FES SENSOR
TECHNOLOGY GMBH

PGA-ADC 3.2

www.fes-sensor.com

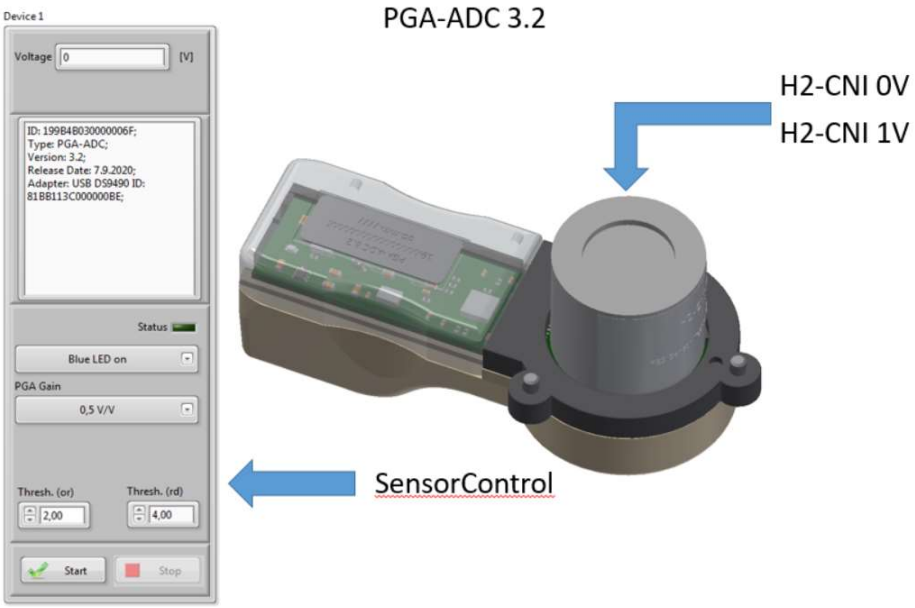
Evaluation Kit for H2-CNI 0V and H2-CNI 1V Hydrogen Sensors

1. DESCRIPTION

The controller PGA-ADC 3.2 serves as evaluation kit for calorimetric, non-isothermally operated H2-CNI 0V and 1V hydrogen sensors. It contains a precision, zero-drift programmable gain instrumentation amplifier (*G* : 0.125, 0.172, 0.25, 0.344, 0.5, 0.688, 1, 1.375, 2, 2.75, 4, 5.5, 8, 11, 16, 22, 32, 44, 64, 88, 128, 176 V/V) and a 16-bit ΔΣ analog-to-digital converter with input current cancellation and a bandgap reference with very high accuracy and low thermal drift of 10 ppm/°C (max). A 1K bit EEPROM for storing adjustments and three switchable LEDs (blue, orange, red) as optical signals for different H2 levels are implemented.

The evaluation kit is operated through a 1-wire bus connector with a personal computer, an installed LabVIEW® runtime and the SensorControl software.

2. APPLICATION



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3. REVISION HISTORY

Date	Rev.	
May 15, 2021	1.0	Initial Version
Dec 4, 2021	1.1	Typographical errors corrected

4. PIN CONFIGURATION OF SENSOR CONNECTOR

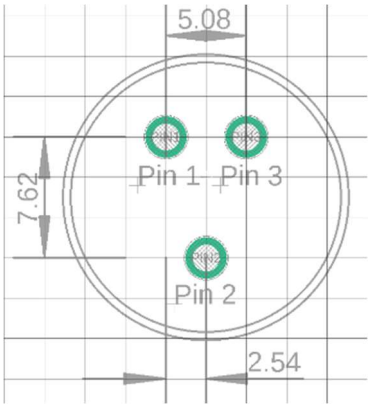


Figure 1: Top view of connections

PIN NO.	SIGNAL NAME	DESCRIPTION
1	VPOW	+12 V positive supply voltage with respect to ground
2	VSIG	Sensor signal with respect to ground AGND
4	AGND	Ground of the internal electronics. The pin is electrically not connected to the housing

5. PIN CONFIGURATION OF 1-WIRE CONNECTOR

Do not connect the evaluation kit to other 1-wire components as the pins 4, 5 and 6 have a different function in common 1-wire networks. Connect the evaluation kit only to our special USB bipolar power source SBPS-eFuse-LDO. This power source also contains a socket for a jack plug which is connected to the +Vpower Output line.

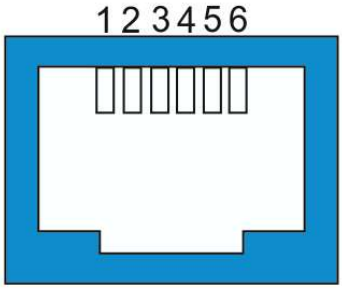


Figure 2: Pinout 6P6C-RJ12 socket

PIN NO.	SIGNAL NAME	DESCRIPTION
1	VDC	+5 V Output
2	AGND	Power Ground
3	OW	1-Wire Data
4	VPOW	+Vpower Output
5	VPOS	+12V Output
6	VNEG	-12V Output

6. SPECIFICATIONS

6.1. ABSOLUTE MAXIMUM RATINGS

At ambient temperature T_a = 20 °C.

Input supply voltage at pin 4 of the 6P6C-RJ12 socket	+15 V
Storage temperature	-40°C to 100 °C

6.2. ESD CAUTION

ESD (electrostatic discharge) sensitive device. Although this product features protection circuitry, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

6.3. LIST OF REQUIRED ADDITIONAL COMPONENTS

PART	DESCRIPTION	QUANTITY
H2-CNI 0V H2-CNI 1V	Calorimetric hydrogen sensor for non-isothermal operation	1
SBPS-eFuse-LDO 3.8 SBPS-LDO 3.10	Bipolar power source, version 3.8 or higher	1
PS 12 Volt	Power supply 12 Volt	1
DS9490R	1-Wire USB Adapter (Maxim Integrated)	1
6p6c RJ12 0,3	Cable 6p6c RJ12 0,3 m	2
Optional:		
TC-1/4	Gas flow test chamber with ¼“ tubes and Swagelok®	1

6.4. RECOMMENDED OPERATING CONDITIONS

At ambient temperature T_a = 20 °C (unless otherwise noted).

	MIN	NOM	MAX	UNIT
VPOW	+9	+12V	+15	V

6.5. MECHANICAL

Length	70 mm
Height	23 mm
Width	33 mm

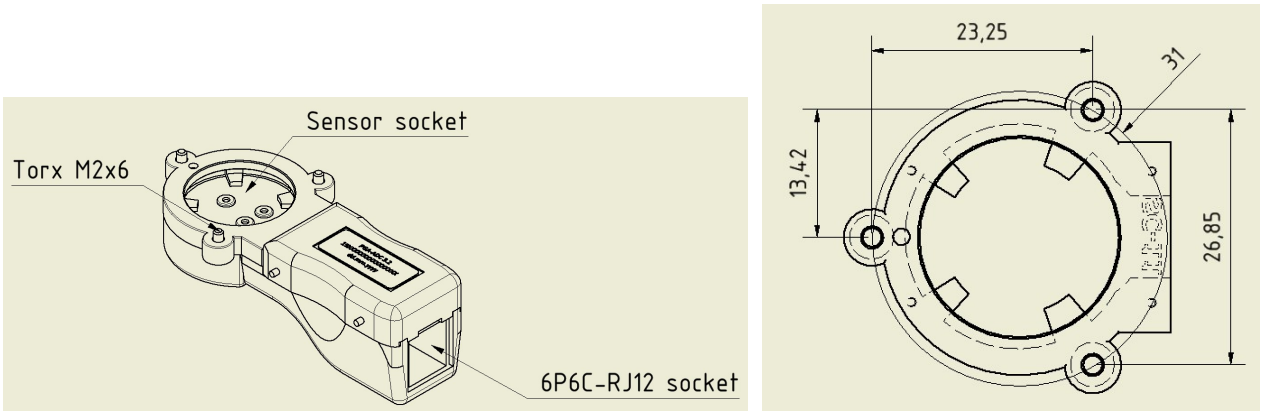
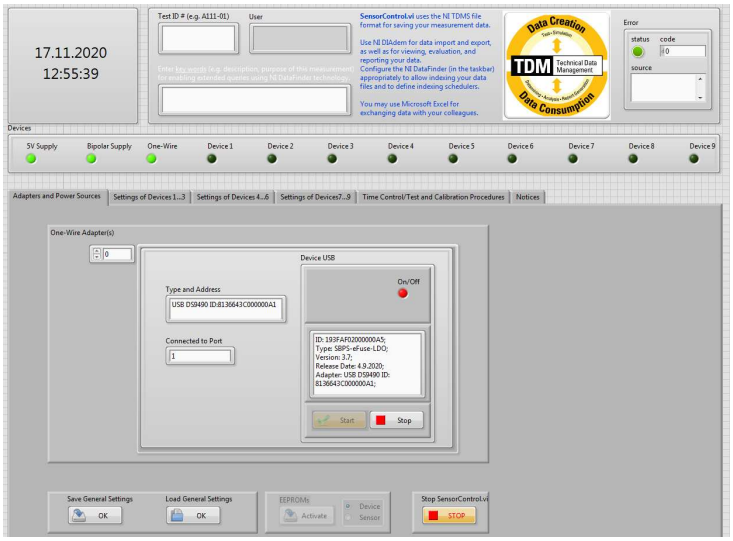
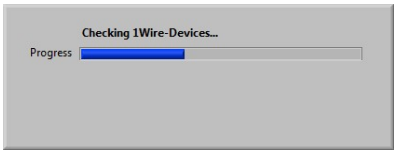
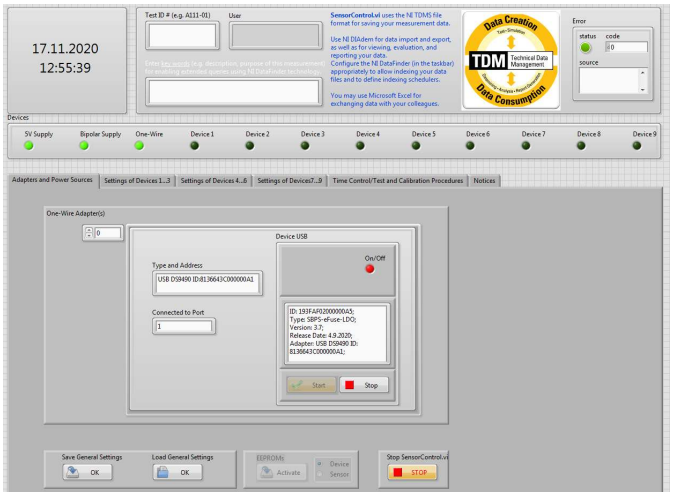
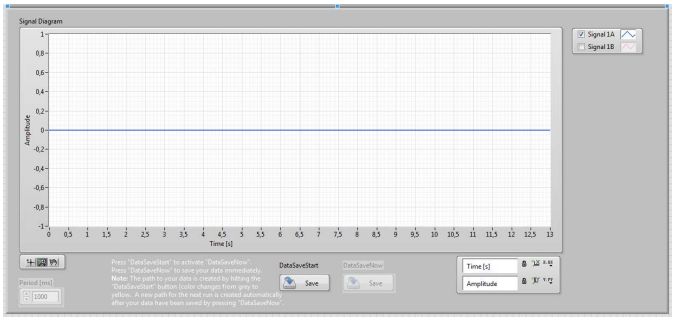
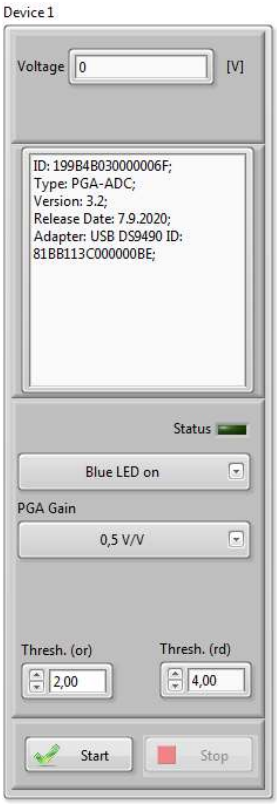


Figure 4: Drawing of PGA-ADC 3.2 (left). Flange with three Torx M2x6 screws (right). All dimensions are in mm.

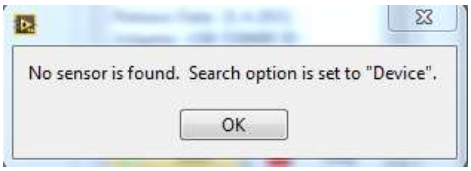
7. OPERATION WITH SENSORCONTROL

#	STEP	FIGURE
Follow "INSTALLATION GUIDE 1-WIRE DRIVER"		
Run SensorControl.vi or SensorControl.exe		
1	Plug 1-Wire USB Adapter to an USB port of the running PC.	
2	Connect RJ12 socket (labeled USB) of the bipolar power source with the 1-wire USB adapter using a 6pc6 cable.	
3	Connect a 12 V plug-in power supply* with the power line and connect it with the bipolar power source. (* recommended for an operation temperature of 80°C at an ambient temperature of 20 °C)	**Attention:** When using SBPS-eFuse-LDO 3.7 or lower versions you must start with steps 1 and 2 before plugging the 12 V power supply. Do not unplug the USB adapter from the computer while the 12 V power supply is still inserted. Later versions of SBPS-eFuse-LDO (> 3.8) and SBPS-LDO (>3.10) have two safety relais to ensure that the 12 V is not passed to the heating element of the sensor before the software has started the controller and controls its actions. However, it is a good practice to perform steps 1 to 5 quickly in the recommended sequence thus enabling the SensorControl software to get ful control over the hardware. Also follow the advice to remove first the 12 V power supply when you have complete the evaluation.
4	Plug the H2-CNI 0V/1V sensor into the controller PGA-ADC and connect one RJ12 socket of the bipolar power source with the sensor controller PrecVS-PGA-ADC using a low-ohmic 6p6c cable	**Note:** Many commercial 6p6c RJ12 cables are used for communication networks. We recommend for the connection between the SBPS-eFuse-LDO and the PGA-ADC a low-ohmic, short cable.

5	Choose “Device” in the EEPROM selection box*  to ensure reading of the controller adjustments from the controller´s internal EEPROM.	
6	Run SensorControl (see User Guide SensorControl.vi for further explanations)	Wait until initialization is completed  and the yellow LED of the SBPS-eFuse-LDO bipolar power source stops blinking. It indicates that the software accesses the I2C bus of the sensor controller and of the sensor. Finally, you get the frontpanel  

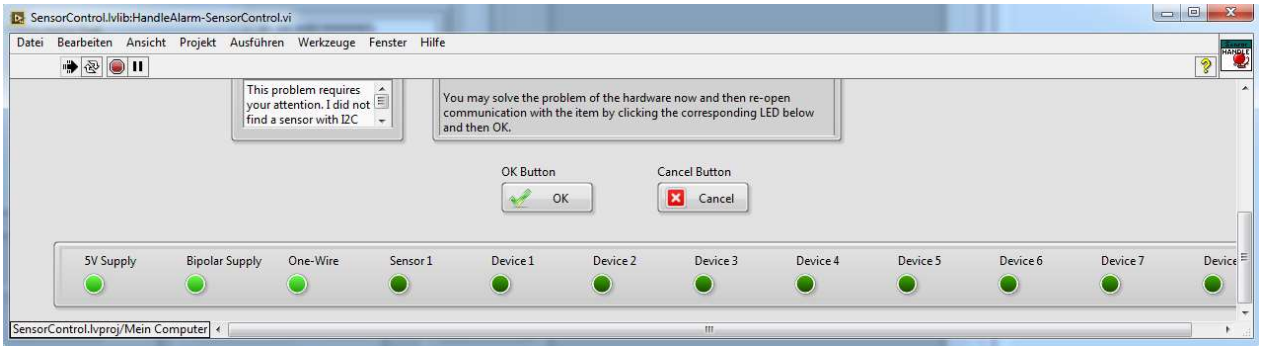
7	Click on the register card “Settings of Sensors 1…3”		**Voltage** shows the signal voltage VSIG of the isothermally operating calorimetric H2-CNI 0V/1V sensor. **Display** shows “Notices to Operators”: ID of device (controller); Type of device; Version of device Release date of device; Adapter to which the device is connected; Type of sensor to which the device is connected; serial number of the sensor, fabrication date and the result of the CRC check of the data integrity. **Status** indicates overdrive condition of the ADC **Ring to switch on and off selected LEDs**. **Ring to select the gain of the programmable gain amplifier** that amplifies the balance voltage. **Threshold** (orange LED) **Threshold** (red LED) **Start** and **Stop** button

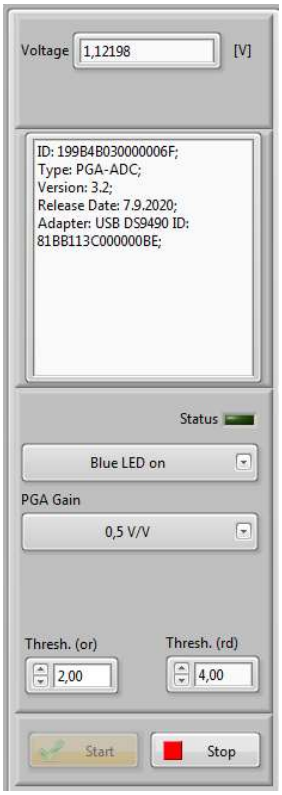
Comment: If you do not have the SensorControl.vi software but using SensorControl.exe you have no LabVIEW tools to select between “Sensor” and “Device” since the selection box is disabled. *Workaround*: start SensorControl and the software automatically is set to “Device”. A notice window appears

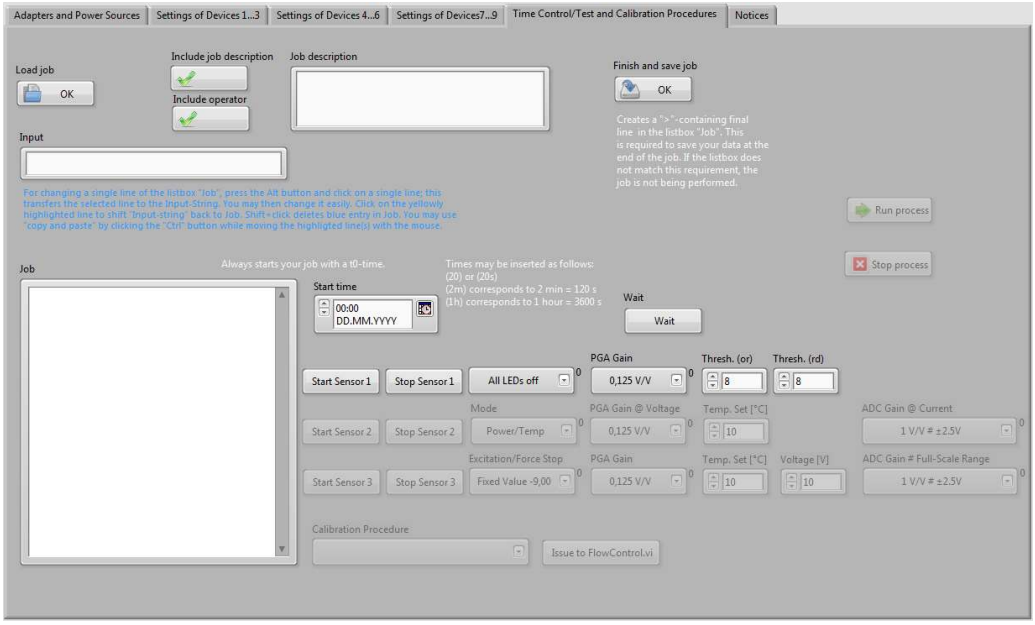


Click “OK”

and subsequently error handling window appears. Click again the “OK Button”. Proceed with step 7.



8	Select “PGA Gain” 0.5 V/V and click “Start”		The signal voltage at pin 2 of the H2-CNI sensor is determined and displayed. The blue LED is switched on automatically if the signal voltage is smaller than the chosen threshold voltages for the orange LED. Note that the threshold voltage for the red LED must be at least 0.1 V larger than the threshold voltage for the orange LED. The input values are corrected correspondingly by the software.

9	Click on register card “Adapters and Power Supplies” and activate EEPROM	EEPROMs Activate	Return to register card“ Settings of Sensors 1…3”. Stop button has disappeared and Start button has changed to Save. Clicking on Save stores all adjustments in the EEPROM of the sensor.
10	Click “Stop”	Stop	Data collection and sensor stop.
Systematic evaluation of sensor properties using register card “Time Control and Calibration Procedures”			
11	Click on register card “Time Control/Test and Calibration Procedures”		This card allows you to define a job which is a list of instructions that are consecutively issued to SensorControl thereby enabling a time-controlled experiment. The job is defined in the window “Job” and written by using the bottoms on the right-hand side of this window. Always use this method to define a job as it is strictly bond to certain format rules. Jobs are started by clicking “Run process” (Do this not now!). A job starts with defining is start value. Times in the past are considered as instruction to start immediately. Then, a sequence of commands follows; they always start with “!”. Clicking on “Wait” produces a line !Wait Start(t). t must be replaced by a waiting time You can insert them as follows: (20) or (20s) (2m) corresponds to 2 min = 120 s (1h) corresponds to 1 hour = 3600 s The wait command is very important as this is the only way to define a time-dependent consecution of other instructions. Instead of writing in the window “Job” you can follow the blue instruction shown below the window “Input”.

Thus one can organize a list of instructions in the window “Job”. You can use the mouse to shift lines in the window; modifying and deleting is also possible.

As an example, try to type the job shown above.

Clicking or selecting certain values in “Mode”, “PGA Gain”, “Supply Voltage” or “Offset” generate corresponding entries in the job.

Clicking on Start Sensor 1 generates a line !Sensor: Start(1) and will be interpreted as to start sensor 1; same holds for clicking on Stop Sensor 1.

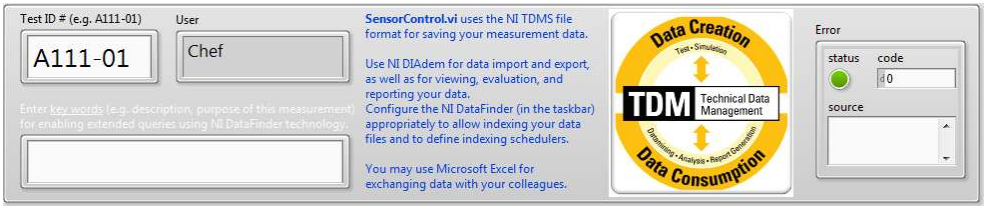
Thus one can organize a list of instructions in the window “Job”. You can use the mouse to shift lines in the window; modifying and deleting is also possible.

A job must be completed with a line that starts with >. This line is created by clicking on “Finish and save job”. It also allows you to save your job on the hard disk in the folder “LabView Data”. The > sign will be interpreted as to save your data and to stop the job.

You may also include a job description and/or the operator name. You can also load previous jobs by clicking on “Load job”.

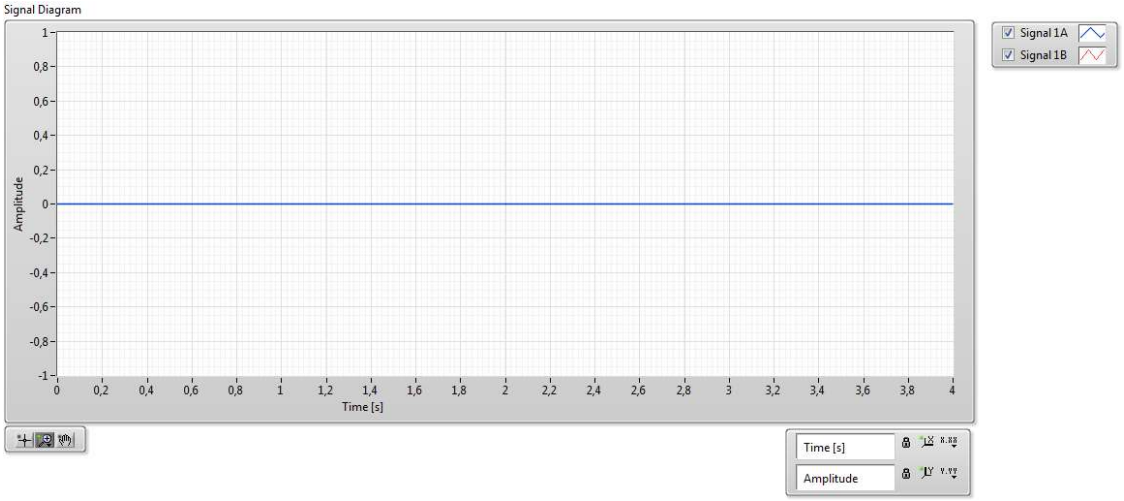
Note: There must be no empty lines in the job; so if empty lines show up delete them or shift the instructions with the mouse. If you type a new entry and you do not see it scroll in the window to the bottom. If you see empty lines, delete them.

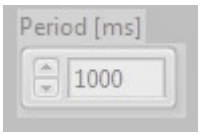
Define a Test ID# in the top box of SensorControl.vi.



(You may also give some key words in the keywords window). The software only accepts Test ID# in the format Xnnn-nn. The “Run process” button is enabled.

The job starts and will be done by clicking on “Run process”. Then the subVI “TimeControl” will take over the control of the software until it is finished by reaching the line >… or by clicking on “Stop process”. You are not limited with the length of your job. They run very safely over long times. Note, however, that data will automatically be stored after 24 h operation. This does not affect running your job.

	Saving data to the hard disk		
12	Click on 		Press "DataSaveStart" to activate "DataSaveNow". Press "DataSaveNow" to save your data immediately. Note: The path to your data is created by hitting the "DataSaveStart" button (color changes from grey to yellow. A new path for the next run is created automatically after your data have been saved by pressing "DataSaveNow". Data are stored in the folder C:/Measurement data/. File names are given as “A111-01_14-05-2020-04-24-03.dat” with the Test ID#, followed by “_”, the date-time and the extension “.dat”. Data are automatically saved 24 h after running SensorControl. Evaluate data with DIADEM (National Instruments). Export to EXCEL is possible.
	Working with the signal diagram		
13	 Signals can be removed from or included in the diagram by setting  . You may also change colors etc. Signals are always recorded independently of whether they are displayed in the diagram. Click on the diagram to have access to further adjustments, e.g. automatic scaling for y and x. Click on  to have more options with respect to handling the signals in the diagram.		

14	All data are displayed as a function of time in the signal diagram at a rate of 1000 ms^{-1}. You may increase the period before you start SensorControl.vi  but only larger times are allowed.

8. ORDERING INFORMATION

PGA-ADC 3.2

9. PACKAGING/SHIPPING INFORMATION

This item is shipped individually in an antistatic bag.

10.NOTES

11.WORLDWIDE SALES AND CUSTOMER SUPPORT

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