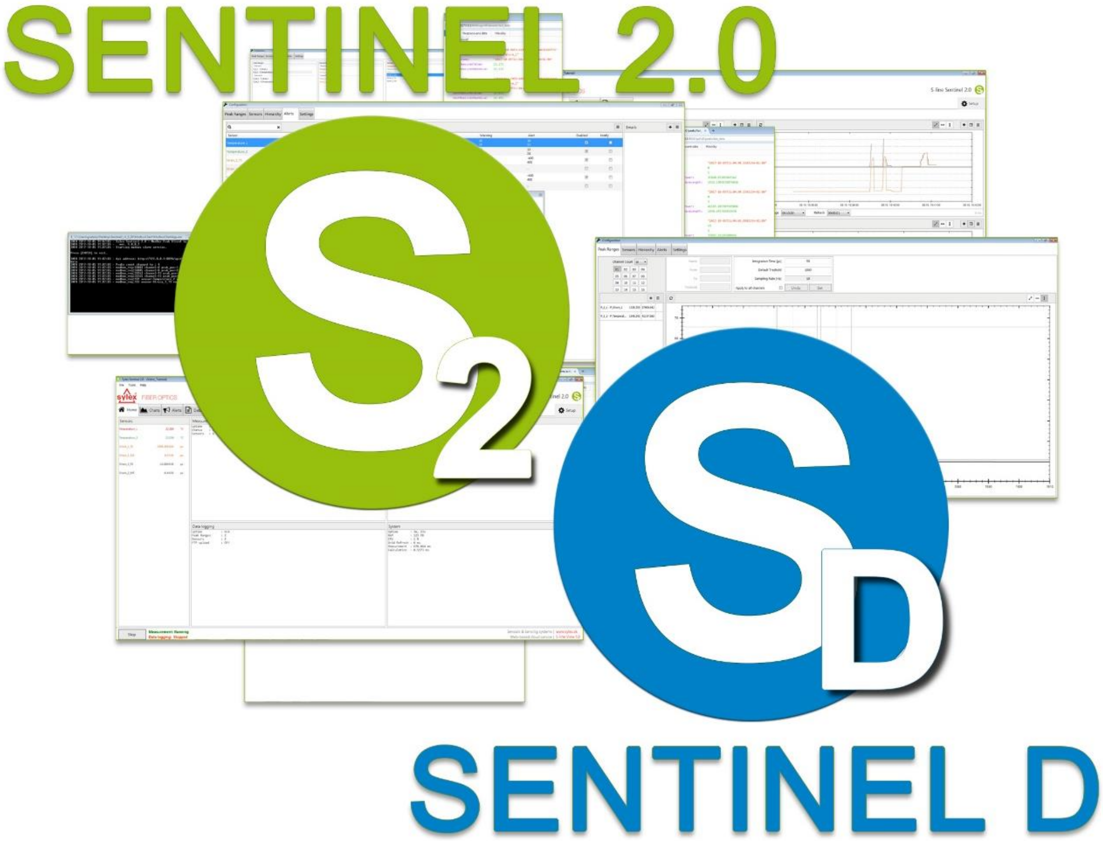
sylex® FIBER OPTICS

Sentinel 2.0, Sentinel-D software manual



Sentinel Software Manual

The current version, Sentinel: 1.1.63

The current version, Sentinel-D: 0.4.6

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1. Introduction

This manual aims to describe the installation, operation, features, and troubleshooting of the Sylex interrogator system S-line and the Sentinel software. The interrogator system from Sylex is a modular-based platform meaning that the configuration of the set-up can be later changed by exchanging certain modules like switches or splitters. All available modules from the S-line family have the same footprint and thus can be stacked on top of each other.

The system features the S-line Scan 800 with 80nm bandwidth, a maximum scanning frequency of 5kHz, and the possibility to use either static or dynamic switches. More information about the platform is available at the Sylex website: https://www.sylex.sk, under Sensing Systems.

1.1. Hardware requirements

The Sentinel software was designed to have low hardware requirements for the driving PC, however, a certain performance of the computer is necessary for the proper working of the software. The Sentinel software is a Windows-based application and thus bear in mind that the operating system needs to be Windows-based.

A list of the hardware specifications for the driving computer with the Sentinel software is listed below.

- Operating system (**OS**): x64, Windows 7 - Windows 10[1] (Ubuntu 22.04[2])
- **CPU**: Intel Pentium N4200 or better (for optimal performance, 4 cores/threads are recommended with a frequency of 2,5 GHz)
- **RAM**: 8 GB RAM or more
- **GPU**: Intel® HD Graphics 505 or better
- **Storage**: SSD
- Available Storage **Space**: 10GB or more
- **I/O:** 1x free USB 2.0 (or later) port

[1] The software can operate even on Windows XP; however, the OS is already discontinued and without the required security updates. We do not recommend running the software on an OS older than (IOT) Windows 7 x64.
[2] Sentinel can be run under Ubuntu 22.04 LTS in Demo mode using „wine“ emulator.

1.2. Industrial computer (S-line Comp 2.x)

To simplify the implementation of the interrogator system and Sentinel software, Sylex offers an industrial computer optimized for both power consumption and Sentinel software. The computer, as any other S-line module, features the same footprint and is thus possible to be stacked below or above the interrogator unit.

The computer features industrial components that should ensure a 24/7 operation of the hardware even in harsh environments. The system performance of the computer is listed below.

- Operating system (**OS**): x64 Windows 10
- **CPU**: Intel Pentium N4200, 4×1,1GHz (2,5Ghz turbo), 2MB Cache
- **RAM**: 8GB DDR3 1866MHz CL13
- **Network**: 2 x 10/100/1000 Mbps (Supports WOL), RJ-45 connector, 802.11 ac/a/b/g/n + Bluetooth 4.1
- **GPU**: Intel Gen9 graphic engine
- **Storage**: SATA III, 128GB SSD
- **Power** consumption: 9-18V, 17W (peak performance)
- **I/O:** 4x USB 2.0, 2xUSB 3.0, Wi-Fi, VGA and HDMI (2560×1600 at 60Hz / 1080P at 60Hz)

2. Hardware Installation

The installation of the hardware (interconnecting with all active and passive modules) is fairly simple. All modules including the computer, if ordered from Sylex, are pre-prepared in the production and tightened together using side plates for each floor. The interconnection between the interrogator and the S-line switch is done through a D-SUB connector located between the interrogator and the switch and is thus hidden. The power adaptors and small accessories are a standard part of the delivery.

The interrogator operates and is driven through the USB port and thus the connection to the computer is made through a free USB port[3]. If a third-party computer is used for driving the interrogator and the software, necessary steps need to be taken to ensure the recognition of the hardware and proper operation.

After connecting the system to the PC for the first time (third-party computer or additionally both S-line Comp), Windows OS will recognize the new hardware, *Figure 1*, through the USB bus (including a new flash drive). The new hardware represents the internal serial link and the internal spectrometer. The serial link is in most cases recognized by the system since it uses standard drivers, however, the spectrometer needs to be installed using the appropriate drivers.

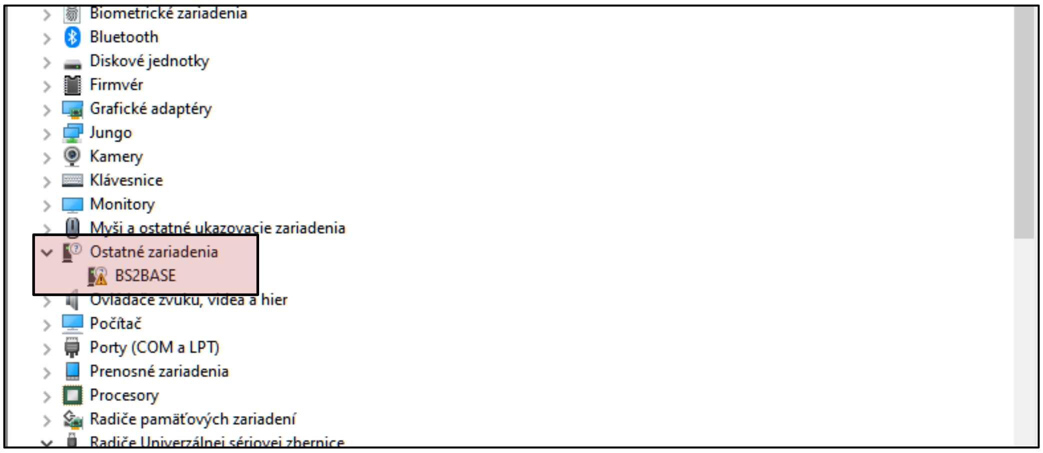


Figure 1: Unknow hardware detected by the OS after connecting the unit to the PC for the first time.

[3] The USB cable for interconnecting the interrogator to the computer is a part of the delivery.

The newly discovered flash drive, *Figure 2*, which is an essential part of the S-line interrogator includes all necessary drivers, libraries, and tools to ensure that the hardware and software will work properly. The missing drivers for the spectrometer are located on the flash drive inside the folder named: **bs_drivers**. Update the drivers within the Windows device manager (⊞ + r, and type: devmgmt.msc) and navigate to this folder within the flash drive.

We recommend that you install as well the drivers, and executables, inside the folder named: **itr_drivers**. You need to execute the installation using administration privileges otherwise the installation will fail.

Other folders are for troubleshooting purposes, error fixes, or administration tools. An important part of the flash drive content is the calibration file for the spectrometer. The file is located within the root of the drive and is named: **Calib_LT_Fxxxx.dat**. The file is saved while the software starts but for troubleshooting, make a note of the string since it represents the S/N of the spectrometer.

```
├────Flash Drive (USB)
│   ├────Documents
│   ├────Sense 2020 USB V1.6.5.5
│   │   └────Spectrum_Data
│   ├────USB2020 Drivers
│   │   ├────32 bits
│   │   └────64 bits
│   └────VC2005 SP1 Redistributable Package
├────dev_fixes
│   └────BaySpec Revover Factory Setting V2200
├────dotnet_fixes
    ├────VC80.MFC
├────itr_drivers
└────bs_drivers
    ├────32bit
    ├────win7_64bit
    └────win8_10
```

Figure 2: Folder structure of the flash drive located inside the S-line module.

3. Software Installation

The Sentinel (Sentinel D – version of the software Sentinel software with dynamic options) software can be downloaded either from the Sylex website or directly requested from the sales team. The software is provided free of charge to every unit (interrogator) from the Sylex portfolio.

The downloaded software is a pre-compiled comprised package and does not require installation. However, administrative privileges are required for certain features. The package can be unpacked anywhere on the hard drive since it is not dependent on any other third-party package. The software uses .Net 4.0 which should be standardly available in all supported operating systems.

```
Application root:
├────DataLogs
├────Drivers
├────Export
│    └────.out
├────licences
└────Sensors
```

Figure 3: Root folder structure of the Sentinel application.

DataLogs – default folder for system data logs. The software saves system events, like alarms, automatically within this folder to keep a track record of the events that were raised during the run. Next to these, the software supports a so-called “default logging” that saves all the data acquired by the system without considering the actual data logging settings. These files include all acquired data without downsampling. The default file location can be changed by altering the “configuration” file manually.

Drivers – the folder includes the basic libraries to run the software. These libraries are essential and should not be altered.

Export – default folder for data logging and saving data. The Sentinel software supports data logging on the fly or FTP. Both files are saved within this folder where the “local” data are kept on the hard drive and the FTP data, within a subfolder called .out, are after sending to the remote location deleted. The default file location can be changed by altering the “configuration” file manually.

Sensors – default project folder. The Sentinel software features saving and loading project files that include the settings of the interrogator and sensors. The default file location can be changed by altering the “configuration” file manually.

3.1. Altering the configuration file

The Sentinel (Sentinel D – version of the software Sentinel software with dynamic options) software has a pre-defined folder structure for saving data and projects, and although the project file can be saved using the dialogue window in a random location, the software uses the pre-defined path of the project file location for other options. To change the default location for data saving, default data saving, and project files, the user has to manually alter the configuration file before starting the application.

The location of the configuration file is within the root folder, filename: **config.ini**. The file can be changed using any text editor like “notepad”. The code snippet below shows the default content of the configuration file with two categories a) general – free to change by the user, and b) advanced – do not recommend to be changed by the user.

```
[General]
;projects_folder_path = c:\tmp\Sentinel\Sensors
;data_logs_path = c:\tmp\Sentinel\DataLogs
;export_folder_path = c:\tmp\Sentinel\Export

[advanced]
multiple_peaks_in_range_is_nan = true
debug_nan_calculus = true
external_switch_delay_ms = 15

software_peak_detection_enabled = false
software_peak_detection_max_count = 24
```

Code snippet 1: Content of the configuration file config.ini - Sentinel.

```
[General]
;projects_folder_path = c:\tmp\Sentinel\Sensors
;data_logs_path = c:\tmp\Sentinel\DataLogs
;export_folder_path = c:\tmp\Sentinel\Export

[device]
;serial_port = COM4

[advanced]
multiple_peaks_in_range_is_nan = true
```

Code snippet 2: Content of the configuration file config.ini – Sentinel-D.

To change the default location of the general-purpose folders, remove the semicolon at the beginning of the line and alter the location with an absolute path of your choice. This is possible to be modified for both the Sentinel and SentinelD configuration files.

Sentinel (config.ini) | options:

- `multiple_peaks_in_range_is_nan = | value: TRUE, FALSE` – allows the coexistence of more than one peak within one peak range (the first peak from the left will be taken into account)
- `debug_nan_calculus = | value: TRUE, FALSE` – enables a higher option of debugging within the log file
- `external_switch_delay_ms = | value: integer (ms)` – add extra delay during switching of the static switch
- `external_switch_delay_ms = | value: integer (ms)` – add extra delay during switching of the static switch
- `software_peak_detection_enabled = | value: TRUE, FALSE` – adjust the peak fitting, S-line Scan 400 only
- `software_peak_detection_max_count = | value: integer` – adjust the peak fitting count, S-line Scan 400 only
- `serial_port = | value: string, COM port number, i.e. COM4` – force the interrogator to look for the switch on the specific serial port, Sentinel-D only

3.2. Start-up attributes of the application

Both the Sentinel and Sentinel D (Sentinel D – version of the software Sentinel software with dynamic options) software feature start-up attributes that can be evoked during the execution of the application to automate the behavior of the application. These attributes can be utilized within a bash script or Windows task to automatically execute the application with defined options and for example, restart the data logging after a power failure.

Note: type ClientApp.exe -h within the CLI to get the full description of all options.

```
Usage:
  ClientApp.exe [<option>...] <project file>

Where:
  <project file>               ssd project file

<option>:
  -h                              print this message
  -autolog=[YES|NO]               (default: YES)
  -switch=[AUTO|NA|COM?]          (default: AUTO)
  -driver=[LOCAL|LOCAL400|REMOTE|LEGACY] (default: LOCAL (S-line800))
  -device_port=[COM?]
  -ip=<ip address>                ip address of remote driver
  -ch_sw_delay=<delay in ms>      (default: 10ms)
  -api_autostart                  (default: disabled)
  -api_port=<ip port>             api listening port (default: 8024)
```

Code snippet 3: Available attributes for the Sentinel application.

```
Usage:
  ClientApp_Dyn.exe [<option>...] <project file>

Where:
  <project file>               ssd project file

<option>:
  -h                              print this message
  -autolog=[YES|NO]               (default: YES)
  -switch=[AUTO|NA|COM?]          (default: AUTO)
  -device_port=[COM?]
  -api_autostart                  (default: disabled)
  -api_port=<ip port>             API listening port (default: 8024)
```

Code snippet 4: Available attributes for the Sentinel-D application.

To use the start-up attributes you need to define the project file for the application and therefore before using them, you need to set up and save your project. The project file location has to be within the default project folder location. A simple example of the use is shown below.

```
clientapp.exe -autolog=YES -switch=AUTO project.ssd
```

Code snippet 5: An example of using the start-up attributes with the Sentinel application.

To start the application during a power shortage, it is necessary to create a batch file using the attributes mentioned above and run it using the “Task Scheduler” within Windows. The settings within the “Task Scheduler” allow to run the script before the user logs on. To achieve this, the “Trigger” option of the new task needs to be set as “Begin the task: At start-up”, and within the General settings, options “Run whether the user is logged on or not” and “Run with highest privileges” needs to be checked.

To run the batch script without the user log on the “Group Policy” needs to be altered as well. Open up the Group Policy Editor using “gpedit.msc”, and navigate to Computer Management >> Windows Settings >> Security Settings >> User Rights. Within this option find “Log on as a batch job”, and add the necessary user within this setting.

Task Scheduler

- General tab
    - Security options: Run whether the user is logged on or not
    - Security options: Run with the highest privileges
- Triggers
    - Begin the task: At start-up

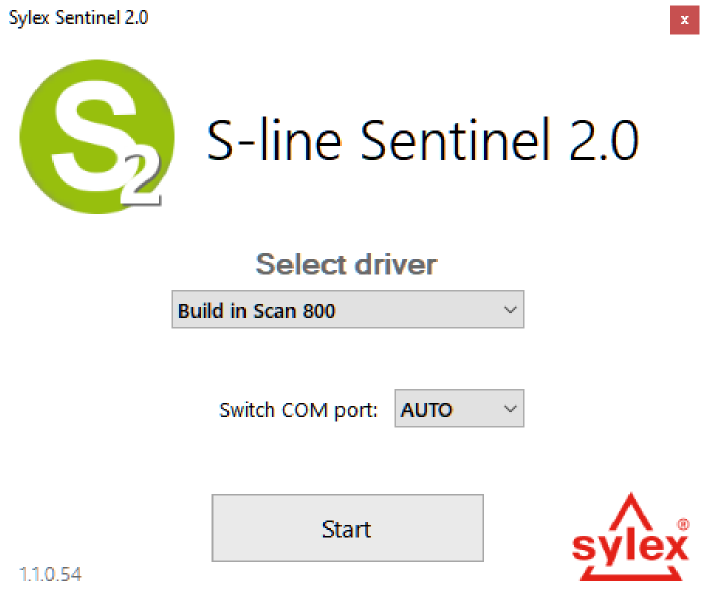
Group Policy Editor

Management >> Windows Settings >> Security Settings >> User Rights >> Log on as a batch job

4. Running the Sentinel (Sentinel-D) application

The Sentinel (Sentinel D – version of the software Sentinel software with dynamic options) software can be started by executing the “ClientApp.exe” within the root folder of the application. The application is also the only executable file within the root folder. For the Sentinel-D application, execute the “ClientApp_Dyn.exe” in order to start the application.

After starting the application, an initialization window (Figure 4) will appear with the initial settings of the application. Within this step, the definition of the hardware is set and those settings are then used during the launch of the application.



Sylex Sentinel 2.0

S-line Sentinel 2.0

Select driver

Build in Scan 800

Switch COM port: AUTO

1.1.0.54

Figure 4: Initialization window of the Sentinel application.

The initialization window provides the user with the configuration to set up the hardware and initialize the application. The settings are different for the S-line Scan 800 and the S-line Scan 400 although following the same logic. The “select driver” list allows the user to choose between the Scan 800, Scan 400, and Demo mode of the application. These settings and options apply to the Sentinel application only, the Sentinel-D application has only the S-line Scan 800 option available. The current version of the application is shown in the left bottom corner of this window.

Demo mode – allows running the application without the hardware connected and serves for learning options only.

Build in Scan 400 – allows running the application with the S-line Scan 400 hardware. During the initialization, the COM port of the 400 unit is necessary to be defined. The switch is detected automatically.

Build in Scan 800[4] - allows running the application with the S-line Scan 800 hardware. During the initialization, the unit is detected automatically and the switch port detection can be set to AUTO or to be defined with a specific COM.

Legacy HW driver[5] - allows running the application with the S-line Scan 800 hardware. During the initialization, the unit is detected.

4.1. GUI of the Sentinel (Sentinel-D) application

After passing the initialization of the application, the main window (Figure 5) with the graphical user interface will appear (GUI in short). The main window gives the user access to all settings and information about the current status of the application and measurement.

The main window of the application provides the user with information and resources the application needs to run. The window is divided into functional tabs, setup, menu, and real-time information. The left bottom corner includes the “start” button for the measurement – not data logging and feedback information if the measurement or the data logging is currently running.

Real-time information – the real-time information includes the current number and values from all defined sensors and is located in the left part of the application window – by default this table is empty. If populated, double-clicking on any of the sensors populated in the table will trigger the opening of the setup window of that sensor. If the interrogator data logging option is idle, the opened sensor setup window can be used to alter the sensor parameters. If the data logging option is turned on, it displays only information about the sensor setup.

[4] If the hardware is not properly connected or installed, the 800 driver will return an error of detection.
[5] The hardware, and internal firmware of the S-line Scan 800 unit went through a generation change, and newer revisions of the software may not be compatible with older HW.

The informative section is divided into Measurements – which indicates if the unit is running and how many sensors are defined, Alerts – if defined, how many sensors exceed the thresholds, Data logging – if the data saving options are defined and turned on, and System – shows the currently allocated resources for the application.

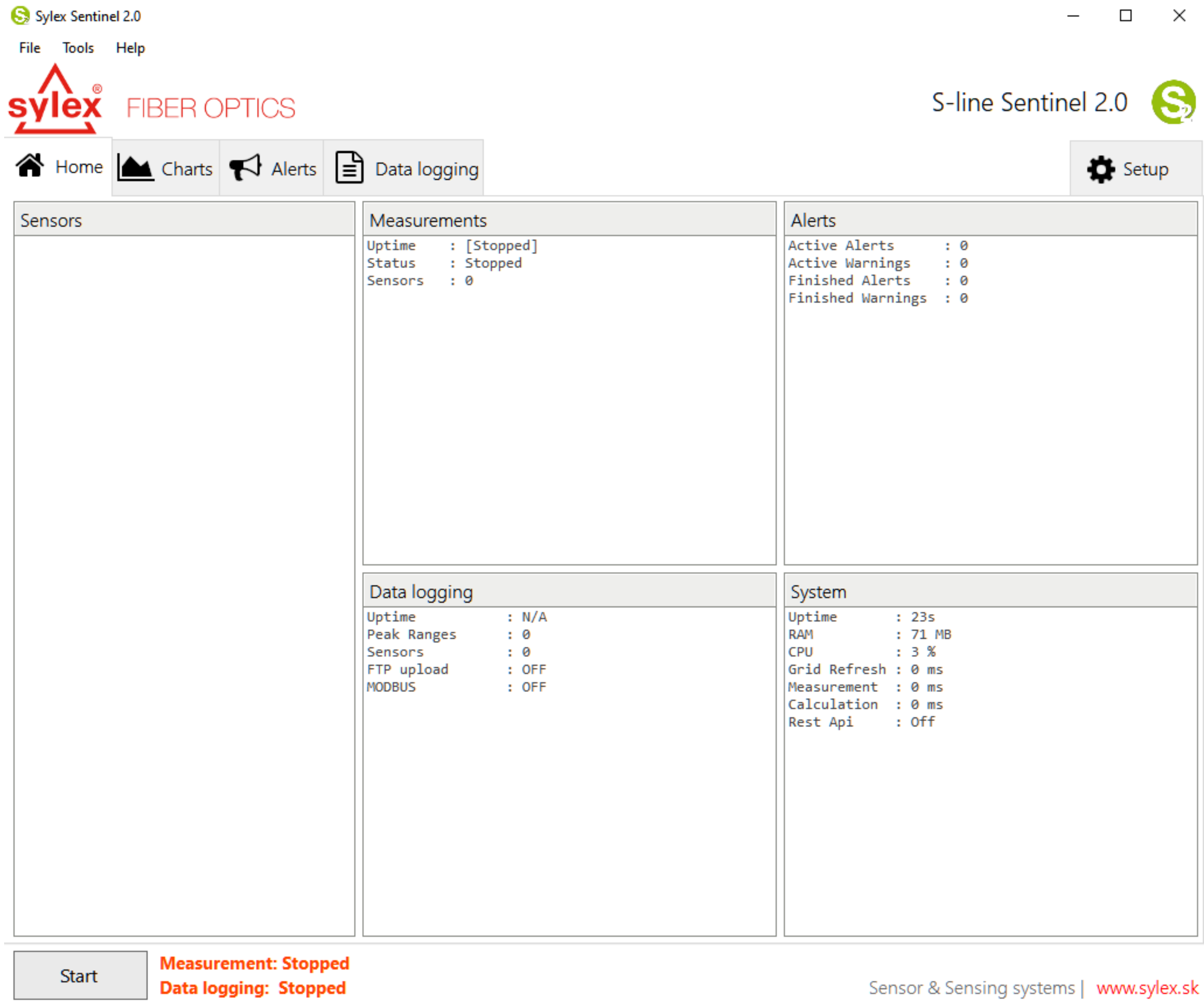
Application menu – located in the upper left part of the main window and divided between different functional options. File – used to save, open a project file or exit the application. Tools – includes some advanced functions of the application like starting the API server. Help – basic information about the application and support options.

- File – available options (New, Open, Open Recent, Save, Save As, and Exit)
- Tools[6] – available options (Administration, Debug, Import Sensors, Start API Server Mode)
- Help – available options (About)

Setup – located in the right upper corner of the application. This option will open a new window that allows the setup of the interrogator, sensors, alerts, etc… The options included within this menu will be covered in the following sections.

Functional tabs – provide the user with visualization options, alerts overview, and data logging options for the application. To use the full potential of these options, the system has to be configured and all sensors defined.

[6] Administration and Debug options are for support cases only. During a normal operations, the use of these options is not necessery.



```
Uptime    : [Stopped]
Status    : Stopped
Sensors   : 0
```

```
Active Alerts       : 0
Active Warnings     : 0
Finished Alerts     : 0
Finished Warnings   : 0
```

```
Uptime              : N/A
Peak Ranges         : 0
Sensors             : 0
FTP upload          : OFF
MODBUS              : OFF
```

```
Uptime        : 23s
RAM           : 71 MB
CPU           : 3 %
Grid Refresh  : 0 ms
Measurement   : 0 ms
Calculation   : 0 ms
Rest Api      : Off
```

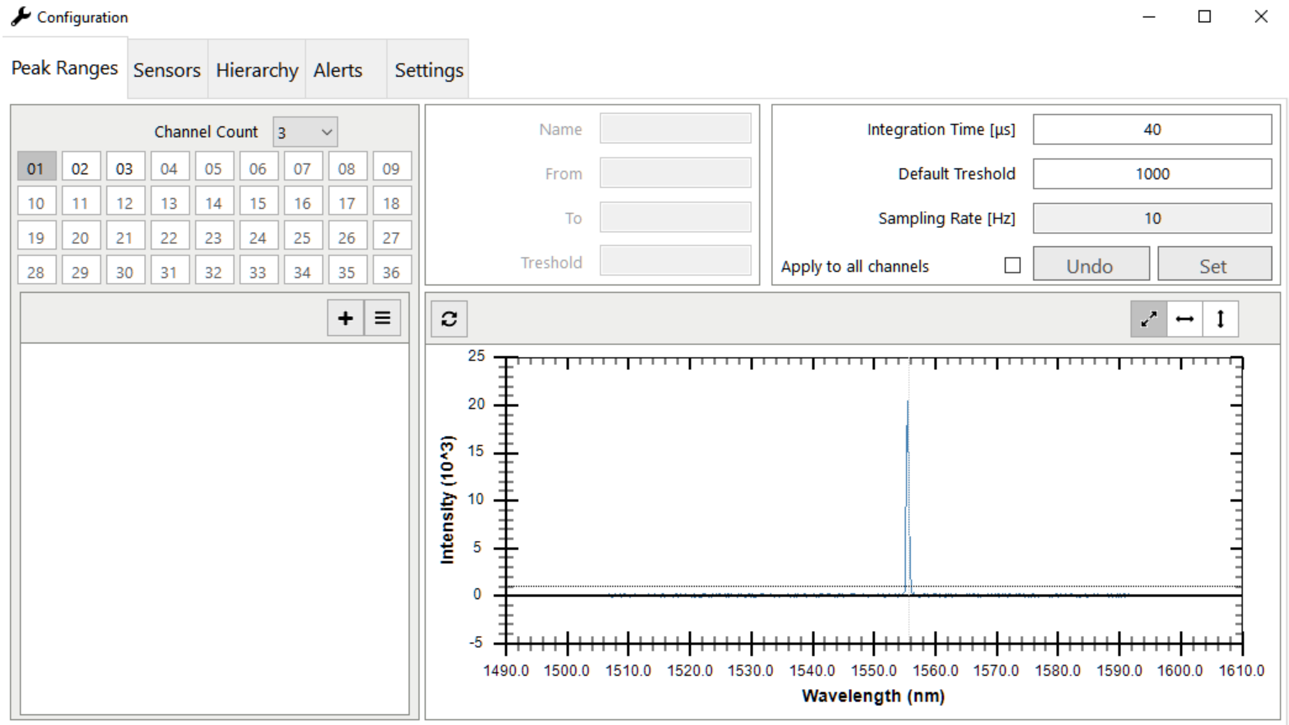
Measurement: Stopped
Data logging: Stopped

Figure 5: The main application window after initialization.

The following sections will describe the menus and functions included in the application for both Sentinel and Sentinel-D. The differences between the static and dynamic applications will be described within each section.

4.2. Setup -> Peak Ranges, Sentinel (Sentinel-D) application

Before using any other function of the software, the software needs to be properly configured concerning the sensors connected to the device (directly or through a switch). For this purpose, the “Setup” menu is used. After opening the “Setup” – located on the upper right of the screen, a new window will appear with several functions and sub-menus. The workflow of the system is logically made from left to right starting with the “Peak Ranges” – Figure 6.



Channel Count: 3

Integration Time [µs]: 40

Default Treshold: 1000

Sampling Rate [Hz]: 10

Figure 6: Definition of the connected sensors and peaks.

The “Peak Ranges” option is used to define the reflections that were detected by the interrogator, set the basic threshold, define the bandwidth within which the reflection (sensor) should work, etc… It is necessary to define individual peaks within this menu otherwise they will be not considered in consequential steps.

Channel count – the channel count of the connected switch is set automatically during the initialization, however, the user can restrict the switching. If the system includes a 16x port switch, the system will be by default switching through all channels. If only the first two channels are used, the user can restrict the channel count to 2 and so restrict the switching to only 2 channels.

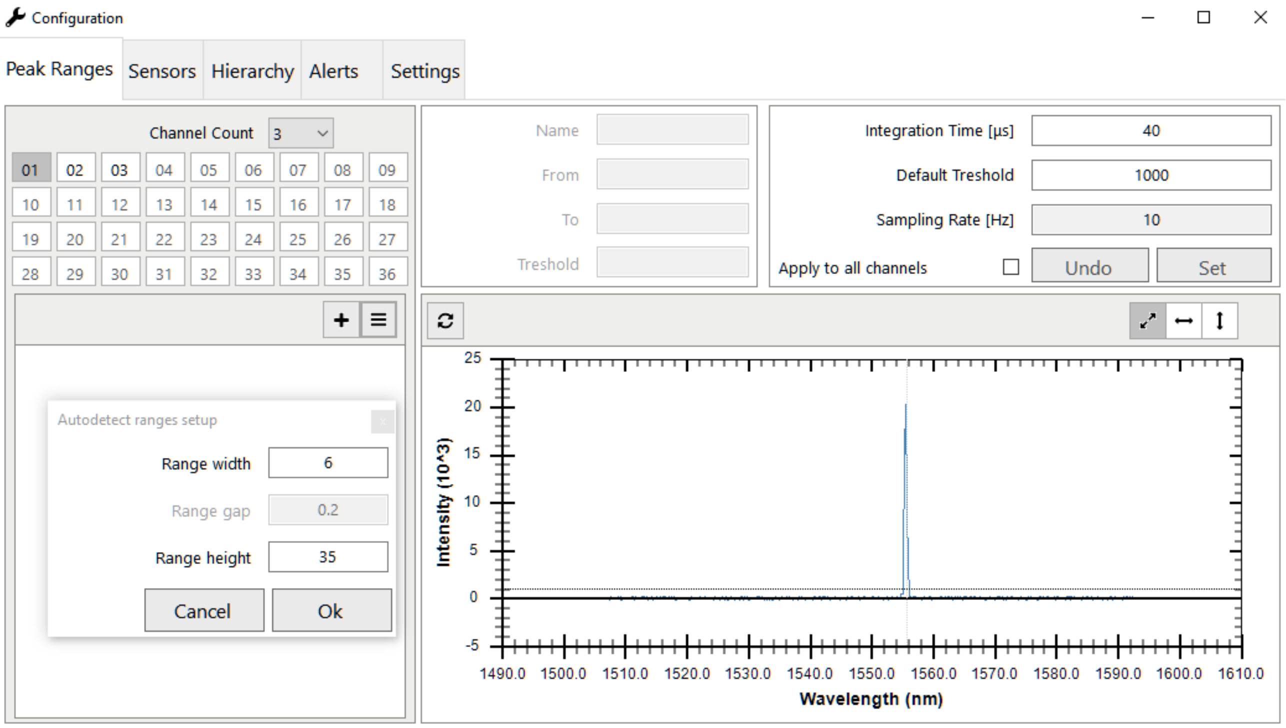
Integration time – defining the time the interrogator receives the signal at each channel. The larger the value, the more incident light will be received by the system, and thus the intensity will be larger. The maximum value of intensity is 64000 a.u. – after this value, the detector will saturate.

Default threshold - expressed in a.u. Intensity units and used for removing the bottom noise floor.

Integration time and default threshold are applied to the channels after hitting the “set” button. The system will ask if he should adapt the peak threshold automatically – changing the integration time will result in higher or lower intensity and thus the peak threshold needs to be adjusted. You can do it manually or automatically by allowing the application to do so.

To define a new peak (reflection, sensor detected by the interrogator), the user needs to first set up the integration time with an appropriate integration time - recommended resulting value of intensity above 10000 and below 55000. This can be done at each channel or for all channels at once using the check box “Apply to all channels”. After setting the integration time, a new peak range can be added by pressing the “**+**” sign below the channel count. The software will open up a new window for peak definition. A new context window will appear with all options to define the current peak.

Alternatively, the advanced “Auto ADD” function can be used by pressing the “≡” sign and choosing the “Auto ADD” option, Figure 7. The “Auto ADD” function will automatically generate peak ranges for all detected peaks at the current channel with the settings that are by default set to Range width = 6nm (3nm from the center of the peak at both sides) and Range height = 35% (second threshold starting at 35% of the intensity of the current peak). The system will create new peak ranges with default names like R_1_1 - R_1_NEW where the first part defines the position of the peak 1CH - 1Peak from the left and the second part a name for the defined peak – this name can be changed by double clicking on the created peak.



Channel Count 3

Name

From

To

Treshold

Integration Time [µs] 40

Default Treshold 1000

Sampling Rate [Hz] 10

Apply to all channels □

Autodetect ranges setup

Range width 6

Range gap 0.2

Range height 35

Figure 7: Auto ADD option for peak definition.

The advanced menu "≡" includes next to the "Auto ADD" function several more functions that can be used to enhance the user experience of the application or to overcome certain issues that can be observed by complicated sensor chains. All available options are listed below.

- Auto ADD (automatically creates peak ranges for all visible peaks)
- Delete All (delete all defined peak ranges)
- Toggle Power Column (suppress the intensity from the table)
- Advanced
  - Adaptive integration mode (not available in Sentinel-D) (utilize the speed of the unit to adjust the integration time to each peak separately)
  - Position-based search (suppresses the peak ranges and allows free movement of the peaks)
- Export spectrum (export the current channel spectrum into a text file)

4.3. Setup -> Peak Ranges (Advanced), Sentinel

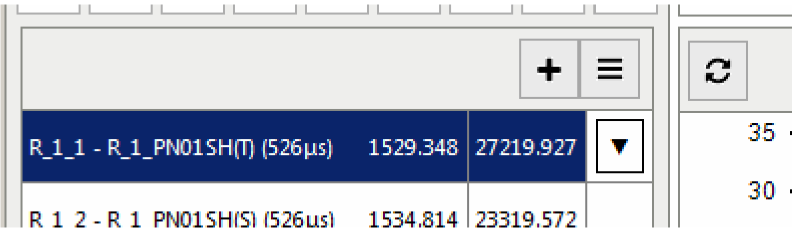
Some advanced functions within the “Peak Ranges” menu are only available for the static application Sentinel and can not be used for the dynamic application. Within these functions belong, the Adaptive integration mode and Position-based search.

Before using these functions, the system has to be properly configured and the peak ranges defined, otherwise, the system will be not able to run these functions.

Adaptive integration mode (not available in SentinelD)

This function is used to even the intensity between peaks at the same channel. In certain cases and difficult chains, the attenuation of the signal can decrease the intensity of the peaks that are further from the closest peak to the interrogator. This can be caused by connector mattings, dispersion, cable bending, etc… The effect is an uneven distribution of power on this channel that can bring the closet peak to saturation and the farthest within the noise floor.

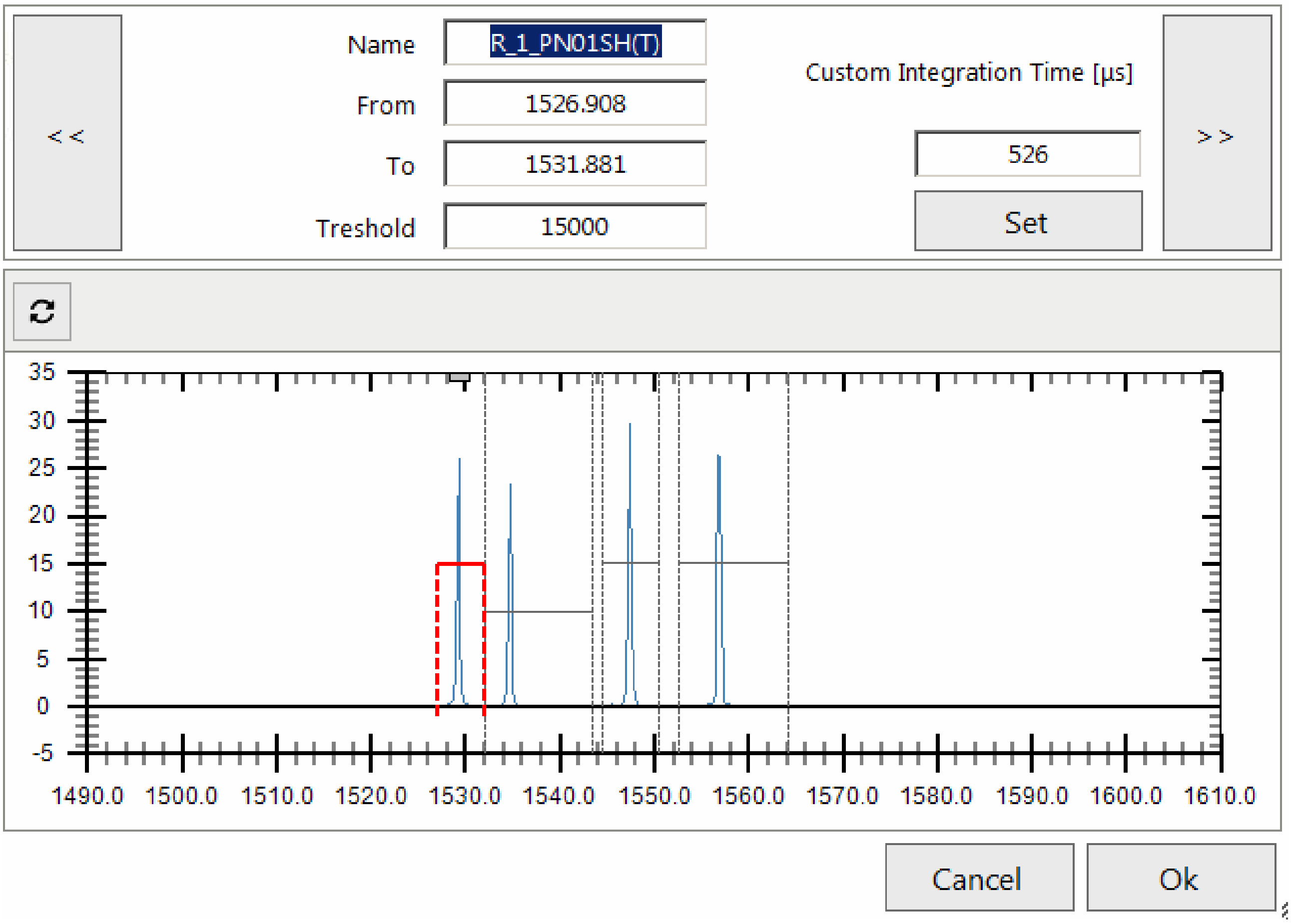
After defining the peak ranges, run the function within the “≡” menu under “Adaptive integration mode” and hit “Start”. The system will scan all ranges and adapt the integration time for each peak separately. This will allow lower integration times and higher integration times across the same channel. After the algorithm is finished, all peaks defined in the system will indicate the custom integration time value next to their name, Figure 8. You can adjust the custom integration time by double-clicking on the defined peak, Figure 9.



R_1_1 - R_1_PN01SH(T) (526µs) 1529.348 27219.927

R_1_2 - R_1_PN01SH(S) (526µs) 1534.814 23319.572

Figure 8: Custom integration time applied to the peak range.



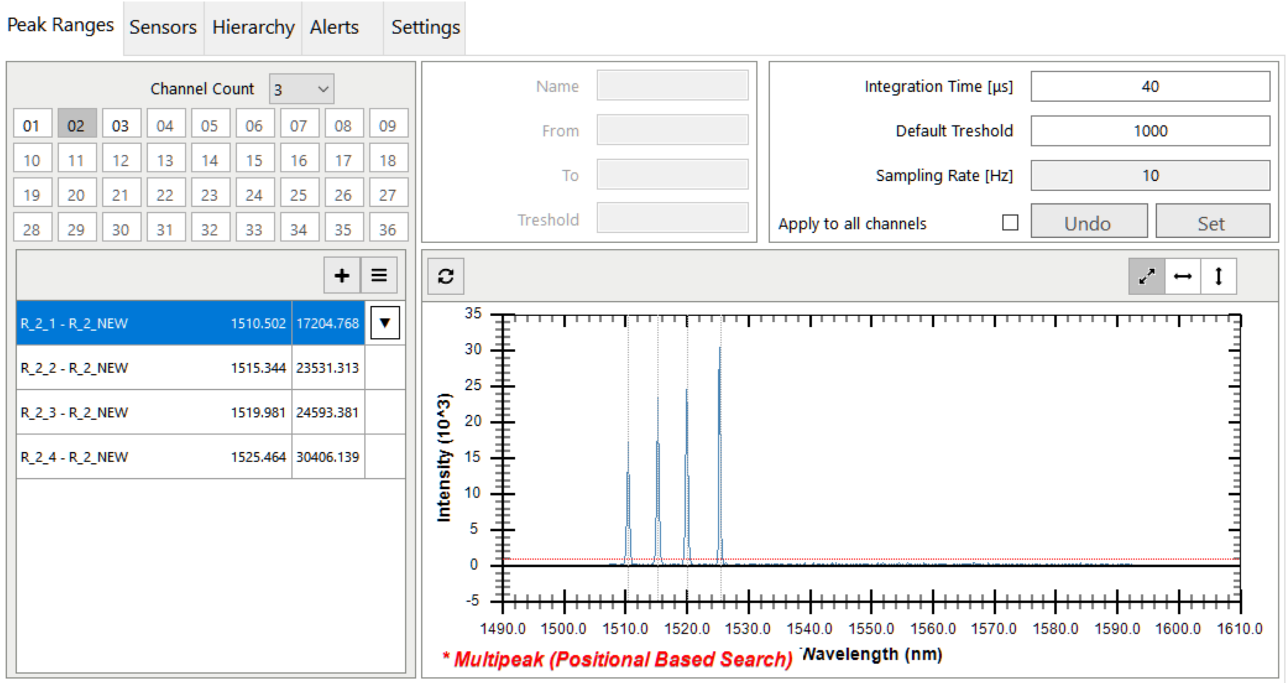
Name: R_1_PN01SH(T)
From: 1526.908
To: 1531.881
Treshold: 15000
Custom Integration Time [µs]: 526

Figure 9: Custom integration time within the peak range settings.

Position-based search (not available in SentinelD)

This function allows a free movement of all peaks at the current channel. It is used in situations with a high number of peaks in a single channel that is intended to move in the same direction at the same time in a high magnitude. To bypass the defined peak ranges, the Position-based search will create only one peak range that will include all peaks in the whole channel.

After defining the peak ranges, run the function within the "≡" menu under "Position-based search". All defined ranges will disappear from the spectrum and the system will track down the peaks according to their current position, Figure 10.



Channel Count 3

R_2_1 - R_2_NEW	1510.502	17204.768
R_2_2 - R_2_NEW	1515.344	23531.313
R_2_3 - R_2_NEW	1519.981	24593.381
R_2_4 - R_2_NEW	1525.464	30406.139

Name

From

To

Treshold

Integration Time [µs] 40

Default Treshold 1000

Sampling Rate [Hz] 10

Apply to all channels □

*** Multipeak (Positional Based Search)**

Figure 10: Enabled position-based search, also called multipeak.

4.4. Setup -> Sensors, Sentinel (Sentinel-D) application

Before creating a sensor, that translates the raw value – wavelength to a physical value like micro strains, it is necessary to define and create the peak ranges. After creating the peak ranges, the defined peaks can be used and utilized within an equation to translate the raw output to a physical value.

The sensors menu, Figure 11, is divided into two main blocks, the left side is used for creating new sensors, and the right side is for the templates. In both sections, the user can freely create either a new sensor using a template or create templates for the sensors. The Sentinel software (Sentinel-D) includes predefined templates for temperature, strain, pressure, and displacement.

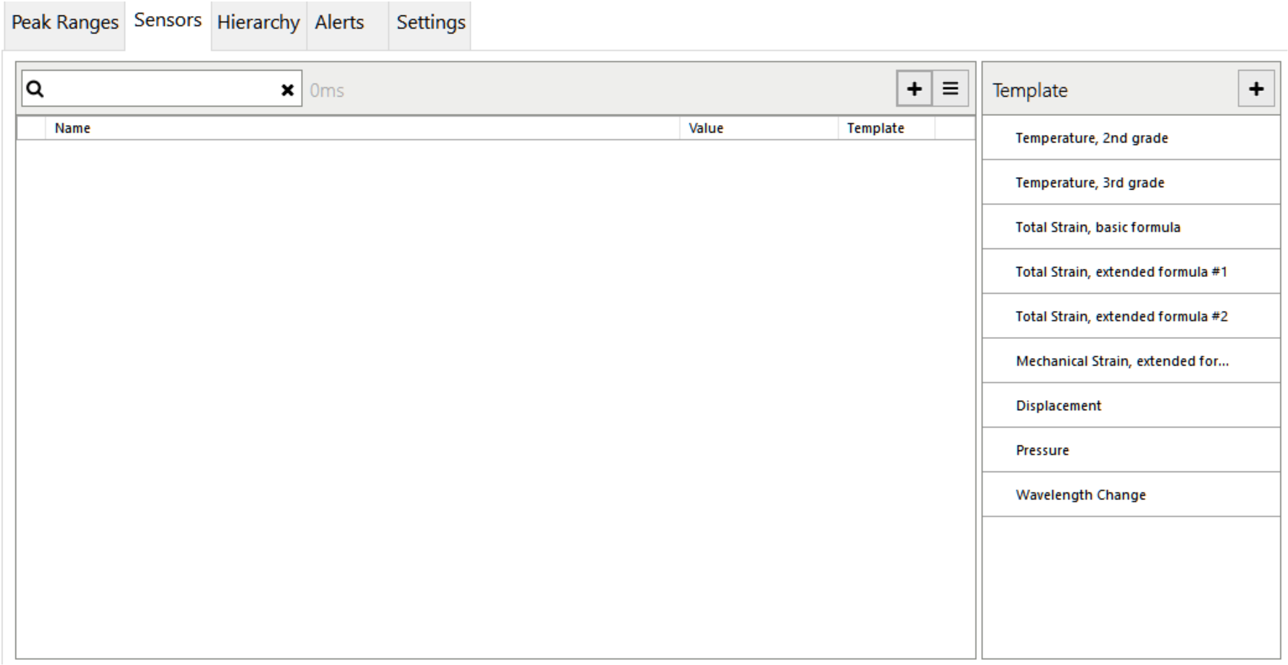


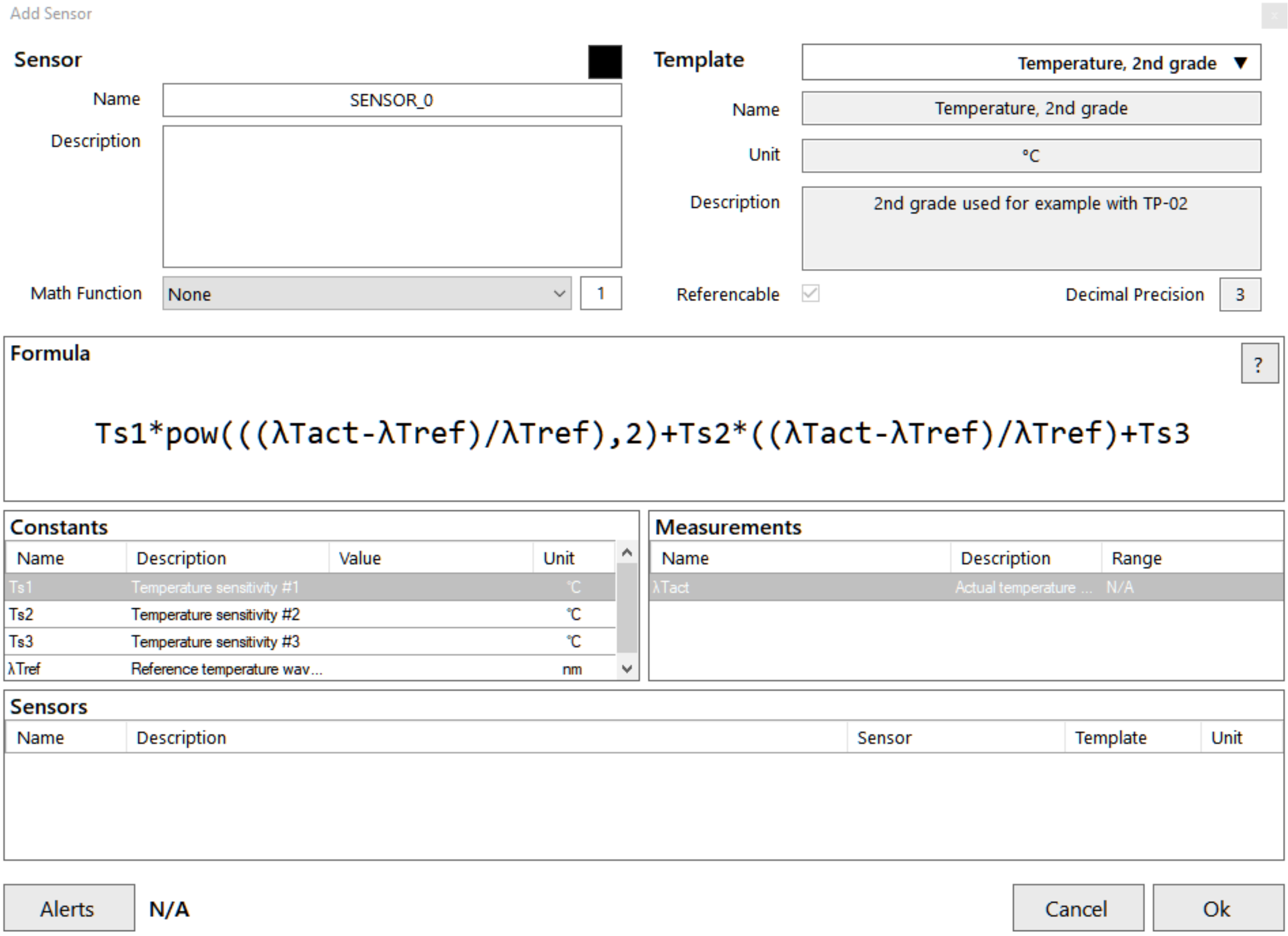
Figure 11: The sensors menu for creating new sensors based on the defined peaks.

To create a new sensor, hit the “**+**” button, and a new menu will appear with different options, Figure 12. In the right upper corner of this menu, the user can choose the appropriate template to use. After choosing the appropriate template, the formula and inputs will change accordingly. During the creation of a new sensor, all variables that the sensor requires need to be filled in.

Constants – provided within the calibration sheets or current values from the peaks or sensors. After double clicking on the appropriated constant, a new window will appear that will allow entering the value manually or by hitting the “…” sign, read the data from an already defined sensor or peak range.

Measurements – readings from the peak range. After double-clicking on the measurement input, a new window will appear allowing the user to choose the channel and the peak to read out.

Sensors – readings coming from already created sensors. After double-clicking on the input, a new window will appear with the list of already created sensors. The readings from these sensors will be used within the actual sensor.



Add Sensor

Sensor

Name: SENSOR_0

Description:

Math Function: None 1

Template: Temperature, 2nd grade ▼

Name: Temperature, 2nd grade

Unit: °C

Description: 2nd grade used for example with TP-02

Referencable ☑

Decimal Precision: 3

Formula

```
Ts1*pow(((λTact-λTref)/λTref),2)+Ts2*((λTact-λTref)/λTref)+Ts3
```

Constants

Name	Description	Value	Unit
Ts1	Temperature sensitivity #1		°C
Ts2	Temperature sensitivity #2		°C
Ts3	Temperature sensitivity #3		°C
λTref	Reference temperature wav...		nm

Measurements

Name	Description	Range
λTact	Actual temperature ...	N/A

Sensors

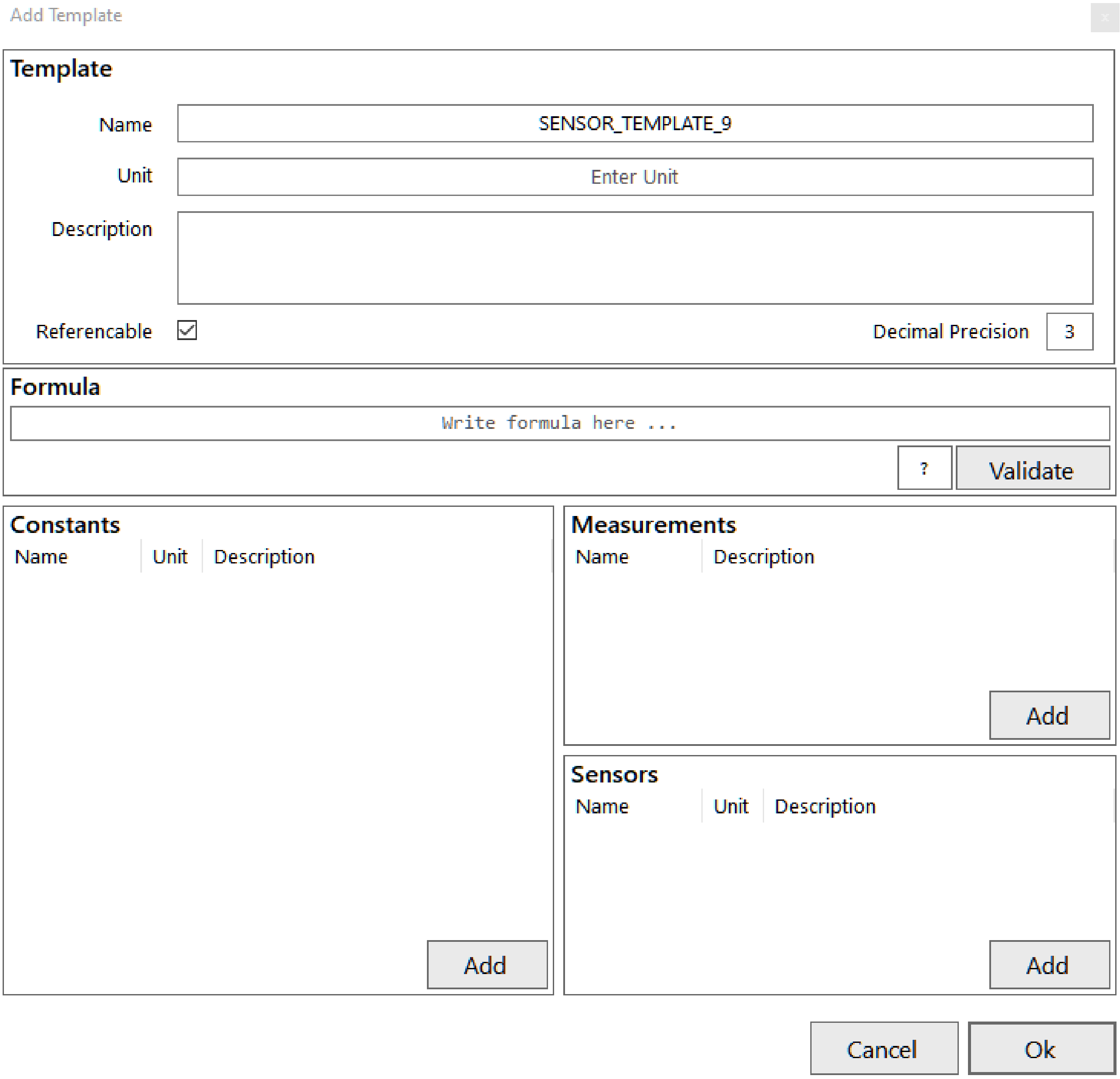
Name	Description	Sensor	Template	Unit

Figure 12: Menu for creating a new sensor.

During the creation of a new sensor, mathematical functions like maximum, minimum, average, or SavitzkyGolay filter can be applied. These settings can be altered also after the sensor has been created.

Most of the sensors support as well referencing. This function, located in the sensor menu under “≡”, will reference the current or all sensors to a 0 by subtracting the current value of the sensor. If this function is applied to the sensor, a ® symbol will appear next to the sensor in the main GUI.

If none of the current templates applies to the user, a new template can be defined by hitting the “**+**” button within the templates section of the sensors window. A new window will appear, in Figure 12, allowing the defining of the template and formula. The formula supports several mathematical functions and the list of them can be evoked by pressing the “?” next to the “validate” button.



Add Template

Template

Name: SENSOR_TEMPLATE_9

Unit: Enter Unit

Description:

Referencable ☑ Decimal Precision: 3

Formula

Write formula here ...

Constants

Name	Unit	Description

Measurements

Name	Description

Sensors

Name	Unit	Description

Figure 13: Creation of a new template for the sensors.

The meaning of each section and field for the template definition is the same as described above. If the user needs to delete a variable that was already defined, the variable needs to be highlighted, and by using the delete button removed. After creating a new template, the new settings including the new template will be saved within the project file.

Next to standard mathematical functions, Sentinel features a few functions that are used to return a specific value from a field. These functions are used to determine either the position of a sensor that has reached the maximum value within a specific field of sensors or to return its value.

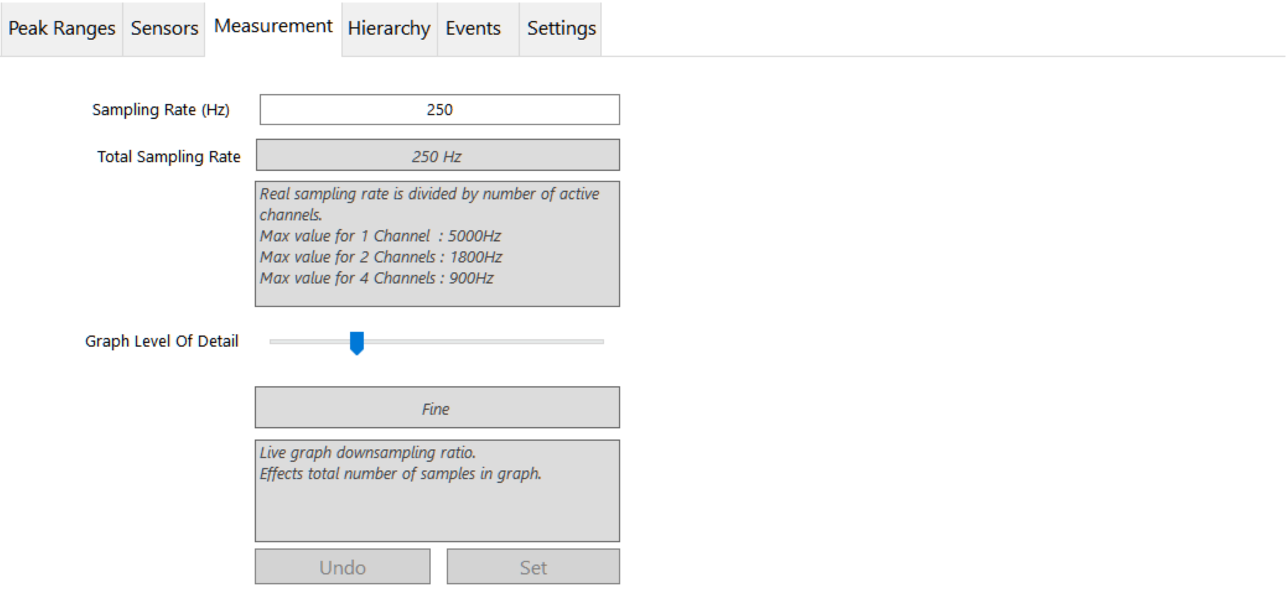
In the case of a newly defined template that would return the maximum value from a field of sensor, the new template will include only variables defined as „sensors“ and no „constants“ or „measurements“.

- max_in([S0, S1, S2, …])
    - Returns the maximum value within the sensors in the field.
- max_in_idx([S0, S1, S2, …])
    - Returns the position of the sensor with the maximum value within the sensors in the field.
- min_in([S0, S1, S2, …])
    - Returns the minimum value within the sensors in the field.
- min_in_idx([S0, S1, S2, …])
    - Returns the position of the sensor with the minimum value within the sensors in the field.
- average_in ([S0, S1, S2, …])
    - Returns the average value within the sensors in the field

4.5. Setup -> Measurement, Sentinel-D application

The Measurement menu is available only within the Sentinel-D application and is used to set up the acquisition frequency of the interrogator, Figure 14. The settings within this menu allow the user to alter the speed of the unit while in the dynamic mode and set the right acquisition speed according to the hardware setup.

The menu includes some examples of how the frequency can change without a switch or with a restricted channel count.



Sampling Rate (Hz): 250

Total Sampling Rate: *250 Hz*

Real sampling rate is divided by number of active channels.
Max value for 1 Channel : 5000Hz
Max value for 2 Channels : 1800Hz
Max value for 4 Channels : 900Hz

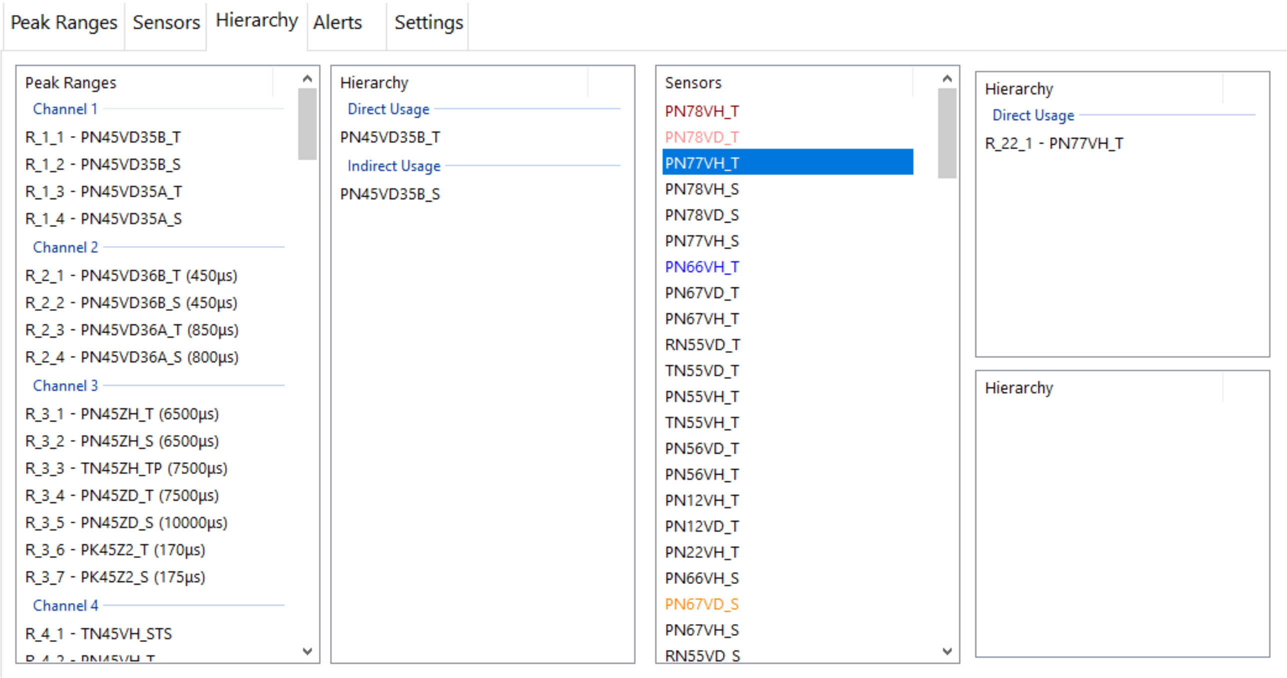
Graph Level Of Detail: *Fine*

Live graph downsampling ratio.
Effects total number of samples in graph.

Figure 14: Measurement settings for the dynamic acquisition.

4.6. Setup -> Hierarchy, Sensors, Sentinel (Sentinel-D) application

The Hierarchy menu shows the direct and indirect connection between, Figure 15, the peak ranges, and the sensors allowing the user to get a better view of what was used without looking within the documentation of the project. The user can either choose a peak range to see his dependency or choose a sensor. This will give the user a better understanding of how connections between the sensors are made and what impact they can have on each other.



Peak Ranges

Channel 1

R_1_1 - PN45VD35B_T
R_1_2 - PN45VD35B_S
R_1_3 - PN45VD35A_T
R_1_4 - PN45VD35A_S

Channel 2

R_2_1 - PN45VD36B_T (450µs)
R_2_2 - PN45VD36B_S (450µs)
R_2_3 - PN45VD36A_T (850µs)
R_2_4 - PN45VD36A_S (800µs)

Channel 3

R_3_1 - PN45ZH_T (6500µs)
R_3_2 - PN45ZH_S (6500µs)
R_3_3 - TN45ZH_TP (7500µs)
R_3_4 - PN45ZD_T (7500µs)
R_3_5 - PN45ZD_S (10000µs)
R_3_6 - PK45Z2_T (170µs)
R_3_7 - PK45Z2_S (175µs)

Channel 4

R_4_1 - TN45VH_STS
R_4_2 - PN45VH_T

Hierarchy

Direct Usage

PN45VD35B_T

Indirect Usage

PN45VD35B_S

Sensors

PN78VH_T
PN78VD_T
PN77VH_T
PN78VH_S
PN78VD_S
PN77VH_S
PN66VH_T
PN67VD_T
PN67VH_T
RN55VD_T
TN55VD_T
PN55VH_T
TN55VH_T
PN56VD_T
PN56VH_T
PN12VH_T
PN12VD_T
PN22VH_T
PN66VH_S
PN67VD_S
PN67VH_S
RN55VD_S

Hierarchy

Direct Usage

R_22_1 - PN77VH_T

Hierarchy

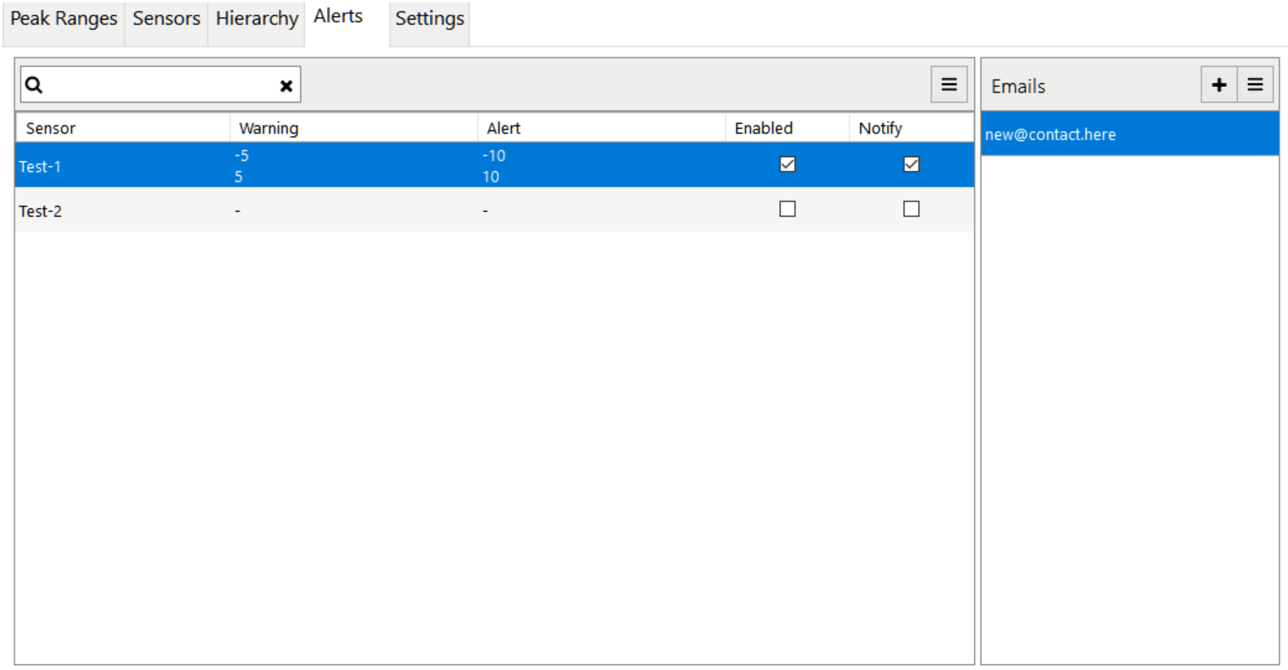
Figure 15: Hierarchy menu and displaying of the connections between the peak ranges and the sensors.

4.7. Setup -> Alerts (Events), Sensors, Sentinel (Sentinel-D) application

The Alerts menu is used for setting up automatic alarms when a defined sensor will exceed certain user-defined thresholds. The menu is different for Sentinel static and Sentinel-D and while for the static application, the menu is used to automate alerts in case of an event, the SetninelD application is used for defining a trigger that starts the data logging.

Alerts, Sentinel

Used for creating an automatic alert upon exceeding a predefined threshold. Every newly created sensor, Figure 16, will appear within the “Alerts” menu and can be used to raise an event upon exceeding a positive or negative predefined threshold. To adjust the thresholds and enable the Warning and Alert options, double-click on the sensor.

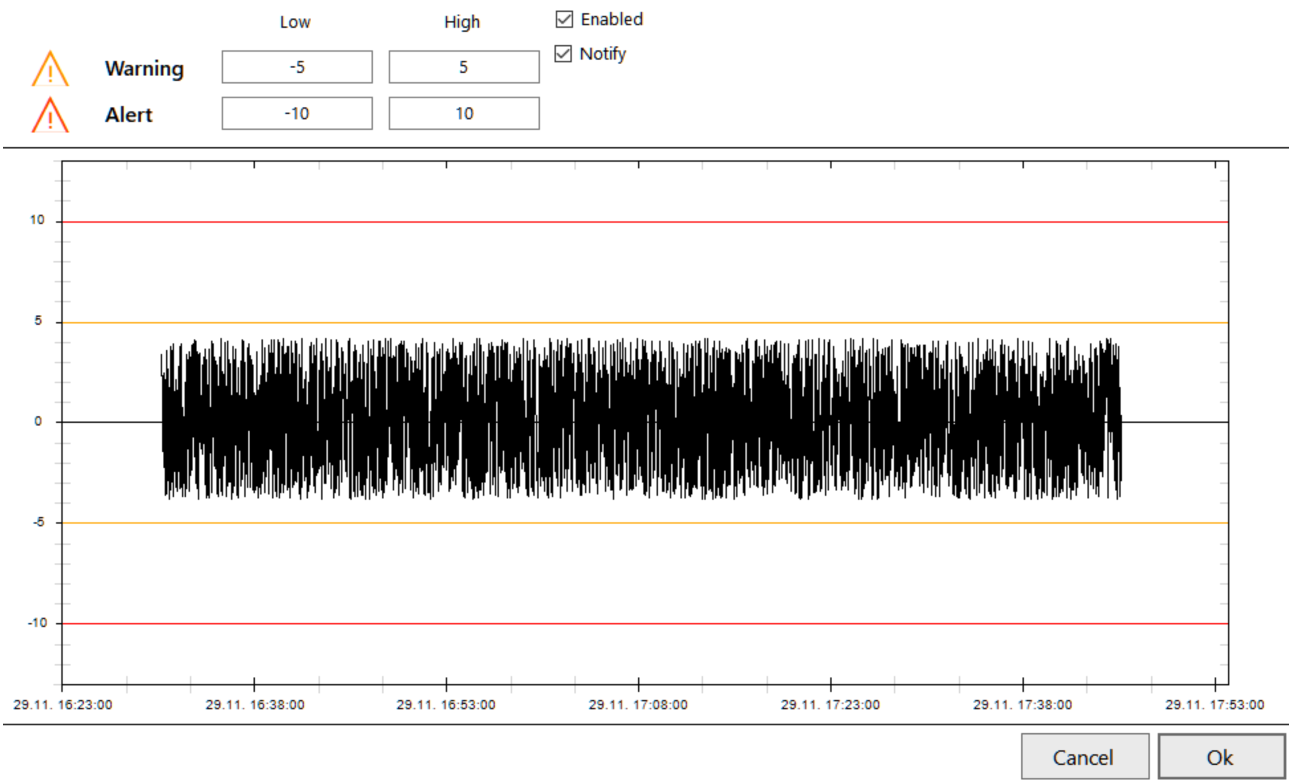


Sensor	Warning	Alert	Enabled	Notify
Test-1	-5 5	-10 10	☑	☑
Test-2	-	-	☐	☐

new@contact.here

Figure 16: Alerts menu with a list of already created sensors.

A new window will appear with the already acquired history of the particular sensor, Figure 17, and options to set the low and high values for the Warning and Alert. Together with this, it is necessary to enable the event and if requested, check the notify checkbox. To send notifications about exceeding the threshold a recipient email needs to be defined and the SMTP server within the Settings menu.



	Low	High
Warning	-5	5
Alert	-10	10

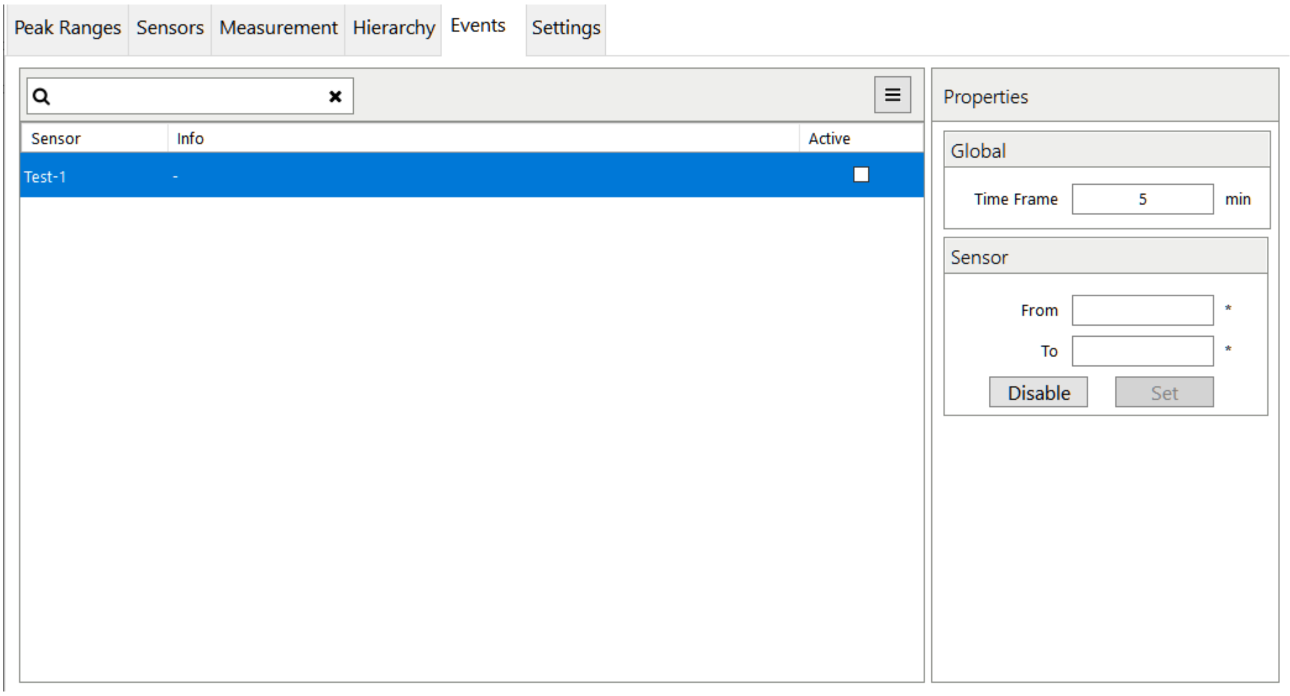
☑ Enabled

☑ Notify

Figure 17: Sensor alert window within the Alerts menu.

Events, Sentinel-D

The Events menu for the Sentinel-D application is different compared to the Sentinel (static) application and is used to set up triggers for data logging instead of warning and alert events. The settings are similar to the Sentinel application and every sensor will appear within this menu, Figure 18. However, instead of setting the event values, the user can set a träigger, and thus if a sensor exceeds a value the system will depending on the data logging settings, start the data logging process within a time frame. The time frame, for example, 1min, defines the data logging to be 1min before the event that triggered the trigger and 1min after the event is finished.



Sensor	Info	Active
Test-1	-	□

Time Frame 5 min

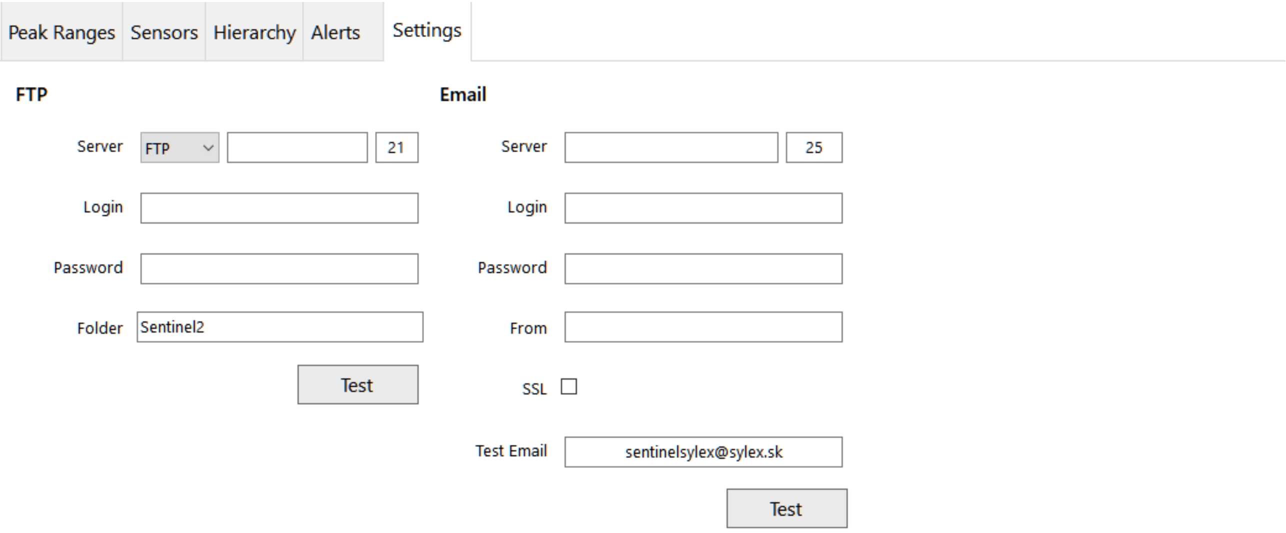
Figure 18: Events menu with a list of already crested sensors.

4.8. Setup -> Settings, Sensors, Sentinel (Sentinel-D) application

The Settings menu is common for both the Sentinel and SetntinelD applications, Figure 19, and includes the settings for the FTP communication and SMTP email server. The options included within the menu are self-explanatory but to summarize the options the user has:

- **FTP** – either FTP or SFTP protocols for establishing remote communication with a server where the data should be sent
- **EMAIL –** defining the SMTP email server that will be used for sending emails upon an alert

Both the FTP and EMAIL settings include a “test” button to verify the communication is working properly.



FTP

Server: FTP, port 21

Login:

Password:

Folder: Sentinel2

Email

Server: port 25

Login:

Password:

From:

SSL ☐

Test Email: sentinelsylex@sylex.sk

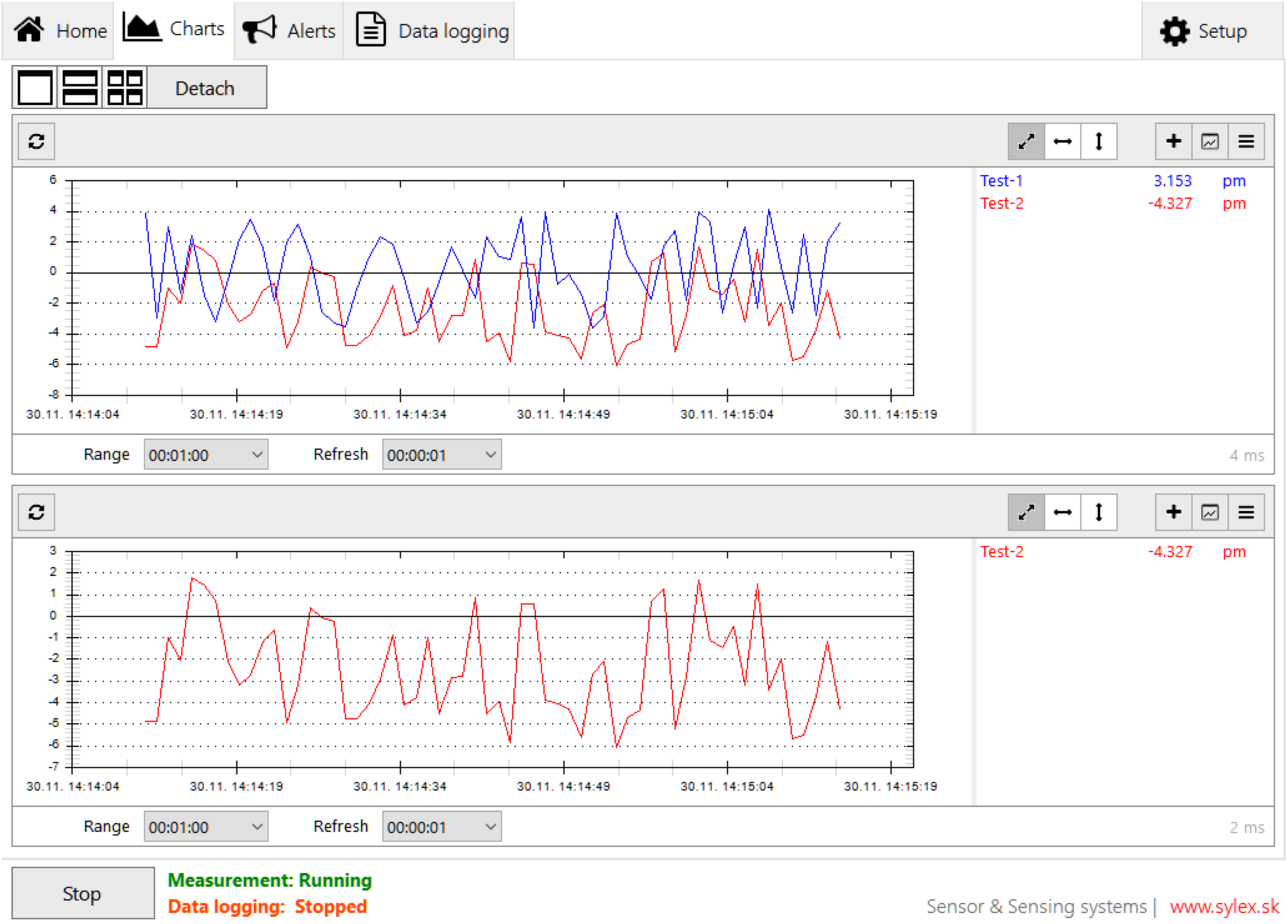
Figure 19: Settings menu for adjusting the FTP and SMTP communication.

4.9. Charts, Sentinel (Sentinel-D) application

The Charts menu, which is accessible from the main menu, is common for both the Sentinel and SetntinelD applications, Figure 20, and is used for real-time data visualization of the defined sensors. Only defined sensors can be used within the charts feature. For Sentinel-D, only one sensor per chart can be drawn out.

Note: these settings are not saved within a project file.

To add a new sensor to the chart, hit the “**+**” button and choose the desired sensor from the list. Use the “**>>**“ sign to move the sensor within the chart or double-click on it to move it to the chart. The feature supports several options that can be raised using the right-up mouse button. Between these options, saving the image, zooming, etc... are possible to be used. A helpful feature is the „marker“ option that allows you to add a horizontal line inside the chart that can represent a visual threshold for the particular chart.



Test-1 3.153 pm
Test-2 -4.327 pm

Range 00:01:00 Refresh 00:00:01

Test-2 -4.327 pm

Range 00:01:00 Refresh 00:00:01

Measurement: Running
Data logging: Stopped

Figure 20: The charts option for real-time data visualization.

Range – the period shown on the chart. The higher the range, the more data will be shown and therefore more memory will be used to maintain the charts.

Refresh – how often the chart should be redrawn with new data. Longer refresh time will not result in losing data, the data will be buffered and drawn after the refresh period will pass.

Color – the color of the sensors can be changed within the "Setup -> Sensors" for each sensor separately.

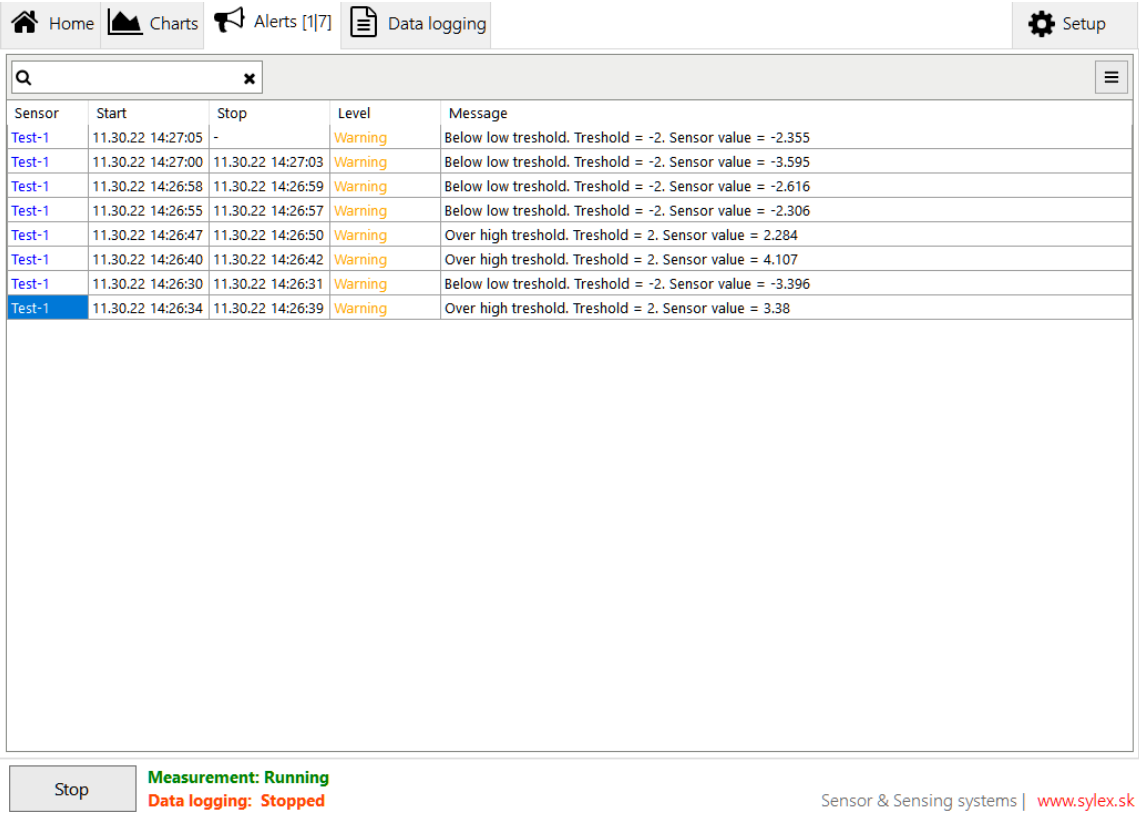
Detach – this will detach the current chart settings in a new window and allow the user to create new charts within the main GUI.

4.10. Alerts, Sensors, Sentinel (Sentinel-D) application

The Alerts menu, which is accessible from the main menu, is common for both the Sentinel and SetntinelD applications, Figure 21, and is used as an alert overview of all sensors that were assigned with warning and alert thresholds. Only sensors that have the warning and alert limits filled in and are enabled within the “setup -> alerts” menu will be considered.

For Sentinel-D, the system shows the sensors that have exceeded the trigger threshold and for Sentinel, the system shows all sensors with warning and alert thresholds. The list will include all sensors that exceeded the pre-define thresholds and within one line the system will address:

- What sensor exceeded the threshold
- When the sensor exceeds the threshold and if returns to normal, as when
- What Level message it is, a warning or alert
- What was the value of the sensor while exceeding the threshold



Sensor	Start	Stop	Level	Message
Test-1	11.30.22 14:27:05	-	Warning	Below low treshold. Treshold = -2. Sensor value = -2.355
Test-1	11.30.22 14:27:00	11.30.22 14:27:03	Warning	Below low treshold. Treshold = -2. Sensor value = -3.595
Test-1	11.30.22 14:26:58	11.30.22 14:26:59	Warning	Below low treshold. Treshold = -2. Sensor value = -2.616
Test-1	11.30.22 14:26:55	11.30.22 14:26:57	Warning	Below low treshold. Treshold = -2. Sensor value = -2.306
Test-1	11.30.22 14:26:47	11.30.22 14:26:50	Warning	Over high treshold. Treshold = 2. Sensor value = 2.284
Test-1	11.30.22 14:26:40	11.30.22 14:26:42	Warning	Over high treshold. Treshold = 2. Sensor value = 4.107
Test-1	11.30.22 14:26:30	11.30.22 14:26:31	Warning	Below low treshold. Treshold = -2. Sensor value = -3.396
Test-1	11.30.22 14:26:34	11.30.22 14:26:39	Warning	Over high treshold. Treshold = 2. Sensor value = 3.38

Measurement: Running
Data logging: Stopped

Figure 21: The alerts window within the main GUI.

The events and alerts that were raised during the measurement are also data logged down within the “DataLogs” folder automatically. If an email address is created within the setup, and the sensor has notification enabled, the same message will be sent to the user.

4.11. Data logging, Sensors, Sentinel application

The Data logging menu, Figure 22, is used to set up and start the data logging the data. The application can data log the peak ranges and thus raw wavelengths, the sensors, and both. It is upon the user to choose what he would like to data log. To select all sensors within the menu, right-click on the area and select “Select all”.

To enable the data logging, the “mode” needs to be set and changed to something else than “Disabled”. To start data logging, the “Start” button has to be hit – the label in the left bottom corner next to data logging will change from “Stopped” to “Running”.

Checkbox “Enabled” – to enable the data logging options.

Mode – FTP, Local, or FTP and Local – determines where the data will be stored or sent.

Interval – expresses the length of how often a new file should be created. If the settings would be for example 5min, every 5min a new file will be created. The maximum length of a single file is 24h.

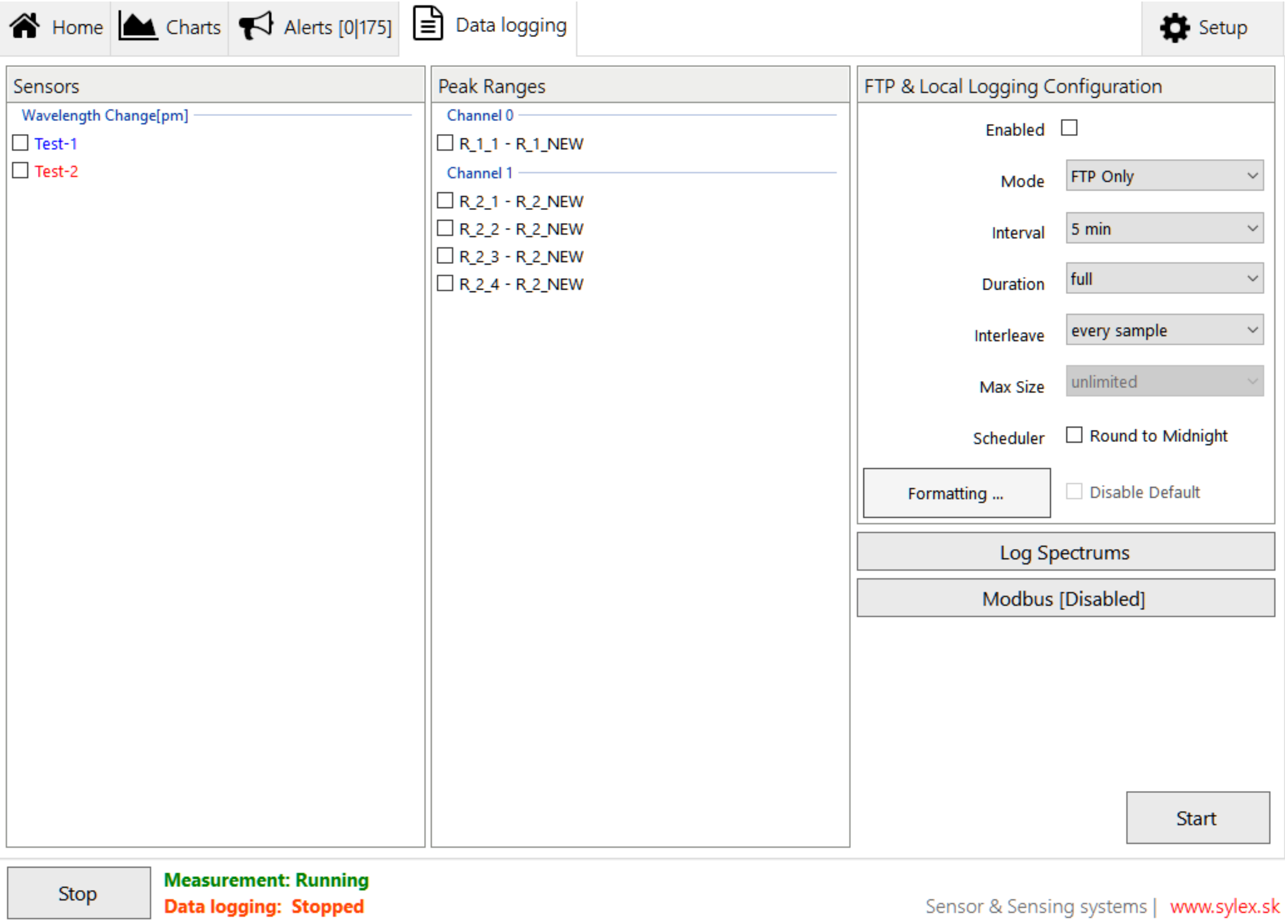
Duration – either set to “full” or “once per interval”. If set to “full”, the data logging will follow the settings made within the menu. If set to “once per interval”, the system will create only one line of data per “Interval”.

Interleave – can be considered as downsampling of the data. The default value is “every sample”, changing it to “every 5th” for example will save the data according to the set value.

Max Size – default, not changeable.

Scheduler – the “round to midnight” ensures that the data logging and thus creation of new files will happen concerning midnight and therefore the system starts to data log when he can come to midnight using the set interval.

Disable Default Logging – if unchecked, the system creates a parallel data thread and saves the data within the "DataLogs" folder without cornering the settings. This means that an interval of 24 hours and every sample will be data logged.



Enabled □

Mode: FTP Only

Interval: 5 min

Duration: full

Interleave: every sample

Max Size: unlimited

Scheduler: □ Round to Midnight

□ Disable Default

Measurement: Running

Data logging: Stopped

Figure 22: The Data Logging menu within the Sentinel application.

Advanced settings

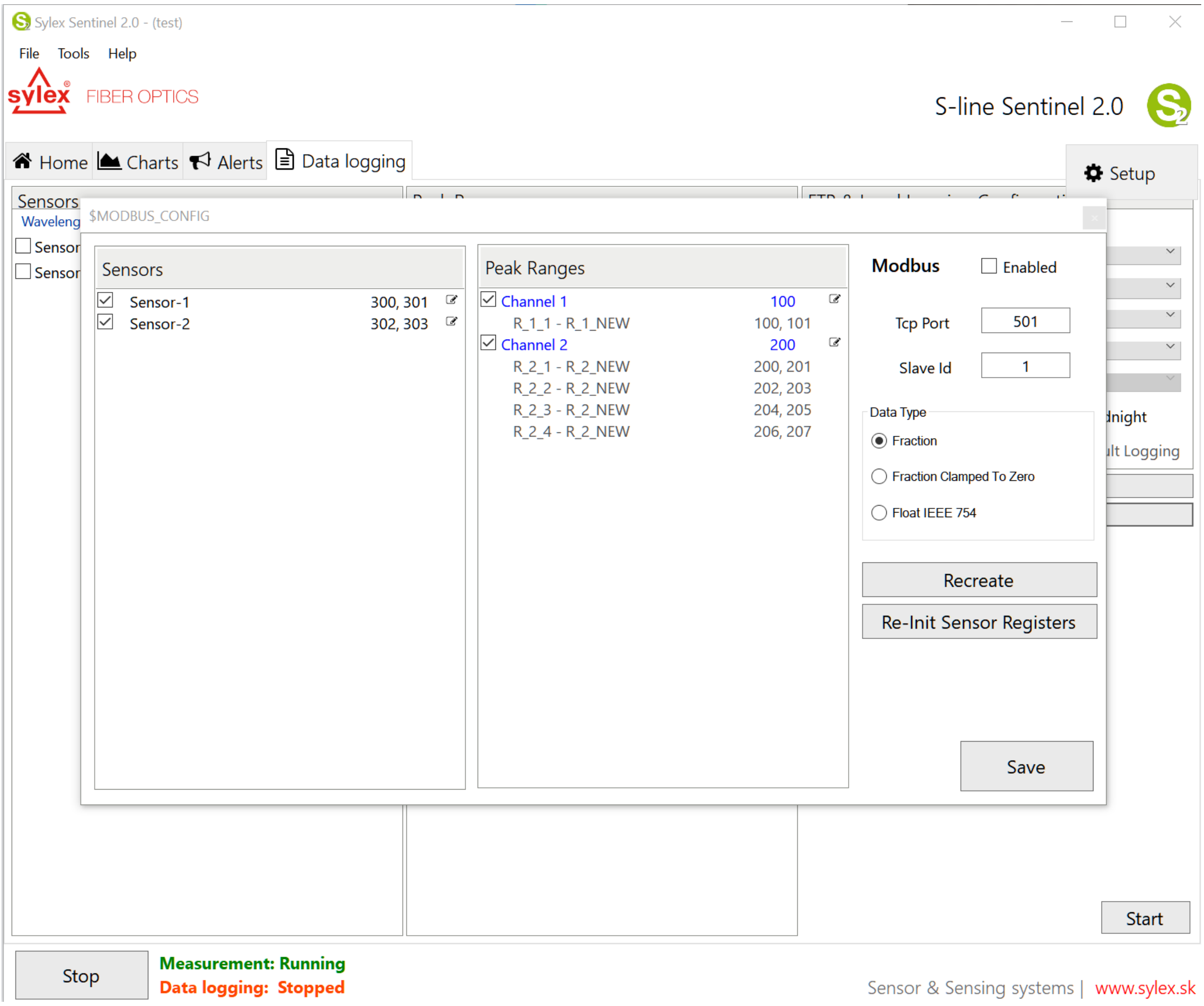
Formatting is used to change the default behavior of the data log file. The default settings include the default time former, separator, extension, etc… The formatting menu allows the user to change it to an appropriate format.

Log Spectrums and **Modbus** extend the data logging options of the software. Spectrum data logging is a parallel thread and is used to save the spectrum image in a defined interval. The Modbus function allows data transfer through the Modbus protocol. Both the raw wavelengths and sensors can be assigned.

4.12. Data logging, Sensors, Sentinel application, Modbus

The inbuilt Modbus protocol inside the Sentinel data-logging settings extends the possibility of data transfer other than the API or raw data logging within the file in CSV format. The Modbus settings are included inside the data logging settings of the software and the protocol can be used alongside the default data saving inside the test file.

The settings of the Modbus, Figure 23, allow the user to configure the way the data will be sent, what kind of data will be sent, etc…



Sensors	
☑ Sensor-1	300, 301
☑ Sensor-2	302, 303

Peak Ranges	
☑ Channel 1	100
R_1_1 - R_1_NEW	100, 101
☑ Channel 2	200
R_2_1 - R_2_NEW	200, 201
R_2_2 - R_2_NEW	202, 203
R_2_3 - R_2_NEW	204, 205
R_2_4 - R_2_NEW	206, 207

Modbus ☐ Enabled

Tcp Port: 501

Slave Id: 1

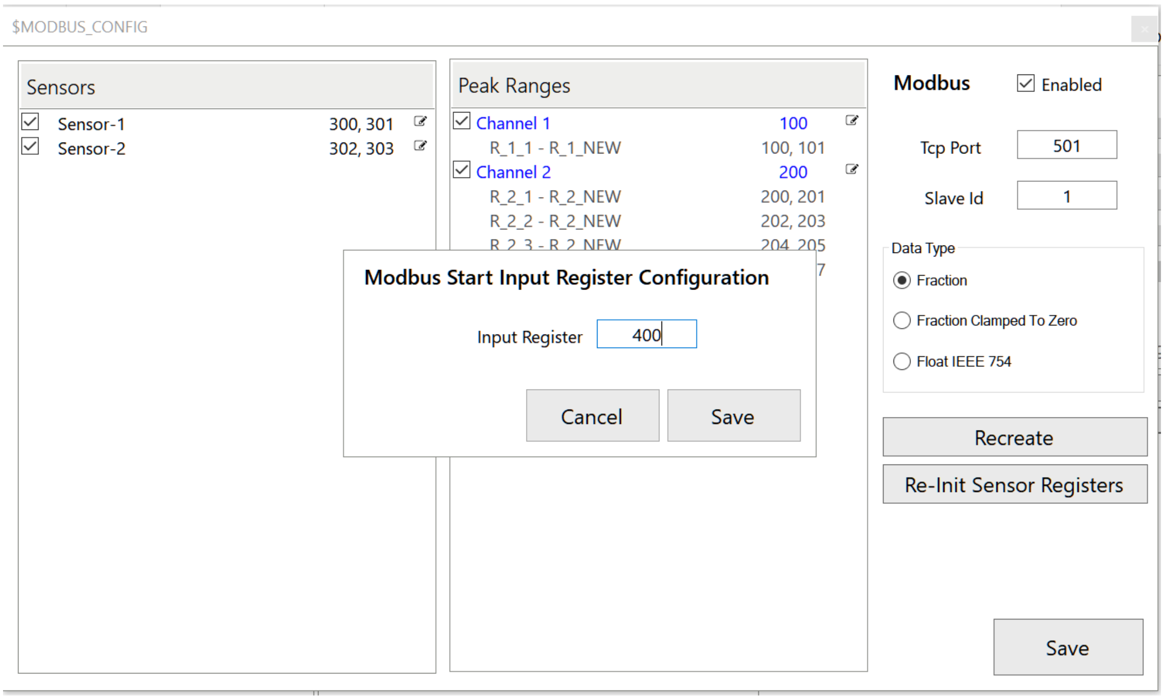
Data Type
- ● Fraction
- ○ Fraction Clamped To Zero
- ○ Float IEEE 754

Measurement: Running
Data logging: Stopped

Figure 23: Modbus settings within the Sentinel application.

The protocol is by default set to work within the **Input Register = 30001-39999**, and therefore the starting register is 100 for the peak ranges and translated to 30100 inside the Modbus protocol. The same applies to the sensors shown in Figure 23, the first sensor will be present in registers 300 and 301. The settings allow the user to change these starting registers with the option to change:

- **Sensor (one by one)** – use the edit icon next to the sensor to change the starting register. For example, changing it to 400 will result in shifting the sensor to 400,401 register, Figure 24.
- **Peak Ranges (Channel)** – use the edit icon next to the sensor to change the starting register to change the starting register for all peaks present on this channel. For example, changing it to 200 will result in shifting the peak registers one after another to 200,201, etc…
- **Re-Init Sensor Registers** – use this option to recreate the starting input register for the sensors. Changing the starting register will shift all sensors one after another to the set option.
-



$MODBUS_CONFIG

Sensors

☑	Sensor-1	300, 301
☑	Sensor-2	302, 303

Peak Ranges

☑	Channel 1	100
	R_1_1 - R_1_NEW	100, 101
☑	Channel 2	200
	R_2_1 - R_2_NEW	200, 201
	R_2_2 - R_2_NEW	202, 203
	R_2_3 - R_2_NEW	204, 205

Modbus Start Input Register Configuration

Input Register: 400

Modbus ☑ Enabled

Tcp Port: 501

Slave Id: 1

Data Type

● Fraction

○ Fraction Clamped To Zero

○ Float IEEE 754

Figure 24: Modifying the Modbus register for a particular sensor.

The settings allow you to do a basic configuration of the Modbus protocol settings, and change the TCP Port (default 501) or Slave Id (default 1). Next to these settings, the option “Data Type” allows to modify how the data with fractions are transferred through the protocol and currently supports these options:

- **Fraction** – the value is sent through two registers as a 16-bit input register data type including negative numbers.
- **Fraction Clamped to Zero** - the value is sent through two registers as a 16-bit input register data type. Negative numbers are set to 0.
- **Float IEEE 754** – the value is sent through two registers as a 32-bit float data type in the input register table.

Example of Modbus calls

Data from the Modbus protocol can be retrieved using different ways, and one option is to use a command line-based Modbus utility like *modpoll*[7]. In the below example, we will pull the data from three sensors through Modbus by using the default “Fraction” settings (Code snippet 5), and as well the “Float IEEE 754” settings (Code snippet 6).

```
>> modpoll.exe -m tcp -a 1 -r 300 -c 6 -t 3 -1 -p 501 127.0.0.1

Protocol configuration: MODBUS/TCP, FC4
Slave configuration...: address = 1, start reference = 300, count = 6
Communication.........: 127.0.0.1, port 501, t/o 1.00 s, poll rate 1000 ms
Data type.............: 16-bit register, input register table

-- Polling slave...
[300]: 4841
[301]: 721
[302]: 2
[303]: 439
[304]: -4839
[305]: -282
```

Code snippet 6: Modbus data poll for three sensors and Fraction settings example.

[7] The utility is used for reference purposes only.

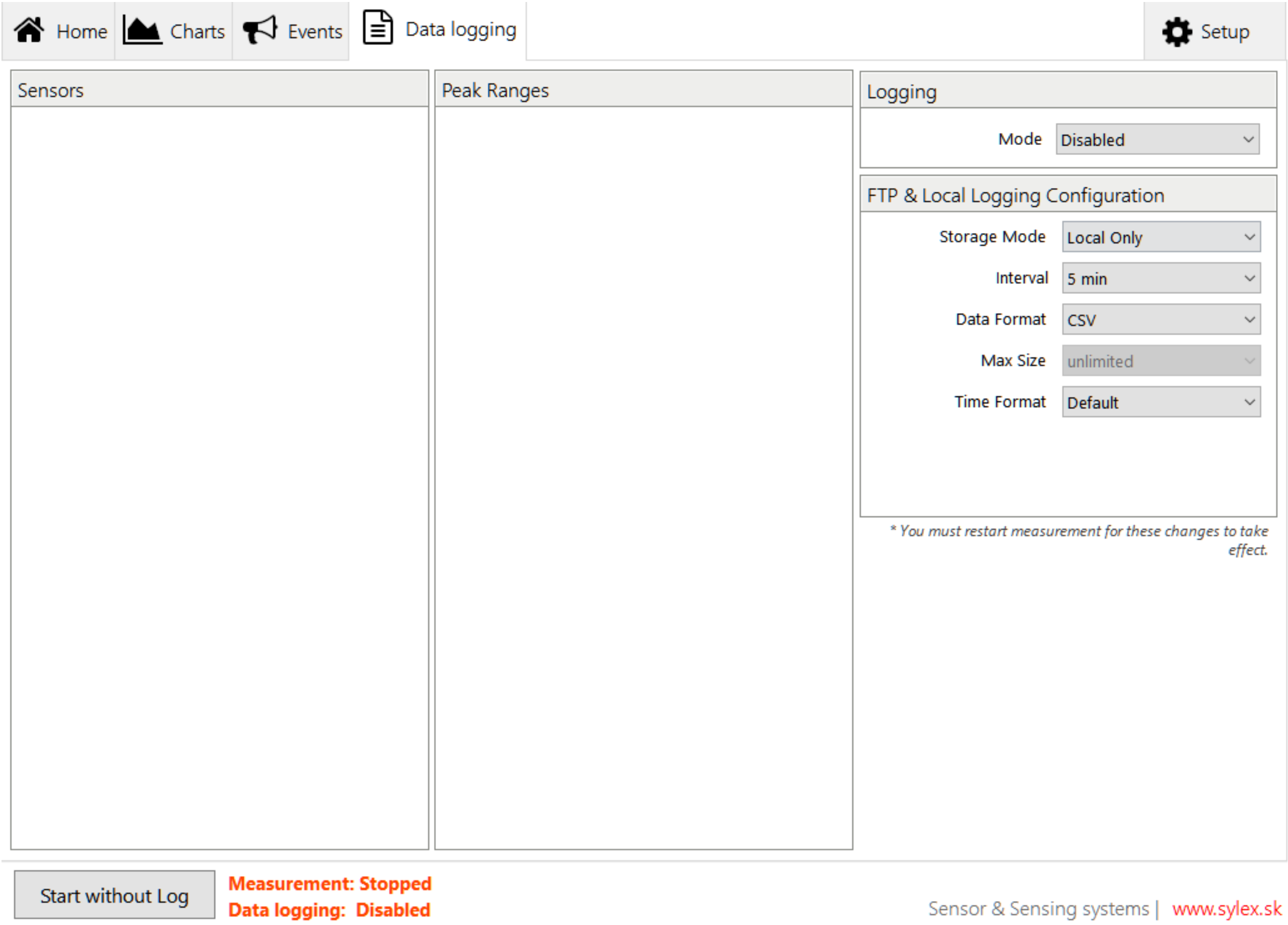
```
>> modpoll.exe -m tcp -a 1 -r 300 -c 6 -t 3:float -1 -p 501 127.0.0.1

Protocol configuration: MODBUS/TCP, FC4
Slave configuration...: address = 1, start reference = 300, count = 6
Communication.........: 127.0.0.1, port 501, t/o 1.00 s, poll rate 1000 ms
Data type.............: 32-bit float, input register table

-- Polling slave...
[300]: 4845.507812
[302]: 4.370000
[304]: -4841.138184
[306]: 0.000000
[308]: 0.000000
[310]: 0.000000
```

Code snippet 7: Modbus data poll for three sensors and Float IEEE 754 settings example.

4.13. Data logging, Sensors, Sentinel-D application

The Data logging menu, Figure 25, is used to set up and start the data logging the data. The application can data log the peak ranges and thus raw wavelengths, the sensors, and both. It is upon the user to choose what he would like to data log. To select all sensors within the menu, right-click on the area and select “Select all”.

To enable the data logging, the “mode” needs to be set and changed to something else than “Disabled”. After that, the start button that by default is labeled as “Start without log” will change the appearance to “Start with log”.



Mode: Disabled

Storage Mode: Local Only

Interval: 5 min

Data Format: CSV

Max Size: unlimited

Time Format: Default

** You must restart measurement for these changes to take effect.*

Measurement: Stopped

Data logging: Disabled

Figure 25: The Data Logging menu within the Sentinel-D application.

Mode – can be set either to “Continous” or “On Event Trigger”. The continuous mode will start a continuous measurement with a maximal length of 24h or the length of the file set within the “Interval” option. The “On Event Trigger” will start the measurement only if a trigger will be triggered and the length of data logging is dependent on the settings of the trigger.

Interval – expresses the length of how often a new file should be created. If the settings would be for example 5min, every 5min a new file will be created. The maximum length of a single file is 24h.

Data Format – either a standard CSV format or a binary format BIN. The binary format is used when a lot of data is expected and it reduces the file size by more than half. The file will be not human readable until converted to a CSV file using the converter located within the root folder of the application.

Max Size – default, not changeable.

Time Format – different options on how the timestamp should look within the data log file.

5. Sentinel API

The Sentinel API allows the user to use the API calls to read out the data from the unit without considering the data log or even starting the data logging at all. The API calls can be sent through a TCP protocol or called locally. The API function of Sentinel creates an API server at the local host at port 8024 – for this reason, the application needs to be launched with administration privileges.

After the creation of the API server, the user can use the API calls to return the data in JSON format. More information about the possibilities of the inbuilt API, examples of the calls, and attributes can be found in the “Sentinel API manual”.

```
>> http://127.0.0.1:8024/api/v1/peaks/last_data

>> http://127.0.0.1:8024/api/v1/sensors/last_data
```

Code snippet 8: Example of an API call returning the raw wavelengths, and sensor data.

6. Sentinel start-up script examples

The Sentinel application supports start-up attributes that were already described within section 3.2. The attributes can be used to automate the behavior of the application after a sudden event or to load a different project file at a certain time, etc…

Below are two examples that use the advantage of the attributes and are used to “kill” and “start” the application with different settings. To ensure the scripts will be running without any issues, lower the Windows UAC to a minimum.

Kill script – version 1.3

```
Rem # Kill the Sentinel process instantly
@echo off
CLS

Rem #Get the current path
SET mypath=%~dp0
echo Current working directory:
echo %mypath%
echo User Account Control Settings needs to be lowered to a minimum
TIMEOUT 3

REM  --> Check for permissions
REM >nul 2>&1 "%SYSTEMROOT%\system32\cacls.exe"
REM >"%SYSTEMROOT%\system32\config\system"

call :isAdmin

REM --> If error flag set, we do not have admin.
if %errorlevel% == 0 (
    goto :run
) else (
    echo Requesting administrative privileges...
    goto :UACPrompt
REM # ) else ( goto gotAdmin
)

exit /b
REM #:gotAdmin
REM #    pushd "%CD%"
REM #    CD /D "%~dp0"
 :isAdmin
    fsutil dirty query %systemdrive% >nul
 exit /b

:run

echo ----------------------------------------------------------
echo Sentinel batch script, example
echo,
echo,          = Sentinel batch script, process termination =
echo,
echo,          #Tomas Salat
echo,           - Version 1.3
echo,           - Sentinel kill process
echo ----------------------------------------------------------
echo,

TIMEOUT 3
for /F "tokens=1" %%i in ('date /t') do set myday=%%i
for /F "tokens=2" %%i in ('date /t') do set mymonth=%%i
for /F "tokens=3" %%i in ('date /t') do set myyear=%%i
set mytime=%time%

echo Current time is %myday%%mymonth%%myyear%%mytime%

REM if timeout will cause any issue, use „SLEEP 3“

tasklist /fi "IMAGENAME eq ClientApp_Dyn.exe" /fo csv 2>NUL | find /I
"ClientApp_Dyn.exe" > NUL
REM # tasklist | find /I "ClientApp_Dyn.exe" > NUL
if "%errorlevel%" == "0" (
                echo "Program found, terminating...."
                TIMEOUT 1
                taskkill /IM "ClientApp_Dyn.exe" /F 2>>
%mypath%/bash_log.txt
                echo [LOG FILE %myday%%mymonth%%myyear%%mytime%] $Process
kill - Process terminated... >> %mypath%/bash_log.txt
                ) else (
                echo "Unknown value, no process to kill, terminate..."
                echo [LOG FILE %myday%%mymonth%%myyear%%mytime%] $Process
kill - Process not found... >> %mypath%/bash_log.txt
                TIMEOUT 1
                )

Rem # Use the absolute path for the CMD since it is started as admin
REM # echo %mypath%
REM # cd %mypath%
REM # tree
REM # %mypath%/ClientApp_Dyn.exe -switch=AUTO -autolog=YES interlab.ssd
REM # TIMEOUT 2

exit /b
:UACPrompt
   echo Set UAC = CreateObject^("Shell.Application"^) >
"%temp%\getadmin.vbs"
   echo UAC.ShellExecute "cmd.exe", "/c %~s0 %~1", "", "runas", 1 >>
"%temp%\getadmin.vbs"

   "%temp%\getadmin.vbs"
   del "%temp%\getadmin.vbs"
exit /b

rem --- END OF BATCH ----

pause
```

Code snippet 9: Kill script example for the Sentinel application.

Startup script - version 1.3

```
Rem # Start Sentinel process instantly
@echo off
CLS

Rem #Get current path
SET mypath=%~dp0
echo Current working directory:
echo %mypath%
echo User Account Control Settings needs to be lowered to minimum
TIMEOUT 3

REM  --> Check for permissions
REM >nul 2>&1 "%SYSTEMROOT%\system32\cacls.exe"
REM >"%SYSTEMROOT%\system32\config\system"

call :isAdmin

REM --> If error flag set, we do not have admin.
if %errorlevel% == 0 (
    goto :run
) else (
    echo Requesting administrative privileges...
    goto :UACPrompt
REM # ) else ( goto gotAdmin
)

exit /b
REM #:gotAdmin
REM #    pushd "%CD%"
REM #    CD /D "%~dp0"
 :isAdmin
    fsutil dirty query %systemdrive% >nul
 exit /b
:run

echo ----------------------------------------------------------
echo Sentinel batch script, example
echo,
echo,          = Sentinel batch script =
echo,
echo,          #Tomas Salat
echo,           - Version 1.3
echo,           - Sentinel start
echo,                - Type ClientApp.exe -h  for help
echo, Usage:
echo,   "ClientApp.exe <option>... <project file>"
echo,
echo, Where:
echo,   "<project file>               ssd project file"
echo,
echo, "<option>:"
echo,   "-h                              print this message"
echo,   "-autolog=[YES|NO]               start measurement and logging on
start (default: YES)"
echo,   "-switch=[AUTO|NA|COM?]          switch configuration : auto scan,
switch not available, or COM port (COM3, COM13, etc.) (default: AUTO)"
echo,   "-driver=[LOCAL|LOCAL400|REMOTE] driver location local(build in) or
remote (default: LOCAL (S-line800))"
echo,   "-device_port=[COM?]             used for S-line400, COM port of
device (COM3, COM13, etc.)"
echo,   "-ip=<ip address>                ip address of remote driver"
echo,   "-ch_sw_delay=<delay in ms>      add custom delay after channel
switch command (defaul: 10ms)"
echo,   "-api_autostart                  start with web api enabed (default:
disabled)"
echo,   "-api_port=<ip port>             api listening port (default: 8024)"
echo ----------------------------------------------------------
echo,

TIMEOUT 3
for /F "tokens=1" %%i in ('date /t') do set myday=%%i
for /F "tokens=2" %%i in ('date /t') do set mymonth=%%i
for /F "tokens=3" %%i in ('date /t') do set myyear=%%i
set mytime=%time%

echo Current time is %myday%%mymonth%%myyear%%mytime%
REM if timeout will cause any issue, use „SLEEP 3“
tasklist /fi "IMAGENAME eq ClientApp.exe" /fo csv 2>NUL | find /I
"ClientApp.exe">NUL
if "%ERRORLEVEL%"=="0" (
                echo "Program found, terminating...."
                TIMEOUT 1
                taskkill /IM "ClientApp.exe" /F 2>> %mypath%/bash_log.txt
                echo [LOG FILE %myday%%mymonth%%myyear%%mytime%] $Process
start - Process terminated... >> %mypath%/bash_log.txt
                ) else (
                echo "Process not running, starting...."
                TIMEOUT 3
                Rem # Use the absolute path for the CMD since it is started
as admin
               echo %mypath%
               cd %mypath%
               tree
               %mypath%/ClientApp.exe -autolog=YES -switch=AUTO projekt.ssd
2>> %mypath%/bash_log.txt
                REM Change projekt.ssd to the desired project of yours
                echo [LOG FILE %myday%%mymonth%%myyear%%mytime%] $Process
start - Process started, most likely... >> %mypath%/bash_log.txt
                )
                TIMEOUT 3

Rem # ClientApp.exe -autolog=YES -switch=AUTO projekt.ssd

exit /b
```

```
:UACPrompt
   echo Set UAC = CreateObject^("Shell.Application"^) >
"%temp%\getadmin.vbs"
   echo UAC.ShellExecute "cmd.exe", "/c %~s0 %~1", "", "runas", 1 >>
"%temp%\getadmin.vbs"

   "%temp%\getadmin.vbs"
   del "%temp%\getadmin.vbs"
exit /b

rem --- END OF BATCH ----

pause
```

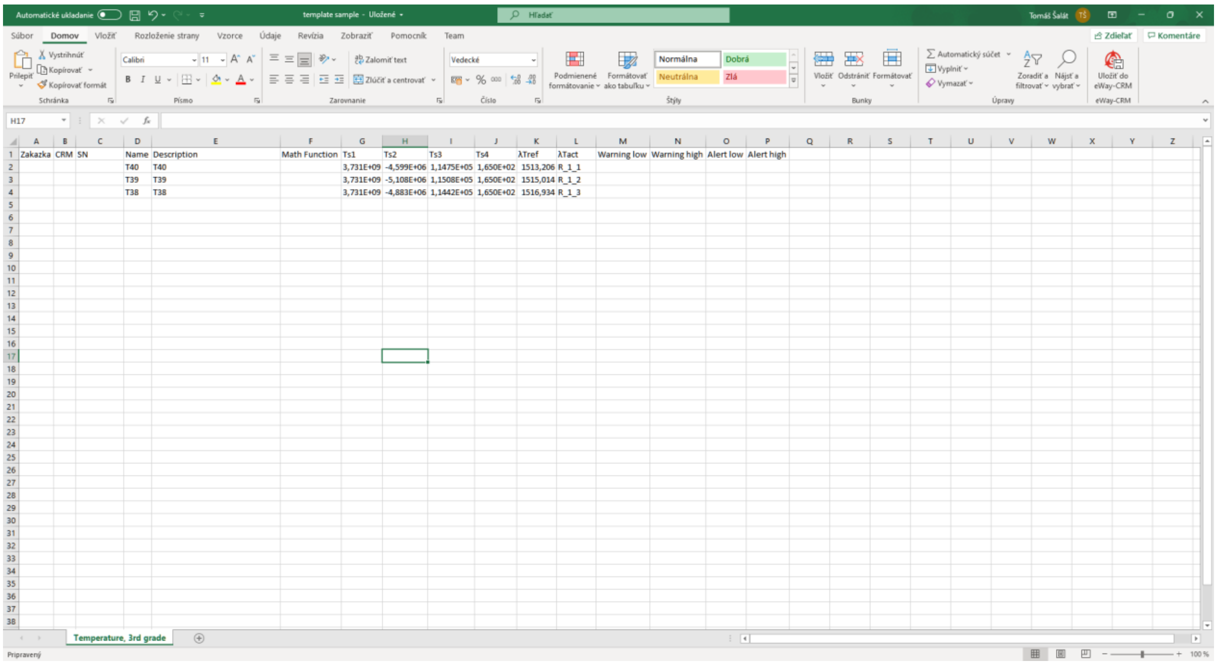
Code snippet 10: Start script example for the Sentinel application.

7. Experimental features – import of sensors

The Sentinel(D) application supports an experimental feature that allows the user to import the sensors from an Excel file and thus substitute the necessity of creating the sensors manually. The feature, at this moment, is supported only by some sensor types but is planned to be enlarged in the future for more sensors. The current sensor types supported are temperature and strain sensors. The feature is accessible from the main menu "Tools -> Import sensors".

To use this in the future, the user has to create the appropriate Excel file, Figure 26, with all mandatory fields filled in. The import supports the linking with peak ranges but before this will be used, the peak ranges have to be defined. Therefore we recommend that the user set the peak ranges at first and only after importing the sensors using this feature.

The Excel templates can be requested at SYLEX support. Please, contact us for more information about this feature and the Excel templates.



H17

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Zakazka	CRM	SN	Name	Description	Math Function	Ts1	Ts2	Ts3	Ts4	λTref	λTact	Warning low	Warning high	Alert low	Alert high
2				T40	T40		3,731E+09	-4,599E+06	1,1475E+05	1,650E+02	1513,206	R_1_1				
3				T39	T39		3,731E+09	-5,108E+06	1,1508E+05	1,650E+02	1515,014	R_1_2				
4				T38	T38		3,731E+09	-4,883E+06	1,1442E+05	1,650E+02	1516,934	R_1_3				

Figure 26: Excel template for sensor import.

Example of use

For a temperature sensor in 3rd grade, the mandatory fields are:

- Name
- Description
- Calibration constants, Ts1-Ts4; λTref
- Optional: λTact
  - If you would like to connect the newly created sensors with an already created peak, you can point the function to assign the peak using his name, i.e. R_1_1

Please verify that Excel didn't change the values from integer/double to string, otherwise, the system will be confused or return NaN.

8. Sentinel, Sentinel-D troubleshooting guide

The table below aims to help you with troubleshooting the unit, connectivity with the unit, etc… It summarizes the most seen issues with the running of the S-line Scan interrogators and Sentinel software.

Behavior or Error message	Error cause and fix
Behavior: The S-line Scan 800 unit is not recognized by the computer	The S-line Scan 800 unit can be without power or the USB cable is not connected properly. Make sure the LED on the power switch is on and that USB cable is connected to the computer.
Error message: The power LED is not lit up	Please, make sure the power adapter is plugged correctly into the outlet and into the unit.
Error message: Unable to connect to the device	Please, verify that the internal flash drive is visible within the computer management to verify the unit's USB cable is plugged into the computer. Make sure that “device manager” – devmgmt.msc, recognize the spectrometer/unit.
Error message: Device serial number mismatch	Please, verify that the internal flash drive is visible within the computer management since the calibration file is located on this flash drive. Please, restart the computer and turn off/on the unit.
Error message: Side-by-side configuration is incorrect	This issue is caused by missing software fixes for the .net framework. Please, install all files from within the folder “dotnet_fixes”, located on the flash drive of the unit.
Error message: Microsoft Dynamics CRM error	Related to a registry issue. Please, navigate to the folder “dev_fixes” located on the flash drive and run “!reg_fix” with administrative privileges - Allows you to register or save performance counter name and registry settings in a file and designate trusted services.

Behavior or Error message	Error cause and fix
Error message: Microsoft.VC80.MFC – could not be loaded	This issue is related to the 64bit libraries and missing software fixes for the .net framework. Please, install all files from within the folder “dotnet_fixes/ VC80.MFC”, located on the flash drive of the unit.
Behavior: The API server is not running	Please, verify that the application was run with administrator privileges and that the firewall is not blocking the default 8024 port.
Error message: Value cannot be null. Parameter name: value	This issue is caused by a generation change in the firmware of one of the key components. A possible workaround is to use either an older version of the software or run the software with a “legacy” driver.
Behavior: Only noise is visible in the spectrum view	Please, verify that the OS recognized the serial to USB converter, and within the device manager, COM ports are present.
Error message: No error message, the software will crash on start-up screen	Please, verify if the “log.txt” located in the root directory includes an ERROR message: *ERROR %timestamp% – Cannot load Counter Name data because an invalid index '' was read from the registry*. If yes, please, navigate to the folder “dev_fixes” located on the flash drive and run “!reg_fix” with administrative privileges - Allows you to register or save performance counter name and registry settings in a file and designate trusted services.
Error message: Value cannot be null. Parameter name: value	Please, make sure that the Vcredist_x64 and Vcredist_x86 located on the internal USB are installed. If unsure, please, install them once more.

If none of the above helps to solve your issue, please, feel free to contact us.

For more information contact our sales team at sales@sylex.sk

* Specifications are subject to change without notice