User's manual
FLIR MR77

Pinless moisture psychrometer with infrared thermometer and Bluetooth METERLiNK®

User's manual
FLIR MR77

#T559822; r.9065/9080; en-US

Table of contents

1 Disclaimers

1.1 Copyright

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 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.

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 information

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

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.

⚠	**WARNING**
Do not look directly into the laser beam. The laser beam can cause eye irritation.	

⚠	**WARNING**
Do not use the laser pointer near explosive gases or in other possible explosive areas. Injury to persons can occur.	

⚠	This symbol, adjacent to another symbol or terminal, indicates that the user must refer to the manual for further information.
⚡	This symbol, adjacent to a terminal, indicates that, under normal use, hazardous voltages may be present.
▣	Double insulation.

2.1 FCC Complicance

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

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to

provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING

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

2.2 Industry Canada compliance

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subjectto the following two conditions: (1) this device may not cause interference, and (2) this devicemust accept any interference, including interference that may cause undesired operation of thedevice.

3 Introduction

Congratulations on your purchase of the FLIR MR77 with METERLiNK® Bluetooth capabilities for use with FLIR infrared (IR) cameras.

This pinless moisture meter incorporates a patented built-in IR thermometer and 20-point memory. You can monitor moisture in wood and other building materials with no surface damage with the pinless moisture sensor (pin-type moisture probe included), and measure humidity and air temperature with the built-in probe, plus non-contact IR temperature using its patented IR design. Advanced functions provide moisture content, dew point, and vapor pressure calculations.

This meter is shipped fully tested and calibrated and, with proper use, will provide years of reliable service.

3.1 Key features

- Quickly indicates the moisture content of materials with pinless technology without damaging the surface.
- Optional remote pin-type probe (MR77-P) allows for moisture readings at different penetration levels (0.9 m (3′) cable length).
- Easy to read, large dual display with backlight feature.
- Simultaneously displays the percentage moisture content of wood or material being tested and the air temperature, IR temperature, or humidity.
- Uses a patented IR design to measure non-contact surface temperature, with an 8:1 distance-to-spot ratio and 0.95 fixed emissivity.
- Built-in humidity/temperature probe measures relative humidity and air temperature plus the mixing ratio and the dew point.
- Measures ambient and surface vapor pressure.
- Automatically calculates the differential temperature.
- Minimum/maximum and data hold modes.
- 20-point internal memory.
- Auto power off and low battery indication.

4 Description

4.1 Meter description

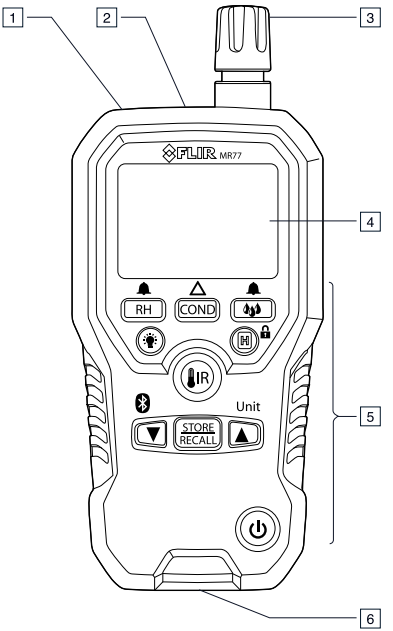


Figure 4.1 Front view

1. IR sensor.
2. Laser pointer diode.
3. Humidity sensor and thermometer.

> **Note**
> Protect the sensor with the protective cap when not in use.

4. LCD display.
5. Function buttons, see section 4.2 *Function buttons*, page 7.
6. External pin probe connection jack (RJ45).

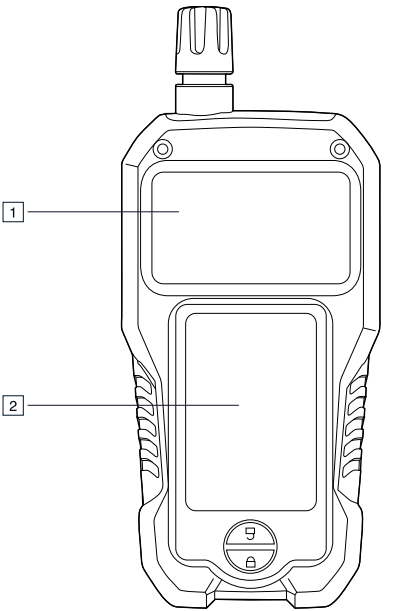


Figure 4.2 Rear view

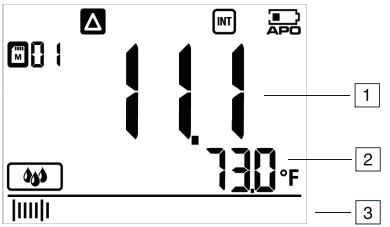
1. Internal moisture sensor.
2. Battery compartment.

4.2 Function buttons

	• Press the button to enter Hygrometer mode, see section 5.3 *Hygrometric measurements*, page 13. • Press the button repeatedly to cycle through the display of relative humidity, dew point temperature, and mix ratio. • Press and hold the button for 2 seconds to enter Humidity alarm set mode, see section 5.9 *Alarm settings*, page 18.
	• Press the button to enter Condensation mode, see section 5.5 *Condensation measurements*, page 15. • Press the button repeatedly to toggle between Condensation mode and Vapor pressure mode, see section 5.6 *Vapor pressure measurements*, page 16. • When in Moisture mode, press and hold the button for 2 seconds to toggle between the relative and absolute readings, see section 5.2 *Moisture measurements*, page 11.
	• Press the button to enter Moisture mode, see section 5.2 *Moisture measurements*, page 11. • Press the button repeatedly to toggle between the internal sensor and external pin probe measurements. • Press and hold the button for 2 seconds to enter Moisture alarm set mode, see section 5.9 *Alarm settings*, page 18.
	Press the button to enable/disable the display backlight.
	• Press the button to toggle between Normal and Hold mode. In Hold mode, the display freezes the last reading and continues to display this value. • Press and hold the button for 5 seconds to toggle between Normal and Locked mode, see section 5.10 *Locked mode*, page 19.
	Press and hold the button to enable IR temperature measurements, see section 5.4 *IR temperature measurements*, page 14.

	• Press and hold the button for 2 seconds to change the unit setting. For more information, see section 5.7 *Selecting measurement units*, page 17. • When in View data mode, press the button to step through the datalogger memory locations.
	When in View data mode, press the button to step through the datalogger memory locations.
	Press the button to capture and store the current readings. For more information, see section 5.8 *Storing and recalling measurements*, page 17.
	Press the button to switch the meter on/off.

4.3 Display description



1. Main display.
2. Secondary display.
3. Bar graph (matches the reading on the main display).

4.4 Status icons and indicators

	Indicates that METERLiNK® (Bluetooth) communication is active, see section 5.11 *Streaming measurement data using Bluetooth*, page 19.
	Indicates that the IR sensor and the laser pointer diode are active.

	Indicates that the meter is displaying relative moisture measurements (solid indicator) or absolute moisture measurements (flashing indicator).
	Indicates that the meter is in Hold mode.
	Indicates that the reading is lower than the Low alarm threshold.
	Indicates that the reading is higher than the High alarm threshold.
	Indicates that the meter is in Locked mode.
	Indicates that the internal moisture sensor is active.
	Indicates that the external pin probe is active.
	Indicates the battery voltage status.
	Indicates that the auto power off function is enabled.
	Indicates the active datalogger memory location (1–20).
	Indicates that the meter is in Hygrometer mode.
	Indicates that the meter is displaying dew point temperature readings on the main display.
	Indicates that the meter is in Condensation mode.
	Indicates that the meter is in Moisture mode.
	Indicates the number that represents the material group under test, see section 7 *Material groups*, page 22.
	Indicates that the meter is displaying vapor pressure in millibar (mBar) or in kilopascal (kPa) units.
	Indicates that the meter is displaying the mixing ratio in grains per pound (GPP) or in grams per kilogram (g/kg) units.

%	Indicates that the meter is displaying relative humidity in percent (%) units.
°C	Indicates that the meter is displaying temperature in degrees Celsius (°C) units.
°F	Indicates that the meter is displaying temperature in degrees Fahrenheit (°F) units.
CAL LIH	High/low calibration point.

5 Operation

5.1 Powering the meter

1. Remove the protective cap from the humidity sensor/thermometer assembly.
2. Press the  button to switch on the meter.
3. If the battery indicator shows that the battery voltage is low or if the meter does not power on, replace the battery. See section 6.2 *Battery replacement*, page 21.
4. Press the  button to switch off the meter.

5.1.1 Auto power off

The meter enters sleep mode after 30 minutes of inactivity. The meter beeps three times 20 seconds before powering off. Press any function button to prevent the meter from powering off. The auto power off time-out is then reset.

5.1.1.1 Disable auto power off

1. To disable the auto power off function, start with the meter switched off.
2. Simultaneously press and hold the  and  buttons until the **APO** indicator disappears, indicating that the function is disabled.

5.2 Moisture measurements

With the meter in Moisture mode, moisture measurements can be performed using either the internal moisture sensor or by connecting the external pin probe.

The internal moisture sensor can detect moisture to a depth of 19 mm (0.75″). The internal moisture reading can be relative or absolute.

The three-digit main display shows the moisture reading, and the four-digit secondary display shows the ambient air temperature. The bar graph matches the reading on the main display.

While in Moisture mode, IR measurements may also be performed, see section 5.4 *IR temperature measurements*, page 14.

5.2.1 Internal moisture sensor

1. Press the button to enter the Moisture mode.

   The and INT indicators are displayed. The indicator is also displayed, indicating that the meter is displaying relative measurements. The ambient temperature is displayed on the secondary display.
2. Place the internal moisture sensor (located on the rear side of the meter) on the surface of the material to be tested.

   The relative moisture reading is displayed on the main display. No units of measurement are displayed.
3. For absolute measurements, follow the steps below:
   1. For best results, keep hands and other surfaces and objects away from the internal moisture sensor area.
   2. Press and hold the COND button for 2 seconds until the indicator flashes, to zero the moisture reading and enable absolute measurements.
   3. Place the internal moisture sensor on the surface of the material to be tested.
      The absolute moisture reading is displayed on the main display. No units of measurement are displayed.
   4. Press and hold the COND button for 2 seconds to return to relative measurements.

5.2.2 External pin probe

1. Connect the external pin probe to the EXT connection jack (located at the bottom of the meter).
2. Press the button to enter the Moisture mode. The indicator is displayed.
3. Press the button once more to activate external pin probe measurements. The EXT indicator is displayed.

4. The MAT 8 indicator shows the currently selected material group number. Refer to section 7 *Material groups*, page 22.

   To change the material group number, do the following:

   1. Press and hold the ▼ and ▲ buttons for 2 seconds to enter the Material group selection mode.

      The MAT 8 indicator flashes.

   2. Use the ▼ and ▲ buttons to step through the nine material group numbers.
   3. Press the STORE RECALL button to set the group and exit the Material group selection mode.

5. Press the probe pins into the material.

   The moisture reading is displayed on the main display, in percent (%).

5.3 Hygrometric measurements

In Hygrometer mode, the meter measures and displays the relative humidity, dew point temperature, mixing ratio, and ambient air temperature.

The three-digit main display shows the relative humidity, dew point temperature, or mixing ratio, and the four-digit secondary display shows the ambient air temperature. The bar graph matches the reading on the main display.

While in Hygrometer mode, IR measurements may also be performed, see section 5.4 *IR temperature measurements*, page 14.

1. Press the RH button to enter Hygrometer mode. The RH indicator is displayed.
2. The relative humidity is displayed on the main display. The ambient air temperature is displayed on the secondary display.

3. Press the RH button repeatedly to cycle through the display of relative humidity, dew point temperature, and mixing ratio.
   - Relative humidity: The RH indicator is displayed and the reading is displayed in percent (%).
   - Dew point temperature: The DEW indicator is displayed and the reading is displayed in °C or °F, depending on the unit setting.
   - Mixing ratio: The reading is displayed in grains per pound (GPP) or grams per kilogram (g/kg), depending on the unit setting.

5.4 IR temperature measurements

IR temperature measurements can be performed in all operating modes.

The meter is equipped with a laser pointer diode, which is used as a targeting pointer for the IR temperature measurements. The target of the measurement should be larger than the size of the laser beam spot. As the distance from an object increases, the spot size of the area measured by the meter becomes larger. The meter's field of view ratio is 8:1, meaning that if the meter is 8 cm (3.2″) from the target, the diameter (spot) of the object under test must be at least 1 cm (0.4″). Refer to Figure 5.1.

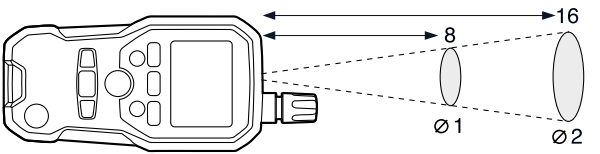


Figure 5.1 IR spot-to-distance ratio

IR measurement notes:

- The object under test should be larger than the than the size of the laser beam spot.
- If the surface of the object under test is covered with frost, oil, grime, etc., clean the surface before measuring.
- If the surface of the object is highly reflective, apply masking tape or flat black paint to the surface before measuring.
- The meter may not make accurate measurements through transparent surfaces such as glass.

- Steam, dust, smoke, etc., may obscure measurements.
- To find a hot spot, aim the meter outside the area of interest, then scan across (in an up and down motion) until the hot spot is located.

⚠ **WARNING**
Do not look directly into the laser beam. The laser beam can cause eye irritation.

⚠ **WARNING**
Do not use the laser pointer near explosive gases or in other possible explosive areas. Injury to persons can occur.

1. Press and hold the IR button to enable the IR sensor and the laser pointer diode. The ✱ indicator is displayed.
2. Aim the laser pointer at the surface to be measured. The IR temperature reading is displayed on the four-digit secondary display.
3. Release the IR button to disable the IR sensor and the laser pointer diode. The last IR temperature reading remains on the display for 8 seconds; then the meter returns to a display of the ambient air temperature, and the ✱ indicator disappears.

5.5 Condensation measurements

In Condensation mode, the meter determines whether a surface is at risk of condensation, based on measurements of the dew point temperature (relative humidity and ambient air temperature) and the IR temperature of the surface.

1. Press the COND button to enter the Condensation mode. The COND indicator is displayed.
2. Aim the meter at the surface. Press and hold the IR button. The ✱ indicator is displayed

3. The dew point temperature is displayed on the main display. The IR temperature of the surface is displayed on the secondary display. The bar graph indicates the level of risk for condensation:
   - If the IR temperature is more than 14°C (25°F) above the dew point temperature, the bar graph is empty.
   - If the IR temperature is 3–14°C (5–25°F) above the dew point temperature, the bar graph indicates a percentage of full scale.
   - If the IR temperature is less than 3°C (5°F) above the dew point temperature, the bar graph is full.
4. Release the IR button to disable the IR sensor and the laser pointer diode.

   The last IR temperature reading remains on the display for 8 seconds; then the meter returns to a display of the ambient air temperature and the ❄ indicator disappears.

5.6 Vapor pressure measurements

Vapor pressure measurement is a special variant of condensation measurement. The meter calculates the vapor pressure based on measurements of the relative humidity and the IR temperature of the surface.

1. Press the COND button to enter Condensation mode. The COND indicator is displayed. The unit of measurement on the main display is °C or °F, depending on the unit setting.
2. Press the COND button once more to enter Vapor pressure mode. The unit of measure on the main display changes to kPa or mBar, depending on unit setting.
3. Aim the meter at the surface. Press and hold the IR button.
4. The vapor pressure is displayed on the main display. The IR temperature of the surface is displayed on the secondary display.
5. Release the IR button to disable the IR sensor and the laser pointer diode.

   The last IR temperature reading remains on the display for 8 seconds; then the meter returns to a display of the ambient air temperature and the ❄ indicator disappears.

5.7 Selecting measurement units

There are two sets of units; US and metric. The unit setting can be changed at any time in any mode, by pressing and holding the ▲ button for 2 seconds.

The unit setting applies to all modes. It is *not* possible to, for example, display moisture in g/kg while showing temperature in °F.

US unit setting:

- Temperature is displayed in degrees Fahrenheit (°F).
- Mixing ratio is displayed in grains per pound (GPP).
- Vapor pressure is displayed in millibars (mBar).

Metric unit setting:

- Temperature is displayed in degrees Celsius (°C).
- Mixing ratio is displayed in grams per kilogram (g/kg).
- Vapor pressure is displayed in kilopascals (kPa).

5.8 Storing and recalling measurements

5.8.1 Datalogger memory locations

The meter has 20 datalogger memory locations for the storage of measurement data. Each memory location stores the current readings for all operating modes, with the current unit settings. Thus, each location contains moisture, humidity, ambient temperature, and IR temperature data.

5.8.2 Storing a measurement

1. Press the STORE RECALL button to capture and store the currently displayed readings.

   The data is saved to the memory location shown by the M 88 indicator. The memory location indicator then advances to the next location. When the 20 memory locations are full, the meter overwrites saved readings, starting with memory location 1.

5.8.3 View data

1. Press and hold the STORE RECALL button for 2 seconds to enter View data mode.

   The M 88 indicator flashes, and the data stored in that location is displayed.
2. Press the ▼ or ▲ button to step through the memory locations.
3. Press the RH, COND, or 🔥 button to display the stored data for the different modes.
4. Press and hold the STORE RECALL button for 2 seconds until a single beep sounds to exit View data mode.

5.8.4 Clearing the memory from data

1. Press and hold the STORE RECALL button for 2 seconds to enter View data mode.
2. In View data mode, press and hold the ▲ and ▼ buttons simultaneously for 3 seconds to clear all data.

5.9 Alarm settings

High and low alarm thresholds can be set for moisture and humidity measurements. If either of the thresholds is exceeded during the measurement, the meter beeps and the corresponding alarm indicator is displayed: the low alarm indicator L or the high alarm indicator H.

The default setting for the moisture and humidity alarms is off.

1. To enter the alarm set mode, do one of the following:

   - To enter the Moisture alarm set mode, press and hold the 🔥 button for 2 seconds.
   - To enter the Humidity alarm set mode, press and hold the RH button for 2 seconds.

   The current high threshold or *OFF* (if the alarm is disabled) is flashing on the main display.
2. To switch from *OFF* to the numerical display, simultaneously press the ▼ and ▲ buttons.

3. Use the ▼ and ▲ buttons to adjust the high alarm threshold.
4. To disable the high alarm, simultaneously press the ▼ and ▲ buttons.
5. When the desired high alarm threshold (or *OFF*) is displayed, press the STORE RECALL button to save the value.

   The current low threshold or *OFF* (if the alarm is disabled) is now flashing on the main display.
6. To switch from *OFF* to the numerical display, simultaneously press the ▼ and ▲ buttons.
7. Use the ▼ and ▲ buttons to adjust the low alarm threshold. The low alarm value cannot exceed the high alarm value.
8. To disable the low alarm, simultaneously press the ▼ and ▲ buttons.
9. When the desired low alarm threshold (or *OFF*) is displayed, press the STORE RECALL button to save the value and exit the alarm set mode.

5.10 Locked mode

In Locked mode, the meter ignores all button presses except H and ⏻. The auto power off function, see section 5.1.1 *Auto power off*, page 11, is disabled in Locked mode.

1. To enter Locked mode, press and hold the H button for 5 seconds.

   The 🔒 indicator is displayed.
2. To exit Locked mode, press and hold the H button for 5 seconds once again.

5.11 Streaming measurement data using Bluetooth

5.11.1 General

Some IR cameras from Flir Systems support Bluetooth communication and to those cameras you can stream measurement data from the meter. The data is then merged into the result table in the IR image.

Streaming measurement data is a convenient way to add important information to an IR image. For example, when identifying a water leakage in a wall, you may want to know the humidity in the wall.

The Bluetooth range is 10m (32ft) maximum.

5.11.2 Procedure

1. Pair the IR camera with the instrument. Refer to the camera manual for information on how to pair Bluetooth devices.
2. Turn on the camera.
3. Turn on the meter.
4. Press and hold the  button on the meter to enable Bluetooth.
5. Take a measurement reading. Results from the meter will now automatically be displayed in the result table in the top left corner of the IR camera screen.

6 Maintenance

6.1 Cleaning and storage

Clean the meter with a damp cloth and mild detergent; do not use abrasives or solvents.

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

6.2 Battery replacement

1. Switch off the meter before attempting to replace the battery.
2. Unscrew and remove the battery compartment cover.
3. Replace the standard 9 V battery.
4. Secure the battery compartment cover.

6.2.1 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.

7 Material groups

The table below shows the relation between the material group number (1–9), the input (ohms), and the wood moisture equivalent (% WME).

	1	2	3	4	5	6	7	8	9
Ohms	%WME								
15 G	7	8.2	9	8	7.1	7	11	10.5	-
8 G	8	10	10.5	9.3	7.5	7.4	11.5	11	-
4.1 G	9	10.8	10.9	9.7	7.9	8.1	12.1	11.6	8.5
1.4 G	10	11.7	11.5	10.4	8.6	8.8	12.7	12.2	9.4
600 M	11	12.7	12.6	11.3	9.5	9.7	13.4	13.4	10.5
290 M	12	13.6	13.7	12.1	10.5	10.5	14	14.3	11.5
160 M	13	14.5	14.5	12.7	11.2	11.2	14.5	15.1	12.5
96 M	14	15.3	15.5	13.4	11.8	11.8	15	16	13.5
44 M	15	16.3	16.7	14.1	12.5	12.6	15.6	17	14.4
29 M	16	16.9	17.5	14.8	13	13.2	16	17.7	14.9
17 M	17	17.7	18.8	15.7	14.3	13.9	16.6	18.5	15.3
11 M	18	18.2	19.7	16.3	15	14.5	17	19.1	16.1
6.9 M	19	19	21	16.9	15.9	15.2	17.6	20	16.7
5.999 M	20	20	22.6	17.8	16.9	16.1	18.4	21.3	17.2
3.899 M	21	20.8	23.5	18.5	17.6	16.8	19.1	22.3	18.3
2.82 M	22	21.5	24.5	29.3	18.3	17.4	19.7	23.2	19.1
1.99 M	23	22.9	26.4	20.2	19.8	18.6	21.2	25.3	19.9
1.31 M	24	23.5	27.4	20.8	20.4	19	22	25.8	20.5
910 K	25	24.2	27.8	21.2	21	19.4	22.7	26.3	~23
680 K	26	25.3	29	22.4	22.3	20.1	23.9	27.3	-
545 K	27	26.5	-	23.3	23.4	20.8	24.7	28.1	-
485 K	28	28	-	24.4	24.8	21.7	25.9	-	-
438 K	29	29.6	-	25.6	26.3	22.9	27.1	-	-

8 Technical specifications

Accuracy specifications for all measurement ranges are applicable under the following ambient conditions: 18 °C to 28 °C (64.4 °F to 82.4 °F); <80% RH.

8.1 General specifications

Display	• 3-digit 15 mm (0.6″) main display • 4-digit 6 mm (0.24″) secondary display • 10-segment bar graph • Memory counter
Controls	• 7 dedicated function buttons: moisture, relative humidity, condensation, hold/lock, up (⇑), down (⇓), store/recall • 4 auxiliary buttons: IR, Bluetooth, backlight/work light, power
Other indications	• 24 icon-style locations + 2-digit memory indicator • Piezo beeper (85 dBA)
Sample rate	2 per second
Backlight	White LED
Internal memory	(1) storage location
Power supply	1 × 9 V battery (MN1604 or equivalent)
Battery life	100 hours, using alkaline batteries, with no backlight/work light use
Auto power off (APO)	After 30 minutes (nominal) inactivity, with audible pre-alert; reset when the power button is pressed. Disable function supported
APO quiescent current	50 µA maximum

Operating temperature	0 to 50°C (32 to 122°F)
Storage temperature	–10 to 60°C (14 to 140°F)
Operating humidity	• 90%, 0 to 30°C (32 to 86°F) • 75%, 30 to 40°C (86 to 104°F) • 45%, 40 to 50°C (104 to 122°F)
Storage humidity	90% maximum
Dimensions (excluding sensor)	139 mm × 72 mm × 42 mm (5.4″ × 2.8″ × 1.7″)
Weight	0.29 kg (0.65 lb.), including batteries
Bluetooth range	10m (32ft) maximum
Agency approvals	FCC Class B

8.2 Humidity meter specifications

Function	Range	Accuracy (of reading)
Relative humidity measurement 20 to 30°C (68 to 86°F)	0–10%	±3%
	10–90%	±2.5%
	90–99%	±3%

8.3 Moisture specifications

Function	Range	Accuracy (of reading)
Pin moisture	0–99% WME	±5%
Pin-less moisture range	0–99.9	Relative measurement

8.4 Thermal measurement range specifications

Function	IR range	Accuracy (of reading)
IR temperature (8:1 ratio)	–20 to –1°C (–4 to 31°F)	±5°C (±9°F)
	0°C (32°F)	±1°C (±2°F)
	1 to 200°C (33 to 392°F)	Greater of ±3.5% or ±5°C (±9°F)
IR Emissivity	0.95 (fixed)	
Sensor temperature	-28 to 77 °C (-18 to 170 °F)	±2 °C (3.6 °F)

8.5 Vapor pressure specifications

Function	Range	Accuracy (of reading)
Vapor pressure measurement –1 to 60°C (30 to 140°F)	0.0–20.0 kPa	Greater of ±2.0% or 0.2 kPa
Dew Point Temperature range	-30 to 100 °C (-22 to 199 °F)	
Mixing Ratio range	0-999 GPP (0 to 160 g/kg)	

9 Technical support

Website	http://www.flir.com/test
Technical support	T&MSupport@flir.com
Repairs	Repair@flir.com

10 Warranties

10.1 FLIR Global Limited Lifetime Warranty

A qualifying FLIR Test and Measurement product (the "Product") purchased either directly from FLIR Commercial Systems Inc and affiliates (FLIR) or from an authorized FLIR distributor or reseller that Purchaser registers on-line with FLIR is eligible for coverage under FLIR's Limited Lifetime Warranty, subject to the terms and conditions in this document. This warranty only applies to purchases of Qualifying Products (see below) purchased and manufactured after April 1, 2013.

PLEASE READ THIS DOCUMENT CAREFULLY; IT CONTAINS IMPORTANT INFORMATION ABOUT THE PRODUCTS THAT QUALIFY FOR COVERAGE UNDER THE LIMITED LIFETIME 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 Limited Lifetime Warranty, Purchaser must fully register the Product directly with FLIR on-line at http://www.flir.com within Sixty (60) DAYS of the date the Product was purchased by the first retail customer (the "Purchase Date"). Qualifying PRODUCTS THAT ARE NOT REGISTERED ON-LINE WITHIN SIXTY (60) DAYS OF THE PURCHASE DATE WILL HAVE A LIMITED ONE YEAR WARRANTY FROM DATE OF PURCHASE.

2. QUALIFYING PRODUCTS. Upon registration, Test and Measurement products that qualify for coverage under FLIR's Limited Lifetime Warranty are: MR7x, CM7x, CM8x, DMxx, VP5x not including accessories which may have their own warranty.

3. WARRANTY PERIODS. For purposes of the The Limited Lifetime Warranty, Lifetime is defined as seven years (7) after the product is no longer manufactured, or ten years (10) from date of purchase, whichever is greater. This Warranty is only applicable to the original owner of the Products.

Any Product that is repaired or replaced under warranty is covered under this Limited Lifetime 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 Limited Lifetime 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, SOFTWARE UPDATES, AND REPLACEMENT OF MANUALS, FUSES, OR DISPOSABLE BATTERIES. FLIR FURTHER EXPRESSLY DISCLAIMS ANY WARRANTY COVERAGE WHERE THE ALLEGED NONCONFORMITY IS DUE TO NORMAL WEAR AND TEAR, OTHER 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 http://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.

7. NON-WARRANTY RETURN. Purchaser 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 http://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.

10.2 FLIR Test and Measurement Limited 2 Year Warranty

A qualifying FLIR Test and Measurement product (the "Product") purchased either directly from FLIR Commercial Systems Inc and affiliates (FLIR) or from an authorized FLIR distributor or reseller that Purchaser registers on-line with FLIR is eligible for coverage under FLIR's Limited Warranty, subject to the terms and conditions in this document. This warranty only applies to purchases of Qualifying Products (see below) purchased and manufactured after April 1, 2013.

PLEASE READ THIS DOCUMENT CAREFULLY; IT CONTAINS IMPORTANT INFORMATION ABOUT THE PRODUCTS THAT QUALIFY FOR COVERAGE UNDER THE 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 Limited Warranty, Purchaser must fully register the Product directly with FLIR on-line at http://www.flir.com within Sixty (60) DAYS of the date the Product was purchased by the first retail customer (the "Purchase Date"). Qualifying PRODUCTS THAT ARE NOT REGISTERED ON-LINE WITHIN SIXTY (60) DAYS OF THE PURCHASE DATE WILL HAVE A LIMITED ONE YEAR WARRANTY FROM DATE OF PURCHASE.

2. QUALIFYING PRODUCTS. Upon registration, Test and Measurement products that qualify for coverage under FLIR's Limited Warranty are: VS70 Videoscope, VSAxx Articulation Camera, VSCxx Camera, VSSxx Probe Spool, VST handset, MR02 Pin Extension Probe, and TAxx not including accessories which may have their own warranty.

3. WARRANTY PERIODS. The applicable Limited Warranty Period measured from the Purchase data are:

Products	Limited Warranty Period
VS70, VSAxx, VSCxx, VSSxx, VST, MR02, TAxx	TWO (2) Years

Any Product that is repaired or replaced under warranty is covered under this 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 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, SOFTWARE UPDATES, AND REPLACEMENT OF FUSES, OR DISPOSABLE BATTERIES. FLIR FURTHER EXPRESSLY DISCLAIMS ANY WARRANTY COVERAGE WHERE THE ALLEGED NONCONFORMITY IS DUE TO NORMAL WEAR AND TEAR, OTHER 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 http://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.

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