



Calibration instructions for the PolyXeta[®] 2 flammable gas sensors

Tutorial Draft Rev. 1

June 2020

| | | |
|-----------|---|-----------|
| 1. | Materials needed for calibration..... | 3 |
| 2. | Calibration sequence | 5 |
| 3. | Calibration using the LCD keypad STL06-PGX2 | 7 |
| 3.1 | Calibration..... | 7 |
| 3.1.1 | Zero calibration | 8 |
| 3.1.2 | Gain calibration | 9 |
| 4. | Calibration using the software tool PCE06-PGX2 | 12 |
| 4.1 | Calibration..... | 13 |
| 4.1.1 | Zero calibration | 14 |
| 4.1.2 | Gain Calibration | 16 |
| 5. | Notes and General Information | 21 |
| 5.1 | Intended product Application | 21 |
| 5.2 | Installers' Responsibilities | 21 |
| 5.3 | Maintenance | 21 |
| 5.4 | Limited Warranty | 21 |

Sensors for detecting flammable gases that use the catalytic sensor must be recalibrated regularly with sample gas. For this sensor technology, recalibration is recommended every six months. This interval is set in the memory of the microprocessor located in the sensor head, together with the calibration data, i.e. the zero and the gain, parameters that will be updated at each calibration operation.

The most used calibration gas is methane. However, the target gas is often used, as for example in the case of Propane.

1. Materials needed for calibration

The materials needed for calibration, as follows:

- Cal01_PX2 - adapter for supplying gas to the sensor head, equipped with a tube for connecting it to the gas cylinder



- LCD Keypad STL06-PGX2 – for sensors' calibration / configuration.



- Software Kit PCE06-PGX2 for sensors' calibration / configuration via PC.



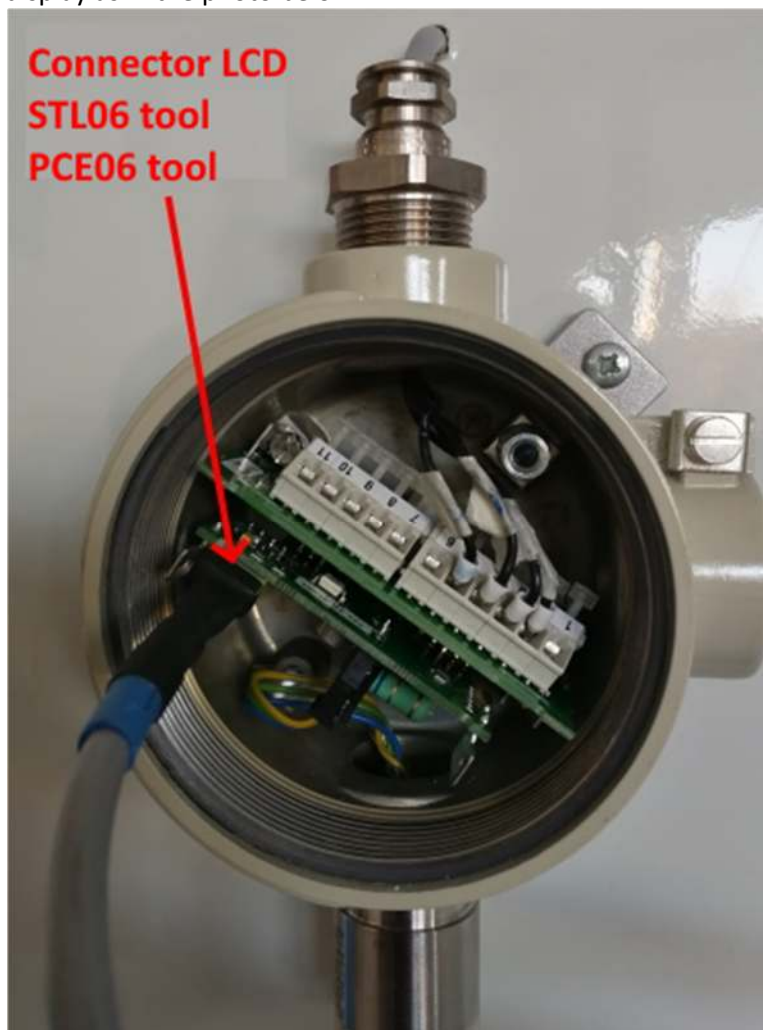
- Calibration gas cylinder with predetermined concentration, provided with gas flow regulator ensuring an adjustable or a fixed gas flow.



2. Calibration sequence

If the sensor is not equipped with an LCD display, calibration can be done with the help of the keypad or by connecting it to the PC through the SW kit, PCE06-PGX2.

1. Open the sensor cover and connect the keypad or the SW kit cable to the connector provided for the LCD display as in the photo below.



2. Make sure there is no gas present and power the sensor.
3. Carry out zero calibration according to the sequence described below, for the keypad (chapter 3.1.1) or for the SW kit (chapter 4.1.1), respectively.
4. Proceed with the gas calibration:
 - Screw the calibration adapter onto the sensor head until it stops;
 - Screw on the flow meter of the gas cylinder and connect the transparent tube between the cylinder and the adapter

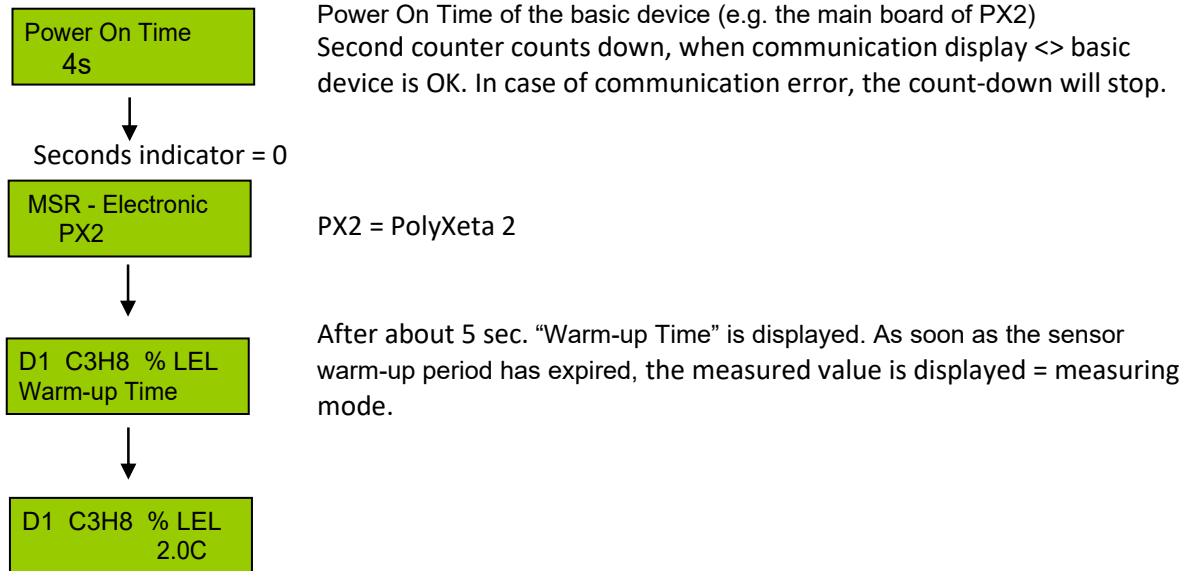


5. Enter the calibration mode in the dialog window, according to the sequence described below, for the keypad (chapter 3.1.2) or for the SW kit (chapter 4.1.2), respectively.
6. During gas supply, the flow must be regulated around 0.5l / min. - check through the position of the dot if provided with the flowmeter. Otherwise, make sure to use a flowmeter with a fixed flow of 0.5l / min.



3. Calibration using the LCD keypad STL06-PGX2


Having connected the LCD keypad, when powerin-on the sensor, the below indicated sequence will follow:

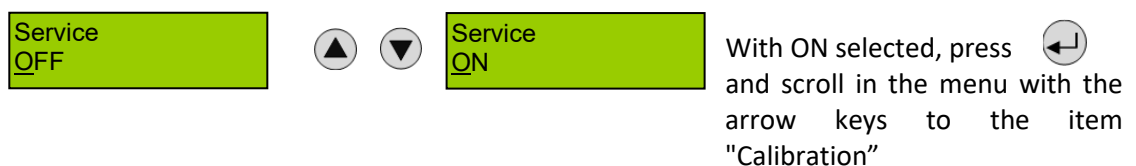


Press the key  and scroll with the keys   in the main menu, down to the item "Installation & Calibration"



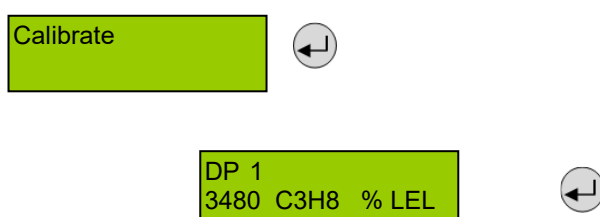
The following area is accessible only if the service mode is set to "ON".

Press the key  and enter the level 1 password (the unique password). Once the password is accepted, the "O" in the word OFF will be underlined and you can switch to ON using the arrow keys



3.1 Calibration

The description of the calibration function can be found on the following pages.



Zero PD 1



Zero calibration (see 3.1.1 for details)



Test gas
XX% LEL



Setting the concentration of the gas used for the calibration (see 3.1.2 for details)



Gain DP 1



Gain calibration



Burn clean



Menu item only available with SC and SX for combustible gases (not detailed in the actual tutorial)

3.1.1 Zero calibration

Zero DP 1



Zero DP 1
0,5% LEL

Step 1: Display of the current value

Apply test gas according to instructions.



Start calibration process.

Zero DP 1
_0,5% LEL

Step 2: Calculation of the new zero Offset
During the calculation, an underscore in line 2 runs
From left to right and the current value drops to zero.

When the current value is stable, press  for terminating the calculation of the new value.

Zero DP 1
SALVA

Step 3: Save the newly calculated zero offset
„SAVE“ is displayed, as long as the function is executed.



Zero DP 1
0,0% LEL □

After the value has been successfully stored, a square appears on the right for a short time = Zero point calibration is finished and new zero offset has been stored with success.





Zero DP 1
0,0% LEL

The display automatically goes to step 1: Display of new zero point

During the calculation phase, the following messages may occur:

| Message | Description |
|------------------------|--|
| Current value too high | Wrong gas for zero point calibration (>10 %) |
| Current value unstable | Is displayed as long as the deviation between two measuring cycles (100mS) is > 3 %. It automatically extinguishes when the sensor signal becomes stable. |
| Time too short | The message "value unstable" starts an internal timer (20 s). Once the timer has run out and the current value is still unstable, the text is displayed. The process starts over again. If the value is stable, the current value is displayed and the calibration procedure is continued. If the cycle is repeated several times, an internal error is present. Stop the calibration process by exiting the calibration menu and replace the sensor head. |

When aborting the zero-offset calibration, the offset value will not be updated. The sensor head continues to use the "old" zero offset.

3.1.2 Gain calibration

After having done the zero calibration, proceed with the gain calibration. Having screwed the test gas adapter to the sensor head, proceed by allowing the gas flowing, the allowable pressure and flow rate as mentioned in chapter 2. The same admissible data to use can be found also in the sensor user manual.

Test gas
XX.X% LEL

Enter concentration of the test gas used.

If using the target gas, in this case the Propane, the value to enter here is the one mentioned on the Propane bottle.

In case methane is being used, see the following note.

NOTE: Cross calibration for combustible gases:

For each combustible gas, a sensitivity factor related to methane is mentioned in the user manual (*) - see note at page 11. The concentration of the methane test gas is multiplied by this factor (factor ZP). The product thereof is entered as test gas value. This value isn't cleared when exiting the menu, therefore before restarting calibration, always check if the value is correct (the value that is found on display is the factor used for the previous gas calibration!).

Proceed with the submenu "Gain"



Gain DP 1



Gain DP 1
48,0%LEL 89,0%

Step 1: Display of the current value and of the sensitivity from the last calibration (example: 89%)

Apply test gas according to instructions.



Start calibration process.

Gain DP 1
50,1% LEL 82%


Step 2: Calculation of the new gain
During calculation an underscore in line 2 runs from left to right and the current value adapts to the set test gas concentration. The sensitivity is recalculated, too. (in the image at 82%). The sensitivity can vary until the saving moment (see Step 3 following)

When the current value is stable, press  for terminating the calculation of the new value.

Gain DP 1
SALVA

Step 3: Save the newly calculated gain ,SAVE' is displayed as long as the function is executed.



Gain DP 1
50,1% LEL 89% 

After the value has been successfully stored, a square appears on the right. = Gain calibration is finished and new gain offset has been stored with success.



Gain PD 1
50,1% LEL 89%

The display automatically goes to step 1: Display

During the calculation phase, the following messages may occur:

| Message | Description |
|------------------------|--|
| Current value too high | Test gas concentration > than set value Internal error → Replace sensor head. |
| Current value too low | No test gas or wrong test gas applied to the sensor |
| Test gas too high | The set test gas concentration must be between 30% and 90% of the measuring range. e.g. <30% too low / >90% too high |
| Test gas too low | |
| Current value unstable | Appears when the sensor signal does not reach the zero point within the target time. Disappears automatically when the sensor signal is stable. |
| Time too short | The message "Time too short" starts an internal timer. Once the timer has run out and the current value is still unstable, the text is displayed. The process starts over again. If the value is stable, the current value is displayed and the calibration procedure is continued. If the cycle is repeated several times, an internal error is present. Stop the calibration process and replace the sensor head . |
| "Sensitivity <" | Sensitivity of the sensor head < 30 %, calibration no longer possible → Replace sensor head. . |
| Internal error | Internal , unrecoverable error → Replace sensor head . |

(*) NOTE:

For ZP Factor see the PX2 user manual table 11.2 as highlighted below

| Sensor head | CAS No. | Target gas | | Test gas | | Factor ZP ¹ | Relative sensit. ² | LEL/ %v/v ⁶ | Admissible range for calibration | | | |
|-------------|-----------|-------------|---------------------------------|----------|----------|------------------------|-------------------------------|------------------------|----------------------------------|---|-----------------|-----------------------|
| | | Meas. range | Gas type | Range | | | | | Value indication | | 4- 20 mA signal | |
| SX1- | | % LEL | | | % LEL | | | Methane | Zero | Gain | Zero | Gain |
| | | | | | | | | | % LEL | Test gas | (mA) | |
| P3400-A | 74-82-8 | 0-100 | Methane ¹ | Methane | 30-90 | 1,00 | 1,00 | 4,40 | - 2 to +3 | 5 % of measuring range or ± 10 % of reading | 3,7 to 4,4 mA | ± 0,5 mA of set value |
| P3435-A | 110-54-3 | | n- Hexane ¹ | | 15-34 | 2,63 | 0,38 | 1,00 | | | | |
| P3440-A | 1333-74-0 | | Hydrogen ¹ | | 32-90 | 0,92 | 1,09 | 4,00 | | | | |
| P3408-A | 7664-41-7 | | Ammonia ¹ | | 35-90 | 0,88 | 1,14 | 15,0 | | | | |
| P3482-A | 67-63-0 | | Iso/Propyl alcohol ¹ | | 15-32 | 2,22 | 0,45 | 2,00 | | | | |
| P3480-A | 74-98-6 | | Propane ¹ | Propane | 30-90 | 1,82 | 0,55 | 1,70 | | | | |
| P3402-A | | | LPG | | 20-40 | 1,82 | 0,55 | 1,20 | | | | |
| P3473-A | 79-20-9 | | Methyl Acetate | Methane | 16-45 | 1,96 | 0,51 | 3,10 | | | | |
| P3410-A | 74-85-1 | | Ethylene | | 20-56 | 1,54 | 0,65 | 2,30 | | | | |
| P3460-A | 106-97-8 | | Iso/n-Butane | | 20-50 | 1,75 | 0,57 | 1,40 | | | | |
| P3475-A | 109-66-0 | | Iso/n-Pentane | | 15-35 | 2,50 | 0,40 | 1,10 | | | | |
| P3427-A | 141-78-6 | | Ethyl Acetate | | 15-34 | 2,63 | 0,38 | 2,00 | | | | |
| P3415-A | 110-82-7 | | Cyclohexane | | 15-42 | 2,08 | 0,48 | 1,00 | | | | |
| P3472-A | 287-92-3 | | Cyclopentane | | 20-55 | 1,59 | 0,63 | 1,40 | | | | |
| P3420-A | 74-84-0 | | Ethane | | 20-58 | 1,52 | 0,66 | 2,40 | | | | |
| P3430-A | 71-43-2 | | Benzol | | 12-30 | 2,85 | 0,35 | 1,20 | | | | |
| P3448-A | 105-46-4 | | Butyl Acetate | | 10-20 | 4,35 | 0,23 | 1,30 | | | | |
| P3468-A | 78-83-1 | | Iso-Butyl Alcohol | | 12-32 | 2,70 | 0,37 | 1,40 | | | | |
| P3470-A | 111-65-9 | | Octane | | 15-35 | 2,50 | 0,40 | 0,80 | | | | |
| P3494-A | 106-98-9 | | Butadiene | | 15-42 | 2,08 | 0,48 | 1,40 | | | | |
| P3495-A | 111-84-2 | | Nonane | | 10-27 | 3,33 | 0,30 | 0,70 | | | | |
| P3490-A | 108-88-3 | | Toluene | | 10-25 | 3,57 | 0,28 | 1,00 | | | | |
| P3485-A | 67-64-1 | | Acetone | | 15-35 | 2,50 | 0,40 | 2,50 | | | | |
| P3425-A | 64-17-5 | | Ethanol | | 15-32 | 2,22 | 0,45 | 3,10 | | | | |
| P3450-A | 67-56-1 | | Methanol | | 22-65 | 1,35 | 0,74 | 6,00 | | | | |
| P3458-A | 78-93-3 | | MEK | | 15-35 | 2,50 | 0,40 | 1,50 | | | | |
| P3491-A | 142-82-5 | | n-Heptane | | 15-36 | 2,32 | 0,43 | 0,85 | | | | |
| P3496-A | 8006-61-9 | | Petrol Vapours | | 22-60 | 1,47 | 0,68 | 1,40 | | | | |
| P3480-B | 74-98-6 | 0-30 | Propane | Propane | 10-27 | 1,82 | 0,55 | 1,70 | | | | |
| P3480-C | 74-98-6 | 0-5000ppm | Propane (ppm) | | 150-4500 | 1,82 | 0,55 | 1,70 | | | | |

Table 11.2: Sensor specifications of combustible gases

¹ Certified according to EN 600079-29-1 by DEKRA Testing and Certification GmbH.

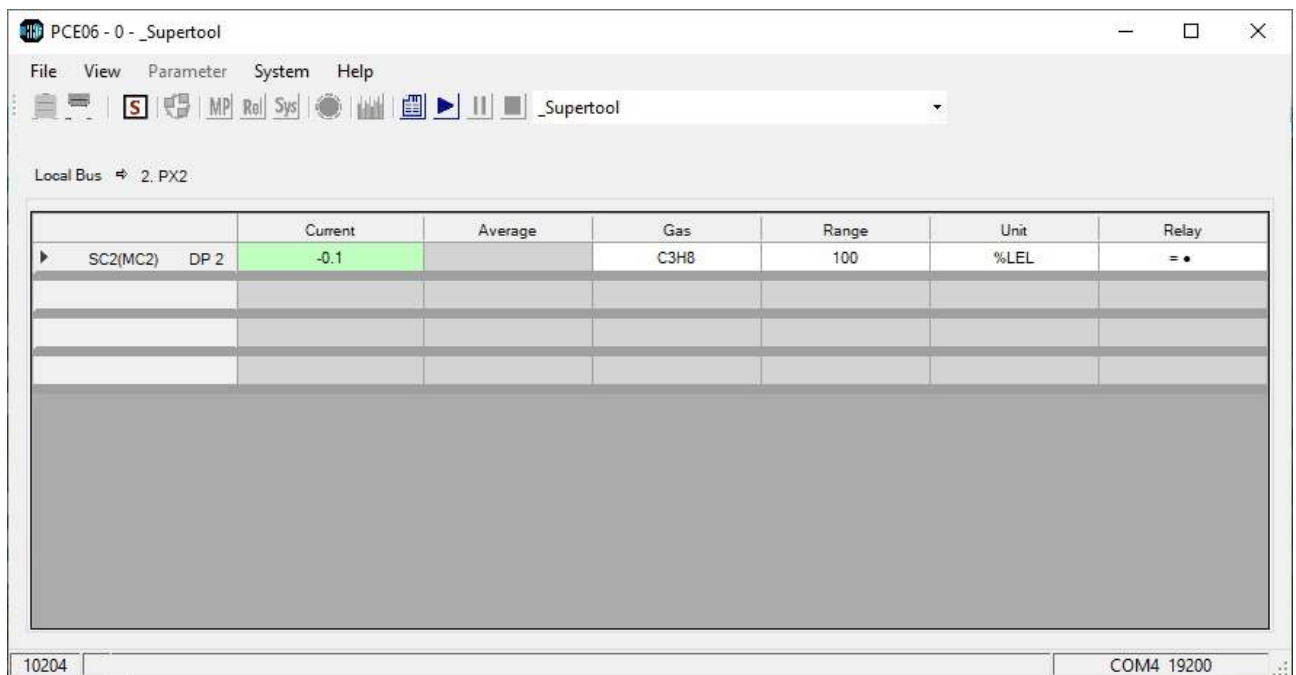
² The cross-sensitivity may vary depending on the sensor types in a range of ± 8 %. The indicated values are only valid for new sensors.

4. Calibration using the software tool PCE06-PGX2

Having connected the software tool between the PC and the sensor, press Connect under the System menu and choose the port indicated by the PC, having previously powered the sensor.

If the sensor has just been connected to 24V, for a few minutes we will have the message "Warm-up" on the yellow background, while the sensor is in the Special state and it is not possible to access the various configuration menus.

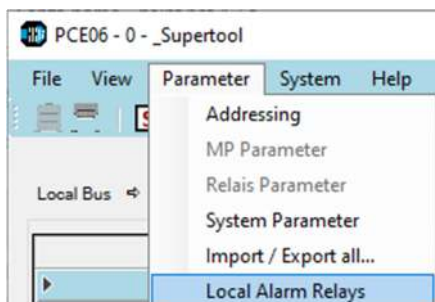
After the warm-up time, the sensor will show the current measured value, as below:



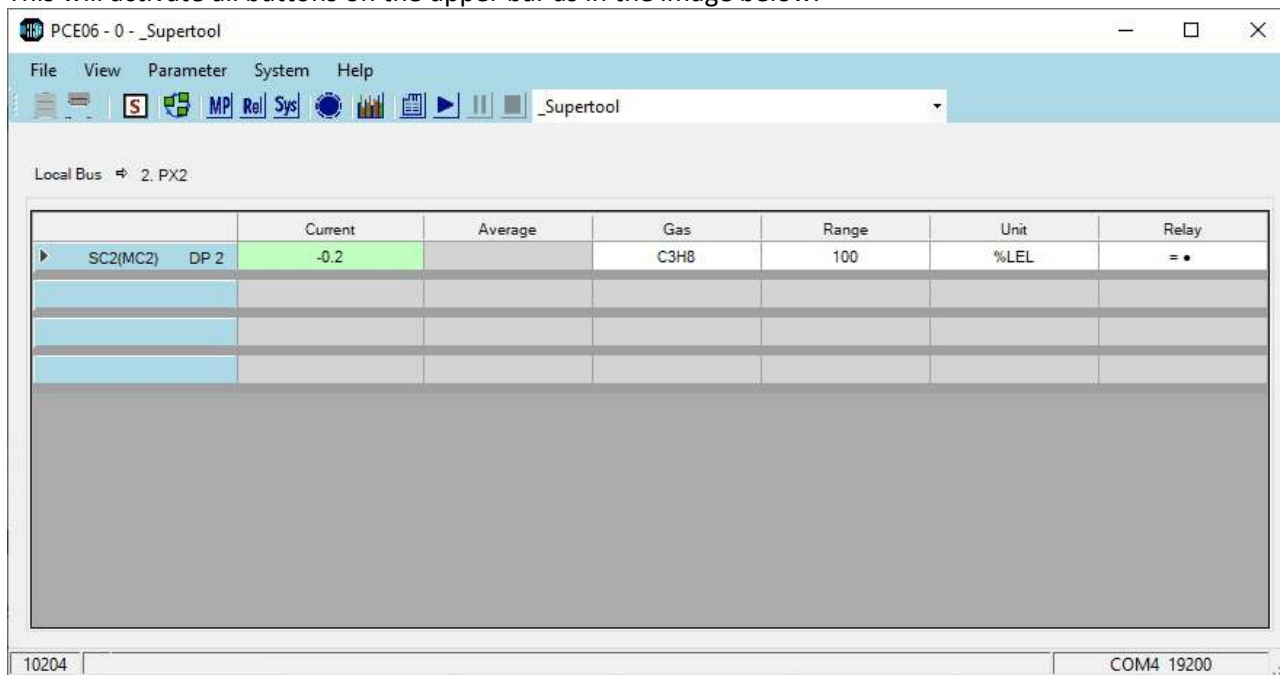
At this moment the sensor is in the normal operating state. To proceed with the calibration, one must enter the "special" state, by pressing the button **S**, or by clicking "Special mode" in the System menu.



Next, go into "Parameter" menu and click on "Local Alarm Relays".



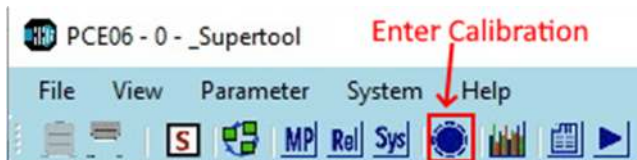
This will activate all buttons on the upper bar as in the image below.



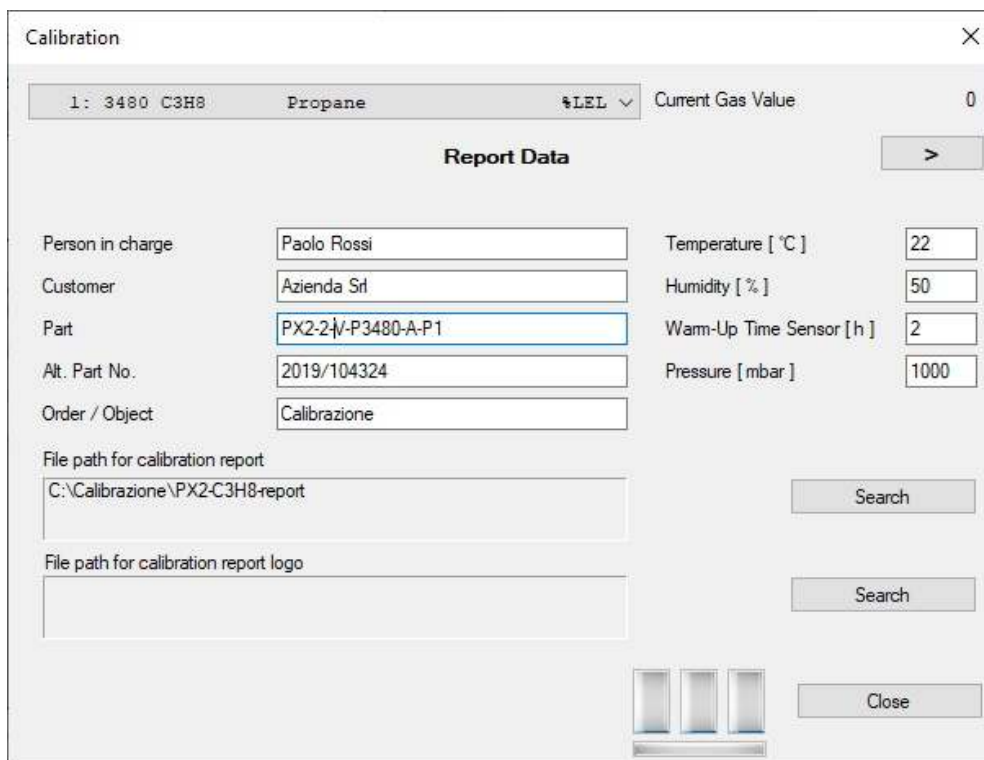
4.1 Calibration

The sequence to be followed for the calibration is presented in the following.

To enter the calibration menu, press the indicated button or click on the "Calibration" option in the "System" drop-down menu.



In the following dialog window, one has to fill in all the fields and choose the folder where the calibration report will be saved (see "File path for calibration report").



Calibration

1: 3480 C3H8 Propane %LEL Current Gas Value 0

Report Data >

Person in charge: Paolo Rossi Temperature [°C]: 22

Customer: Azienda Srl Humidity [%]: 50

Part: PX2-2-P3480-A-P1 Warm-Up Time Sensor [h]: 2


Alt. Part No.: 2019/104324 Pressure [mbar]: 1000

Order / Object: Calibrazione

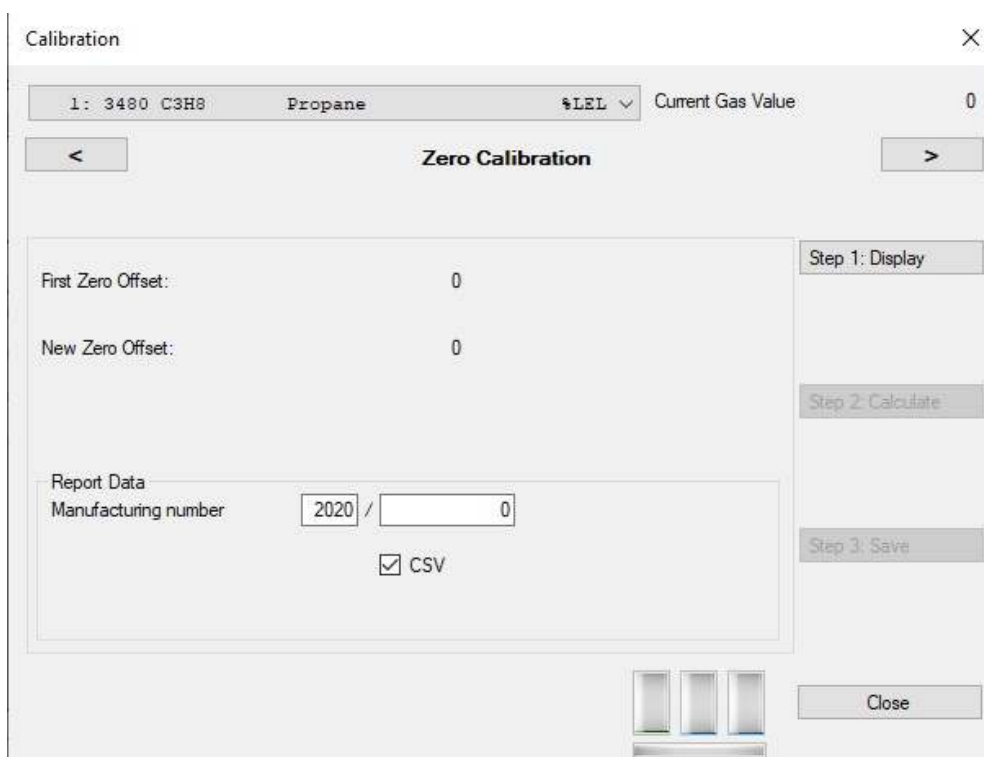
File path for calibration report: C:\Calibrazione\PX2-C3H8-report Search

File path for calibration report logo: Search

Close

Once the data has been filled in, press the arrow button , to the right of the "Report Data" label and the zero calibration dialog box opens.

4.1.1 Zero calibration



Calibration

1: 3480 C3H8 Propane %LEL Current Gas Value 0

< **Zero Calibration** >

First Zero Offset: 0

New Zero Offset: 0

Report Data

Manufacturing number: 2020 / 0

☒ CSV

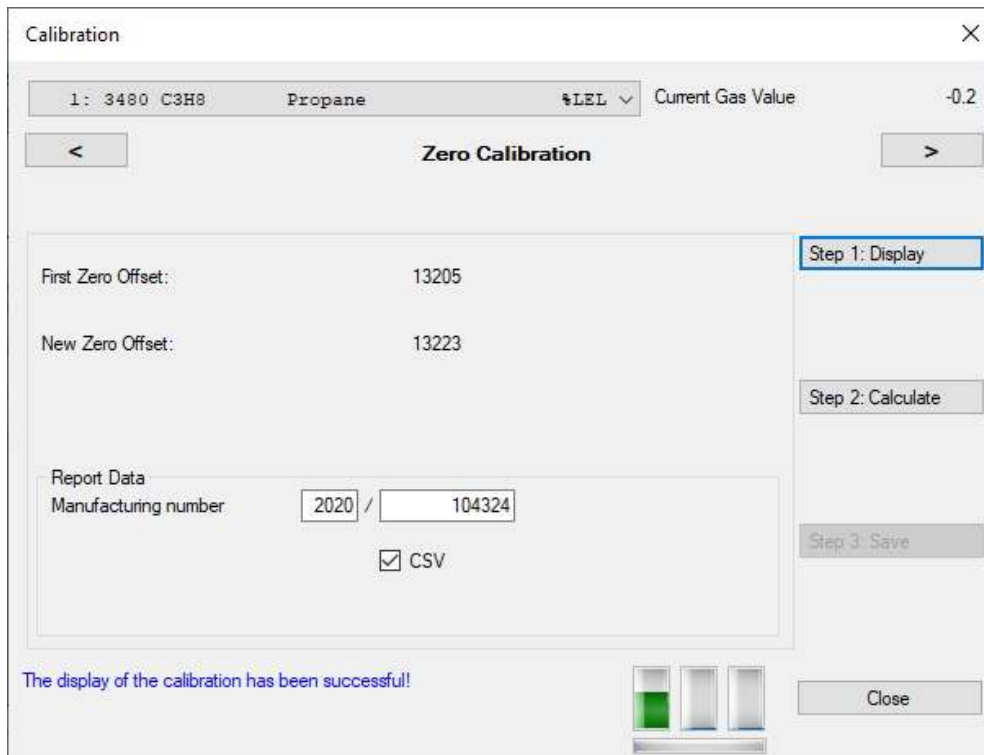
Step 1: Display

Step 2: Calculate

Step 3: Save

Close

After having filled in, in the "Manufacturing number" box, the serial number located on the edge of the sensor head, press the button **Step 1: Display**. The screen changes, showing the first zero offset and the new estimated offset.



Calibration

1: 3480 C3H8 Propane %LEL Current Gas Value -0.2

< Zero Calibration >

First Zero Offset: 13205

New Zero Offset: 13223

Report Data

Manufacturing number 2020 / 104324

☒ CSV

Step 1: Display

Step 2: Calculate

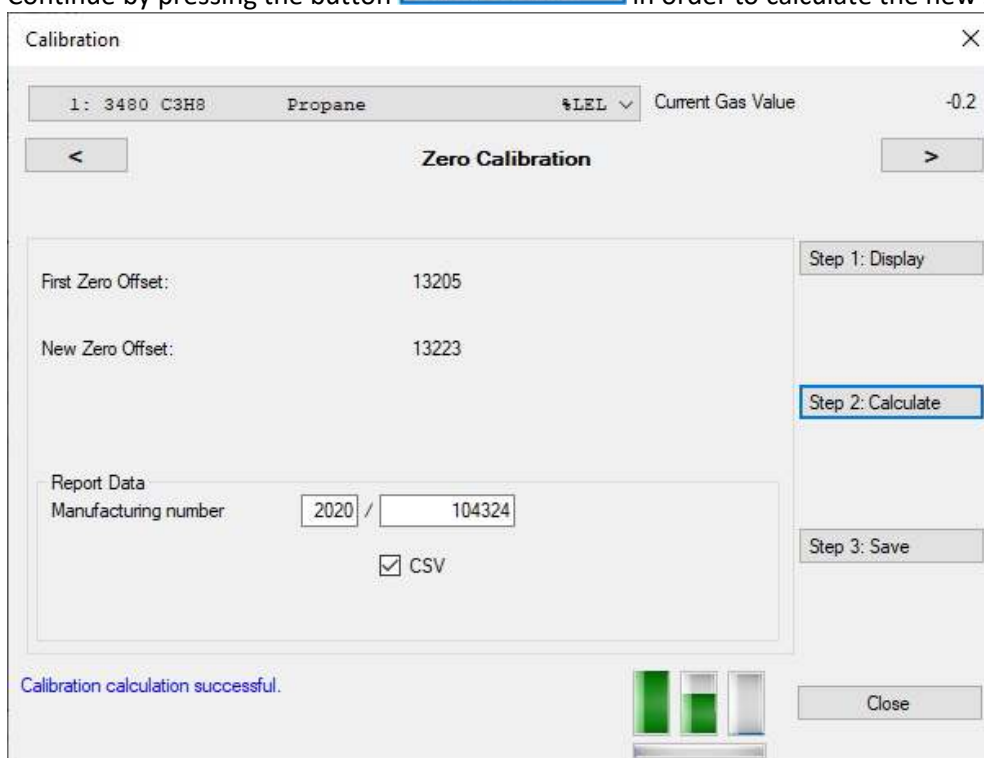
Step 3: Save

The display of the calibration has been successful!

Close

If the operation is successful, the following message is shown in blue on the screen: "The display of the calibration has been successful".

Continue by pressing the button **Step 2: Calculate** in order to calculate the new zero value.



Calibration

1: 3480 C3H8 Propane %LEL Current Gas Value -0.2

< Zero Calibration >

First Zero Offset: 13205

New Zero Offset: 13223

Report Data

Manufacturing number 2020 / 104324

☒ CSV

Step 1: Display

Step 2: Calculate


Step 3: Save

Calibration calculation successful.

Close

If the operation is successful, the following message is shown in blue on the screen "Calibration calculation successful". At this point, continue by saving of the operation by pressing the button

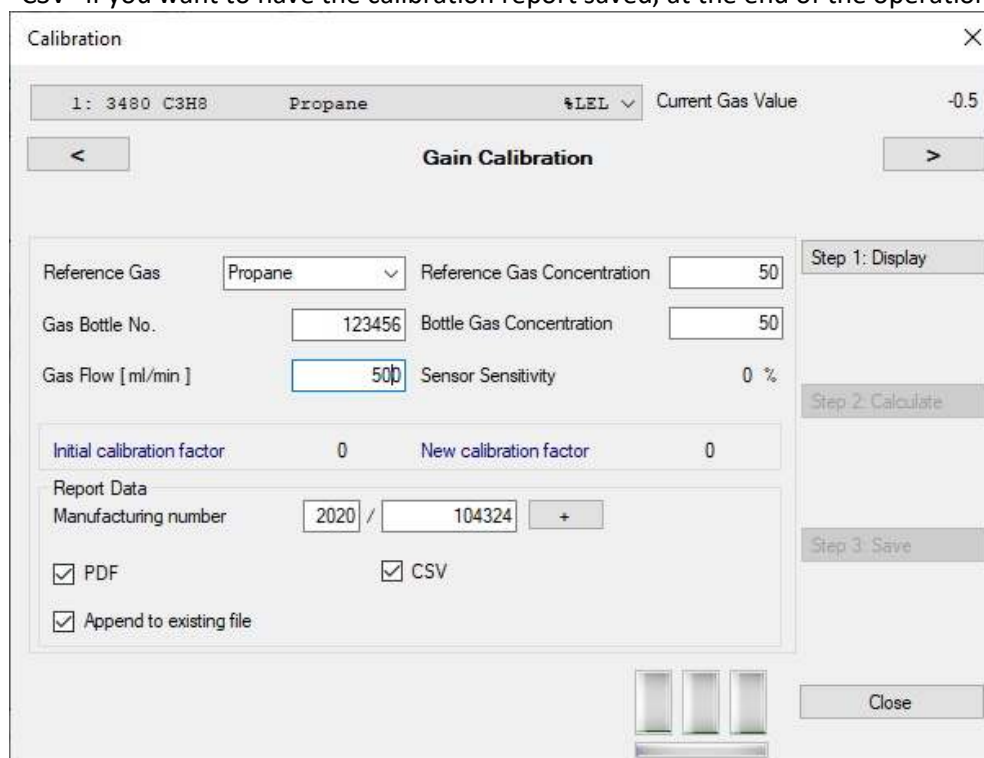
Step 3: Save

After the Save operation, pressing the arrow button , to the right of the "Zero Calibration" label, the dialog box window for gain calibration opens.

4.1.2 Gain Calibration

In the dialog box that opens, the data related to the calibration gas used must be completed. One may choose to use the target gas, or the methane, in which case the relative sensitivity factor is taken into account, which must be entered under "Reference gas concentration" (see factor ZP as previously explained at chapter 3.1.2).

In the case described below, Propane will be used to calibrate a Propane sensor. Check "PDF" and / or "CSV" if you want to have the calibration report saved, at the end of the operation.



The screenshot shows the "Calibration" dialog box with the "Gain Calibration" tab selected. The top section displays "1: 3480 C3H8 Propane %LEL Current Gas Value -0.5". Below this, the "Gain Calibration" section contains several input fields: "Reference Gas" (Propane), "Reference Gas Concentration" (50), "Gas Bottle No." (123456), "Bottle Gas Concentration" (50), "Gas Flow [ml/min]" (50), and "Sensor Sensitivity" (0 %). There are also fields for "Initial calibration factor" (0) and "New calibration factor" (0). The "Report Data" section includes "Manufacturing number" (2020 / 104324) and checkboxes for "PDF", "CSV", and "Append to existing file". On the right side, there are three buttons: "Step 1: Display", "Step 2: Calculate", and "Step 3: Save". At the bottom right, there is a "Close" button.

Make sure that the adapter is screwed onto the sensor head and the gas cylinder connected with the appropriate tube, then open the tap of the flow meter by delivering gas to the sensor. Press the button

Step 1: Display

and wait for the current value to get stable - see the rectangle highlighted in red in the following image:

Calibration

1: 3480 C3H8 Propane %LEL Current Gas Value 46.0

< Gain Calibration >

Reference Gas Propane Reference Gas Concentration 50

Gas Bottle No. 123456 Bottle Gas Concentration 50

Gas Flow [ml/min] 500 Sensor Sensitivity 107 %

Initial calibration factor 1345 New calibration factor 0

Report Data

Manufacturing number 2020 / 104324 +

☒ PDF ☒ CSV

☒ Append to existing file

Step 1: Display

Step 2: Calculate

Step 3: Save

The display of the calibration has been successful!

Close

When the value begins to stabilize, press the button **Step 2: Calculate** and wait for feedback. If the reading concentration continues to change, the message will be "Sensor stabilization time running .." notifying that the calculation is still in progress:

Calibration

1: 3480 C3H8 Propane %LEL Current Gas Value 50.5

< Gain Calibration >

Reference Gas Propane Reference Gas Concentration 50

Gas Bottle No. 123456 Bottle Gas Concentration 50

Gas Flow [ml/min] 500 Sensor Sensitivity 0 %

Initial calibration factor 1345 New calibration factor 0

Report Data

Manufacturing number 2020 / 104324 +

☒ PDF ☒ CSV

☒ Append to existing file

Step 1: Display

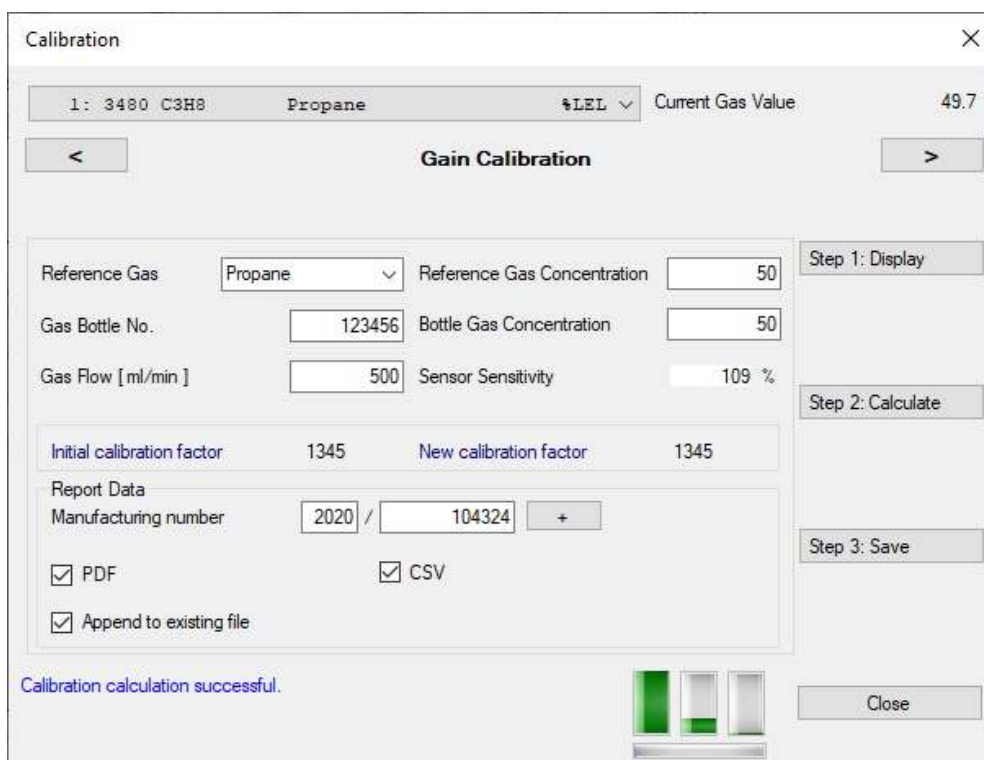
Step 2: Calculate

Step 3: Save

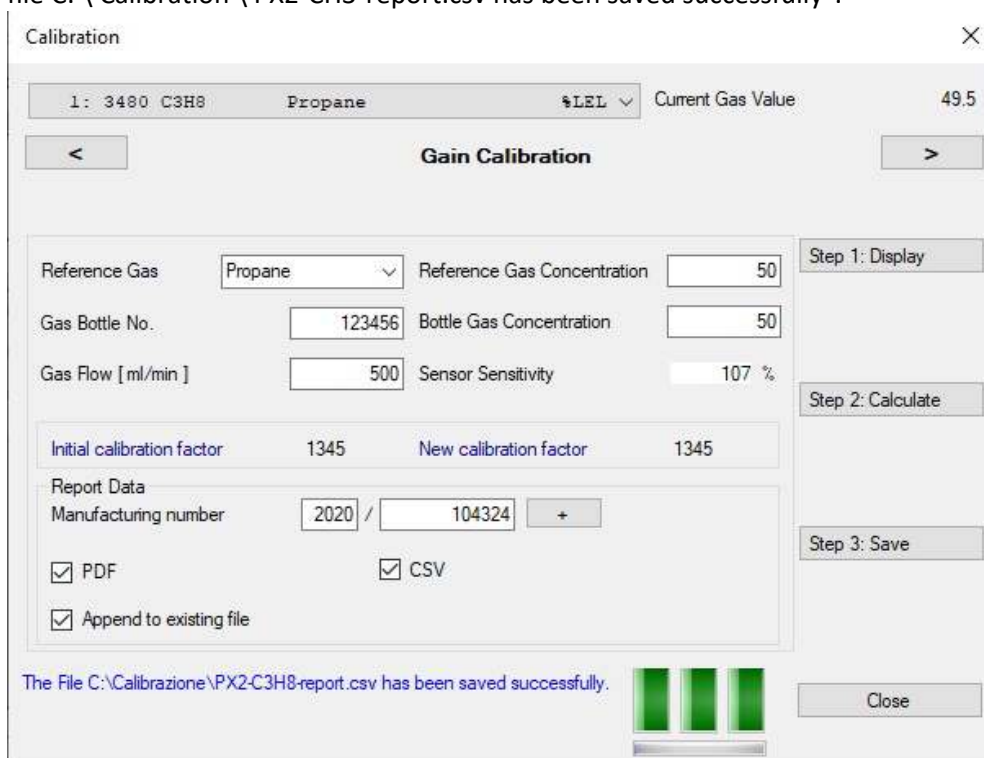
Sensor stabilisation time running...

Close

After the sensor reading value has become stable, the message becomes "Calibration calculation successful", as in the following screen:

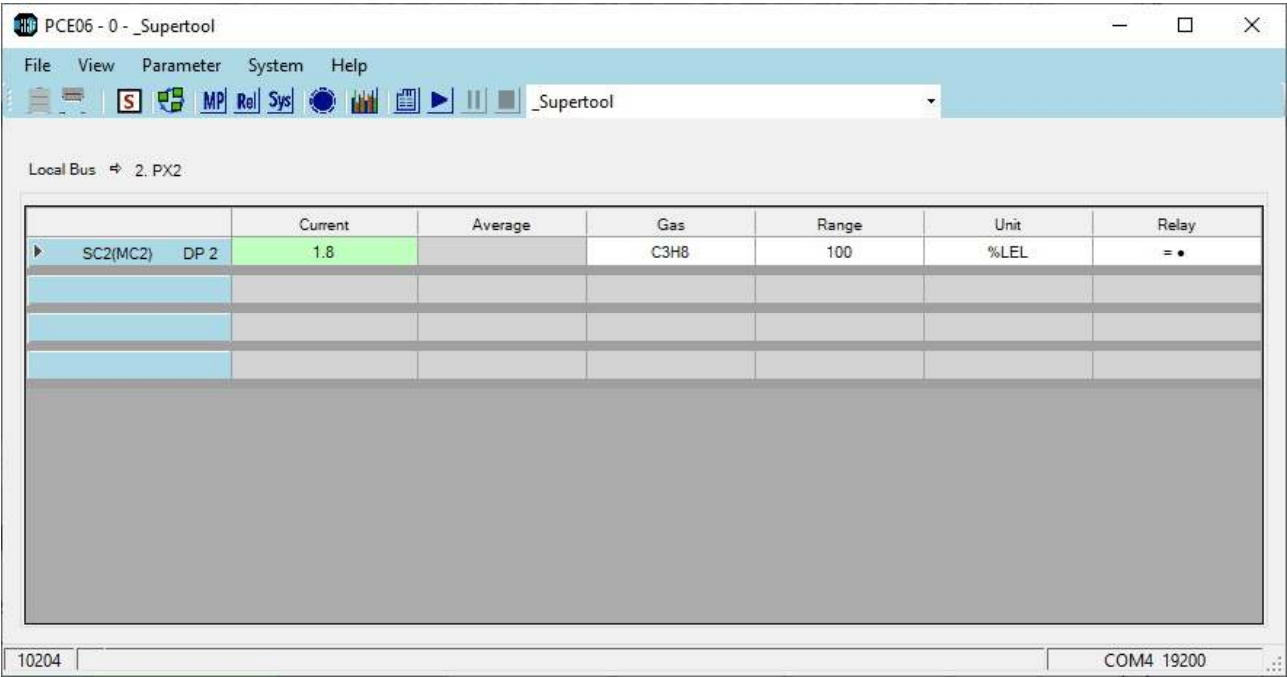


Continue with data saving by pressing the button **Step 3: Save** and after the data has been saved, the message indicating the folder with the saved file is displayed. See in the example, the message: "The file C: \ Calibration \ PX2-CH3-report.csv has been saved successfully".

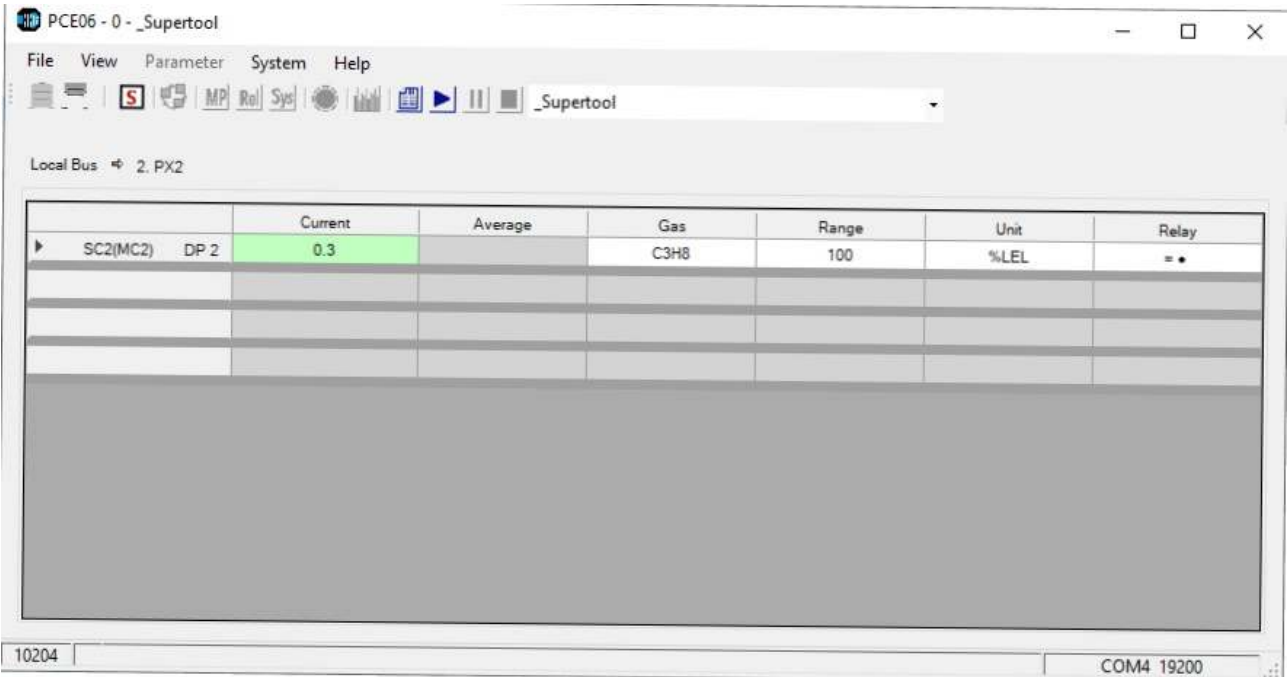


Exit the dialog box by pressing the button **Close**

Close the gas tap and unscrew the adapter from the sensor head waiting for the reading value to return to zero:



Exit the Special mode by pressing the **S** button or un-checking “Special mode” under “System” menu.



The calibration report will be found in the previously chosen folder:



CALIBRATION PROTOCOL

Part No.: PX2-2-V-P3480-A-P1
Date: 14/02/2020 **Employee:** Paolo Rossi
Manufacturing number: 2020/104324

Reference dates

| | | | |
|--|------------|-------------------------------------|-----------|
| Calibration gas: | C3H8 | Alternate Calibration Gas: | C3H8 |
| Gas concentration: | 50.0 %LEL | Alternate Gas Concentration: | 50.0 %LEL |
| Gas bottle: | 123456 | | |
| Measuring range: | 100 %LEL | | |
| Temperature: | 22 °C | Humidity: | 50 %rH |
| Pressure: | 1000 mbar | | |
| Gas flow: | 500 ml/min | | |
| Warm-Up Time Sensor: | 2 h | | |
| Given calibration value: | 50.0 %LEL | Actual calibration value: | 49.4 %LEL |
| Difference target / actual value: | 90.12 % | | |

This report was created automatically and is also valid without a signature.

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5. Notes and General Information

It is important to read this user manual thoroughly and clearly in order to understand the information and instructions. The PolyXeta®2 devices must be used within product specification capabilities. The appropriate operating and maintenance instructions and recommendations must be followed.

Due to on-going product development, MSR-Electronic GmbH reserves the right to change specifications without notice. The information contained herein is based upon data considered to be accurate. However, no guarantee is expressed or implied regarding the accuracy of these data.

5.1 Intended product Application

The PolyXeta®2 devices are designed and manufactured for control applications and air quality compliance in commercial buildings and industrial manufacturing plants.

5.2 Installers' Responsibilities

It is the installer's responsibility to ensure that all PolyXeta®2 devices are installed in compliance with all national and local codes and OSHA requirements. Installation should be implemented only by technicians familiar with proper installation techniques and with codes, standards and proper safety procedures for control installations and the latest edition of the National Electrical Code (ANSI/NFPA70).

The equipotential bonding required (also e.g. secondary potential to earth) or grounding measures must be carried out in accordance with the respective project requirements. It is important to ensure that no ground loops are formed to avoid unwanted interference in the electronic measuring equipment.

It is also essential to follow strictly all instructions as provided in the user manual.

5.3 Maintenance

It is recommended checking the PolyGard®2 device regularly. Due to regular maintenance any performance deviations may easily be corrected. Re-calibration and part replacement in the field may be implemented by a qualified technician and with the appropriate tools. Alternatively, the easily removable plug-in Sensor Cartridge with the sensor element may be returned for service to MSR-Electronic GmbH.

5.4 Limited Warranty

MSR-Electronic GmbH warrants the PolyXeta®2 devices for a period of one (1) year from the date of shipment against defects in material or workmanship. Should any evidence of defects in material or workmanship occur during the warranty period, MSR-Electronic GmbH will repair or replace the product at their own discretion, without charge. This warranty does not apply to units that have been altered, had attempted repair, or been subject to abuse, accidental or otherwise. The warranty also does not apply to units in which the sensor element has been overexposed or gas poisoned. The above warranty is in lieu of all other express warranties, obligations or liabilities.

This warranty applies only to the PolyXeta®2 devices. MSR-Electronic GmbH shall not be liable for any incidental or consequential damages arising out of or related to the use of the PolyXeta®2 devices.