R·sensors

Appendix 4

NDAS Software

User Manual

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Appendix 4. NDAS Software

Overview

NDAS software is designed to control the **NDAS** series data loggers and digital modules installed in combined instruments of the CME-xxxxND series (hereinafter referred to as a 'device'). The software allows doing:

- initial configuring of the device prior to operation
- selection of operation mode
- parameters setting
- system status monitoring
- registration of seismic signals on the built-in SD card
- real-time signal preview
- sending test signals on the connected sensors.

The software can be connected to devices by means of wireless communication or USB (virtual COM-port). The software can carry out operations with several devices at once including those of different types.
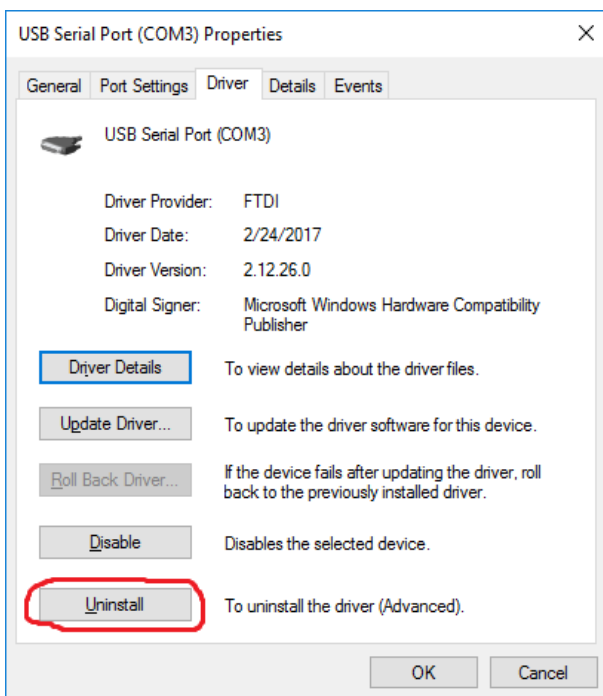
Driver Installation

Installation of the FTDI driver is necessary to work via a low-speed USB connection before the operation starts. For most cases, it is recommended using drivers' automatic search under Windows OS. Below is a process of drivers' manual installation when automatic installation could not set up the driver or its installation caused errors.

Connect the device to the USB port via a low-speed connection. The description of how to connect including a cable type is given in the user manuals for the devices. The device must appear as a COM port in the Device Manager tab.

Fig. 1. Uninstalling of the Old Driver

If the system reports that the required driver is already set up, delete it with the 'Delete the driver software for this device' command. After the driver has been deleted, click 'Scan for hardware changes'. Select the driver from the '/additional/virtual.com' folder from the software distributive.
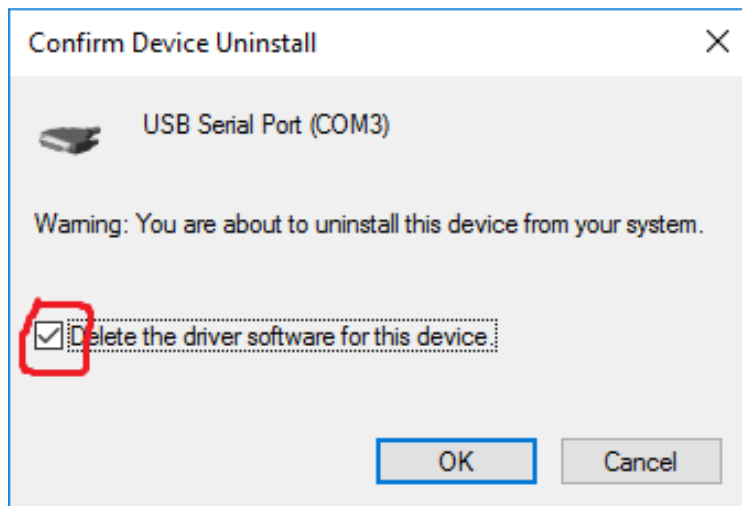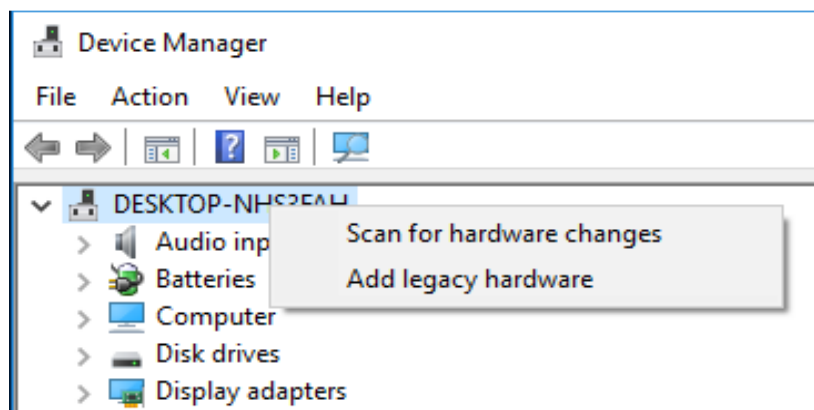

Fig. 2. Confirmation

Fig. 3. Scanning for hardware changes

Software Installation

Install the NDAS software from the corresponding folder by running the 'setup.exe' file. The installation procedure is standard and does not require any special actions.

First Start, Wi-Fi Configuration

Start the **NDAS_app** application from the Start menu. Select the connection type – USB if the device is connected via a low-speed USB port or Wi-Fi if a wireless connection is used (Fig. 4).
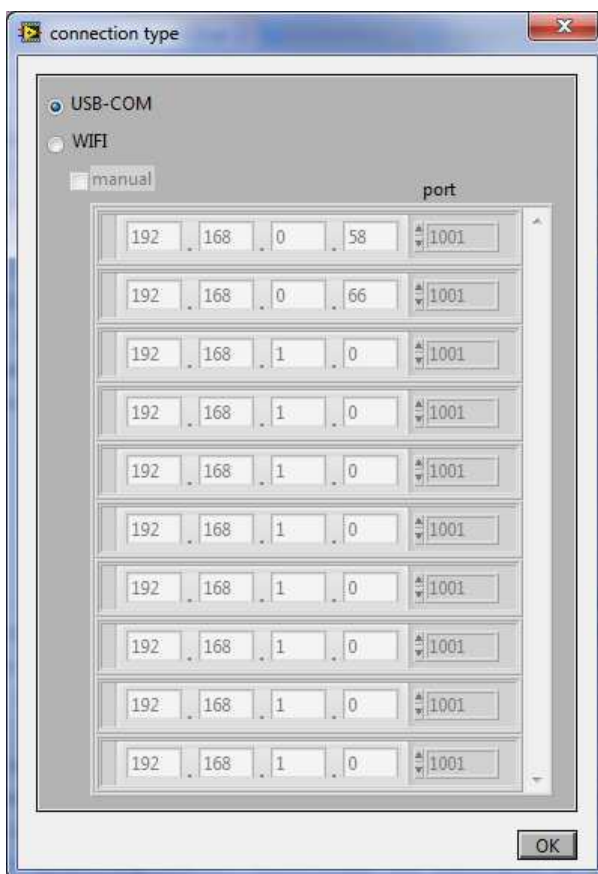

Fig. 4. Connection Types

After you click 'OK', a table will be displayed. Select the device according to its serial number with setting a 'tick' (flag) (Fig. 5) in the left square.
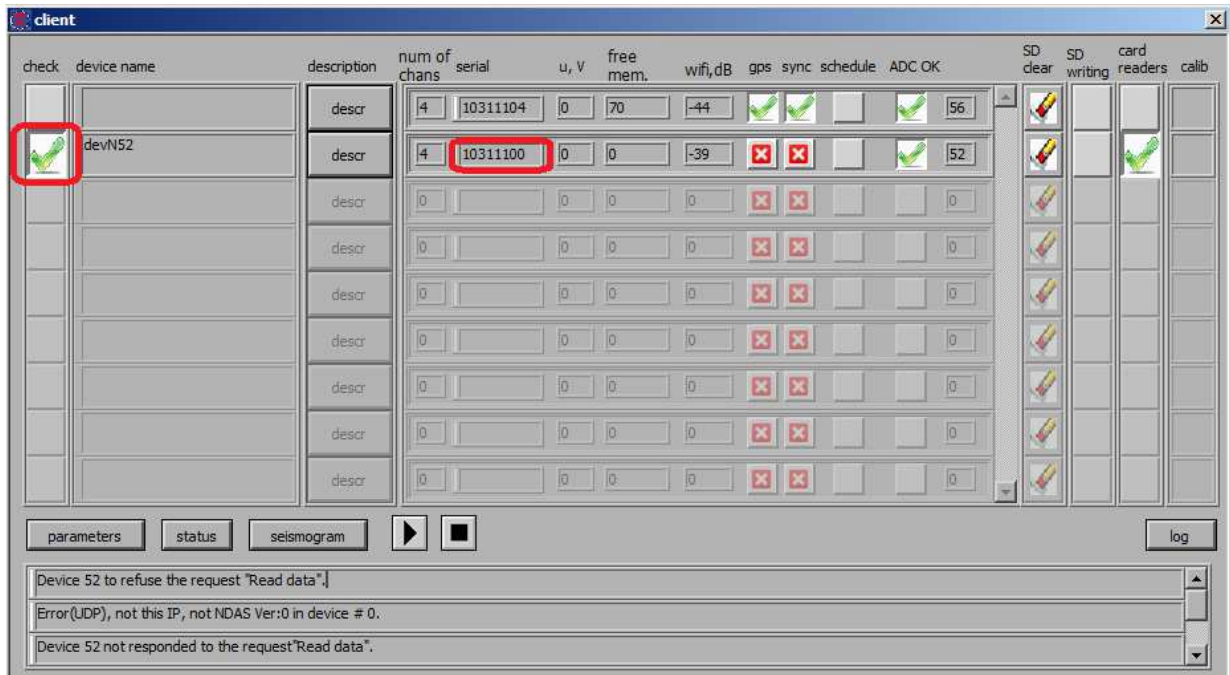
Fig. 5. Device selection

It is possible to rename the device with a more suitable name for your comfortable operations, for example, a name of a seismic station or a conditional installation site. To rename, double-click the name field (Fig. 6). The name remains in the device's internal memory and will be visible in a window of seismograms. Besides, the '**descr**' button makes it possible to add a text comment which will be also visible.
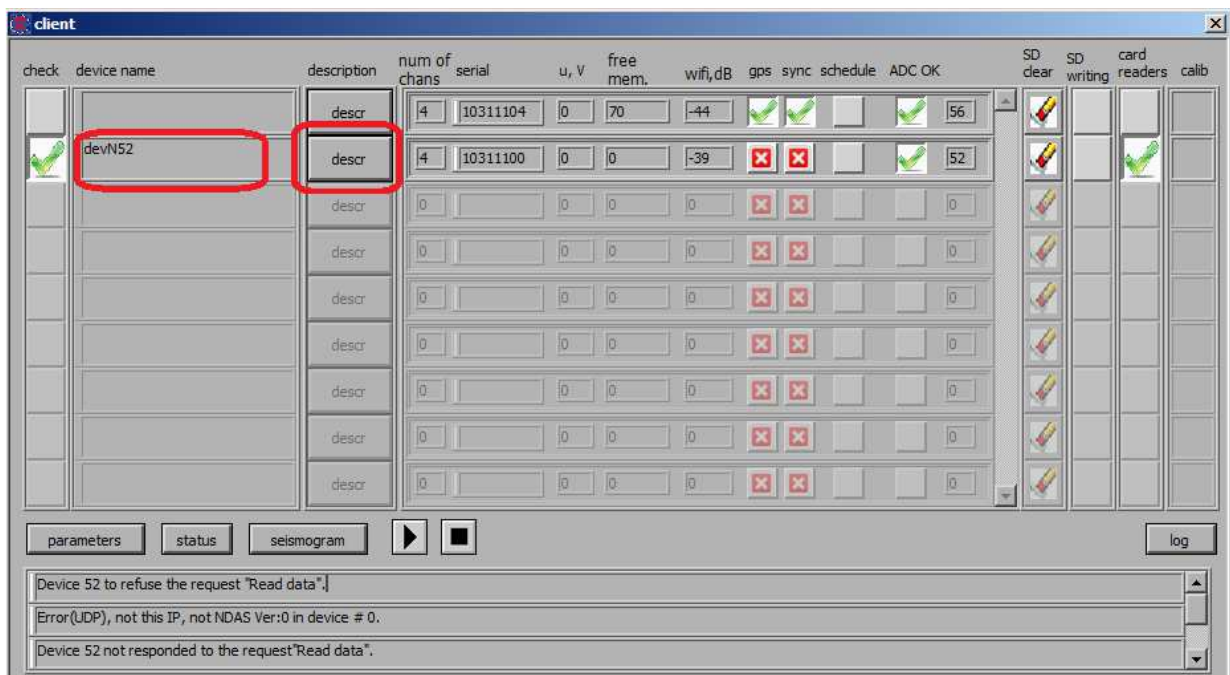

Fig. 6. Setting a name for the device

To setup Wi-fi, select the device with a '**check**' flag (fig. 5) and click '**parameters**'. In the parameters window (Fig. 7) enter the name of your Wi-Fi network (SSid), the password, and a security type in the corresponding fields. Click **'APPLY'**. Initial parameters of the Wi-fi network setup are given in Fig. 7.

The device can operate in the access point mode. For this purpose, set a flag in the corresponding access point square.
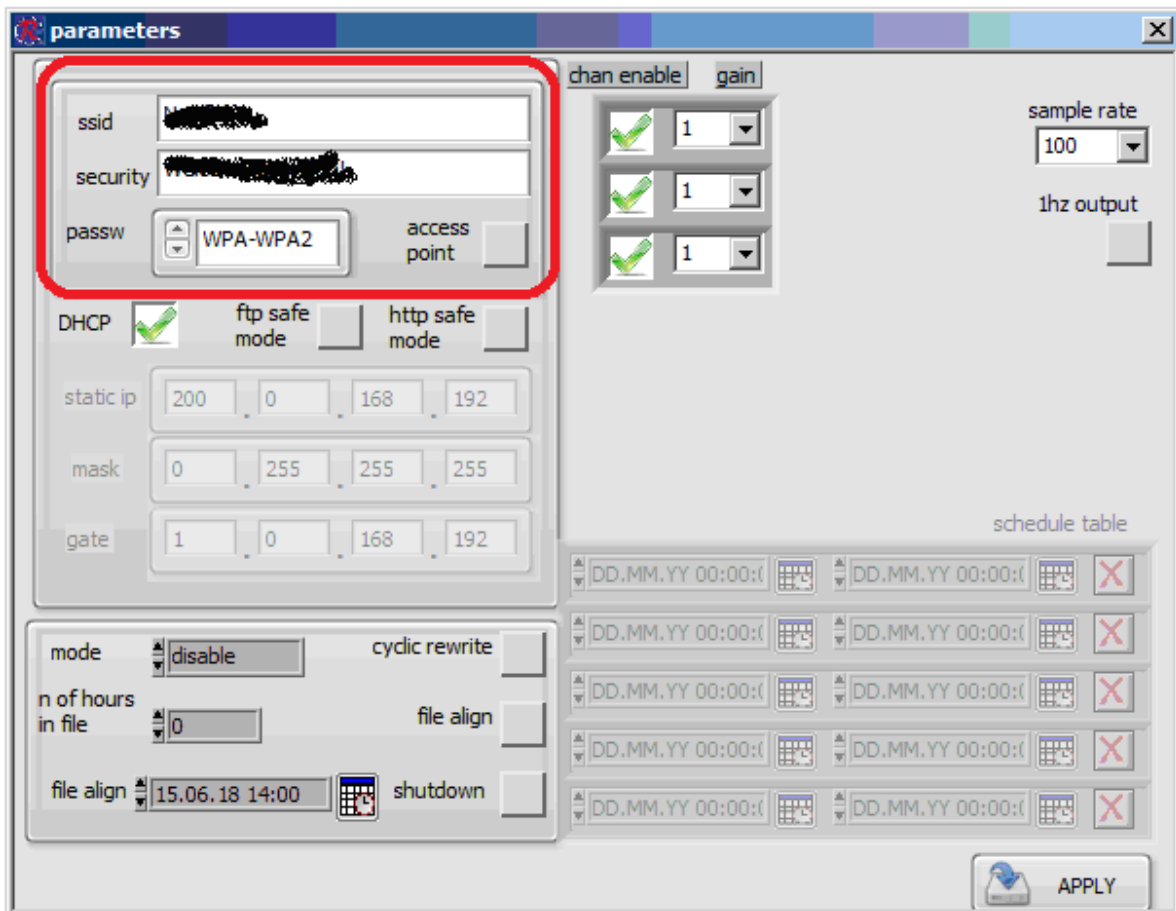

Fig. 7. Parameters Window

Since that moment the device will try to connect to a wireless network. If the connection is successful, all further actions to setup and control the device can be made both via USB low-speed link or sWi-Fi connection.

To start the configuring via a wireless connection from this moment on, close the program and, then, restart it with selecting a Wi-fi connection in the first window (Fig. 4). During the operation via Wi-Fi, all similar settings can be changed for several devices at once. In order to do it, select the devices with the '**check**' flag from the list in a devices selection window (Fig. 5).

Main Table

Fig. 8. Main program window

The table of the detected devices is presented in the main program window. The devices are being found gradually within several minutes. If the Wi-Fi connection mode is selected, then the USB-connected devices are not displayed. Similarly, when a USB is selected, the Wi-Fi connected devices are not visible.

The left third part of the list includes the following.

The 'check' column allows to select the devices for operations. The next column 'name' displays the name given to the device if this was made earlier. With clicking the 'descr' button in the 'description' column, it is possible to read a text comment to the device if it was written earlier.
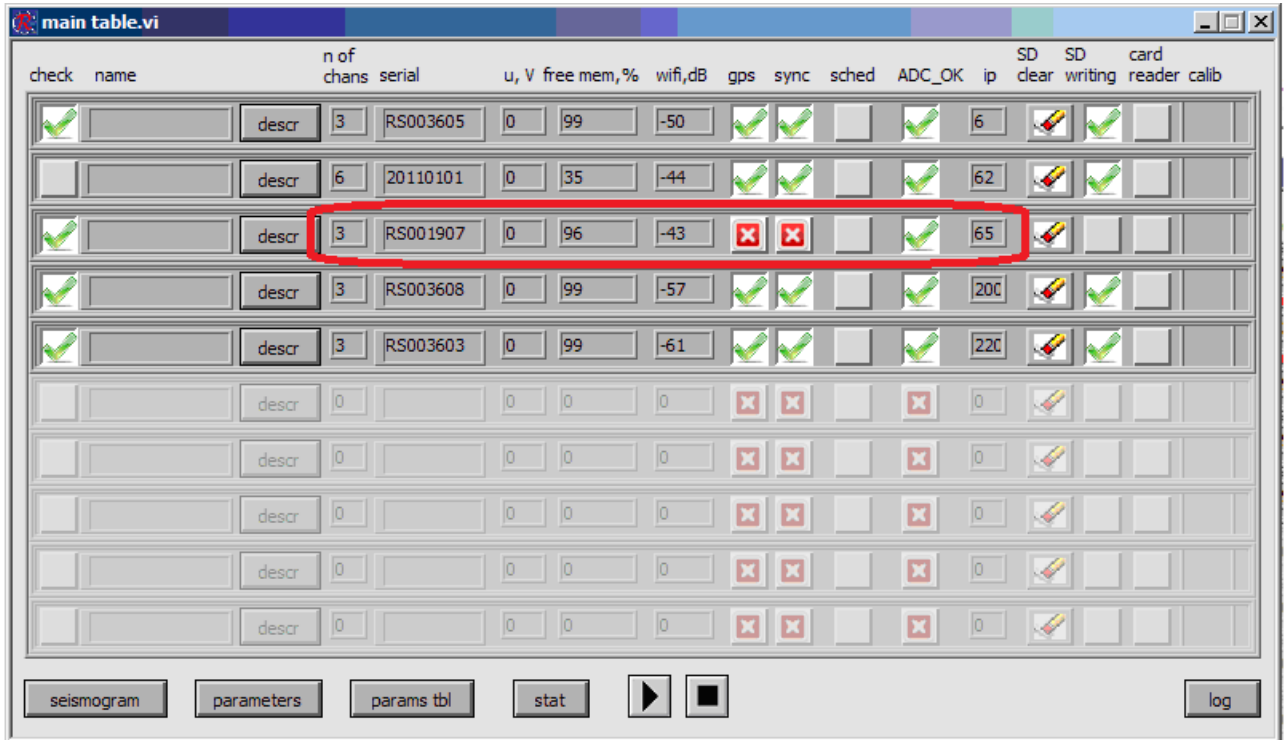
Fig. 9 The brief status of the device

In the middle of the table there is a field for a device's brief status (fig. 9). It includes the information on:

"**n of chans**" – the number of channels of a device;

"**serial**" – the serial number of a device;

"**u,V**" – the supply voltage from the main power source of a device;

"**free mem**." – the free memory of a device in per cent;

"**Wi-Fi, dB**" – the Wi-Fi channel quality conditions in dB;

"**gps**" – the presence of a GPS signal;

"**sync**" – the presence of synchronization of the reference generator;

"**schedule**" – scheduled recording status

"**ADC OK**" – ADC status;

"**ip**" – the last three digits of the device's IP address.
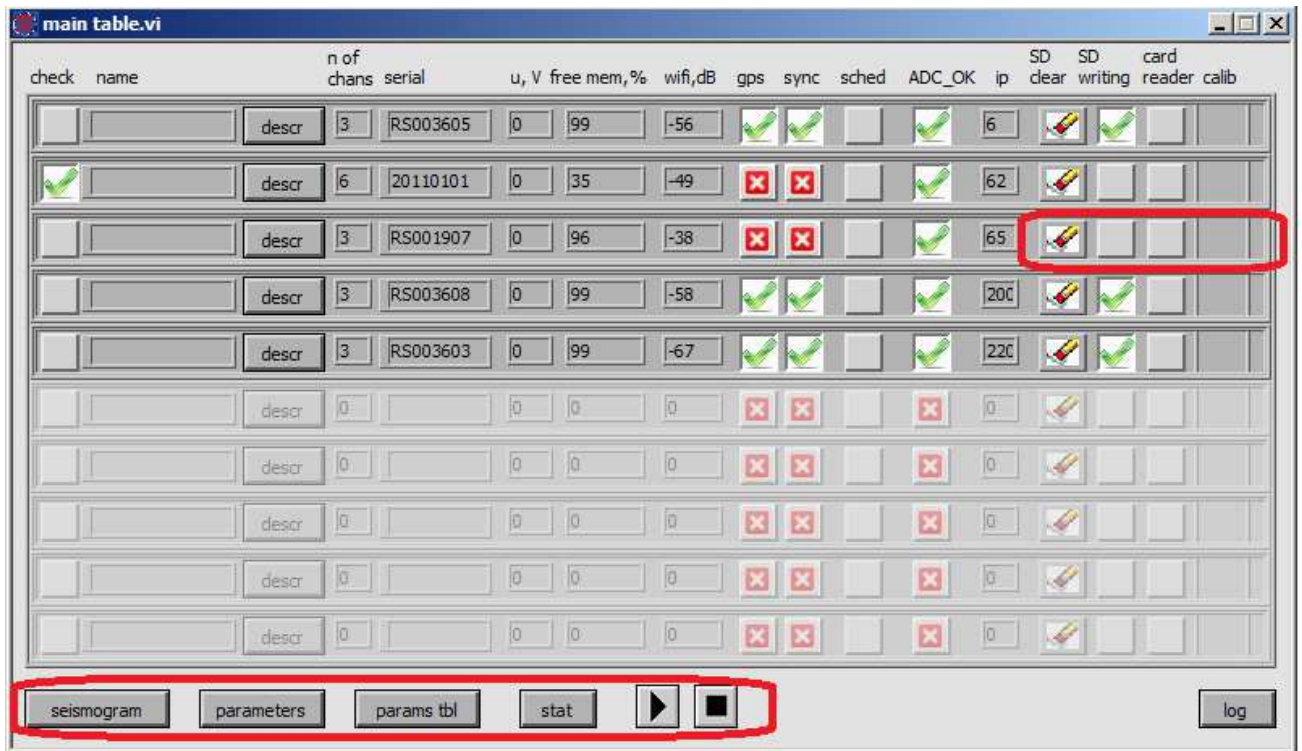
Fig. 10. Controls of Devices

There are controls of devices on the right and below the list of devices. Depending on an operation mode, it is possible to operate with a group of 5 (a signal view mode) up to 20 (ADC parameters setup) devices. Moreover, depending on the mode, devices of only one type (ADC parameters setup) as well as devices of different types (like viewing of parameters and the status) can be selected. If it is impossible apply the selection of different types, an error message is displayed.

The controls allow for:

button **'seismogram'** – switch to viewing signals acquired by the devices;

button **'parameters'** – switch to the device's parameters setup;

button **'params tbl'** – switch to viewing the set parameters for a group of devices as a table;

button **'stat'** – switch to viewing detailed information on the status of devices as a table;

button ▶ - manual start of signal recording;

button ■ - manual stop of signal recording;

"**SD clear**" – clearing of the memory stick (it causes reset of the device);

button/indicator **'SD writing'** – allows to start and stop recording in a manual mode as well as to display a recording indication. Setting the flag ✓ means that the device is recording a signal;

button/indicator **'card reader'**– allows to switch the device into a internal data storage reading mode and back to normal operation. The presence of the flag means that the device is in the reading mode. The acquisition of signals in this mode is impossible.

button **'calib'** – opens a submenu of test signals. The following types of test signals are possible:

- a single impulse of a 1 sec. duration and a 1 V amplitude

- a periodic sequence of impulses of a 1 sec. duration and a 1 V amplitude

- a sinusoid of 1 Hz frequency and 1 V amplitude

- a sinusoid of 10 Hz frequency and 1 V amplitude

Fig. 11. Log button

The **'log'** button let view the system log-file.

Setup of Parameters
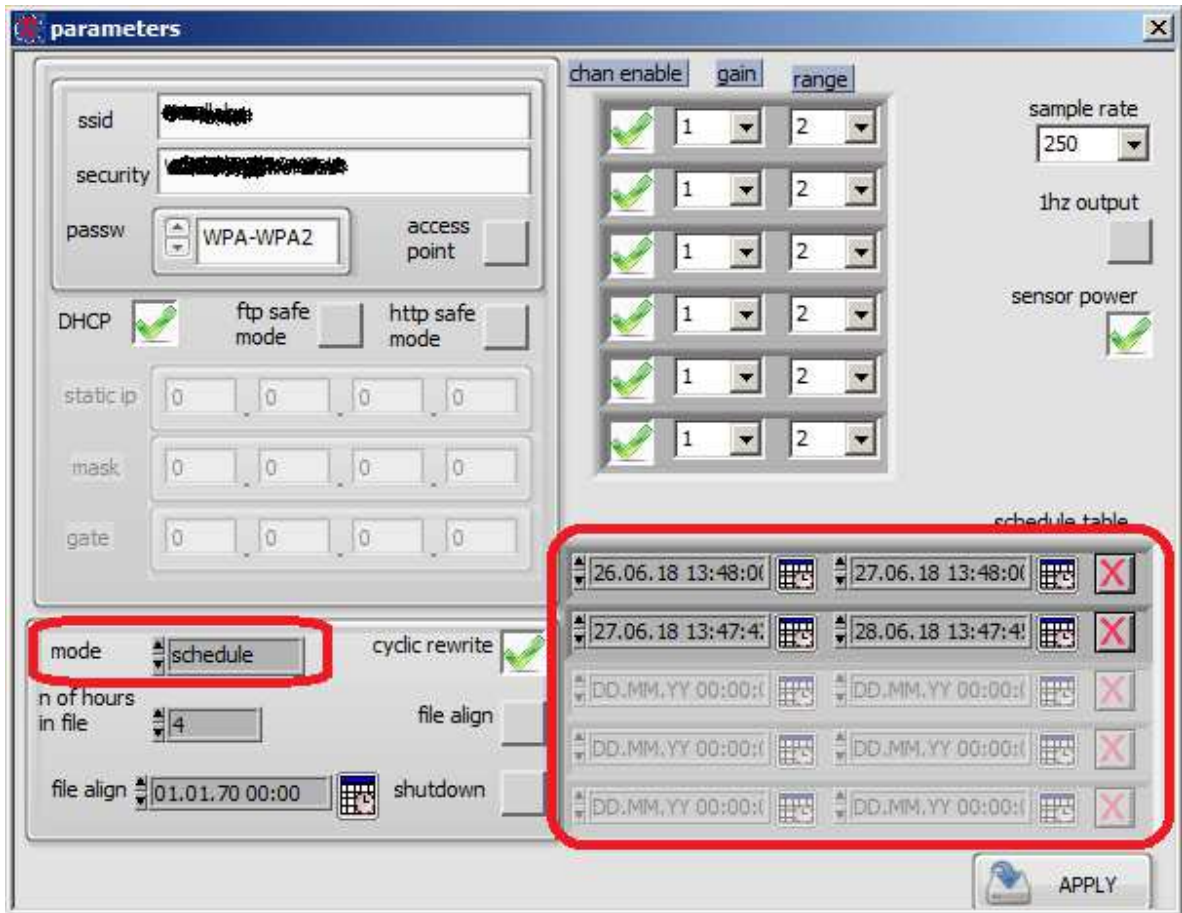
Fig. 12. Device Parameters: Mode and Schedule

In addition to the Wi-Fi parameters setup, the Parameters window allows to configure:

Conditions to start the recording (controlled in the 'mode' field):

The **'mode'** field can be set up as follows:
- **manual**: the start and stop occurs only by the manual command from NDAS software or Web-interface of the device. The calendar is not used.
- **schedule**: the device starts and stops operating according to the calendar. If this option is activated, upon completion of record the device can be switched into a standby mode. If needed, set a **'shut down'** flag in the window.
- **immediate**: recording starts right after power on. The files recorded before the time synchronization occurs are saved in the 'No_Data' separate folder. After the synchronization is finished, the recording continues to the folder with a current date and time.
- **sync**: recording starts only after the synchronization has been finished.

When the **'schedule'** setting is selected in the **'mode'** field, the device turns on and off recording according to the preset start and stop times consecutively for each row in the table. The entries which are having stop time at past moment are not processed.

If the device is powered on in the moment after the start time of the current record fragment but until its completion, recording starts from the moment of synchronization until the stop time specified in the table.

Start time and stop time are specified in UTC up to a second. Pay attention to the correction for time zones. For example, Moscow time zone is UTC+03:00.

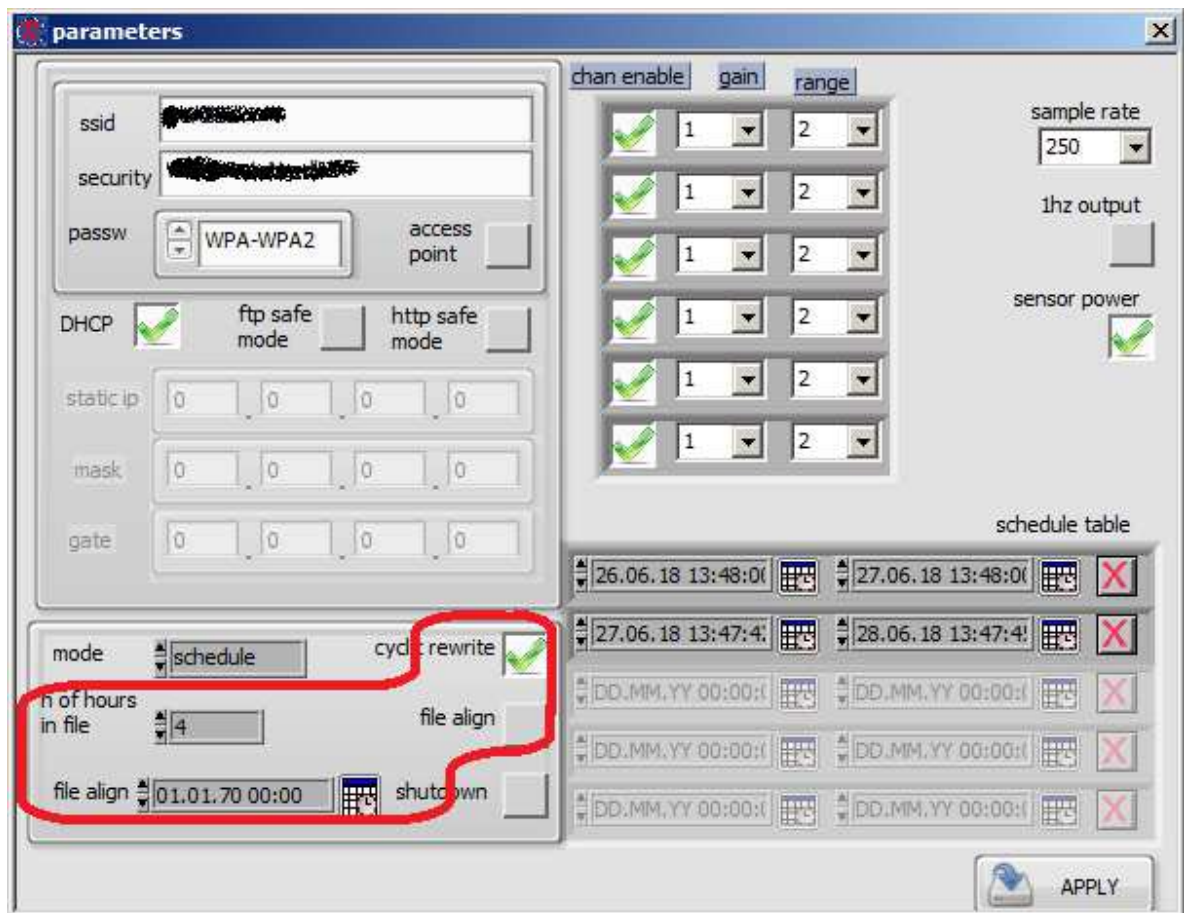- **Files Recording mode**: operation mode switches are located to the left of the date and time fields (Fig. 13)

Fig. 13. Operation Modes

The flag in the **'cyclic rewrite'** field activates the ring record mode on the card when newer data are recorded over the oldest data when free room is over.

There is the **'n of hours in file'** window under the '**schedule**'. The field determines the length of a continuous recording into one file. Time is defined in full hours; the maximum value is 240 (10 days). The **'0'** setting is equivalent to setting the maximum length of record (240 hours).

The **'file align'** flag allow to synchronize the start of each recorded files on different devices. It is possible to set up the same moment of start of a segment of recording for a group of devices. At this situation the first segment is recorded until the starting moment of the next segment (i.e. it can have any smaller length). Further on, the start of every next segment is reckoned from the time set in the **'file align'** field. For example, it is possible to start the next segment on a group of devices at 0:00 – in an equal hour.
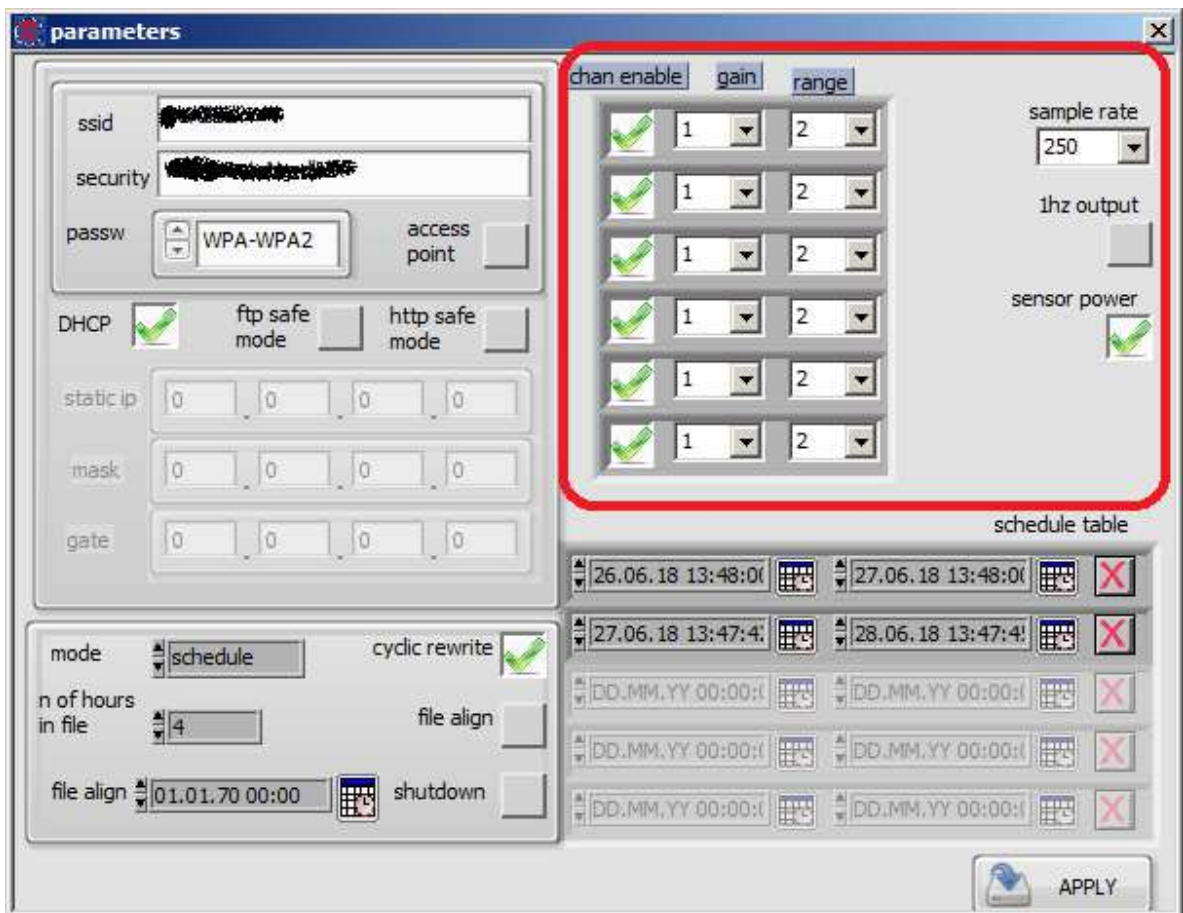
Fig. 14. ADC Operation Modes

- **ADC Operation Mode**:

The ADC Parameters field is located in the upper right corner. A flag in the **'chan enable'** filed enables or disables a channel of the device.

Adjustment of a **'gain'** is located to the right of this field. It is possible to select a gain out of the list of values provided by a device. If a selection of an input range is provided, a list of possible **range** values will be available. Depending on the device inner structure, a channel can be selected individually or in a group of channels or all channels of the device can be selected at the same time.

A list of sampling frequencies **'sample rate'** supported by the device is located in the upper right corner. Sampling frequency is set up for all channels of the device at the same time.

If **'1hz output'** is enabled with a flag, a signal is being recorded with two sampling rates – the main one which is set up in the **sample rate** window, and **1 Hz** in different files.

The **'sensor power'** flag allows to power on and off the sensors connected to a device (not applicable for all devices).

To apply all changes of parameters, it is necessary to click the 'APPLY' button before escaping from a window. In most cases, saving the parameters requires reset of the device. The device is unavailable for a time of reset. After the reset, resynchronization with GPS is necessary.

Parameters Table

Fig. 15. Parameters Table

Viewing the parameters as a table is useful for checking the accuracy of parameters set for a group of devices.

The first tab allows to check the ADC's following parameters:

"**device name**" – a number or name assigned to a device;

"**serial**" – the device's serial number;

"**sample rate**" – the preset sampling rate;

"**1Hz output**" – if the 1Hz recording option is activated;

"**sensor power**" – if power supply to the sensors is enabled;

"**gain range** " – a value of current input range and gain for each channel.

If necessary, it is possible to edit parameters of each device with clicking the 'edit' button on the right.

Other tabs allow for checking and editing parameters of calendar and network settings for the devices as well as viewing of system information.

Status Table

Fig. 16. Status Table

The status table provides all available information on the device condition:

"**serial**" – the serial number of a device;
"**name**" – the number or a short comment assigned to the device;
"**gps date time**" – time on the clock of the device;
"**firmware version**" – a firmware version of the device;
"**gps valid**" – presence of time synchronization with GPS;
"**temperature, degree**" – the device's temperature in degrees;
"**pressure, Pa**" – atmospheric pressure in Pa;
"**azimuth, degree**" – orientation of a sensitivity axis with respect to the magnetic North pole direction;
"**tilt, degree**" – inclination of a sensitivity axis with respect to vertical;
"**longtitude**" – device longitude on GPS;
"**latitude**" – device width on GPS;
"**height, sea level, m**" – device height in meters above the sea level on GPS;
"**volage, V**" – supply voltage from the main power source in volts;
"**mem, MB**" – volume of the internal memory.

Some part of information is unavailable in different devices. In this case, the corresponding windows display zero or 'N/A'.

Viewing of the acquired signals on the fly

The **'seismogram'** button in the main table switches the software into the signal view mode to view signals. Set **'check'** to the necessary devices in the main table (Fig. 5) and then click **'seismogram'** to enter view mode. It is possible to view data from up to 5 devices at once. It is also possible to view data from devices having a different number of channels.
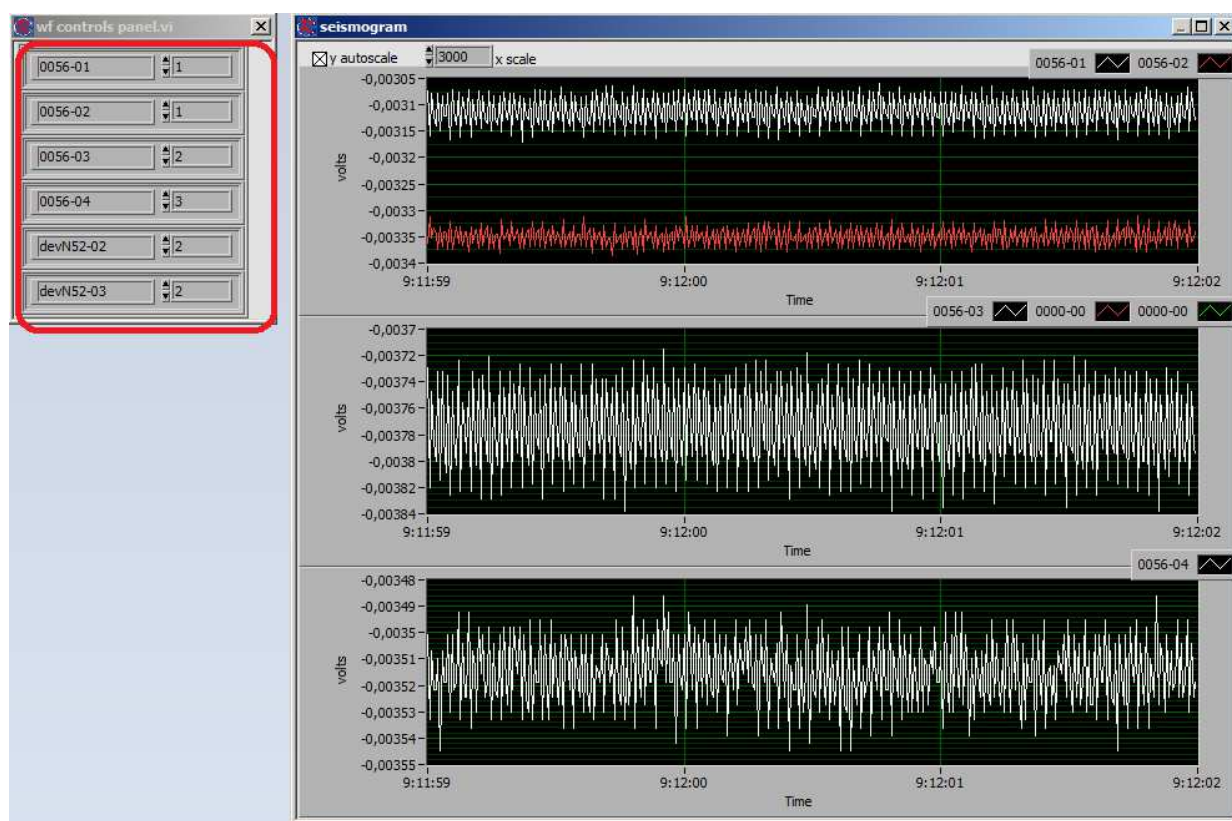
Fig. 17. Signal View Window

The list of available channels for each device is provided in the left smaller window (Fig. 17). It is possible to select a window in which the signal from a channel will be displayed by changing the number on the right.
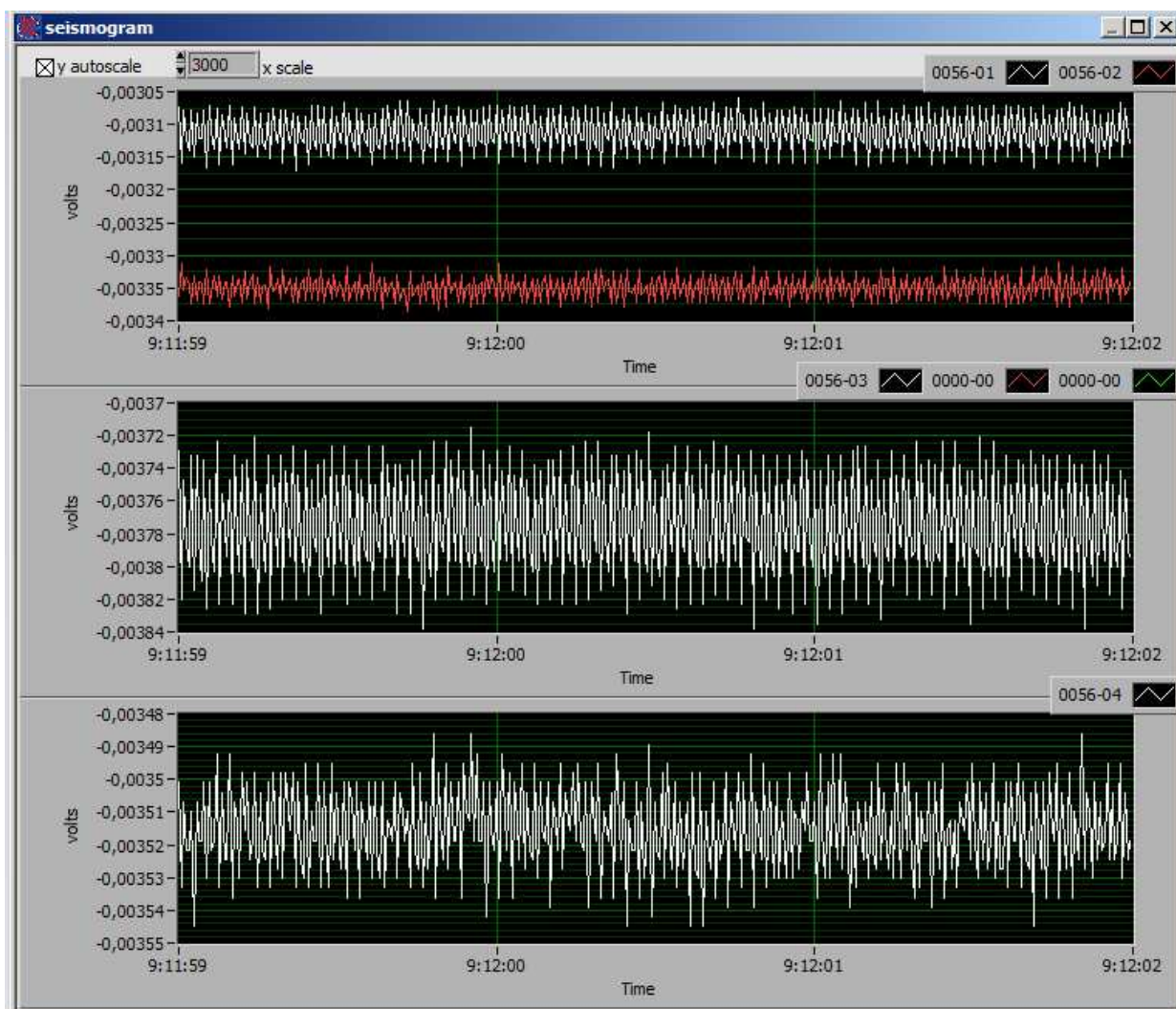
Fig. 18. Signal View Main Window

The main window (Fig. 18) allows to select an automatic scale of a signal with the **'y autoscale'** checkbox and set **'x scale'** – the width of the windows (time scale).

The right top of each window includes the numbers or names of devices and number of channel which are displayed in the window as well as a color of a presented signal. One window can contain up to 5 diagrams. Besides, by a right click, some additional instruments for preview setup are available.

Recording Format of the Memory Card

Data are being recorded to the memory card in a device's proprietary format .SIV. The description of files naming system is provided in item 4.2.3. 'File system'.

To convert data into other formats, use the data converter furnished with the device's software.

Start the **conv.bat** file to use the converter. Enter a path to the initial data folder in a corresponding window and a path to the folder where the converted data will be recorded. Select the output format by a tick. Click 'OK'.
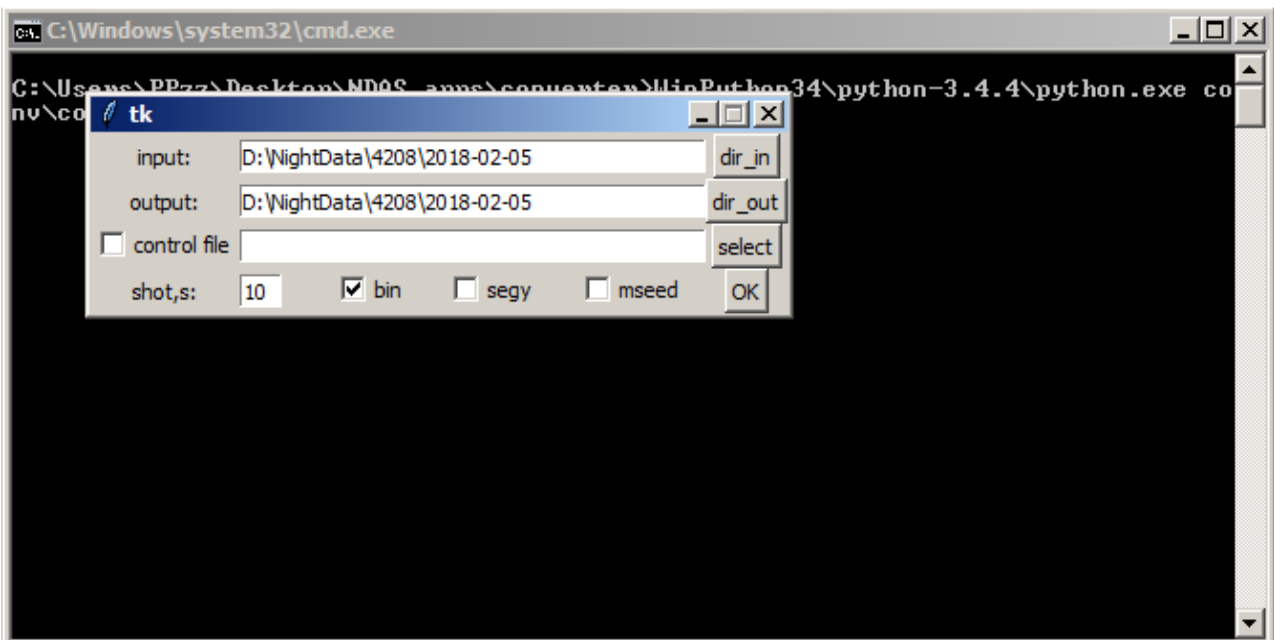

Fig. 19. Data Converter Window

While converting, the service data are copied to a separate .CSV file. This file contains the data including recording time data, coordinates and the sensors' readings which are available in the device. The data are updated every minute, therefore every line of the file contains a new minute of recording.

Column	Value	Description
Sample time	ns *	Recording start time of a minute block according to the data logger's clock
GPS time	ns *	Time of the latest drift measurement on the GPS clock
Drift	ns *	The drift of the clock measured in the GPS time point is given as a difference between a true time on GPS and a time on the data logger's clock: d = tGPS – tLocal
Acc (Z, X, Y)	mg	Indications of the three-axis accelerometer (available not in all models of devices!)
Comp (Z, X, Y)	mG	Indications of the three-axis magnetometer (available not in all models of devices!)
Press_reg	Pa	Indications of the pressure sensor (available not in all models of devices!)
Power_reg	V	Value of main supply voltage (work only when powered via an external source; if powered via USB, the voltage is not measured)
Temper_reg	°C	The data logger's temperature
h	m	Height above the sea level – according to the GPS receiver
lat	°	Width – in degrees
lon	°	Longitude – in degrees
Sample rate	1/s	Sampling rate of a signal
Sample time	s	Recording start time of a minute block on the data logger's clock given in a format which is clear to a user

* Time is given in the UNIX Time format with the resolution of 1 nanosecond. The UNIX-time is a standard format of time in which a time starting point is considered midnight (0:00:00 AM UTC) on January 1, 1970.