Thermoeye Inc.

THERMOEYE

TMC80 / TMC160

Sensor Control SDK Manual

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Revision

Version	Date	Contents
0.1	SEP.12.2023	Draft
1.0	OCT.12.2023	1st Release
1.1	JAN.08.2024	Modified Flux Parameters UI, Gain Mode State API
1.2	JAN.16.2024	Changed model name
1.3	MAR.07.2024	Added TMC80 Product

Chapter

1. ThermoCamSDK GUI

ThermoCamSDK provides the GUI required to control the FLIR Lepton 3.5 thermal imaging sensor on the camera device.

1.1. Flux Parameters

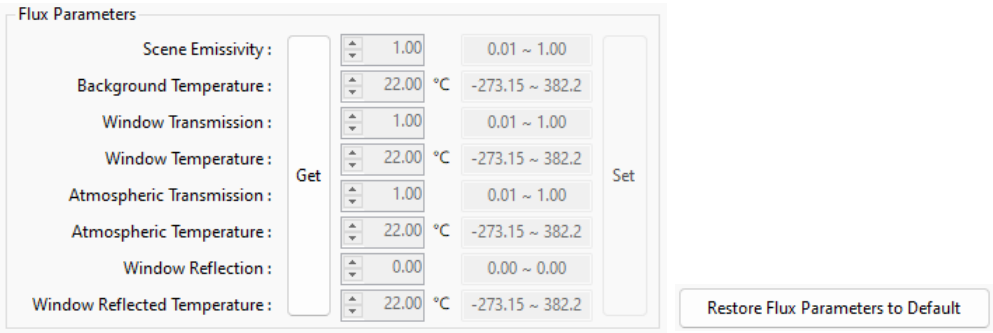

Figure 1. Flux Parameters

User can read the various Flux Parameters set on the sensor and configure them to the desired values.

The **Get** button allows you to read the values set on the sensor and display them in the input box for each parameter.

After you change each parameters to the desired values within the configurable range, the **Set** button allows you to set the changed values to the sensor.

The **Restore to Flux Parameters to Default** button allows you to restore factory default values to the sensor.

1.2. Gain Mode State

Figure 2. Gain Mode State

User can read the Gain Mode state set on the sensor and change it to the desired configuration.

The **Get** button allows you to read the state set on the sensor and display it on the High / Low / Automatic selection button.

After selecting **High**, the **Set** button allows you to change the state to the High Gain Mode. It provides higher responsivity and lower noise metrics for normal operation.

After selecting **Low**, the **Set** button allows you to change the state to the Low Gain Mode. It provides lower responsivity and higher noise metrics, but with the benefit of increased intra-scene range necessary to view hotter scenes.

After selecting **Automatic**, the **Set** button allows you to change the state to the Automatic Gain Mode. It allows the camera to automatically switch the gain mode based on the temperature of the scene and preset thresholds.

1.3. Flat Field Correction

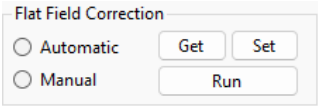

Figure 3. Flat Field Correction

User can read the Flat Field Correction mode set on the sensor and change it to the desired configuration, and perform the FFC behavior manually.

The **Get** button allows you to read the mode set on the sensor and display it on the Automatic / Manual selection button.

After selecting **Automatic**, the **Set** button allows you to change the mode to the Automatic FFC. The sensor will perform the FFC automatically.

After selecting **Manual**, the **Set** button allows you to change the mode to the Manual FFC. The sensor will perform the FFC manually if you push the **Run** button.

2. ThermoCamSDK C# API

ThermoCamSDK provides the C# APIs to control the functionalities of thermal sensor.

The sample project was created on Microsoft Visual Studio Community 2022 and was implemented on Windows .NET Framework 4.8.

2.1. `ThermoEngine.ICameraControl` Interface

2.1.1. Definition

```
public interface ICameraControl
```

- The **`ICameraControl`** Interface provides functionalities to control the sensor of camera device.
- Each method requires the creation of an **`ICameraControl`** Interface instance and must call the **`Control`** Field as shown in the example below.

  ```
  mCamera.Control.GetSensorModelName();
  ```

- Methods

GetFluxParameters	Gets flux parameters of camera sensor
SetFluxParameters	Sets flux parameters of camera sensor
SetDefaultFluxParameters	Sets flux parameters of camera sensor to factory default values
GetGainModeState	Gets Gain Mode state of camera sensor
SetGainModeState	Sets Gain Mode state of camera sensor
GetFlatFieldCorrectionMode	Gets Flat Field Correction mode of camera sensor
SetFlatFieldCorrectionMode	Sets Flat Field Correction mode of camera sensor
RunFlatFieldCorrection	Executes Flat Field Correction of camera sensor

2.1.2. `GetFluxParameters` Method

```
public bool GetFluxParameters(
    out double sceneEmissivity, out double backgroundTemperature,
    out double windowTransmission, out double windowTemperature,
    out double atmosphericTransmission, out double atmosphericTemperature,
    out double windowReflection, out double windowReflectedTemperature
)
```

- Gets flux parameters of camera sensor
- Parameters

  `sceneEmissivity`: obtained ratio value for scene emissivity, 0.01 ~ 1

  `backgroundTemperature`: obtained Celsius value for background temperature, -273.15 ~

382.2

`windowTransmission`: obtained ratio value for window transmission, 0.01 ~ 1

`windowTemperature`: obtained Celsius value for window temperature, -273.15 ~ 382.2

`atmosphericTransmission`: obtained ratio value for atmospheric transmission, 0.01 ~ 1

`atmosphericTemperature`: obtained Celsius value for atmospheric temperature, -273.15 ~ 382.2

`windowReflection`: obtained ratio value for window reflection,
0 ~ 1-`windowTransmission`

`windowReflectedTemperature`: obtained Celsius value for window reflected temperature, -273.15 ~ 382.2

- Return Value

  True if this method gets values from device successfully; otherwise, false if an exception is raised.

- Remarks

Parameter	Minimum	Maximum	Default	Unit
`sceneEmissivity`	0.01	1	1	
`backgroundTemperature`	-273.15	382.2	22	℃
`windowTransmission`	0.01	1	1	
`windowTemperature`	-273.15	382.2	22	℃
`atmosphericTransmission`	0.01	1	1	
`atmosphericTemperature`	-273.15	382.2	22	℃
`windowReflection`	0	1-`windowTransmission`	0	
`windowReflectedTemperature`	-273.15	382.2	22	℃

2.1.3. `SetFluxParameters` Method

```
public bool SetFluxParameters(
    double sceneEmissivity, double backgroundTemperature,
    double windowTransmission, double windowTemperature,
    double atmosphericTransmission, double atmosphericTemperature,
    double windowReflection, double windowReflectedTemperature
)
```

- Sets flux parameters of camera sensor

- Parameters

  `sceneEmissivity`: ratio value to be set for scene emissivity, 0.01 ~ 1

  `backgroundTemperature`: Celsius value to be set for background temperature, -273.15 ~ 382.2

`windowTransmission`: ratio value to be set for window transmission, 0.01 ~ 1

`windowTemperature`: Celsius value to be set for window temperature, -273.15 ~ 382.2

`atmosphericTransmission`: ratio value to be set for atmospheric transmission, 0.01 ~ 1

`atmosphericTemperature`: Celsius value to be set for atmospheric temperature, -273.15 ~ 382.2

`windowReflection`: ratio value to be set for window reflection,
0 ~ 1-`windowTransmission`

`windowReflectedTemperature`: Celsius value to be set for window reflected temperature, -273.15 ~ 382.2

- Return Value

  True if this method sets values to device successfully; otherwise, false if an exception is raised.

- Remarks

Parameter	Minimum	Maximum	Default	Unit
`sceneEmissivity`	0.01	1	1	
`backgroundTemperature`	-273.15	382.2	22	℃
`windowTransmission`	0.01	1	1	
`windowTemperature`	-273.15	382.2	22	℃
`atmosphericTransmission`	0.01	1	1	
`atmosphericTemperature`	-273.15	382.2	22	℃
`windowReflection`	0	1-`windowTransmission`	0	
`windowReflectedTemperature`	-273.15	382.2	22	℃

2.1.4. `SetDefaultFluxParameters` Method

```
public bool SetDefaultFluxParameters(
    out double sceneEmissivity, out double backgroundTemperature,
    out double windowTransmission, out double windowTemperature,
    out double atmosphericTransmission, out double atmosphericTemperature,
    out double windowReflection, out double windowReflectedTemperature
)
```

- Sets flux parameters of camera sensor to factory default values

- Parameters

  `sceneEmissivity`: obtained default ratio value for scene emissivity, 0.01 ~ 1

  `backgroundTemperature`: obtained default Celsius value for background temperature,
  -273.15 ~ 382.2

  `windowTransmission`: obtained default ratio value for window transmission, 0.01 ~ 1

`windowTemperature`: obtained default Celsius value for window temperature, −273.15 ~ 382.2

`atmosphericTransmission`: obtained default ratio value for atmospheric transmission, 0.01 ~ 1

`atmosphericTemperature`: obtained default Celsius value for atmospheric temperature, −273.15 ~ 382.2

`windowReflection`: obtained default ratio value for window reflection, 0 ~ 1−`windowTransmission`

`windowReflectedTemperature`: obtained default Celsius value for window reflected temperature, −273.15 ~ 382.2

- Return Value

  True if this method sets values to device successfully; otherwise, false if an exception is raised.

- Remarks

Parameter	Minimum	Maximum	Default	Unit
`sceneEmissivity`	0.01	1	1	
`backgroundTemperature`	−273.15	382.2	22	℃
`windowTransmission`	0.01	1	1	
`windowTemperature`	−273.15	382.2	22	℃
`atmosphericTransmission`	0.01	1	1	
`atmosphericTemperature`	−273.15	382.2	22	℃
`windowReflection`	0	1−`windowTransmission`	0	
`windowReflectedTemperature`	−273.15	382.2	22	℃

2.1.5. `GetGainModeState` Method

```
public int GetGainModeState()
```

- Gets Gain Mode state of camera sensor
- Return Value

  0 if mode is high or 1 if mode is low or 2 if mode is auto; otherwise, −1 if an exception is raised.

- Remark

  The parameter state, "2 = auto" is only support for TMC80 & TMC160.

2.1.6. `SetGainModeState` Method

```
public bool SetGainModeState(int state)
```

- Sets Gain Mode state of camera sensor
- Parameters

  `state`: Gain Mode state value to be set, 0 = high or 1 = low or 2 = auto
- Return Value

  0 if mode is high or 1 if mode is low or 2 if mode is auto; otherwise, -1 if an exception is raised.
- Remark

  The parameter state, "2 = auto" is only support for TMC80 & TMC160.

2.1.7. `GetFlatFieldCorrectionMode` Method

```
public int GetFlatFieldCorrectionMode()
```

- Gets Flat Field Correction mode of camera sensor
- Return Value

  0 if mode is manual or 1 if mode is automatic; otherwise, -1 if an exception is raised.

2.1.8. `SetFlatFieldCorrectionMode` Method

```
public bool SetFlatFieldCorrectionMode(int mode)
```

- Sets Flat Field Correction mode of camera sensor
- Parameters

  `mode`: Flat Field Correction mode value to be set, 0 = manual or 1 = automatic
- Return Value

  True if this method sets mode to device successfully; otherwise, false if an exception is raised.

2.1.9. `RunFlatFieldCorrection` Method

```
public bool RunFlatFieldCorrection()
```

- Executes Flat Field Correction of camera sensor

- Return Value

  True if camera sensor executes Flat Field Correction successfully; otherwise, false if an exception is raised.