MFS02 EvaKit

Thermal Mass Flow Sensor

For an easy evaluation of the MFS02 flow sensor

FLOW
TEMPERATURE
HUMIDITY
CONDUCTIVITY

INNOVATIVE SENSOR TECHNOLOGY

Benefits & Characteristics

- High sensitivity
- Excellent measuring dynamics
- Fully calibrated and with USB connection
- Software included with graphical signal representation
- Data logging function
- Integrated flow channel with pneumatic connectors

Illustration

Technical Data

Operating measuring range:	0 ml/min to 200 ml/min
Power supply:	USB
Accuracy:	+/- 1 % at 25 °C
Pneumatic connection:	Hose with ID = 6 mm
PC connection:	USB 1.1 or 2.0 compatible

For details about the MFS02 flow sensor see specific MFS02 data sheet.

For configuration details see application note

Order Information

	Microflowsens EVA-KIT
Order code	250.00007

DFEVAKit_E2.1

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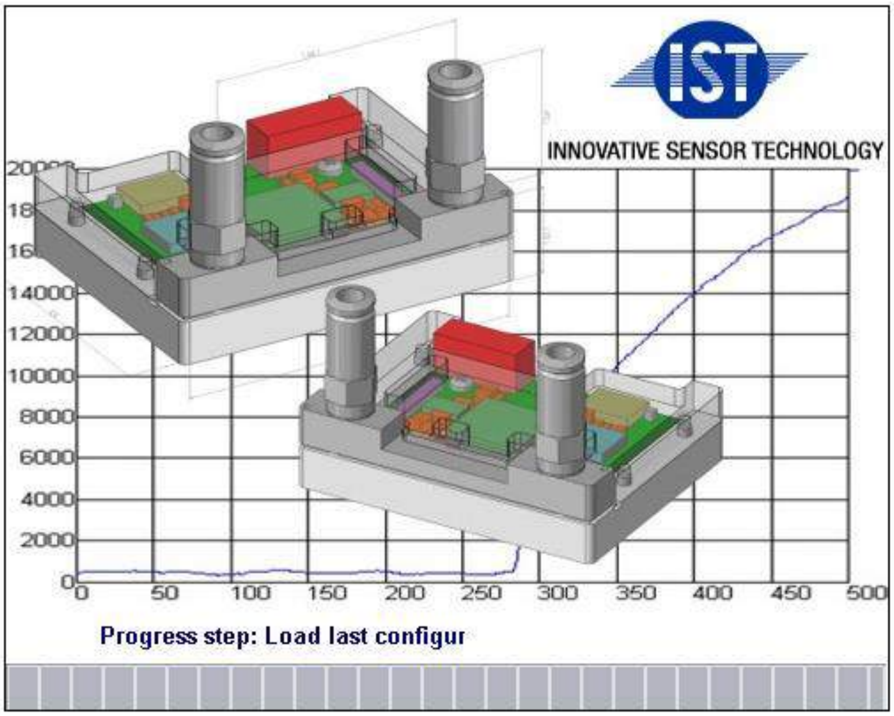
ISO 9001 RoHS

MFS02 EvaKit

Instruction Manual



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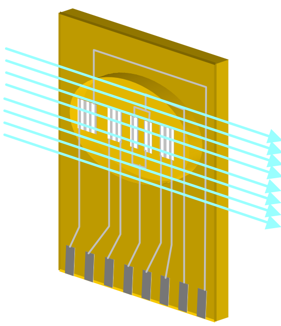
Introduction

The EVAKit is a gas flow module, based on the RTD On Membrane™ -Sensor Technology (ROM) of the company IST AG. (10µm thin Polymer membrane on glass substrate)

Microflow™ Sensors (3.5 x 5 x 0.5mm) manufactured using this technology are characterized by a high sensitivity , high measuring dynamics, a wide measuring range, stability and low power consumption.



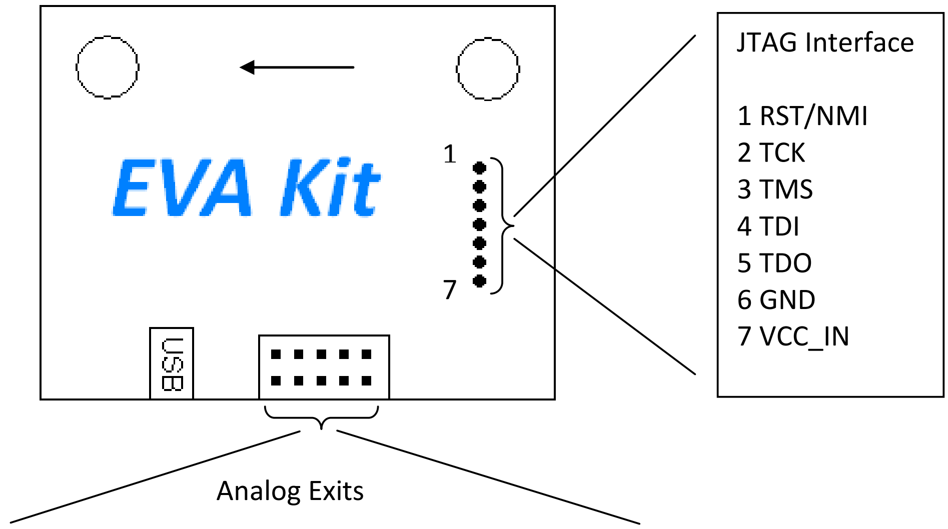
The EVAKit is used for a simple evaluation of this sensor technology for customer applications in order to test the properties of the sensors for a possible future series application. The EVAKit has been calibrated for operation with air under standard conditions. Other gases are possible on request. After installing a Windows Software and driver (see subsequent sections) and establishing USB connection, the device is ready for operation. This connection is also used for feeding.

The measuring range varies from 0…..200ml/min air. The air is fed over the provided hose connectors (hose ID = pun 6x1) in direction of the arrow.

Possible application areas for Microflow Sensors

- Spirometer
- Differential pressure measuring (bypass module instead of differential pressure sensors)
- Low flow / high flow gas measuring
- Gas dosage
- Aspiration monitoring in climate and gas measuring devices

1.EVAKit Pin Configuration



Gnd	DA_D	3.6V	x	x
DA_B	DA_A	12V	15V	x

DA_B : Temperature
DA_D : Flow Low
DA_A : URight (Flow High)

The voltage of the analog exits ranges between 0…13.5V. For more details on configuration, please see point 4.5.

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2 Driver, Software and Accessories

2.1 FTDI CDM Drivers

To enable communication between EVAKit and your computer, it might be necessary to install the Virtual COM Port Driver by FTDI to ensure that the Microflow software can identify the EVAKit. Latest drivers can be found under http://www.ftdichip.com/Drivers/VCP.htm .

2.2 Microflow

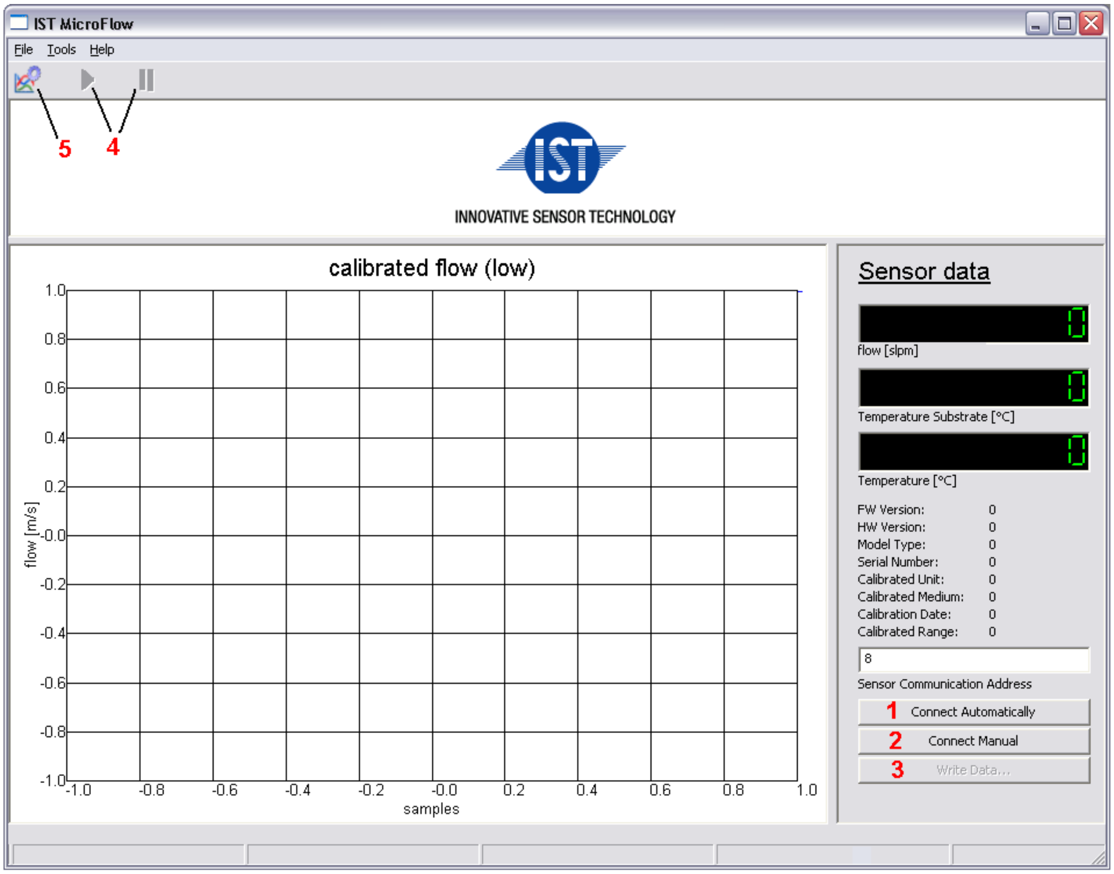
The programme Microflow enables communication between EVAKit and your computer. Installation: Microflow is available as a .zip file and has to be unzipped into a target directory of your choice. The programme can be started by executing the file "frmISTMicroFlow.exe" in your target directory.

2.3 Required Accessories

To connect the EVAKit with your computer a USB cable type Mini-B (5-pin) is required, see illustration below.

If the EVAKit needs to be re-calibrated, an additional measuring device for airflow is required and a software capable of calculating regression polynomial parameters (e.g. Datafit or Excel).

3 Microflow GUI



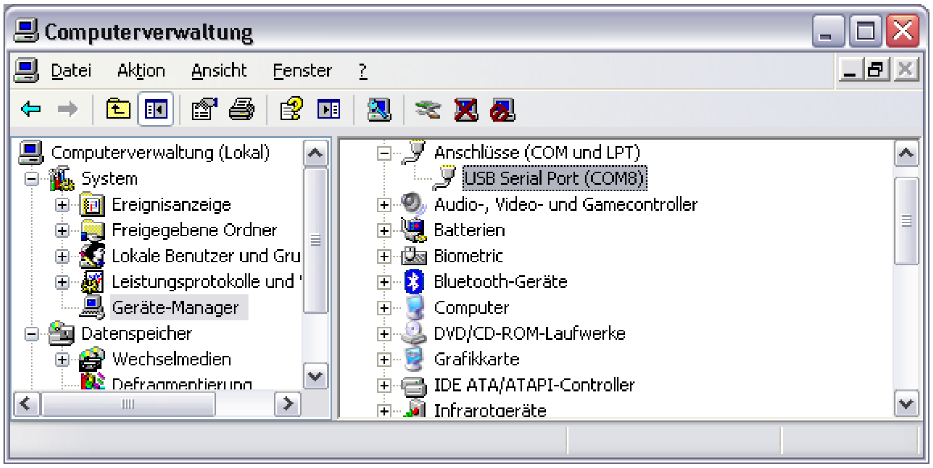
3.1 Connect Automatically

Once the EVAKit has been connected to the computer, connection can be started with “Connect Automatically”. The corresponding port will be searched automatically and inserted into the text field above and the connection to the EVAKit will be started.

3.2 Connect Manually

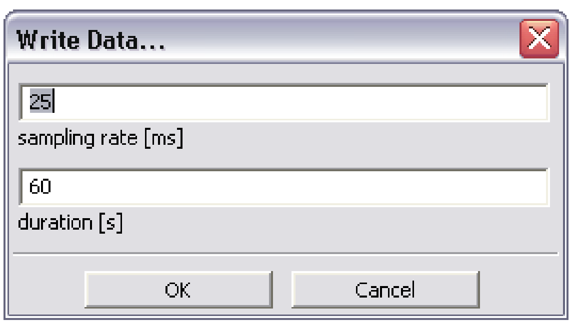
If "Connect Automatically" cannot detect the EVAKit, you can try to establish a connection to the EVAKit manually. You need to indicate the address of the COM port to which the EVAKit is connected in the text field above the button. Once it has been detected, the address should be displayed in the device manager under Ports (COM and LPT) → USB Serial Port (COMX). The number which needs to be indicated in the text field is x.

(The device manager can be opened e.g. over control panel → Administrative Tools → Computer management or with Start → Run Open: devmgmt.msc → OK.)
If the USB serial port is not displayed in the device manager, the driver, as instructed in point 2, might not have been installed correctly.



3.3 Write Data...

The button will only be activated once the data retrieval (see 3.4 below) has been started. A Log file with den measurements will be generated. The name of the file is
MESSDATUM_STARTZEIT.txt
and can be found in the program directory in the subfolder "Data". The measurements can for example be imported into Excel.



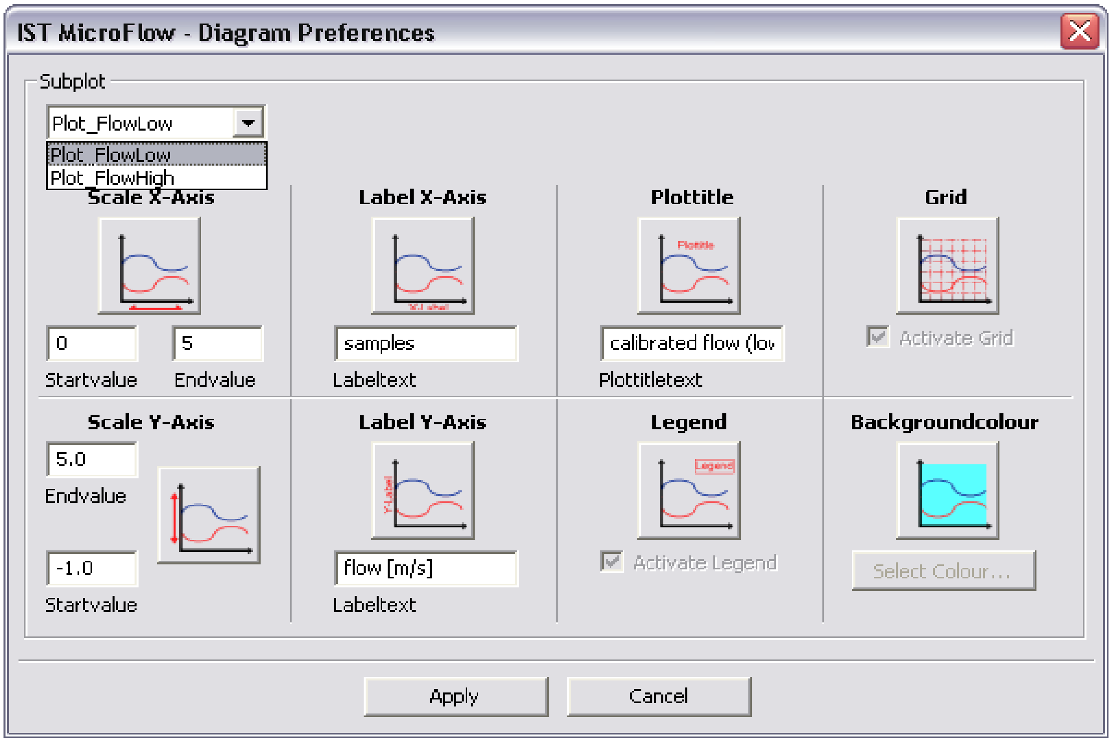
In the dialog the interval between the measurements (sampling rate in milliseconds) and the overall duration (duration in seconds) can be specified. As soon as “OK” is pressed, the recording is started.

3.4 Data Retrieval start/stop

As soon as the connection to the EVAKit has been established, the data retrieval can be started or stopped using the Play / Pause buttons. The data are continuously read by the Kit and displayed in the diagram.

3.5 Diagram Preferences

The diagram settings can be displayed using the button at the top left in the main window. The following dialog appears:



The two output modes Flow_Low und Flow_High can be chosen in the dropdown menu. With Flow_Low the flow value is calculated from the voltage at the flow sensor.
With Flow_High the flow value is calculated from the voltage URight. Flow_Low can be calibrated over the parameters in 4.4 and Flow_High with the parameters in 4.3.

Scale X-Axis: These settings do not cause anything. The scaling cannot be changed. Always the last 200 values are displayed.

Scale Y-Axis: Here, the start and end values of the Y-Axis can be specified. If in both values, "-1" is entered, the scaling of the Y-Axis will automatically adjust itself so that all values are displayed. However the Y-Axis will also adjust itself with fixed settings as soon as the EVAKit data exceed the range.

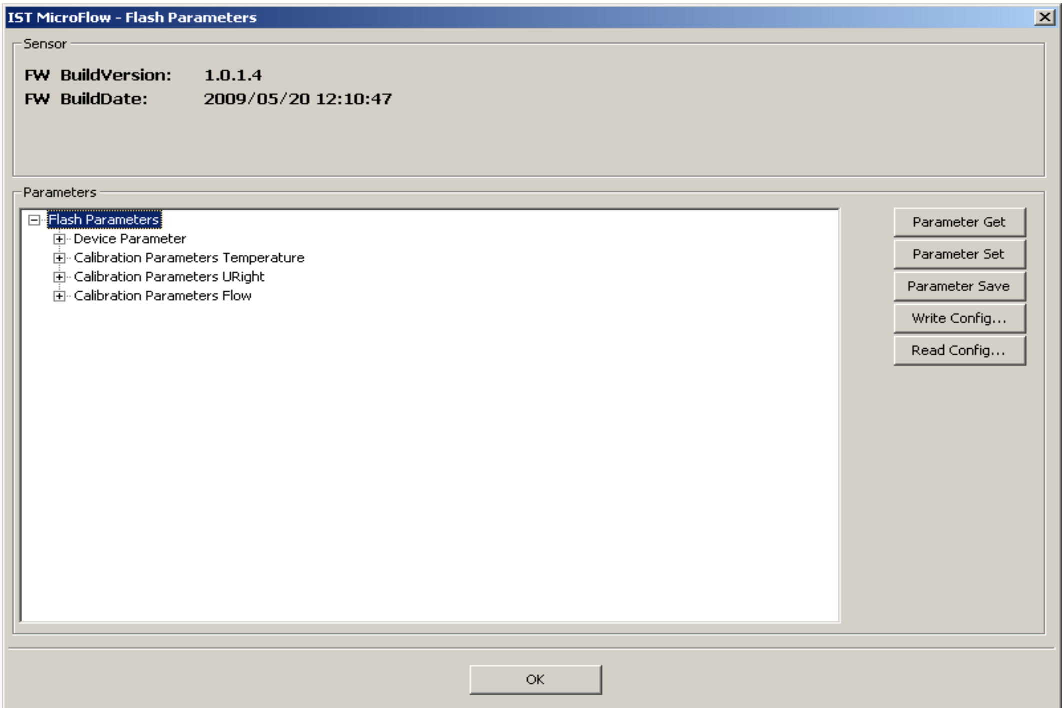
Label X/Y- Axis, Plot Title: With this the axis caption and the diagram title can be changed. The axis caption does not affect the scaling.

Grid, Legend and Background colour are not available.

3.6 Calibration Mode

If the EVAKit needs to be re-calibrated, an additional reference measuring device for the flow rate and software capable of calculating regression polynomial parameters (e.g. Datafit – Trial version or Excel).
The "Calibration Mode" can be accessed over the menu Tools -> Calibration Mode. Also in the Menu Tools you can find "Command Mode". However, it is not available. Calibration Mode is only available once the EVAKit has been connected and the data retrieval has been

paused.



Parameter Get: The calibration parameters are read from the EVAKit Flash memory.

Parameter Set: The changed parameters are temporarily stored in the EVAKit memory. Once the power supply to the Kit is interrupted (e.g. by pulling the USB cable), the old values will be re-established.

Parameter Save: The parameters will be saved permanently and will be preserved even in the event of a loss of power supply. However, they need to be transferred to the EVAKit using “Parameter Set" previously.

Write Config... Opens a dialog in order to save the parameter data into a file

Read Config... Previously saved parameters can be retrieved by the file.

4 EvaKit Calibration

The EVAKit has already been pre-calibrated. Further adjustments should normally not be necessary. In Calibration Mode a lot of parameters can be changed. It is therefore recommendable to create a backup copy with “Write Config” previous to any changes. This will allow restoring a working configuration just in case. Please see point 4.5 if information is needed on what influence the various parameters have on the calibration.

4.1 Device Parameters

None of the parameters under this rubric have an influence on the measurement performance except the usDAC_X values. Most of the settings here should be clear due to their name.

usDAC_A - D	Need to be in the range 0...4096. (It is advisable to set them all to 0)

4.2 Calibration Parameters Temperature

usTemperatureMode	unused!
fTemperatureOffset	Offset correction for temperature display in GUI
fTemperatureIncrease	linear correction for temperature display in GUI
fTemperatureDACOffset	]
fTemperatureDACx1	]Polynomial factors for analog exit DA_B
fTemperatureDACx2	]
fTemperatureDACx3	]
iResistorBridge	unused!

4.3 Calibration Parameters URight

URight is displayed once Flow_High has been chosen.

fURightTemperatureOffset	Offset correction for temperature dependence
fURightTemperatureIncrease	linear correction for temperature dependence
fURightOffset	unused!

Form of the Regression Polynomials:
ax^5 + bx^4 + cx^3 + dx^2 + ex + f   [x indicates the modified raw data URight]

fURneg_X5 , fURpos_X5 =a	
fURneg_X4 , fURpos_X4 =b	
fURneg_X3 , fURpos_X3 =c	neg_X parameters are used if x <= zeroline.
fURneg_X2 , fURpos_X2 =d	pos_X parameters are used if x > zeroline.
fURneg_X1 , fURpos_X1 =e	zeroline see 4.4 Calibration Parameters Flow
fURneg_off , fURpos_off =f	

UR_DAC_A_inc	unused!
UR_DAC_A_off	upper limit for the analog exit DA_A in [ml/min]
U[illegible]ffset_cor	additional Offset of neg_off resp. pos_off

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4.4 Calibration Parameters Flow

Flow is displayed once Flow_Low has been chosen.

zeroline : raw data threshold value, from which the polynomial for the negative range is changed to the polynomial for the positive range.

Form of Regression Polynomials:
ax^5 + bx^4 + cx^3 + dx^2 + ex + f [x indicates the raw data flow]

neg_X5, pos_X5 = a
neg_X4, pos_X4 = b
neg_X3, pos_X3 = c neg_X parameters are used if x <= zeroline.
neg_X2, pos_X2 = d pos_X parameters are used if x > zeroline.
neg_X1, pos_X1 = e
neg_off, pos_off = f

Flow_DAC_D_inc unused
Flow_DAC_D_off upper limit for the analog exit DA_D in [ml/min]

Flow_offset_cor additional Offset of neg_off or pos_off

4.5 Calculation of the Polynomial Parameters for Re-Calibration

It is possible to calibrate the indicated values of Flow_Low, Flow_High and the temperature values. The above mentioned parameters can be used as default values to depict the raw data on the displayed values.

To re-calibrate a reference measuring device is required in order to be able to adjust the raw data to the measurement values. Below you will find a short description of how the in GUI displayed values respectively analog exits (green) are calculated from raw data (red) and parameters (blue.

4.5.1 Temperature

Display in Microflow GUI:
x = raw data
a...d = fTemperatureDACx3... fTemperatureDACOffset
Temperature = (x*fTemperatureIncrease) + fTemperatureOffset
Analog exit DA_B = a*x^3 + b*x^2 + c*x + d

Attention: Changes of the parameters for the analog exit affect also the values of Flow_Low and Flow_High!

4 Flow_High (= URight)

In order to achieve the raw data, all parameters of "Calibration Parameters URight" are set to 0, except fURpos_X1 = 1. With these settings data pairs (URight | setpoint value) are determined by measurements.

Afterwards the parameters pos_X5...pos_off respectively neg_X5...neg_off can be determined based on the data pairs for the regression polynomial (e.g. in Datafit).

Analog exit (Pin DA_A) and display in Microflow GUI:
r0 = raw data
r = modified raw data (temperature dependence)
a...f = fURpos_X5... fURpos_off respectively fURneg_X5... fURneg_off

r = r0 + (TempRawdata*fURightTemperatureIncrease + fURightTemperatureOffset)

Flow_High = (ar^5 + br^4 + cr^3 + dr^2 + er + f) + UR_offset_cor

Analog exit:
DA_A = (Flow_High / UR_DAC_A_off) * 13.5V , Analog exit is min. 0V and max 13.5V

4.5.3 Flow_Low

To determine the raw data all parameters in "Calibration Parameters Flow" are set to 0 except pos_X1 = 1 and pos_off to approx. -31300. pos_off might differ slightly. The parameter should be selected in such a way that the raw data for the entire measurement range (0 - 1 l/min) can be displayed by GUI.

The raw data are calculated as follows:
Raw data = [flow (slpm) in GUI] * 1000 - pos_off

[example: For an applied flow of 100 ml/min, pos_off = -31385 and pos_X1 = 1 the value 3.377 is displayed in the Microflow GUI. This is equivalent to a raw data value of 3377 - (-31385) = ***34762.*** *Therefore the data pair (34762 | 100) would be determined.]*

Afterwards the parameters pos_X5...pos_off resp. neg_X5...neg_off for the regression polynomial can be determined based on the data pairs (e.g. in Datafit).

Analog exit (Pin DA_D) and display in Microflow GUI:
x = raw data
a...f = pos_X5... pos_off resp. neg_X5... neg_off

Flow_Low = (a*x^5 + b*x^4 + c*x^3 + d*x^2 + e*x + f) + Flow_offset_cor

Analog exit:
DA_D = (Flow_Low / FLOW_DAC_D_off) * 13.5V ,Analog exit is min. 0V und max. 13.5V