

Thermoeye Inc.



TMC160

Sensor Control SDK Manual

Contact help@thermoeye.co.kr
Technical Support <https://github.com/ThermoEye>

서울특별시 동작구 사당로 169, 5 층 (07003)

Revision

| Version | Date | Contents |
|---------|-------------|--|
| 0.1 | SEP.12.2023 | Draft |
| 1.0 | OCT.12.2023 | 1 st Release |
| 1.1 | JAN.08.2024 | Modified Flux Parameters UI, Gain Mode State API |
| 1.2 | JAN.16.2024 | 제품명 변경 |
| | | |
| | | |
| | | |

목차

| | |
|--|---|
| 1. ThermoCamSDK GUI..... | 3 |
| 1.1. Flux Parameters..... | 3 |
| 1.2. Gain Mode State..... | 3 |
| 1.3. Flat Field Correction..... | 4 |
| 2. ThermoCamSDK C# API..... | 5 |
| 2.1. ThermoEngine.ICameraControl Interface | 5 |
| 2.1.1. Definition..... | 5 |
| 2.1.2. GetFluxParameters Method | 5 |
| 2.1.3. SetFluxParameters Method | 6 |
| 2.1.4. SetDefaultFluxParameters Method..... | 7 |
| 2.1.5. GetGainModeState Method | 8 |
| 2.1.6. SetGainModeState Method | 8 |
| 2.1.7. GetFlatFieldCorrectionMode Method | 9 |
| 2.1.8. SetFlatFieldCorrectionMode Method | 9 |
| 2.1.9. RunFlatFieldCorrection Method..... | 9 |

1. ThermoCamSDK GUI

카메라 장치의 FLIR Lepton 3.5 열화상 센서 제어에 필요한 UI를 제공합니다.

1.1. Flux Parameters

| Parameter | Current Value | Range |
|------------------------------|---------------|-----------------|
| Scene Emissivity | 1.00 | 0.01 ~ 1.00 |
| Background Temperature | 22.00 °C | -273.15 ~ 382.2 |
| Window Transmission | 1.00 | 0.01 ~ 1.00 |
| Window Temperature | 22.00 °C | -273.15 ~ 382.2 |
| Atmospheric Transmission | 1.00 | 0.01 ~ 1.00 |
| Atmospheric Temperature | 22.00 °C | -273.15 ~ 382.2 |
| Window Reflection | 0.00 | 0.00 ~ 0.00 |
| Window Reflected Temperature | 22.00 °C | -273.15 ~ 382.2 |

그림 1. Flux Parameters

센서에 설정된 다양한 Flux Parameters를 읽고 원하는 값으로 설정할 수 있습니다.

Get 버튼을 누르면 현재 센서에 설정된 값을 읽어와 각 Parameter별 설정창에 표시합니다.

이후 각 Parameter를 설정 가능 범위내의 값으로 변경 후 **Set** 버튼을 누르면 변경된 값이 센서에 반영됩니다.

Restore to Flux Parameters to Default 버튼을 누르면 센서의 공장 초기화 값으로 설정됩니다.

1.2. Gain Mode State

그림 2. Gain Mode State

센서에 설정된 Gain Mode 상태를 읽고 변경할 수 있습니다.

Get 버튼을 누르면 현재 센서에 설정된 값을 읽어와 High / Low / Automatic 선택 버튼에 표시합니다.

High 선택 후 **Set** 버튼을 누르면 High Gain Mode로 설정되며 센서가 일반적인 동작으로 높은 응답성과 낮은 잡음 수치 기준을 제공합니다.

Low 선택 후 **Set** 버튼을 누르면 Low Gain Mode로 설정되며 센서가 낮은 응답성과 높은 잡음 수치 기준을 제공하지만, 더 뜨거운 장면을 보는데 필요한 장면 내 범위를 증가시킬 수 있는 이점이 있습니다.

Automatic 선택 후 **Set** 버튼을 누르면 Automatic Gain Mode로 설정되며 센서가 카메라 장면의 온도와 미리 설정된 임계 값을 기반으로 Gain Mode가 자동으로 전환됩니다.

1.3. Flat Field Correction

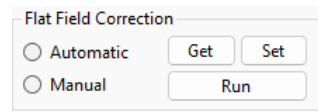


그림 3. Flat Field Correction

센서에 설정된 Flat Field Correction 모드를 읽고 변경할 수 있으며, 수동으로 Flat Field Correction 기능을 수행할 수 있습니다.

Get 버튼을 누르면 현재 센서에 설정된 값을 읽어와 Automatic / Manual 선택 버튼에 표시합니다.

Automatic 선택 후 **Set** 버튼을 누르면 Flat Field Correction 모드가 자동으로 설정되며 센서가 자동으로 보정을 수행합니다.

Manual 선택 후 **Set** 버튼을 누르면 Flat Field Correction 모드가 수동으로 설정되며, **Run** 버튼을 누를 때마다 보정을 수행합니다.

2. ThermoCamSDK C# API

열화상 센서의 기능 제어를 위한 API를 제공합니다.

Sample project는 Microsoft Visual Studio Community 2022에서 생성되었으며, Windows .NET Framework 4.8 기준으로 구현되었습니다.

2.1. ThermoEngine.ICameraControl Interface

2.1.1. Definition

```
public interface ICameraControl
```

- 카메라 장치를 제어하기 위한 기능을 제공합니다
- 각 Method를 사용하기 위해서는 ICameraControl Interface instance 생성이 필요하며, 아래 예시와 같이 Control Field를 호출해야 합니다.

```
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 | °C |
| windowTransmission | 0.01 | 1 | 1 | |
| windowTemperature | -273.15 | 382.2 | 22 | °C |
| atmosphericTransmission | 0.01 | 1 | 1 | |
| atmosphericTemperature | -273.15 | 382.2 | 22 | °C |
| windowReflection | 0 | 1-windowTransmission | 0 | |
| windowReflectedTemperature | -273.15 | 382.2 | 22 | °C |

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 | °C |
| windowTransmission | 0.01 | 1 | 1 | |
| windowTemperature | -273.15 | 382.2 | 22 | °C |
| atmosphericTransmission | 0.01 | 1 | 1 | |
| atmosphericTemperature | -273.15 | 382.2 | 22 | °C |
| windowReflection | 0 | 1-windowTransmission | 0 | |
| windowReflectedTemperature | -273.15 | 382.2 | 22 | °C |

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 | °C |
| windowTransmission | 0.01 | 1 | 1 | |
| windowTemperature | -273.15 | 382.2 | 22 | °C |
| atmosphericTransmission | 0.01 | 1 | 1 | |
| atmosphericTemperature | -273.15 | 382.2 | 22 | °C |
| windowReflection | 0 | 1-windowTransmission | 0 | |
| windowReflectedTemperature | -273.15 | 382.2 | 22 | °C |

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 ThermoCam160E.

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 ThermoCam160E.

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.