Advanced Lepton® Usage on Windows®

REV - 06/26/18
Presentation Outline

The purpose of this presentation is to demonstrate the following:

• Discover the Lepton User App advanced functionality

• Learn differences between Colorized & Raw images

• Introduce Automatic Gain Control (AGC)

• Demonstrate how to change palettes and when to use them

• Learn about TLinear and how to calculate pixel temperatures
Requirements

Everything covered in **PureThermal 2 & Basic Lepton Features** including:

- Lepton Camera
- Lepton User App
- Supported PureThermal board
  - **WARNING: Firmware v1.0.0 doesn't support the PureThermal 2 board**
    
    [https://github.com/groupgets/purethermal1-firmware/releases/latest](https://github.com/groupgets/purethermal1-firmware/releases/latest)

- Windows 10 PC running the Lepton User App
- Knowledge of the Lepton User App basic functionality
Colorized or Raw?
**Colorized**

- Lepton creates a pseudo-color image
- Coloring is based on the current palette
- FLIR default is Automatic Gain Control (AGC), applied in the Colorized mode (RGB 888)
- Lepton outputs images colorized RGB888
- PureThermal supports output of a variety of other color formats
- Lepton User App saves images as jpegs

**Example colorized output**
• Each pixel value is represented in grayscale by 16 bits
• Pixel value can cover all 14 bits of thermal information from the Lepton
• This information contains thermal data
• Normalization such as automatic gain control (AGC) should be applied to create a visible usage image. When in RAW video output mode, the user will need to apply their own AGC algorithm to obtain the best contrast of the scene
• The Lepton User App saves images as a tiff file
A. Viewing raw thermal images can be challenging
   • Unless there are huge temperature differences, the hottest and coldest pixels look the same

B. Applying an AGC is used to set the coldest pixels to 0 and the hottest to 1
   • The app performs this when displaying the RAW image
Toggling in the App
Viewing the Images

- Saved colorized images can be viewed normally with most image viewers
  - Lacks ability to extract temperature data
- Raw images cannot be viewed like a regular image
  - Need to use a viewer such as ImageJ which applies normalization
  - Allows for the recovery of temperature data if captured with a calibrated camera
When and Where to Use Palettes
Changing Palettes in the App

- The Lepton will have a default palette at App launch
- Select the different buttons to change the Lepton's palette
Palettes Examples
Why are different palettes needed?

• User preference

• The best palette to use varies by application
  • Range of temperature in scene
  • Temperature of target in scene
  • Objective of application

• Test multiple palettes to distinguish differences in temperature more clearly
Example Use Case

The image on the left is clearly a handprint, the one on the right is less clear.
TLinear Mode to Get Temperature
TLinear

- Lepton 2.5 and 3.5 both support Temperature Linear (TLinear) mode
- Each pixel represents the temperature at that point in centikelvin (cK)
  - Convert centikelvin to Celsius with \( TC = \frac{TcK}{100} - 273.15 \)
  - Where \( TC \) is the temperature in °C and \( TcK \) is the temperature in cK
  - Example: \( \frac{29587}{100} - 273.15 = 22.72°C \)
Saving images using TLinear

- Supported in Lepton 2.5 & Lepton 3.5
- Switch to Raw mode and enable TLinear
- TLinear is not available in Colorized USB Video Mode
More Information

- Learn more about Lepton and join the conversation on our developer forum at the [Lepton Developer Site](#).
- Firmware [download page](#).
- Click [here](#) to learn more about PureThermal 2.