Thermoeye Inc.

THERMOEYE

TMC256

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	1st Release
1.1	NOV.27.2023	Flux Parameters에 distance parameter 추가
1.2	JAN.08.2024	Flux Parameters UI, Gain Mode State API 수정 Store Config Permanently, Restore to Factory Default 버튼 추가
1.3	JAN.16.2024	FFC Parameters 추가, 제품명 변경

목차

1. ThermoCamSDK GUI

카메라 장치의 InfiRay Tiny1-C 열화상 센서 제어에 필요한 UI를 제공합니다.

1.1. Flux Parameters

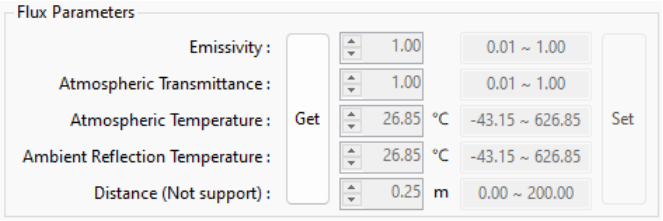

그림 1. Flux Parameters

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.

1.2. Gain Mode State

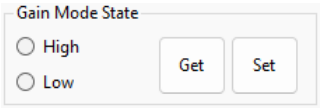

그림 2. Gain Mode State

센서에 설정된 Gain Mode 상태를 읽고 변경할 수 있습니다.

Get 버튼을 누르면 현재 센서에 설정된 값을 읽어와 High / Low 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 잡은 수치 기준을 제공하지만, 더 뜨거운 장면을 보는데 필요한 장면 내 범위를 증가시킬 수 있는 이점이 있습니다.

1.3. FFC Parameters

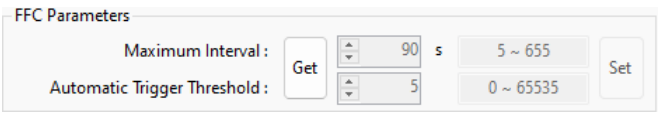

그림 3. FFC Parameters

센서의 자동 Flat Field Correction 동작 조건을 조절할 수 있도록 FFC 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.

1.4. Flat Field Correction

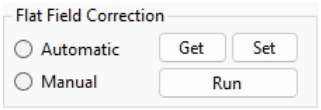

그림 4. Flat Field Correction

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.

1.5. Store Config Permanently / Restore to Factory Default

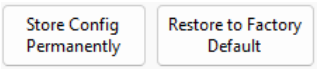

그림 5. Flat Field Correction

Store Config Permanently 버튼을 누르면 사용자가 설정한 Flux Parameters, Gain Mode State, Flat Field Correction, FFC Parameters 정보를 센서 내부 메모리에 저장합니다. 카메라 장치의 전원이 꺼져도 사용자가 설정한 상태를 유지하며, 재시작 후에도 사용자가 설정한 센서 상태로 동작합니다.

Restore to Factory Default 버튼을 누르면 카메라 장치가 재시작되며, **Store Config Permanently** 버튼으로 저장된 모든 사용자 설정은 센서의 공장 초기화 값으로 설정됩니다.

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
GetFlatFieldCorrectionParameters	Gets Flat Field Correction parameters of camera sensor
SetFlatFieldCorrectionParameters	Gets Flat Field Correction parameters 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
StoreUserSensorConfig	Stores user configurations of camera sensor permanently
RestoreDefaultSensorConfig	Restores sensor configurations to factory default of camera sensor

2.1.2. `GetFluxParameters` Method

```
public bool GetFluxParameters(
    out double emissivity,
```

```
    out double atmosphericTransmittance,
    out double atmosphericTemperature,
    out double ambientReflectionTemperature,
    out double distance
)
```

- Gets flux parameters of camera sensor
- Parameters

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

  `atmosphericTransmittance`: obtained ratio value for atmospheric transmittance, 0.01 ~ 1

  `atmosphericTemperature`: obtained Celsius value for atmospheric temperature, -43.15 ~ 226.85 (high gain), -43.15 ~ 626.85 (low gain)

  `ambientReflectionTemperature`: obtained Celsius value for ambient reflection temperature, -43.15 ~ 226.85 (high gain), -43.15 ~ 626.85 (low gain)

  `distance`: obtained meter value for distance, 0 ~ 200, Not support

- Return Value

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

- Remarks

Parameter	Minimum	Maximum	Default	Unit
`emissivity`	0.01	1	1	
`atmosphericTransmittance`	0.01	1	1	
`atmosphericTemperature`	-43.15	226.85(high gain) 626.85(low gain)	26.85	℃
`ambientReflectionTemperature`	-43.15	226.85(high gain) 626.85(low gain)	26.85	℃
`distance`	0	200	0.25	m

2.1.3. `SetFluxParameters` Method

```
public bool SetFluxParameters(
    double emissivity,
    double atmosphericTransmittance,
    double atmosphericTemperature,
    double ambientReflectionTemperature,
    double distance
)
```

- Sets flux parameters of camera sensor
- Parameters

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

`atmosphericTransmittance`: ratio value to be set for atmospheric transmittance, 0.01 ~ 1

`atmosphericTemperature`: Celsius value to be set for atmospheric temperature, -43.15 ~ 226.85 (high gain), -43.15 ~ 626.85 (low gain)

`ambientReflectionTemperature`: Celsius value to be set for ambient reflection temperature, -43.15 ~ 226.85 (high gain), -43.15 ~ 626.85 (low gain)

`distance`: meter value to be set for distance, 0 ~ 200, Not support

- Return Value

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

- Remarks

Parameter	Minimum	Maximum	Default	Unit
`emissivity`	0.01	1	1	
`atmosphericTransmittance`	0.01	1	1	
`atmosphericTemperature`	-43.15	226.85(high gain) 626.85(low gain)	26.85	℃
`ambientReflectionTemperature`	-43.15	226.85(high gain) 626.85(low gain)	26.85	℃
`distance`	0	200	0.25	m

2.1.4. `SetDefaultFluxParameters` Method

```
public bool SetDefaultFluxParameters(
    out double emissivity,
    out double atmosphericTransmittance,
    out double atmosphericTemperature,
    out double ambientReflectionTemperature
)
```

- Sets flux parameters of camera sensor to factory default values

- Parameters

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

  `atmosphericTransmittance`: obtained default ratio value for atmospheric transmittance, 0.01 ~ 1

  `atmosphericTemperature`: obtained default Celsius value for atmospheric temperature, -43.15 ~ 226.85 (high gain), -43.15 ~ 626.85 (low gain)

  `ambientReflectionTemperature`: obtained default Celsius value for ambient reflection

temperature, -43.15 ~ 226.85 (high gain), -43.15 ~ 626.85 (low gain)

`distance`: obtained default meter value to be set for distance, 0 ~ 200, Not support

- Return Value

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

- Remarks

Parameter	Minimum	Maximum	Default	Unit
`emissivity`	0.01	1	1	
`atmosphericTransmittance`	0.01	1	1	
`atmosphericTemperature`	-43.15	226.85(high gain) 626.85(low gain)	26.85	℃
`ambientReflectionTemperature`	-43.15	226.85(high gain) 626.85(low gain)	26.85	℃
`distance`	0	200	0.25	m

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. `GetFlatFieldCorrectionParameters` Method

```
public bool GetFlatFieldCorrectionParameters(
    out double maxInterval,
    out double autoTriggerThreshold
)
```

- Gets Flat Field Correction parameters of camera sensor
- Parameters

  `maxInterval`: obtained time value in seconds for maximum interval, 5 ~ 655

  `autoTriggerThreshold`: obtained count value for automatic trigger threshold, 0 ~ 65535
- Return Value

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

Parameter	Minimum	Maximum	Default	Unit
`maxInterval`	5	655	90	s
`autoTriggerThreshold`	0	65535	5	Counts

2.1.8. `SetFlatFieldCorrectionParameters` Method

```
public bool SetFlatFieldCorrectionParameters(
    double maxInterval,
    double autoTriggerThreshold
)
```

- Sets flux parameters of camera sensor
- Parameters

  `maxInterval`: time value in seconds to be set for maximum interval, 5 ~ 655

  `autoTriggerThreshold`: count value to be set for automatic trigger threshold, 0 ~ 65535
- Return Value

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

Parameter	Minimum	Maximum	Default	Unit
`maxInterval`	5	655	90	s

`autoTriggerThreshold`	0	65535	5	Counts

2.1.9. `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.

2.1.10. `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.

2.1.11. `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.

2.1.12. `StoreUserSensorConfig` Method

```
public bool StoreUserSensorConfig()
```

- Stores user configurations of camera sensor permanently
- Return Value

  True if camera sensor stores user configurations successfully; otherwise, false if an exception is raised.

- Remarks

  Only support for TMC256.

2.1.13. `RestoreDefaultSensorConfig` Method

```
public bool RestoreDefaultSensorConfig()
```

- Restores sensor configurations to factory default of camera sensor
- Return Value

  True if camera sensor restores user configurations successfully; otherwise, false if an exception is raised.

- Remarks

  Device will reboot automatically. Only support for TMC256.