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1.0 Document

1.1 Revision History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>6/26/2013</td>
<td>Initial Release</td>
</tr>
<tr>
<td>110</td>
<td>8/29/2013</td>
<td>Add limitation on 60Hz/50Hz operation. Modified AGC description for 0.5X zoom mode.</td>
</tr>
<tr>
<td>111</td>
<td>09/12/2013</td>
<td>Updated discrete table</td>
</tr>
<tr>
<td>120</td>
<td>11/19/2013</td>
<td>Updated for general release. Included more explanation of features of zoom capability.</td>
</tr>
<tr>
<td>121</td>
<td>4/21/2014</td>
<td>Clarification of zoom features.</td>
</tr>
</tbody>
</table>

1.2 Scope

This Application Note describes the operational controls of a special Tau2 324/336 configuration with the ability to zoom to 0.5X, 1X, 2X and 4X. This feature is only available on Tau2 324/336 cameras with a specific firmware/software load. This option is available to OEM customers only and it is not currently a feature for all general Tau customers. If this feature is desired for a different camera, please contact your sales person to request a specific OEM part number and identify the lens type requested.

Here is a sample of some of the resources that can be found on the FLIR website:

<table>
<thead>
<tr>
<th>Document Title</th>
<th>Document Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tau Quick Start Guide</td>
<td>102-PS242-01</td>
<td>Quick Start Guide for first-time use</td>
</tr>
<tr>
<td>FLIR Camera Controller GUI User’s Guide</td>
<td>102-PS242-02</td>
<td>Detailed Descriptions for functions and adjustments for FLIR cameras using the FLIR Camera Controller GUI</td>
</tr>
<tr>
<td>Tau 2 Electrical IDD</td>
<td>102-PS242-41</td>
<td>Written for Electrical Engineers to have all necessary information to interface to a Tau 2 camera</td>
</tr>
<tr>
<td>Tau 2/Quark Software IDD</td>
<td>102-PS242-43</td>
<td>Written for Software Engineers to have all necessary information for serial control of Tau 2 and Quark</td>
</tr>
<tr>
<td>Assorted Mechanical Drawings and Models</td>
<td>Various</td>
<td>There are drawings and 3D models for various camera configurations for mechanical integration</td>
</tr>
<tr>
<td>Application Notes</td>
<td>Various</td>
<td>Written for Systems Engineers and general users of advanced features such as Gain Calibration, Supplemental FFC Calibration, NVFFC Calibration, Bad Pixel Killing, detailed use of CameraLink, CameraLink Accessory Modifications, On-Screen Symbology, AGC/DDE explanation, Camera Mounting, Spectral Response, Optical Interface for lens design, and others.</td>
</tr>
</tbody>
</table>

There is also a large amount of information in the Frequently Asked Questions (FAQ) section on the FLIR website: [http://www.flir.com/cvs/cores/knowledgebase/](http://www.flir.com/cvs/cores/knowledgebase/). Additionally, a FLIR Applications
Description of Feature

The Tau 2 half zoom feature is only available on 324x256 and 336x256 sensors (not the 640). This build will include the same features described in the Tau 2 literature for the 324/336 configuration except as described in this document. This version will be a variant of the Tau 2.4 release and upgrades to future Tau 2 releases will not necessarily support these features. Quark does not currently support this feature. This feature only works in 30Hz/25Hz (NTSC and PAL) mode or the sub-9Hz equivalents. It does not work in 60Hz/50Hz mode.

2.1 Tau 2 Half Zoom Variants

The Tau 2 half zoom variant is available in the 324 25um and 336 17um version. It is not available in a 640 17um pixel version. The Tau 2 Half Zoom feature displays the native resolution of the sensor and will not interpolate up to a VGA resolution while in ½ zoom.

The part numbers for the Half Zoom version are:

- 46324001X-FPHF2 / 46336001X-FPHF2, 30Hz/25Hz lensless
- 46324001X-FPHF2 / 46336001X-SPHF2, sub-9Hz Lensless

And with the lens attached

- 46324YYYH-FPHF2* / 46336YYYH-FPHF2*, 60Hz/50Hz lensless
- 46324YYYH-FPHF2* / 46336YYYH-SPHF2*, sub-9Hz Lensless

* Where YYY is the lens variant described in Table 1. Not all part numbers may be released in SAP but will be based on customer’s requests and specific OEM numbers opened for the customer.

Table 1. Tau 2 lenses available.

<table>
<thead>
<tr>
<th>YYY</th>
<th>Lens focal length</th>
</tr>
</thead>
<tbody>
<tr>
<td>007</td>
<td>7.5mm</td>
</tr>
<tr>
<td>009</td>
<td>9mm</td>
</tr>
<tr>
<td>013</td>
<td>13mm</td>
</tr>
<tr>
<td>019</td>
<td>19mm</td>
</tr>
<tr>
<td>025</td>
<td>25mm</td>
</tr>
<tr>
<td>035</td>
<td>35mm</td>
</tr>
<tr>
<td>W35</td>
<td>W35mm</td>
</tr>
<tr>
<td>050</td>
<td>50mm</td>
</tr>
<tr>
<td>060</td>
<td>60mm</td>
</tr>
<tr>
<td>100</td>
<td>100mm</td>
</tr>
</tbody>
</table>
## 2.2 Camera Outputs

The Tau 2 camera has several output interfaces. These will remain the same as the general Tau release except where noted here.

### 2.2.1 LVDS video:

Format 324/336x256 14-bit, 0.5X zoom is not available. Output is the same as normal Tau2 cameras.

Format 640x512 8 bit AGC corrected, 0.5X zoom is available. The blank area outside the image in 0.5X zoom mode will have a value of zero.

### 2.2.2 CMOS video:

Format 324/336x256 14-bit, 0.5X zoom is not available. Output is the same as normal Tau2 cameras.

Format 640x512 8 bit AGC corrected, 0.5X zoom is available. The blank area outside the image in 0.5X zoom mode will have a value of zero.

### 2.2.3 Pan/Tilt

The Pan/Tilt controls will be available but the width/height will be limited by the amount of zoom applied. The 0.5X zoom will not have the ability to Pan/Tilt. Pan/Tilt will operate only when zoomed in beyond the 0.5X zoom mode. For example, you can Pan/Tilt in 0.8X mode but not in 0.5X mode.

All Tau2s have the ability to pan and tilt beyond the normal boundaries. The table below is in the format of the FLIR SWIDD and shows the command to enable pan and tilt beyond the normal limits.

<table>
<thead>
<tr>
<th>0x70</th>
<th>PAN_AND_TILT</th>
<th>setPanTilt</th>
<th>4</th>
<th>rowOffset: (tilt position), 68 to -68; columnOffset: (pan position), 81 to -81;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>setPanTiltIgnoreLimits</td>
<td>6</td>
<td>Byte 0-1: const_0x0000; Byte 2-3: columnOffset; Byte 4-5: columnOffset; setPanTiltIgnoreLimits: Ignores pan/tilt limits;</td>
</tr>
</tbody>
</table>

### 2.2.4 Video Color

The video color displayed in the BT.656 and analog video is determined by the Tau LUT file. The Half Zoom camera configuration has a special LUT file which has color 0 set to the fill color for all LUTs.

### 2.2.5 BT.656:

640x480 NTSC resolution (525/60) or 640x512 PAL resolution (625/50). PAL format will have additional black bars around active image to achieve correct aspect ratio. At zoom levels less than 1X there will be black borders.

Zoom available: 0.5X, 1X, 2X, 4X.

E-zoom will function for level between 0.5X and 4X.
Note: The commands for 0.5X to 4X will be represented by 1X to 8X in the GUI and serial commands.

### 2.2.6 Analog output:
NTSC or PAL. PAL format will have additional black bars around active image to achieve correct aspect ratio. At zoom levels less than 1X the border will be black in color.

Zoom available 0.5X, 1X, 2X, 4X.

E-zoom will function for levels between 0.5X and 4X.

Note: The commands for 0.5X to 4X will be represented by 1X to 8X in the GUI and serial commands.

### 2.3 Zoom Software Controls
The 0.5X zoom feature will be controlled by the 0x32 e-zoom control. The Zoom state will be savable and power cycle persistent.

In the ‘Unzoom’ mode the display will have black borders and the qVGA resolution is not interpolated up to VGA resolution in the analog mode. Customers can use the digital zoom (e-zoom) feature to move from 0.5X zoom to 1X zoom. Doing so will move from a 320 image with black bars to an image that fills the whole display (no black boards in NTSC). Zoom up to 4X is supported with this build and the 324/336 detectors.

The commands for 0.5X to 4X will be represented by 1X to 8X in the GUI and serial commands. A value of 1X in the software will correspond to a 0.5X zoom output and an 8X zoom in the software will correspond to an actual 4X zoom on the display. No actual 8X zoom is achievable with this feature and the maximum zoom allowed for a 324/336 sensor is still 4X as our other documentation will show.

### 2.4 AGC
The Half Zoom feature only operates on the AGC corrected 8-bit data. 14 bit output is unchanged from standard Tau 2.

#### 2.4.1 AGC Range
The standard Tau 2 AGC converts the 14-bit data range (0-16383) into the 8-bit data range (0-255). The Half Zoom AGC has an 8-bit range limited to 1-255 because level zero is used by the fill value.

#### 2.4.2 AGC ROI
The AGC ROI window setting usually corresponds to 100% of what is on the display. With this 0.5X zoom configuration this is still true for all zoom levels equal to or greater than 1X (1.01X through 8X). When using a scale factor less than 1X (.5X through .99X) the AGC ROI window is 100% of the active pixels. This effectively means the black borders will never be considered as part of the AGC ROI and only the active pixel area will be used.
For example:

AGC ROIs between 50% and 100% use a window that is the size of the active pixel area.

Once the camera is in a 1X zoom the display is used for the AGC window. When the image is zoomed in to fill the entire display then the normal functionality of cameras is identical to other documentation including the FLIR camera controller GUI users’ guide.

2.5 Tau GUI Support for Half Zoom
The Tau GUI will support this feature. If you enable ‘unzoom’ the image will be just the 320 image in the center screen (with black borders). For 2X zoom you will fill the full VGA display when using 8 bit video. See Figures 1-4 for more information.

2.6 On Screen Symbols
The Tau on screen symbols will be described by the Tau Symbols Application note 102-PS242-100-08. The default factory symbols will be placed in the 640x512 analog/BT.656 window regardless of zoom.
level applied as shown in Figure 1 through Figure 4. For example, if you enable the temperature bar
graph it will be shown in the black portion of the image when set to Half Zoom.

Tau cameras normally include a 2X and 4X indicator in the lower center of the display for 2X and 4X
zoom respectively, and there is no indicator for 1X zoom. The factory zoom symbol for this
configuration shall be the same as the standard Tau cameras. An option to delete the zoom symbols with
a field upgrade file is available (no_zoom_symbols.pcf)

The standard Tau camera has a Flat Field Correction Imminent indicator in the upper right hand corner of
the screen. This configuration has the same FFC indicator as the standard Tau. The FFC indicator can be
turned off with by setting the FFC warn time indicator to zero. Notice that the FFC indicator is displayed
in the black portion of the screen as shown below when in Half Zoom mode.

Figure 1. Example image of Half Zoom. This can be achieved by clicking ‘Unzoom’ in the GUI.
No zoom indicator, and FFC icon in upper right. Sensor resolution = Display resolution. (FLIR
logo present in some versions.)

Figure 2. Example image of 1X Zoom. This can be achieved by clicking ‘Zoom 2X’ in the GUI.
No zoom indicator, and FFC icon in upper right. One pixel on sensor = 2x2 on display. (FLIR logo present in some versions.)

Figure 3. Example image of 2X Zoom. This can be achieved by clicking ‘Zoom 4X’ in the GUI. No zoom indicator, and FFC icon in upper right. Image shown with Zoom level indicator off. One pixel on sensor = 4x4 on display. (FLIR logo present in some versions.)

Figure 4. Example image of 4X Zoom. This can be achieved by clicking ‘Zoom 4X’ in the GUI. No zoom indicator, and FFC icon in upper right. FLIR logo present in some versions. Image shown with Zoom level indicator off. One pixel on sensor = 8x8 on display. Since the ‘unzoom’ mode is actually the native resolution of the sensor, the camera will support up to 8X zoom (instead of the normal 4X zoom in a normal Tau2 320 camera, see section 2.3 for more information.)
2.7 Discrete Pin Function

A discrete pin function file will be loaded into this camera configuration with the functions described in Table 2.

Table 2 Discrete function pinout table.

<table>
<thead>
<tr>
<th>50-pin connector</th>
<th>Tau name</th>
<th>Function</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>Discrete 0</td>
<td>Not defined</td>
<td>Note 6</td>
</tr>
<tr>
<td>20</td>
<td>Discrete 1</td>
<td>Not defined</td>
<td>Note 6</td>
</tr>
<tr>
<td>23</td>
<td>Discrete 2</td>
<td>Do FFC</td>
<td>Note 1</td>
</tr>
<tr>
<td>24</td>
<td>Discrete 3</td>
<td>FFC imminent</td>
<td>Note 2</td>
</tr>
<tr>
<td>25</td>
<td>Discrete 4</td>
<td>FFC mode</td>
<td>Note 3</td>
</tr>
<tr>
<td>26</td>
<td>Discrete 5</td>
<td>LUT Toggle</td>
<td>Note 4</td>
</tr>
<tr>
<td>3</td>
<td>Discrete 6</td>
<td>Not defined</td>
<td>Note 6</td>
</tr>
<tr>
<td>4</td>
<td>Discrete 7</td>
<td>Zoom Toggle</td>
<td>Note 5</td>
</tr>
</tbody>
</table>

Note 1. This function is required for effective use of Shutterless Tau cameras. The application of Positive going edge to this pin shall perform the Do FFC function (0x12 command).

Note 2. This pin be normally at 0V and change to 3.3V when the FFC imminent Icon is present on the analog display. The FFC_Warn_time command (0x3C) shall control both the analog icon and this pin.

Note 3. This function is required to enable additional user control of camera. The default state is Automatic mode with the input at 3.3 volts held by an internal pull-up. When the signal is pulled to zero volts the camera will switch into Manual mode. The FFC_Mode_Select (0x11 0=manual, 1=automatic) command has equal precedence with the discrete pin and the camera will be in the last state set by either the discrete or serial command. The camera will power up in the saved default state and switch to the discrete input defined state when the pin state is changed.

Note 4. This function will change the color LUT from the current value to the next LUT in the table when the Discrete pin transitions from the floating state to the ground state. No LUT change happens on the transition from ground to float. The LUT state after LUT14 will be LUT1.

Note 5. This function will change the current zoom state from 0.5X to 1X to 2X to 4X zoom then repeat whenever the discrete pin changes from the float state to the ground state. The e-zoom command (0x32) has equal precedence with this command.

Note 6. Not defined. Connection of either 3.3V or 0V to this pin will have no effect on camera operation.

3 Known Bugs

1. Tearing when switching between zoom levels with slow configurations.
2. IceFire LUT has blue border in <1X zoom.
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