FLIR MODEL DM284

True RMS Industrial Multimeter with IGM™
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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: 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.

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. Safety

Safety Notes
• Before operating the device, you must read, understand, and follow all instructions, dangers, warnings, cautions, and notes.
• FLIR Systems reserves the right to discontinue models, parts or accessories, and other items, or to change specifications at any time without prior notice.
• Remove the batteries if the device is not to be used for an extended period of time.
Warning Statements

- Do not operate the device if you do not have the correct knowledge. Incorrect operation of the device can cause damage, shock, injury or death to persons.
- Do not start a measuring procedure before you have set the function switch to the correct position. Failure to do so can cause damage to the instrument and can cause injury to persons.
- Do not change to the resistance mode when measuring voltage. This can cause damage to the instrument and can cause injury to persons.
- Do not measure the current on a circuit when the voltage increases to more than 1000 V. This can cause damage to the instrument and can cause injury to persons.
- You must disconnect the test leads from the circuit under test before you change the range. Failure to observe this warning can damage the instrument and cause bodily injury.
- Do not replace the batteries before you remove the test leads. This can cause damage to the instrument and can cause injury to persons.
- Do not use the device if the test leads and/or the device show signs of damage. Injury to persons can occur.
- Be careful performing measurements if the voltages are > 25 VAC rms or 35 VDC. There is a risk of shock from these voltages. Injury to persons can occur.
- Do not do diode, resistance or continuity tests before you have removed the power from capacitors and other devices under test. Injury to persons can occur.
- Be careful when performing voltage checks on electrical outlets. These checks are difficult because of the uncertainty of the connection to the recessed electrical contacts. You must not rely solely on this this device when determining if the terminals are not “live”. There is a risk of electrical shock. Injury to person can occur.
- Do not touch expired/damaged batteries without gloves. Injury to persons can occur.
- Do not cause a short circuit of the batteries. This can cause damage to the instrument and can cause injury to persons.
- Do not put the batteries into a fire. Injury to persons can occur.
- Use extreme caution when the laser pointer is on.
- Do not point the beam toward anyone's eye or allow the beam to strike the eye from a reflective surface.
- Do not use the laser near explosive gases or in other potentially explosive areas.
- Refer to the CAUTION statement label (shown below) for critical safety information.
Cautions
Do not use the device in a manner not specified by the manufacturer. This can cause damage to the protection provided.

<table>
<thead>
<tr>
<th></th>
<th>This symbol, adjacent to another symbol or terminal, indicates that the user must refer to the user manual for further information.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This symbol, adjacent to a terminal, indicates that, under normal use, hazardous voltages may be present.</td>
</tr>
<tr>
<td></td>
<td>Double insulation.</td>
</tr>
</tbody>
</table>

UL listing is not an indication or a verification of the accuracy of the meter

3. Introduction
Thank you for selecting the FLIR DM284 True RMS Digital MultiMeter with IGM™ (Infrared Guide Measurement). The DM284 can measure voltage up to 1000V AC/DC and includes Low-Z (low impedance), VFD (low pass filter), and offers Smart/Classic Diode modes. This device is shipped fully tested and calibrated and, with proper use, will provide years of reliable service.

3.1 Key Features
- 6000 count 2.8” digital TFT display with bargraph
- Built-in IGM™ Infrared imager with laser pointer and crosshair targeting
- Measures Voltage, Current (A, mA, µA), Frequency, Resistance/Continuity, Diode (Classic and Smart modes), Capacitance, and Temperature
- Built-in non-contact voltage detector (NCV)
- Customizable via easy-to-use menu system
- Automatic and Manual ranging
- Input over-voltage warning
- MIN-MAX-AVG memory
- PEAK MIN and PEAK MAX
- Flex Clamp direct input
- On-screen programming menu navigation
- Variable-frequency drive VFD mode (low-pass filter)
- Low-Z (low impedance) mode
- Relative mode
- Data Hold and Auto Hold
- Auto Power OFF
- Safety Category Rating: CAT IV-600V, CAT III-1000V.
- Equipped with batteries, test leads, alligator clips, test lead storage/holder attachment, Type-K thermocouple, and Quick Start booklet.
4.1 Front and Back Meter Descriptions

**Fig. 4-1 Front View**

1. Work Light and NCV detector area
2. LCD Display
3. Navigation/OK buttons
4. MODE Button
5. RANGE Button
6. Work light Button
7. Rotary Function Switch
8. Positive (+) Probe Input Jack for \( A \) (Current).
9. Positive (+) Probe Input Jack for \( mA \) (Current).
10. COM (-) Probe Input Jack
11. Positive (+) Probe Input Jack for all inputs except \( A \) and \( mA \)
12. Display ‘Hold’ \( (H) \) button
13. Cancel/Return Button
14. IGM™ Button

**Fig. 4-2 Rear View**

1. Test Lead holder attachment mounts
2. Thermal Imaging lens
3. Laser pointer lens
4. Lens cover slide control
5. Tripod mount (test lead holder attaches here also)
6. Tilt Stand (Battery Compartment located beneath the stand)
### 4.2 Function Switch Positions

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Detect AC voltage through the non-contact sensor at the top of the meter." /> Detect AC voltage through the non-contact sensor at the top of the meter.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Measure voltage through the probe inputs with a low-impedance load positioned across the inputs that stabilizes the measurement." /> Measure voltage through the probe inputs with a low-impedance load positioned across the inputs that stabilizes the measurement.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Meter is switched OFF and in full power-saving mode." /> Meter is switched OFF and in full power-saving mode.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="FLEX Direct: Auxiliary channel for use with optional Flexible Current clamp or standard clamp adaptors when &gt; 600A measurements are required. In this mode, the meter will display true rms ACA measurements from the connected device. Frequency (Hz) can be displayed by pressing the MODE button." /> FLEX Direct: Auxiliary channel for use with optional Flexible Current clamp or standard clamp adaptors when &gt; 600A measurements are required. In this mode, the meter will display true rms ACA measurements from the connected device. Frequency (Hz) can be displayed by pressing the MODE button.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Measure AC voltage (V) through the probe inputs." /> Measure AC voltage (V) through the probe inputs.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Measure DC voltage (V) through the probe inputs." /> Measure DC voltage (V) through the probe inputs.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Measure low voltage (mV) through the probe inputs. Use the MODE button to select AC/DC voltage." /> Measure low voltage (mV) through the probe inputs. Use the MODE button to select AC/DC voltage.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Measure temperature through the probe inputs using a thermocouple adaptor. Use the MODE button to select Temperature (see Section 5.2.2, Thermal Settings Menu, to select °C or °F unit of measure)." /> Measure temperature through the probe inputs using a thermocouple adaptor. Use the MODE button to select Temperature (see Section 5.2.2, Thermal Settings Menu, to select °C or °F unit of measure).</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Measure resistance, continuity, capacitance, or diode through the probe inputs. Use the MODE button to select the desired function." /> Measure resistance, continuity, capacitance, or diode through the probe inputs. Use the MODE button to select the desired function.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Measure current through the probe inputs (A or mA). Use the MODE button to select AC or DC." /> Measure current through the probe inputs (A or mA). Use the MODE button to select AC or DC.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Measure µA current through the probe inputs. Use the MODE button to select AC or DC." /> Measure µA current through the probe inputs. Use the MODE button to select AC or DC.</td>
<td></td>
</tr>
</tbody>
</table>

---

*Fig. 4-3 Function Switch*
4.3 Function Buttons and Selector/Navigation Pad

**MODE** Button
Use to select a sub-function of the primary function. See Section 4.3.1, **MODE Button Operation**, for details.

**RANGE** Button
From Auto range mode, press to select Manual range mode. From Manual range mode, quick press to change the range (scale). Long press to activate Auto range mode.

**IGO** Button
Press to activate the Thermal Camera IGM™ (Infrared Guide Measurement).

**Selector**/Navigation Pad
Use the selector/navigation pad to enable extended functionality modes and to navigate mode menu options.

**Previous** Button
Press to return from a menu screen (no function in normal mode).

**Hold** Button
Press to enter the Hold mode (display hold or auto hold as selected in the Settings Menu see Section 5.2.8, Multimeter settings Menu).

**Light** Button
Press to enable/disable the work light.

### 4.3.1 MODE Button Operation

<table>
<thead>
<tr>
<th>Rotary Switch Position</th>
<th>Switch Sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCV</td>
<td>No operation</td>
</tr>
<tr>
<td>LoZ</td>
<td>ACV → DCV → Frequency</td>
</tr>
<tr>
<td>Flex</td>
<td>ACA → Frequency</td>
</tr>
<tr>
<td>ACV</td>
<td>ACV → Frequency</td>
</tr>
<tr>
<td>DCV</td>
<td>No operation</td>
</tr>
<tr>
<td>mV (Temperature)</td>
<td>ACmV → DCmV → Frequency → Temperature</td>
</tr>
<tr>
<td>Resistance</td>
<td>Resistance → Continuity → Capacitance → Diode</td>
</tr>
<tr>
<td>µA</td>
<td>ACµA → DCµA</td>
</tr>
<tr>
<td>A (A Terminal)</td>
<td>ACA → DCA → Frequency</td>
</tr>
<tr>
<td>mA (mA Terminal)</td>
<td>ACmA → DCmA → Frequency</td>
</tr>
</tbody>
</table>
4.3.2 Selector/Navigation Pad Operation
There are five (5) buttons arranged in a square that make up the Selector/Navigation pad, as shown in Figure 4-4.

![Selector Navigation Pad](image)

**Fig. 4-4 Selector Navigation Pad**

OK button (center) is used to access the main menu and select/change menu options.

LEFT/RIGHT buttons: The left/right buttons are used to navigate the menus.

UP/DOWN buttons: The up/down buttons are used to navigate the menus.

### 4.4 Display Icons and Status Indicators

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="LoZ" /></td>
<td>Low Impedance mode</td>
</tr>
<tr>
<td><img src="image" alt="Voltage" /></td>
<td>Sensed voltage is &gt; 30 V (AC or DC)</td>
</tr>
<tr>
<td><img src="image" alt="Voltage" /></td>
<td>Non-Contact Voltage detector (low sensitivity mode) for 160~1000V range</td>
</tr>
<tr>
<td><img src="image" alt="Voltage" /></td>
<td>Non-Contact Voltage detector (high sensitivity mode) for 80~1000V range</td>
</tr>
<tr>
<td><img src="image" alt="Arrow Up" /></td>
<td>MAX (Maximum) reading value displayed</td>
</tr>
<tr>
<td><img src="image" alt="Arrow Down" /></td>
<td>MIN (Minimum) reading value displayed</td>
</tr>
<tr>
<td><img src="image" alt="Arrow Up Down" /></td>
<td>AVG (Average) reading value displayed</td>
</tr>
<tr>
<td><img src="image" alt="Arrow Up" /></td>
<td>PEAK MAX value displayed</td>
</tr>
<tr>
<td><img src="image" alt="Arrow Down" /></td>
<td>PEAK MIN value displayed</td>
</tr>
<tr>
<td>Icon</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td><img src="image" alt="Auto Range Mode" /></td>
<td>Auto range mode</td>
</tr>
<tr>
<td><img src="image" alt="Display Hold" /></td>
<td>Display Hold</td>
</tr>
<tr>
<td><img src="image" alt="Auto Hold" /></td>
<td>Auto Hold</td>
</tr>
<tr>
<td><img src="image" alt="Relative Mode" /></td>
<td>Relative mode</td>
</tr>
<tr>
<td><strong>0000</strong></td>
<td>Primary display (large digits)</td>
</tr>
<tr>
<td><strong>0000</strong></td>
<td>Secondary display (smaller digits)</td>
</tr>
<tr>
<td><strong>PROBE</strong></td>
<td>Test lead connection error</td>
</tr>
<tr>
<td><img src="image" alt="Emissivity Setting" /></td>
<td>Emissivity setting</td>
</tr>
<tr>
<td><img src="image" alt="Battery Voltage Status" /></td>
<td>Battery voltage status</td>
</tr>
<tr>
<td><img src="image" alt="Auto Power Off Function" /></td>
<td>Auto power off function enabled</td>
</tr>
<tr>
<td><img src="image" alt="AC Current/Voltage" /></td>
<td>AC current or voltage</td>
</tr>
<tr>
<td><img src="image" alt="DC Current/Voltage" /></td>
<td>DC current or voltage</td>
</tr>
<tr>
<td><img src="image" alt="Flex Clamp Direct Input" /></td>
<td>Flex Clamp Direct Input</td>
</tr>
<tr>
<td><img src="image" alt="Continuity Function" /></td>
<td>Continuity function</td>
</tr>
<tr>
<td><img src="image" alt="Diode Test Function" /></td>
<td>Diode test function</td>
</tr>
<tr>
<td><img src="image" alt="Work Light Active" /></td>
<td>Work light active</td>
</tr>
<tr>
<td><img src="image" alt="Bar Graph Measurement Indicator" /></td>
<td>Bar Graph Measurement Indicator</td>
</tr>
<tr>
<td><img src="image" alt="Bar Graph OL (Overload) Indicator" /></td>
<td>Bar Graph OL (overload) Indicator</td>
</tr>
</tbody>
</table>
5. Options and Settings Menus

5.1 Using the Options and Settings Menus

- Press OK to open the main menu. Use the navigation pad arrows to step through the menu icons. From left to right, as shown below, they are Image Mode, Thermal Settings, VFD, Advanced Menu, and Multimeter Settings.

- Press OK to open a menu item or to set an option ON or OFF. When an option is switched ON, a blue dot will appear next to the menu icon. The navigation arrows are sometimes used to select an option.

- Use the Return/Exit button to exit menu levels and to return to the normal display mode.

- The icons that are available differ in the Multimeter and IGM™ modes. The following information will detail this and other menu operations.

5.2 Options and Settings Details

5.2.1 Image Mode Menu

This icon is only available in the IGM™ mode. The Image Mode has two sub-menu selections: Image + DMM mode and Image Only mode:

- Image + DMM (default option): Display will show all IR data and DMM data.
- Image Only: Display will show IR data only.
- For both options, the status bar will show Battery, APO, Work Light, and Laser icons when applicable.
- Image Mode option is disabled (grayed out) in DMM mode.

Press OK on the Image Mode icon and use the arrows to select IGM + DMM or IMAGE.

5.2.2 Thermal Settings Menu

The following options are available in the Thermal Settings menu. More in-depth information may be found in the dedicated IGM section of this manual.

- IGM Color Palette selection. Press OK to select one of the display color palettes (Iron, Rainbow, or Gray).
• **Emissivity**: Press OK then use the up/down arrows to scroll to the desired preset (0.95, 0.85, 0.75, 0.65) or to the fine tuning icon. To fine tune, press OK at the fine tuning icon and then use the arrow buttons to make a selection, press OK to confirm. The available range is 0.10 to 0.99 in 0.01 steps.

![Emissivity Icon]

• **Laser pointer**: Press OK at this icon to switch the laser pointer ON (blue circle icon) or OFF (empty circle icon).

• **Cross hairs**: Press OK at this icon to switch the cross hairs ON or OFF.

• **Temperature Differential**: Only available when you select DMM IGM in the Image Mode Menu (above) and mV/Temp on the rotary switch. Press OK to switch this mode ON (blue dot) or OFF. When ON, the display shows the Type K Thermocouple temperature and IGM mode temperature differential (delta).

5.2.3 VFD Mode

In VFD (variable-frequency drive) mode, high-frequency noise is eliminated from the Multimeter voltage measurement through the use of a low-pass filter. VFD mode is available when measuring AC voltage or AC current.

1. Press the OK button to access the menu. Press OK at the VFD icon to select.
2. The blue dot next to the icon and the VFD display icon will appear.
3. De-select the VFD mode by pressing OK again. The blue dot and VFD display icon will switch OFF when de-selected.

5.2.4 Advanced Menu

Press OK to open the Advanced Menu. Three selections are available: MAX-MIN-AVG, PEAK, and Relative Mode. The next three sections cover these features in detail.

5.2.5 MIN-MAX-AVG Mode

This mode is accessed through the Advanced Menu, see previous section. The meter captures and displays the minimum, maximum, and average readings, updating only when a higher/lower value is registered. The meter also averages the total sum of all recorded values.

Press OK to show the maximum ↑, minimum ↓, and average ➕ readings on the display.
5.2.6 Peak Mode

This mode is accessed through the Advanced Menu, see above. In Peak mode, the meter captures and displays the positive and negative ACA and ACV peak values. The Peak display values changes only when higher/lower values are registered.

1. Press OK to show the Peak Max ↑ and Peak Min ↓ readings on the display.
2. Press OK to switch this mode OFF.

5.2.7 Relative mode

This mode is accessed through the Advanced Menu, see above.

1. Press OK on this icon to capture a reference reading that subsequent measurements can be compared with.
2. A blue dot is shown next to the icon when this mode is selected.
3. The reference value will be displayed next to the Relative icon.
4. The primary display will show the difference between the measured value and the stored reference.
5. Press OK at this icon to switch the Relative mode OFF.

5.2.8 Multimeter Settings Menu

1. Press OK to open the main menu
2. Navigate to the Multimeter Settings icon using the arrow buttons
3. Open the Settings menu by pressing the OK button.
4. See the Settings menu example below. The items in the example may differ from the meter that you have depending on the firmware version. Customize the settings as described below:

- Diode ➨ (Smart or Classic modes); see Section 7.11, Classic Diode, and Section 7.12, Smart Diode. Use the OK button to choose the desired setting.
- ⚠ Auto power off (APO): Press OK to open the sub-menu. Use the arrow buttons to choose the time period after which the meter enters sleep mode. Press OK to confirm the selection (a blue dot will appear next to the selection).
- ✂ Auto hold: Use the OK button to toggle ON (blue dot) and OFF. For more information, see Section 7.4, Data Hold and Auto Hold.
- °C/°F Temperature units. Use the OK button to toggle °C and °F.
- **Coarse Resolution (C.r. ON/OFF).** Use the OK button to toggle ON (blue dot) and OFF. This function is for Voltage function only. The range and resolution for the Voltage function will change as follows when Coarse Resolution is enabled:
  - 600.0mV → 600mV
  - 6.000V → 6.00V
  - 60.00V → 60.0V
  - 600.0V → 600V
  - 1000V → 1000V
  - Default: OFF

- **Language:** Scroll to the desired language and press OK.

- **Help Screen:** View the FLIR Customer Care contact information.

- **Information:** View DMM, IGM, and Laser technical information.
6. Meter Power

6.1 Powering the Meter

1. Set the function switch to any position to switch on the meter.

2. If the battery indicator shows that the battery voltage is low, if one of the Low Battery screens appears (shown below), or if the meter does not power on, replace the batteries. See Section 9.2, Battery Replacement. If using the Model TA04 charging system, please recharge the rechargeable battery.

![Low Battery Screenshots]

6.2 Auto Power OFF (APO)

The meter enters sleep mode after a programmable period of inactivity, to customize this setting please see Section 5.2.8, Multimeter Settings Menu. The default time-out is 10 minutes. The time can be set from 1 ~ 10 minutes (select OFF to disable the APO). 20 seconds prior to entering APO mode, the meter beeps; at this point, press any button or turn the Rotary Switch to reset the APO timer.
7. MultiMeter Operation

**Caution**: Before operating the device, you must read, understand, and follow all instructions, dangers, warnings, cautions, and notes.

**Caution**: When the meter is not in use, the function switch should be set to the OFF position.

**Caution**: When connecting the probe leads to the device under test, connect the COM (negative) lead before connecting the positive lead. When removing the probe leads, remove the positive lead before removing the COM (negative) lead.

### 7.1 Auto/Manual Range Mode

In Auto range mode, the meter automatically selects the most appropriate measurement scale. In Manual range mode, the desired range (scale) can be adjusted by the user. Auto range mode is the default mode of operation. When a new function is selected with the function switch, the starting mode is Auto range and the **Auto** indicator is displayed.

1. To enter Manual range mode, short press the **RANGE** button. To change the range, press the **RANGE** button repeatedly until the desired range is displayed.
2. To return to the Auto range mode, long press the **RANGE** button until the Auto Range **Auto** indicator is again displayed.

### 7.2 Probe Connection Alert

For current measurements, when the probe leads are not plugged into the correct jacks for the measurement selected by the function switch, the probe display alert ‘PROBE’ is shown.

### 7.3 Out of Range Warning (OL)

If the input is over/under the full-scale range in Manual range mode, or if the signal has exceeded the maximum/minimum input in Auto range mode, ‘OL’ is displayed.

### 7.4 Data Hold and Auto Hold

The meter has two HOLD modes: classic Data Hold and Auto Hold. To select Data Hold or Auto Hold as the default, please use the Settings menu (see Section 5.2.8, Multimeter Settings Menu). Refer to the paragraphs below for instructions on using the Hold modes.

#### 7.4.1 Data Hold Mode

In Data Hold mode, the primary meter display freezes the last reading. To enter/exit Data Hold mode, press the **HOLD** button. In Hold mode, the **HOLD** indicator is displayed.

#### 7.4.2 Auto Hold Mode

In Auto hold mode, the secondary display freezes the last reading and the **H** icon is displayed. The real-time reading is displayed on the primary display.
The held reading will not change unless the difference between the held reading and any new reading is > 50 digits.
The Auto hold function will capture a reading if the reading is > 1% full scale (trigger level) for Voltage, Current, and Capacitance. For Resistance, Diode, and Temperature the trigger is active as long as OL (over range).
To enter/exit Auto hold mode, press the HOLD button.

7.5 Status Bar and Menu Icons
The Status Bar is located at the top of the display and separated into two groups: Right and Left side groups.
The Right side group is located at the top right of the display. The icons are shown below, in Section 4, Meter Description and Reference, and other relevant areas of this manual when applicable.

- Auto Hold
- Data Hold
- Auto Range
- VFD mode
- Low Impedance mode
- Work light
- Auto Power OFF (APO)
- Battery status

The Left side group is located at the top left of the display. The icons are shown below and other relevant areas of this manual when applicable.

- FLEX Clamp Adaptor icon
- FLEX Clamp Adaptor range
- Hazardous voltages present icon
There are 5 main options in the Menu bar. These are explained in some detail in Section 5, *Options and Settings Menus*.

- Image Mode (available in IGM™ mode only)
- Thermal Settings (available in IGM™ mode only)
- VFD (low pass filter)
- Advanced Features Menu
- Multimeter Settings

- Use the Left / Right button to move the cursor
- Press the OK button to select an option.
- Up / Down buttons are not used for Menu bar operation.
- If an option is disabled (grayed) it is not available for the currently active mode.

### 7.6 Test Lead Holder Accessory

If desired, connect the supplied Test Lead Holder to the rear of the meter. The Test Lead Holder connects to the back of the meter (to items 1 and 5 as shown in Fig. 4-2 in Section 4, *Meter Description and Reference Guide*).
7.7 Voltage and Frequency Measurements

1. Set the function switch to one of the following positions:
   - \( V \) (VDC) or \( \bar{V} \) (VAC) for high voltage measurements.
   - \( mV \) (milli-volts) for low voltage measurements (use MODE to select AC or DC).
   - LoZ for voltage measurements using the meter’s low input impedance mode. The LoZ indicator will be displayed (use MODE to select AC or DC).

2. Insert the black probe lead into the negative COM terminal and the red probe lead into the positive terminal.

3. For \( mV \) and LoZ measurements use the MODE button to select AC or DC measurement:
   - The \( \bar{\ } \) indicator will be displayed for AC measurements.
   - The \( \bar{\ } \) indicator will be displayed for DC measurements.

4. Connect the probe leads in parallel to the part under test.

5. Read the voltage value on the display.

6. The Frequency (Hz) of the measured voltage is shown on the smaller, secondary display digits above the primary voltage reading. Press the MODE button to view only the Frequency reading.

7. Refer to Section 5, Options and Settings Menus, for customizing the meter and using the VFD, MIN-MAX-AVG, Peak, and Relative modes of operation.

![Fig. 7-1 Voltage and Frequency Measurements](image-url)
7.8 Non-Contact Voltage Detector

1. Set the function switch to the NCV position. See Figure 7-2.
2. Be sure to remove the test leads from the meter when doing NCV tests.
3. Use the RANGE button to choose High (80~1000V) or Low (160~1000V) Sensitivity mode.
4. Position the top of the meter close to a source of voltage or electromagnetic field.
5. When a voltage or electromagnetic field is detected the meter will emit a continuous tone and the displayed NCV icon will turn red in color and blink.

Fig. 7-2 Non-Contact Voltage Detector
7.9 Resistance Measurements

Warning: Do not perform diode, resistance or continuity tests before removing power from capacitors and other devices under test during a measurement. Injury to persons can occur.

1. Refer to Fig. 7-3. Set the function switch to the Ω position.
2. Use MODE to step to the Ω display if necessary.
3. Insert the black probe lead into the negative COM terminal and the red probe lead into the positive Ω terminal.
4. Touch the tips of the probe across the circuit or component under test.
5. Read the resistance value on the display.
6. Refer to Section 5, Options and Settings Menus, for customizing the meter and using the MIN-MAX-AVG and Relative modes of operation.

Fig. 7-3 Resistance and Continuity Measurements
7.10 Continuity Test

Warning: Do not perform diode, resistance or continuity tests before removing the power from capacitors and other devices under test during a measurement. Injury to persons can occur.

1. Refer to Fig. 7-3. Set the function switch to the position.
2. Use the button to select continuity. The indicator will be displayed.
3. Insert the black probe lead into the negative COM terminal and the red probe lead into the positive terminal.
4. Touch the tips of the probe across the circuit or component under test.
5. If the resistance is < 20Ω the meter beeps. If the resistance is > 200Ω the meter will not beep. > 20Ω but < 200Ω the beeping will stop at an unspecified point.

7.11 Classic Diode Test

Warning: Do not perform diode tests before removing the power to the diode or other devices under test during a measurement. Injury to persons can occur.

1. If not already selected, choose CLASSIC Diode test mode in the Settings menu (Section 5.2.8, Multimeter Settings Menu).
2. Set the function switch to the diode position. Use the MODE button to select the diode test function. The diode indicator will be displayed.
3. Insert the black probe lead into the negative COM terminal and the red probe lead into the positive terminal.
4. Touch the tips of the probe across the diode or semiconductor junction under test in one polarity (direction) and then in the opposite polarity as shown in Fig. 7-4.
5. If the reading is between 0.400 and 0.800V in one direction and OL (overload) in the opposite direction, the component is good. If the measurement is 0V in both directions (shorted) or OL in both directions (open), the component is bad.
Fig. 7-4 Classic Diode Test
7.12 Smart Diode Test

**Warning:** Do not perform diode tests before removing the power from capacitors and other devices under test during a measurement. Injury to persons can occur.

1. If not already selected, choose SMART Diode test mode in the Multimeter Settings menu ([Section 5.2.8, Multimeter Settings Menu](#)).
2. Set the function switch to the diode position. Use the MODE button to select the diode test function. The diode indicator will be displayed.
3. Insert the black probe lead into the negative COM terminal and the red probe lead into the positive Ω terminal.
4. Touch the tips of the probe across the diode or semiconductor junction under test.
5. If the reading is between ± 0.400 ~ 0.800V, the component is good; BAD or O.L displays indicate a defective component.

**NOTES:** In SMART Diode mode the meter checks diodes using an alternating test signal sent through the diode in both directions. This allows the user to check the diode without having to reverse polarity manually. The meter display will show ± 0.400 ~ 0.800V for a good diode, ‘BAD’ for a shorted diode, and ‘O.L’ for an opened diode. See Fig. 7-5 below:

![Image of diode test results](#)
7.13 Capacitance Measurements

**Warning**: Do not perform capacitance tests before removing power to the capacitor or other devices under test during a measurement. Injury to persons can occur.

1. Set the function switch to the position.
2. Use the button to select the capacitance measurement. The F (Farad) unit of measure will be displayed.
3. Insert the black probe lead into the negative COM terminal and the red probe lead into the positive terminal.
4. Touch the tips of the probe across the part under test.
5. Read the capacitance value on the display.
6. Refer to Section 5, Options and Settings Menus, for customizing the meter and using the MIN-MAX-AVG and Relative modes of operation.

**Note**: For very large capacitance values, it may take several minutes for the measurement to settle and the final reading to stabilize.

---

Fig. 7-6 Capacitance Measurements
7.14 Type K Temperature Measurements

1. Set the function to the Temperature position.
2. Use the [MODE] button to select temperature measurement. The °F or °C unit will be displayed. To change from F to C or from C to F, please use the Multimeter Settings menu (Section 5.2.8, Multimeter Settings Menu).
3. While observing the polarity, insert the thermocouple adapter into the negative COM terminal and the positive terminal.
4. Touch the tip of the thermocouple to the part under test. Keep the thermocouple tip on the part until the reading stabilizes.
5. Read the temperature value on the display.
6. To avoid electrical shock, disconnect the thermocouple adapter before turning the function switch to another position.
7.15 Current and Frequency Measurements (A, mA, µA)

For test lead current measurements, disconnect the part under test and connect the test leads in series with the part, see Figure 7-8.

Fig. 7-8 Disconnected component

7.15.1 Test Lead Current Measurements (A, mA, and µA)

1. For test lead measurements (A, mA, and µA), set the function switch to the \( \text{A} \) or \( \text{mA} \) or \( \mu \text{A} \) position.

2. Insert the black probe lead into the negative COM terminal and the red probe lead into one of the following positive terminals:
   - A for high current measurements.
   - mA for lower current measurements.
   - µA for micro-amp measurements

3. Use the \( \text{MODE} \) button to select AC or DC measurement.
   - The \( \approx \) indicator will be displayed for AC measurements.
   - The \( \mu \) indicator will be displayed for DC measurements.

4. Connect the probe leads in series with the part in accordance with Fig. 7-8 and Fig. 7-9 for ‘A’ measurements, Fig. 7-10 for mA measurements, or Fig. 7-11 for µA measurements.

5. Read the current and frequency values on the display. Frequency (Hz) is available only in the A AC and mA AC modes. Use the \( \text{MODE} \) to view the Frequency only.

6. Refer to Section 5, Options and Settings Menus, for customizing the meter and using the VFD, MIN-MAX-AVG, Peak, and Relative modes of operation.
Fig. 7-9 High Current ‘A’ Measurements
Fig. 7-10 mA Current Measurements

Fig. 7-11 μA Current Measurements
7.15.2 FLEX Clamp Adaptor Current and Frequency Measurements
FLIR Flex Clamp Adaptors (Models TA72 and TA74, for example) and other clamp adaptors can be connected to the DM284 to display current measurements made by a clamp adaptor.

1. Turn the function dial to the position.
2. Connect a Clamp adaptor as shown in Fig. 7-12.
3. Set the Range of the Flex Clamp Adaptor to match the range of the DM284.
4. Use the RANGE button to select the range of the DM284 (1, 10, 100 mv/A). The selected range will be shown on the right side of the DM284 display.
5. Operate the Flex Clamp per instructions provided with the Flex Clamp meter.
6. Read the current measured by the Flex Clamp on the DM284 LCD. The frequency is also shown on the DM284’s secondary display.

![Fig. 7-12 FLEX Clamp Application](image.png)
8. IGM™ (Infrared Guided Measurement) Operation

8.1 Thermal Camera IGM™ Basics

In the Thermal Imaging mode, the user can measure a targeted surface’s temperature. This is accomplished by detecting the energy emitted by the surface under test. A thermal image of the area under test is viewed in the same manner as with dedicated thermal imaging devices, where color variations reflect temperature variations. See Section 8.7, Infrared Energy and Thermal Imaging Theory for in-depth information. The laser pointer and display cross hairs assist in targeting.

- **Press the IGM button to open the Thermal Imager.** In Fig 8-1 the meter is set to color palette IRON. Select other palettes in the Thermal Settings Menu.
- **Open the protective lens cover on the back of the meter.** The protective lens cover can easily be slid up (open) or down (closed) by hand. See Section 4, Meter Description and Reference Guide for exact position of rear cover.

![IGM Display Example](image)

1. **IGM Temperature measurement** represents the temperature of the spot sensed. Note that while the temperature reading is stabilizing dashes will be displayed temporarily.

2. The currently selected Emissivity ($\varepsilon$) value. Use the Thermal Settings Menu to change the emissivity setting. See Section 8.6, Emissivity Factors for Common Materials.

3. **Status Bar Icon area**

4. **Highest reading** measured in the current frame

5. The **Thermal scale** shows the range of colors for thermal images. The lighter the color, the warmer the temperature; the darker the color, the cooler the temperature.

6. **Lowest reading** measured in the current frame.

7. **Menu Bar area**

8. **Cross hairs** for surface targeting.

9. **Thermal image frame**

10. **DMM measurement** is shown below the temperature measurement. Set the meter to show Multimeter readings superimposed on the image in the Image Mode menu.
To customize the Thermal Imager, refer to Section 5.2.2, Thermal Settings Menu. For basic operation follow these steps:

1. Set the function switch to any position.
2. Press the IGM button to switch the IGM Thermal Imager ON. Point the thermal imaging lens (located on the rear of the meter) toward an area to measure.
3. The display will show the temperature measurement in the upper left hand corner for the targeted area along with the currently selected emissivity value.
4. In the Thermal Imaging mode, the laser pointer and display cross hairs can be used to assist in targeting. These tools can be switched ON or OFF in the Thermal Settings Menu.
5. In the Thermal imaging mode, the meter continues to operate normally as a Multimeter allowing any of the electrical functions to be used. Note that in the Thermal Imaging mode the electrical functions are shown on the left side of the display and can be switched off if desired in the Image Mode menu.
6. The Distance to Spot ratio for the imager is 30:1 meaning that the measurement spot is 30 times smaller than the distance from meter to spot (at a distance of 30”, the meter ‘sees’ a target spot of 1”). See Fig. 8-2.
7. The thermal imager’s FOV (Field of View) is 50 degrees (top view) and 38.6 degrees (side view), see Fig. 8-3 (a) and (b).

![Fig. 8-2 Distance-to-Spot ratio 30:1](image-url)
8.2 Thermal Settings Menu

Press OK to open the main menu and then press OK on the Thermal Settings icon. See the Thermal Settings screenshot example and descriptions below.

- **IGM Color Palette selection.** Press OK to select one of the display color palettes (Iron, Rainbow, or Gray).

- **Emissivity:** Press OK then use the up/down arrows to scroll to the desired preset (0.95, 0.85, 0.75, 0.65) and press OK. To fine tune, press OK at the fine tuning icon (located below the presets) and then use the arrow buttons to make a selection. The available range is 0.10 to 0.99 in 0.01 steps.

- **Laser pointer:** Press OK at this icon to switch the laser pointer ON (blue dot next to icon) or OFF.
• **Cross hairs**: Press OK at this icon to switch the IGM target cross hairs ON or OFF.

• **Temperature Differential**: Thermocouple temperature minus IGM temperature. Only available when **Image + DMM** is selected in the Image Mode Menu (see next section) and **mV/Temp** is selected with the rotary switch. Press OK to switch this mode ON or OFF.

In **Fig. 8-4**, the 3rd row shows a differential temperature of 5.0°F (IGM temperature is 85.0°F and the Type-K temperature is 80.0°F in the example). See **Section 7.14, Type-K Temperature Measurements** for Type-K measurements.

![Fig. 8-4 Type-K / IGM Temperature Differential Reading Example](image)

**8.3 Image Mode Menu**

Press OK to open the Main menu and then press OK on the Image Mode icon. Select **Image + DMM** mode or **Image Only** mode from the Image Mode menu using the arrow buttons.

- **Image + DMM** (default mode): Display will show all IR data and DMM data.
- **Image Only**: Display will show IR data only.
- For both options, the status bar will show Battery, APO, Work Light, and Laser icons when applicable.

**8.4 Status Bar Display Icons**

The Status Bar is located at the top-right corner. There are 2 rows of icons as shown. The icons are always on the right side of the display and in the same sequence. From top left to right these Status Bar icons are: Auto Hold, Data Hold, Auto Range, Laser Pointer, Work light, APO, battery status, VFD, FLEX clamp input/range, and Low Impedance mode (LoZ). For details on these, please refer to **Section 4, Meter Description and Reference Guide** and **Section 7, Multimeter Operation**.
To customize the display layout please refer to Section 5, Settings and Options Menus.

8.5 Using the Multimeter in the IGM™ mode
The Multimeter can be used as described in Section 7, Multimeter Operation while the IGM™ mode is active. Multimeter readings, status bar icons, and operational modes such as PEAK, RELATIVE, and MIN-MAX-AVG can be viewed directly on top of the thermal image when IMAGE + DMM mode is selected in the Image Mode menu (see Section 5.2.1, Image Mode Menu).

8.6 Emissivity Factors for Common Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Emissivity</th>
<th>Material</th>
<th>Emissivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt</td>
<td>0.90 to 0.98</td>
<td>Cloth (black)</td>
<td>0.98</td>
</tr>
<tr>
<td>Concrete</td>
<td>0.94</td>
<td>Skin (human)</td>
<td>0.98</td>
</tr>
<tr>
<td>Cement</td>
<td>0.96</td>
<td>Leather</td>
<td>0.75 to 0.80</td>
</tr>
<tr>
<td>Sand</td>
<td>0.90</td>
<td>Charcoal (powder)</td>
<td>0.96</td>
</tr>
<tr>
<td>Soil</td>
<td>0.92 to 0.96</td>
<td>Lacquer</td>
<td>0.80 to 0.95</td>
</tr>
<tr>
<td>Water</td>
<td>0.92 to 0.96</td>
<td>Lacquer (matt)</td>
<td>0.97</td>
</tr>
<tr>
<td>Ice</td>
<td>0.96 to 0.98</td>
<td>Rubber (black)</td>
<td>0.94</td>
</tr>
<tr>
<td>Snow</td>
<td>0.83</td>
<td>Plastic</td>
<td>0.85 to 0.95</td>
</tr>
<tr>
<td>Glass</td>
<td>0.90 to 0.95</td>
<td>Timber</td>
<td>0.90</td>
</tr>
<tr>
<td>Ceramic</td>
<td>0.90 to 0.94</td>
<td>Paper</td>
<td>0.70 to 0.94</td>
</tr>
<tr>
<td>Marble</td>
<td>0.94</td>
<td>Chromium Oxides</td>
<td>0.81</td>
</tr>
<tr>
<td>Plaster</td>
<td>0.80 to 0.90</td>
<td>Copper Oxides</td>
<td>0.78</td>
</tr>
<tr>
<td>Mortar</td>
<td>0.89 to 0.91</td>
<td>Iron Oxides</td>
<td>0.78 to 0.82</td>
</tr>
<tr>
<td>Brick</td>
<td>0.93 to 0.96</td>
<td>Textiles</td>
<td>0.90</td>
</tr>
</tbody>
</table>
8.7 Infrared Energy and Thermal 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 DM284.

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 has to be some source of visible light (something hot, such as the sun or lights) that reflects off of the objects in the scene to the camera. The same is true with human eyesight; the vast majority of 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.

This is why 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 of these forms of radiation travel at the speed of light. Infrared radiation lies between the visible and RADAR portions of the electromagnetic spectrum.

The primary source of infrared radiation is heat or thermal radiation. Any object that has a temperature radiates in the infrared portion 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 offers training (including online training) and certification in all aspects of thermography: http://www.infraredtraining.com/.
9. Maintenance

9.1 Cleaning and Storage
Wipe the housing with a damp cloth as needed. Use a high quality lens wipe to remove dirt or smudges from the meter lenses and display window. Please do not use abrasives or solvents to clean the meter housing, lenses, or display window.

If the meter is not to be used for an extended period, remove the batteries and store them separately.

9.2 Battery Replacement
The Battery symbol flashes with no ‘bars’ when the batteries have reached a critical level. The meter displays readings within specifications while the low battery indicator is on. The meter powers off before it displays an out of tolerance reading.

**WARNING:** To avoid electrical shock, disconnect the meter from any connected circuits, remove the test leads from the meter terminals, and set the function switch to the OFF position before attempting to replace the batteries.

1. Unscrew and remove the battery compartment cover.
2. Replace the four (4) standard AAA batteries, observing correct polarity.
3. If using the Model TA04 rechargeable lithium polymer battery system, please recharge the rechargeable battery.
4. Secure the battery compartment cover.

9.3 Fuse Replacement
The two fuses are accessed via the battery compartment. The fuses are rated:
- mA: 440 mA, 1000 V IR 10 kA fuse (Bussmann DMM-B-44/100).
- A: 11 A, 1000 V IR 20 kA fuse (Bussmann DMM-B-11A).
- Fuse kit PN: FS881, contains one of each fuse type.

9.4 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.
10. Specifications

10.1 General specifications

- **Maximum voltage:** 1000 V DC or 1000 V AC RMS
- **Display Counts:** 6000
- **Polarity Indication:** Automatic, positive implied, negative indicated
- **Over-range Indication:** OL
- **Measuring Rate:** 3 samples per second
- **Power Requirements:**
  - 4 x 1.5 V AAA alkaline or lithium batteries or optional Model TA04 lithium polymer rechargeable battery system
  - **Battery Type:** Alkaline ‘AAA’ Battery x 4
    - Battery Life: approximately 9 hours (DMM) or 2 hours (IGM)
  - **Battery Type Energizer L92 Ultimate Lithium ‘AAA’ Battery x 4**
    - Battery Life: approximately 11.5 hours (DMM) or 5.5 hours (IGM)
  - **Optional Rechargeable Battery Type:** 3000mA Li-Polymer FLIR PN: TA04-KIT
    - Battery Life: approximately 30 hours (DMM) or 12 hours (IGM)
- **Auto Power Off:** Default 20 minutes
- **Operating Temp/RH:**
  - 14°F to 86°F (-10°C to 30°C), < 85% RH
  - 86°F to 104°F (30°C to 40°C), < 75% RH
  - 104°F to 122°F (40°C to 50°C), <45% RH
- **Storage Temperature/RH:**
  - -4°F to 140°F (-20°C to 60°C), 0-80% RH (without batteries)
- **Temperature Coefficient:** 0.1 x (specified accuracy)/°F, < 64.4°F (18°C), >82.4°F (28°C)
- **Operating Altitude:** 6560’ (2000m)
- **Calibration Cycle:** One year
- **Weight:** 18.9 oz. (537g)
- **Dimensions:** (L x W x H) 7.9 x 3.7 x 1.9 in. (200 x 95 x 49mm)
- **Safety:** Complies with IEC 61010-1 CAT IV-600 V, CAT III-1000V
<table>
<thead>
<tr>
<th>CAT</th>
<th>Application Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Circuits not connected to mains.</td>
</tr>
<tr>
<td>II</td>
<td>Circuits directly connected to a low-voltage installation.</td>
</tr>
<tr>
<td>III</td>
<td>Building installation.</td>
</tr>
<tr>
<td>IV</td>
<td>Source of the low-voltage installation.</td>
</tr>
</tbody>
</table>

EMC: EN 61326-1
Pollution degree: 2
Drop protection: 3m (9.8’)
Max. Operating Altitude: 2000m (6562 ft.)
Vibration: Random Vibration per MILPRF28800F Class 2

10.2 Thermal Imaging Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR Temperature Range</td>
<td>14 ~ 302°F (-10 ~150°C)</td>
</tr>
<tr>
<td>IR Temperature Resolution</td>
<td>0.1°F/C</td>
</tr>
<tr>
<td>Image Sensitivity</td>
<td>&lt; or equal to 150mK (0.15°C)</td>
</tr>
<tr>
<td>IR Temperature Accuracy</td>
<td>3°C or 3% whichever is greater (&gt;77°F [25°C]) or 9°F (5°C) (14~77°F [-10 to 25°C])</td>
</tr>
<tr>
<td>Emissivity</td>
<td>0.95 maximum (4 presets and a fine tuning feature)</td>
</tr>
<tr>
<td>Distance to Spot ratio</td>
<td>30:1</td>
</tr>
<tr>
<td>Response time</td>
<td>150ms</td>
</tr>
<tr>
<td>Spectral Response</td>
<td>8~14um</td>
</tr>
<tr>
<td>Scanning type</td>
<td>Continuous</td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.5%</td>
</tr>
<tr>
<td>Image Detector</td>
<td>Lepton</td>
</tr>
<tr>
<td>Field of View (FOV)</td>
<td>120 x 160 pixels (50°)</td>
</tr>
<tr>
<td>Color Palettes</td>
<td>Iron, Rainbow, and Greyscale</td>
</tr>
<tr>
<td>Laser type</td>
<td>Class 1</td>
</tr>
<tr>
<td>Laser power</td>
<td>&lt; 0.4mW</td>
</tr>
</tbody>
</table>
10.3 Electrical Specifications

Accuracy is given as ± (% of reading + counts of least significant digit) at 73.4°F ± 9°F (23°C ± 5°C), with relative humidity < 80%

Temperature coefficient: 0.1 * (Specified accuracy) / °F, < 64.4°F (18°C), > 82.4°F (28°C)

AC Function notes:
- ACV and ACA are ac coupled, true RMS.
- For all AC functions, LCD displays 0 counts when the reading < 10 counts.
- For square waves, accuracy is unspecified.
- For non-sinusoidal waveforms, additional accuracy for Crest Factor (C.F.):
  ○ Add 1.0% for C.F. 1.0 to 2.0
  ○ Add 2.5% for C.F. 2.0 to 2.5
  ○ Add 4.0% for C.F. 2.5 to 3.0
- Max. Crest Factor of Input Signal:
  ○ 3.0 @ 3000 counts
  ○ 2.0 @ 4500 counts
  ○ 1.5 @ 6000 counts
- Frequency Response is specified for sine waveform.

## DC Voltage

<table>
<thead>
<tr>
<th>Range</th>
<th>OL Reading</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.000V</td>
<td>6.600V</td>
<td>0.001V</td>
<td>±(0.09% + 2D)</td>
</tr>
<tr>
<td>60.00V</td>
<td>66.00V</td>
<td>0.01V</td>
<td></td>
</tr>
<tr>
<td>600.0V</td>
<td>660.0V</td>
<td>0.1V</td>
<td></td>
</tr>
<tr>
<td>1000V</td>
<td>1100V</td>
<td>1V</td>
<td></td>
</tr>
</tbody>
</table>

Input Impedance: 10MΩ
Overload Protection: AC/DC 1000V

## AC Voltage

<table>
<thead>
<tr>
<th>Range</th>
<th>OL Reading</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Freq. Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.000V</td>
<td>6.600V</td>
<td>0.001V</td>
<td>±(1.0% + 3D)</td>
<td>45Hz ~ 500Hz</td>
</tr>
<tr>
<td>60.00V</td>
<td>66.00V</td>
<td>0.01V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>600.0V</td>
<td>660.0V</td>
<td>0.1V</td>
<td>±(1.0% + 3D)</td>
<td>45Hz ~ 1kHz</td>
</tr>
<tr>
<td>1000V</td>
<td>1100V</td>
<td>1V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Input Impedance: 10MΩ (< 100pF)
Overload Protection: AC/DC 1000V
Lo-Z Voltage (Auto AC & DC Detection)

<table>
<thead>
<tr>
<th>Range</th>
<th>OL Reading</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>600.0V DC &amp; AC</td>
<td>660.0V</td>
<td>0.1V</td>
<td>±(2.0% + 3D)</td>
</tr>
<tr>
<td>1000V DC &amp; AC</td>
<td>1100V</td>
<td>1V</td>
<td></td>
</tr>
</tbody>
</table>

Input Impedance: about 3kΩ
Frequency Response: 45 ~ 1kHz (Sine Wave)
Overload Protection: AC/DC 1000V

DC mV

<table>
<thead>
<tr>
<th>Range</th>
<th>OL Reading</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>600.0mV</td>
<td>660.0mV</td>
<td>0.1mV</td>
<td>±(0.5% + 2D)</td>
</tr>
</tbody>
</table>

Input Impedance: 10MΩ
Overload Protection: AC/DC 1000V

AC mV

<table>
<thead>
<tr>
<th>Range</th>
<th>OL Reading</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>600.0mV</td>
<td>660.0mV</td>
<td>0.1mV</td>
<td>±(1.0% + 3D)</td>
</tr>
</tbody>
</table>

Frequency Response: 45 ~ 1kHz (Sine Wave)
Input Impedance: 10MΩ
Overload Protection: AC/DC 1000V

DC Current

<table>
<thead>
<tr>
<th>Range</th>
<th>OL Reading</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>60.00mA</td>
<td>66.00mA</td>
<td>0.01mA</td>
<td>±(1.0% + 3D)</td>
</tr>
<tr>
<td>400.0mA</td>
<td>660.0mA</td>
<td>0.1mA</td>
<td></td>
</tr>
<tr>
<td>6.000A</td>
<td>6.600A</td>
<td>0.001A</td>
<td>±(1.0% + 3D)</td>
</tr>
<tr>
<td>10.00A</td>
<td>20.00A</td>
<td>0.01A</td>
<td></td>
</tr>
</tbody>
</table>

The accuracy of measurements > 10A is unspecified.
Maximum measurement time: > 5A for max. 3 minutes with at least 20-minute rest time.
> 10A for max. 30 seconds with at least 10-minute rest time.
Overload Protection: AC/DC 11A for A terminal. AC/DC 660mA for mA terminal.
**AC Current**

<table>
<thead>
<tr>
<th>Range</th>
<th>OL Reading</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>60.00mA</td>
<td>66.00mA</td>
<td>0.01mA</td>
<td>±(1.5% + 3D)</td>
</tr>
<tr>
<td>400.0mA</td>
<td>660.0mA</td>
<td>0.1mA</td>
<td></td>
</tr>
<tr>
<td>6.000A</td>
<td>6.600A</td>
<td>0.001A</td>
<td>±(1.5% + 3D)</td>
</tr>
<tr>
<td>10.00A</td>
<td>20.00A</td>
<td>0.01A</td>
<td></td>
</tr>
</tbody>
</table>

Accuracy of readings > 10A is unspecified.

Maximum measurement time: > 5A for max. 3 minutes with at least 20-minute rest time.
> 10A for max. 30 seconds with at least 10-minute rest time.
Frequency Response: 45 ~ 1kHz (Sine Wave)
Overload Protection: AC/DC 11A for A terminal. AC/DC 660mA for mA terminal.

**DC μA**

<table>
<thead>
<tr>
<th>Range</th>
<th>OL Reading</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>400.0μA</td>
<td>440.0μA</td>
<td>0.1μA</td>
<td>±(1.0% + 3D)</td>
</tr>
<tr>
<td>4000μA</td>
<td>4400μA</td>
<td>1μA</td>
<td></td>
</tr>
</tbody>
</table>

Input Impedance: approx. 2kΩ
Overload Protection: AC/DC 1000V

**AC μA**

<table>
<thead>
<tr>
<th>Range</th>
<th>OL Reading</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>400.0μA</td>
<td>440.0μA</td>
<td>0.1μA</td>
<td>±(1.0% + 3D)</td>
</tr>
<tr>
<td>4000μA</td>
<td>4400μA</td>
<td>1μA</td>
<td></td>
</tr>
</tbody>
</table>

Input Impedance: approx. 2kΩ; Frequency Response: 45 ~ 1kHz (Sine Wave)
Overload Protection: AC/DC 1000V

**Resistance**

<table>
<thead>
<tr>
<th>Range</th>
<th>OL Reading</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>600.0Ω</td>
<td>660.0Ω</td>
<td>0.1Ω</td>
<td>±(0.9% + 5D)</td>
</tr>
<tr>
<td>6.000kΩ</td>
<td>6.600kΩ</td>
<td>0.001kΩ</td>
<td>±(0.9% + 2D)</td>
</tr>
<tr>
<td>60.00kΩ</td>
<td>66.00kΩ</td>
<td>0.00kΩ</td>
<td>±(0.9% + 2D)</td>
</tr>
<tr>
<td>600.0kΩ</td>
<td>660.0kΩ</td>
<td>0.1kΩ</td>
<td>±(0.9% + 2D)</td>
</tr>
<tr>
<td>6.000MΩ</td>
<td>6.600MΩ</td>
<td>0.001MΩ</td>
<td>±(0.9% + 2D)</td>
</tr>
<tr>
<td>50.00MΩ</td>
<td>55.00MΩ</td>
<td>0.01MΩ</td>
<td>±(3.0% + 5D)</td>
</tr>
</tbody>
</table>

Overload Protection: AC/DC 1000V
### Continuity

<table>
<thead>
<tr>
<th>Range</th>
<th>OL Reading</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>600.0Ω</td>
<td>660.0Ω</td>
<td>0.1Ω</td>
<td>±(0.9% + 5D)</td>
</tr>
</tbody>
</table>

Continuity: Built-in beeper sounds when measured resistance is less than 20Ω and is off when measured resistance is more than 200Ω. Between 20Ω and 200Ω the beeper will stop at an unspecified point.

Continuity Indicator: 2KHz Tone Buzzer; Response Time of Buzzer: < 500μsec.

Overload Protection: AC/DC 1000V

### Diode

<table>
<thead>
<tr>
<th>Range</th>
<th>OL Reading</th>
<th>Resolution</th>
<th>Typical Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.500V</td>
<td>1.550V</td>
<td>0.001V</td>
<td>0.400 ~ 0.800V</td>
</tr>
</tbody>
</table>

Open Circuit Voltage: Approx. 1.8V; Overload Protection: AC/DC 1000V

### Frequency

<table>
<thead>
<tr>
<th>Range</th>
<th>OL Reading</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>100.00Hz</td>
<td>100.00Hz</td>
<td>0.01Hz</td>
<td></td>
</tr>
<tr>
<td>1000.0Hz</td>
<td>1000.0Hz</td>
<td>0.1Hz</td>
<td>±(0.1% + 2D)</td>
</tr>
<tr>
<td>10.000kHz</td>
<td>10.000kHz</td>
<td>0.001kHz</td>
<td></td>
</tr>
<tr>
<td>100.00kHz</td>
<td>100.00kHz</td>
<td>0.01kHz</td>
<td></td>
</tr>
</tbody>
</table>

### ACV - Minimum Sensitivity (including LoZ ACV):

<table>
<thead>
<tr>
<th>Range</th>
<th>5Hz ~ 1kHz</th>
<th>1kHz ~ 10kHz</th>
<th>&gt;10kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>600.0mV</td>
<td>60mV</td>
<td>100mV</td>
<td>Unspecified</td>
</tr>
<tr>
<td>6.000V</td>
<td>0.6V</td>
<td>6V</td>
<td>Unspecified</td>
</tr>
<tr>
<td>60.00V</td>
<td>6V</td>
<td>10V</td>
<td>Unspecified</td>
</tr>
<tr>
<td>600.0V</td>
<td>60V</td>
<td>100V</td>
<td>Unspecified</td>
</tr>
<tr>
<td>1000V</td>
<td>600V</td>
<td>Unspecified</td>
<td>Unspecified</td>
</tr>
</tbody>
</table>

### ACA - Minimum Sensitivity:

<table>
<thead>
<tr>
<th>Range</th>
<th>5Hz ~ 10kHz</th>
<th>&gt;10kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>60.00mA</td>
<td>10mA</td>
<td>Unspecified</td>
</tr>
<tr>
<td>600.0mA</td>
<td>60mA</td>
<td>Unspecified</td>
</tr>
<tr>
<td>6.000A</td>
<td>2A</td>
<td>Unspecified</td>
</tr>
<tr>
<td>10.00A</td>
<td>2A</td>
<td>Unspecified</td>
</tr>
</tbody>
</table>
### FLEX Clamp Adaptor Current - Minimum Sensitivity:

<table>
<thead>
<tr>
<th>Range</th>
<th>5Hz ~ 10kHz</th>
<th>&gt;10kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.00A</td>
<td>3.00A (0.300V)</td>
<td>Unspecified</td>
</tr>
<tr>
<td>300.0A</td>
<td>30.0A (0.300V)</td>
<td>Unspecified</td>
</tr>
<tr>
<td>3000A</td>
<td>300A (0.300V)</td>
<td>Unspecified</td>
</tr>
</tbody>
</table>

Minimum Frequency: 5Hz  
Overload Protection: AC/DC 1000V or 600A

### Capacitance

<table>
<thead>
<tr>
<th>Range</th>
<th>OL Reading</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000nF</td>
<td>1100nF</td>
<td>1nF</td>
<td>±(1.9% + 5D)</td>
</tr>
<tr>
<td>10.00µF</td>
<td>11.00µF</td>
<td>0.01µF</td>
<td>±(1.9% + 2D)</td>
</tr>
<tr>
<td>100.0µF</td>
<td>110.0µF</td>
<td>0.1µF</td>
<td></td>
</tr>
<tr>
<td>1.000mF</td>
<td>1.100mF</td>
<td>0.001mF</td>
<td></td>
</tr>
<tr>
<td>10.00mF</td>
<td>11.00mF</td>
<td>0.01mF</td>
<td></td>
</tr>
</tbody>
</table>

Overload Protection: AC/DC 1000V

### Flex Current

<table>
<thead>
<tr>
<th>Range</th>
<th>OL Reading</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.00A</td>
<td>33.00A</td>
<td>0.01A</td>
<td>±(1.0% + 3D)</td>
</tr>
<tr>
<td>300.0A</td>
<td>330.0A</td>
<td>0.1A</td>
<td></td>
</tr>
<tr>
<td>3000A</td>
<td>3300A</td>
<td>1A</td>
<td></td>
</tr>
</tbody>
</table>

Accuracy does not include the accuracy of the Flexible Clamp Meter.  
Frequency Response: 45 ~ 1kHz (Sine Wave)  
Overload Protection: AC/DC 1000V

### Type-K Temperature

<table>
<thead>
<tr>
<th>Range</th>
<th>OL Reading</th>
<th>Resolution</th>
<th>Accuracy (DMM)</th>
<th>Accuracy (IGM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40.0°C to 400.0°C</td>
<td>≤ -44.0°C, ≥ 440.0°C</td>
<td>0.1°C</td>
<td>± (1% + 3°C)</td>
<td>± (1% + 5°C)</td>
</tr>
<tr>
<td>-40.0°F to 752.0°F</td>
<td>≤ -44.0°F, ≥ 824.0°F</td>
<td>0.1°F</td>
<td>± (1% + 5.4°F)</td>
<td>± (1% + 9°F)</td>
</tr>
</tbody>
</table>

The accuracy applies with a 30-minute warmup time and is unspecified when the Work Light is ON.  
Accuracy does not include the accuracy of the thermocouple probe.  
Accuracy specification assumes surrounding temperature stable to ±1.8°F (±1°C). For surrounding temperature changes of ± 2 °C, rated accuracy applies after 2 hours.  
Overload Protection: AC/DC 1000V.
NCV (Non-Contact Voltage Detector)
Voltage Range (High Sensitivity): 80V to 1000V
Voltage Range (Low Sensitivity): 160V to 1000V

Peak Max and Peak Min Hold
For ACV, AC mV, ACA, ACmA, AC μA, and Flex Current modes (unavailable for LoZ mode)
Specified accuracy ± 150 digits for < 6000 counts
Specified accuracy ± 250 digits for >= 6000 counts

VFD (Low Pass Filter)
For ACV, AC mV, ACA, ACmA, AC μA, and Flex Current modes (unavailable for LoZ mode)
Specified accuracy is for 45Hz ~ 65Hz
Specified accuracy ± 4% for 65Hz ~ 400Hz
Accuracy is unspecified for > 400Hz
Cut-off Frequency: 800Hz (± 100Hz)

Work Light
Color Temperature: 4000-5000°K
Beam Angle: ± 20°
Light Output: 70 lumens, minimum
Power: 0.5 Watt RMS

11. Technical Support

<table>
<thead>
<tr>
<th>Main Website</th>
<th><a href="http://www.flir.com/test">http://www.flir.com/test</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Support Website</td>
<td><a href="http://support.flir.com">http://support.flir.com</a></td>
</tr>
<tr>
<td>Technical support Email</td>
<td><a href="mailto:TMSupport@flir.com">TMSupport@flir.com</a></td>
</tr>
<tr>
<td>Service/Repair Support Email</td>
<td><a href="mailto:Repair@flir.com">Repair@flir.com</a></td>
</tr>
<tr>
<td>Support Telephone number</td>
<td>+1 855-499-3662 option 3 (toll-free)</td>
</tr>
</tbody>
</table>
12. Warranties

12.1 FLIR Test & Measurement Imaging Product 10-year/10-year Warranty

Congratulations! You (the “Purchaser”) are now the owner of a world-class FLIR Imaging Test and Measurement product. A qualifying FLIR Imaging Test and Measurement product (the “Product”) purchased either directly from FLIR Commercial Systems Inc. and affiliates (FLIR) or from an authorized FLIR distributor that Purchaser registers on-line with FLIR is eligible for coverage under FLIR’s industry-leading 10-10 Limited Warranty, subject to the terms and conditions in this document. This warranty only applies to purchases of Qualifying Products (see below) purchased after September 2015 and only to the original Purchaser of the Product.

PLEASE READ THIS DOCUMENT CAREFULLY; IT CONTAINS IMPORTANT INFORMATION ABOUT THE PRODUCTS THAT QUALIFY FOR COVERAGE UNDER THE 10-10 LIMITED WARRANTY, PURCHASER’S OBLIGATIONS, HOW TO ACTIVATE THE WARRANTY, WARRANTY COVERAGE, AND OTHER IMPORTANT TERMS, CONDITIONS, EXCLUSIONS AND DISCLAIMERS.

1. PRODUCT REGISTRATION. To qualify for FLIR’s 10-10 Limited Warranty, the Purchaser must fully register the Product directly with FLIR on-line at www.flir.com WITHIN Sixty (60) DAYS of the date the Product was purchased by the first retail customer (the “Purchase Date”). PRODUCTS THAT ARE NOT REGISTERED ON-LINE WITHIN Sixty (60) DAYS OF THE PURCHASE DATE OR PRODUCTS WHICH DO NOT QUALIFY FOR THE 10-10 WARRANTY WILL HAVE A LIMITED ONE YEAR WARRANTY FROM THE DATE OF PURCHASE.

2. QUALIFYING PRODUCTS. Upon registration, a list of thermal Imaging Test and Measurement Products that qualify for coverage under FLIR’s 10-10 Warranty can be found at www.flir.com/testwarranty

3. WARRANTY PERIODS. The 10-10 Limited Warranty has two separate periods of warranty coverage (the “Warranty Period”), depending on the Imaging Test and Measurement Product part:

Product components are warranted for a period of ten (10) years from the Purchase Date;

Thermal imaging sensor is warranted for a period of ten (10) years from the Purchase Date.

Any Product that is repaired or replaced under warranty is covered under this 10-10 Limited Warranty for one hundred eighty days (180) days from the date of return shipment by FLIR or for the remaining duration of the applicable Warranty Period, whichever is longer.

4. LIMITED WARRANTY. In accordance with the terms and conditions of this 10-10 Limited Warranty, and except as excluded or disclaimed in this document, FLIR warrants, from the Purchase Date, that all fully registered Products will conform to FLIR’s published Product specifications and be free from defects in materials and workmanship during the applicable Warranty Period. PURCHASER’S SOLE AND EXCLUSIVE REMEDY UNDER THIS WARRANTY, AT FLIR’S SOLE DISCRETION, IS THE REPAIR OR REPLACEMENT OF DEFECTIVE PRODUCTS IN A MANNER, AND BY A SERVICE CENTER, AUTHORIZED BY FLIR. IF THIS REMEDY IS ADJUDICATED TO BE INSUFFICIENT, FLIR SHALL REFUND PURCHASER’S PAID PURCHASE PRICE AND HAVE NO OTHER OBLIGATION OR LIABILITY TO BUYER WHATSOEVER.

5. WARRANTY EXCLUSIONS AND DISCLAIMERS. FLIR MAKES NO OTHER WARRANTY OF ANY KIND WITH RESPECT TO THE PRODUCTS. ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (EVEN IF PURCHASER HAS NOTIFIED FLIR OF ITS INTENDED USE FOR THE PRODUCTS), AND NON-INFRINGEMENT ARE EXPRESSLY EXCLUDED FROM THIS AGREEMENT. THIS WARRANTY EXPRESSLY EXCLUDES ROUTINE PRODUCT MAINTENANCE, AND SOFTWARE UPDATES. FLIR FURTHER EXPRESSLY DISCLAIMS ANY WARRANTY COVERAGE WHERE THE ALLEGED NONCONFORMITY IS DUE TO NORMAL WEAR AND TEAR OTHER THAN SENSORS, ALTERATION, MODIFICATION, REPAIR, ATTEMPTED REPAIR, IMPROPER USE, IMPROPER MAINTENANCE, NEGLECT, ABUSE, IMPROPER STORAGE, FAILURE TO FOLLOW ANY PRODUCT INSTRUCTIONS, DAMAGE (WHETHER CAUSED BY ACCIDENT OR OTHERWISE), OR ANY OTHER IMPROPER CARE OR HANDING OF THE PRODUCTS CAUSED BY ANYONE OTHER THAN FLIR OR FLIR’S EXPRESSLY AUTHORIZED DESIGNEE.
THIS DOCUMENT CONTAINS THE ENTIRE WARRANTY AGREEMENT BETWEEN PURCHASER AND FLIR AND SUPERSEDES ALL PRIOR WARRANTY NEGOTIATIONS, AGREEMENTS, PROMISES AND UNDERSTANDINGS BETWEEN PURCHASER AND FLIR. THIS WARRANTY MAY NOT BE ALTERED WITHOUT THE EXPRESS WRITTEN CONSENT OF FLIR.

6. WARRANTY RETURN, REPAIR AND REPLACEMENT. To be eligible for warranty repair or replacement, Purchaser must notify FLIR within thirty (30) days of discovering of any apparent defect in materials or workmanship. Before Purchaser may return a Product for warranty service or repair, Purchaser must first obtain a returned material authorization (RMA) number from FLIR. To obtain the RMA number Owner must provide an original proof of purchase. For additional information, to notify FLIR of an apparent defect in materials or workmanship, or to request an RMA number, visit www.flir.com. Purchaser is solely responsible for complying with all RMA instructions provided by FLIR including but not limited to adequately packaging the Product for shipment to FLIR and for all packaging and shipping costs. FLIR will pay for returning to Purchaser any Product that FLIR repairs or replaces under warranty.

FLIR reserves the right to determine, in its sole discretion, whether a returned Product is covered under warranty. If FLIR determines that any returned Product is not covered under warranty or is otherwise excluded from warranty coverage, FLIR may charge Purchaser a reasonable handling fee and return the Product to Purchaser, at Purchaser’s expense, or offer Purchaser the option of handling the Product as a non-warranty return. FLIR shall not be responsible for any data, images or other information that may be stored on the returned Product which was not included in the Product at the time of purchase. It is Purchaser’s responsibility to save any and all data prior to returning the Product for warranty service.

7. NON-WARRANTY RETURN. Purchase may request that FLIR evaluate and service or repair a Product not covered under warranty, which FLIR may agree to do in its sole discretion. Before Purchaser returns a Product for non-warranty evaluation and repair, Purchaser must contact FLIR by visiting www.flir.com to request an evaluation and obtain an RMA. Purchaser is solely responsible for complying with all RMA instructions provided by FLIR including but not limited to adequately packaging the Product for shipment to FLIR and for all packaging and shipping costs. Upon receipt of an authorized non-warranty return, FLIR will evaluate the Product and contact Purchaser regarding the feasibility of and the costs and fees associated with Purchaser’s request. Purchaser shall be responsible for the reasonable cost of FLIR’s evaluation, for the cost of any repairs or services authorized by Purchaser, and for the cost of repackaging and returning the Product to Purchaser. Any non-warranty repair of a Product is warranted for one hundred eighty days (180) days from the date of return shipment by FLIR to be free from defects in materials and workmanship only, subject to all of the limitations, exclusions and disclaimers in this document.