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 TGS 2611 TGS 2442 TGS 2444 TGS 2620 TGS 2600 TGS 2104 TGS 2201 TGS 2602 TGS 813 TGS 826 TGS 8xx	LP-Gas detection Methane detection CO detection -pulsed sensor detection of Ammonia detection of solvent vapors detection of air contaminants detection of gasoline exhaust gases detection of gasoline exhaust gases detection of air contaminants Combustible gases ¹ Ammonia ¹
Applied sensor	AS-MLC AS-MLN AS-MLK AS-MLV	CO sensor - low power NO2 sensor - low power CH4 sensor - low power VOC sensor - low power
UST	GGS1000 family ² GGS2000 family ² GGS3000 family ² GGS4000 family ² GGS5000 family ² GGS6000 family ² GGS7000 family ²	especially suitable for leak detection of combustible gases sensor for CO-, hydrogen- und alcohol, low cross sensitivity to CH4 methane sensor for hydrocarbons, especially suitable for stationary observation of LEL selective sensor for ammonia, with low cross sensitivity to CH4, CO, H2and humidity sensor especially sensitive to nitric oxide and ozone sensor for hydrogen, with low cross sensitivity to CH4, humidity and alcohol sensor for detection of NO2 - smouldering fires
FIS	SB-95-12 SB-11A SP-11 SB-12A SP-12A SB-15 SP-15A SB-500 SB-19 SP-19 SB-30 SP-31 SB-41 SP-41 SB-41 SP-41 SB-42A SP-53A SP-53B SP3-AQ2 SP3S-AQ2 SB-AQ1	CO and CH4 sensor HC detection HC detection Methane detection LP-Gas detection LP-Gas detection CO detection -pulsed sensor Hydrogen detection Alcohol detection Alcohol and solvents detection Refrigerants detection Refrigerants detection Refrigerants detection Refrigerants detection Ammonia detection (high conc) Ammonia detection (low conc) Indoor air quality (VOCs) 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.

JLMlogSP 1J654818	18001100			- • • ×						
File Help										
Measurement Analysis	Measurement Analysis Analysis Graph Setup									
Measurement	Measurement Telnet Server									
Cycle Interval [ms]	1000		V Active							
Edit										
Stick	Sensor	Mode								
1J6548181B001100	AS-MLV	25ms -> 1/1600 1	/2800 1/2300							
Telnet Server 192.168.1.	25:23 ClientIP: 127.0.0.1			.41						

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.

insor													
Sensor	sor AS-MLV		Sensor Voltage			500m	V	•	Loa	d	Save		
Maximum Heater Voltage [V] 2,8		Resist	ance Rang	je [Ohm]	5k - 1N	1	•						
yde													
Step In	terval [ms] 25	۲	Count 3	۲							Loa	d	Save
#	Duration	Heat	er Voltage					l I	-		_		
1	1	1,6			Ξ	2,5						•	
2	1	2,8			ebe	2							
3	1	2,3			⁷ olta	1,5	••••						
					er 🗸	1							
					leat	0 5							
					T	0,0							
						0	10	20	30	40	50	60	70

The subframe named *Cycle* shows the heater cyling 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.

S JLMlogSP 1J6548181B001100	
File Help Measurement Analysis Parameters Algorithm PCA Components 2	
Add Delete ✓ Direct 1J6548 18 1B00 1100/AS-MLV/0[1.60V]/Sensor Resistance ✓ Direct 1J6548 18 1B00 1100/AS-MLV/1[2.80V]/Sensor Resistance ✓ √x 1J6548 18 1B00 1100/AS-MLV/1[2.80V]/Sensor Resistance ✓ Direct 1J6548 18 1B00 1100/AS-MLV/2[2.30V]/Sensor Resistance	Add Delete ✓ 0 ✓ ✓ 1 ✓ ✓ 2 ✓ ✓ 3 ✓ ✓ 4 ✓ ✓ 5 ✓ ✓ 6 ✓ ✓ 7 ✓ ✓ 8 ✓ ✓ 9
Telnet Server 192.168.1.25:23 ClientIP: 127.0.0.1	ب اند

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).

Add Features								
Interface 1J65481813000E00 / Sensor 1	▼							
Channel Sensor Resistance	•							
Select Cyde Steps								
0 - 0ms - 0.00 1 - 25ms - 0.40 2 - 50ms - 0.20 3 - 75ms - 0.00 4 - 100ms - 0.30								
Algorithm Direct	•							
	Cancel Ok							

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.

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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.

5 JLMlogSP 1J654818	31B001100				
File Help					
Measurement Analysis	Analysis Graph Set	q			
Features	▼ Max Points	50 🔻		Clear	
420.000 7			·7		
400.000 +					
380.000	÷			✓ — Direct AS-MLV/0/Sensor Resistance	
360.000				☑ ──── Direct AS-MLV/1/Sensor Resistance	
340.000				✓ —— √x AS-MLV/1/Sensor Resistance	
320.000				Direct AS-MLV/1/Sensor Resistance	
300.000 +				✓ — Direct AS-MLV/2/Sensor Resistance	
280.000 +			·		
260.000 +	÷				
240.000 +	;;;-				
220.000 +					
200.000	44-	J 			
180.000 +			I I I I I I I I I I I I I I I I I I I		
160.000 +	J	L			
140.000			·		
120.000	· · · · · ·		1		
80.000	1 I I				
60.000					
40.000	1 1 1 1	· · · · · · · · · · · · · · · · · · ·			
20.000					
0	1 2 3	4 5	6 7		
Telnet Server 192 168 1	25-23 ClientIP- 127.0.0	1			
Temet Server 192,100,1	25.25 Chenue: 127.0.0	1			-11



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 '.'.

#>>>>> #JLMlog #Started #Interva	>>>>> gSP d 16.04.2 al [ms]	1.3 013 17:18 250	1.3.4854 8:19	4.62283 41380.7	2105824	07					
#Stick Id	d Stick	Sensor	Sensor	Gain Resi	stance	Step Inte	erval	Sten Co	unt		
noticit it	Duratic	on/Heate	rVoltage]	stance	Step me	21 Vai	5100 00	ane		
#0	1J65482	, 180C0009	900	TGS260	0	1000	25	4	[1/1100]][1/1400][1/900]
	[1/1700]									
#1	1J65483	L81B0011	L00	AS-MLV	21677.8	9453125	25	3	[1/1600]][1/2600][1/2100]
#ListEnd	d										
#Stick Id	d Sensor '	Voltage [V]	Sensor O	Current [µ	JA]	Heater \	/oltage [V]	Heater (Current [mA]
#<<<<	<<<<<										
0	0.09923	9	5.96141	.E-10	1.28396	3.46604	E-5	0.09936	31	-6.2126	E-8
	1.57417	2.20515	E-5	0.09923	9	1.88762	E-7	1.09637	-3.16621	1E-6	
1	1.00033	3 2.79601	.E-6	1.59947	0.01447	41	1.00039	7.75457	E-5	2.5971	0.0192104
	1.00033	9.51332	2E-5	2.10063	0.01508	12					

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:

Version Information	×
JLMlogSP	
Current Version	
Version: 1.3	
Build: 1.3.4854.62283	
New Version	
No new updates available	
	Install
Automatically check for updates during	program start
JLM Innovation GmbH	
http://www.jlm-innovation.de	
mailto:support@jlm-innovation.de	
JLM Innovation GmbH	Copyright 2013

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.