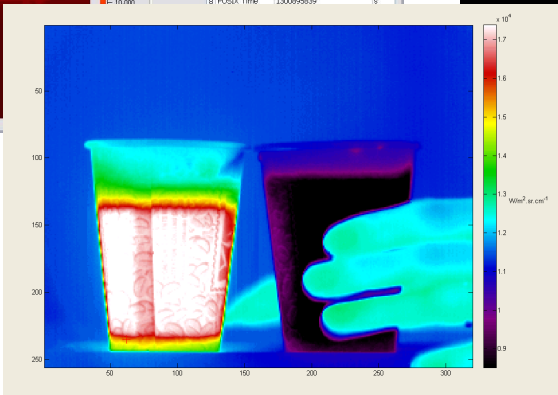
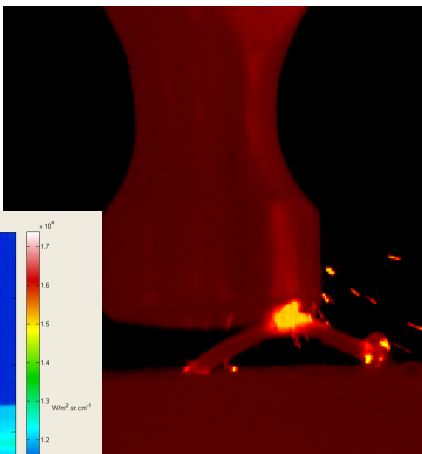
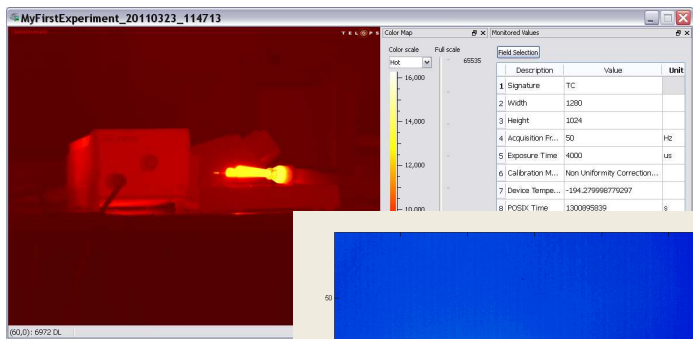




# Telops Infrared Camera Series

## User's Guide

**Preliminary**  
 March 2011  
 TEL-IRCDEV-00101-c v1.0



100-2600, avenue St-Jean-Baptiste, Québec (Québec), Canada, G2E 6J5,  
 Tel (418) 864-7808, Fax (418) 864-7843, [www.telops.com](http://www.telops.com)

Copyright © 2011 Telops Inc.

## Copyright

Copyright © 2011 Telops Inc. All Rights Reserved.

This document and the all accompanying software are copyrighted and all rights are reserved by Telops Inc. The document and software may not be copied, photocopied, reproduced, translated, or reduced to any electronic medium or machine-readable form, in whole or in part, without prior written consent from Telops Inc..

Windows XP is a trademark of Microsoft Corporation. All rights reserved.

## Software License and Limited Warranty Agreement

Products from Telops Inc. are provided with the following Software License, Software Disclaimer of Warranty, and Hardware Limited Warranty (collectively, the Agreement).

**1. LICENSE TO USE.** Telops grants you a non-exclusive and non-transferable license for the internal use only of the accompanying software and documentation and any error corrections provided by Telops (collectively "Software").

**2. RESTRICTIONS.** Software is confidential and copyrighted. Title to Software and all associated intellectual property rights is retained by Telops and/or its licensors. Except as specifically authorized in any Supplemental License Terms, you may not make copies of Software as specified in the License to use, other than a single copy of Software for archival purposes. Unless enforcement is prohibited by applicable law, you may not modify, decompile, or reverse engineer Software. You acknowledge that Software is not designed, licensed or intended for use in the design, construction, operation or maintenance of any nuclear facility. Telops disclaims any express or implied warranty of fitness for such uses. No right, title or interest in or to any trademark, service mark, logo or trade name of Telops or its licensors is granted under this Agreement.

**3. LIMITED WARRANTY.** Telops warrants to you that for a period of ninety (90) days from the date of purchase, as evidenced by a copy of the receipt, the media on which Software is furnished (if any) will be free of defects in materials and workmanship under normal use. Except for the foregoing, Software is provided "AS IS". Your exclusive remedy and Telops's entire liability under this limited warranty will be at Telops's option to replace Software media.

**4. DISCLAIMER OF WARRANTY.** UNLESS SPECIFIED IN THIS AGREEMENT, ALL EXPRESS OR IMPLIED CONDITIONS, REPRESENTATIONS AND WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT ARE DISCLAIMED, EXCEPT TO THE EXTENT THAT THESE DISCLAIMERS ARE HELD TO BE LEGALLY INVALID.

**5. LIMITATION OF LIABILITY.** TO THE EXTENT NOT PROHIBITED BY LAW, IN NO EVENT WILL TELOPS OR ITS LICENSORS BE LIABLE FOR ANY LOST REVENUE, PROFIT OR DATA, OR FOR SPECIAL, INDIRECT, CONSEQUENTIAL, INCIDENTAL OR PUNITIVE DAMAGES, HOWEVER CAUSED REGARDLESS OF THE THEORY OF LIABILITY, ARISING OUT OF OR RELATED TO THE USE OF OR INABILITY TO USE SOFTWARE, EVEN IF TELOPS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. In no event will Telops's liability to you, whether in contract, tort (including negligence), or otherwise, exceed 100 USD. The foregoing limitations will apply even if the above stated warranty fails of its essential purpose.

**6. Termination.** This Agreement is effective until terminated. You may terminate this Agreement at any time by destroying all copies of Software. This Agreement will terminate immediately without notice from Telops if you fail to comply with any provision of this Agreement. Upon Termination, you must destroy all copies of Software.

**7. Export Regulations.** All Software and technical data delivered under this Agreement are subject to Canadian export control laws and may be subject to export or import regulations in other countries. You agree to comply strictly with all such laws and regulations and acknowledge that you have the responsibility to obtain such licenses to export, re-export, or import as may be required after delivery to you.

**8. U.S. Government Restricted Rights.** If Software is being acquired by or on behalf of the U.S. Government or by a U.S. Government prime contractor or subcontractor (at any tier), then the Government's rights in Software and accompanying documentation will be only as set forth in this Agreement; this is in accordance with 48 CFR 227.7201 through 227.7202-4 (for Department of Defense (DOD) acquisitions) and with 48 CFR 2.101 and 12.212 (for non-DOD acquisitions).

**9. Governing Law.** Any action related to this Agreement will be governed by the Province of Quebec law. No choice of law rules of any jurisdiction will apply.

**10. Severability.** If any provision of this Agreement is held to be unenforceable, this Agreement will remain in effect with the provision omitted, unless omission would frustrate the intent of the parties, in which case this Agreement will immediately terminate.

**11. Integration.** This Agreement is the entire agreement between you and Telops relating to its subject matter. It supersedes all prior or contemporaneous oral or written communications, proposals, representations and warranties and prevails over any conflicting or additional terms of any quote, order, acknowledgment, or other communication between the parties relating to its subject matter during the term of this Agreement. No modification

of this Agreement will be binding, unless in writing and signed by an authorized representative of each party.

THE ABOVE ARE THE ONLY WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, THAT ARE MADE BY TELOPS ON THIS PRODUCT. BECAUSE SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF LIABILITY OR CONSEQUENTIAL OR INCIDENTAL DAMAGES, THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

## **Customer Support**

Telops strives to improve its products and help its customers be successful. If you have questions that are not covered in the present manual, have any software problems, or need service, please contact Telops Customer Support to the email, fax or street address below.

Telops inc. (Headquarters)  
100-2600 avenue St-Jean-Baptiste  
Québec QC, G2E 6J5  
Canada

Phone: (418) 864-7808  
1-888-880-7808  
Fax: (418) 864-7843  
E-mail: [contact@telops.com](mailto:contact@telops.com)  
Web: [www.telops.com](http://www.telops.com)

## TABLE OF CONTENTS

## TABLE OF CONTENTS

Copyright .....	iii
Software License and Limited Warranty Agreement.....	iii
Customer Support.....	v
<b>Table of Contents.....</b>	<b>vii</b>
<b>List of Figures .....</b>	<b>xiii</b>
<b>List of Tables .....</b>	<b>xvii</b>
<b>About this Manual .....</b>	<b>xix</b>
Audience .....	xix
Conventions used in Telops manuals.....	xix
Feedback to Us .....	xix
<b>Chapter 1      Telops Infrared Camera Series .....</b>	<b>1</b>
<b>1.1          The Infrared Camera series .....</b>	<b>1</b>
<b>1.1.1          Radiometric Calibration .....</b>	<b>1</b>
<b>1.1.2          Applications .....</b>	<b>2</b>
<b>1.2          Product Line .....</b>	<b>3</b>
<b>1.3          System overview.....</b>	<b>3</b>
<b>1.3.1          FAST-IR 1000 .....</b>	<b>5</b>
<b>1.3.2          HD-IR 1280.....</b>	<b>5</b>
<b>1.3.3          TEL-1000 MW/LW/VLW .....</b>	<b>6</b>
<b>1.4          Technical specifications.....</b>	<b>7</b>
<b>1.5          Customer Benefits.....</b>	<b>8</b>
<b>1.6          Safety and Precautions.....</b>	<b>9</b>
<b>1.6.1          Before operating the equipment: .....</b>	<b>9</b>
<b>1.6.2          While operating the equipment: .....</b>	<b>9</b>
<b>Chapter 2      Quick Set-Up .....</b>	<b>11</b>
<b>2.1          Computer and software.....</b>	<b>11</b>
<b>2.1.1          Recommended computer.....</b>	<b>11</b>
<b>2.1.2          Software Installation.....</b>	<b>12</b>
<b>2.2          Infrared Camera installation .....</b>	<b>12</b>
<b>2.2.1          Tripod interface.....</b>	<b>12</b>
<b>2.2.2          Table top mounting .....</b>	<b>12</b>
<b>2.2.3          External optics (optional).....</b>	<b>13</b>



## LIST OF TABLES

## LIST OF TABLES

Table 1-1. Standard Telops Infrared Camera Series description.....	6
Table 1-2. Telops Infrared Camera Series sensor specifications.....	7
Table 1-3. Telops Infrared Camera Series detector configuration.....	8
Table 3-1. Power Supply Specifications .....	24
Table 3-2. Power Connectors Specifications.....	26
Table 3-3. Touchpad LED status indicators.....	29
Table 3-4. Camera Link® bit assignments .....	30
Table 3-5. Compatible external lens .....	35
Table 3-6. Attenuation filter list .....	36
Table 4-1. Self test description.....	41
Table 4-2. Cooler ready criteria .....	43
Table 4-3. Windowing limitation (pixel units).....	47
Table 4-4. Frame rate limitation .....	49
Table 4-5. Exposure time limitation .....	52
Table 4-6. Sensor well depth availability .....	60
Table 6-1. Playback buttons description .....	102
Table 6-2. Matlab IRCam Toolbox.....	108
Table 8-1. XML Camera Interface Error Codes .....	119
Table 8-2. IR Camera Series Image Header .....	123
Table 8-3. Bad Pixel Map Header definition.....	124

## ABOUT THIS MANUAL

### Audience

This manual presents the characteristics of all the Telops Infrared Camera Series and provides information concerning set up, operation and maintenance of these sensors.

This high end camera should only be used, maintained and serviced by properly trained personnel, capable of carefully following the procedures and guidelines given in this User's Manual. This manual should be thoroughly read and understood before proceeding with the safe operation of this instrument.

This document covers the hardware and software aspects of the instrument.



A separate document covers the information on the optional *HypIR Software SDK Manual* [RD 1].

### Conventions used in Telops manuals

**Software commands** and Dialog box names appear as shown here

Text to be entered into software is in small sans serif type.



This symbol refers to another manual or document

**NOTE:** *Supplemental information to help the reader*

**IMPORTANT!** *Information that is important, but that does not concern the safe use of the equipment.*



**Caution:** *indicates that a potentially hazardous situation where caution is required. Follow the instructions carefully to avoid bodily harm or injury, damage to the equipment or other property damage.*

### WARNING!

**Failure to comply with warnings can result in serious injury or loss of life.**

### Feedback to Us

The information in this manual have been extensively tested and verified. As Telops is committed to continuous development and progress, you might find some features of the product that have been changed since the time of printing. Please let us know about any error you find and your suggestions for improvements for future editions by contacting Customer Support at the address/telephone number given on page v.

## TELOPS INFRARED CAMERA SERIES

### 1.1 The Infrared Camera series

The Telops Infrared Camera Series are state of the art accurate cooled imaging sensors that provide high resolution and high frame rate images (up to 1000 fps) about the infrared (IR) radiation emitted by targets under measurement.

These infrared cameras bring a breakthrough in today's infrared thermal imaging industry. Emerging as the fastest, highest defined and real-time calibrated (RTTC) cameras available yet, these instruments are sized, configured and priced to open the door to many new uses of thermography. They provide a series of unique high-performance features enabling scientists and infrared professionals to obtain ultrafast real-time temperature calibrated radiometric measurements, while allowing the visualization, detection, identification of images of remote substances and targets previously invisible.

The Telops Infrared Camera Series share the following characteristics:

- Same external look (independent of model)
  - Rugged, sealed metal enclosure
  - Conduction cooled enclosure
- Software controllable autonomous operation
- Compatible with commercial IR lenses
- Models offered in different versions
- Cameras are also available as OEM
- Several accessories are offered

#### 1.1.1 Radiometric Calibration

Accurate radiometric calibration is a key feature of modern infrared cameras. Considering the newly available infrared focal plane arrays (FPA) exhibiting very high spatial resolution and faster readout speed, Telops developed a method to provide a dedicated radiometric calibration of every pixel. The novel approach is based on detected fluxes rather than detected counts as is customarily done. This approach features many advantages including the explicit management of the main parameters used to change the gain of the camera, namely the exposure time. The method not only handles the variation of detector spectral responsivity across the FPA pixels but also provides an efficient way to correct for the change of signal offset due to camera self-emission and detector dark current. The method is designed to require as few parameters as possible to enable a real-time implementation for megapixel-FPAs and for data throughputs larger than 100 Mpixels/s [RD 3].



### 1.1.2 Applications

Infrared cameras are less ubiquitous than cameras operating in the visible range (such as CCD and CMOS), but their use is becoming more widespread as the price of IR technology is decreasing. Infrared imagery enables to meet the requirements of specialized applications that cannot be met by a standard visible camera such as night vision, thermography and non-destructive testing. Another factor helping the dissemination of the IR technology is the ease of use that is featured by new cameras being introduced to the market.

The Telops Infrared Camera Series allow non-contact remote sensing temperature measurement. As such, the infrared camera can act as a useful thermometer for measuring temperature under circumstances where thermocouples or other probe sensors cannot be used or do not produce accurate data. A typical example is for moving objects or in applications where a fast response is required.

These instruments are highly developed sensors which have wide-spread application in industrial processing and scientific research. Typical applications are listed below.

- Signature acquisition
- Surveillance
- Ballistics, Missile
- Chemical Warfare Agent (CWA) Gases Detection & Identification
- Jet engine characterization
- High temperature thermography (up to 1500°C range)
- Explosion and Material Characterization
- Combustion and Fluid Dynamics
- NDT (Non Destructive Testing), QC (Quality Control) and Processing
- Airborne Surveys, etc.



Figure 1–1. Telops Infrared Camera Series (FAST-IR-1000 Model)

## 1.2 Product Line

The Telops Infrared Camera Series hardware and software product line is shown in the figure below:

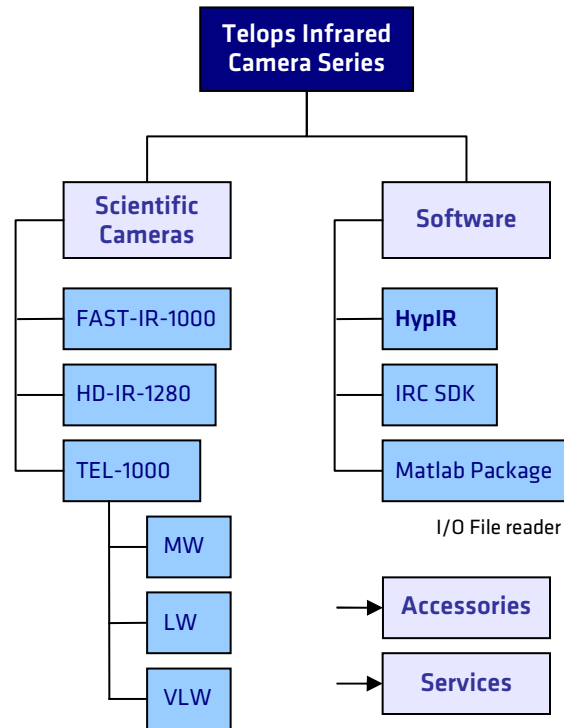


Figure 1–2. Telops Infrared Camera Series product line

Models and versions description are given in the following Section 1.3, software is presented in Chapter 6, services and support are listed in Chapter 8. Accessory list can be obtained by contacting Telops Customer Support (see page v).



For complementary information on the optional HypIR Software Development Kit, refer to the *HypIR SDK Manual* [RD 1].

## 1.3 System overview

The Telops Infrared Camera Series is software controlled using a Camera Link® based serial communication connection. The configuration, monitoring, and real-time housekeeping data collection are also performed using this link. Sequences from the sensor are sent to a frame-grabber card in the computer using the Camera Link® full protocol.

In the Telops Infrared Camera Series, data output is fully user selectable. The camera processing board allows outputting the data in any configura-

tion in real time. Data is measured and digitized in analog-to-digital ADC counts (RAW format), and can be averaged during acquisition (AVG). Images can be processed for Non Uniformity Correction (NUC) and radiometrically calibrated as thermal images (RTTC), and stored in real time sequence for a given experiment (a sequence is a series of images resulting from an experiment). The images can be produced by the entire focal-plane array (FPA), or from a smaller area, depending on the area of interest (AOI) and field of view (FOV) settings.

By the nature of their design, radiation detectors are strongly affected by ambient temperature changes. To maintain high measurement accuracy, the Telops Infrared Camera Series allow precise compensation of this temperature drift using a proprietary calibration method making the camera inherently immune to any temperature variations.

This technique makes the camera utilization blackbody free and implicitly handles the camera exposure times, frame rates, automatically compensates for changes in instrument self-radiance and handles a broad range of scene and ambient temperatures.

A dedicated Windows XP based GUI application software named HypIR is used for scene sequence acquisition, sensor head configuration and control, as well as viewing live or pre-recorded sequences. Figure 1–3 shows the user interface during a typical scene acquisition.

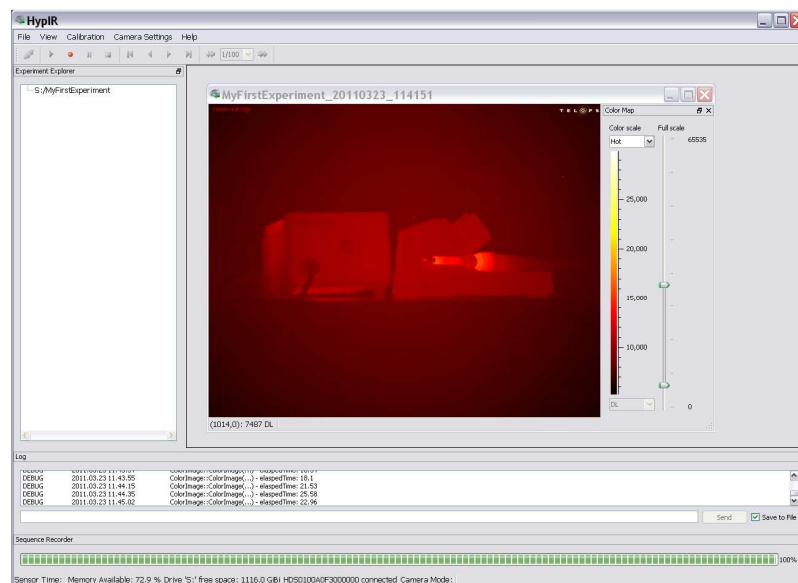


Figure 1–3. HypIR user interface front end.

Further in the document, the Telops camera series are referred to as the model types enumerated below:

### 1.3.1 FAST-IR 1000

The **FAST-IR 1000** is the fastest infrared camera available on the market. Being the first 1000 fps full frame solution, it allows unprecedented thermal imaging of dynamic events with much more temporal resolution than currently available cameras. The camera features the embedded electronics necessary to perform the radiometric calibration (presented in Chapter 5) in real-time on the full data rate ( $> 100$  Mpixels/s).

The FPA consists of an actively cooled Indium Gallium Arsenide (InGaAs) detector Integrated Detector Dewar Cooler Assembly (IDDCA). The FPA is a  $320 \times 256$  array of detectors, sensitive in the  $3\ \mu\text{m}$  to  $5\ \mu\text{m}$  spectral range.

### 1.3.2 HD-IR 1280

The **HD-IR 1280** is the first  $1280 \times 1024$  pixel camera solution making it the highest resolution infrared camera available. Equipped with a High Definition (HD) array of actively cooled InGaAs, the detector covers the  $3.6\ \mu\text{m}$  to  $4.9\ \mu\text{m}$  spectral range.

This camera captures extremely high-quality infrared images (as seen in Figure 1-4), allowing for much more thermal detail in the IR images, which in turn allows much better analysis of captured images. Additionally, both spot size resolution (the resolution within an individual spot), and temperature measurement are significantly better than lower-end cameras.

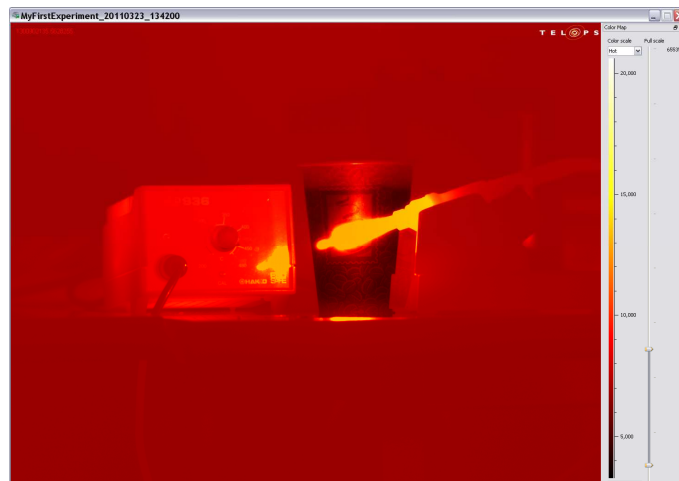


Figure 1-4. High definition image from the HD-IR-1280 camera.

### 1.3.3 TEL-1000 MW/LW/VLW

The **TEL-1000** thermal camera series are versatile instruments allowing data collection at high frame rate or IR target in the middle, long or very long wave spectral region. The FPA consists of an actively cooled Mercury Cadmium Telluride (MCT, also known as HgCdTe) detector.

This flexible state-of-the-art scientific grade camera family benefits from exceptional image accuracy and sensitivity, as described below for each of the offered models:

The **TEL-1000-MW** is equipped with a 640×512 array of detectors covering the 3  $\mu\text{m}$  to 5  $\mu\text{m}$  spectral range.

The **TEL-1000-LW** is equipped with a 640×512 array of detectors covering the 8  $\mu\text{m}$  to 9.6  $\mu\text{m}$  spectral range.

The **TEL-1000-VLW** is equipped with a 320×256 array of detectors covering the 7.7  $\mu\text{m}$  to 11.8  $\mu\text{m}$  spectral range.

Each camera model is available in four specific packages defined as versions. Table 1–1 summarizes the possible version packages for each camera type (refer to Section 4.2 for feature description).

Table 1–1. Standard Telops Infrared Camera Series description

Version	100	250	500	1000
FAST-IR	✓	✓	✓ <sup>1</sup>	✓ <sup>1</sup>
HD-IR	✓	✓	✓ <sup>1</sup>	✓ <sup>1</sup>
TEL-1000 MW/LW	✓	✓		
TEL-1000 VLW			✓ <sup>1</sup>	✓ <sup>1</sup>
RTTC	Upgradable	✓	✓	✓
AEC	Optional	Optional	✓	✓
EHDRI	Optional	Optional	Optional	Optional
AEC+	N/A	N/A	✓	Optional
SFW	N/A	N/A	Optional	✓

<sup>1</sup> Operational modes vary depending on the model

## 1.4 Technical specifications

The following table provides a summary of the characteristics for the different available camera models and configurations.

Table 1–2. Telops Infrared Camera Series sensor specifications

Configuration	FAST-IR 1000	HD-IR 1280	TEL-1000 MW	TEL-1000 LW	TEL-1000 VLW
Detector type	InSb	InSb	MCT	MCT	MCT
Pixel pitch	30 $\mu\text{m}$	15 $\mu\text{m}$	16 $\mu\text{m}$	16 $\mu\text{m}$	30 $\mu\text{m}$
Spectral range*	3 – 5 $\mu\text{m}$	3.6 – 4.9 $\mu\text{m}$	3 – 5 $\mu\text{m}$	8–10 $\mu\text{m}$	7.7–11.8 $\mu\text{m}$
FPA array format	320×256	1280×1024	640×512	640×512	320×256
ADC resolution	16 bits	14 bits	16 bits	16 bits	16 bits
Frame rate (full frame)	1000 fps	50 fps	115 fps	115 fps	300 fps
NEdT	< 20 mK	< 25 mK	< 23 mK	< 27 mK	< 21 mK
Measurement temperature range	–20°C to +150°C up to 1500°C, optional				
Accuracy	1°C or 1% of reading				
Communication	Camera Link® serial port				
Data transfer	Camera Link® Base/Full				
Acquisition software	Telops HypIR or Telops SDK				
User control	Windows XP-based HypIR application program				
Cooling	FPA cooling: Closed cycle Camera cooling: Forced convection outside sealed conductive enclosure				
Image Storage	External Computer Hard Disk storage (optional), Custom File Format: HCC (see Appendix C)				
Environmental Specification	Operating Temperature: –10..+50°C Storage Temperature: –20..+60°C IPR <sup>2</sup> Code 52 (Dust & Vertically dripping water protected) Humidity: Operating and storing 10% to 95%, non-condensing				
Analog Video	NTSC or PAL (EIA-170 or CCIR 624, respectively)				
Power supply	24 VDC, 80 W steady state, 160 W peak				
Physical Characteristics	Dimensions: 352×216×235 mm Weight camera head: 10.5 kg Weight power supply: 300 g				

**NOTE:** These specifications are provided for illustrative purposes only. Telops reserves the right to update these values periodically. Please consult a Telops sales representative to get accurate specifications.

**NOTE:** \*Other spectral ranges available upon request.

<sup>2</sup> IPR Code [http://en.wikipedia.org/wiki/IP\\_Code](http://en.wikipedia.org/wiki/IP_Code)

The different cameras are offered for various spectral range and detector configurations. The following tables introduce the detector configuration in function of the different model.

Table 1–3. Telops Infrared Camera Series detector configuration

Spatial Resolution	<i>f</i> #	Spectral Range	Version	Standard/Optional
<b>FAST-IR 1000</b>				
320×256	<i>f</i> /2.3	3 – 5 μm	All	S
	<i>f</i> /2.3	1.5 – 5 μm	100/250	O
<b>HD-IR 1280</b>				
1280×1024	<i>f</i> /3	3.6 – 4.9 μm	All	S
	<i>f</i> /3	3 – 5 μm	All	O
	<i>f</i> /3	1.5 – 5 μm	100/250	O
<b>TEL-1000 MW/LW</b>				
640×512	<i>f</i> /2.0	8 – 10 μm	All	S
640×512	<i>f</i> /4.0	3 – 5 μm	All	S
<b>TEL-1000 VLW</b>				
320×256	<i>f</i> /1.94	7.7 – 11.8 μm	500/1000	S

**NOTE:** A non-classified version of the HD-IR 1280 is also available.  
Contact Telops for details.

## 1.5 Customer Benefits

As an ultrafast high resolution infrared camera, the Telops sensors provide outstanding thermal imaging of the highest quality and present a range of benefits to the customer such as:

- Blackbody free automatic real-time NUC/Temperature calibration
- Ultra-compact, lightweight & fully integrated design
- Ease of operation
- Precision non-contact temperature measurement
- Plug-and-play connectivity
- Long durability
- High reliability
- Rapid delivery

## 1.6 Safety and Precautions

The following precautions must be observed whenever the equipment is operated, serviced, or repaired in order to protect the infrared camera from damage.

### **WARNING!**

**Failing to comply with any of the instructions, precautions or warnings contained in this manual is in violation of the standards of design, manufacture, and intended use of the equipment.**

**Telops assumes no liability for the user's failure to comply with any of these safety requirements.**

### 1.6.1 Before operating the equipment:

- Inspect the equipment for any signs of damage, and read this manual thoroughly.
- Install the equipment as specified in the documentation provided.
- Make sure that the correct line voltage is available and that the correct fuse is installed.
- Ensure that line-voltage power outlet that will be used is properly earthed.

### 1.6.2 While operating the equipment:

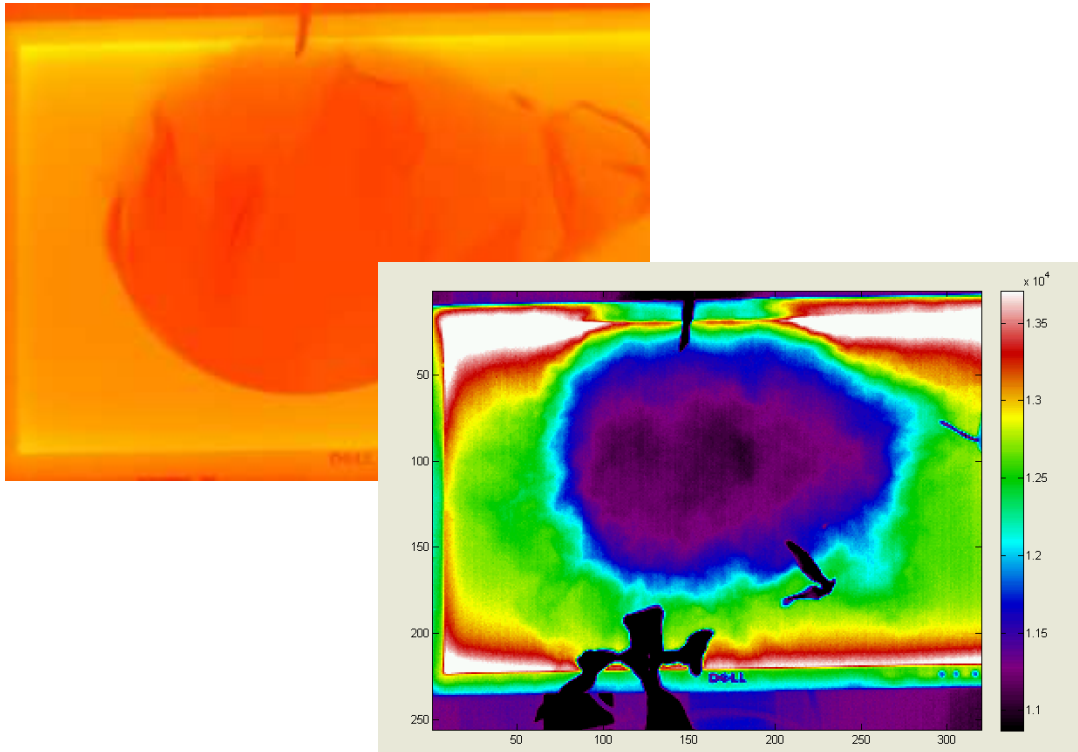
- Do not operate the equipment in the presence of flammable gases, fumes, or dust.
- Do not operate the equipment when its covers or panels have been removed.
- Do not use repaired fuses and avoid any situations that could short-circuit the fuse.
- Do not attempt to adjust or perform any maintenance or repair procedure when the equipment is opened and connected to a power source at the same time. Any such procedure should only be carried out by a qualified service professional.
- Do not attempt any adjustment, maintenance, or repair procedure to the equipment if immediate Infrared Camera aid is not accessible.
- Do not direct the infrared camera at very high intensity radiation sources such as the sun, CO<sub>2</sub> lasers, arc welders, etc.
- Wait for 10 s or longer to restart the camera after turning it off.
- Protect the infrared camera from rough handling situations that may cause physical damage to the camera's external housing, lenses and internal components.
- The infrared camera should only be operated when the ambient temperature is between -10 and +50 degrees Celsius. ((???)



- The infrared camera incorporates precision optical equipment and static-sensitive electronics which should be protected from shock and vibration at all times.
- Do not cover, impede or otherwise block the air ventilation ports on the infrared camera covers.
- Do not attempt to open the camera body as this action will void the manufacturer's warranty.

**WARNING!** High voltages may be present inside the enclosure even when the equipment is not connected to the power source because some of the internal capacitors may remain charged.

**WARNING!** The Telops Infrared Camera Series does not incorporate any user serviceable parts. Never attempt to disassemble or modify the camera. Opening the unit housing voids the warranty.



## Accelerating Innovation, Exceeding Expectations

### ► About Telops

Telops specializes in the design and production of sophisticated opto-electronic systems for the defense, aerospace and telecommunications industries. A reliable source of accelerated innovation in optronics, the experienced engineering team thrives on high expectations and great challenges. Technical experts understand your business and their diverse backgrounds represent a powerful source of innovation. Telops also excels at project management while remaining flexible since the team understands that changes can be inevitable. Whether you are looking for equipment, expertise or outsourcing, we will turn your high expectations into success.

[www.telops.com](http://www.telops.com)