



# **Tau™ 1 and 2 Product Comparison**

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# 1 Document

## 1.1 Revision History

Version	Date	Comments
100	02/08/2013	Initial release.
110	05/20/2013	Updated for Tau 2.4 Release

## 1.2 Scope

Tau™ is a family of miniature infrared imaging cores from FLIR Systems®, offered in various configurations. The purpose of this document is to provide a summary of all features and general changes between the Tau 1.X and Tau 2 products for a quick reference and product comparison. All features and changes are described in the Tau 2 Product Specification and/or Tau 2 Software IDD documents.

While Tau 2 resembles the Tau 1.5 (324x256) and Tau 1.7 (640x512) configurations in size and shape, it is a different product providing more capabilities not possible with the older hardware platform. Furthermore it is intended that most features will be field-upgradeable with feature improvements over time. Consequently this product comparison will be updated to reflect the new features of each upgrade. The features by Tau 2 release are summarized in Table 1 - Table 4.

For customers that wish to remain on a particular Tau 2 release, an OEM part number may be obtained (e.g. 46640001X-FPOEM instead of 46640001X-FPNLX). For OEM part numbers, FLIR will hold the camera software and firmware fixed and will not upgrade to each release unless otherwise requested.

## 2 References

The following documents form a part of this product comparison to the extent specified herein.



## 2.1 FLIR Website / Contact Information

In multiple locations throughout this document, FLIR’s Tau website is referenced as a source of additional information. This website can be accessed via the following URL:

[www.flir.com/cvs/cores/uncooled/products/tau/](http://www.flir.com/cvs/cores/uncooled/products/tau/)

Additionally, FLIR’s Applications Engineering Department is referenced as a resource for obtaining additional help or information. The department can be accessed via the following phone number: +1-805-964-9797 (or toll-free within the United States at 888-747-FLIR (888-747-3547).) Email requests can be addressed to [SBA-cores@flir.com](mailto:SBA-cores@flir.com)].

## 2.2 FLIR Systems Documents

102-PS242-100-14	Advanced Radiometry Application Note
102-PS242-40	Tau 2 Product Specification
102-PS242-41	Tau 2 Electrical Interface Description Document (IDD)
102-PS242-43	Tau2/Quark Software IDD

## 2.3 Abbreviations / Acronyms

CMOS	Complementary Metal-Oxide-Semiconductor
IDD	Interface Description Drawing / Document
LVDS	Low-Voltage Differential Signaling
ROI	Region of Interest



### 3 Summary of New Features in Tau 2

The following list summarizes the new features relative to previous releases beginning with Tau 1.X, which refers to the Tau 1.5 and Tau 1.7 products. The summary should serve as a basic description of the new features available in Tau 2 for comparison with Tau 1.X. The Tau 2 Product Specification provides a complete list of details related to each feature. Tables 1, 2, and 3 in section 3.2 depict the Tau 2 release succession and the corresponding features that were introduced. The tables should serve as a reference guide to the documents in which the features and software commands are fully defined.

#### 3.1 New Features

##### 3.1.1 General Functionality

- Continuous electronic zoom
  - The user has the ability to zoom to any zoom width down to 80 pixels wide in addition to the discrete 2x/4x/8x zoom steps (restrictions on zoom factor still apply depending on resolution, see the Tau 2 Software IDD) and may also choose an increment or decrement method. The legacy zoom capability and commands have been preserved.
- Electronic Zoom in the 8-bit digital channels
  - Selectable option to enable the continuous electronic zoom feature in the 8-bit CMOS or 8-bit LVDS output. This feature will make the digital output resolution 640x512 regardless of FPA type and the frame rate will be limited to 30Hz NTSC or 25Hz PAL.
- Colorization in the 8-bit digital channels
  - Selectable option to enable Bayer encoding for colorized digital data with 8-bits. Bayer encoding pattern is also software selectable for end-users that have already designed for specific encoding patterns.
- Radiometric accuracy improved and available for all standard part numbers
  - Spotmeter and isotherms are now available for all standard part numbers (e.g. 46640019H-FPNLX).
  - The typical radiometric performance is now improved. The use of an additional temperature sensor on the camera housing has been employed. The accuracy improvement and availability for all standard part numbers is not field upgradeable, due to factory calibration necessary for the feature.
- Advanced radiometry features and accuracy option (requires OEM part number)



- OEMs with “Advanced Radiometry” will receive further improved accuracy on the order of  $\pm 5$  C° in high-gain state (varies slightly across the full operating temperature range). The ability to perform a field radiometric calibration is included.
- OEMs with “Advanced Radiometry” will receive per pixel radiometric information (i.e. moveable spotmeter) and additional spotmeter data (e.g. standard deviation, minimum, and maximum pixel values with the ROI). See the Radiometry Application Note for further details.
- OEMs with “Advanced Radiometry” may enable the TLinear feature which gives digital data linear in scene temperature, i.e. in real-time operation, the pixel values in the 14-bit digital data correspond to the temperature of the scene. See the Radiometry Application Note for further details.
- 8-bit snapshot and playback
  - 8-bit snapshots in BMP8 format may be stored and played back on analog video. This snapshot feature is in addition to the original 14-bit snapshot feature.
  - Snapshot memory for both 14-bit and new 8-bit snapshots has been increased.
- Fault tolerant FW upgrades
  - For Tau 2, the upgrades load into a secondary location to preserve the original firmware. SW upgrades remain fault tolerant.
- Revert applies to all digital channels
  - In Tau 1, only invert (vertical image flip) was applied to the digital channels. For Tau 2, both invert and revert (horizontal image flip) are applied to the digital channels.
- Splash screen delay time is adjustable
  - The display time of the start-up splash screen is now user configurable and unlike Tau 1, the user may set the display time independent from loading a new splash screen.
- Selectable symbol resolution for all configurations
  - Independent of camera resolution (e.g. 324x256), the symbol resolution can be selected as either 640x512 or 324x256.
- Isotherm with three color ranges
  - Tau 1 included two color ranges, and Tau 2 now includes three color ranges. For Tau 2, the top half of the color palette may be mapped to a lower (yellow), middle (orange), and upper (red) threshold.
- Overtemp indicator
  - As a diagnostic feature, the Tau 2 core can report a status indicating whether the operating temperature is higher than the specified temperature range. Some configurations can also display an overtemp indicator.
- Improved full temperature performance (-40°C to 80°C)
  - Improved factory calibration procedure and software were introduced to improve image quality over temperature. This update does not affect the user interface or the field calibration procedures available in the Camera Controller GUI.



### 3.1.2 Imaging Features

- 60Hz frame rates available
  - Resolutions lower than 336x256 have a software selectable frame rate of 60Hz/50Hz and 30Hz/25Hz for NTSC/PAL.
- New output resolution options
  - The factory output resolutions now include a 336x256 17micron option and a variety of aggregated options based on the base resolutions. For lower resolutions configurations, aggregation or pixel averaging creates an effective larger pixel size over a traditional sensor of the same resolution (not user selectable).
- Low gain mode for all configurations
  - Tau 1 had the low gain option for the 324x256, 25micron configuration only. Tau 2.4 introduced the low gain option for all 17micron configurations. Note that for older Tau 2 cameras, this feature is not field-upgradeable due to the calibration procedure required.

### 3.1.3 Interface Features

- New auto-polarity detection
  - Tau 2 automatically detects whether standard or inverted logic is transmitted over RS232.
- New baud rate options
  - The auto-baud mode remains (auto-detection of either 57.6k or 921.6k), and fixed baud rates from 9.6k to 921.6k are also supported.
- CMOS/LVDS bit-width independently selectable
  - In Tau 2, the 8-bit CMOS may be used simultaneously with 14-bit LVDS and vice versa.
- Iris-style shutters are available for all Tau 2 part numbers
  - Iris-style shutters provide a more mechanically compact camera.



### 3.2 New Features by Release

Release Version	Release Date	New Features relative to Tau 1.X:	Reference Documents
2.0	October 2011	New auto-polarity detection	102-PS242-43, section 3.1.1
		New baud rate options are provided	102-PS242-43, section 3.1.2, command 0x07
		Digital output mode updates to support setting CMOS and LVDS bit-width independently	102-PS242-43, command 0x12
		60Hz frame rate is available for array sizes 336x256 and smaller	102-PS242-40 rev100 and later, section 3.3.2 102-PS242-43, command 0x72
		Splash screen display time is adjustable via command	102-PS242-43, command 0x31
		FW / SW upgrade is fault tolerant	102-PS242-40 rev100 and later, section 3.3.1.4
		Revert applies to all digital output channels	102-PS242-40 rev100 and later, section 3.3.2.3
		All configurations, regardless of number of pixels, can provide 640x512 symbol resolution	102-PS242-40 rev100 and later, section 3.3.2.8
		Isotherms provide three color ranges rather than two	102-PS242-43, command 0x23
		Iris-style shutter option available for all resolutions	102-PS242-40 rev100 and later, section 3.1.1.1

**Table 1: New Features for Tau 2.0 release relative to Tau 1.X**





Release Version	Release Date	New Features relative to Tau 2.0:	Reference Documents
2.1	August 2012	Addition of available resolution options	102-PS242-40 rev110 and later, section 3.2.1
		New continuous electronic zoom feature	102-PS242-40 rev110 and later, section 3.3.2.4 102-PS242-43, command 0x32
		Selectable symbol resolution	102-PS242-40 rev110 and later, section 3.3.2.8
		New 8-bit snapshot / playback feature	102-PS242-40 rev110 and later, section 3.3.2.9 102-PS242-43, command 0x82
		New advanced radiometric features and improved accuracy (OEMs with “Advanced Radiometry” only)	102-PS242-40 rev110 and later, section 3.3.3.3 102-PS242-43, various commands
		New over-temperature indicator	102-PS242-40 rev111 and later, section 3.3.4.4 102-PS242-43, command 0x20

**Table 2: New Features for Tau 2.1 release relative to Tau 2.0**

Release Version	Release Date	New Features relative to Tau 2.1:	Reference Documents
2.1.1	November, 2012	The supplemental FFC feature now available in Tau2	102-PS242-40 rev112 and later, section 3.3.2.11

**Table 3: New Features for Tau 2.1.1 release relative to Tau 2.1**



Release Version	Release Date	New Features relative to Tau 2.1.1:	Reference Documents
2.4	June 2013	Continuous eZoom available in 8-bit digital output	102-PS242-40 rev130 and later, section 3.3.2.4, 3.2.1, and 3.2.2 102-PS242-43 rev120 and later, command 0x12
		Colorization available in 8-bit digital output	102-PS242-40 rev130 and later, section 3.3.2.7 102-PS242-43 rev120 and later, command 0x12
		TLinear and new external scene parameters (OEMs with “Advanced Radiometry” only)	102-PS242-40 rev130 and later, section 3.3.3.3 102-PS242-43 rev120 and later, commands 0x8E and 0xE5
		Low gain mode for all configurations	102-PS242-40 rev130 and later, section 3.3.2.2

**Table 4: New Features for Tau 2.4 release relative to Tau 2.1.1**

## 4 Summary of Changes from Tau 1 to Tau 2

### 4.1 General Changes

- The LVDS digital output utilizes two data lines for all Tau 2 part numbers
  - The LVDS digital output utilized one data line for Tau 1.5 (320 resolution) and now two data lines are employed for Tau 2. The change was made to allow a uniform electrical interface across all Tau 2 configurations. See the Tau 2 Electrical IDD for further details.
- Additional temperature sensor on the internal front housing face
  - The new temperature sensor provides improved radiometric accuracy.
  - Currently, all Tau 2 part numbers include this temperature sensor. If the additional temperature sensor is not desired, contact FLIR for further information.
- Power consumption is marginally higher for Tau 2, due to the increased feature set and larger FPGA
  - The peak current draw has also increased. See the Tau 2 Electrical IDD for further details.
- Pan/Tilt is now limited to range of  $\pm 40$  pixels



- For experienced users, the limitation may be removed by using a separate command. Contact the FLIR Applications Engineering department for further details and instructions.
- AGC ROI change
  - The coordinates to set the ROI via software command are now expressed as percentages.
  - A single AGC ROI is defined for Tau 2, as opposed to Tau 1.X in which a separate ROI for each zoom factor was defined.

## 4.2 Software Command Changes

The following software commands existed in Tau 1 and were altered for Tau 2. Not including the exceptions below, backwards compatibility with software commands was intentionally maintained to facilitate integration of the Tau 2 product in place of Tau 1. Some new features were accomplished by adding new sub-commands for existing software commands and some new features required entirely new commands. The new commands or sub-commands supporting the increased feature set for Tau 2 are not included in this section as they will not affect backward compatibility and are well documented in the Tau 2 Software IDD. The changes in Tau 2 relative to existing Tau 1 commands are highlighted in **blue font** for emphasis:



ID	Function Code (hex)	Command	Description	Byte Count	Argument (i.e., Data Bytes) (hex)	Notes
76	0x4C	AGC_ROI	Gets or sets the Region of Interest (ROI) used by some of the AGC algorithms in normal and zoom modes. Assumes signed coordinates relative to center value of (0,0), and coordinates are expressed as percentages (-512 = -50%, +512 = +50%). See para. 3.3.2.4 of ref. 3 for a more complete explanation.  Note: Unlike Tau 1.X or Tau 2.0, only a single ROI is defined for Tau 2.1. It is applied whether video is zoomed or unzoomed.	Get Cmd: 0	None	Range: $\pm 512$ ( $\pm 50\%$ )  It does not apply to all AGC algorithms.
				Reply: 8	Bytes 0-1: Left Bytes 2-3: Top Bytes 4-5: Right Bytes 6-7: Bottom	
112	0x70	PAN_AND_TILT	Gets or sets the pan (x axis) and tilt position (y axis) for the zoom window relative to the center of the unzoomed window.	Get Cmd: 0 (Reply: 4)	None	
				Set Cmd: 4 & Reply: 4	Bytes 0-1: Tilt position in rows Bytes 2-3: Pan position in columns	Limited to a range of -40 to +40  Contact the FLIR Applications Engineering department for instructions to surpass the limit range.

*Note: The VIDEO\_MODE command (#15) is the legacy command for zoom, and the command does maintain backwards compatibility. If used in conjunction with the new EZOOM\_CONTROL command (#50) in Tau 2 for the purpose of displaying zoom symbols, the interaction between both zoom commands should be considered. See the Tau 2 Software IDD for further details.*



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This equipment must be disposed of as electronic waste.

Contact your nearest FLIR Commercial Systems, Inc. representative for instructions on how to return the product to FLIR for proper disposal.

**FCC Notice.** This device is a subassembly designed for incorporation into other products in order to provide an infrared camera function. It is not an end-product fit for consumer use. When incorporated into a host device, the end-product will generate, use, and radiate radio frequency energy that may cause radio interference. As such, the end-product incorporating this subassembly must be tested and approved under the rules of the Federal Communications Commission (FCC) before the end-product may be offered for sale or lease, advertised, imported, sold, or leased in the United States. The FCC regulations are designed to provide reasonable protection against interference to radio communications. See 47 C.F.R. §§ 2.803 and 15.1 et seq.

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