

JLMlogSP for MOXstick

Manual Version 1.3

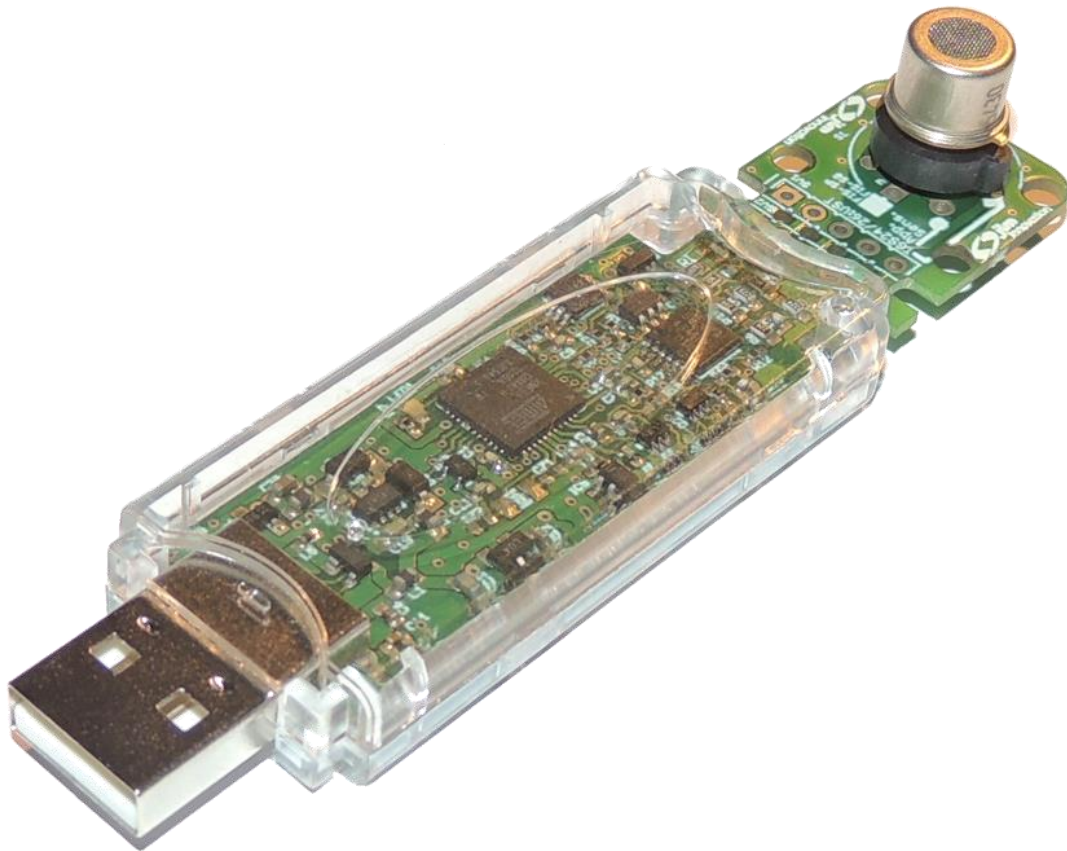
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Introduction

The MOXstick is a USB interface for excitation and readout of resistive sensors. It is especially tuned to the requirements of Metal Oxide Semiconductor gas sensor.



The USB stick is divided into a large part containing acquisition and excitation electronics, and a smaller back part containing the sensor socket. This back part can be split from the main board and connected using the available connector pads and a flat five way cable. This provides freedom for sensor placement, in case it needs to be mounted remotely (for instance in a sensing chamber).

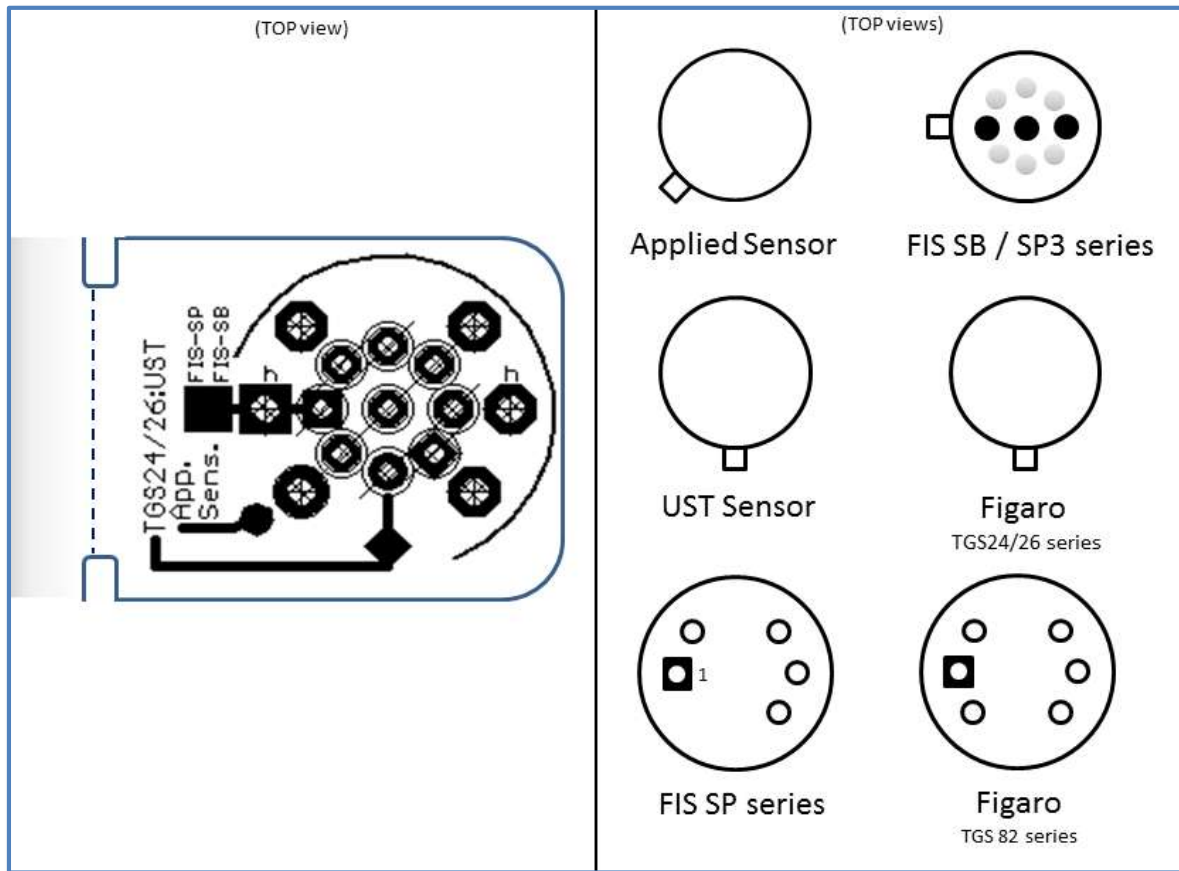
The MOXstick is directly recognized by Windows without the need for any driver installations.

The universal sensor socket allows the connection of a large number of sensors from different manufacturers. This is accomplished with different sensor orientations when connecting to the available pins. Care must be taken to ensure the validity of the sensor connection, by observing the provided on-board connection summary, as described in paragraph *Sensor connection*.

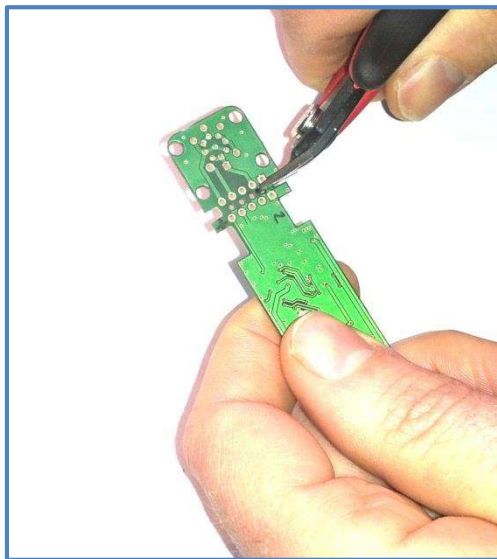
The JLMlog SP software provides a simple interface for heater voltage programming and data logging. Sensor resistance, heater current and heater voltage are recorded and stored to a text file immediately. The software can operate a multitude of MOXsticks simultaneously. See paragraph *JLMlog SP software* for details.

Sensor connection

At the back portion of the MOXstick PCB-board there is a universal sensor connector to connect the sensors (see figure below).



The sensors will typically be mounted on the universal connector by use of pin headers, or alternatively directly soldered into it. Note that connection of the Figaro TGS 82x sensors has two possible positions which are equally valid. A comprehensive summary table of compatible sensor models is provided in the next page.



Break-out board detaching

Take especial care to cut both sides of the cutting line first. Small diagonal cutting pliers can be used for that purpose. Once both sides of the cutting line are cut at the right place, the board can be finally detached by breaking the rest with your fingers.

Sensor Compatibility table		
Manufacturer	Model	Description / use (according to manufacturer)
FIGARO	TGS 2610	LP-Gas detection
	TGS 2611	Methane detection
	TGS 2442	CO detection -pulsed sensor
	TGS 2444	detection of Ammonia
	TGS 2620	detection of solvent vapors
	TGS 2600	detection of air contaminants
	TGS 2104	detection of gasoline exhaust gases
	TGS 2201	detection of gasoline exhaust gases
	TGS 2602	detection of air contaminants
	TGS 813	Combustible gases ¹
	TGS 826	Ammonia ¹
	TGS 8xx	¹
Applied sensor	AS-MLC	CO sensor - low power
	AS-MLN	NO2 sensor - low power
	AS-MLK	CH4 sensor - low power
	AS-MLV	VOC sensor - low power
UST	GG51000 family ²	especially suitable for leak detection of combustible gases
	GG52000 family ²	sensor for CO-, hydrogen- und alcohol, low cross sensitivity to CH4 methane
	GG53000 family ²	sensor for hydrocarbons, especially suitable for stationary observation of LEL
	GG54000 family ²	selective sensor for ammonia, with low cross sensitivity to CH4, CO, H2and humidity
	GG55000 family ²	sensor especially sensitive to nitric oxide and ozone
	GG56000 family ²	sensor for hydrogen, with low cross sensitivity to CH4, humidity and alcohol
FIS	GG57000 family ²	sensor for detection of NO2 - smouldering fires
	SB-95-12	CO and CH4 sensor
	SB-11A	HC detection
	SP-11	HC detection
	SB-12A	Methane detection
	SP-12A	Methane detection
	SB-15	LP-Gas detection
	SP-15A	LP-Gas detection
	SB-500	CO detection -pulsed sensor
	SB-19	Hydrogen detection
	SP-19	Hydrogen detection
	SB-30	Alcohol detection
	SP-31	Alcohol and solvents detection
	SB-41	Refrigerants detection
	SP-41	Refrigerants detection
	SB-42A	Refrigerants detection
	SP-42A	Refrigerants detection
	SP-53A	Ammonia detection (high conc)
	SP-53B	Ammonia detection (low conc)
	SP3-AQ2	Indoor air quality (VOCs)
	SP3S-AQ2	Indoor air quality (VOCs)
	SB-AQ1	Indoor air quality

¹ Available upon request

² Please contact us for recommendations on heater resistance and chip size selection.

The JLMlog SP software

Installation

The *JLMlog SP* software is delivered as a setup program. Please install the software by running the setup program and following the directions in the setup program. You will need administrator rights to install the software.

After install the software you may wish to check for updates. The software contains an automatic check for updates which gives you the option to download and install new versions directly from inside the software. More information can be found under paragraph *Setup Tab* below.

Prerequisites

The *JLMlog SP* software and the USB stick will work under Windows XP or higher. After plugging in the USB stick for the first time, Windows will identify the stick. Windows already contains the necessary drivers and will configure the drivers automatically.

Software Overview

The *JLMlog SP* software provides very complete functionality in the shape of a very compact software interface, its main functionalities are:

- Sensor resistance, sensor current, Sensor voltage, Heater resistance, Heater voltage, Heater current, Heater power viewing and (long term) logging functions.
- MOXstick heater voltage cycle definition and programming
- Graphical sensor feature selection
- Elementary signal preprocessing functions
- Graphical selection of training dataset
- Principal Component Analysis (PCA) calculation and display
- Real-time updating of PCA plots using newly acquired data

The software functions are accessible through four different tabs in the main interface window: Measurement, Analysis, Analysis graph and Setup Tabs.

Starting JLMlog SP

Please connect the USB stick to the computer before starting the software. The software will automatically detect the USB stick. If more than one MOXstick are connected, one plot line will appear for each of them in the data plots.

All settings in the software are automatically stored when closing the software. When starting the software the last settings are loaded.

Important: In order to save any measurement data, the log file has to be activated before taking the measurements!

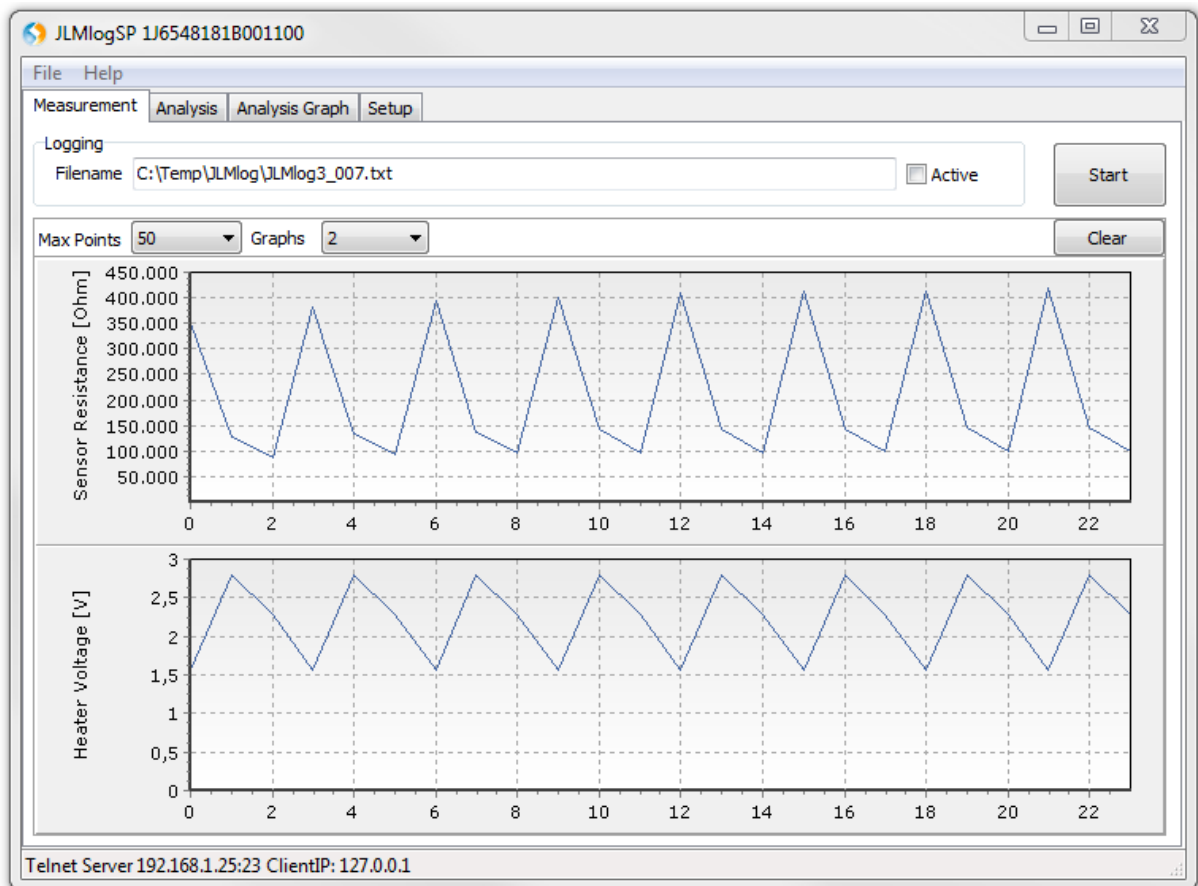
The firmware on the USB stick has to match the software. The software will upgrade the firmware on the USB stick if it detects an older version of the firmware on the USB stick.

Using JLMlog SP

The main software window is divided in four tabs.

The measurement tab

It consists a graph area and an user input area on top. The top area of two main parts. The upper area contains all controls to set operation modes and parameters for the measurement.



Graphs can be zoomed by dragging a box into the desired area. Double clicking or dragging a box from lower right to upper left will undo the zoom. Holding the right mouse button allows to shift a zoomed graph.

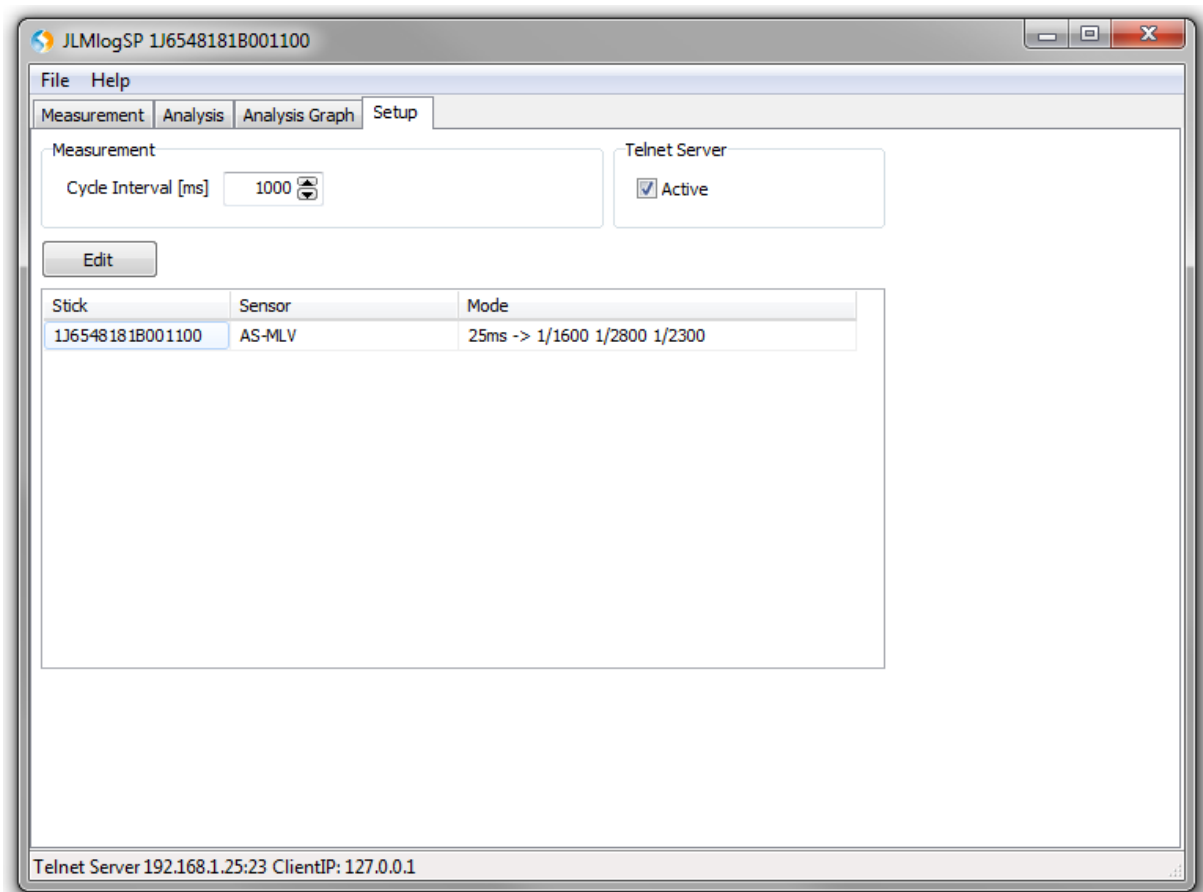
The top part allows to enter the name of the log file, activate datalogging (using the checkbox) and actually starting the measurement by clicking into the START button (see at the end *Logging Data*).

The Max Points parameter controls the number of measurements shown in the graph.

In order to avoid high computing load due to drawing of complex graphs, it is advised to choose a low number of graphs and Max Points.

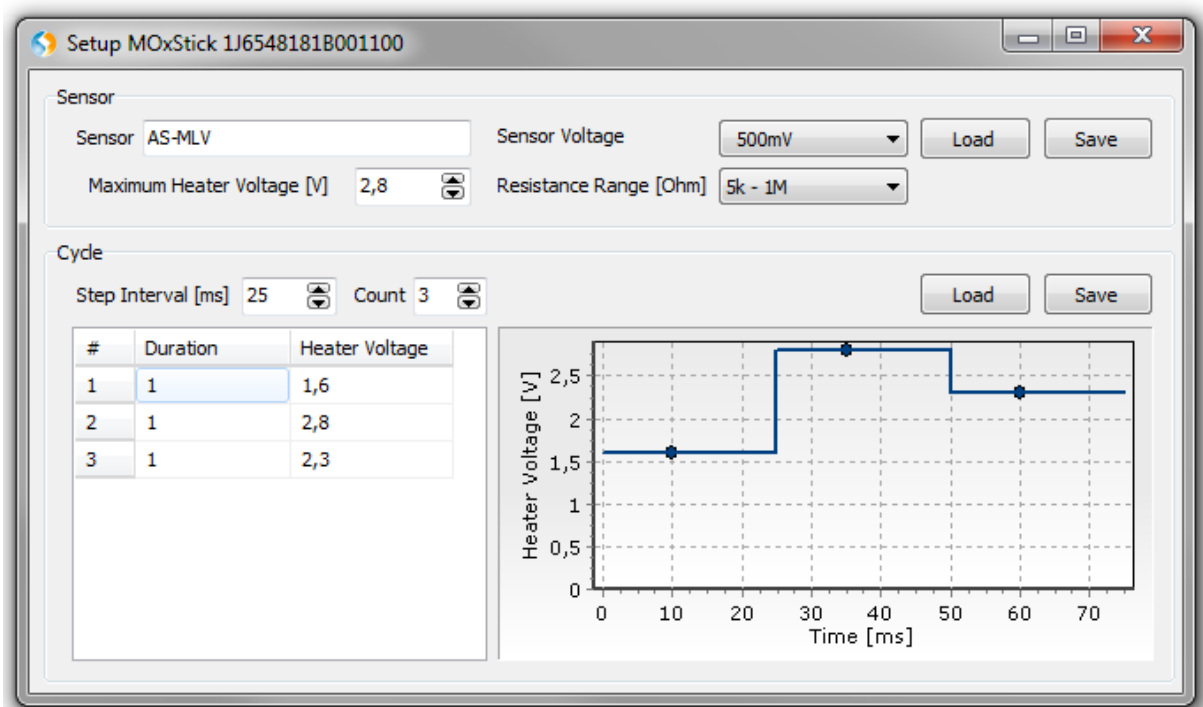
The Setup tab

The different MOXsticks plugged into your PC will show up in the setup tab identified by their serial numbers. The overall measurement cycle interval is shown on top (this number cannot be lower than the longest programmed cycle for a sensor, plus a short ms of margin) Each of them can be individually configured by clicking on *Edit* while the correct stick is selected in the bottom window.



The Active checkbox for the Telnet Server allows to enable and disable the telnet server (see below).

The *Edit* window allows to change the settings of a given sensor, its naming (Sensor), the maximum allowed voltage to the heater *Maximum Heater Voltage*, the expected *Resistance Range* to measure, and the Sensor readout voltage (*Sensor Voltage*). This last voltage is precisely the voltage drop that will be applied across the sensor sensing resistance, if self-heating of the sensor is an issue, lower settings should be used. Please select Sensor voltage, Resistance Range and Maximum Heater Voltage according to the specifications of the sensor manufacturer.



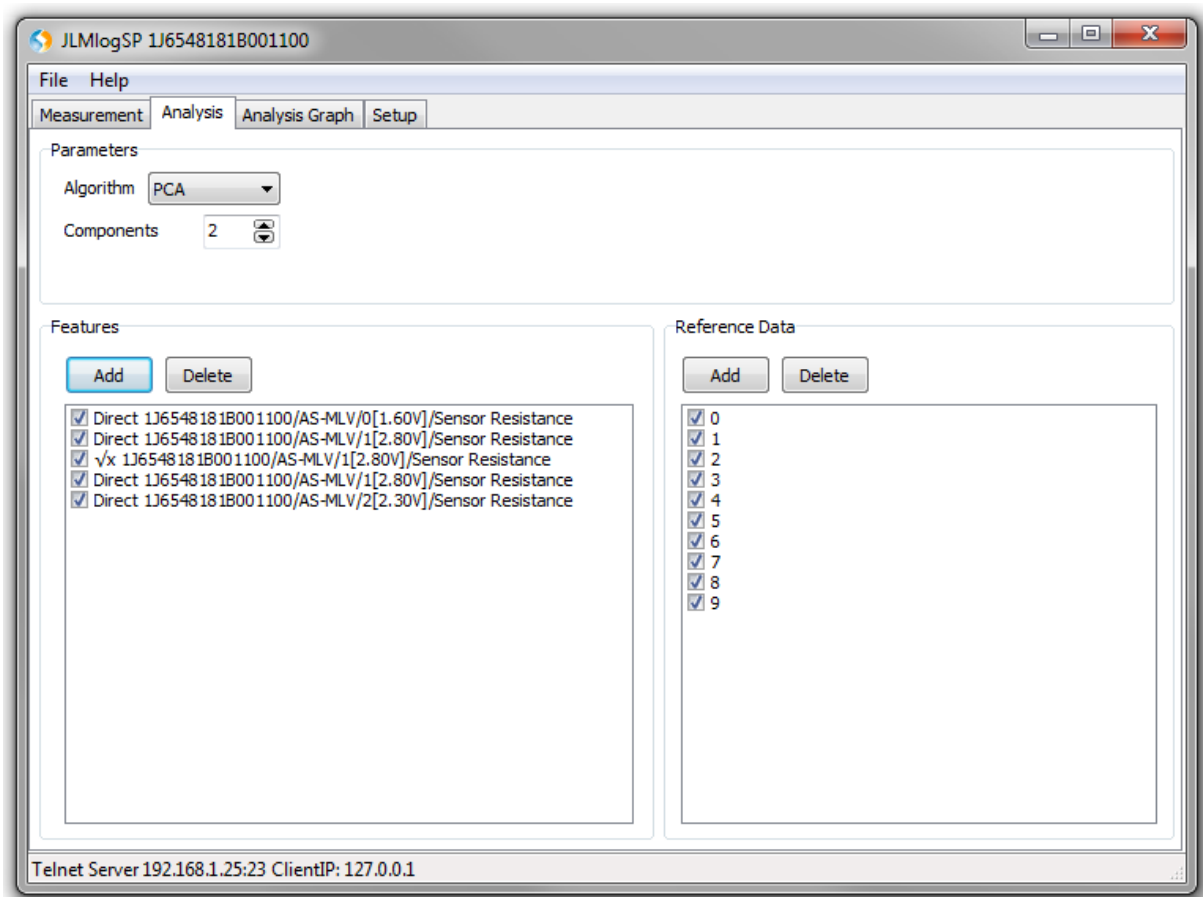
The subframe named *Cycle* shows the heater cycling definition tool. Each step has a set duration (*Step Interval*), the duration of every heater step is set in number of *Step Interval* units, and the total number of cycle intervals is defined in *Count*. For each cycle interval, the *Duration* and the *Heater Voltage* can be set. A graph in the bottom right shows a summary of the programmed heater excitation waveform. The *Edit* tab allows saving and loading the programmed settings for the parameters, and the cycle. At the end of each cycle interval, a measurement point is taken.

The changes are applied instantaneously, when the edit window is closed. If you want to keep a previous setup, make use of the 'save' and 'load' buttons, as you will have no 'undo' or 'cancel' options.

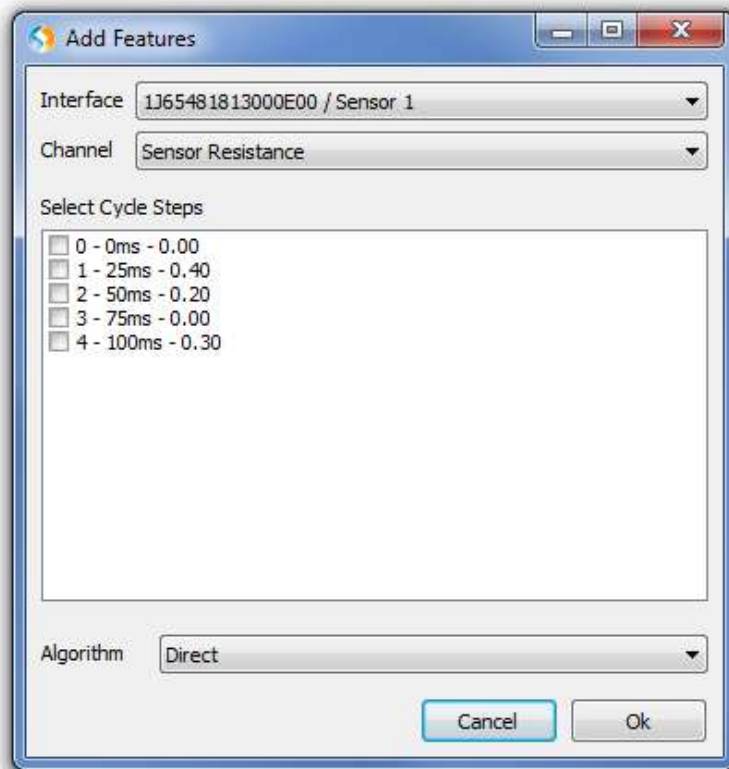
Attention: Do not set heater voltages in excess of the recommendations for the sensor device, as this will damage the sensor!

The Analysis Tab

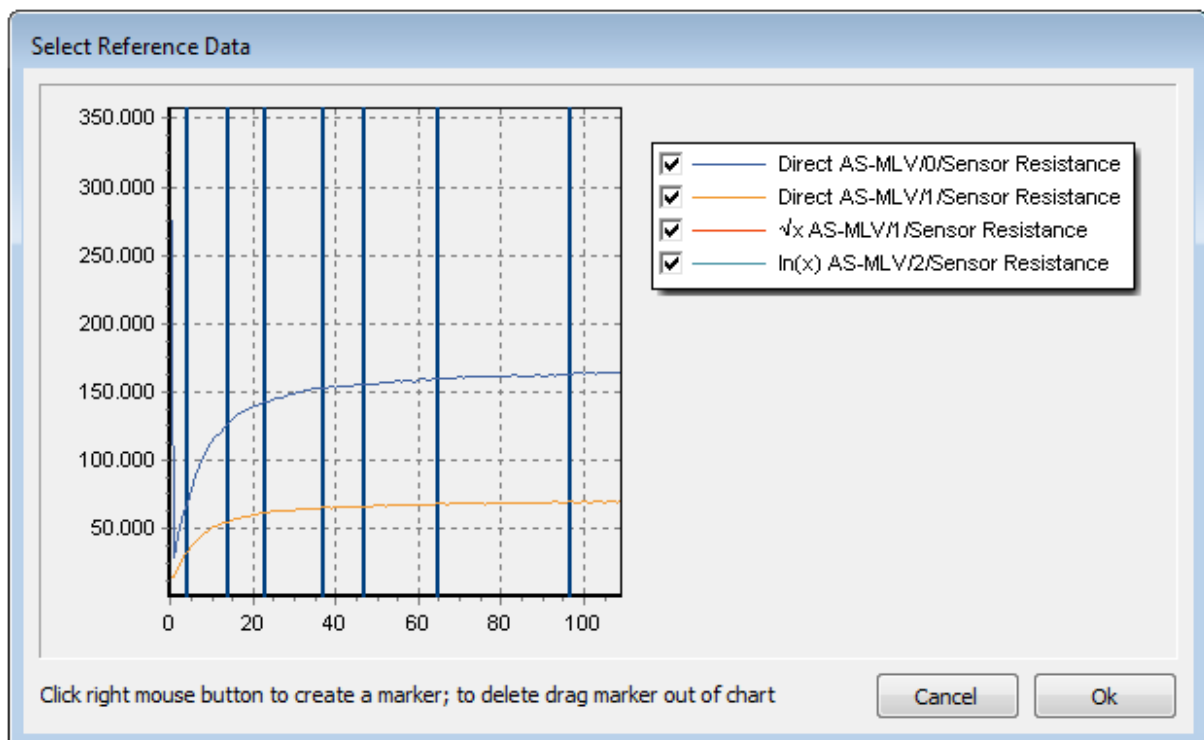
Currently, PCA analysis is supported by JLMlog SP. The Analysis Tab will soon incorporate other analysis options, selectable under the *Algorithm* menu.



In order to add features to the Analysis, the button *Add* needs to be clicked. A new window appears showing the different measurements for each Cycle Interval and for each sensor. It is then possible to add each measurement to the analysis, applying a pre-processing algorithm (*Algorithm* menu).



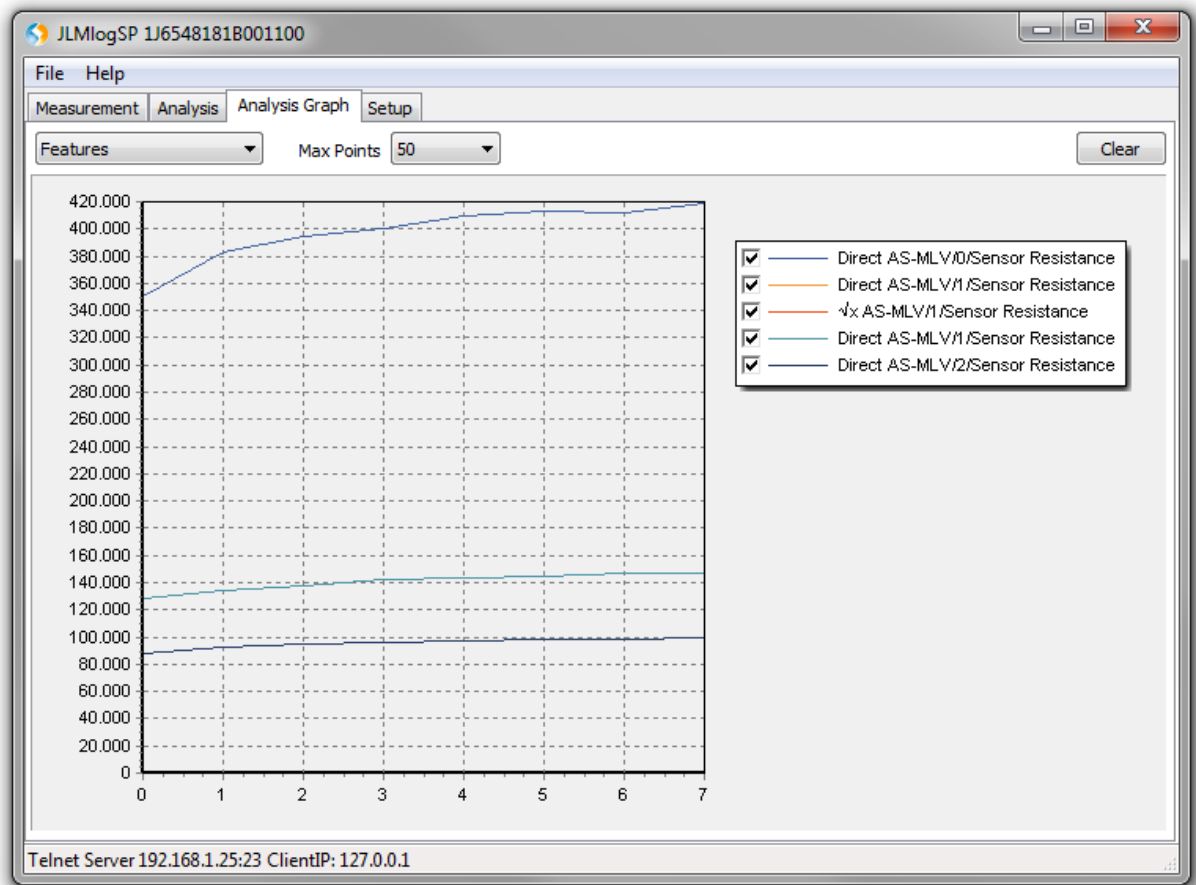
After the features have been selected, a training or reference set needs to be defined in order to compute the PCA scores. The subframe *Reference Data* contains the *Add* button for this purpose. Once the button is clicked, a new window appears showing the features extracted for the current dataset.

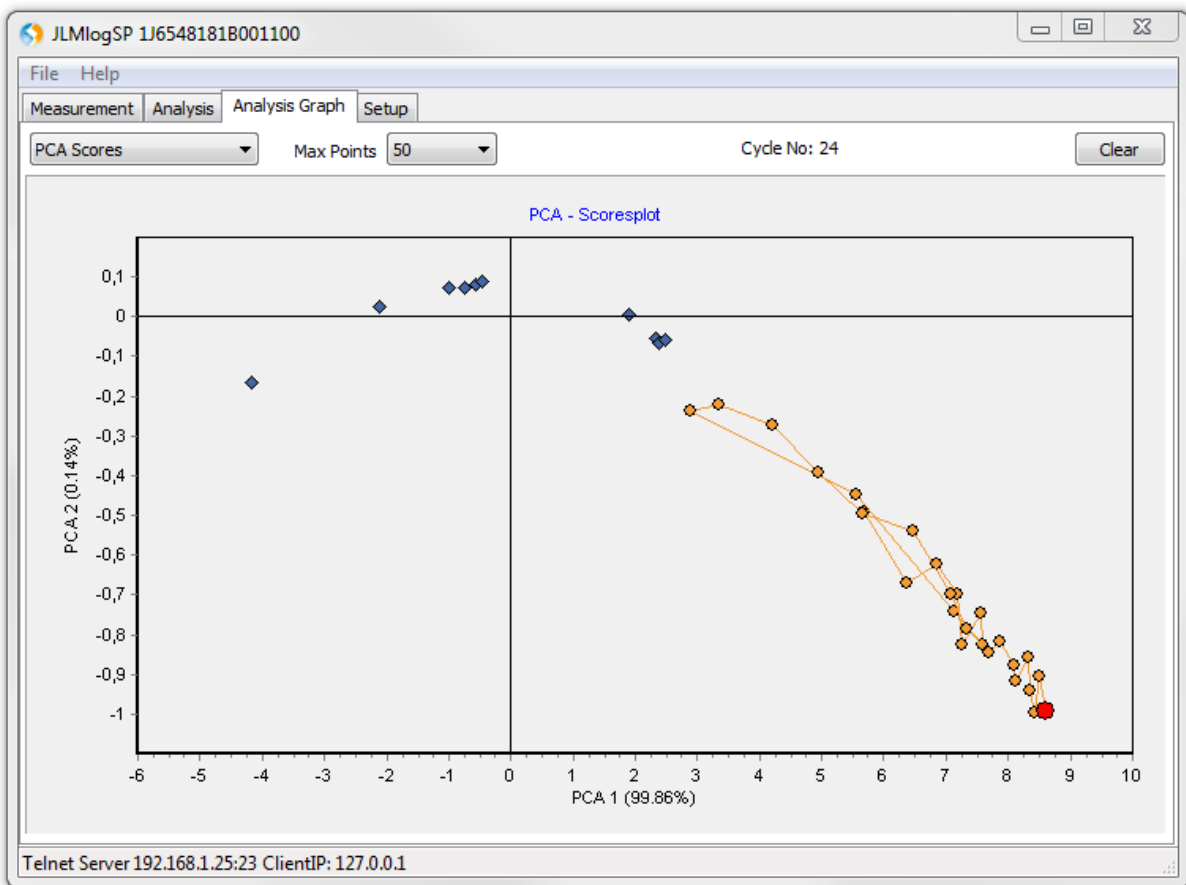


Right clicking in the points of interest will show a blue selection bar indicating that the point has been selected as reference data point.

The Analysis Graph Tab

Once features and reference data has been selected, the *Analysis* results are shown in the *Analysis Graph* Tab. It is possible to view the PCA Scores, PCA Loadings, and the Features. The lines connecting the points show trajectories in time. Reference data are shown as diamond-shaped blue points, and the general data as yellow round points. The larger red point indicates the latest measurement. The *Max Points* selection allows to show only the last 50, 100, 250, 500, 1000 or 2000 data points of the current acquisition. During the acquisition of measurement data it is advisable to choose a low number of data points, to avoid constant redrawing of complex graphs.





Logging data

Measurement data can automatically be logged to a text file. This option needs to be activated before the measurement is started.

The following box contains an example of a log file. The first lines are the header of the log file. The first line contains a text to identify the file as a JLMlog file.

Lines containing non measurement data (e.g. header) always start with #.

All subsequent lines contain measurement data. The general format is tab delimited floating point. The decimal sign is always the point ' '.

```
#>>>>>>>>>>
#JLMlogSP      1.3      1.3.4854.62283
#Started16.04.2013 17:18:19      41380.7210582407
#Interval [ms]   250
#List
#Stick Id Stick   Sensor  Sensor Gain Resistance   Step Interval   Step Count
      [Duration/HeaterVoltage]...
#0      1J6548180C000900      TGS2600      1000   25      4      [1/1100][1/1400][1/900]
      [1/1700]
#1      1J6548181B001100      AS-MLV 21677.89453125 25      3      [1/1600][1/2600][1/2100]
#ListEnd
#Stick Id Sensor Voltage [V]      Sensor Current [µA]      Heater Voltage [V]      Heater Current [mA]
#<<<<<<<<<<<
0      0.099239      5.96141E-10      1.28396 3.46604E-5      0.0993631      -6.2126E-8
      1.57417 2.20515E-5      0.099239      1.88762E-7      1.09637 -3.16621E-6
1      1.00033 2.79601E-6      1.59947 0.0144741      1.00039 7.75457E-5      2.5971 0.0192104
      1.00033 9.51332E-5      2.10063 0.0150812
```

If the file already exists at measurement start, a new file will be generated with the same name plus a number string appended or incremented.

Telnet Server

The program has a built in telnet server, that allows to communicate with the program from other software and computers. Measurements can be started and stopped and parameters can be read. Adjustment of parameters has to be done via the JLMlogSP software and cannot be done via telnet.

If the telnet server is active, the current IP address and port, where the server can be reached, is shown in the status line. If a client is connected to the server the IP address of the client is shown too.

The telnet server listens on port 23 and accepts 4 commands:

V<Enter> Send software version

Returns the a string in the format:

```
# programname buildversion
```

```
# JLMlogSP 1.3.4854.62283
```

C<Enter> Send all measurement settings

Sends the complete header as in a log file containing all measurement parameters

S<Enter> Start the measurement

Starts a measurement. The complete header with all measurement parameters is sent first. Then the measurement data is sent, one line per stick and cycle. The format is the same as for the log file.

X<Enter> Stop the measurement

Stops a measurement

Main menu items

The **File -> Load Log File** menu item imports the data from an old log file. Only data from MOXsticks, that are connected to the PC are imported!

The **File -> Clear Data** menu item removes current measurement data from memory.

The **File -> Exit** closes the software.

The **Help -> Manual** menu item opens this manual in a pdf reader (must be installed independently).

The **Help -> About** menu item opens following dialog:



When opening this dialog, the program will check for new versions of the software via internet. If a newer version is found, the **Install** button will be enabled. If you click the **Install** button the setup program for the newest version is retrieved and started.

If **Automatically check for updates during program start** is enabled, the software will check for new versions via the internet whenever the program is started. If a new version is found, this dialog will appear automatically.