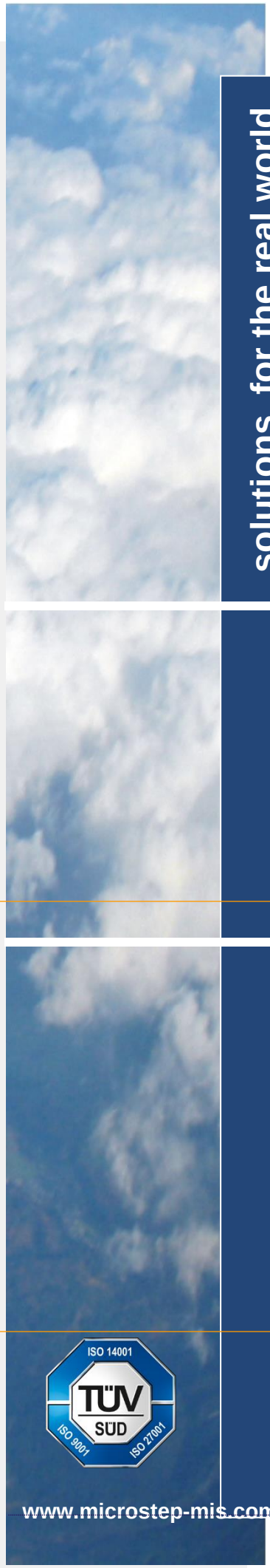

CalibLab

Calibration Laboratory

Version: 1.3

User's Guide

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ISO 14001 TÜV SÜD ISO 9001 ISO 27001

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MicroStep-MIS develops, manufactures and markets monitoring and information systems. The key fields of our activities are meteorology, aviation, environmental sciences, seismology, power engineering, civil defense but also information systems in tourism.

MicroStep-MIS operates worldwide. Our core customer groups are airports, meteorological and seismological institutes, environmental authorities, industry, power stations and electricity distribution companies.

Table of contents

About this reference

The CalibLab user guide is dedicated to users of the Calibration Laboratory.

Typographical conventions

Throughout this guide, several typographical conventions are used to help reader to follow instructions and identify the important information.

The special note for the reader, warning or example:

Note: *The comment section will not be shown on the calibration certificate.*

Attention: *Don't forget to insert blind stops.*

Warning: *Restoring the database will erase the actual state of database and replace it with the data loaded from file.*

Example 1: *Example demonstrates the adjustment procedure of humidity probes.*

The text output, listing of a file:

```
<?xml version="1.0" encoding="utf-8"?>
<Settings>
  <Item1>Example</Item1>
</Settings>
```

The special characters are written in the following form (in brackets):

```
p<CR><LF>
! 54.5,25.8<CR><LF>
```

Part of Graphical User Interface (button label, field label, menu item):

Print **Calibrate** **File -> Save As**

1. Introduction

MicroStep-MIS introduces the IMS4 CalibLab, a universal, intuitive, easy to use, and flexible calibration laboratory, which can be easily installed in any metrological, meteorological, aviation, or industry institute.

IMS4 CalibLab brings the possibility to calibrate relative humidity, barometric pressure, temperature, wind sensors, and much more, using unified and modular software, supporting multiple calibration chambers and devices, enabling calibration of almost any sensor on the market automatically, quickly, and reliably.

1.1 System description and architecture

MicroStep-MIS has prepared equipment and measurement standards for laboratories:

- temperature
- relative humidity
- atmospheric pressure
- wind speed and direction

The software may be configured to calibrate other quantities as well. By general it requires:

- a reference sensor,
- a device, which generates the desired value of quantity – Generator,
- device which measures/switches the results from the sensors
- device which measures the ambient conditions of the measurement

The above-mentioned devices may be combined with others other devices over the same communication channel, or multi-purpose devices may be used.

1.1.1 Temperature calibration

The temperature calibration laboratory consists of a thermostatic bath, which works as a temperature generator, voltage or resistance meter and computer. The calibrated device may be analog voltage, PRT (platinum resistance thermometer) sensor (e.g. Pt100), digital sensor or just temperature indicator.

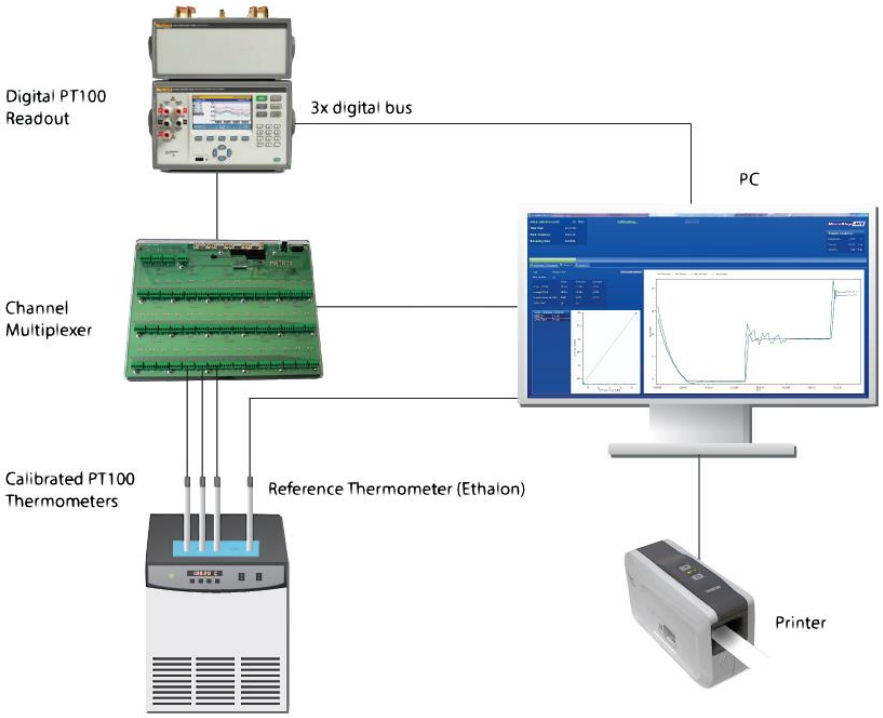

Figure 1: Example temperature calibration schematic

The sensor must be submersible to the calibration liquid. If the calibrated sensors are PRT sensors, then all sensors are switched by channel multiplexer to the resistance meter using 4-wire connection. Other types of sensors may be connected by serial line, SDI-12 or as analogue voltage. Even non-electrical sensors may be calibrated, but then manual value reading is required.

1.1.2 Relative humidity calibration

The relative humidity calibration laboratory consists of Humidity Generator (e.g. Humiwell) data acquisition device (e.g. Humiwell with external card). This generator creates desired conditions of air (dew point and temperature) in a closed chamber. The reference sensor is a chilled mirror sensor, which measures the dew point of mixture in air. The temperature in the whole chamber is controlled to a constant value. The relative humidity is calculated from dew point and temperature by the reference sensor or the software. The sensors may be with analog voltage output or intelligent digital sensors.

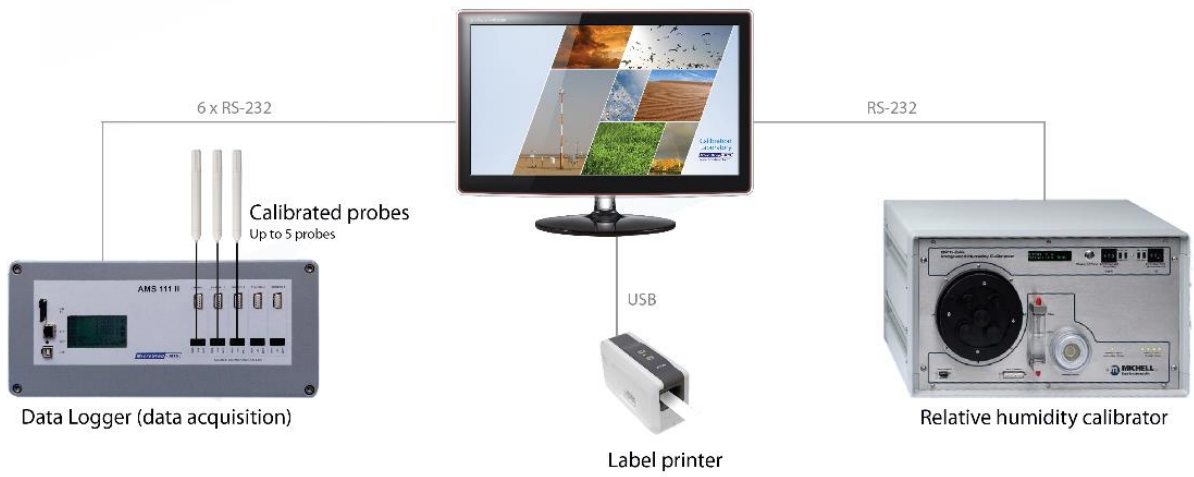

Figure 2: Example humidity calibration schematic

1.1.3 Atmospheric pressure calibration

The calibration laboratory consists of Pressure generator (e.g. Pressurewell), data acquisition device and optionally vacuum pump, air compressor or pressure distributor (if not already included in Pressure generator). The calibrated barometer must have pressure inlet, otherwise it is necessary to use a pressurized chamber.

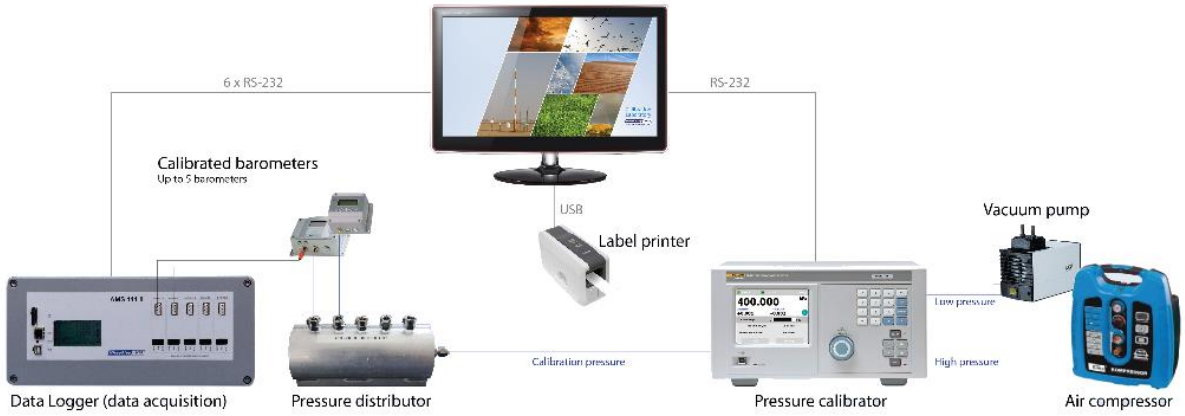

Figure 3: Example pressure calibration schematic

2. Starting of system

Before starting the system, the workplace must be prepared. It means installing the required hardware and software.

2.1 Laboratory wiring

Each type of the calibration laboratory must be connected according to schematic. This schematic is designed individually depending on the used instruments.

2.2 Software installation

Minimum system requirements:

CPU:	1 GHz
RAM:	512 MB
OS:	Microsoft Windows 7 or higher
Framework:	.NET Framework 4.5.2

The CalibLab software needs the following software for proper working:

- Database server PostgreSQL
- PDF generator software (e.g. OpenOffice/LibreOffice Writer or Microsoft Word)
- Document printer application (e.g. OpenOffice/LibreOffice Writer or Microsoft Word)

After first start, the database connection must be configured. The CalibLab will create the database structure. Then it will be able to store the calibration results in a database.

3. Using of system

The CalibLab User Interface is designed to be helpful in many common tasks. After starting the program, you can select your action.

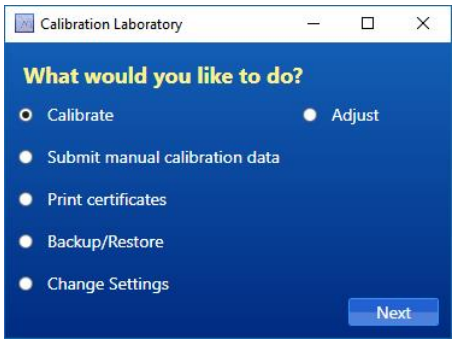

Figure 4: Selection of action

3.1 Prepare the calibration

If you only need to measure the sensors, choose **Calibrate**; otherwise if you want to modify the result of intelligent sensor, select the **Adjust** option instead of **Calibrate** then click **Next** button.

If the software is configured to handle multiple Calibration modes, then you have to choose. This option is not shown if the Calibration Laboratory is designed for single purpose. Then select the number of sensors.

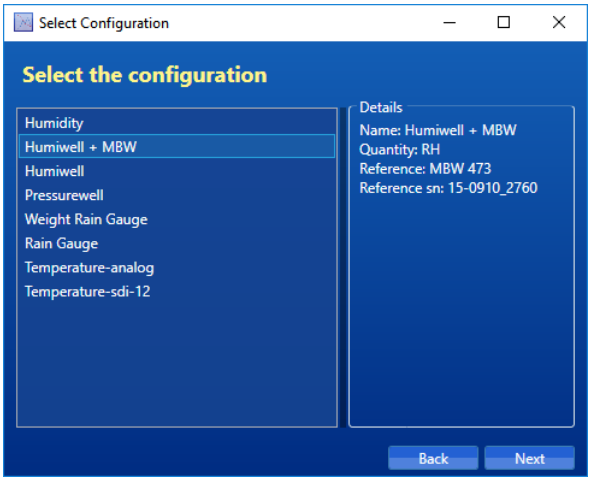

Figure 5: Selection of configuration (optional)

3.1.1 Select the calibrated sensors

There are two types of User interface, depending on the configuration. One is with limited number of devices, where it is enough to select the count of sensors and then the Sensor Driver. The sensor driver is a configuration which contains all of the settings of the sensor. This includes information about communication, adjustment, calculations, uncertainties etc. There can be more drivers to the same Sensor type and each can work differently. Different driver is needed when you are using analog output of sensor and different when you use digital communication. See chapter 3.4 for details.

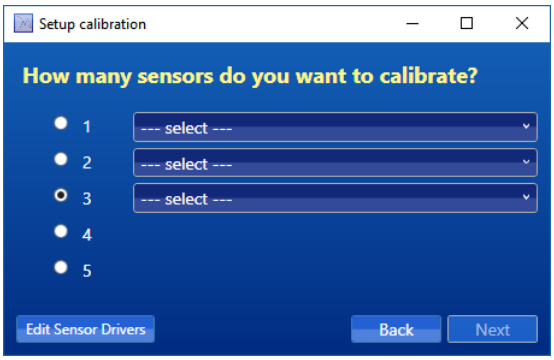

Figure 6: Select the number of calibrated devices

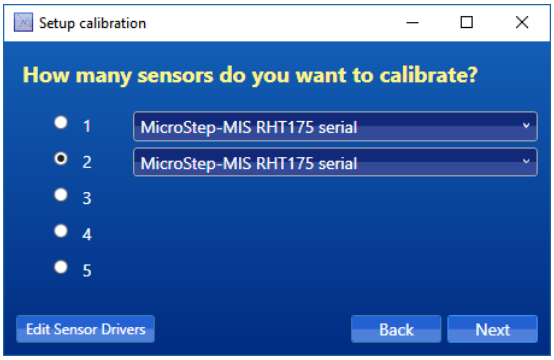

Figure 7: Select the Sensor drivers

The other type of user interface offers you to calibrate more than 5 sensors and the number of calibrated sensor must be entered manually.

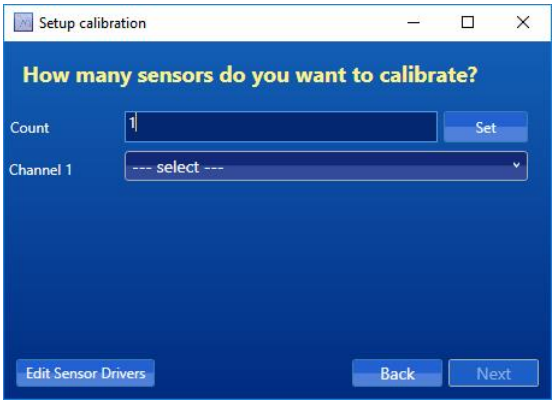

Figure 8: Enter the number of calibrated sensors

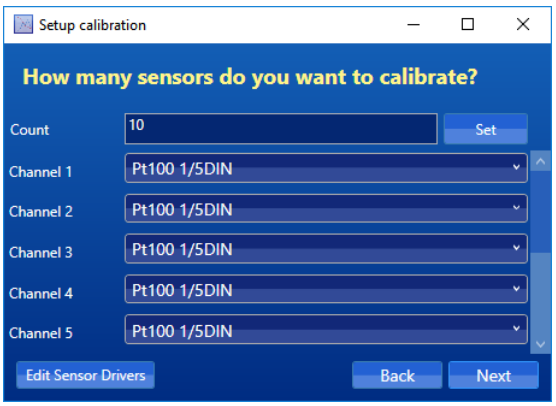

Figure 9: Select the Sensor drivers

3.1.2 Check sensors and enter serial numbers

On the next page (Figure 10 or Figure 11) enter the serial numbers from the sensors and connect them. If the calibrated sensors are intelligent sensors with digital interface and the sensor driver supports it, then it can automatically read the serial number from the sensor. Just hit the **Read serial number from sensors** button. If all sensors are connected and the serial numbers are filled for all calibrated sensors, then you can continue to next step. If the **Next** button is not clickable, then either a serial number is missing or the sensor does not respond. The response of sensor is marked with green tick ✔ if the sensor is OK or red cross ✘ if there is error with the connection / communication.

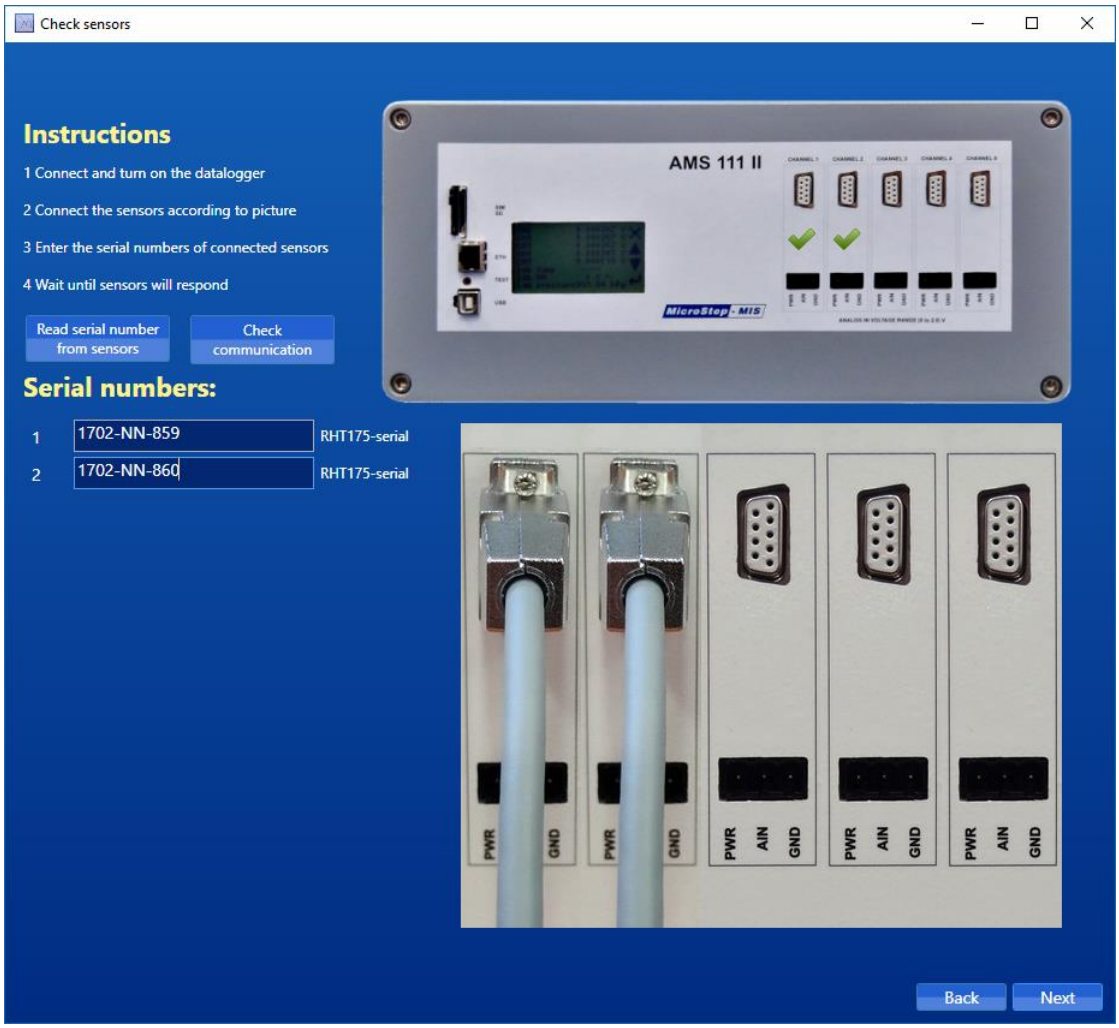

Figure 10: Enter the serial numbers (with images)

There are two modes of this screen, one above is configured for limited number of sensors, but with graphical help of connection, and the other type below is an unlimited list of sensors, but without the graphical help. The graphical view is configurable and may be adjusted for the workplace.

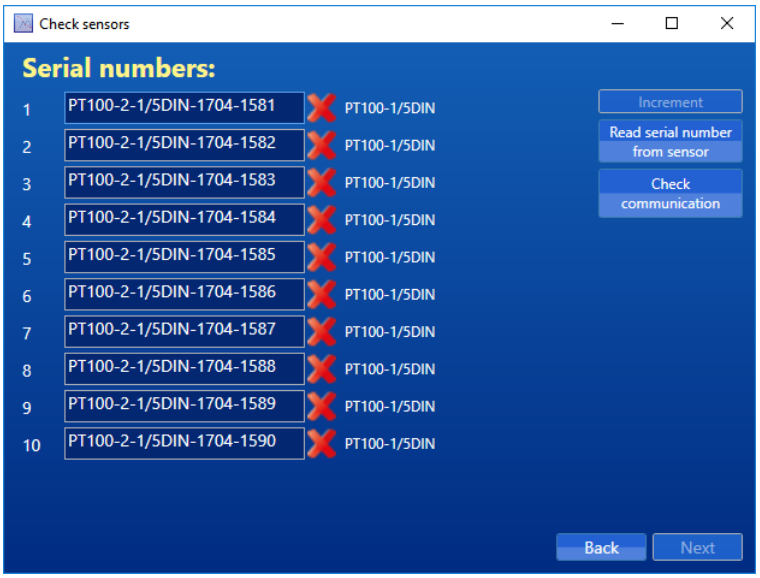

Figure 11: Enter the serial numbers (unlimited number of sensors)

Sometimes it takes a while to finish checking all of the sensors, if there are many. If you are sure that the sensor is connected correctly, you can check the communication by pressing **Check communication** button (Figure 12). One common problem with communication can be that the communication line is occupied by another program. If you see that the **Connect** button is clickable and the **Disconnect** is not, then it means that the communication line is not open. If you found that the communication needs modification, you can edit it by clicking **Edit drivers**. To reflect those changes in actually used sensors, click **Reload drivers**.

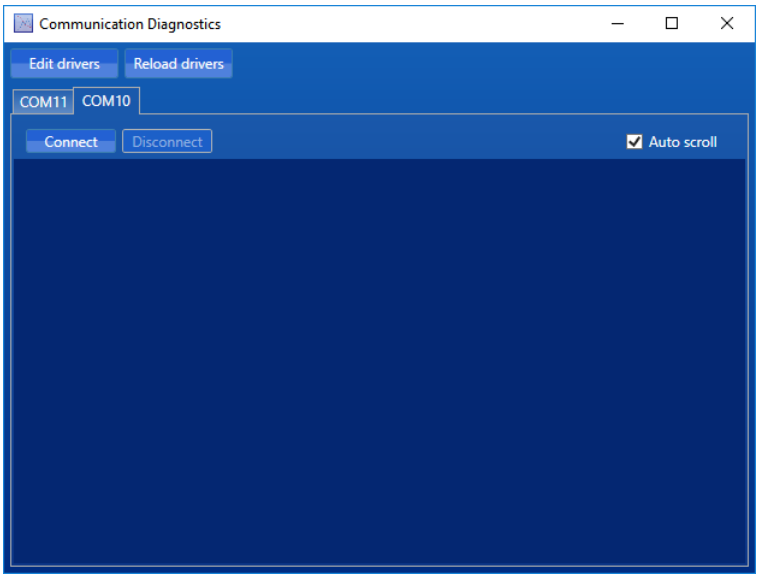

Figure 12: Communication diagnostics

If the communication is OK for all of the sensors, then you may continue to **Next** step (Figure 13).

If the system is configured so, then it can show you additional steps with pictures and descriptions of preparing the measurement process. For example, it can notify that you have to turn the calibrator on, attach the wires or tubes, or any other instruction, which is customized for the workstation.

3.1.3 Details about calibration

After these steps, you can define details about the measurement. Who performed it, and who approved this measurement. Optionally you can fill the customer details. This information may be printed on the calibration certificate (except comment, which is intended only for marking the measurement).

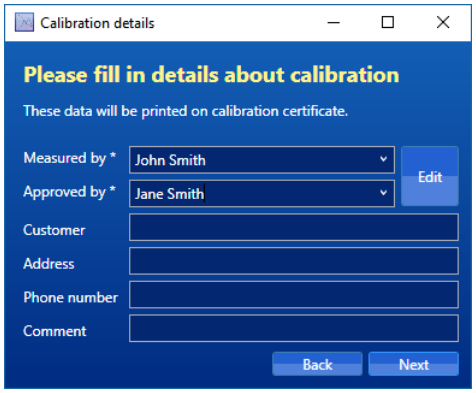

Figure 13: Enter the details about calibration

3.1.4 Calibration profile

Before starting the calibration, you must set the calibration profile (Figure 14 or Figure 16). You have to set the **Set point** to desired value. This value is in the main units of quantity e.g. in °C for temperature calibration or % for relative humidity calibration. Optionally there may be other secondary quantities e.g. temperature during the relative humidity calibration. Then you must to define the duration of that point. If you want to use a point just for stabilization purpose, you can disable the point by unchecking the **Enabled** box. This way the measurements of that point will not be stored to results.
You can add points by clicking **Add point** button (Figure 15). You can change the order of points by moving **Up** and **Down**.
The lastly used profile will remain after you close the program (different profile for calibration and adjustment), but we recommend you to **Save** the profile, which you intend to use often. Then you can load different profiles by pressing **Load** button. The saved profiles are identified by a name, which you have to enter at save and select at load.

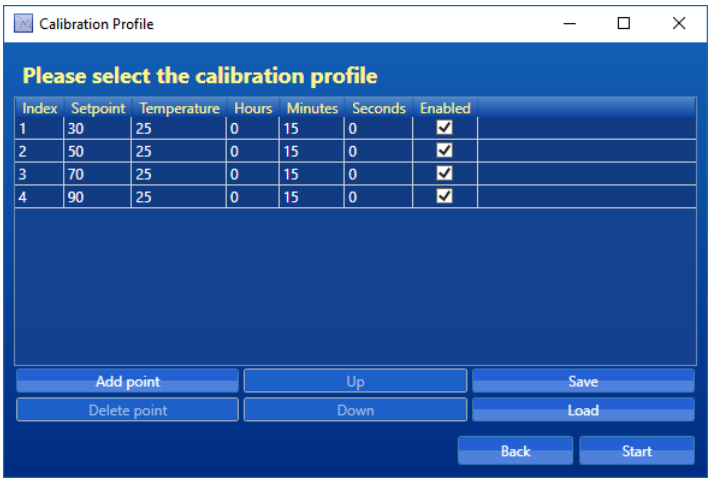

Figure 14: Edit the calibration profile

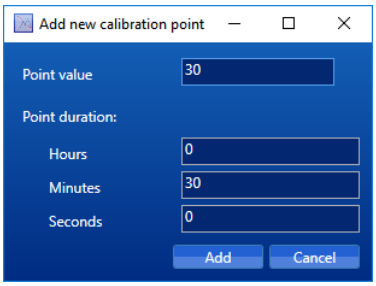

Figure 15: Add calibration point

For adjustment purpose the settings are the same, but additionally you must define the number of points, which belong to adjustment procedure. E.g. if you set **Adjustment points** to 4, then the first four calibration points (indices from 1 to 4) will be used to modify the measurement results of the sensor and the remaining points will function as a regular calibration. This way you can verify whether the sensor was correctly adjusted. You will be able to show the points of adjustment in the calibration certificate in a separate table. We recommend you to choose the points in the whole measurement range of the sensor, to achieve best results.

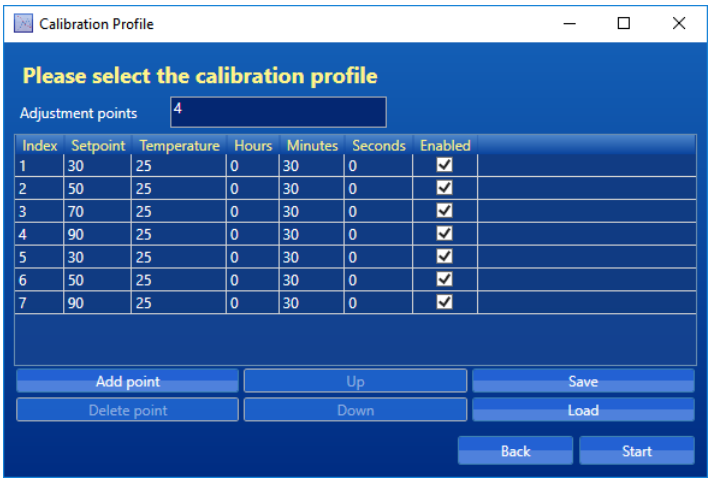

Figure 16: Edit the adjustment profile

3.2 Calibration process

When the calibration is started, it shows the main screen. This screen contains an upper part, which is always visible and lower part, where the different tabs are shown. The upper part shows the **actual calibration point**, **remaining/total time** of calibration, **Ambient conditions** in laboratory and the progress indicator. The progress indicator indicates at which calibration point the calibration actually is in the selected profile. If there are errors, then these errors are in front of the user in the center of the upper part and also offers a solution. The program has also sound warning if action is required from the user. This sound warning can be muted. For example, it can detect that the reference value is far from the desired value. This may indicate that the calibrator is not turned on or it is not attached correctly to computer. Each sensor tab shows a colored circle. If the circle is red, it indicated a problem with that particular sensor.

3.2.1 Reference tab

When the calibration is started, it is navigated to tab **Reference**. On this tab, you can see the desired value and the actually measured value of main quantity, or other quantities if there are any. You can control the calibration by buttons **Start**, **Stop**, **Pause** and **Resume**. There are buttons to show the Communication of reference sensor, or communication with generator. In some cases, these communication channels are combined, and both of the buttons point to the same channel. The **Errors** button will show a tab with detected errors during the calibration. The **Advanced options** offer few settings to be changed, like number of required points, minimal stability etc.

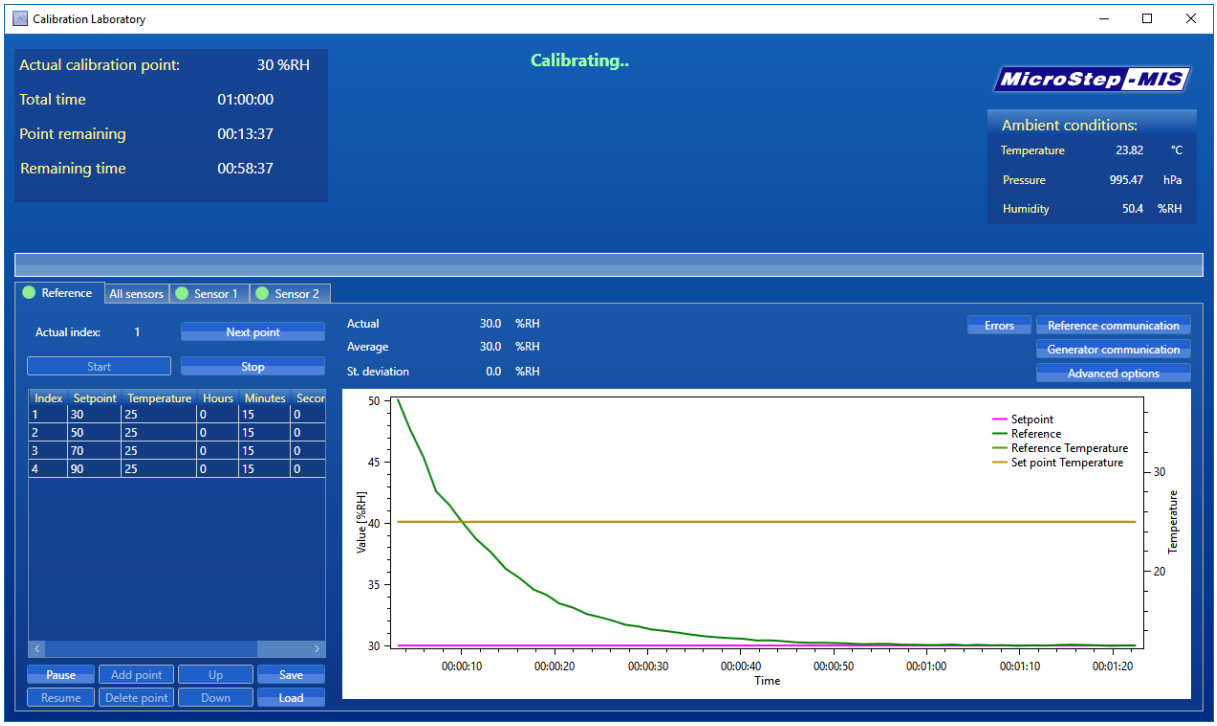

Figure 17: Main view of calibration - Reference

The time graph can be zoomed/un-zoomed by scrolling the mouse wheel. If the mouse pointer is on axis, then it zooms only that axis. By dragging with left mouse button, you can read the chart values. By dragging with the center button (scroll wheel), you can zoom in a selection. Double clicking with the mouse wheel will restore the zoom to default. By dragging with the right button, you can move the chart.

3.2.2 Sensor tab

Each calibrated sensor has its own tab, where the details are shown. There is a table with actual values, the time chart, the table with finished calibration points and also the chart with these calibration points. The calibration point which will be stored on the certificate is chosen as an average of the points, which have the smallest dispersion. This means that the most stable part of the measurement process will be used. The communication channel of this sensor can be opened by **View communication** button.

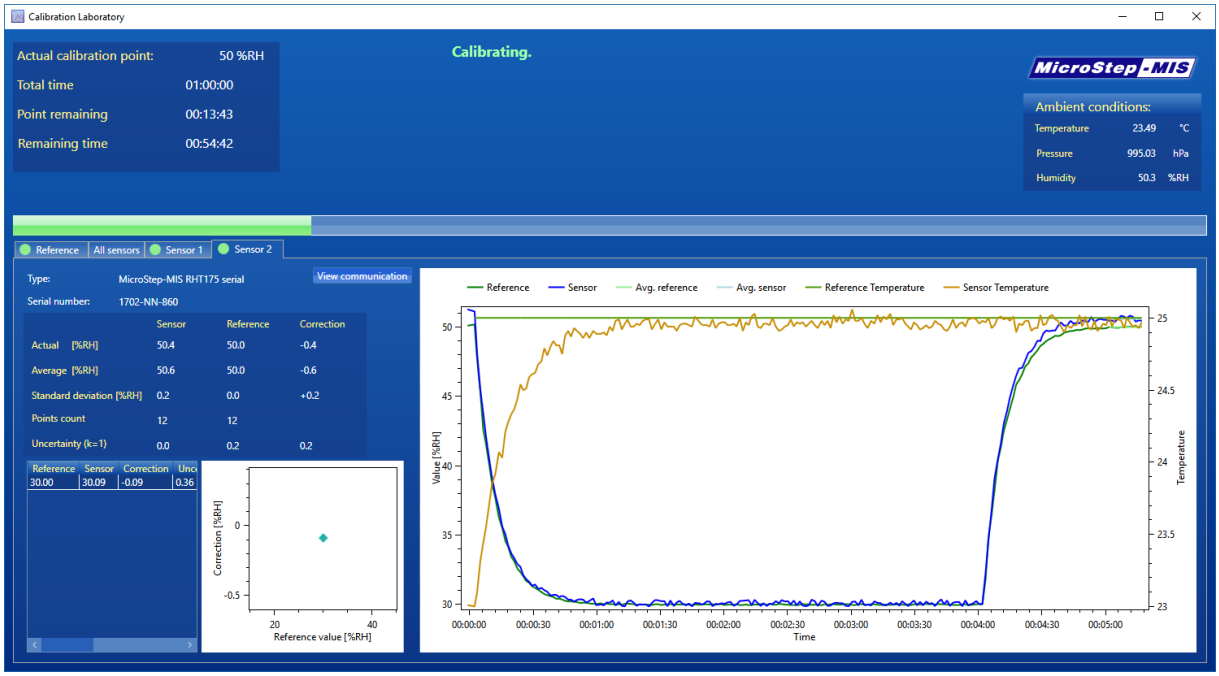

Figure 18: Sensor view

The tab **All sensors** shows the reference value and the main quantity of all sensors at once. Here you can see the difference between sensors. The usage of the graph is the same as described in the Reference Tab section.

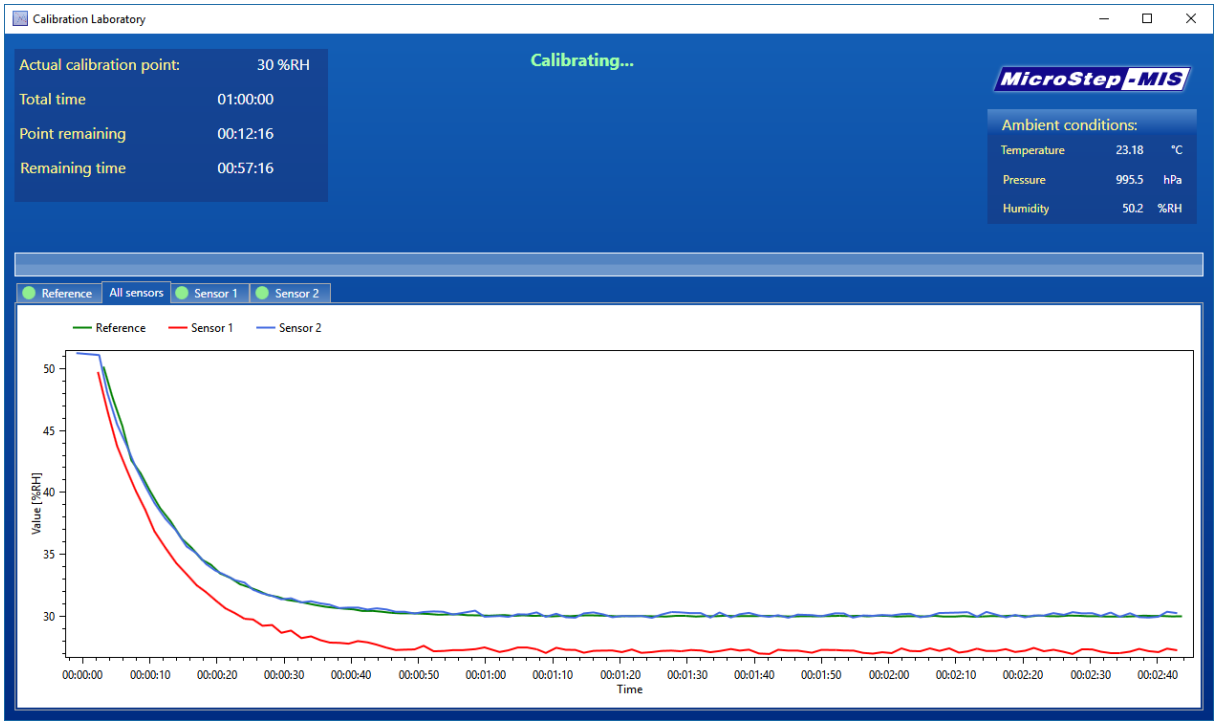

Figure 19: All sensors at once

Once the calibration is complete, it is possible to print the calibration certificates. The results of calibration may be added to third party information system, if this system is configured. See 3.3.3 for details. It is also possible to go back to main screen and perform a second calibration or simply close the application. The certificates may be printed later as they are stored in the database.

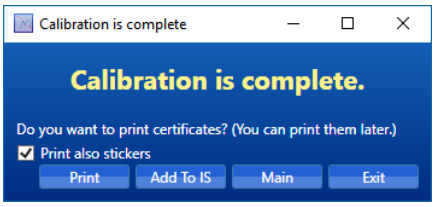

Figure 20: Notification about finished calibration

3.3 Print / manage certificates

To print the certificates, choose **Print certificates** from the main menu.

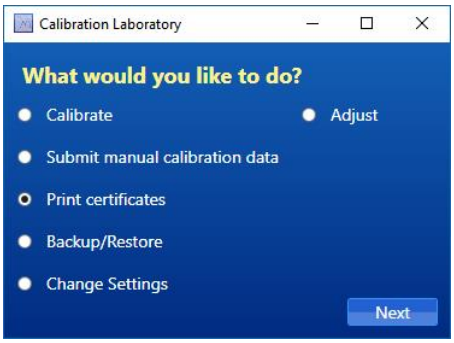

Figure 21: Manage certificates

The program will load the certificates from the database. The certificates are filtered by **Year** and **Type** of certificates. Each certificate type has its own numbering, which is reset every year. The Certificate identification name is configurable and may consist of order number, year and type name or type code. By default, all certificates are named this way:

Certificate number/*Name*/*Year*

For example: 0135/RH/2017.But by configuration it is possible to have identification for example: 2017_300_135, where the 300 is the certificate type code.

Figure 22: Database view with certificates

It is possible to group certificates by date of calibration. This way the sensors which were calibrated together will be selected. To select additional sensors, press and hold Ctrl key while clicking on unselected certificate.
If the certificates are selected, you can print them by clicking **Print selected**. It is possible to print stickers on different printer, which you can stick on the calibrated sensor or attach to calibration certificate. To print the stickers, check the **Print also stickers** box before clicking on **Print selected** button.
If you want to create a file certificates, click **Export** or **Export as PDF**. The **Export** button will use the default file type of the template, whereas **Export to PDF** will convert any file type to PDF.
To see details about certificates, you can double click and open them in a new window.

Printing or Exporting certificates requires a template to be defined. If the template is not present you are unable to click **OK** button (Figure 23).

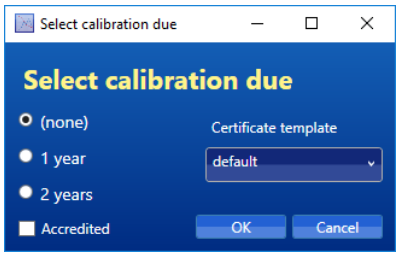

Figure 23: Details before printing or exporting

The calibration due date may be changed in this screen, if the template supports it. If there are more types of templates present, then you have to select from the list. If you check **Accredited** box, then the accreditation logo will be included in the calibration certificate.

3.3.1 Graphic preview

If you want to compare multiple certificates graphically, select them and click **Graphic preview** button. It will show Figure 24.

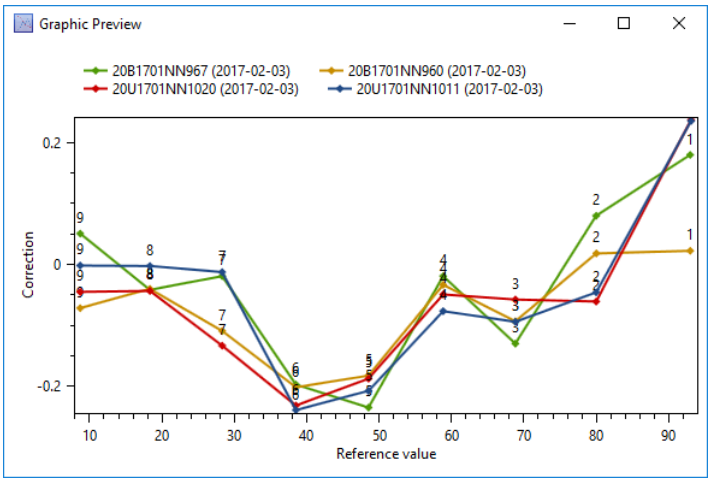

Figure 24: Graphic preview

To change the **Chart type**, select a right type in the main screen. This setting changes all charts, the graphic preview windows and the details of individual certificate. On Figure 24 the selected type is **Line with numbers**. The numbers mean the order of measurement.

3.3.2 Create Report

If you want to process the measured data in Microsoft Excel or other table processing software, then it is possible to export the data from the selected certificates in CSV file format. To do this, click **Create Report** button. This will open a window with settings. You can export the data in different ways. If the "**Include only one reference value**" option is chosen, then only the main quantity of reference sensor will be included. Otherwise all quantities will be included. The same is valid to the sensor. If the **Use corrections** option is chosen, the sensor values will not contain absolute values, but difference to reference value. Corrections of other quantities may be related to references main quantity or each quantity may be related to references' quantities.

Example 1: *If these options are chosen:* **Include all reference values**, **include all sensor values**, **use corrections** *and* **Corrections related to corresponding value**, *and both, the sensor and reference has two values (humidity and temperature), then you will see these two columns for each sensor:*
reference humidity minus sensor humidity
reference temperature minus sensor temperature.

If the **Use absolute values** option is chosen, then the reference will be included near all sensor values, so it is possible to calculate the correction in other table processing software.

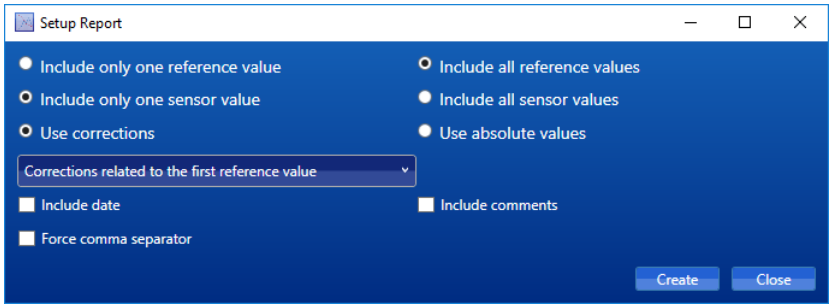

Figure 25: Report detail

3.3.3 Add to IS

The CalibLab is capable of exporting the results in text of file format to third party information systems, if there is a custom driver to this information system (IS). If the system is configured so, then in the list of certificates there is a button **Add to IS**. Select the certificates you want to export and click on **Add to**

IS. This button opens a window where you can choose from different information system drivers (Figure 26).

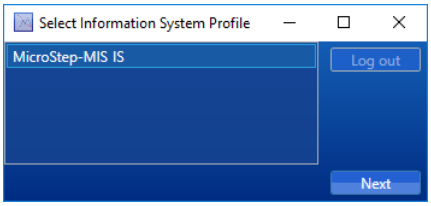

Figure 26: Add to IS

If the information system requires login, then a window with user name and password is shown.

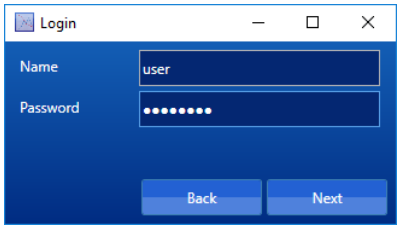

Figure 27: Login to IS

After successful login, the information system driver searches the calibrated sensor in that information system. It uses the sensor type, manufacturer and serial number to identify the sensor. If the sensor is not found in the information system, then it is shown in **Not Found** group. You must select the template, which is used to convert the data from certificate to file, which will be sent to the IS. By clicking **Next**, the certificates in **Found** group will be added to the information system.

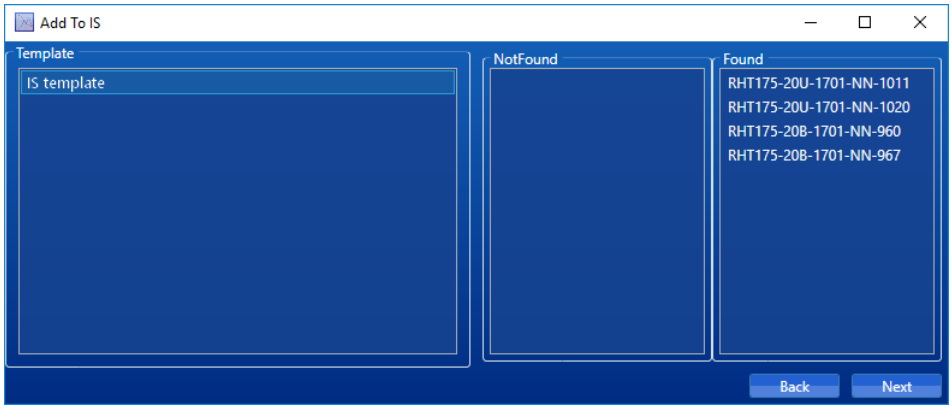

Figure 28: Select template of IS export

3.3.4 Edit templates

The **Edit templates** button will open an editor of document templates. The document templates are regular documents, but with special marks, to which the CalibLab will insert data from certificate. The supported file types are:

- OpenOffice documents (.ODT)
- Microsoft Word documents (.DOCX)
- Text files (.TXT)
- Comma separated files (.CSV)

It is possible to define a template for printing documents and template for printing small stickers. You can include many fields of data. The list of fields is defined under **Help** button.

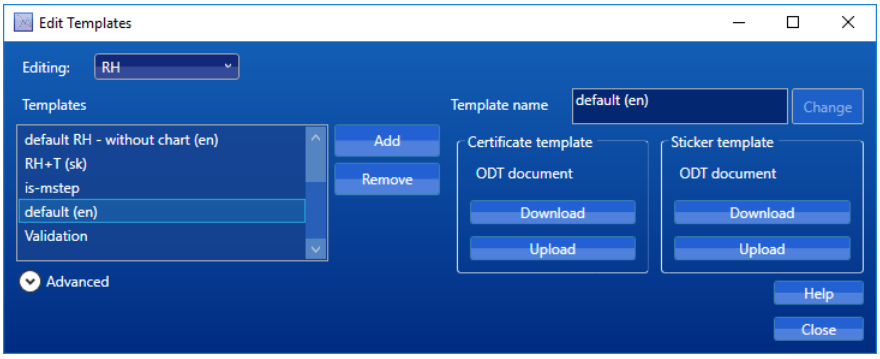

Figure 29: Edit templates

Select the certificate type you wish to edit from the **Editing** selector. If there are no templates for that type, you can add by clicking **Add** button. You will have to select the template file from computer.

Note: *You have to close the file before trying to upload in CalibLab.*

If you are editing an existing template, then select it from the list and you can **Download** it from program, make changes and **Upload** again to database.

3.4 Change sensor drivers

The sensor driver is a configuration which contains all of the settings of the sensor. This includes information about communication, adjustment, calculations, uncertainties etc. There can be more drivers to the same Sensor type and each can work differently. Different driver is needed when you are using analog output of sensor and different when you use digital communication.
To open the Edit Sensor Drivers window, select Calibrate or Adjust at the main screen and click **Edit Sensor Drivers** button in Figure 7 or Figure 8.
Select a driver from a list and click **Edit selected**. If you choose **Copy selected**, then you can make little differences in existing driver. The button **Edit sensor types** will show you the list of defined sensor types in the database.

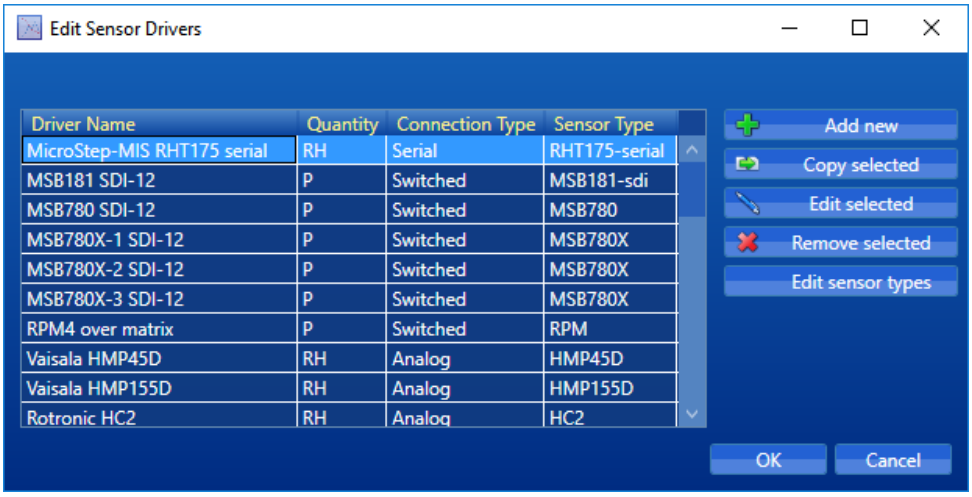

Figure 30: Edit sensor drivers

The driver must have a unique name. You can select the types of the driver. The **Manual** type is not trying to measure anything from any device. If you select Manual, then during the calibration you will have to enter the values into a form. This mode is for non-electrical sensors, where the only way to get value is by reading the value from an indicator. The **Direct** (Chapter 3.4.2) option is when each calibrated sensor has a direct communication connection. This connection can be Serial port, TCP connection or even USB connection, with specific drivers. The **Analog** mode (Chapter 3.4.3) is when the sensor has analog voltage output and it is measured over the defined analog inputs of the workplace. The **Switched**

or **Switched direct** (Chapter 3.4.4) mode is useful if the sensor must to share some resources with other devices/instruments. The **Sdi12** option is a bus connection.

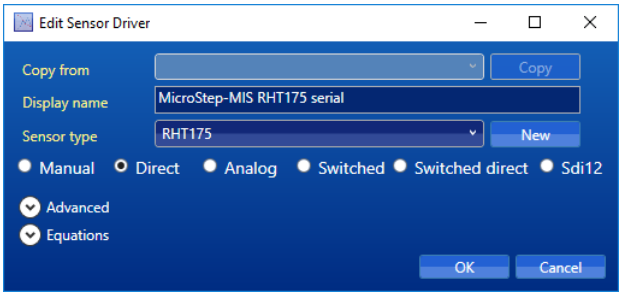

Figure 31: Edit sensor driver view

To associate the driver with sensor type, select the **Sensor Type** from a list. If the desired type is missing, you can create a new. Then you can copy the values from an existing sensor type.

If you open the **Advanced** group, then you can modify the settings. The details are described in the following chapters.
If you open Equations group, you can find editors of some equations.

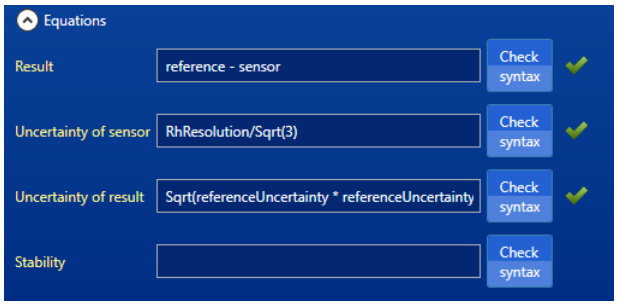

Figure 32: Edit equations

The **Result** equation is optional. If it is empty, then the result of calibration will be the correction. This correction will be calculated as a difference average reference value minus average sensor value. If the equation is not empty, then the result is evaluated in every step, and the average Result value is calculated from these calculated values.

The **Uncertainty of sensor** is an equation of calculating Uncertainty Type B (non-statistical) for the sensor value U_{S_B}. The Uncertainty Type A (statistical) of sensor U_{S_A} is calculated automatically from the standard deviation of the measurement. The combined uncertainty of sensor value U_{S_C} will be calculated as square root of the sum of squares of both types of uncertainty.

$$U_{S_B} = f_{Uncertainty\ of\ sensor}(variables) \tag{1}$$

$$U_{S_A} = \sqrt{\frac{1}{n-1}\sum_{i=0}^{n}(s_i - \bar{s})} \tag{2}$$

$$U_{S_C} = \sqrt{U_{S_A}^2 + U_{S_B}^2} \tag{3}$$

The above-mentioned equations have index R if the equation is defined for the reference sensor and index S when it is referring to calibrated sensor.

The **Uncertainty of result** is optional. By default, it will compute the uncertainty by combining the combined uncertainty of reference and combined uncertainty of sensor (previous equation and statistical). If not defined, the value is the following:

$$U_C = \sqrt{U_{S_C}^2 + U_{R_C}^2} \quad (4)$$

Otherwise the value of U_C will be the result of equation defined.
In the calibration certificate an expanded uncertainty is provided which is expanded with the coverage factor k=2.
The **Stability** equation is an equation which determine whether the readings of the sensor are stable. If the result of the equation is zero or false, then the sensor value is not counting to the averages. Otherwise the values are accepted as valid measurements. If the equation is not defined, then all values are accepted.

3.4.1 Association with database

Each driver must be associated with a **Sensor Type** (on Figure 31), which is stored in the database. This way it is enough to define the sensor type only once, and there can be multiple drivers of the same sensor. For example, some sensors offer both digital and analog interface. The physical sensor is the same, but you need different drivers for different interfaces. Information about sensor type may be used in the calibration certificate. The sensor type is identified by a short text identifier **ID**.

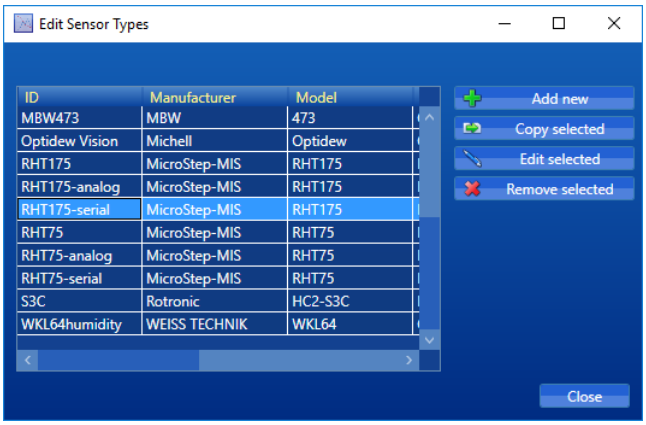

Figure 33: Edit sensor types

If you edit a sensor type, you must enter the name of **Manufacturer**, the measuring **Range**, the **Model** and **Description**. This information will be shown on calibration certificate. Once the sensor type was created, the **ID** cannot be modified. It is possible to delete the type and recreate if that sensor was never used in any calibration.

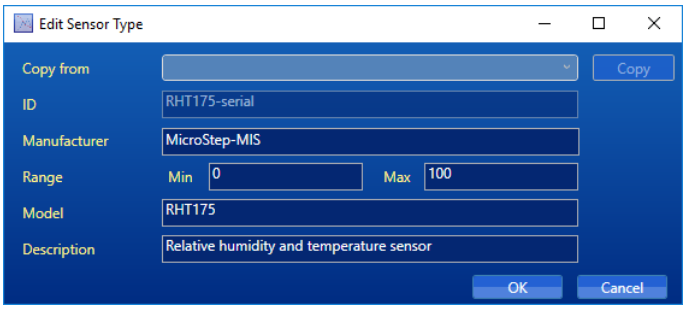

Figure 34: Edit sensor type view

3.4.2 Direct communication - serial port / TCP

The direct communication channel settings are common for Serial port or TCP connections. If the used communication channel is Serial port, then the serial parameters are used when communicating with a sensor. These settings are automatically switched e.g. when the same channel is defined for different devices. Under the Commands part there is a list of commands. The commands may have a query to device and parse the results. During executing any command the executed command has exclusive access to the communication line. A command can return zero, one or unlimited number of values. If the Command **Type** is **Execute**, then the command is just executed and no value is read from the

sensor. Executing commands consists of sending the **Query** and waiting until **End string** is received or the **Timeout** occur. If the command type is **Single**, then in addition to **Execute** type a numeric value is also parsed. If the **Type** is **Collection**, then multiple values may be parsed from the response of sensor. If there are multiple commands, then an array of numeric result of all commands is created. The first value is the main quantity and the other values are additional values. For example, a relative humidity probes' response may be 57.1,23.2,14.2, then from these three values the first is relative humidity, the second is temperature and the third is the dew point. The relative humidity is the main quantity in relative humidity calibration laboratory.

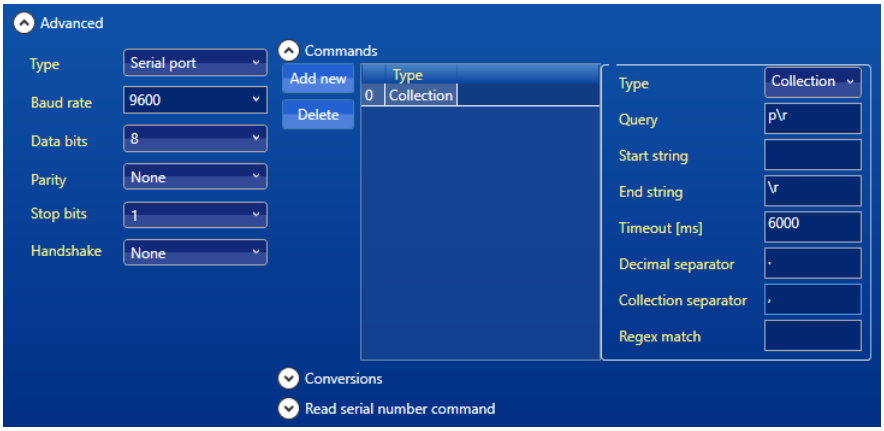

Figure 35: Edit direct sensor driver - advanced

The **Conversions** section may change the value units to other units, or may perform mathematical equations with the measured values. Each row corresponds to a value which was measured. For example, if you add a linear equation y=10*x+0, then it will convert kilopascals to hectopascals. You can add also multiple equations for one quantity by using **Combined** equation type.

The **Read serial number command** is a special command which must return only a **Single** text value – the serial number of the sensor. This command will be executed when the **Read Serial number from sensors** button is clicked (Figure 10 or Figure 11).

3.4.3 Analog sensor

The settings of analog sensor are very simple. You just define the voltage output range and the corresponding value range. Then the program determines how to calculate the value from voltage.

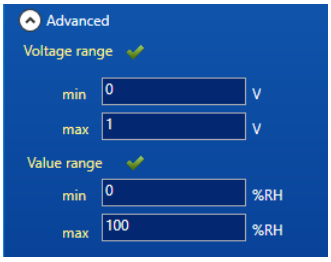

Figure 36: Edit analog sensor driver - advanced

3.4.4 Switched or Switched direct sensor

The **Switched** sensor uses for communication the communication line which is configured in the switcher settings. The switcher device (e.g. Matrix) then switches the relays to the sensor's channel, and then it executes commands on the defined communication line.
The **Switched direct** mode differs from **Switched** in the used communication line. In **Switched direct** mode the switcher is just used to switch the electrical wires, but the calibrated sensor has its own direct communication line (own serial port or TCP channel). The setting of the communication is the same as in **Direct** channel in both switched modes. The only difference to **Direct** is that the communication line

or other electrical wire is switched before measurement, whereas in direct mode everything remains connected during the whole calibration process.

3.5 Submit manual calibration data

If manual measurement was performed, you can add these values to the database. This way you have the same benefits as with automatic calibration, like unique certificate number, possibility to generate certificates, compare the result with other measurements, etc.
To enter manual data to database select **Submit manual calibration data** option in main menu.

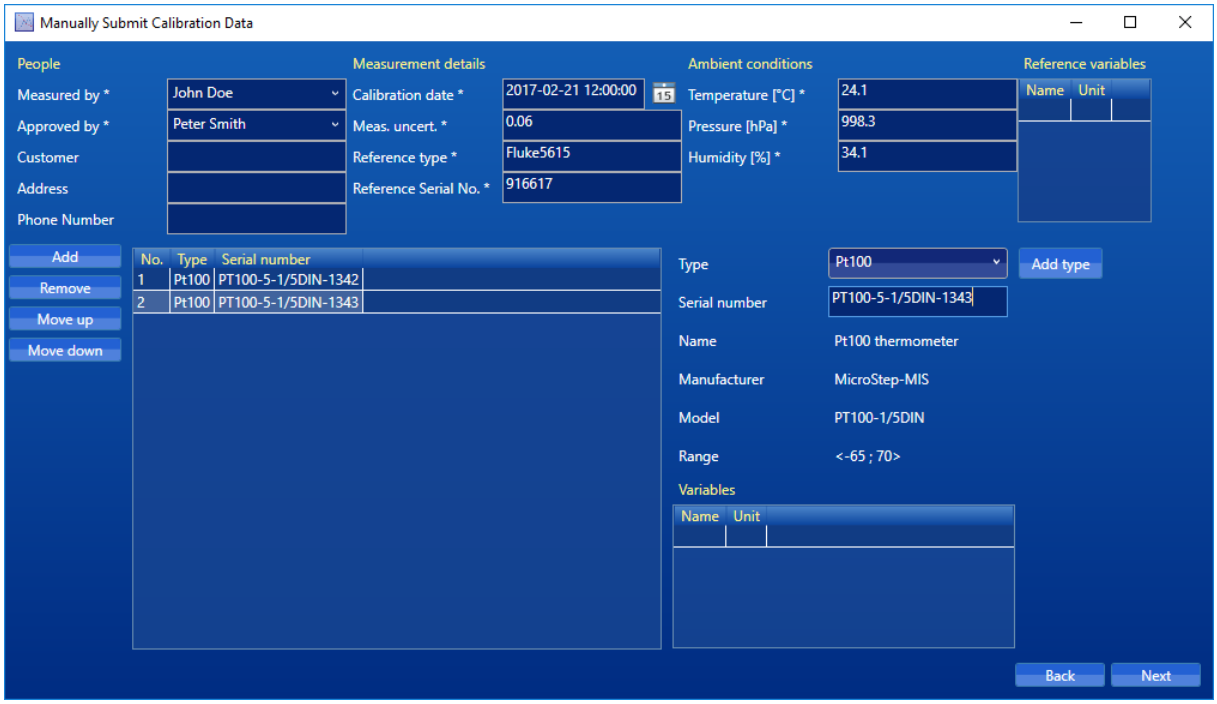

Figure 37: Submit manual calibration data - prepare

On Figure 37 there is a setup screen. Enter all fields marked with asterisk (*), then click **Add** button to add calibrated sensor. Click on added row in the list and edit its **Type** and **Serial number**. If all values are filled correctly, you can continue to the next screen.

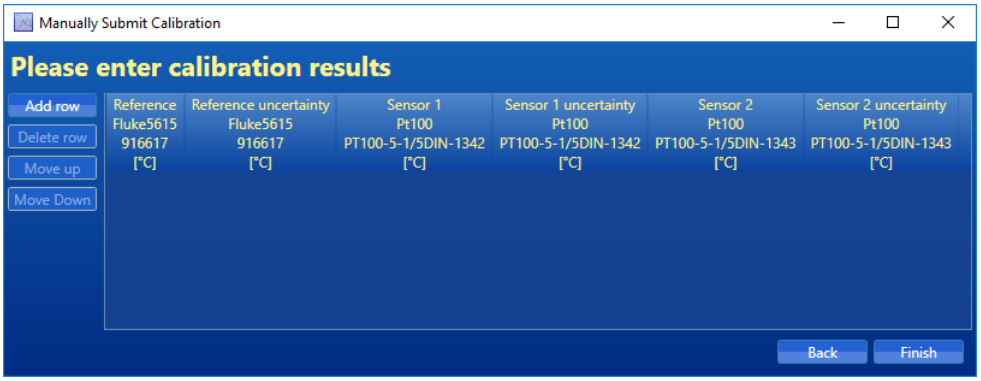

Figure 38: Submit manual calibration data – empty data

Click Add row to add new rows and then start filling the table with the values. Fill the uncertainty column with the determined uncertainty value of the manual measurement.

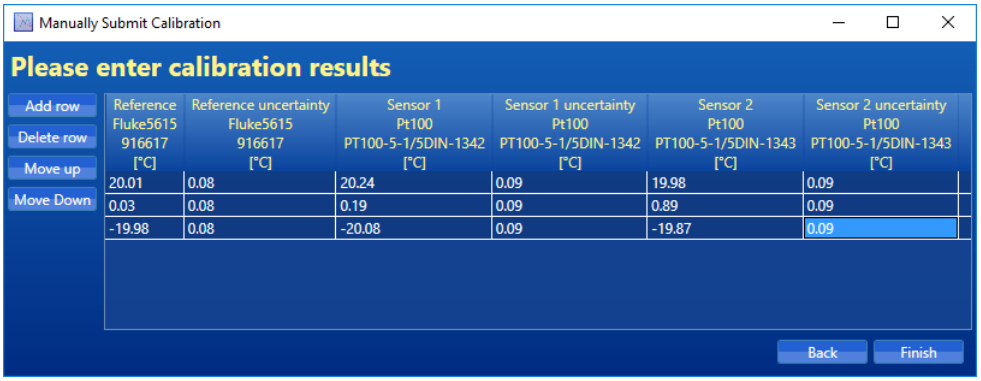

Figure 39: Submit manual calibration data – filled data

You can move the row order by clicking **Move up** and **move down** buttons. If you found that something was entered incorrectly on the previous page, you can click **Back** button, your entered data will not be lost. You can copy the data from Microsoft Excel, or other table processing software.

When finished check the table again. If there are errors then correct them, as you will not be able to make corrections to submitted data. If everything is correct click **Finish** button.

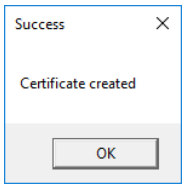

Figure 40: Submit manual calibration data – successful

If you see the Success message, then the data is correctly inserted into database. You can print certificates in **Print certificates** view of main screen.

4. Database backup

It is recommended to make backups of valuable data in database. You can do it by backing up the database server regularly or you can configure the CalibLab to store the data to a file. Backing up will allow you to restore the system if the database server stops working. To back up the database from Program, choose **Backup/Restore** from main menu, then click **Backup** button. You will have to select the destination folder. The file will be automatically named by the current date and time.

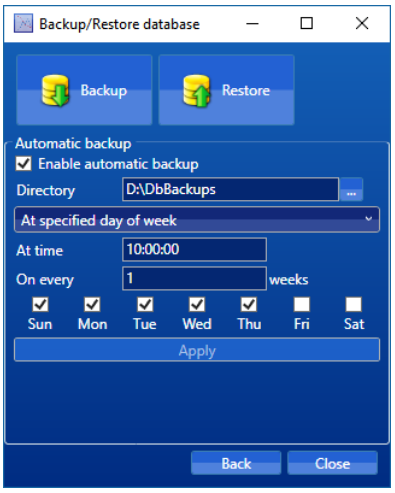

Figure 41: Backup database

If you don't want to backup manually, you can automate backups. Check the **Enable automatic backup** box, select the destination directory and fill the intervals. Then if there are changes, click **Apply**. This way the operating system will start the CalibLab on background, to perform backup operation, then it quits. You will not notice this backup. It will not affect calibrations.

4.1 Restore database

If the database system failed, or you need to transfer data from one server to another, Click **Restore** button. Then select the file you want to restore.

Warning: *Restoring the database will erase the actual state of database and replace it with the data loaded from file. Please double check that it is OK to delete the actual state. We suggest you to back up the database if it is not empty. If you don't back up your data, you may lose the calibration results.*

5. Change settings

Some settings are dependent only on the workstation computer. This includes for example the COM port number for a specified device or the printer settings. These settings may be edited under **Change settings** option in main menu. You can change the connection strings of channel numbers. If you enter **COM***n*, then serial port will be used, if you enter **TCP:***address*:*port*, then TCP connection will be used on that channel

The **Output directory** is the place where the certificates are created. (By **Exporting** or **Exporting as PDF** in **Print certificates** view)

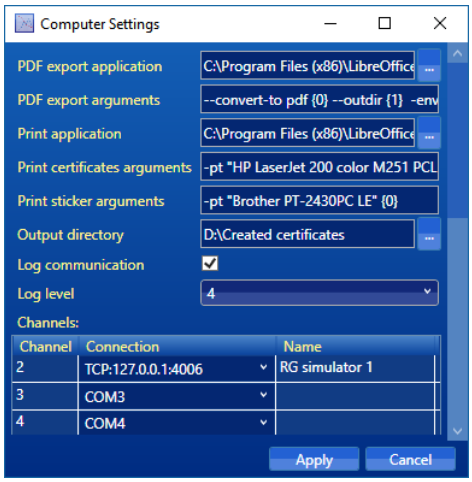

Figure 42: Change settings

The **PDF export application** is the path to a third-party application, which is capable of converting files to PDF format. This can be done by OpenOffice, LibreOffice, or other programs. The **PDF export arguments** are the arguments which are passed to that application. It replaces `{0}` with file name and `{1}` with output directory.

The **Print application** is the path to a third-party application, which is capable of printing files. The application has two types of arguments, by which you can change the printer type for sticker or paper printer.

6. Troubleshooting

The following table describes the common problems and solutions:

Problem	Reason	Solution	Details
Program shows warning at startup	There was an error on previous run	Send us the error report, so we can fix problems	
Program shows warning after selecting calibration/adjustment	Communication lines are occupied	Ensure that the program is started only once and no other programs are using the communication lines associated with the calibration devices.	
A sensor shows red cross.	The sensor is not connected or powered	Ensure that the sensor is correctly attached to the measurement unit. Also, ensure that the measurement unit is well powered and connected to the computer. The status is not updated immediately. Please wait a minute or two to see whether it responds or not.	
	The sensor is in wrong mode	Study the manual of the sensor to see whether special conditions are needed to communicate with sensor, such changing the mode of operation or timing after power up	
	The sensor is broken	Do not calibrate broken sensors	
All sensors are responding, but can't continue with calibration.	Serial numbers are not set for every sensor.	Ensure that all serial numbers are correctly written to the table.	
Big sensor error	Sensor is not attached to the calibrator	Attach the sensor to the calibrator	
	The reading of the sensor is not steady	Increase the duration of the point in profile	3.1.4
	The sensor is out of tolerance	Confirm the error of the sensor and continue the calibration process	
		Remove the faulty sensor from calibration process	
Big reference error	The calibrator is not turned on.	Turn the calibrator on	
	The measurement point is too short.	Increase the duration of the point.	
	The calibrator is unable to reach the desired value	Change the value in the set point to reachable value. Then repeat the calibration	
		Perform maintenance of the calibrator.	
Point measurement repeat	The measurement point in profile is too short	Increase the duration of the point.	3.1.4
Ambient conditions are empty	The sensor of ambient conditions is not connected.	Connect the sensors of ambient conditions	
Cannot print certificate	No template defined	Add a template to database.	3.3.4

Register