THERMOEYE

# TmSDK Manual

Revision

| Version | Date | Contents |
|---|---|---|
| 0.1 | Aug.28.2024 | Draft |
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# 1. Introduction

TmSDK is a development kit required for controlling TMCxxx series cameras. This document provides instructions on setting up the development environment for TmSDK across various platforms and programming languages.

## 1.1. Download TmSDK

Download: https://github.com/ThermoEye/TmSDK

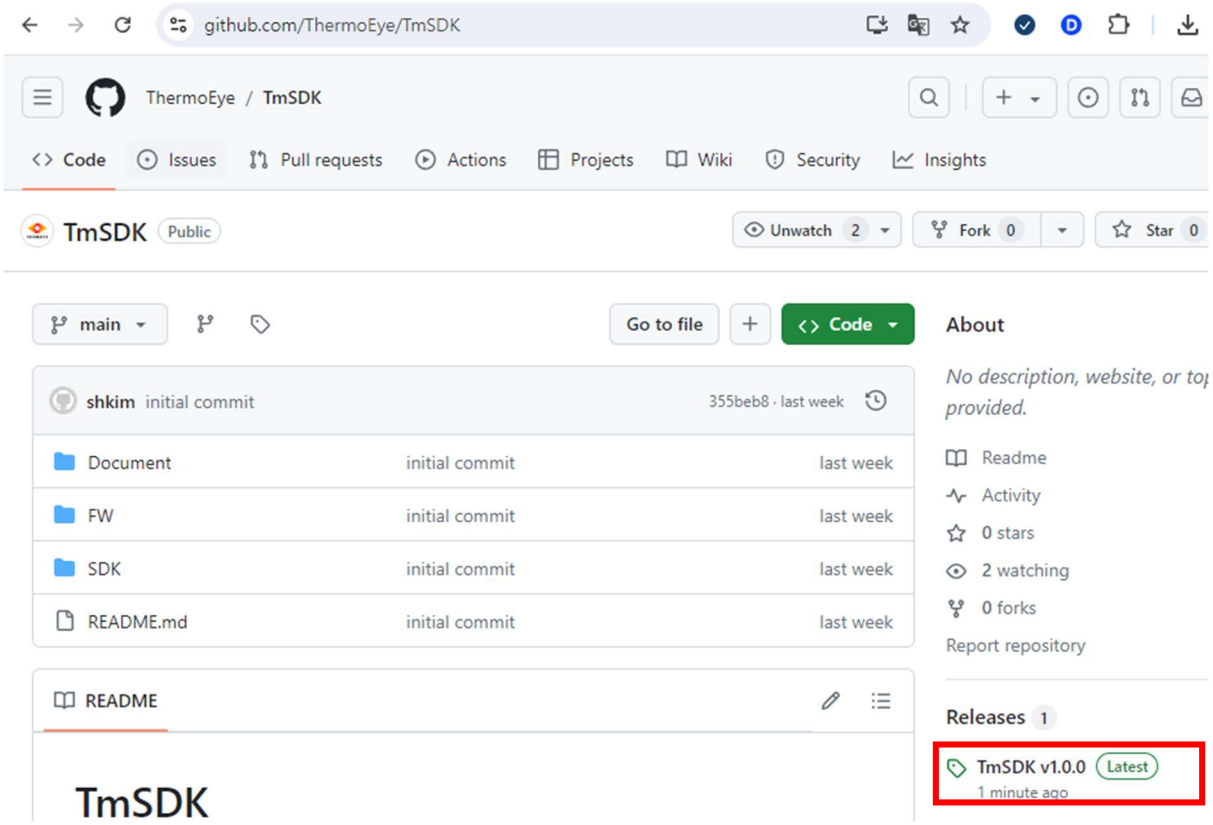


**Figure 1 Thermoeye github**

## 1.2. SDK directory structure

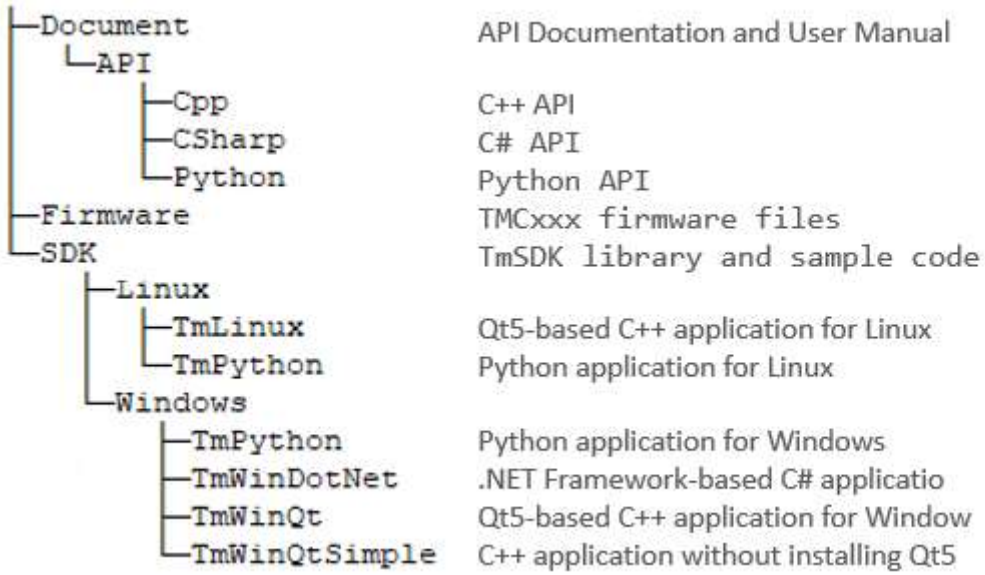


**Figure 2 TmSDK directory structure**

## 1.3. How to refer to API document

Check by running the ***.html** file in a web browser from the Document/API directory.

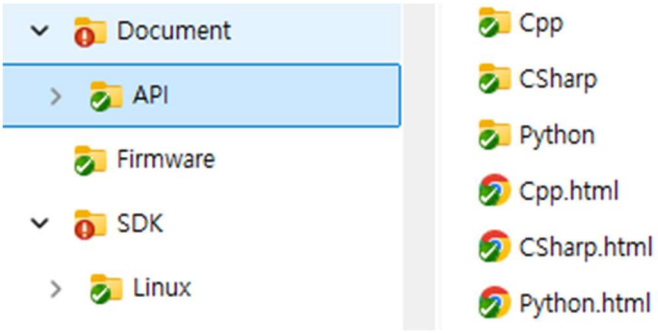


**Figure 3 API document**

# 2. Development Environment

Provide a development environment for C++/C#/Python languages in Windows and Linux environments.

## 2.1. Windows C++

Provide a C++ development environment using Qt5 on Windows.

Requirement:

Windows 11

Visual Studio 2022

Qt5.14.2

### 2.1.1. Use without requiring Qt5 installation

Open the **TmWinQtSimple.sln** file located in **SDK₩Windows₩TmWinQtSimple** using Visual Studio. This project uses Qt5 libraries, which are included in the project folder, so there is no need for a separate installation of Qt5.

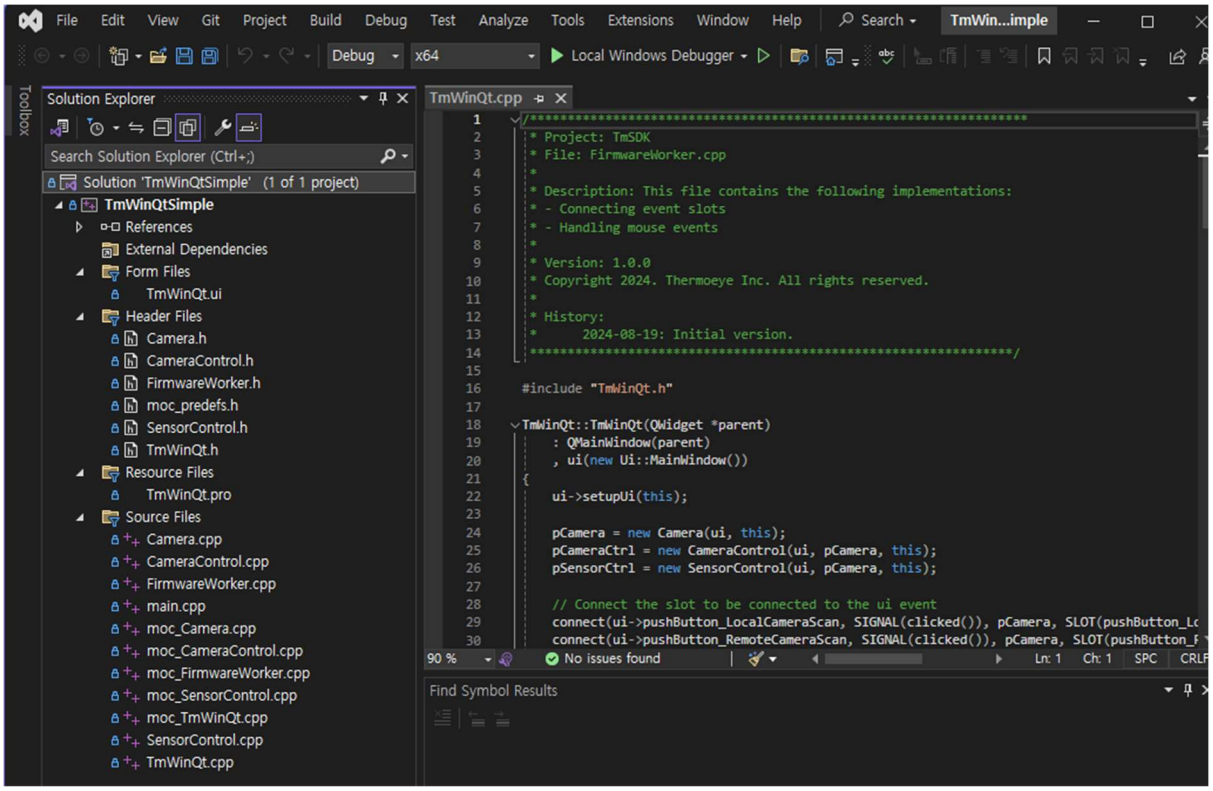


**Figure 4 TmWinQtSimple Project**

When building in release mode, the TmWinQtSimple.exe file is generated in the SDK₩Windows₩TmWinQtSimple₩Release directory.

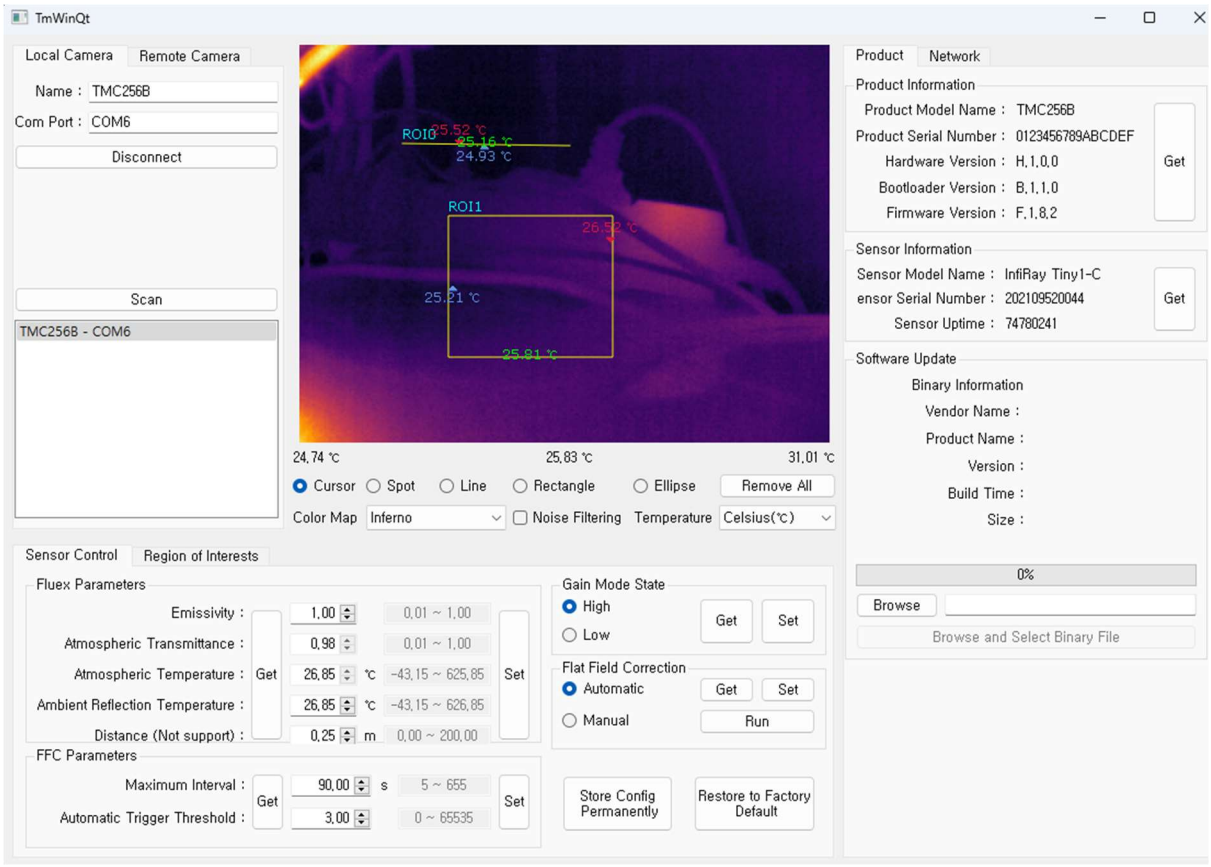


**Figure 5 Run TmWinQtSimple**

### 2.1.2. Install Qt5

- Download Qt5.14.2

Download: https://download.qt.io/archive/qt/5.14/5.14.2

| Name | Last modified | Size | Metadata |
|---|---|---|---|
| Parent Directory | | - | |
| submodules/ | 31-Mar-2020 09:27 | - | |
| single/ | 31-Mar-2020 10:10 | - | |
| qt-opensource-windows-x86-5.14.2.exe | 31-Mar-2020 10:18 | 2.3G | Details |
| qt-opensource-mac-x64-5.14.2.dmg | 31-Mar-2020 10:16 | 2.6G | Details |
| qt-opensource-linux-x64-5.14.2.run | 31-Mar-2020 10:14 | 1.2G | Details |
| md5sums.txt | 31-Mar-2020 10:32 | 207 | Details |

**Figure 6. Qt5 download page**

- Install Qt5

  Run the downloaded installation file, check **MSVC 2017 64-bit**, **Qt Creator 4.11.1** and click Next.

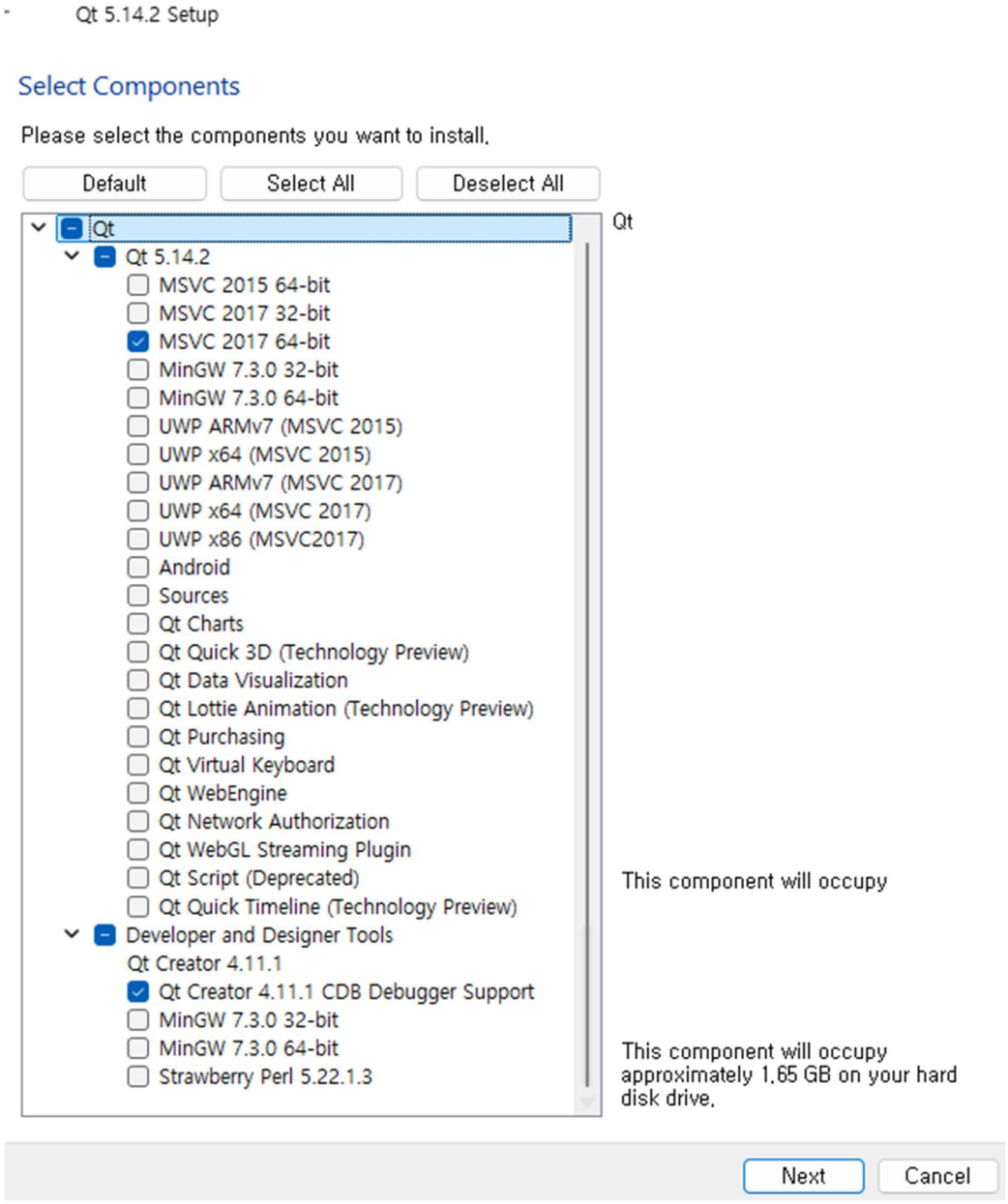


**Figure 7. Install Qt5.14.2**

- Register environment variables

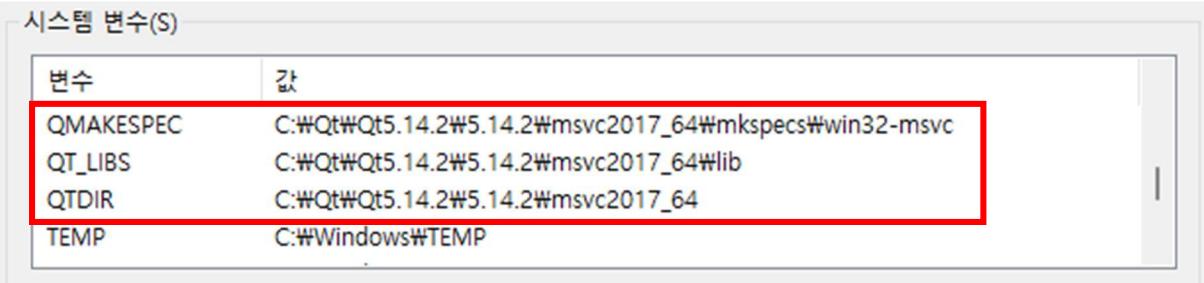


**Figure 8. System variables for qt5**

Add C:₩Qt₩Qt5.14.2₩5.14.2₩msvc2017_64₩bin to **PATH** variable.

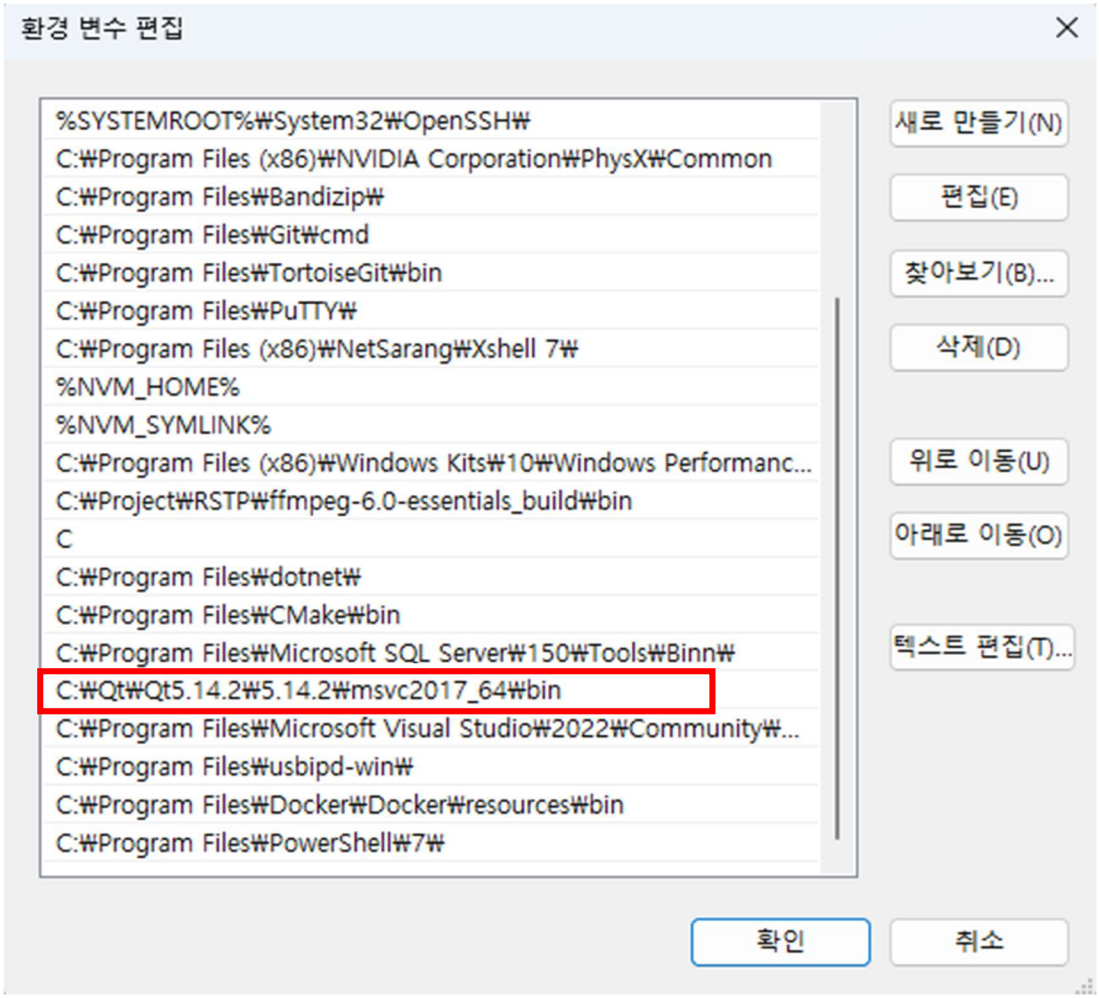


**Figure 9. PATH variable**

- Add Qt Visual Studio Tools to Visual Studio

  Open the SDK₩Windows₩TmWinQt₩TmWinQt.sln file in Visual Studio. From the Menu Bar, go to **Extensions** > **Manage Extensions**. After clicking, search for and install **Qt Visual Studio Tools.** Restart Visual Studio to install Qt Visual Studio Tools.

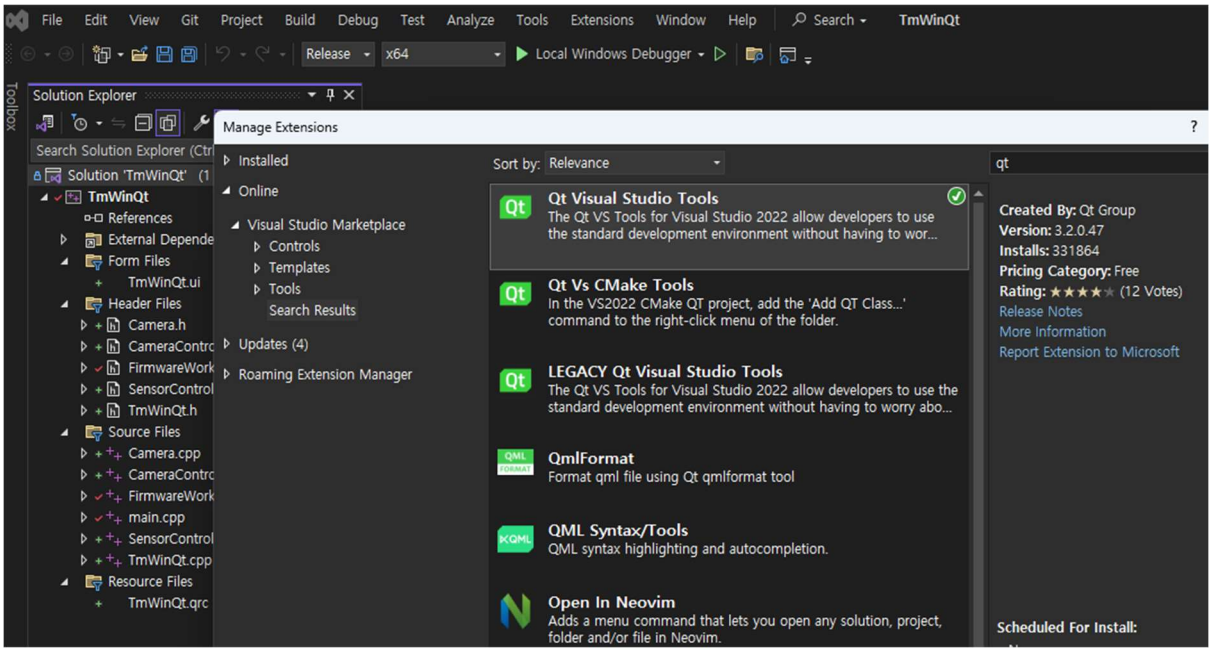


**Figure 10. Qt Visual Studio Tools**

- Add Qt Version

  Add Qt version to Visual Studio and check the Qt version set in your TmSDK project.

  Go to **Menu Bar** > **Qt VS Tools** > **Qt Versions**.

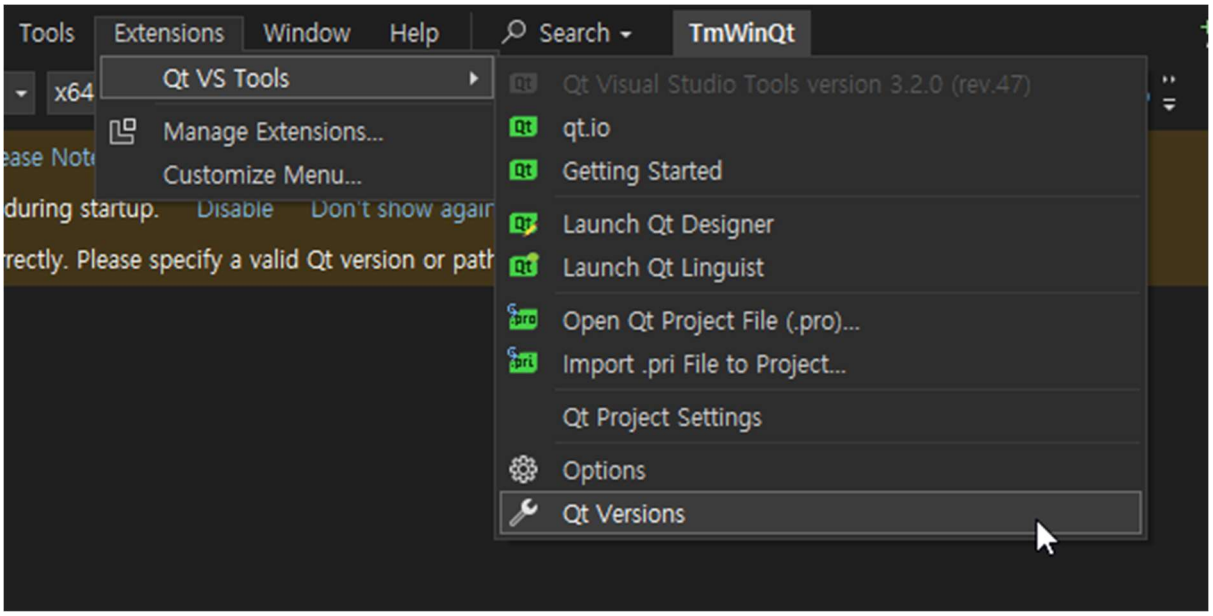


**Figure 11. Qt Versions**

Click **Add New Qt Version** and set the qmake path for Qt5.


**Figure 12. Add New Qt version**

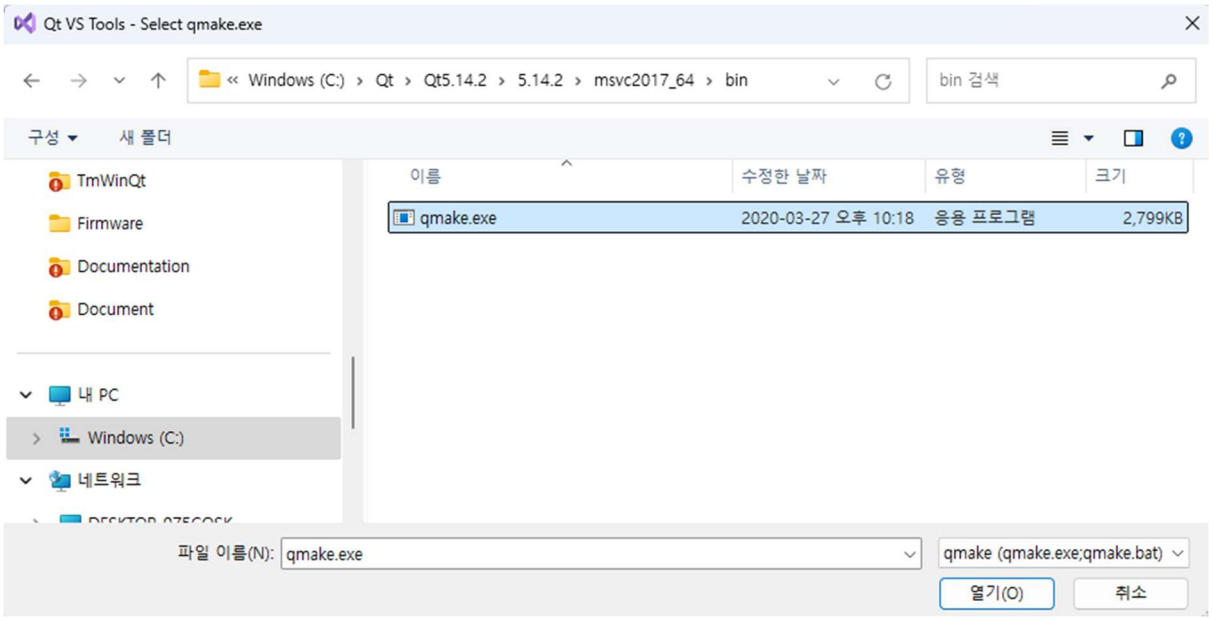


**Figure 13. Select qmake**

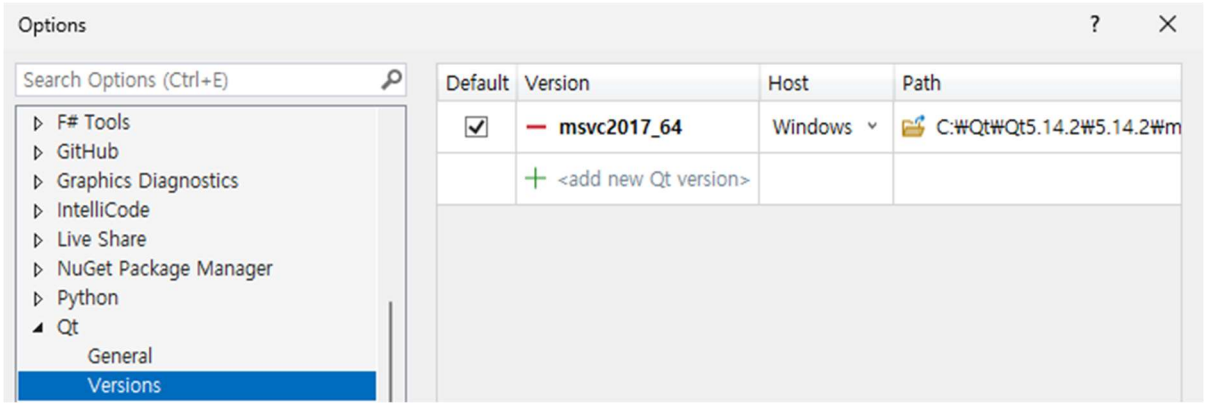


**Figure 14. Added New Qt version**

Check the Qt version in the properties of the TmWinQt project.

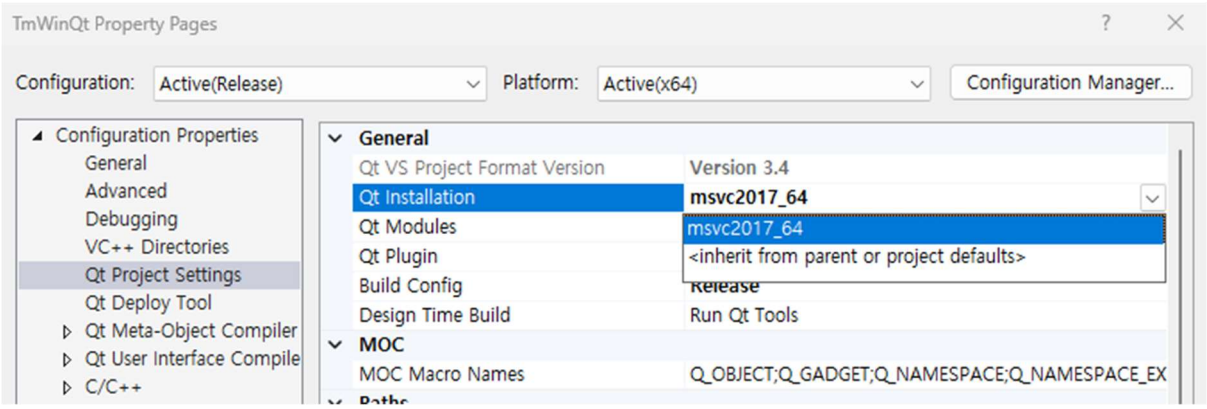


**Figure 15. Check qt version of TmWinQt project**

### 2.1.3. Build TmWinQt

Build TmWinQt to obtain **TmWinQt.exe** in build₩x64₩Release.

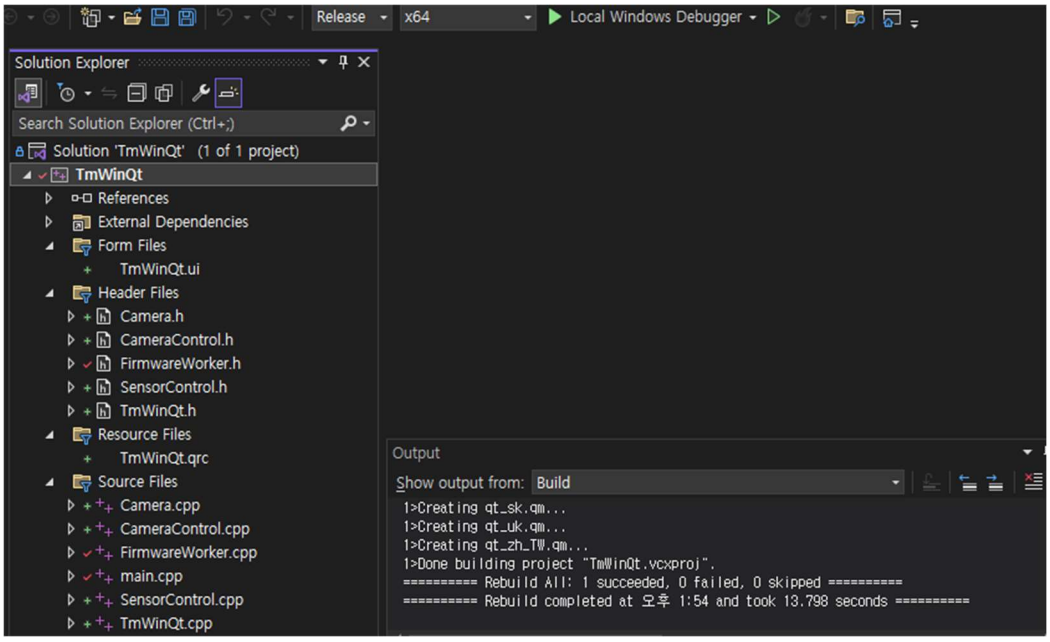


**Figure 16. Build TmWinQt**

#### 2.1.4. Run TmWinQt

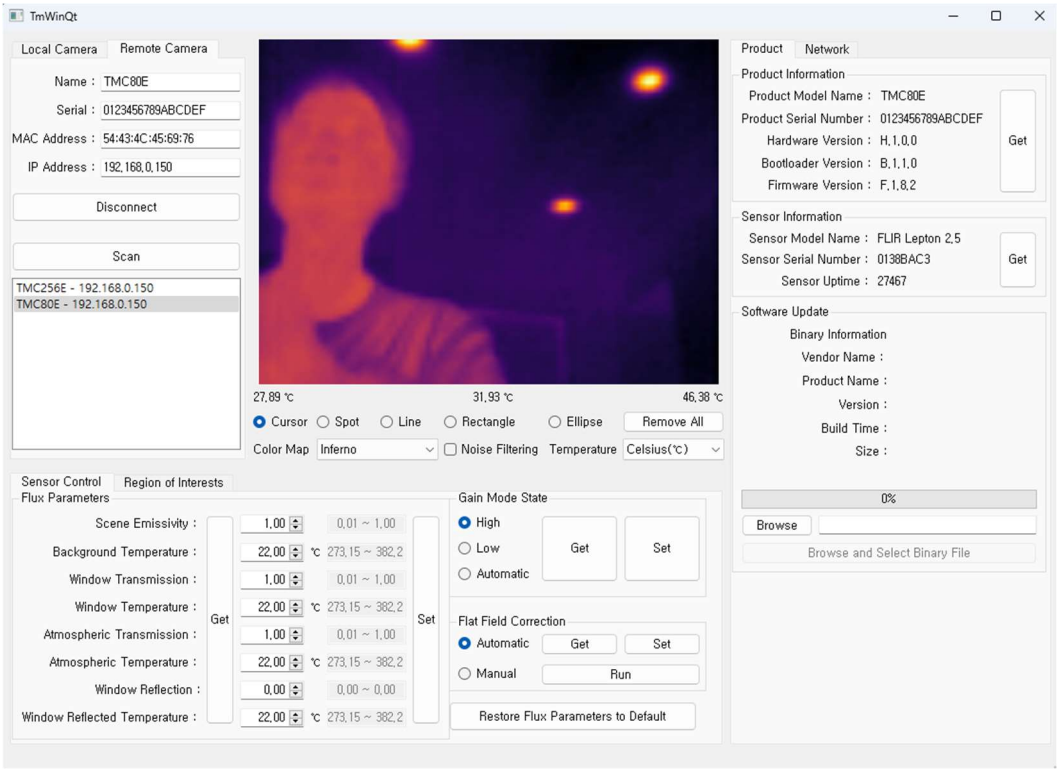


**Figure 17. Build TmWinQt**

## 2.2. Windows C# (TBD)

## 2.3. Windows Python

Requirement:

Windows 11

Python 3.9 or higher.

Visual Studio 2022 (Optional)

### 2.3.1. Install Python

- Download Python

https://www.python.org/downloads/windows/

### 2.3.2. Install Packages

```
> pip install pyqt5
> cd SDK\Windows\TmPython
> pip install TmSDK-1.0.0-py3-none-win_amd64.whl
```

### 2.3.3. Run TmPython

```
> python TmPython.py
```

## 2.4. Linux C++

Requirement:

Ubuntu 24.04

Gcc-11

Qt5.14.2

### 2.4.1. Install packages

- Install gcc-11

```
$ sudo add-apt-repository ppa:ubuntu-toolchain-r/test
$ sudo apt-get install gcc-11 g++-11
$ sudo update-alternatives --install /usr/bin/gcc gcc /usr/bin/gcc-11 110 --slave /usr/bin/g++ g++ /usr/bin/g++-11
```

- Install Qt5

```
$ sudo apt install qtbase5-dev mesa-common-dev qtcreator
```

- Install other packages

```
$ sudo apt install openexr libdc1394-dev libavcodec-dev libavformat-dev
libswscale-dev make libgstreamer-plugins-base1.0-dev
```

  - Proceed after connecting the USB camera to your PC.

```
$ ls –l /dev/ttyACM0

crw-rw---- 1 root dialout 4, 73 Aug  5 14:21 /dev/ttyACM0

$ sudo usermod -a -G dialout $USER
```

- Create a symbolic link file for opencv library

```
$ cd SDK/Linux/TmLinux/lib

$ ln –s libopencv_world.so libopencv_world.so.410
```

#### 2.4.2. Build TmLinux

```
$ cd ..

$ qmake TmLinux.pro

$ export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:./lib

$ make
```

#### 2.4.3. Run TmLinux

```
$ ./TmLinux
```

## 2.5. Linux Python

Requirement:

Ubuntu 24.04

Qt5.14.2

Python 3.9 or higher

#### 2.5.1. Install python3

```
$ sudo apt install python3

$ sudo apt install python3-pip

$ sudo apt install python3.12-venv
```

### 2.5.2. Install packages

```
$ sudo apt install openexr libdc1394-dev libavcodec-dev libavformat-dev libswscale-dev make libgstreamer-plugins-base1.0-dev
```

```
$ cd ./SDK/Linux/TmPython

$ python3 -m venv tmsdk

$ source tmsdk/bin/activate

(tmsdk)$ pip install TmSDK-1.0.0-py3-none-manylinux2014_x86_64.whl

(tmsdk)$ pip install PyQt5

(tmsdk)$ export LD_LIBRARY_PATH=$(pip show TmSDK | grep Location | cut -d ' ' -f 2)/TmCore
```

### 2.5.3. Run TmPython

```
$ python3 ./TmPython.py
```

# 3. Install Camera

Connect the camera device to a Windows PC via Ethernet or USB cable and check the connection status with the TmSDK.

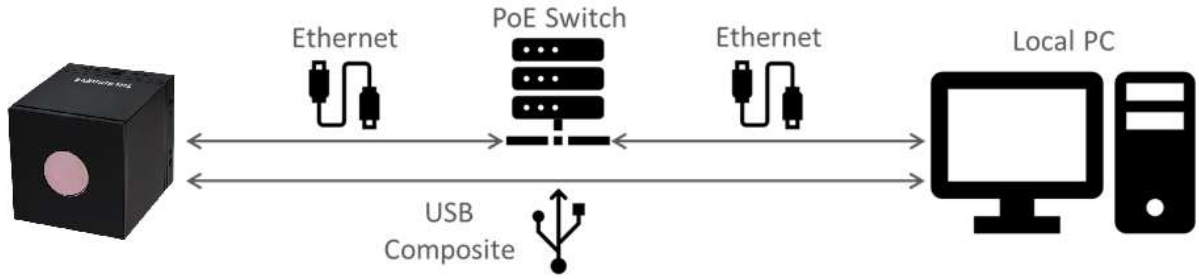


**Figure 15. System Configuration Diagram**

## 3.1. Ethernet

Connect the camera device and a network switch that supports PoE with an RJ-45 Ethernet cable. And the LED will turn on when it boots up normally.

When you run the TmSDK on a PC connected to the network, you can find connectable camera devices on the network and view the device list and product information on the **Remote Camera** tab, as shown below.

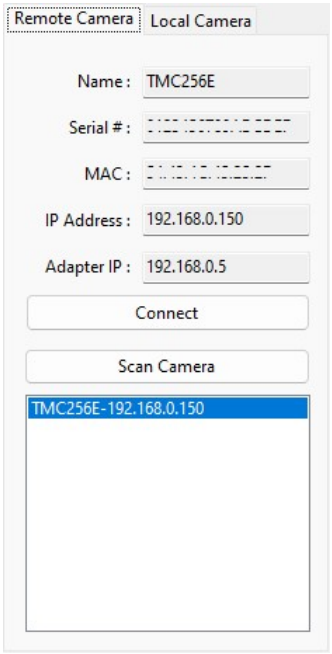


**Figure 16. Ethernet Connection**

The default network settings for your device are:

- IP Assignment: Static
- IP Address: 192.168.0.150
- Subnet Mask: 255.255.255.0
- Gateway: 192.168.0.1
- Main DNS Server: 164.124.101.2
- Sub DNS Server: 168.126.63.1
- Protocol and Port:
UDP (15000), RTSP/TCP (554), RTP/UDP (50000-51000)

Network settings can be changed on the **Network** tab after connecting with the camera device.

## 3.2. USB

Connect the camera device and a PC with an USB cable.

When you run the TmSDK on your PC, you can find connectable camera devices and view the device list and product information in the **Local Camera** tab, as shown below.

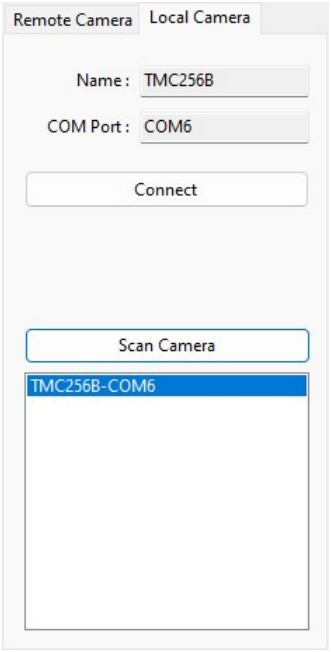


**Figure 17. USB Connection**

You can also view the connection information in the Windows Device Manager.

USB connection is possible using the product name and COM port number of the camera device.

The COM port number might change each time you connect the camera device with a USB cable.

If you change the display to "View ⇨ Devices by container" from the menu in Device Manager, you can see the USB camera product name and COM port number included with the camera device at a once.

# 4. TmSDK GUI

User can view the video playback and temperature values from camera device, and it provides the UI needed to inquire and set information.

## 4.1. Screen Layout

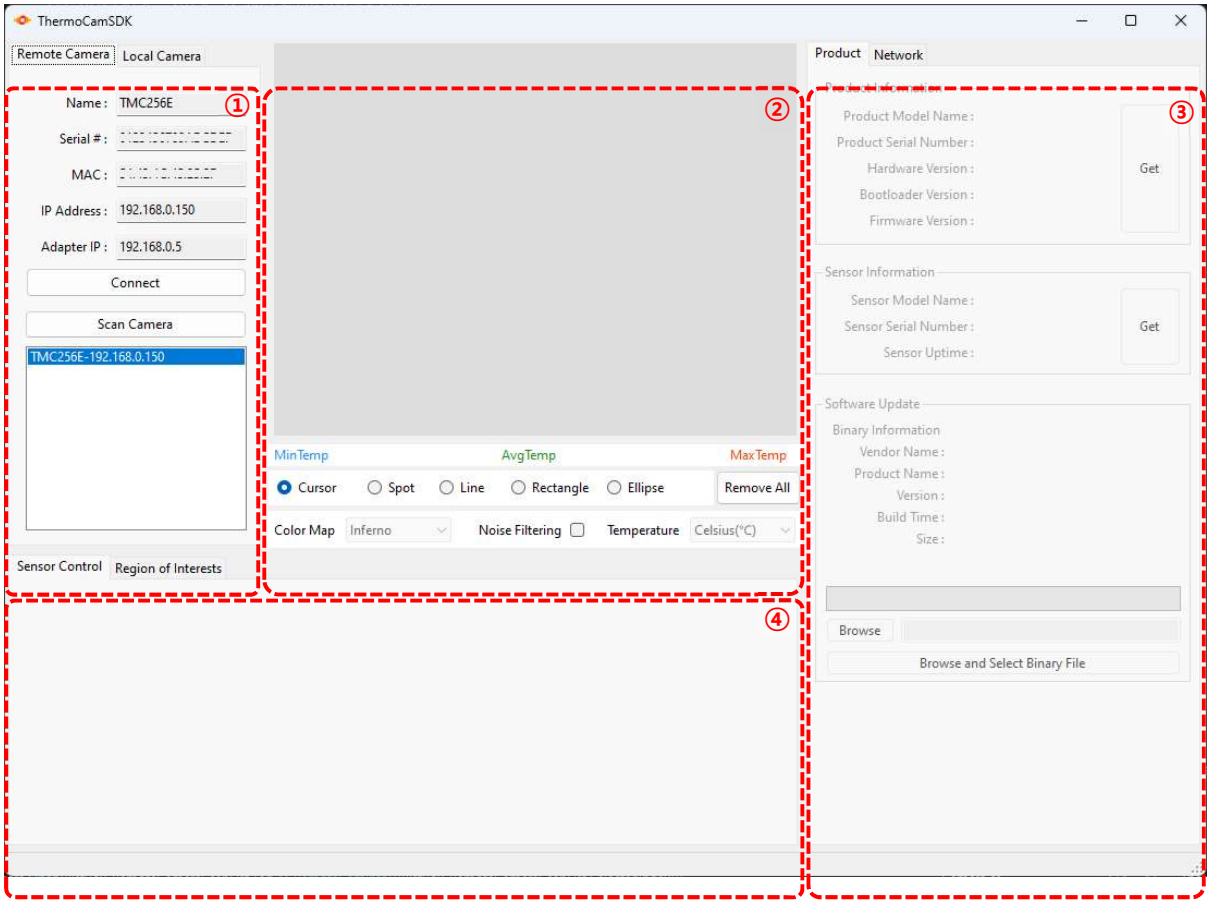


**Figure 18. Screen Layout**

① Scan Camera Devices & Connection Panel

Get connectable device information via Remote Camera (Ethernet Network) / Local Camera (USB), Connection

② Video Playback & Temperature Information Panel

Play live streaming video, Display the highest / average / lowest raw data values & temperatures within an image frame, Add / Remove ROIs, Color Map, Enhance image quality, Change temperature units

③ Inquiry Product Information & Setting Panel

View camera product and thermal sensor information, Software update, Inquire / Set ethernet network information

④ Thermal Sensor Control & ROI Lists Management Panel

Control thermal sensor specific features, Add / Remove ROIs

## 4.2. Remote Camera

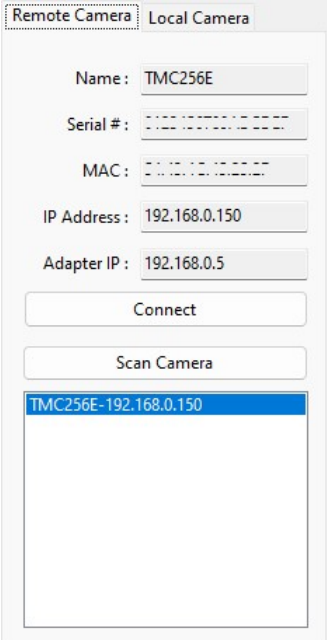


**Figure 19. Remote Camera**

The **Scan Camera** button allows you to search for connectable camera devices via ethernet network by manually and displays them in the list below. When you select a device from the search list, the details of that device are displayed above the Connect button, as shown below.

- Name: Product name

- Serial Number: Product unique number

- MAC Address: Unique identifier assigned to a network interface

- IP Address: IP address assigned to the device

- Adapter IP: Local network adapter IP address to which the device is connected

The **Connect** button allows you to initiate a connection with the selected device and play the video after a few moments. The Local Camera connection is disabled at that time.

The **Disconnect** button allows you to stop the video and disconnect from the device.

## 4.3. Local Camera

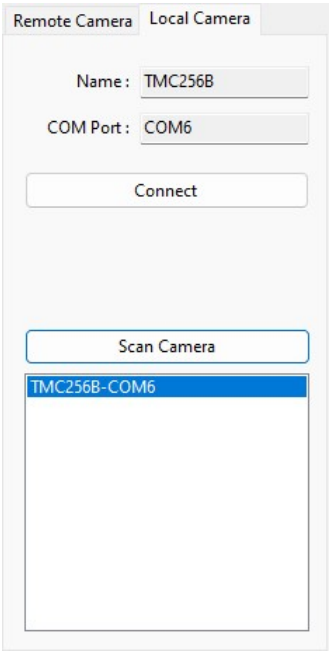


**Figure 20. Local Camera**

The **Scan Camera** button allows you to search for connectable camera devices via USB by manually and displays them in the list below. When you select a device from the search list, the details of that device are displayed above the Connect button, as shown below.

- Name: Product name

- COM Port: Port name of serial communication interface

The **Connect** button allows you to initiate a connection with the selected device and play the video after a few moments. The Remote Camera connection is disabled at that time.

The **Disconnect** button allows you to stop the video and disconnect from the device.

## 4.4. Video Playback & Temperature Information

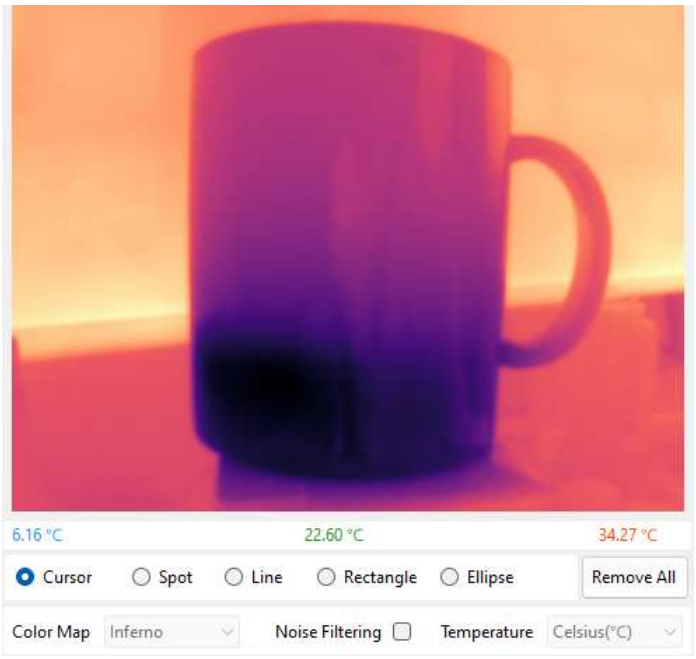


**Figure 21. Video Playback & Temperature Information**

Once the connection with the device is established, the camera transmits the image frame

information captured in real time in raw data format. The TmSDK on the PC converts the received raw data into video images by the Thermoeye protocol and displays them. The color sense of the video is controlled by the **Color Map** menu at the bottom left, where you can select one of the following: Grayscale / Autumn / Bone / Jet / Winter / Rainbow / Ocean / Summer / Spring / Cool / Hsv / Pink / Hot / Parula / Magma / Inferno / Plasma / Viridis / Cividis / Twilight / TwilightShifted / Turbo / DeepGreen.

Below the video image displays the highest / average / lowest temperatures within the image frame. The temperature unit can be selected from Raw / Celsius (℃) / Fahrenheit (℉) / Kelvin (K) through the **Temperature** menu on the bottom right.

The **Noise Filtering** check box allows you to improve the image quality of the playback video.

You can also set an ROI within the video to show the highest/average/lowest temperatures. You can set multiple regions by selecting different ROI types: Spot / Line / Rectangle / Ellipse. You can remove all ROIs with the **Remove All** button. Detailed ROI list management can be done in the Region of Interests tab of the bottom Thermal Sensor Control and ROI List Management panel.

## 4.5. Product Information

The **Get** button allows you to check the product information of the connecting device.


**Figure 22. Product Information**

- Product Model Name: Product model name
- Product Serial Number: Product unique number
- Hardware / Bootloader / Firmware Version: Hardware and software version information

## 4.6. Sensor Information

The **Get** button allows you to check the thermal sensor information of the connecting device.

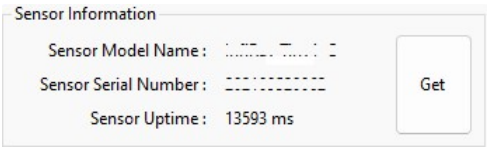


**Figure 23. Sensor Information**

- Sensor Model Name: Sensor model name
- Sensor Serial Number: Sensor unique number
- Sensor Uptime: Sensor operating time

## 4.7. Software Update

The **Browse** button allows you to select a firmware binary file for device to update.

It will then display the version information contained in the firmware binary, and if the file is updateable for the connecting device, the **Start** button will be enabled and pressing it will start the download to the device.

After a while, the device will automatically restart when the download is complete, and the LED will turn on again when normal operation is complete after update.

Then restart the TmSDK to verify that the device can connect, and check new version information on Product Information.

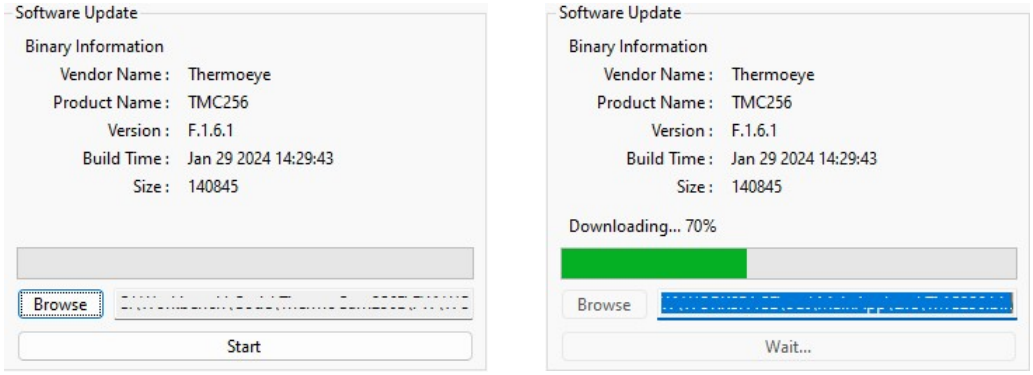


**Figure 24. Software Update**

## 4.8. Network Configuration

The **Get** button allows you to check the network information set up on device.

The **Set** button allows you to store the configuration you want to change. Then, you need to restart the device by pressing the **Reboot to Apply Changes** button to operate with the new configuration.

The **Set to Factory Default** button allows you to restore the network information to factory default configuration. Then, you need to restart the device by pressing the **Reboot to Apply Changes** button to operate with the new configuration.

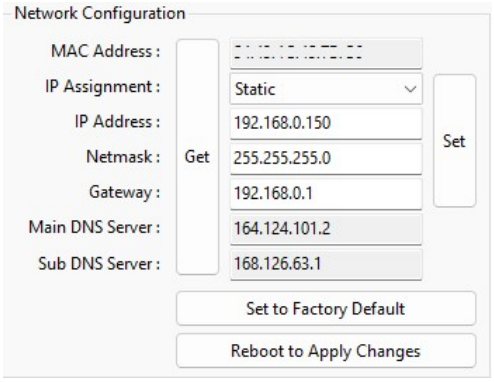


**Figure 25. Network Configuration**

- MAC Address: Unique identifier assigned to a network interface
- IP Assignment: IP assignment method (Static / DHCP)
- Netmask: Subnet mask address
- Gateway: Gateway address
- Main DNS Server: Main DNS server address
- Sub DNS Server: Sub DNS server address

Each address can only support IPv4 format.

When changing configuration, you should contact your network administrator or Internet service provider for additional considerations, such as unique IP bands, the presence of a DHCP server, firewalls, and port forwarding, depending on your network system configuration and protocols.

## 4.9. Region of Interests

You can view the list of set ROIs in the Video Playback and Temperature Information panel and add / remove them.

ROI List enumerates the list of set ROIs and the **Remove** button allows you to delete the selected ROI.

You can select a desired ROI from Spot / Line / Rectangle / Ellipse and enter arbitrary coordinates, and press the **Add** button. Then added ROI will be displayed on the video image and added it to the ROI List.

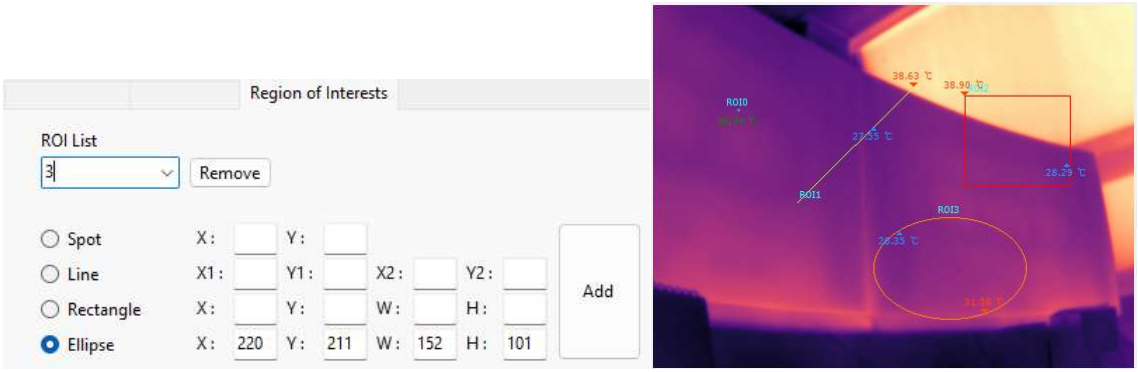


**Figure 26. Region of Interests**

## 4.10. Sensor Control

Thermal sensor control feature is available separately by product specification.

Please contact the Thermoeye for more information.

# 5. Troubleshooting

Please refer to this if you encounter any problems during product installation or SDK development.

## 5.1. Scan Camera is not working on Remote Camera

If you execute Scan Camera to find a Remote Camera connected to PoE on a PC equipped with Wi-Fi wireless adapter, but you cannot find any device, please set all of **Microsoft Wi-Fi Direct Virtual Adapter** devices to **Disable device** on the network adapter in the PC's Device Manager as follows.

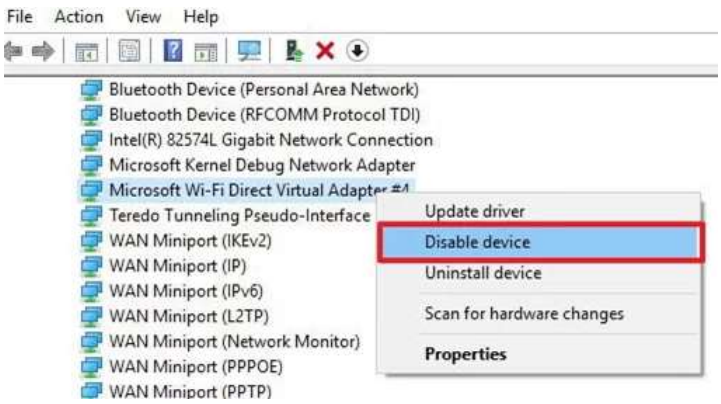


**Figure 27. Network adapter**

# 6. Support

Thermoeye Inc. operates service channels to keep your camera running at all times. If you discover a problem with your camera, please get in touch with us for technical support.

- ✓ Website: www.thermoeye.co.kr
- ✓ E-mail: help@thermoeye.co.kr
- ✓ Tel: +82-70-4489-6196
- ✓ Head Office: 307, Research Building 3, 70, Yuseong-daero 1689 beon-gil, Yuseong-gu, Daejeon, Republic of Korea
- ✓ Seoul R&D: 4~5F, 169 Sadang-ro, Dongjak-gu, Seoul, Republic of Korea

Please visit the Thermoeye Github to download detailed product manuals and SDK for application development.

- ✓ https://github.com/ThermoEye/TmSDK

# 7. Glossary

| Term | Definition |
|---|---|
| CDC ACM | USB Communication Device Class – Abstract Control Model |
| COM port | USB serial COMmunication port |
| DHCP | Dynamic Host Configuration Protocol |
| DNS | Domain Name System |
| FOV | Field Of View |
| IP | Internet Protocol |
| LED | Light-Emitting Diode |
| MAC | Media Access Control |
| NEDT | Noise Equivalent Differential Temperature |
| NETD | Noise Equivalent Temperature Difference |
| PoE | Power over Ethernet |
| ROI | Region Of Interest |
| RTSP | Real-Time Streaming Protocol |
| RTP | Real-time Transport Protocol |
| TCP | Transmission Control Protocol |
| UDP | User Datagram Protocol |
| USB | Universal Serial Bus |
| USB-HS | USB High Speed |
| UVC | USB Video device Class |
| VOx | Vanadium Oxide |