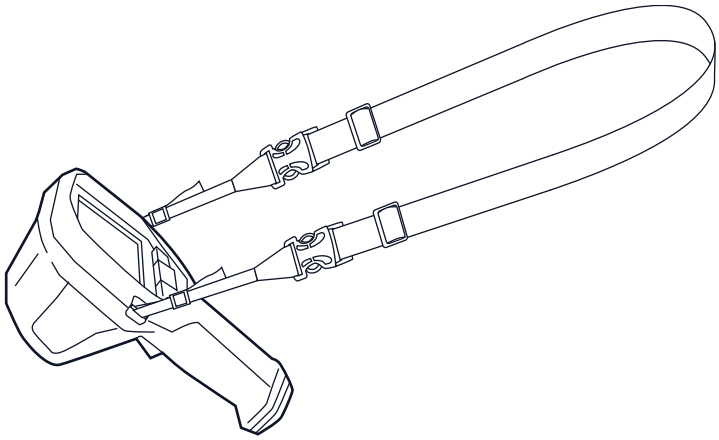


9.2.2 Explanation

The lanyard strap is attached at position 2 on the camera (see section 9.1 *Camera*, page 11). The retractable lanyard is then connected to the lanyard strap.

9.3 Neck strap

9.3.1 Figure

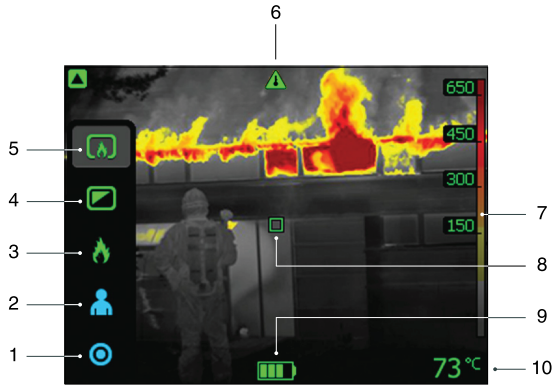


9.3.2 Explanation

The neck strap is attached at position 2 on the camera (see section 9.1 *Camera*, page 11).

10 Screen elements

10.1 Figure



10.2 Explanation

1. Heat detection mode. Optimized for searching hotspots during overhaul after the fire is out.
2. Search and rescue mode. Optimized for maintaining high contrast in the infrared image while searching for people.
3. Fire mode. Similar to the NFPA firefighting mode, but with a higher-temperature starting point for the heat colorization.
4. Black and white firefighting mode. Multipurpose mode for the initial fire attack with life rescuing operation and control of the fire.
5. NFPA firefighting mode. Multipurpose mode for the initial fire attack with life rescuing operation and control of the fire.
6. Overheating indicator. The indicator provides a visual warning to the user that the thermal imager is about to shut down due to internal overheating.
7. Temperature scale.
8. Spotmeter.
9. Battery condition indicator.
10. Spotmeter temperature.

Note

- The green icon color indicates that the camera automatically switches between the high-sensitivity range and the low-sensitivity range, depending on the object.
- The blue icon color indicates that the temperature range is locked.
- NFPA = National Fire Protection Association, an international non-profit organization (http://www.nfpa.org).

11 Operation

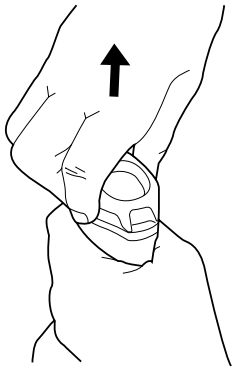
11.1 Removing the battery

11.1.1 Procedure

Follow this procedure:

1. Pull the eccentric latch.

2. Pull out the battery from the battery compartment.



11.2 Charging the battery

11.2.1 General

Charge the battery for 4 hours before starting the camera for the first time, or until the blue battery condition LED glows continuously.

11.2.2 Procedure

Follow this procedure:

1. Put the battery in the standalone battery charger.
2. Connect the power supply cable plug to the connector on the standalone battery charger.
3. Connect the power supply mains-electricity plug to a mains socket.
4. Disconnect the power supply cable plug when the blue battery condition LED glows continuously.

11.3 Turning on and turning off the camera

- Push the on/off button to turn on the camera.
- Push and hold the on/off button for more than 3 seconds but less than 10 seconds to put the camera in standby mode. The camera then automatically turns off after 6 hours.
- Push and hold the on/off button for more than 10 seconds to turn off the camera.

11.4 Selecting camera modes

11.4.1 General

The FLIR K series features five different camera modes. You select camera mode by pushing the *Mode* button.

The five different camera modes are:

1. NFPA firefighting mode. (*NFPA* = *National Fire Protection Association*, an international non-profit organization. See *www.nfpa.org* for more details.)
2. Black and white firefighting mode.
3. Fire mode.
4. Search and rescue mode.
5. Heat detection mode.

Each mode is optimized for a certain type of firefighting application. In addition, the modes differ in the following way:

- Modes with green icons (1–3 below): The camera switches between the high-sensitivity range (–20 to +150°C (–4 to +302°F)) and the low-sensitivity range (0 to +650°C (+32 to +1202°F)) automatically when objects with a temperature above 150°C (302°F) enters the field of view of the camera.
- Modes with blue icons (4–5 below): The temperature range is locked to the high-sensitivity range (–20 to +150°C (–4 to +302°F)). This is useful if you need to maintain the best possible image for objects with a temperature below 150°C (302°F), even if there are objects with a temperature above 150°C (302°F) in the field of view of the camera.

11.4.2 Explanation of the different camera modes

11.4.2.1 NFPA firefighting mode

Figure 11.1 NFPA firefighting mode.

The *NFPA standardized firefighting mode* is the default mode of the camera. It is a multi-purpose mode for the initial fire attack with life rescuing operation and control of the fire. The camera automatically switches between the high-sensitivity range and the low-sensitivity range, to maintain an optimal infrared image while at the same time maintaining a safe and consistent heat colorization of the fire scene.

- Automatic range.
- Colorization of heat: +150 to +650°C (+302 to +1202°F).
- High-sensitivity range: –20 to +150°C (–4 to +302°F).
- Low-sensitivity range: 0 to +650°C (+32 to +1202°F).

11.4.2.2 Black and white firefighting mode

Figure 11.2 Black and white firefighting mode.

The *black and white firefighting mode* is an NFPA standardized firefighting mode. It is a multipurpose mode for the initial fire attack with life rescuing operation and control of the fire. It is specifically designed for fire services that do not want to use the heat colorization feature.

The camera automatically switches between the high-sensitivity range and the low-sensitivity range, to maintain an optimal infrared image.

- Automatic range.
- High-sensitivity range: –20 to +150°C (–4 to +302°F).
- Low-sensitivity range: 0 to +650°C (+32 to +1202°F).

11.4.2.3 Fire mode

Figure 11.3 Fire mode.

The *fire mode* is similar to the NFPA standardized firefighting mode, but with a higher-temperature starting point for the heat colorization. It is suitable for fire scenes with higher background temperatures, where there are already a lot of open flames and a high background temperature. The camera automatically switches between the high-sensitivity range and the low-sensitivity range, to maintain an optimal infrared image while at the same time maintaining a safe and consistent colorization of heat.

- Automatic range.
- Colorization of heat: +250 to +650°C (+ 482 to +1202°F).
- High-sensitivity range: –20 to +150°C (–4 to +302°F).
- Low-sensitivity range: 0 to +650°C (+32 to +1202°F).

11.4.2.4 Search and rescue mode

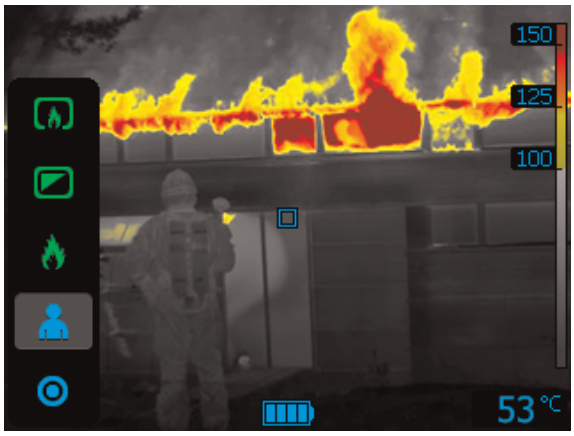


Figure 11.4 Search and rescue mode.

The *search and rescue mode* is optimized for maintaining high contrast in the infrared image while searching for people in landscapes, buildings, or traffic accident scenes.

- High sensitivity range only.
- Colorization of heat: +100 to +150°C (+212 to +302°F).
- High-sensitivity range: –20 to +150°C (–4 to +302°F).

11.4.2.5 Heat detection mode

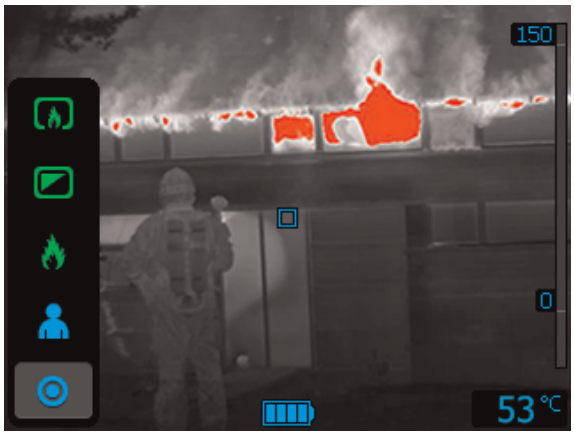


Figure 11.5 Heat detection mode.

The *heat detection mode* is optimized for searching hotspots during overhaul after the fire is out—typically to ensure that there is no hidden fire left. This mode can also be used to find thermal patterns, for example signs of people in car seats after accidents, to ensure that everyone has been found. This mode can also be used to search for people in water and open landscapes.

- High-sensitivity range only.
- Colorization of heat: the 20% highest temperatures in the scene.
- High-sensitivity range: –20 to +150°C (–4 to +302°F).

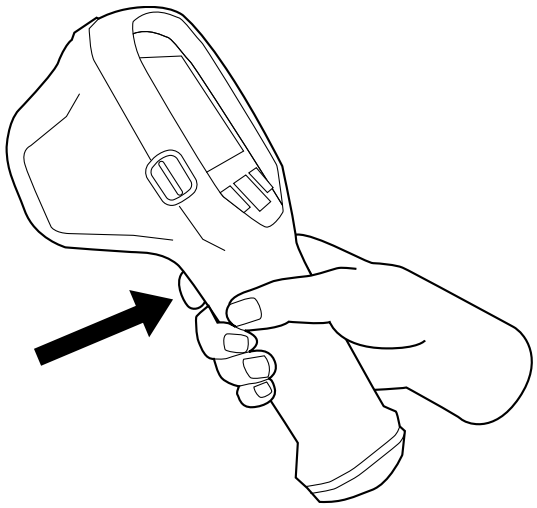
11.5 Saving an image

11.5.1 General

You can save images to the camera's image archive.

Note
The maximum number of images that can be saved in the image archive is 200. When the number of images exceed 200, images are deleted on a *first-in, first-out basis*, i.e., the 201st image will delete the 1st image, the 202nd image will delete the 2nd image, and so on.

11.5.2 Figure



11.5.3 Procedure

Follow this procedure:

1. Aim the camera toward an object of interest.
2. To save an image, pull the trigger.

11.6 Connecting the camera to a computer

11.6.1 General

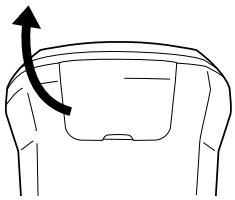
You can connect the camera to a computer, using the USB cable. Once connected, you can move the images from the camera's image archive to the computer. You can also import the images into our FLIR Tools software. A download card for FLIR Tools is included in the transport case.

For more information about FLIR Tools, see the FLIR Tools manual on the User Documentation CD-ROM, or on the *Help* menu in FLIR Tools.

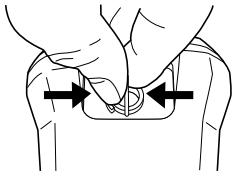
11.6.2 Procedure

Follow this procedure:

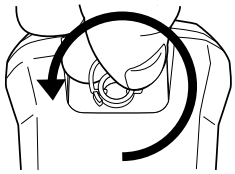
1. Fold up the rubber cover at the top of the camera.



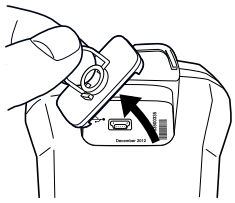
2. Hold the metal ring firmly.



3. Rotate the ring approx. 110° counter-clockwise.

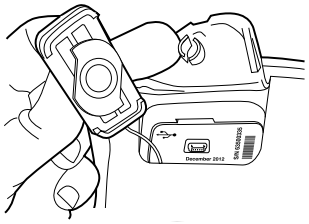


4. Pull out the plastic insert.



⚠ CAUTION
The plastic insert has an O-ring seal. Do not damage the O-ring seal.

5. Connect the USB cable to the USB Mini-B connector in the connector bay.



6. Do one of the following:
   - Move the images to the computer using a drag-and-drop operation.

     Note
     Moving an image using a drag-and-drop operation does not delete the image in the camera.

   - Move the images to the computer using FLIR Tools.

11.7 Viewing saved images

11.7.1 General

When you save an image, the image is stored in the camera's image archive. To display the image again, you can recall it from the archive.

11.7.2 Procedure

Follow this procedure:

1. Push and hold the *Mode* button, then push the *Zoom* button. This will display the screen below.

2. Select *Archive* by pushing the *Mode* button. This will display the screen below.

3. In the image archive, do one of the following:
   - Select *Next* by pushing the *Mode* button to navigate in the image archive.
   - Select *Maximize* by pushing the *Zoom* button to enlarge a specific image.
4. Select *Exit* by pushing the *On/off* button to exit the image archive.

11.8 Changing settings (in the camera)

11.8.1 General

You can change a variety of settings. These settings include the following:

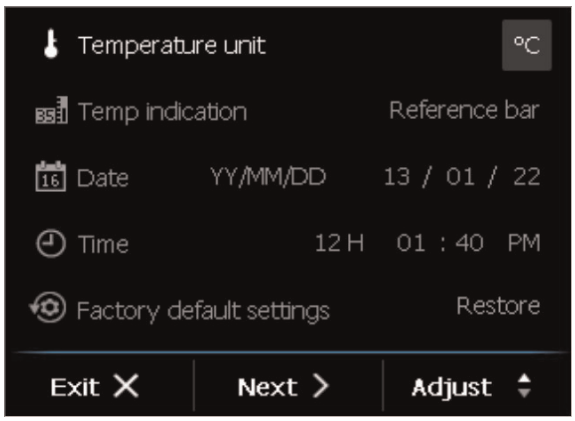
- Temperature unit.
- Temperature indication.
- Date.
- Time.
- Factory default settings.

11.8.2 Procedure

Follow this procedure:

1. Push and hold the *Mode* button, then push the *Zoom* button. This will display the screen below.

2. Select *Settings* by pushing the *Zoom* button. This will display the screen below.

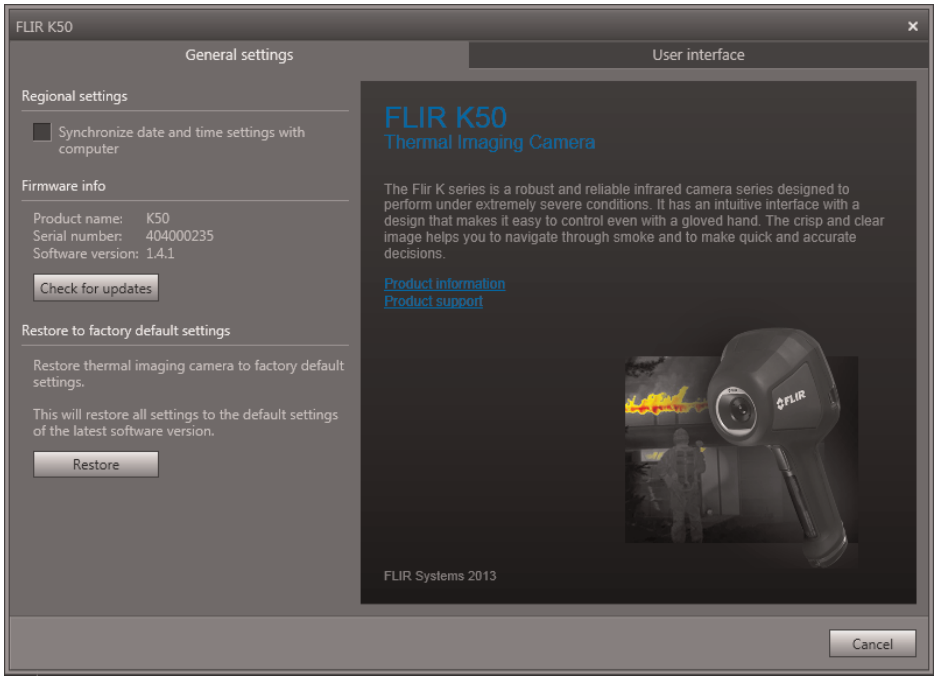


3. Select *Next* by pushing the *Mode* button to navigate to the parameter that you want to change.
4. Select *Adjust* by pushing the *Zoom* button to change the value.
5. Select *Exit* by pushing the *On/off* button to confirm the choice and exit the dialog box.

11.9 Changing settings (in FLIR Tools)

11.9.1 The General settings tab

11.9.1.1 Figure



11.9.1.2 Explanation

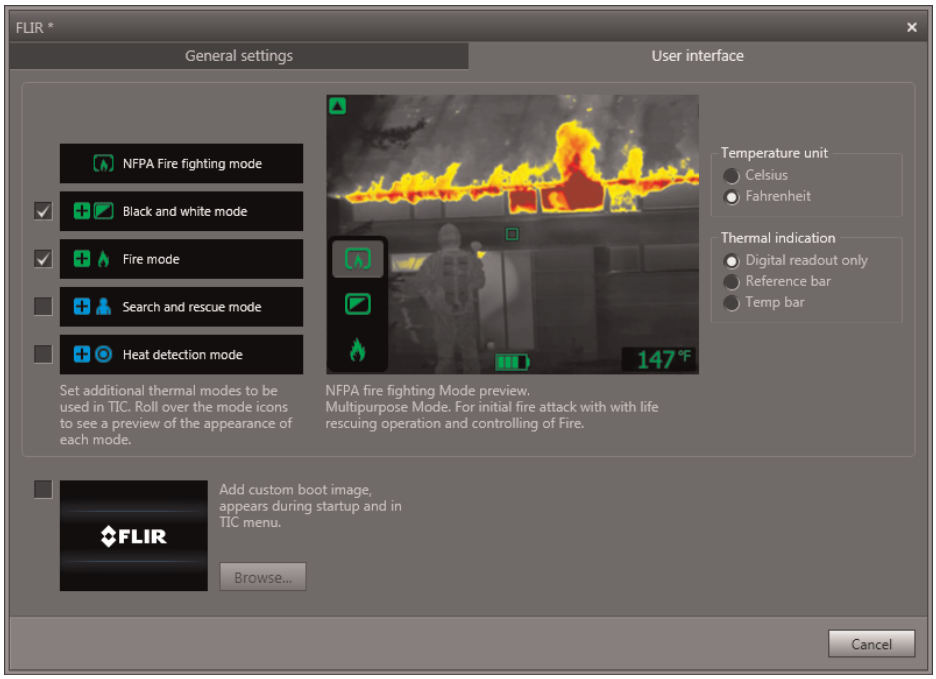
Regional settings area: To synchronize the camera's date and time settings with the computer, select the checkbox.

Firmware info area: To check whether a newer version of the camera firmware exists, click *Check for updates*, and follow the on-screen instructions.

Restore to factory default area: To restore all camera settings to the factory defaults, click *Restore*.

11.9.2 The User interface tab

11.9.2.1 Figure



11.9.2.2 Explanation

Camera modes area: To define which camera modes to enable in the camera, select the camera mode. For more information on each camera mode, see section 11.4.2 *Explanation of the different camera modes*, page 15.

Temperature unit area: To select a different temperature unit, click *Celsius* or *Fahrenheit*.

Thermal indication area > *Digital readout only*: To display the thermal information in the image as the temperature of the spotmeter only, select *Digital readout only*. In modes with automatic heat colorization, the colorization of the image will remain but the static heat color reference icon will not be displayed.

Thermal indication area > *Reference bar*: In modes with automatic heat indication colorization, a vertical heat color reference bar is displayed in the thermal indication area. This static icon shows how heat colors are applied to the range of the camera mode. The colors yellow, orange, and red correspond to a temperature-dependent change in hue as the temperature increases.

Thermal indication area > *Temp bar*: To display the thermal information in the image as a temperature bar, similar to a thermometer, click *Temp bar*. This displays a dynamic vertical temperature bar on the right side of the image. The top of the dynamic bar represents the temperature of the measured spot. In modes with automatic heat colorization, the colorization of the image will remain, with a static heat color reference icon displayed next to the temp bar.

Custom boot image area: To specify your own unique image to appear during start-up, click *Browse*, and navigate to the image file. This is useful for, for example, identifying your fire department cameras. By incorporating your fire department's logo, and a unique identity number in the image, you can keep track of your cameras. This image can also be accessed from the camera menu.

12 In-truck charger (optional accessory)

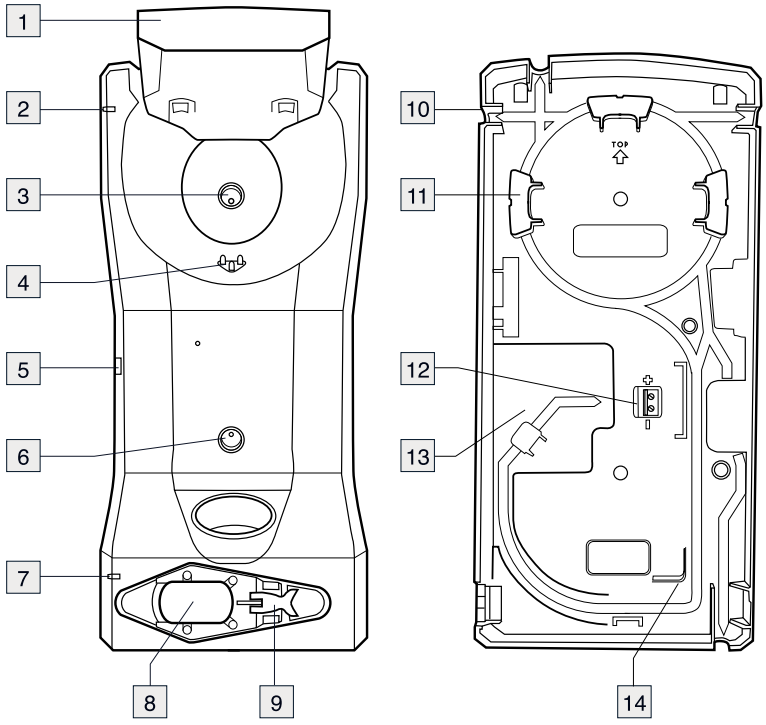
12.1 Introduction

Thank you for choosing the FLIR K series in-truck charger from FLIR Systems.

The in-truck charger is intended to be mounted on a flat surface in the cab, in one of the equipment lockers, or in another suitable compartment on the fire engine. The in-truck charger has five ports for cable routing—one through the rear of the metal bracket and one port on each side of the in-truck charger.

The in-truck charger can also be powered using a standard FLIR Systems power supply, and has a battery charger located at the lower front of the unit.

12.2 Parts and functions



1. Top cover.
2. LED indicator for the camera charger.
3. Hole for attaching the charger housing to the metal bracket.

4. Connectors in the cradle.
5. Connector to power the charger using a standard FLIR Systems power supply.
6. Hole for attaching the charger housing to the metal bracket.
7. LED indicator for the battery charger.
8. Battery slot.
9. Eccentric latch to secure the battery during charging.
10. Cable port (1 of 4).
11. Routing support.
12. 12–24 VDC cable plinth.
13. Recess for the cable.
14. Routing support.

12.3 Choosing a suitable position

Before mounting the in-truck charger, take a few minutes to think about a suitable position.

The mounting position should be protected from rain and road splash, and it should be reasonably easy to install a permanent cable running from the fire engine's 12–24 VDC system to the in-truck charger.

Additional considerations may be important, e.g., getting access to panels and equipment behind the in-truck charger.

12.4 Recommended cable area and fuse

Cable area	1.5 mm^2 (No. 15 AWG)
Fuse	5 A

12.5 Mounting instructions

Follow this procedure:

1. Permanently install a cable running from the fire engine's 12–24 VDC system to the selected mounting position of the in-truck charger. Do not connect this cable to the 12–24 VDC system at this time. The routing must include a fuse installed close to the battery. See above for the fuse recommendation.
2. Remove the two screws that hold the metal bracket.
3. Remove the metal bracket.
4. Use the metal bracket as a template to mark where the mounting holes should be drilled.
5. Drill the holes.
6. Mount the metal bracket using the rivets and/or screws that come with the in-truck charger.
7. Connect the cable to the cable plinth on the rear of the in-truck charger.

Note
Take note of the polarity when you connect the cable to the cable plinth.

8. Route the cable so that it exits through the cable port of your choice.
9. Mount the in-truck charger to the metal bracket using the two screws that you removed in Step 2 above.
10. Permanently connect the cable to the fire engine's 12–24 VDC system.

12.6 Charging the camera

Follow this procedure:

1. Pull up the top cover of the in-truck charger.
2. Push the camera into position.
3. Push down the top cover.
   The charging of the camera has now started, and is finished when the blue light glows continuously. Charging a fully depleted camera takes approximately 4 hours.

12.7 Charging a battery separately

FLIR K series batteries can be charged separately using the battery charger at the lower front of the unit.

Follow this procedure:

1. Pull the eccentric latch on the bottom of the camera.
2. Pull out the battery from the camera.
3. Push the battery into the slot at the lower front of the charger.
4. Secure the battery using the eccentric latch on the charger.
   The charging of the battery has now started, and is finished when the blue light glows continuously. Charging a fully depleted battery takes approximately 4 hours.

12.8 Technical data

Dimensions (height × width × depth)	380 mm × 180 mm × 153 mm (15″ × 7.1″ × 6″)
Weight	2.2 kg (4.8 lb)
Power input	12–24 VDC
Charging time (camera)	≈ 4 hours
Charging time (separate battery)	≈ 4 hours
Maximum current	3 A
Nominal current	2.3 A

12.9 Cleaning

⚠ **CAUTION**
Disconnect the in-truck charger from the fire engine's 12–24 VDC system before cleaning.

The in-truck charger can be cleaned using warm water or a weak detergent solution. Do not use solvents or similar liquids.

12.10 Customer support

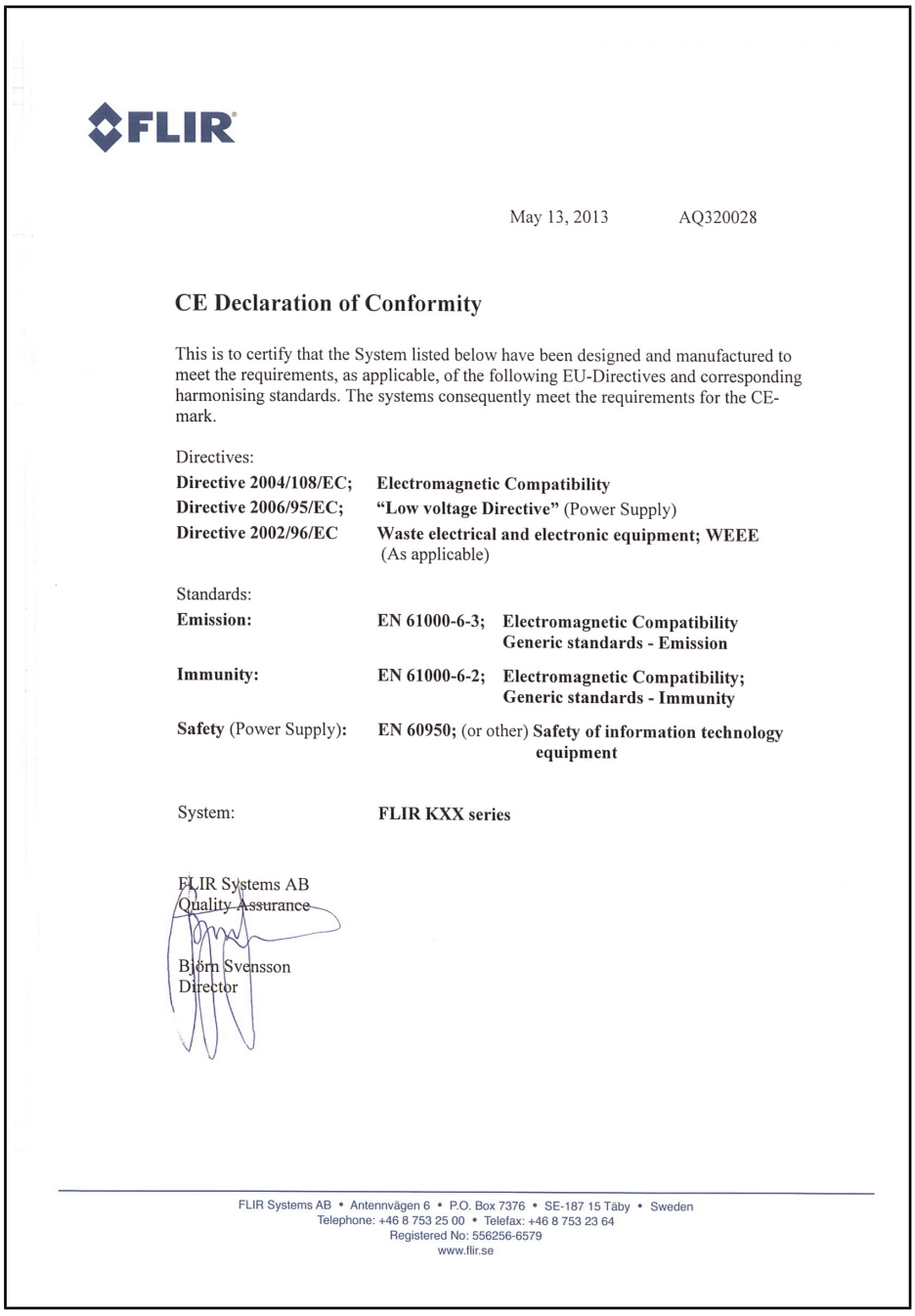
Should you experience any problems, do not hesitate to contact our Customer Support at http://support.flir.com.

13 Technical data

For technical data on this product, refer to the product catalog and/or technical datasheets on the User Documentation CD-ROM that comes with the product.

The product catalog and the datasheets are also available at http://support.flir.com.

14 Declaration of conformity



FLIR

May 13, 2013 AQ320028

CE Declaration of Conformity

This is to certify that the System listed below have been designed and manufactured to meet the requirements, as applicable, of the following EU-Directives and corresponding harmonising standards. The systems consequently meet the requirements for the CE-mark.

Directives:

Directive 2004/108/EC;	**Electromagnetic Compatibility**
Directive 2006/95/EC;	**"Low voltage Directive"** (Power Supply)
Directive 2002/96/EC	**Waste electrical and electronic equipment; WEEE** (As applicable)

Standards:

Emission:	**EN 61000-6-3; Electromagnetic Compatibility Generic standards - Emission**
Immunity:	**EN 61000-6-2; Electromagnetic Compatibility; Generic standards - Immunity**
Safety (Power Supply)**:**	**EN 60950;** (or other) **Safety of information technology equipment**
System:	**FLIR KXX series**

FLIR Systems AB
Quality Assurance

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Director

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Registered No: 556256-6579
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15 Cleaning the camera

15.1 Camera housing, cables, and other items

15.1.1 Liquids

Use one of these liquids:

- Warm water
- A weak detergent solution

15.1.2 Equipment

A soft cloth

15.1.3 Procedure

Follow this procedure:

1. Soak the cloth in the liquid.
2. Twist the cloth to remove excess liquid.
3. Clean the part with the cloth.

CAUTION

Do not apply solvents or similar liquids to the camera, the cables, or other items. This can cause damage.

15.2 Infrared lens

15.2.1 Liquids

Use one of these liquids:

- A commercial lens cleaning liquid with more than 30% isopropyl alcohol.
- 96% ethyl alcohol (C_2H_5OH).
- DEE (= 'ether' = diethylether, $C_4H_{10}O$).
- 50% acetone (= dimethylketone, $(CH_3)_2CO$)) + 50% ethyl alcohol (by volume). This liquid prevents drying marks on the lens.

15.2.2 Equipment

Cotton wool

15.2.3 Procedure

Follow this procedure:

1. Soak the cotton wool in the liquid.
2. Twist the cotton wool to remove excess liquid.
3. Clean the lens one time only and discard the cotton wool.

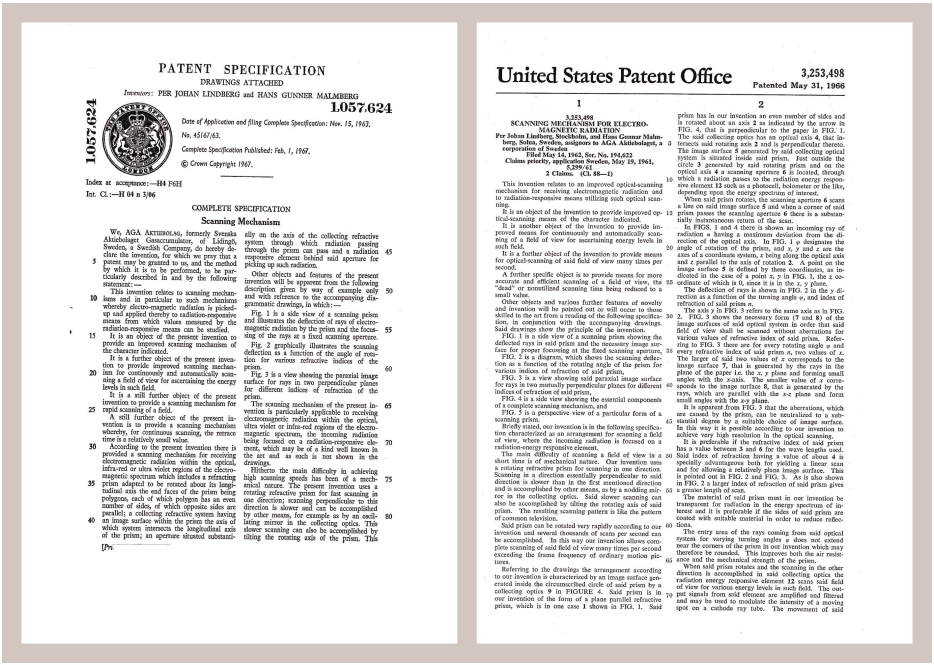
WARNING

Make sure that you read all applicable MSDS (Material Safety Data Sheets) and warning labels on containers before you use a liquid: the liquids can be dangerous.

CAUTION

- Be careful when you clean the infrared lens. The lens has a delicate anti-reflective coating.
- Do not clean the infrared lens too vigorously. This can damage the anti-reflective coating.

FLIR Systems was established in 1978 to pioneer the development of high-performance infrared imaging systems, and is the world leader in the design, manufacture, and marketing of thermal imaging systems for a wide variety of commercial, industrial, and government applications. Today, FLIR Systems embraces five major companies with outstanding achievements in infrared technology since 1958—the Swedish AGEMA Infrared Systems (formerly AGA Infrared Systems), the three United States companies Indigo Systems, FSI, and Inframetrics, and the French company Cedip. In November 2007, Extech Instruments was acquired by FLIR Systems.



PATENT SPECIFICATION

DRAWINGS ATTACHED

Inventors: PER JOHAN LINDBERG and HANS GUNNER MALMBERG

1,057,624

Date of Application and filing Complete Specification: Nov. 15, 1963.
No. 45167/63.

Complete Specification Published: Feb. 1, 1967.

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Index at acceptance:—H4 F6H

Int. Cl.:—H 04 n 3/06

COMPLETE SPECIFICATION

Scanning Mechanism

United States Patent Office 3,253,498 Patented May 31, 1966

Figure 16.1 Patent documents from the early 1960s

The company has sold more than 258,000 infrared cameras worldwide for applications such as predictive maintenance, R & D, non-destructive testing, process control and automation, and machine vision, among many others.

FLIR Systems has three manufacturing plants in the United States (Portland, OR, Boston, MA, Santa Barbara, CA) and one in Sweden (Stockholm). Since 2007 there is also a manufacturing plant in Tallinn, Estonia. Direct sales offices in Belgium, Brazil, China, France, Germany, Great Britain, Hong Kong, Italy, Japan, Korea, Sweden, and the USA —together with a worldwide network of agents and distributors—support our international customer base.

FLIR Systems is at the forefront of innovation in the infrared camera industry. We anticipate market demand by constantly improving our existing cameras and developing new ones. The company has set milestones in product design and development such as the introduction of the first battery-operated portable camera for industrial inspections, and the first uncooled infrared camera, to mention just two innovations.

Figure 16.2 LEFT: Thermovision Model 661 from 1969. The camera weighed approximately 25 kg (55 lb.), the oscilloscope 20 kg (44 lb.), and the tripod 15 kg (33 lb.). The operator also needed a 220 VAC generator set, and a 10 L (2.6 US gallon) jar with liquid nitrogen. To the left of the oscilloscope the Polaroid attachment (6 kg/13 lb.) can be seen. RIGHT: FLIR i7 from 2012. Weight: 0.34 kg (0.75 lb.), including the battery.

FLIR Systems manufactures all vital mechanical and electronic components of the camera systems itself. From detector design and manufacturing, to lenses and system electronics, to final testing and calibration, all production steps are carried out and supervised by our own engineers. The in-depth expertise of these infrared specialists ensures the accuracy and reliability of all vital components that are assembled into your infrared camera.

16.1 More than just an infrared camera

At FLIR Systems we recognize that our job is to go beyond just producing the best infrared camera systems. We are committed to enabling all users of our infrared camera systems to work more productively by providing them with the most powerful camera–software combination. Especially tailored software for predictive maintenance, R & D, and process monitoring is developed in-house. Most software is available in a wide variety of languages.

We support all our infrared cameras with a wide variety of accessories to adapt your equipment to the most demanding infrared applications.

16.2 Sharing our knowledge

Although our cameras are designed to be very user-friendly, there is a lot more to thermography than just knowing how to handle a camera. Therefore, FLIR Systems has founded the Infrared Training Center (ITC), a separate business unit, that provides certified training courses. Attending one of the ITC courses will give you a truly hands-on learning experience.

The staff of the ITC are also there to provide you with any application support you may need in putting infrared theory into practice.

16.3 Supporting our customers

FLIR Systems operates a worldwide service network to keep your camera running at all times. If you discover a problem with your camera, local service centers have all the equipment and expertise to solve it within the shortest possible time. Therefore, there is no need to send your camera to the other side of the world or to talk to someone who does not speak your language.

16.4 A few images from our facilities

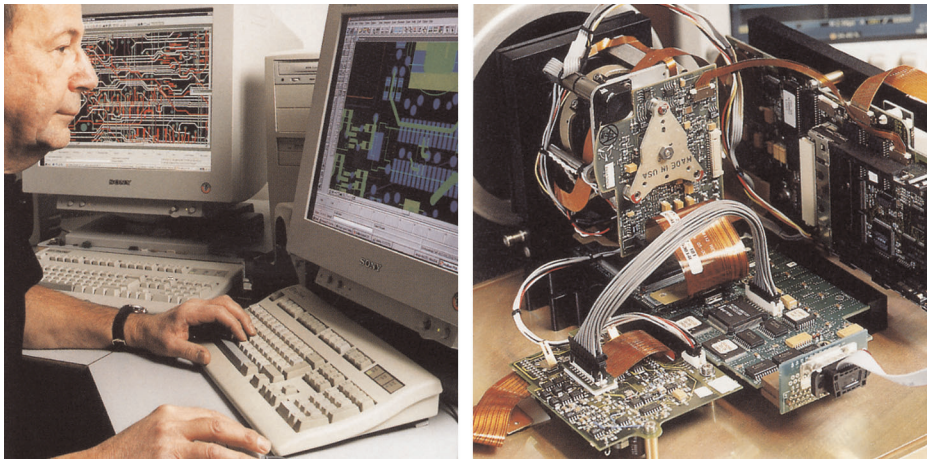

Figure 16.3 LEFT: Development of system electronics; RIGHT: Testing of an FPA detector

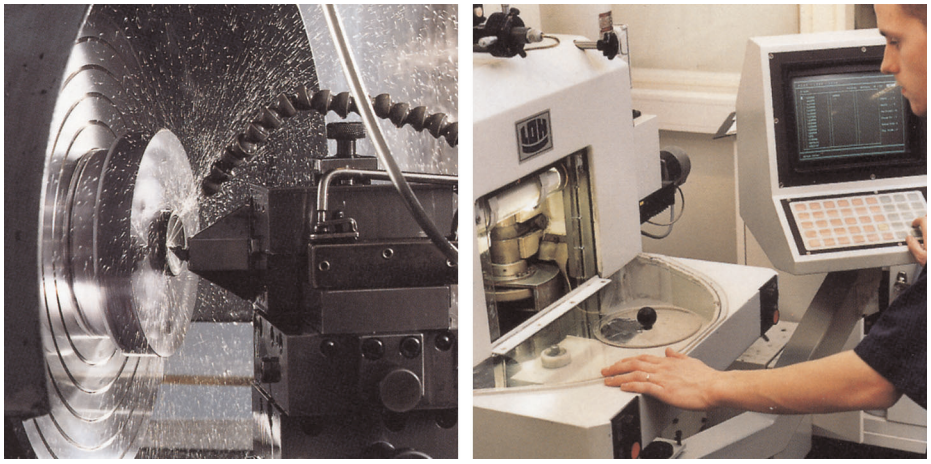

Figure 16.4 LEFT: Diamond turning machine; RIGHT: Lens polishing

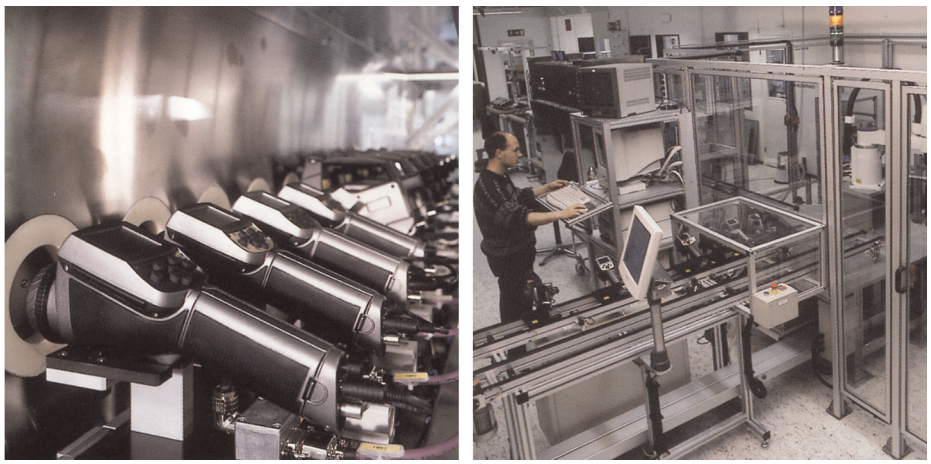

Figure 16.5 LEFT: Testing of infrared cameras in the climatic chamber; RIGHT: Robot used for camera testing and calibration

17 History of infrared technology

Before the year 1800, the existence of the infrared portion of the electromagnetic spectrum wasn't even suspected. The original significance of the infrared spectrum, or simply ‘the infrared’ as it is often called, as a form of heat radiation is perhaps less obvious today than it was at the time of its discovery by Herschel in 1800.

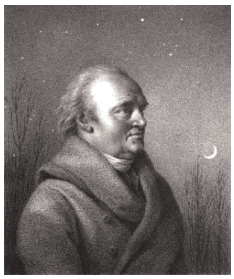

Figure 17.1 Sir William Herschel (1738–1822)

The discovery was made accidentally during the search for a new optical material. Sir William Herschel – Royal Astronomer to King George III of England, and already famous for his discovery of the planet Uranus – was searching for an optical filter material to reduce the brightness of the sun’s image in telescopes during solar observations. While testing different samples of colored glass which gave similar reductions in brightness he was intrigued to find that some of the samples passed very little of the sun’s heat, while others passed so much heat that he risked eye damage after only a few seconds’ observation.

Herschel was soon convinced of the necessity of setting up a systematic experiment, with the objective of finding a single material that would give the desired reduction in brightness as well as the maximum reduction in heat. He began the experiment by actually repeating Newton’s prism experiment, but looking for the heating effect rather than the visual distribution of intensity in the spectrum. He first blackened the bulb of a sensitive mercury-in-glass thermometer with ink, and with this as his radiation detector he proceeded to test the heating effect of the various colors of the spectrum formed on the top of a table by passing sunlight through a glass prism. Other thermometers, placed outside the sun’s rays, served as controls.

As the blackened thermometer was moved slowly along the colors of the spectrum, the temperature readings showed a steady increase from the violet end to the red end. This was not entirely unexpected, since the Italian researcher, Landriani, in a similar experiment in 1777 had observed much the same effect. It was Herschel, however, who was the first to recognize that there must be a point where the heating effect reaches a maximum, and that measurements confined to the visible portion of the spectrum failed to locate this point.

Figure 17.2 Marsilio Landriani (1746–1815)

Moving the thermometer into the dark region beyond the red end of the spectrum, Herschel confirmed that the heating continued to increase. The maximum point, when he found it, lay well beyond the red end – in what is known today as the ‘infrared wavelengths’.

When Herschel revealed his discovery, he referred to this new portion of the electromagnetic spectrum as the ‘thermometrical spectrum’. The radiation itself he sometimes referred to as ‘dark heat’, or simply ‘the invisible rays’. Ironically, and contrary to popular opinion, it wasn't Herschel who originated the term ‘infrared’. The word only began to appear in print around 75 years later, and it is still unclear who should receive credit as the originator.

Herschel’s use of glass in the prism of his original experiment led to some early controversies with his contemporaries about the actual existence of the infrared wavelengths. Different investigators, in attempting to confirm his work, used various types of glass indiscriminately, having different transparencies in the infrared. Through his later experiments, Herschel was aware of the limited transparency of glass to the newly-discovered thermal radiation, and he was forced to conclude that optics for the infrared would probably be doomed to the use of reflective elements exclusively (i.e. plane and curved mirrors). Fortunately, this proved to be true only until 1830, when the Italian investigator, Melloni, made his great discovery that naturally occurring rock salt (NaCl) – which was available in large enough natural crystals to be made into lenses and prisms – is remarkably transparent to the infrared. The result was that rock salt became the principal infrared optical material, and remained so for the next hundred years, until the art of synthetic crystal growing was mastered in the 1930’s.

Figure 17.3 Macedonio Melloni (1798–1854)

Thermometers, as radiation detectors, remained unchallenged until 1829, the year Nobili invented the thermocouple. (Herschel’s own thermometer could be read to 0.2 °C (0.036 °F), and later models were able to be read to 0.05 °C (0.09 °F)). Then a breakthrough occurred; Melloni connected a number of thermocouples in series to form the first thermopile. The new device was at least 40 times as sensitive as the best thermometer of the day for detecting heat radiation – capable of detecting the heat from a person standing three meters away.

The first so-called ‘heat-picture’ became possible in 1840, the result of work by Sir John Herschel, son of the discoverer of the infrared and a famous astronomer in his own right. Based upon the differential evaporation of a thin film of oil when exposed to a heat pattern focused upon it, the thermal image could be seen by reflected light where the interference effects of the oil film made the image visible to the eye. Sir John also managed to obtain a primitive record of the thermal image on paper, which he called a ‘thermograph’.

Figure 17.4 Samuel P. Langley (1834–1906)

The improvement of infrared-detector sensitivity progressed slowly. Another major breakthrough, made by Langley in 1880, was the invention of the bolometer. This consisted of a thin blackened strip of platinum connected in one arm of a Wheatstone bridge circuit upon which the infrared radiation was focused and to which a sensitive galvanometer responded. This instrument is said to have been able to detect the heat from a cow at a distance of 400 meters.

An English scientist, Sir James Dewar, first introduced the use of liquefied gases as cooling agents (such as liquid nitrogen with a temperature of -196 °C (-320.8 °F)) in low temperature research. In 1892 he invented a unique vacuum insulating container in which it is possible to store liquefied gases for entire days. The common ‘thermos bottle’, used for storing hot and cold drinks, is based upon his invention.

Between the years 1900 and 1920, the inventors of the world ‘discovered’ the infrared. Many patents were issued for devices to detect personnel, artillery, aircraft, ships – and even icebergs. The first operating systems, in the modern sense, began to be developed during the 1914–18 war, when both sides had research programs devoted to the military exploitation of the infrared. These programs included experimental systems for enemy intrusion/detection, remote temperature sensing, secure communications, and ‘flying torpedo’ guidance. An infrared search system tested during this period was able to detect an approaching airplane at a distance of 1.5 km (0.94 miles), or a person more than 300 meters (984 ft.) away.

The most sensitive systems up to this time were all based upon variations of the bolometer idea, but the period between the two wars saw the development of two revolutionary new infrared detectors: the image converter and the photon detector. At first, the image converter received the greatest attention by the military, because it enabled an observer for the first time in history to literally ‘see in the dark’. However, the sensitivity of the image converter was limited to the near infrared wavelengths, and the most interesting military targets (i.e. enemy soldiers) had to be illuminated by infrared search beams. Since this involved the risk of giving away the observer’s position to a similarly-equipped enemy observer, it is understandable that military interest in the image converter eventually faded.

The tactical military disadvantages of so-called 'active’ (i.e. search beam-equipped) thermal imaging systems provided impetus following the 1939–45 war for extensive secret military infrared-research programs into the possibilities of developing ‘passive’ (no search beam) systems around the extremely sensitive photon detector. During this period, military secrecy regulations completely prevented disclosure of the status of infrared-imaging technology. This secrecy only began to be lifted in the middle of the 1950’s, and from that time adequate thermal-imaging devices finally began to be available to civilian science and industry.

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