ADVACAM
Imaging the Unseen

WidePIX
CHROMATIC Industry
CHROMATIC SenseEdge

User manual

Content of package

- **WidePIX CHROMATIC Industry** (or **SenseEdge**) detector
- PoE Injector - IEEE 802.3bt (PoE++) – 95 W
- Ethernet cable M12 to RJ45 Cable Assy CAT6a ethernet 1m
- 2x quick coupling for water cooling (for 4x6 mm plastic hose)
- USB memory stick with control software Pixet Pro
- Magnet – for IP address reset
- M12 connector (optional; not required when using PoE)

1. Start guide

Device Setup and Safety

1. The device should be positioned securely to avoid falls or damage caused by contact with other objects
2. Connect the device to the water-cooling system. **Thermal stabilization to 22 °C** is strongly recommended. Overheating can cause damage to the device.
3. Connect the Ethernet cable. Use a **shielded Cat6a (or higher) Ethernet cable, 23 AWG recommended**, up to 30 meters. The cable must support 1 Gb/s or higher

   a. **Using PoE**
   Connect the Ethernet cable to an **external PoE injector or PoE-enabled switch**. The injector or switch must support **IEEE 802.3bt Type 3 (PoE++)** and deliver **at least 60 W** of power. Both the power delivery and the data transfer are provided by the Ethernet cable. **Important:** The device will not operate with lower power ports.

   b. **Alternative – Without Poe**
   Connect a **+48V DC power adapter** to the device's power connector. In this configuration, the Ethernet cable is used **only for data transfer** and should be connected directly to your computer. **Warning:** Do **NOT** combine PoE with the power adapter.

LAN requirements

- Connect the Ethernet cable from the PoE injector (or from device if not using PoE) directly to the network card or via a gigabit switch with no load on other ports.
- To fully utilize the **WidePIX CHROMATIC Industry**, network card must support speeds of at least 1 Gb/s.
- If there is a slower or more complex network between the **WidePIX** and the computer, the framerate may be limited, bad frames can occur, or some measurements may fail.

Network Configuration and IP Addressing

1. From factorial setting IP address is set **192.168.1.100** and Subnet mask **255.255.255.0**
2. If the device was previously used and the IP was changed but is now unknown, device requires the reset of IP address (see the IP address reset tutorial, below this section).
3. To ensure correct communication, modify the network settings on your PC.

a. Change network settings for Windows 11

(older Windows versions are very similar, see YouTube tutorial [Network setting Windows 10])

I) Go to ***Start*** > ***Settings*** > ***Network & Internet*** > ***Ethernet***

II) Select the **Ethernet** connection used for the device

III) In IP assignment, click on ***Edit***, see Figure 1: Network setting W1

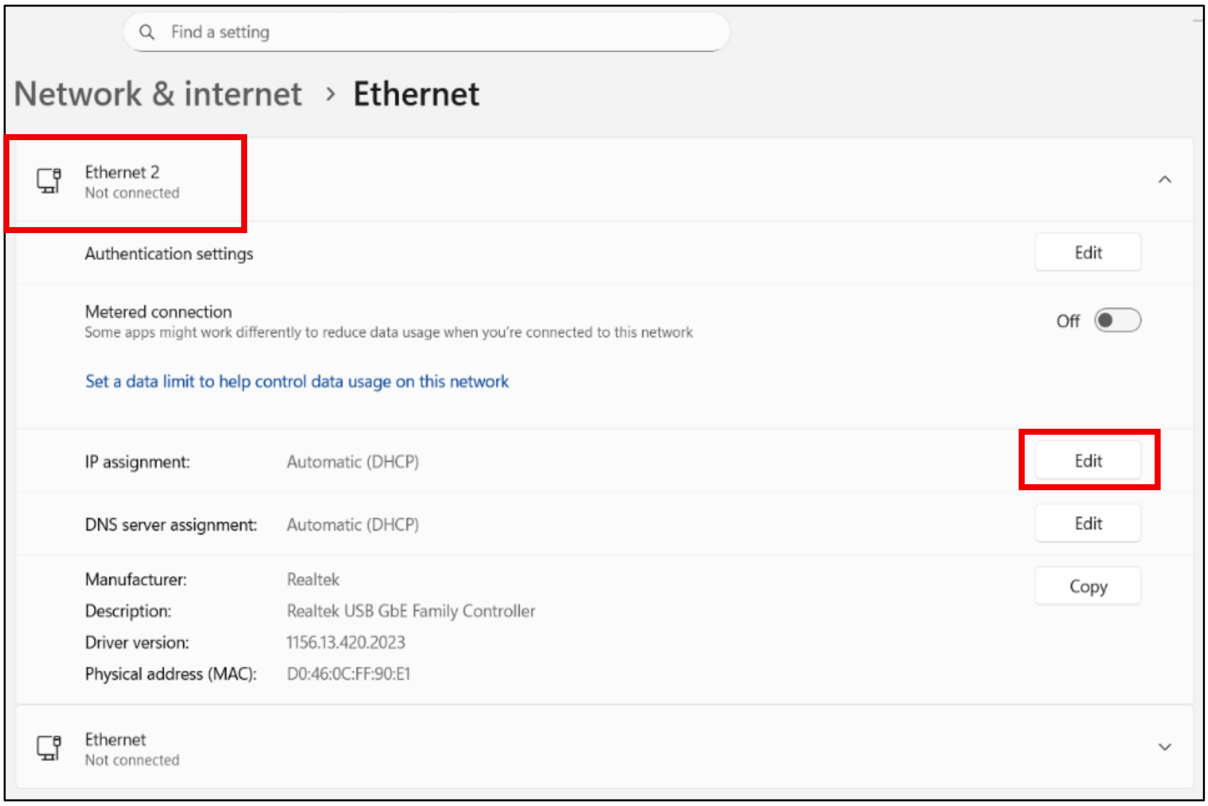


Figure 1: Network setting W1

IV) Set Edit IP setting to ***Manual*** and then switch On IPv4, see Figure 2: Network setting W2.

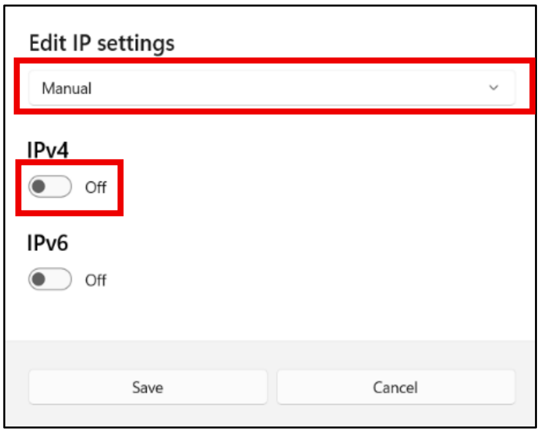


Figure 2: Network setting W2

V) Additional settings will pop-up, fill up IP address and Subnet mask as shown below and click on ***Save button***. Note: last number of IP addresses should be different from IP addresses of device (use 2-254). Example: If device IP is **192.168.1.100** you need to use different, for example **192.168.1.200**, subnet mask is always **255.255.255.0** see bellow Figure 3: Network setting W3

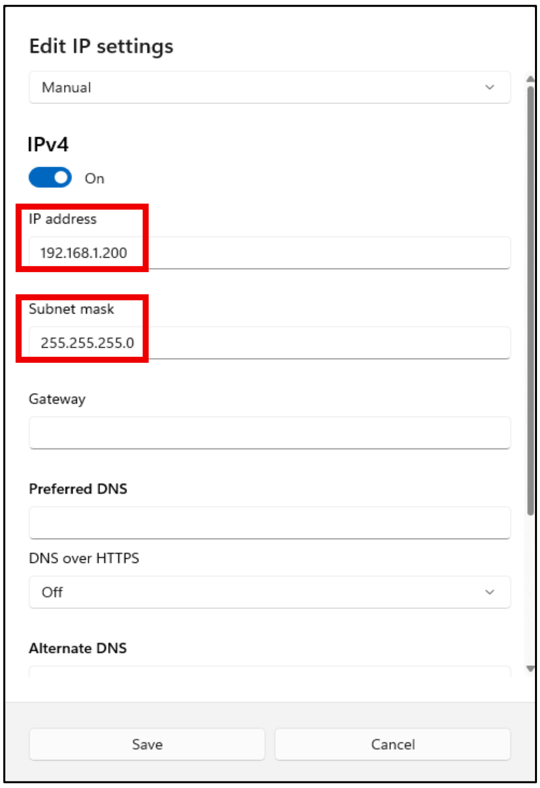


Figure 3: Network setting W3

VI) Now you can connect to detector. Open your web browser and type IP address of device **192.168.1.100** (this is IP from factorial setting or after IP reset, if changed use new set one). Page with ADVACAM interface should open in your browser. In bottom panel you can update/change default IP address if needed. See Figure 4: Network setting W4

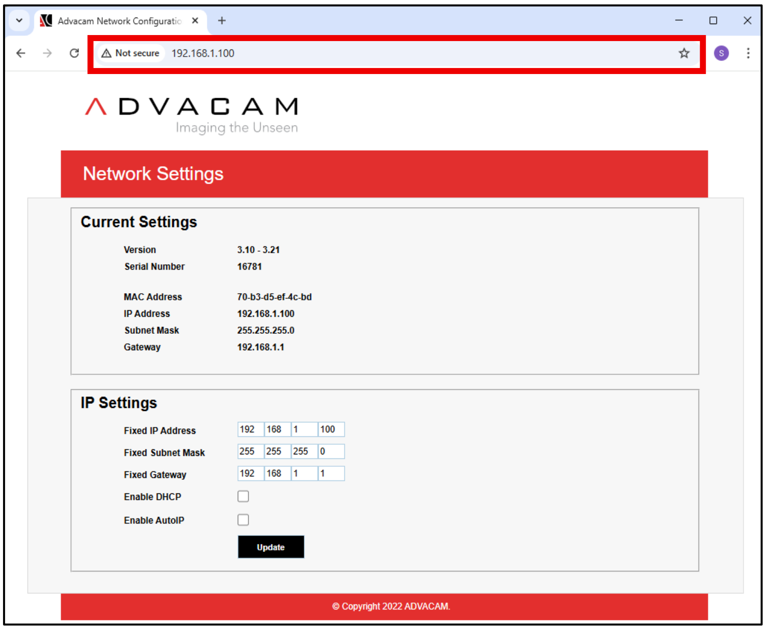


Figure 4: Network setting W4

b. Change network settings for macOS 13

See Network Setting for MacOS (second part of YouTube video tutorial)

I) Go to Apple menu > ***System Settings***, click ***Network*** in the sidebar, click a network service you want to edit, see Figure 5: Network setting M1.

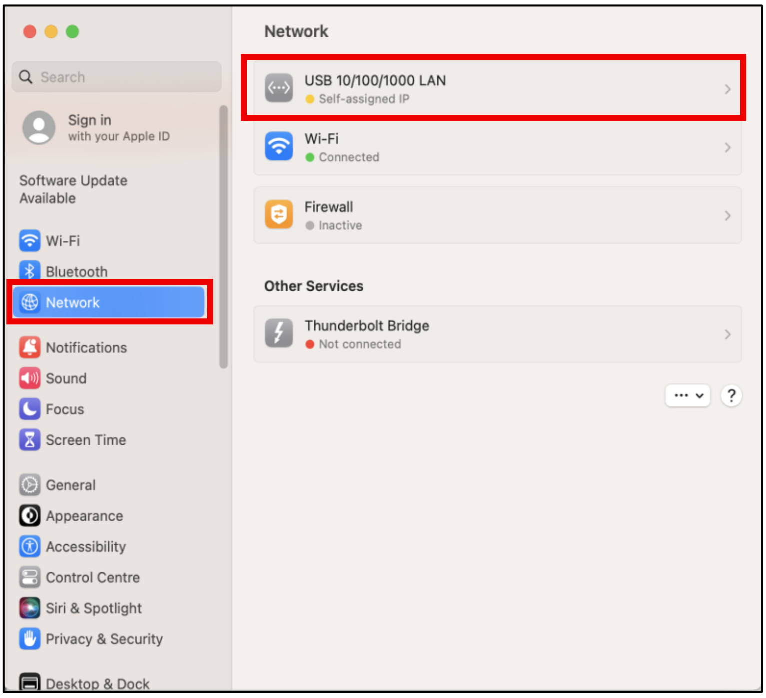


Figure 5: Network setting M1

II) Click ***TCP/IP*** in the sidebar, edit Configure IPv4 to ***Manually***, fill up **IP address** and **Subnet mask** as shown below and click on ***OK*** button. Note: last number of IP addresses should be different from IP addresses of device (use 2-254). Example: If device IP is **192.168.1.100** you need to use different, for example 192.168.1.200, see Figure 6: Network setting M2.

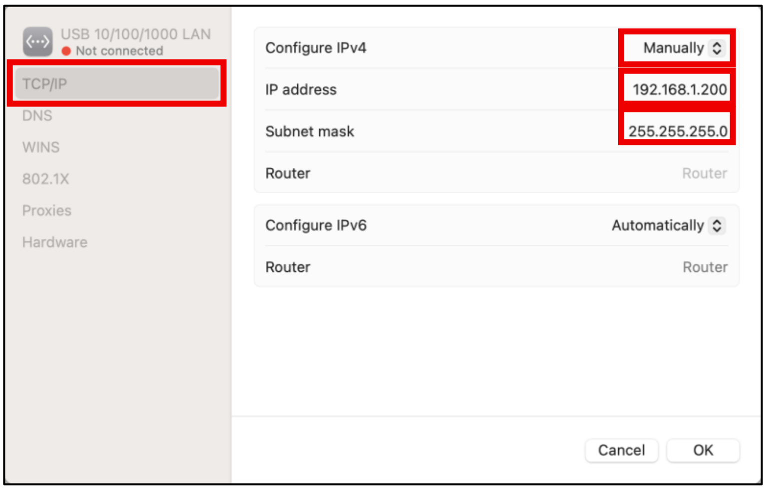


Figure 6: Network setting M2

III) Now you can connect to detector. Open your web browser and type IP address of device **192.168.1.100** (this is IP from factorial setting or after IP reset, if changed use new set one). Page with ADVACAM interface should open in your browser. In bottom panel you can update/change default IP address if needed.

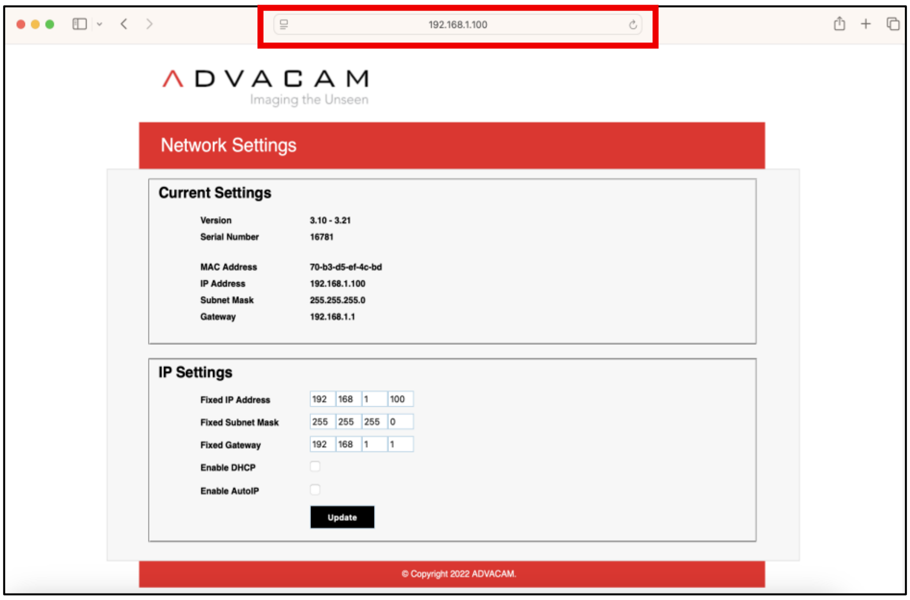


Figure 7: Network setting M3

c. Change network settings (for Linux)

I) Click on the ***network icon*** in the top-right corner of your screen (Wi-Fi or wired symbol).

II) Select icon for **Settings**.

III) In the **Network settings** window, pick your connection from the left sidebar. Click the gear icon next to your active network.

IV) Go to the **IPv4** tab. Change the Method from ***Automatic (DHCP)*** to ***Manual***.

V) Enter your IP address 192.168.1.200, Netmask 255.255.255.0 Note: last number of IP addresses should be different from IP addresses of device (use 2-254). Example: If device IP is **192.168.1.100** you need to use different, for example **192.168.1.200**

VI) Click ***Apply***.

VII) Disconnect and reconnect to the network to apply changes.

IP address reset

1. Connection to a cooling system is required for proper operation of the device.
2. Disconnect the device from any network if connected.
   - If connected via PoE, disconnect Ethernet cable from PoE injector to PC,
   - If connected to a classical power supply, disconnect Ethernet cable from device to PC
3. Connect power via PoE (or Power supply)
4. After the device init (**R1** is **Orange**, changes to **Red** and turns off), attach the magnet to magnetic sensor (see Figure 8 below). When the magnetic field is recognized, **R1** turns **Blue**. If **R1** starts blinking **Blue**, you have missed the IP mode change time window (~5 s after power up) and need to start the process over.
5. When the change mode is enabled, **R1** changes to one of the colors indicating the actual settings (listed below).
6. Use magnet for selecting the preferred settings. There are 3 possibilities of the **R1** color for different IPv4 configurations:
   - **Red** = Auto IP (random 169.254. ...)
   - **Green** = DHCP (required DHCP server running on router/computer)
   - **Yellow** = Static IP (set default 192.168.1.100)
7. Wait for several seconds. **R1** blinks several times and turns off. Now the setting is saved.
8. Connect the device to the specified network.

Note: More information on IP address change and a short video guide can be found on our wiki: https://wiki.advacam.cz/wiki/WidePix_POE_v2_Quick_Start_Guide

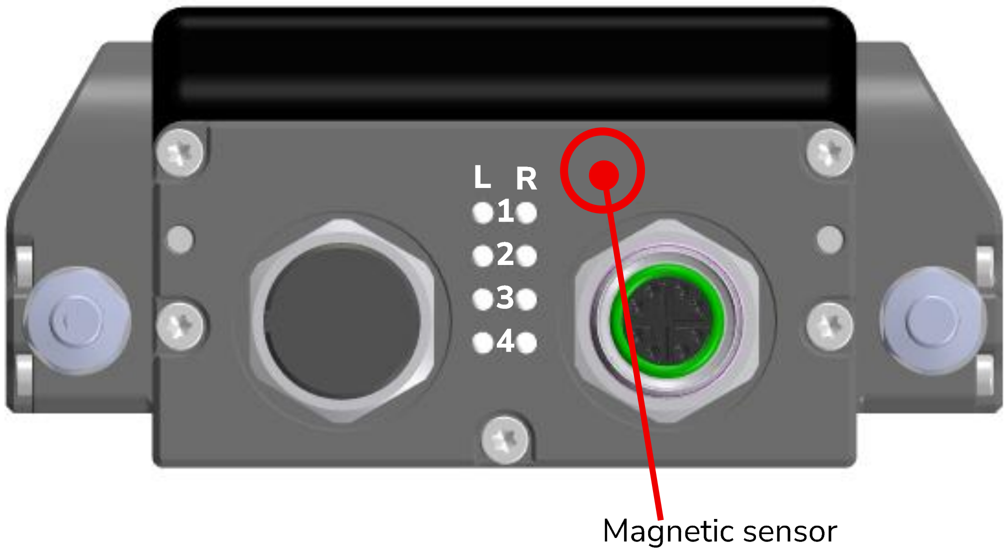


Figure 8: Illustrative render for **WidePIX CHOMATIC Industry** bottom view**.** Symbols L, R, 1-4 are not engraved on the actual device

Description of LED indicators

The **WidePIX CHROMATIC Industry** panel is equipped with eight LED that provide real-time information about the device's status, operation, and connectivity. Understanding these signals helps users quickly diagnose normal operation, initialization, warnings, and potential errors.

LEDs Left side

L1. **Device status**

- **Green** blinking 2s - device ready, OK
- **Orange** still - just init (about 1s)
- **Red** blinking - overtemperature (> 55˚C) warning
- **Red** still - fatal error, power cycle the device. If this LED is still red, contact Advacam technical support.

L2. **Error code LED**

- **Green** blinking according to the error (it does not prevent functionality of the device)
- In this case, Technical Support will ask the customer to make 10 s video

L3. **Reserved for internal purpose**

- **Violet** still - the device restarted itself (it is not a problem at the device starting, but if this occurs during measurement, it will probably stop working)

L4. **Power supply for the row segment**

- **Orange** still - power on (when pixet is running)
- The LED stays on even when Pixet crashes!

LEDs Right side

R1. **FPGA**

- **Orange** still - shutter is open
- **Orange** changes to **Red** during init
- It is used also during IP reset procedure (described below)

R2. **Device power**

- **Blue** still - power on
- **Blue** blinks shortly during init
- **Blue** still and **Green** blinking (result is **Blue-Turquoise**) - communication with Pixet during FW revert procedure (described below)

R3+R4. **Eth link** (R3 **Green**, R4 **Red**)

- None - no connection
- Only **Green** blinking - 1 Gbit/s, ok
- Only **Red** blinking - lower speed
- Both **Red** and **Green** blinking - lower speed
- Both **Red** and **Green** blinking shortly during init
- Both **Red** and **Green** still - connected to switch, but without access to network

2. Pixet Pro – GUI

Pixet Pro, developed by ADVACAM, is a desktop application for expert users that provides full control of the Timepix- and Medipix-based detectors. It is used in manufacturing processes such as testing and calibration, as well as in the development phase. The application is powerful, so inexperienced users could set the device into a non-functioning state. Recovery is possible by loading the factory settings shipped with the detector.

This section summarizes basic Pixet Pro settings. For more advanced information, refer to the **Pixet manual** under the ***Help*** panel in **Pixet** – Advacam Wiki.

Here you can find summary and basic setting for Pixet, for advance information see Pixet manual under **Help** panel in **Pixet**.

Installation

1. Install the **Pixet** application from attached USB memory stick or from ADVACAM website:
   - **Pixet** for Windows is distributed as a single executable file for automatic installation. Run ***setup.exe*** and follow the instructions it the setup wizard.
   - **Pixet** for macOS system is distributed as a standard ***.dmg*** file. After mounting the ***pixet.dmg*** file a window with disk content will open. To install, move the ***Pixet*** file to the ***Application*** folder.
   - **Pixet** for Linux system is distributed as a single ***.tar*** file. To install, untar the file at a required location. The application is launched by executing the ***pixet.sh*** script.
2. Run **Pixet** application. A table with available devices will pop up, see Figure 9. Choose your device.

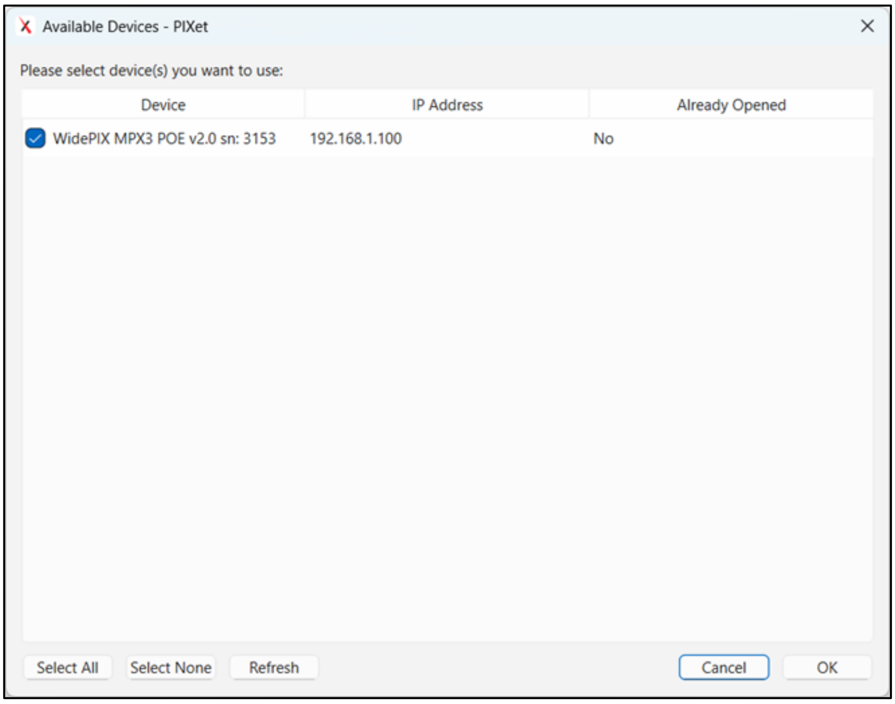


Figure 9: Available devices

3. The Pixet program will open. The ***device ID*** icon appears in the left panel.
4. If it is first time connected to your computer or to new one, error message will appear and *Config. file* needs to be loaded.

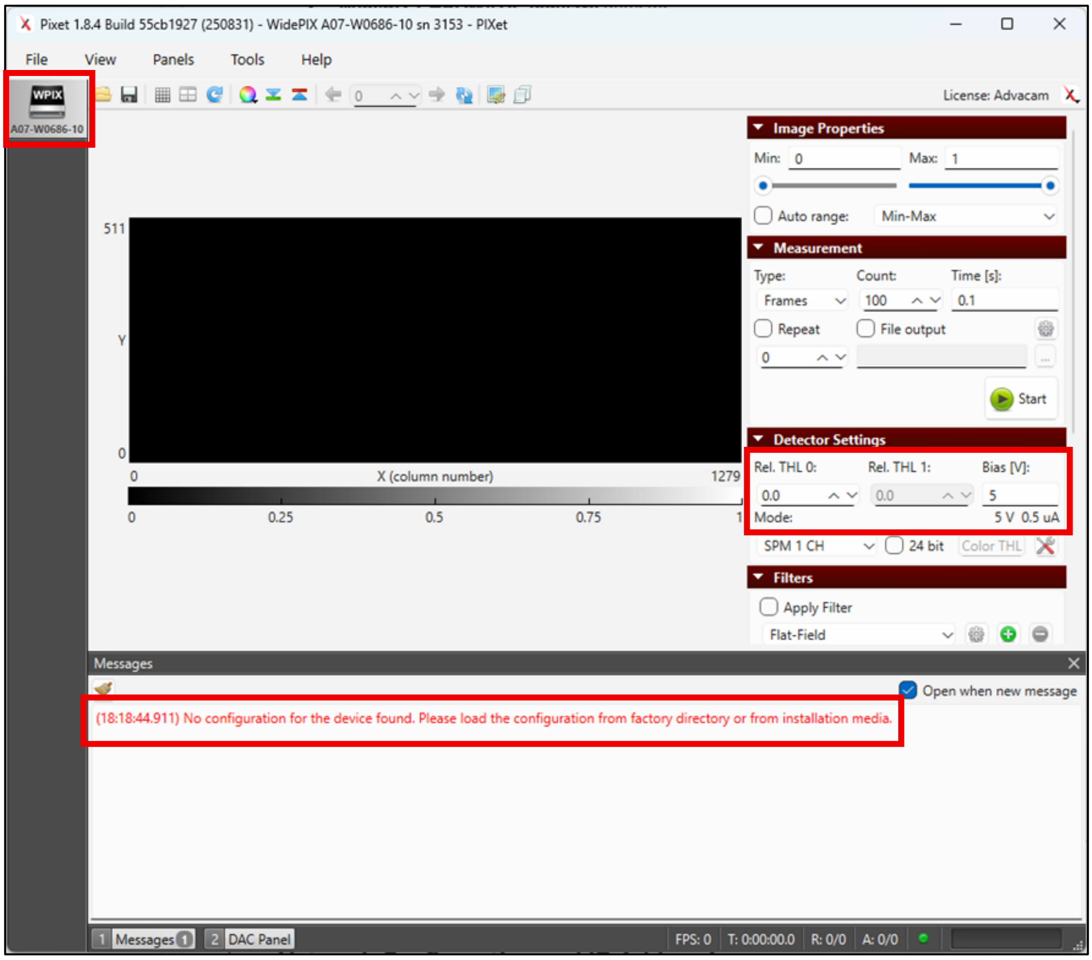


Figure 10: Example of new device connected before Config file was loaded. In Detector setting section THL are without units and values are set to zero. Also, Error message occurred.

5. To Load configuration: ***File > Load config.*** > find config file on attached USB driver, it is ***.xml*** file named same as ID of the device (in this show example - *A07-W0686-10.xml*)

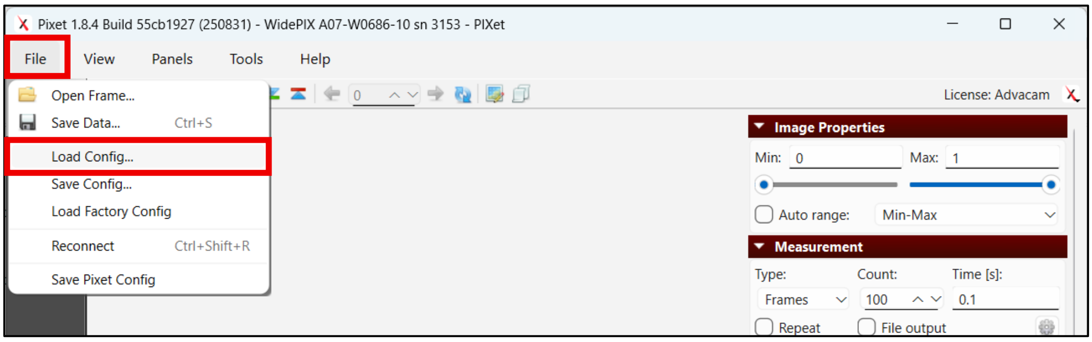


Figure 11: Configuration file - loading

6. Configuration file contains default settings of the detector including calibration of energy thresholds to keV. Settings of thresholds in keV and bias voltage are shown in the **Detector Settings** panel when the configuration is properly loaded. The device is now ready for use. However, it is advisable not to start any measurements until the thermal equilibrium is established (~ 5 minutes). For CdTe sensors, it is advisable to expose the detector to X-rays for a few minutes prior to measurement.
7. Last settings are stored locally upon closing **Pixet** and reloaded the next time the same device is used. Defaults can be restored any time by loading the default configuration.

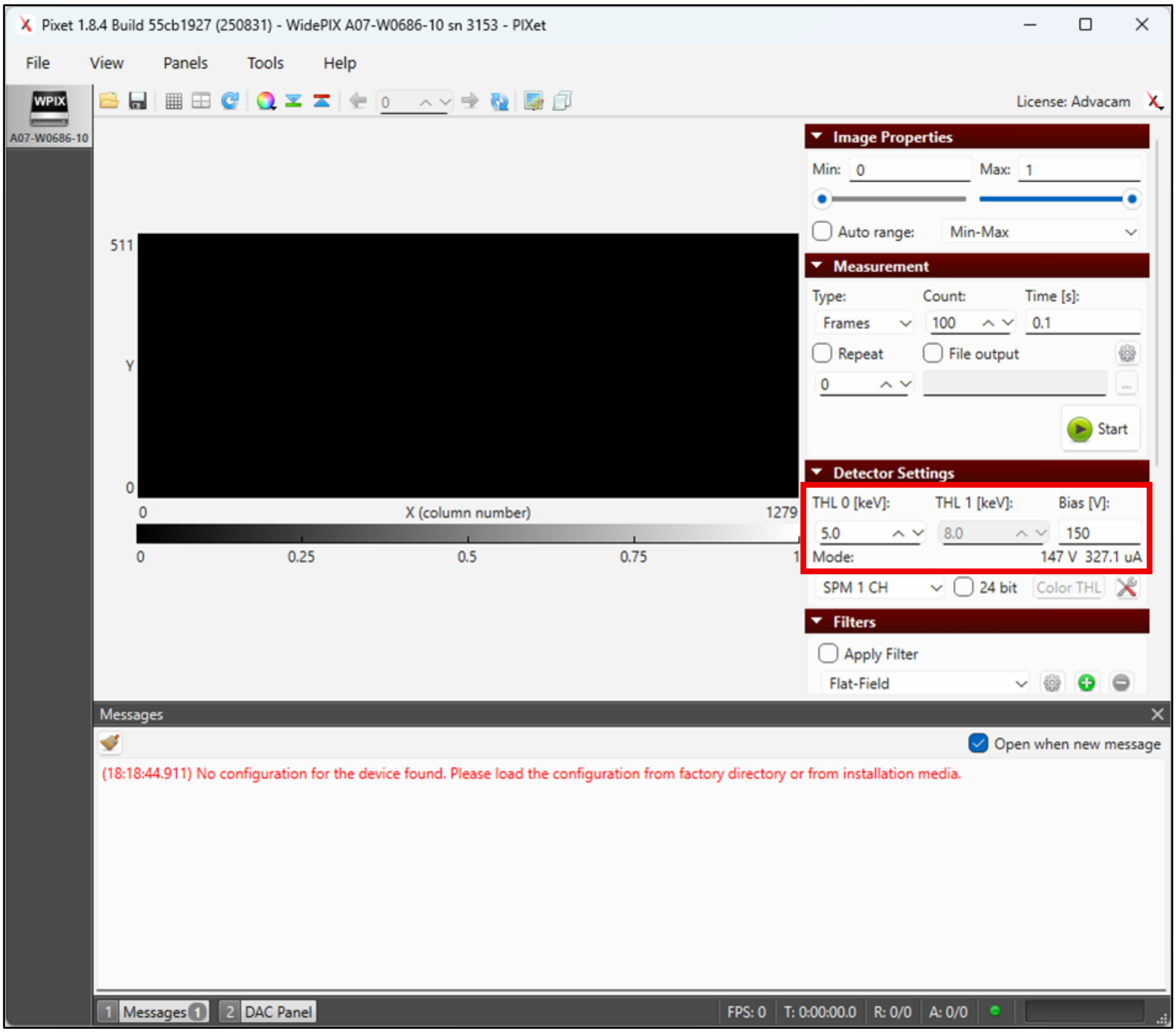


Figure 12: Example after loading *Config file*. In Detector setting section THL shows units and values from calibration are set. Also, bias voltage is set. (for CdTe, polarity should be set negative but show positive value under).

Main tool bar

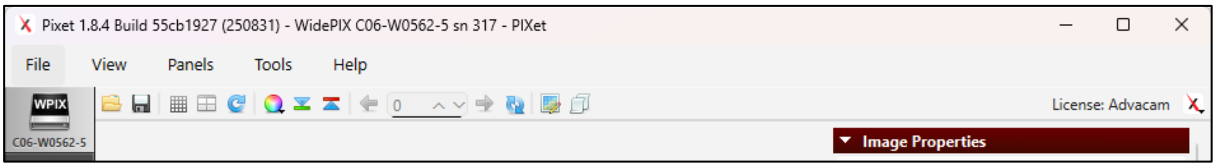
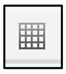


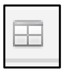
Figure 13: The icons in the toolbar are described below from the left side to the right side.

Open Frame: Opens and loads measured data from hard disk into the software. The frames can also be opened by dragging and dropping frames on to the frame panel.

Save data: Saves all the measured data (frames) from memory to a hard drive. Users can choose between several file formats to save the frames.



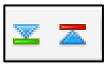
Show grid: Shows grid over the frame that highlights borders between pixels of the frame.



Show chip ID number

Rotate clockwise: Rotates the frame clockwise by 0, 90, 180 or 270 degrees.

Color map: In the Color map dropdown box it is possible to select colors that are used to map values of the frame.



Under warning, Over warning: These two buttons set if the values under the selected range or over the selected range should be highlighted with special color. You can set the range using the Min and Max fields in the Image Properties panel on the right side. For the gray map there are green color (under values) and red color (over values)

Frame: Shows the frame with selected index. By clicking on arrows previous or next frame could be shown. Only work with Frame type.

Auto update: If enabled every new measured frame is automatically shown in the frame panel. When not enabled, the frames are measured in the memory but are not shown in the frame panel. To accelerate the measuring of frames from the device, it is recommended to disable this option.

Pixel configuration: Shows the pixel configuration toolbar and pixel configuration frames (Mask bits, Test bits, ...) Measurements: Measurement utilities.

Python Scripting: Runs the integrated Python console. Program can control the Pixet program and use graphic features.

Understanding the Medipix3 chip operation – WidePIX CHROMATIC

Comparison of Medipix and Timepix chips

- Timepix-based detectors allow both the photon counting and spectroscopic “time-over-threshold” measurement. Medipix-based detectors operate only in the photon counting mode. However, the radiation spectra can be measured using a threshold scan.
- Timepix-based detectors have single energy threshold. All energies below the set value are cut off. Devices are set to a minimal threshold above noise by default. This is typically 5 keV. The threshold can be adjusted by user in the counting mode.
- Medipix3 detectors have one or more adjustable energy thresholds. The number of thresholds varies according to the sensor pixel pitch and the mode of operation. The logic is the same as for Timepix-based detectors; all available thresholds cut off lower radiation energies. Minimum threshold is typically higher compared to Timepix-based devices and depends on additional settings.
- Unlike the Timepix-based detectors, the Medipix3 offers several operation modes for the counting measurement. The list of modes is described in the following section.

Overview of Medipix3 read-out chip operation

Each pixel of the Medipix3 (MPX3) chip has **two thresholds** and **two 12-bit counters**, which can be alternatively merged with one **24-bit counter**, providing enhanced dynamic range.

In principle, two main modes of operation are available:

1. **Single Pixel Mode (SPM):** every pixel works independently of its neighbors, analogous to Timepix-based devices.
2. **Charge Summing Mode (CSM):** two thresholds are used for energy discrimination. The algorithm is as follows: the detected quantum of radiation generates an electric charge in the sensor. The charge is typically collected to two or more pixels and creates an electric signal in each pixel. The signal is compared to the first threshold in every pixel. Signals below the threshold are cut off (similar to the SPM). The signal/charge of 4 neighboring pixels is reconstructed (summed) and assigned to the pixel with the largest charge deposition. The result is then compared to the second threshold, signals below the threshold are omitted.

The CSM suppresses the effect of charge sharing and the images are sharper in comparison to the SPM.

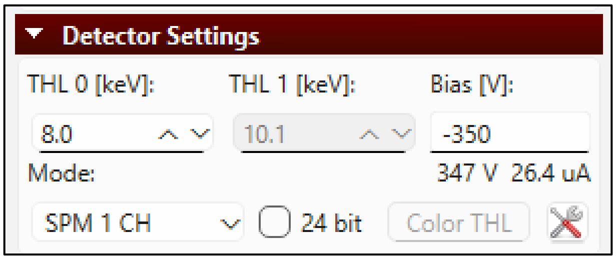
Both modes can be moreover operated in several **ranges** which define the minimal and maximal achievable threshold. Selection of the range affects also further properties, such as the energy resolution and stability (noise) of the detector. The range setting can be found in literature under the term “gain mode”.

Setting the operation mode and counter depth

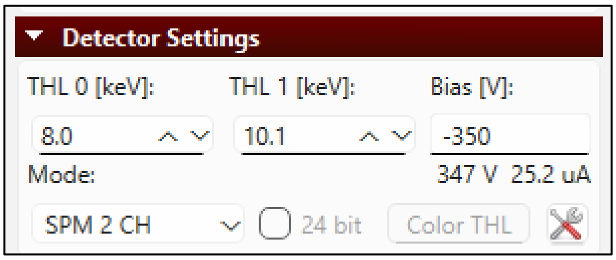
More details in section: **3. Practical examples of measurements**

Mode of operation can be selected via drop-down list in the **Detector Settings** panel:

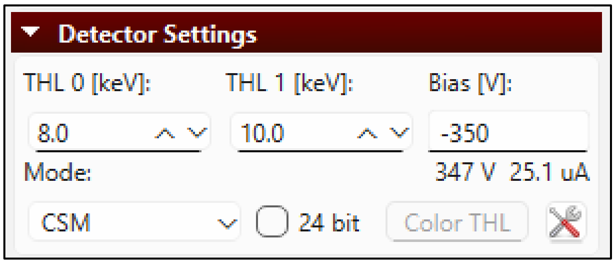
SPM 1 CH (Single Pixel Mode – one channel) One counter is in use. One energy threshold (energy channel) is available. Output: one 12-bit or 24-bit image representing the number of events per pixel.



SPM 2 CH (Single Pixel Mode – two channels) Two counters are in use. Two energy thresholds (energy channels) are available. Output: two 12-bit images representing the number of events per pixel.

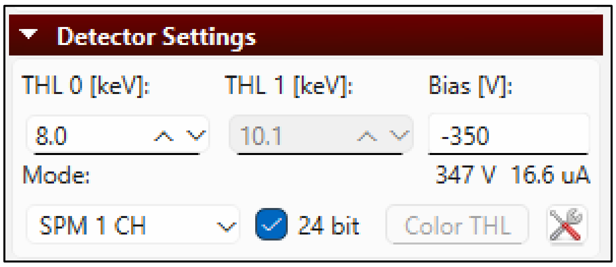


CSM (Charge Summing Mode) Two energy thresholds are in use. Output: one 12-bit or 24-bit image representing the number of events per pixel. For more information see tutorial How to use CSM.



After changing the operation mode, values of the energy thresholds may change according to the respective energy calibration.

Counter depth is set to 12 bits by default. Check the checkbox in **Detector Settings** panel for 24-bit depth.



Setting the range – advanced

Click on the ***More Detector Settings*** button in the **Detector Settings** panel. New window will appear. Select the range in the drop-down list within the **Settings section** of the first **Detector** tab:

- **Broad** – the largest threshold range.
- **Narrow** – better energy resolution at lower energies.
- **Super Narrow** – very limited threshold range, the best energy resolution at lower energies, better signal-to-noise ratio, this range does not support CSM operation mode.

Click ***OK*** to confirm the changes.

By default, the detector will be calibrated for the **Narrow** gain mode. Additional gain modes can be added upon request. **Broad range** and combination of **Super narrow mode with CSM** is not available with silicon detectors.

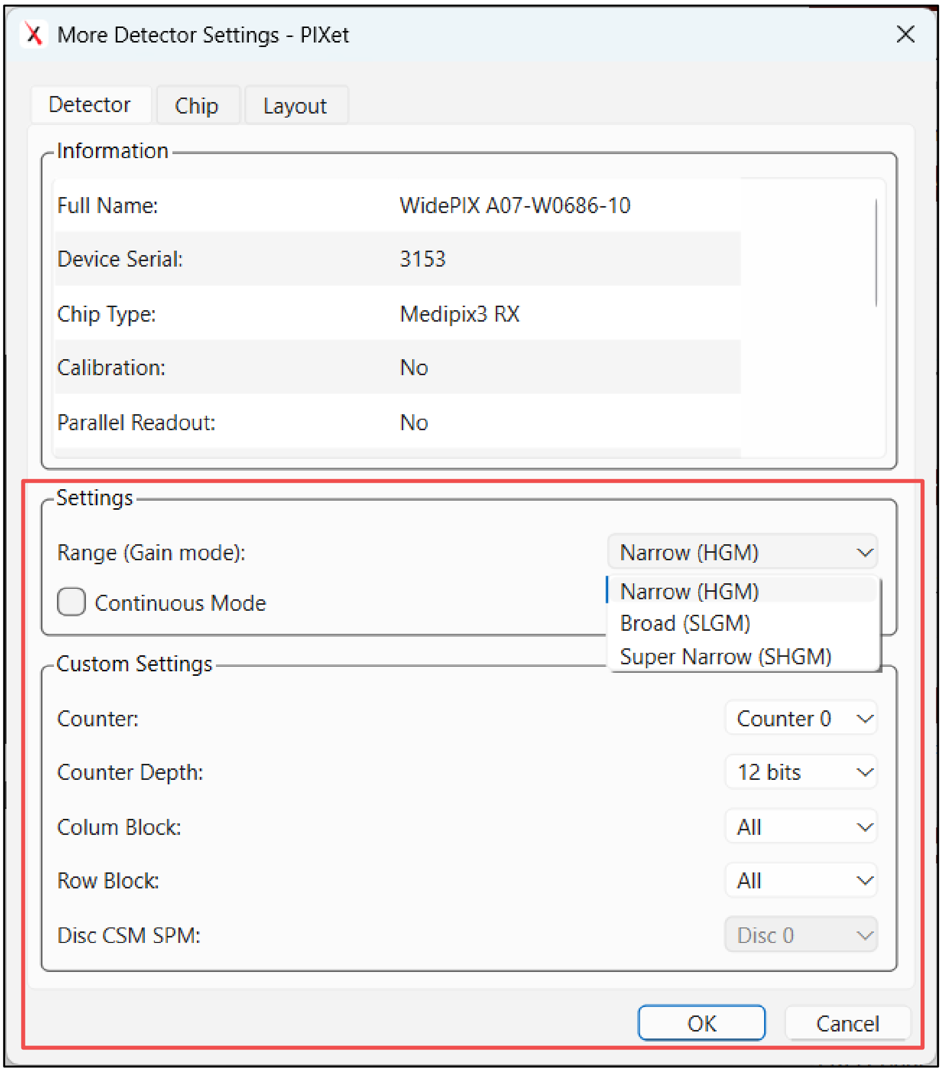


Figure 14: More detector settings

Note: **More Detector Settings** section is intended for **expert users only.** Any modification of **Custom Settings** section may lead to unpredictable behavior of the device!

Useful tips and how-tos

Here are several tips for more effective and comfortable use:

- Composition of panels on the right side of the **Pixet** window can be configured in *Panels* in menu bar.
- Orientation of the image (rotation, mirroring) can be customized in *View* drop-down list in menu bar.
- To keep the aspect ratio of the image, click on ***View > Ensure Aspect Ratio*** in menu bar.
- Default colormap is gray. Colormap can be selected via drop-down list under the ***Multicolored icon*** located in main toolbar.
- **Image Properties** panel allows you to adjust brightness and contrast of the displayed images by setting the range to be displayed. ***Auto range*** option provides automatic adjustment.
- **Advanced Image Properties** panel allows to set **gamma correction** for better visibility of features within measured sample.
- **Pixet** allows opening and showing previously saved images by drag and drop into image area of the **Pixet** window. When multiple images are dragged and dropped, one can browse them using blue arrows in the main toolbar.
- Images can be zoomed by holding the left mouse button in the frame, dragging the mouse to create a selection rectangle and releasing the mouse button. To restore the original frame size, double click on the image.
- Application output including error messages are shown in **Messages** panel.
- In case of hardware disconnection, the device can be reconnected by clicking ***File > Reconnect*** in menu bar without restarting **Pixet** application.

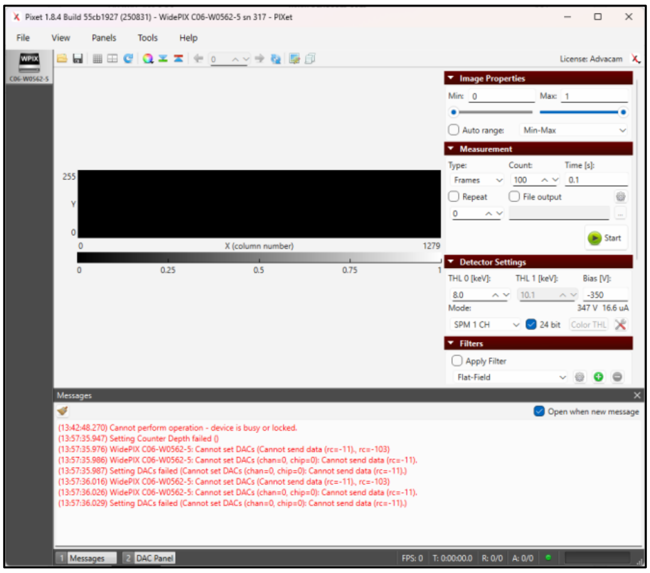


Figure 15: Message panel with Error messages.

Synchronization

This feature is available for **WidePIX CHROMATIC Industry** and **SenseEdge** models upon request. For detailed information, please contact ADVACAM Support support@advacam.cz.

3. Practical examples of measurements

Measurement in SPM 1 CH – using one threshold

Set the device to **SPM 1 CH** operation.

Switch on / off the **24-bit** counter depth (optional).

Set first threshold (if needed) **THL 0 [keV]** to desired value (It is not recommended to use lower value than shown after *Loading Config file*). Second threshold **THL 1 [keV]** is not in use for this operation mode.

Note: If **[keV]** is not shown, Config. file was not loaded.

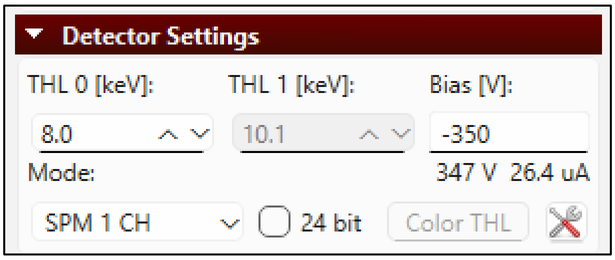


Figure 16: Detector setting for SPM1

Controlling the measurement parameters via Measurement panel

Select type of measurement in **Type** drop-down list. There are two options:

For single acquisition select ***Frames*** and set parameter **Count** to 1.

Integral – several acquisitions are added to one frame. Number of acquisitions to be added is defined by parameter **Count**.

Set the exposure time of individual frame acquisitions in seconds using **Time [s]**.

Checking the ***Repeat*** checkbox and setting the number of repetitions using the text box underneath will cause repeating the defined measurement several times. Setting the number of repetitions to zero value means "repeat forever". If the ***Repeat*** checkbox is unchecked, the number of repetitions is not in use.

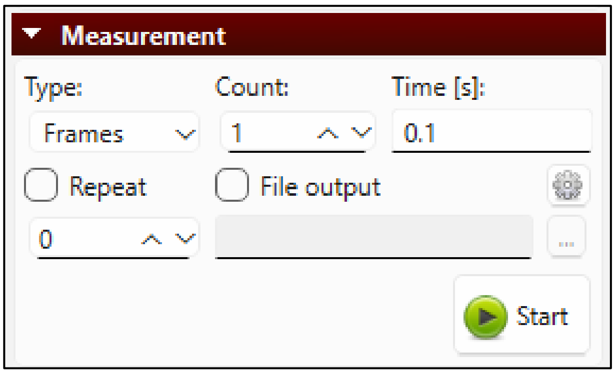


Figure 17: Measurement panel

Note: In case of combining ***Repeat*** and ***Frames***, it is advisable to set the **Count** parameter to value greater than 1, especially for acquisition times shorter than 1 s. This prevents unwanted increase in dead time measurement.

Starting the measurement

Start / stop the measurement using ***Start / Stop*** button on the **Measurement panel**. Progress of the measurement is shown in the status bar at the bottom of the window.

Once the measurement is finished, the measured frame is shown in the image preview area of the **Pixet** window.

Automatic saving of measured data

Check ***File output*** in **Measurement panel** for automatic saving. Then click on the button with three dots. A system dialog window will appear to Select the target destination and filename. Confirm by clicking the ***Save*** button. Measured data are saved automatically during the measurement. A warning dialog will appear if the file name and destination is used for another measurement.

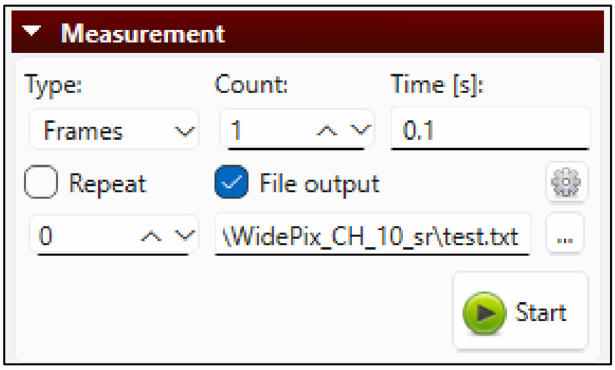


Figure 18: Automatic saving example.

Two files are saved by default to each frame:

- data file (*.txt*)
- Description file (*.dsc*) which contains information about the device, used configuration, measurement settings, etc.

For detailed **Saving option**, see YouTube tutorial Data saving and Data format

Manual saving of measured data

Click on ***File > Save Data*** option in menu bar or ***Saving icon*** or ***Ctrl + S***. A system dialog window will appear. Select what you want to save, see Figure 19.

Save raw data option will save last set of measurements. ***Save Current Frame*** option will save current frame from screen with applied filters. Option ***Save All Frames*** is similar to the ***Save raw Data*** in this case.

Select the target destination and filename and confirm by clicking the ***Save*** button.

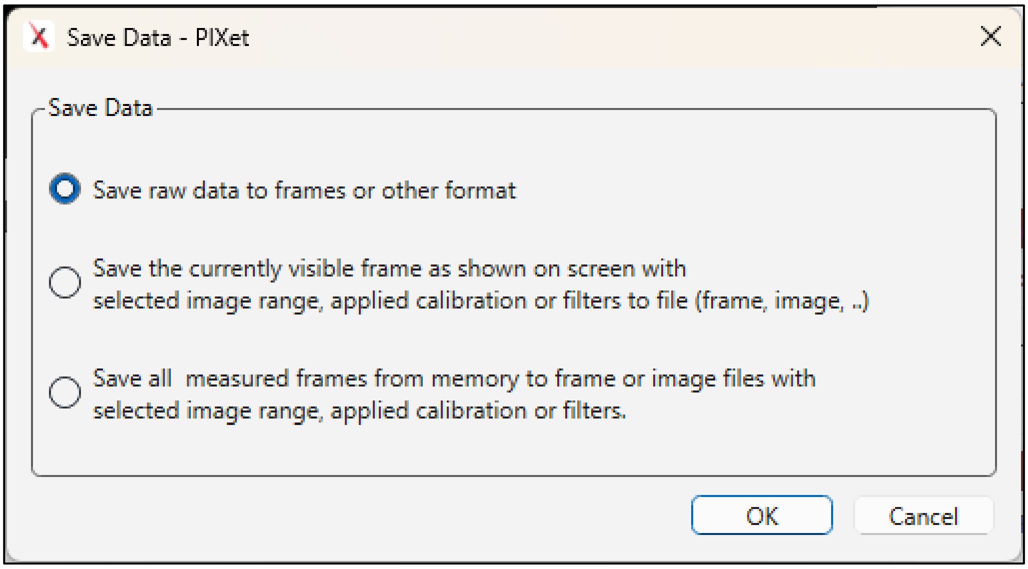


Figure 19: Saving options

Measurement in SPM 2 CH – using two thresholds

- Set the device to **SPM 2 CH** operation mode as described above.
- 24-bit counter depth is not available.
- Set both thresholds **THL 0 [keV]**, **THL 1 [keV]** to desired values. Second threshold should be higher than the first threshold. It is not recommended to use lower value than shown after ***Loading Config file***.

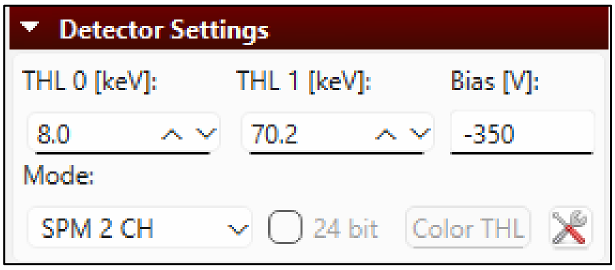


Figure 20: Detector setting for SPM 2. THL 1 should be higher than THL 0

Controlling and starting the measurement is same as in example for SPM 1.

Once the measurement is finished, the measured frames are shown in the image preview area of the Pixet window. Use buttons below the image to switch between the energy channels.

Saving measurement is similar as in example for SPM 1 CH. Four files are saved by default:

- data file (*.txt*) for first channel with ending "_THL0"
- description file (*.dsc*) for first channel with ending "_THL0"
- data file (*.txt*) for second channel with ending "_THL1"
- description file (*.dsc*) for second channel with ending "_THL1"

Measurement in CSM

- Set the device to **CSM** operation mode as described above.
- Switch on / off the 24-bit counter depth as described above (optional).
- Set both thresholds **THL 0 [keV], THL 1 [keV]** to desired values. Second threshold must be higher than first threshold.

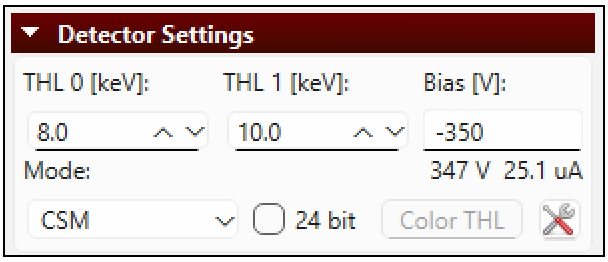


Figure 21: Detector setting for CSM

Controlling and starting the measurement is same as in example for SPM 1.

Measurement in Time Delayed Integration regime

Time Delayed Integration (TDI) is implemented for **WidePIX CHROMATIC Single Row** devices only and is available upon request. TDI can be used for continuous scanning where, for example, samples move on a conveyor belt along the detector.

To switch on / off this functionality click on ***More Measurement Settings*** button in the **Measurement panel**. New window will appear. Then check / uncheck ***Time Delayed Integration (TDI)*** checkbox in the **Advanced Measurement Settings** section on the first tab ***General***. Confirm the change by clicking ***OK***.

All operation modes, bit depths and ranges of static measurement (as described in previous section) are implemented also in TDI.

Alignment of the experiment

Sample measurement has to move along with the detector. Movement of the sample with respect to the WidePIX device must be in the sense from the top to the image bottom (i.e. towards the device readout peripheries; by default, the image in **Pixet** is oriented with peripheries at the bottom).

Set the **operation mode, counter depth** and **energy threshold(s)** as desired. Switch on the TDI regime as described above.

Measurement panel

- Set the **Type** of measurement to ***Frames***.
- Set number of frames into **Count**.
- ***Enable repeating*** and set number of **Repeats**.
- Set acquisition **Time [s]** corresponding to the movement of the sample by chip size (dead time for the chip read-out should be included). The chip size is 256 × 0,055 = 14,08 mm. Hence, the exposure time corresponds to the speed the sample moves along this distance. To achieve perfect synchronization time can be optimized by evaluation of object sharpness.

4. Advanced control using Python Scripting

The **Pixet GUI** has **Python Scripting**. This plugin allows the user to perform complex measurements controlling the detectors automatically via Python commands and scripts. Click on the ***Python Scripting*** icon on the right edge of the main toolbar to start the **Python Scripting** plugin. A new window with simple editor will open. The window contains a python console, where python commands can be run one by one with immediate output. The console also contains the output of executed python script.

The **Python Scripting** embeds a full **python 3.12** (for Pixet Pro 1.8.4 and older, **python 3.7.x** was used) interpreter including the standard python libraries. All standard functionality of python is therefore accessible. Please refer to www.python.org or www.learnpython.org for more information about Python programming language. List of functions can be found also in the main panel of the **Python Scripting** window ***Help > Function List...***

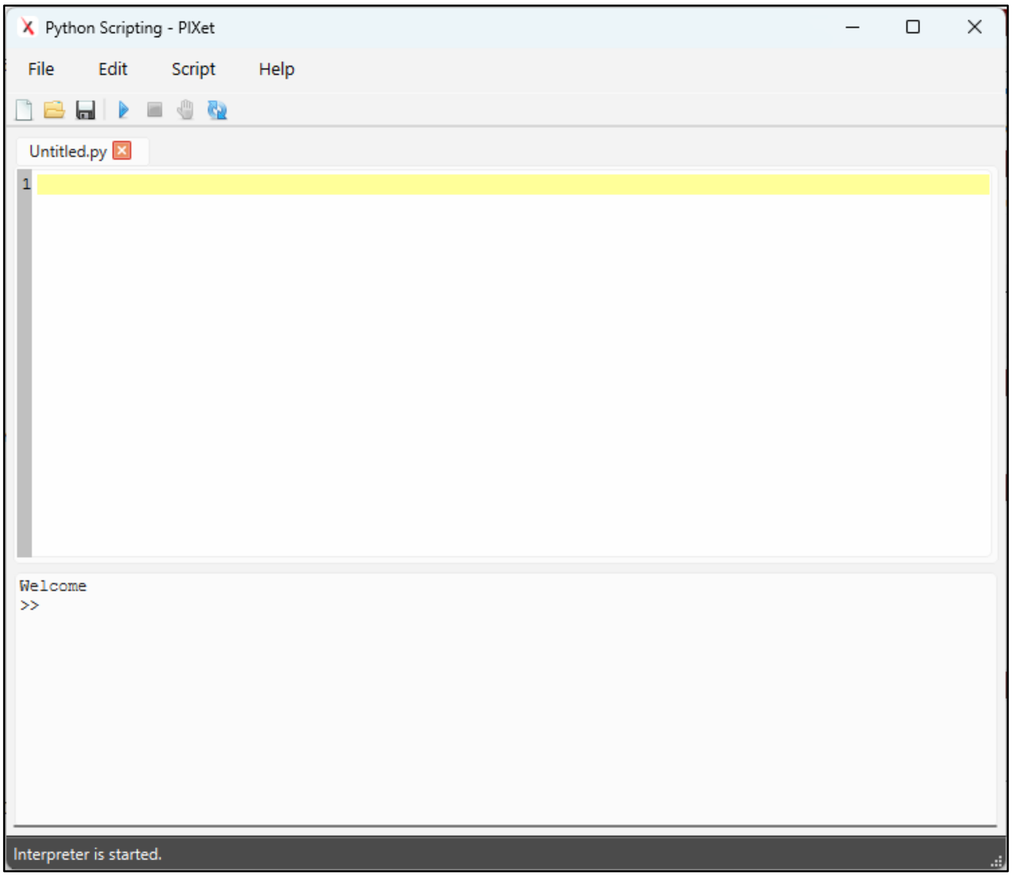


Figure 22: Python Scripting window.

The **Pixet API** (Application Programming Interface) is accessible in the scripts via a **pixet** variable. This variable represents the **IPixet** object that provides all the necessary methods to get information about all connected devices, log messages to log file, access the **Pixet** menu, etc. A list of all available objects, methods and constants of the **Pixet API** can be found on Python API.

Sample script #1

Detector settings (operation mode, counter depth, range, threshold), simple acquisition

```
# get list of all connected Medipix3 devices
devices = pixet.devicesByType(pixet.PX_DEVTYPE_MPX3)

# get first device from list
dev = devices[0] # returns IDevMpx3 object

# set operation mode
dev.setOperationMode(pixet.PX_MPX3_OPM_SPM_1CH)
#     SPM 1 CH:  pixet.PX_MPX3_OPM_SPM_1CH (0)
#     SPM 2 CH:  pixet.PX_MPX3_OPM_SPM_2CH (1)
#     CSM:       pixet.PX_MPX3_OPM_CSM (2)

# get operation mode
print('Operation mode: ' + str(dev.operationMode()))

# set counter depth
dev.setCounterDepth(pixet.PX_MPX3_CNTD_24B)
# 12 bits:  pixet.PX_MPX3_CNTD_12B (2)
# 24 bits:  pixet.PX_MPX3_CNTD_24B (3)

# get counter depth
print('Counter depth: ' + str(dev.counterDepth()))

# set range
dev.setGain(pixet.PX_MPX3_GAIN_SUPERHIGH)
#     Super Narrow: pixet.PX_MPX3_GAIN_SUPERHIGH (0)
#     Narrow:       pixet.PX_MPX3_GAIN_HIGH (1)
#     Broad:        pixet.PX_MPX3_GAIN_SUPERLOW (3)

# set threshold
th_index = pixet.PX_MPX3_TH0  # index of threshold to be changed
# THL 0: pixet.PX_MPX3_TH0 (0)
# THL 1: pixet.PX_MPX3_TH1 (1)
chip = 4              # chip index (chips are counted from 0!, choose Chip number - 1)
# chip #1:   0
# chip #5:   4
# all chips: pixet.PX_CHIP_ALL (-1)
```

```
th_energy = 30          # new value of threshold in keV
dev.setThreshold(chip, th_index, th_energy, pixet.PX_THLFLG_ENERGY)

# acquisition
acqCount = 1      # number of acquisitions
acqTime = 10      # time of acquisition in seconds
dev.doSimpleAcquisition(acqCount, acqTime, pixet.PX_FTYPE_NONE, '')

# get last acquired image
frame = dev.lastAcqFrameRefInc()
data = frame.data()
```

Sample script #2

Integral acquisition, saving the data

```
# get first device from list of all connected Medipix3 devices
dev = pixet.devicesByType(pixet.PX_DEVTYPE_MPX3)[0]

# set operation mode
dev.setOperationMode(pixet.PX_MPX3_OPM_SPM_2CH)

# set acquisition parameters
acqCount = 10       # number of acquisitions for integral measurement
acqTime = 0.1       # time of one acquisition
fileName = './test/image.txt'

# integral acquisition, saving
dev.doSimpleIntegralAcquisition(acqCount, acqTime, pixet.PX_FTYPE_AUTODETECT, fileName) # data are automatically saved
```

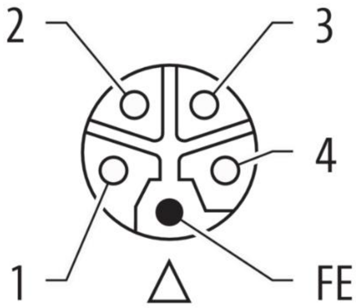
Sample script #3

Threshold scan

```
# get first device from list of all connected Medipix3 devices
dev = pixet.devicesByType(pixet.PX_DEVTYPE_MPX3)[0]

# set operation mode
dev.setOperationMode(pixet.PX_MPX3_OPM_CSM)

# set acquisition parameters
th = pixet.PX_MPX3_TH1  # index of threshold to be changed
ths = range(10,45,5)    # thresholds in keV
acqCounts = [1 for number in ths]
acqTimes = [0.1 for number in ths]
output = './test_'      # destination path

# threshold scan
for i in range(len(ths)):
    print('TH: {}'.format(ths[i]))
    dev.setThreshold(pixet.PX_CHIP_ALL, th, ths[i], pixet.PX_THLFLG_ENERGY)

    fileName = output + str(ths[i]).zfill(3) + 'keV.txt'

    dev.doSimpleIntegralAcquisition(acqCounts[i], acqTimes[i], pixet.PX_FTYPE_AUTODETECT, fileName)
```

5. Power Supply Wiring (Alternative to PoE)

When using the optional M12 connector for external power (48 V DC, min 50 W), the wiring must be done. Connect as follows:



- **Pin 1:** +48 V DC
- **Pin 3:** GND
- **Pin 2** and **Pin 4**: Do not connect (Auxiliary pins are not used in this configuration)
- **FE (Functional Earth):** Connect to chassis ground for shielding.

Ensure the Ethernet cable is used only for data transfer in this configuration.

Warning: Do **not** connect PoE and the external power adapter simultaneously!