

## XEN-5310 / XEN-85000 LabView program H2-Polling RS232 communication software Version 1.3.4

For read-out of the XEN-5310 thermal conductivity sensor electronics via the XEN-85000 ftdi USB-RS232 interface electronics, a LabView program is available from Xensor Integration, for Windows 7 and Windows XP.

This is a manual describing the installation and operation of this LabView software.

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### Xensor Integration bv

Distributieweg 28  
2645 EJ Delfgauw  
The Netherlands

Phone +31 (0)15-2578040    Founded 18 May 1988    ABN-AMRO 60 50 40 311  
Fax +31 (0)15-2578050    Trade reg. 27227437    IBAN NL42ABNA0605040311  
Email [info@xensor.nl](mailto:info@xensor.nl)    Site [www.xensor.nl](http://www.xensor.nl)    VAT NL 009122746 B01

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## 1 Installation

To run the LabView software in combination with the ftdi hardware, some programs have to be installed first, incorporated in the

Installation package labview h2 software v1.3.4:

- LVRTE2014\_f1Patchstd.exe
- NI\_VISA\_5.2.0-runtime.exe
- cdm\_2.08.24-setup.exe
- H2 Polling RS232 communication v1.3.4.exe (and 2 supporting files)

The first three programs have to be installed, and the computer has to be restarted. Then the Polling program will run without installing.

## 2 Versions

This version of the H2-Polling RS232 Communication LabView program, v1.3.4, d.d. 11 December 2014, is compatible with the following firmware versions of XEN-5310:

\Measuring Refresh Rate	Hydrogen	Helium	General	Vacuum
1 Hz	H2-1.3.2-1.00	He-1.3.2-1.00	Gen-1.3.2-1.00	Vac-1.3.2-1.00
2 Hz	H2-1.3.2-0.50	He-1.3.2-0.50	Gen-1.3.2-0.50	Vac-1.3.2-0.50
4 Hz	H2-1.3.2-0.25	He-1.3.2-0.25	Gen-1.3.2-0.25	Vac-1.3.2-0.25

### 3 The Settings Page

When the Polling program opens, the Settings page comes up automatically, see Fig. 1.

In the settings page, the file path for filing the measurement data has to be given.

Then, 1 or more COM ports have to be chosen to select the device to be recorded.

By clicking the pull-down arrow at the right of the **COM port** selector, a choice is given of available COM ports, and also a refresh command becomes available to refresh the available COM ports.

Note, that the COM ports are read out sequentially. So, for maximum speed, only one COM port should be enabled.

The **Enable** button should be activated (indicated by the green light in the button) to actually measure the COM port to its left. When enabling more COM ports, the overall data refresh rate is determined by the total data read time of all ports together. Time outs (if a COM port does not communicate) will increase the cycle time by 1-2 seconds per faulty communication port.

The **Baud rate** of the XEN-5310 devices is generally 115200, so no adjustments are needed there. Some older devices are programmed at 9600 baud, and the rate needs to be changed. If the wrong rate is chosen, no communication will take place.

The **COM ports** button at the left of the COM port selectors allows to choose even more COM ports than 4, default the selector is at 0, but it can be increased to add more COM port enablers.

The windows **Rxbuffer** and **Rxdata** are normally not used.

The **Start** button at the bottom of the Settings page starts the measurements, indicated by a green **Running light**.

The **Stop** button stops the measurements, this can take up to several seconds depending on the total time to measure all active COM ports.

The **Iteration** window shows the number of measurements since the latest start of measurements.

The **Quit** button exits the program when not running, the X at the top right of the screen exits anyway.

The **Delay** window allows to slow up the measurements if they go to rapid,. The Delay is in seconds, however, XEN-5310 device time is measured in the data refresh time, included in the firmware code displayed on the Reception History Page. This can be 1 s (standard), 0.5 s (fast) or 0.25 s (very fast, and without humidity measurement/correction). So, to get the correct time for the 0.50 and 0.25 firmware version, the system time has to be divided by 2, resp. 4. The system time is the time since power-up of the XEN-5310.

In the **File path** window the file name for storing the data shown the Reception History has to be given by the user. Each measurement is immediately stored in, there is no need for any further action to save data. Data are appended to a file if the file already exists, the file is not overwritten. If the file does not exist, a new file of that name is created.

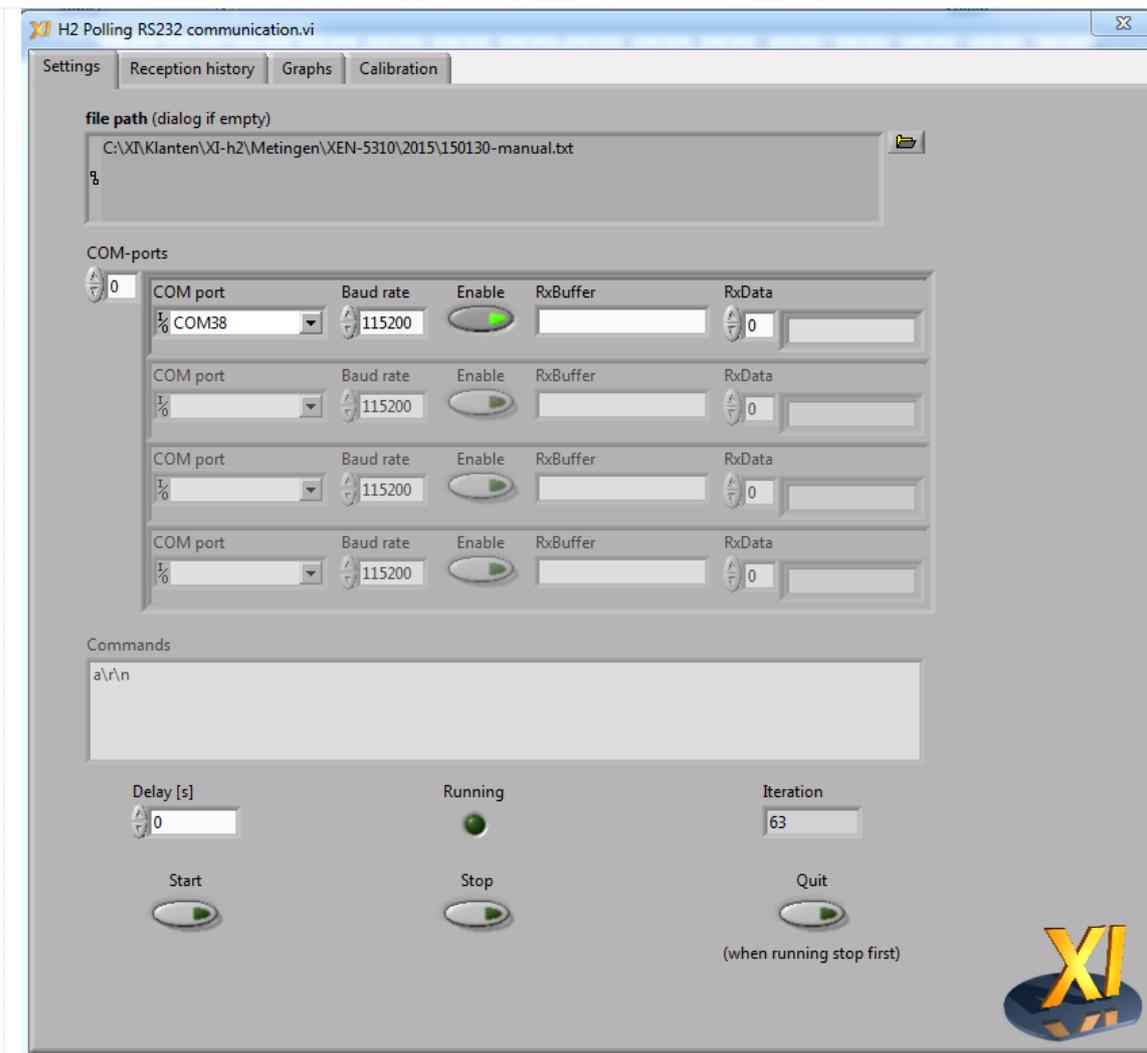


Figure 1: The Settings page

## 4 The Reception History Page

On the reception history page, the measurement data are shown as numbers, up to 30 lines, this can be changed by altering the **History length** window, see Fig. 2. Old data can be removed by pressing the **Clear History** button.

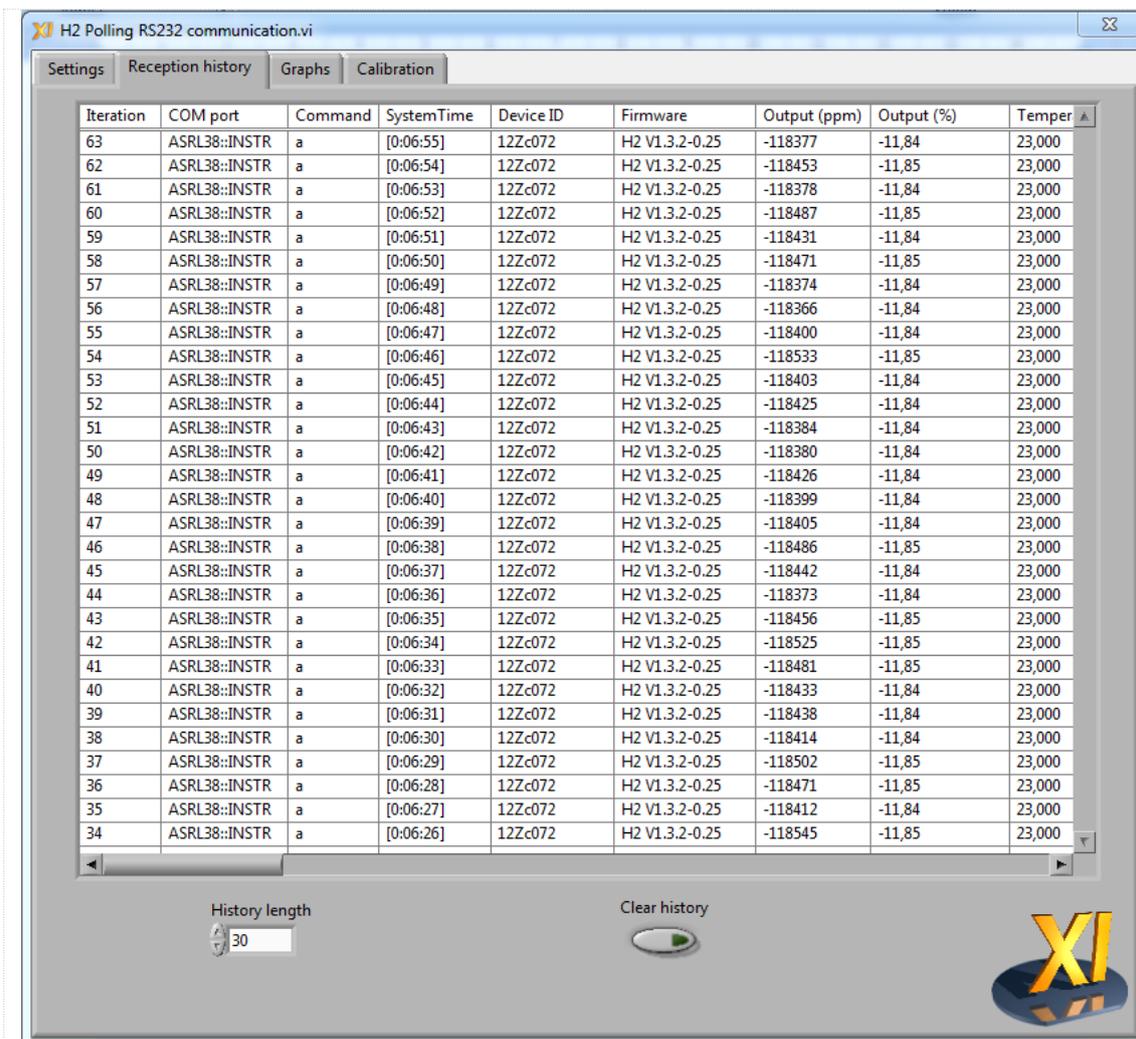


Figure 2: The Reception History Page

By moving the bar at the bottom of the data window, more data to the right can be accessed.

As can be seen in the most right column in Fig. 2, it can be that there are only zeros after the decimal separator, if this separator is a comma. This separator should be changed into a point(.), and then, trailing digits will appear, see Fig. 3. This can be done in the Country & Language part of the configuration screen.

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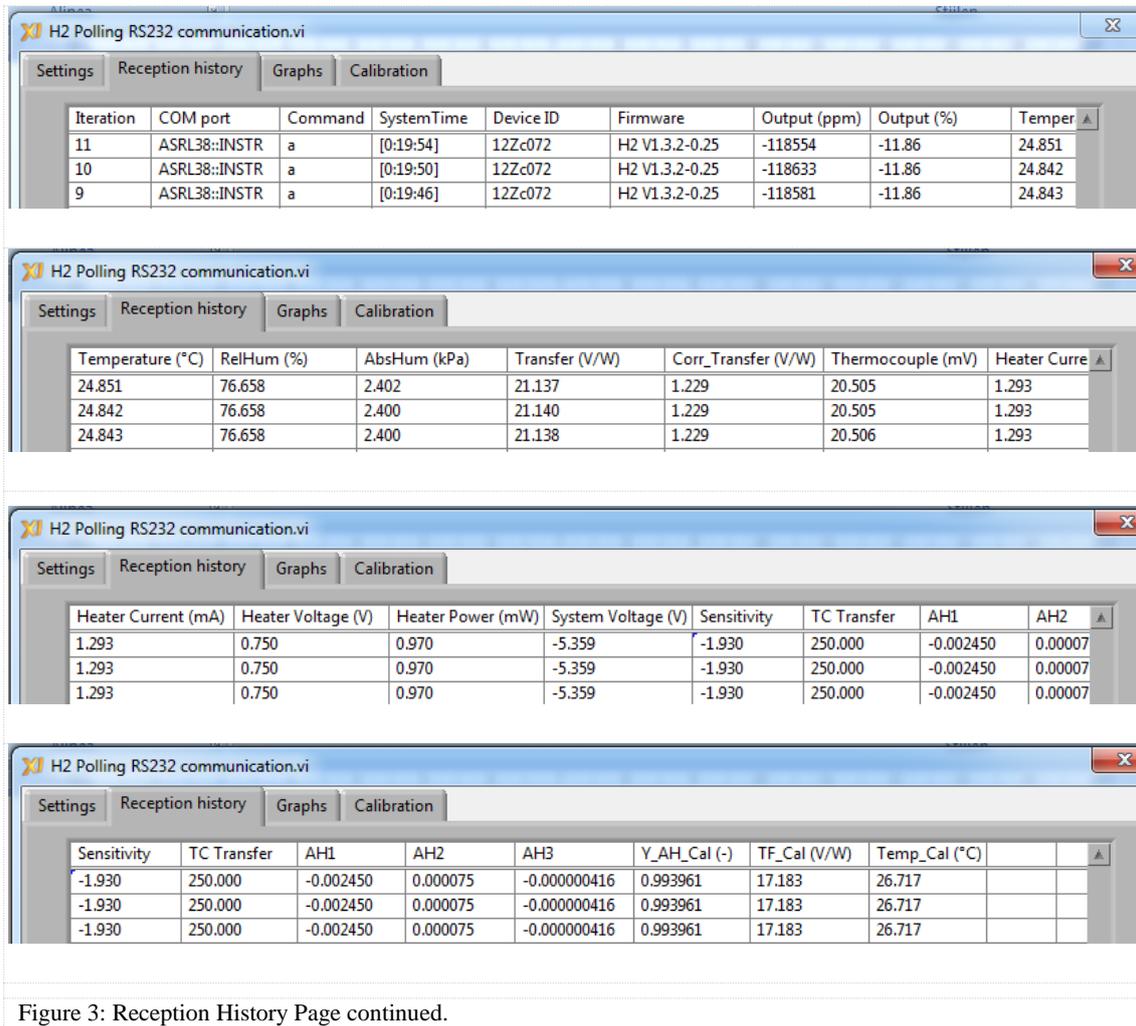


Figure 3: Reception History Page continued.

**Iteration** is the number of the measurement, this is counted per device and starts at 0. The iteration restarts at 0 after a stop and (re)start of the measurements.

**COM port** shows the com port of the device, this can be used (together with the iteration for a single measurement run) for sorting if more devices are measured at the same time.

**Command** a tells the XEN-5310 to send all data.

**System Time** is in hours/minutes/second, but based on the data refresh rate. For a 1 Hz refresh rate is standard time, for a 2 Hz and 4 Hz refresh rate this system time should be divided by 2, resp 4, to get real time. System time starts at the latest power up of the device. This can also be used for sorting if more devices are measured at the same time.

**Device ID** shows the serial number of the device, this should be written on the PCB as well.

This can also be used for sorting if more devices are measured at the same time.

**Firmware** shows the firmware version of the device.

**Output** in % and ppm is the deviation of the corrected transfer with respect to the calibration transfer.

In case of calibration for hydrogen (firmware starting with H2, as is the case here), the output is given as ppm and % H2 concentration. Figure 3 shows the Sensitivity (4<sup>th</sup> screen), for 0-4% hydrogen this is -1.93 %/% change in output for change in hydrogen concentration.

If the firmware starts with He, the device is calibrated for helium, and other coefficients are used to calculate the helium concentration from the change in transfer. For firmware starting with Gen, a general output is given with a sensitivity of +1, i.e., the change of the corrected transfer is given.

**Temperature** in °C is the temperature measured with a Pt100 element in the sensing-element housing.

**RelHum** (Relative Humidity in %) is the RH measured by the separate RH sensor. In the 0.25 s version of the XEN-5310 (indicated by the 0.25 in the firmware version number), RH measurement is not performed and correction for humidity is not performed. The indicated value is invalid, as is the case in Fig.3.

**Abs Hum** column gives the absolute humidity pressure in kPa.

**Transfer** in V/W (output voltage of the thermocouple sensing element divided by the heater power) is what has been measured.

**Corr\_transfer**, the corrected transfer gives the nominal transfer (but not in V/W) as calculated after correcting for the differences between the temperature and humidity during calibration and during measurement. The remaining difference from unity is then ascribed to the parameter to be measured.

**Thermocouple** is the output voltage of the thermopile measuring the temperature elevation of the heater element.

**Heater Current** in mA is the current through the heater element on the sensing element's membrane.

**Heater Voltage** in V is the voltage across the heater element on the sensing element's membrane.

**Heater Power** in mW, the multiplication of Heater Current and Heater Voltage is the power dissipated in the membrane. The **Thermocouple** voltage divided by the **Heater Power** gives the measured **Transfer**.

**System Voltage** in V gives the power supply voltage of the XEN-5310 after stabilization. This should normally read as about 3.2 V.

In this 0.25 s version of the XEN-5310 (indicated by the 0.25 in the firmware version number), no system voltage measurement is performed, and the indicated value is invalid.

**Sensitivity** is a nominal multiplication factor to convert a change in transfer into a change in measurement parameter. For hydrogen concentrations between 0-4% a factor of -1.93 %/% (or -1.93 ppm/ppm) is chosen, indicating that a 1% increase in hydrogen concentration leads to a 1.93% decrease in output level. For full-range hydrogen firmware, a look-up Table is used. For He (helium) firmware, a polynomial is used, for Gen (General) firmware unity sensitivity is used, the **Output** simple shows the deviation of the corrected transfer from the calibration transfer, and the same applies to Vac (vacuum) firmware.

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**TC Transfer** is the correction factor in the firmware for temperature changes.

**AH1-AH2-AH3** are correction factors in the firmware for changes in relative humidity.

**Y\_AH\_Cal** (-) is the correction factor used for humidity during calibration.

**TF\_Cal** (V/W) is the transfer during calibration.

**Temp\_Cal** (°C) is the temperature during calibration.

These three factors give the XEN-5310 measurement data during calibration. It is possible to update these calibration data by performing a new calibration using the Calibration Page.

These data are used, together with subsequent temperature and humidity measurement to first calculate the corrected transfer at the subsequent measurement. Then difference between the corrected and actually measured transfer is used to calculate the output signal, either using the Sensitivity, or with a more complicated formula or look-up Table.

As indicated above, in the 0.25 s devices no correction is made for humidity. Changing humidity levels may therefore result in errors, the higher the temperature, the higher the potential error.

## 5 The Graphs Page

On the Graphs Page, various parameters can be viewed as a function of time (measurement iteration). From one XEN-5310, several graphs can be seen simultaneously, this does not influence the data refresh rate.

Fig. 4. Shows 4 different data from the same device, with 0.25 s data refresh rate. From these graphs we can see that the peak-peak noise on the output signal is of the order of 150 ppm H<sub>2</sub>, or 300 ppm of the transfer ( $6/20\ 000 = 300$  ppm). For the thermocouple voltage it is about 3  $\mu$ V on 20500  $\mu$ V, so the heater power also induces some noise.

The data to be displayed can be chosen with the drop down menu, just as the COM port to be displayed can be chosen in that way.

Start and stop the display with the **Start/Stop** button, clear with the **Clear plot** button. The data number shown under the graph is not the same as the measurement iteration number.

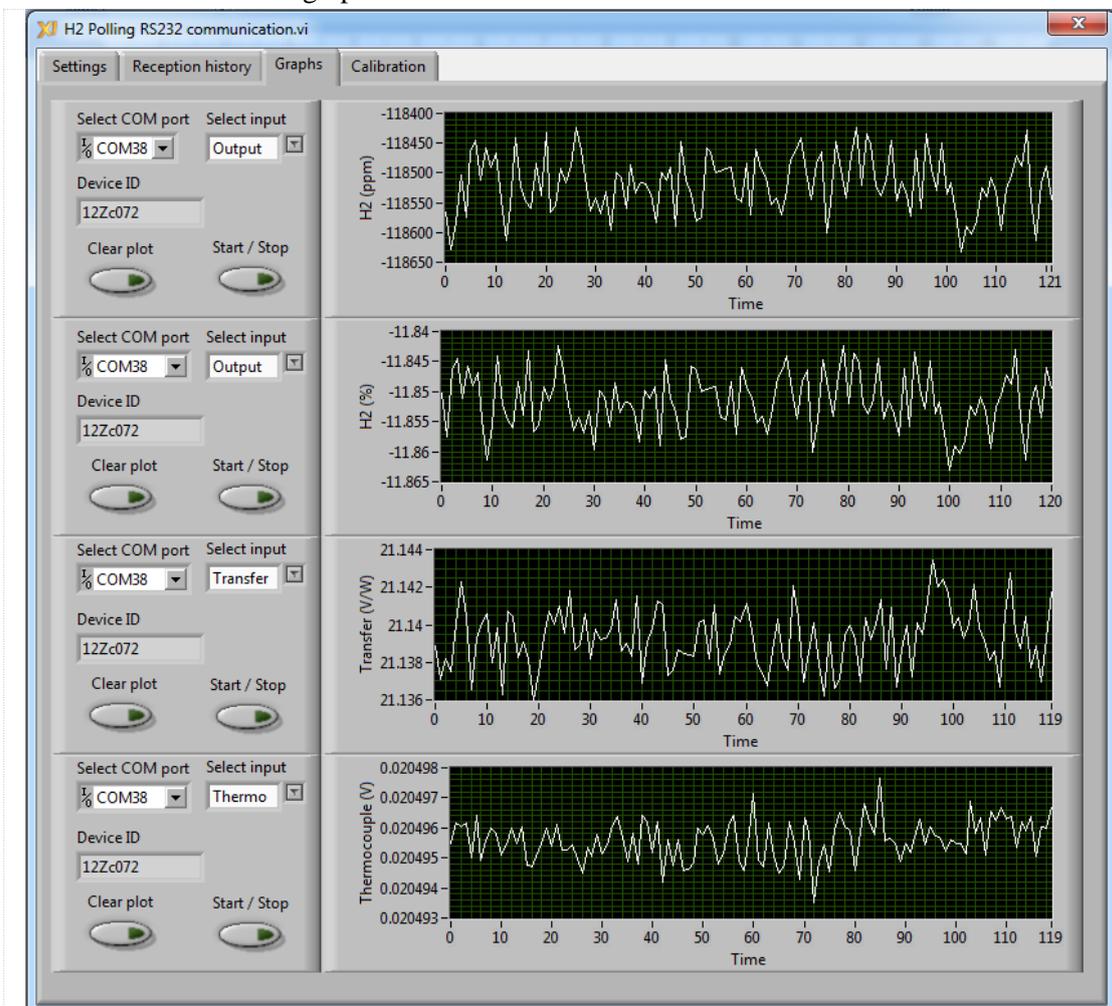


Figure 4: The Graphs Page

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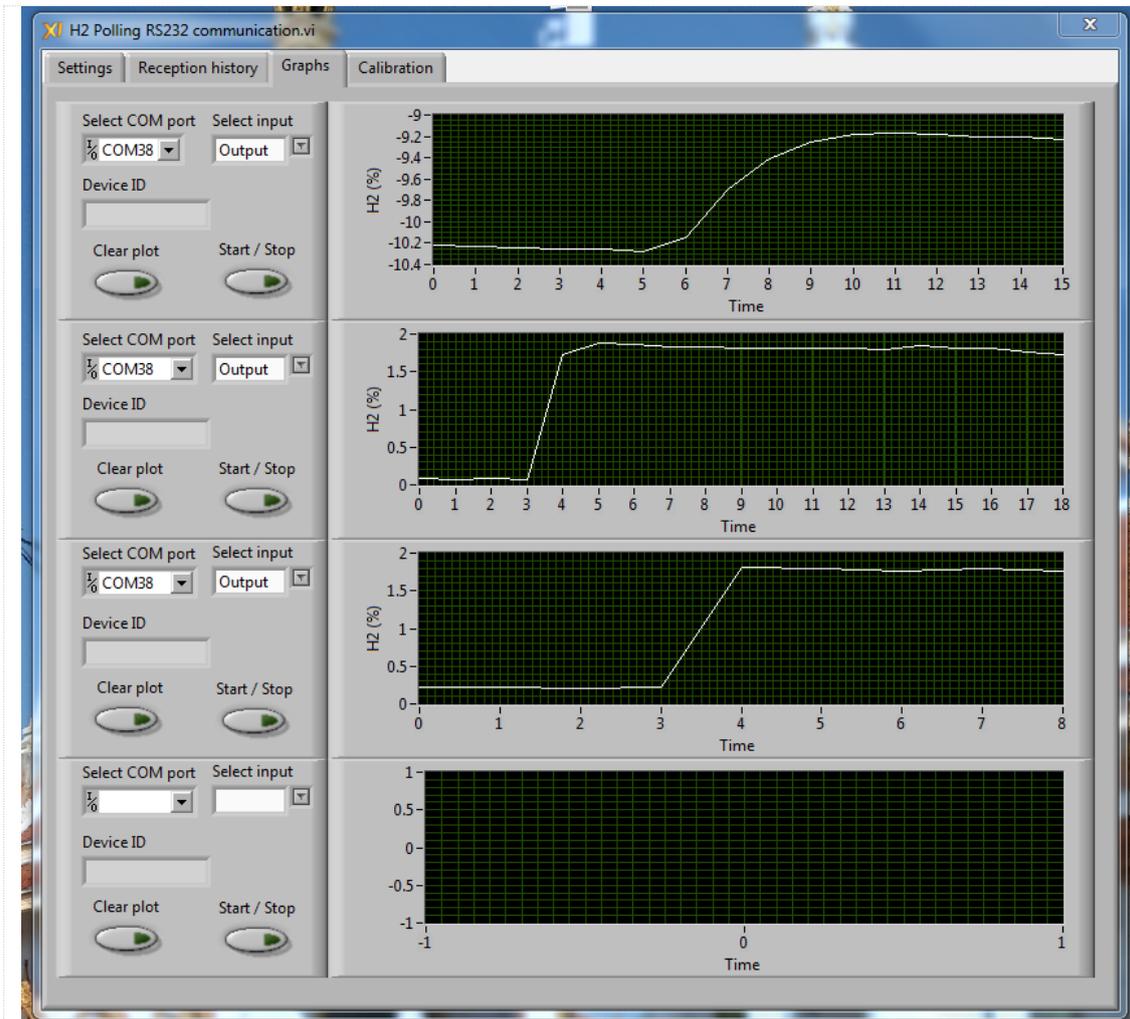


Figure 5: Output of the same XEN-5310, for a step in H2 concentration from 0% to 2% , with different sensing elements:

- top graph shows the standard 1 s device response ( $t_{90}$ );
- middle graph shows a fast 0.2 s device response ( $t_{90}$ );
- third graph shows an ultra-fast 0.08s response device ( $t_{90}$ ).

In all cases, the data refresh time is 0.25 s, this is the time per count.

Fig. 5 shows data from subsequent measurements by activating different graphs for the different measurements. Between these three measurements, the sensing element was exchanged, starting with the standard element, then a faster sensing element was used, and finally an ultra-fast element was used. In this special version, the sensing element was not soldered directly onto the XEN-5310, by was inserted into a socket that was soldered onto the XEN-5310 instead. The firmware was H2-1.3.2-0.25, so that each count indicates 0.25 s.

## 6 Calibration Page

The Calibration Page allows calibration of the device, which should result in a near-zero output after the calibration. These data are stored in the XEN-5310, and recalibration can be carried out when so desired. Calibration starts by pushing the Enable button (after stopping the measurements) and the Start Calibration button. The calibration takes a number of seconds. After calibration, the Enable button should be pushed out again.

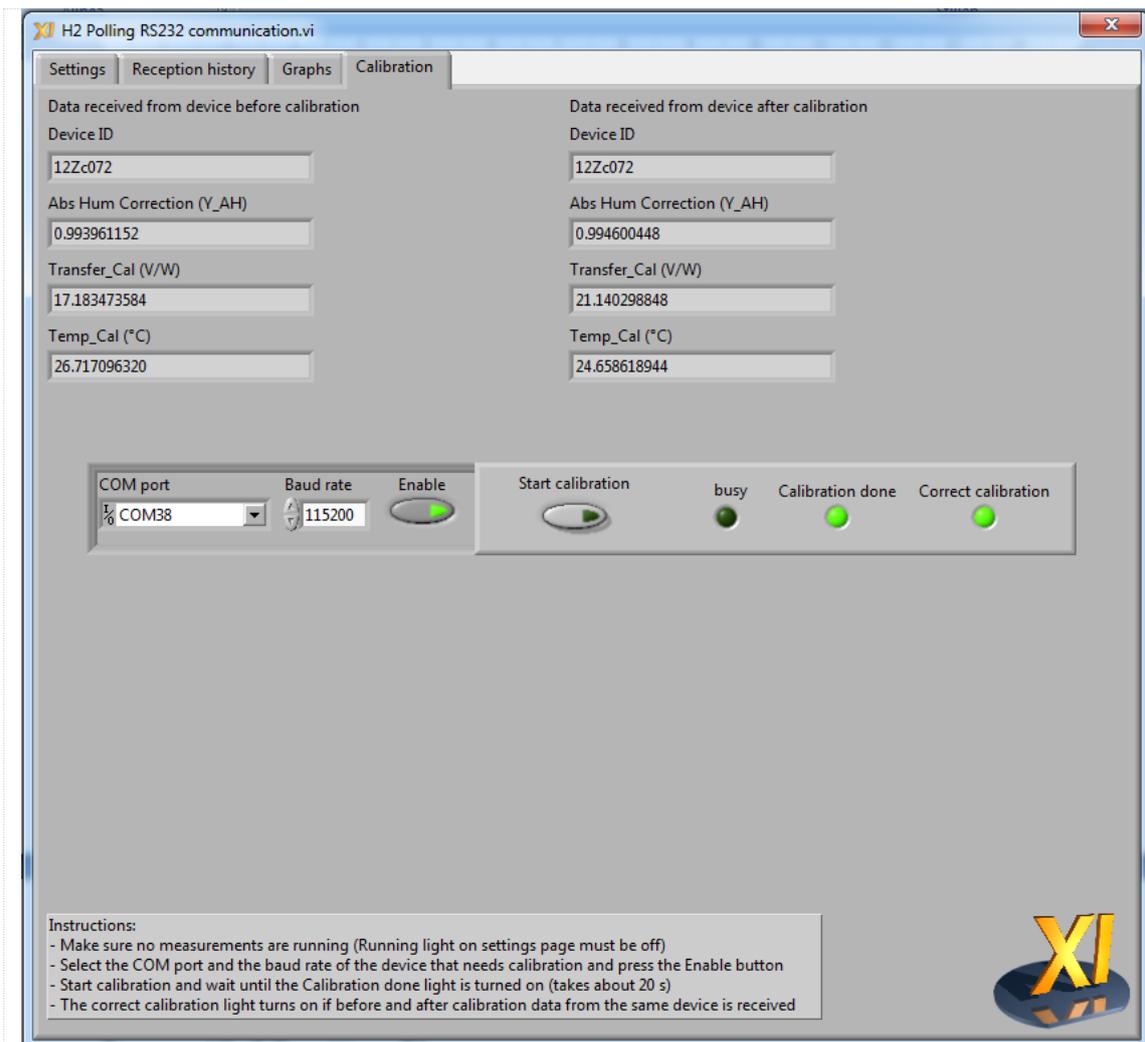


Figure 6: The Calibration Page, with data of the device before and after calibration. The big difference in Transfer (left 17 V/W, right 21 V/W) is caused by changing the sensing element to another type. This also accounts for the large (offset/output) signal before calibration.