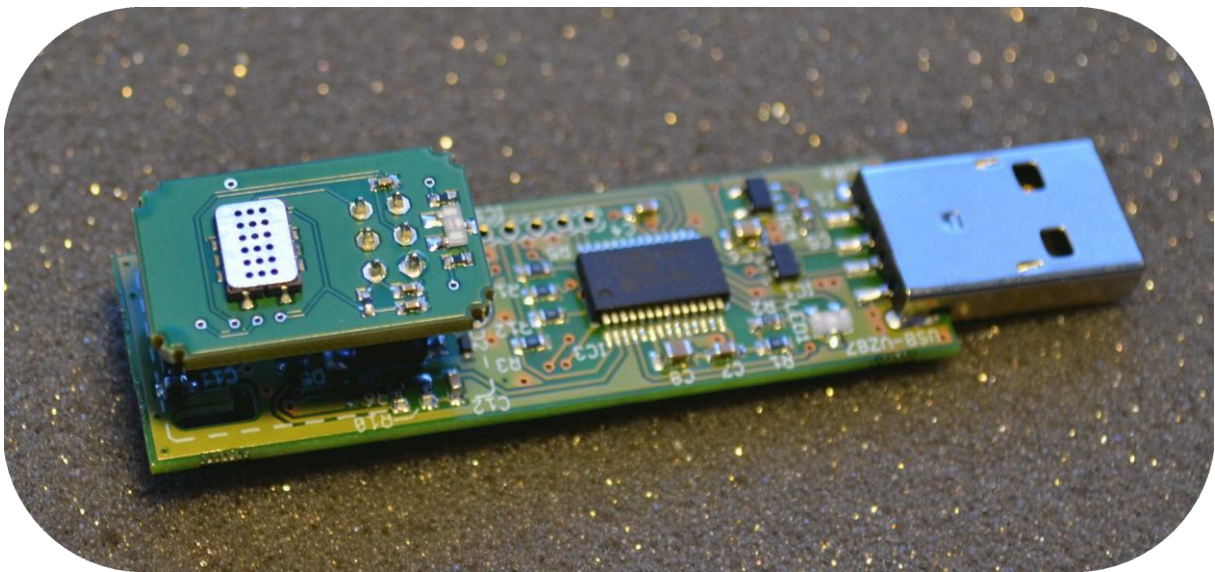# Instruction Manual
USB Demo Kit for VZ-87

Version 1.2 12/2014

*Please read and understand this instruction manual
before handling and operating this demo kit.*

THIS DEVICE IS AN INDICATOR; IT IS NOT INTENDED TO BE USED AS A SECURITY DEVICE.

General information

The USB demo kit for VZ-87 is a device designed to provide easy and fast demonstration of the behaviour of SGX Sensortech indoor air quality monitoring solution.

The kit allows the readout of a VZ-87 module in order to display measurements of the calculated CO2 equivalent and VOC values based on a metal oxide semiconductor gas sensor. Semi-conducting gas sensor exhibits an decrease of resistance value in presence of VOCs.

The device can perform continuous exposure monitoring and data logging of raw sensor signal, CO2 equivalence (measure based on VOC correlated with CO2), VOC, temperature and humidity in environmental conditions for solution developers or people interested in air quality monitoring.

Features include :

- **Environmental monitoring**
Display gas concentration and a chart of actual measurements
Display temperature and relative humidity on demand
I2C communication (status readings, settings)
Real time clock for stand alone operation
Data logging
Store date and time, status, calculated tVOC concentration [ppb], calculated CO2 equivalence concentration [ppm] , raw sensor value (resistance value in Ohms), relative humidity [%] and temperature [°C]

- **Programmable sampling rate**
Stand alone data storage capacity of 1016 data points. Storage intervals programmable for internal and PC data logging.

- **Autonomous**
Pluggable on 5V AC/DC for stand alone data logging with RTC

- **Compact package**
Small size: L x W x H: 73.5 x 17.5 x 16 mm (including USB connector)

- **User friendly**
Easy and speedy setup
Simple data analysis

- **Applications**
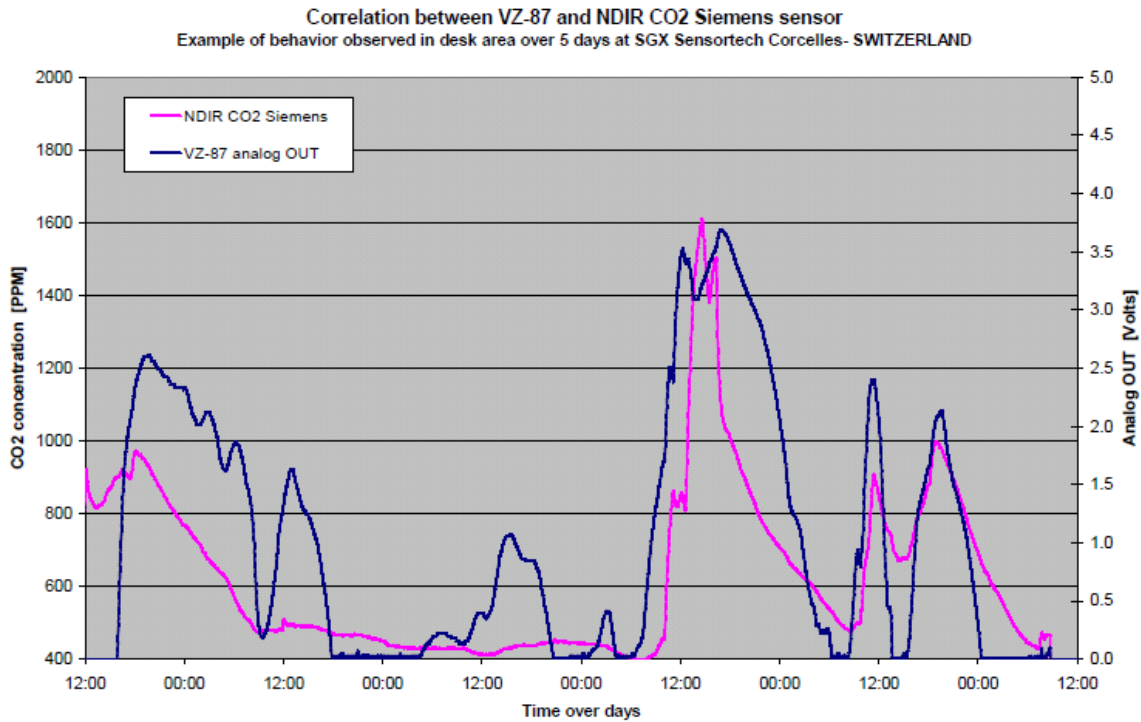Evaluation of sensor performance for indoor applications
Detection of VOCs pollution peaks
CO2 equivalence monitoring
Development of solutions for indoor air quality

CO2-VOCs consistency

VZ-87 product has been developed as a demo unit in order to evaluate performances in desk area. Algorithm parameters have been defined to follow CO2 variations in known conditions with a correlation ratio between VOCs and CO2.

Correlation between VZ-87 and NDIR CO2 Siemens sensor
Example of behavior observed in desk area over 5 days at SGX Sensortech Corcelles- SWITZERLAND

As you can see in chart above (VZ-87 monitoring 5-days example), VZ-87 output is slightly different from true CO2 concentration measured with another costly technology (NDIR). This is obviously linked with the fact that MiCS-5524 MOX sensor is not measuring directly the CO2 gas concentration but the VOCs.

These VOCs may come from several sources like:
- Cleaning and maintenance supplies
- Carpets, fabrics, finishes and furniture
- Office equipment (copiers, printers)
- Microbial action
- Renovations
- Pesticides
- Human occupancy (exhalation and perfume)

Only the last one is clearly correlated with CO2 (exhalation of humans).
This explains the differences observed between CO2 – ppm monitoring with NDIR detector and IAQ devices.

Spending upwards of 95% of one's time inside a sealed, high-efficiency building has led to a rise in "sick building syndrome" (SBS) complaints.

According to the American Lung Association, the top five indoor air pollutants include (in alphabetical order):

- Carbon monoxide - > seen by VZ-.87 and not by NDIR CO2 module
- Formaldehyde - > seen by VZ-.87 and not by NDIR CO2 module
- Microbial contaminants
- Second hand tobacco smoke - > partially seen by VZ-.87 and not by NDIR CO2 module
- Volatile organic compounds (VOCs) - > seen by VZ-.87 and not by NDIR CO2 module

VOCs detector complements CO2 monitors by providing air quality level correlated with CO2 generated by human presence + VOCs from other sources.

USB-VZ87 Demo Kit specifications

CO2 equ range :	0 to 2000 ppm equ.
tVOC range :	0 to 1000 ppb (isobutylene equ. or other according to VZ-87 firmware version)
Dimensions :	73.5 x 17.5 x 16 mm (including USB connector)
Weight :	< 10 gr.
Operating temperature:	5 to 50°C
Operating relative humidity:	5 to 95% non condensing
Detector:	Semi-conducting gas sensor on smart board VZ-87 T&RH sensor on USB-demo kit
Battery:	on board battery for RTC 3.0V/48mAh, typ CR1225
Electrical operation:	5V, 100 mA
Visual indicator:	1 status LED on the USB board and 1 status LED on VZ-87
Direct readout:	CO2 equ and tVOCs concentrations, chart of last 10 minutes of data logging On demand: temperature, relative humidity and memory filing level
Data storage capacity:	Embedded real time clock and eeprom with 1016 data points with programmable interval 5 sec up to 12hours for stand alone data logging

Warranty:

SGX warrants this product to be free from defects in material and workmanship for a period of 1 year from date of shipment.

This warranty does not apply to defects resulting from product modification or misuse of any product or part. This warranty also does not apply to fuses, software, battery, damage resulting from battery leakage. The warranty is not applicable to problems arising from normal wear and tear or from failure to follow operating instructions.

Disclaimer:

This device is for indoor monitoring purposes only. It is intended to provide an indication of the indoor VOCs concentration changes and CO_2 equivalence concentration changes. SGX denies any responsibility resulting from the misuse of this product.

Operation of USB-VZ-87 kit

Shipment content

The following items are included with the USB-VZ-87 kit:

- USB-VZ87 board
- VZ-87 IAQ sensor module
- USB 2.0 male/female extension cable 1 meter
- Wall adapter
- Button cell (for clock)
- USB-VZ-87 Instruction Manual (via website)
- "PC Manager" exe-file (via website)

Device handling

Avoid touching the area surrounding the sensor (aluminium cap of sensor present on VZ-87 sensor module) with bare hands. Grease or organic solvents (perfumes) can generate errors. To prevent contamination that could degrade performance, handle the sensor module VZ-87 only by pinching the sides of the board.

Some more caution to take:
- Avoid any use of silicon spray for moulded/injected plastic part used for package as it will poison the sensor over time (silicon spray is used for easy and fast part release in injection moulding process)
- Avoid any variable heat source close to the sensor (voltage regulator, radiator, transformer, …) as it may affect sensor readings
- Avoid use of rechargeable battery in vicinity of sensor as it may outgas during charging

Storage

Storage temperature should be comprised between -20°C and 50°C and relative humidity between 10 and 80%.

The device should not be stored in silicon contaminated atmosphere (typically HMDS gas). Storage in such conditions may produce sensors sensitivity losses.
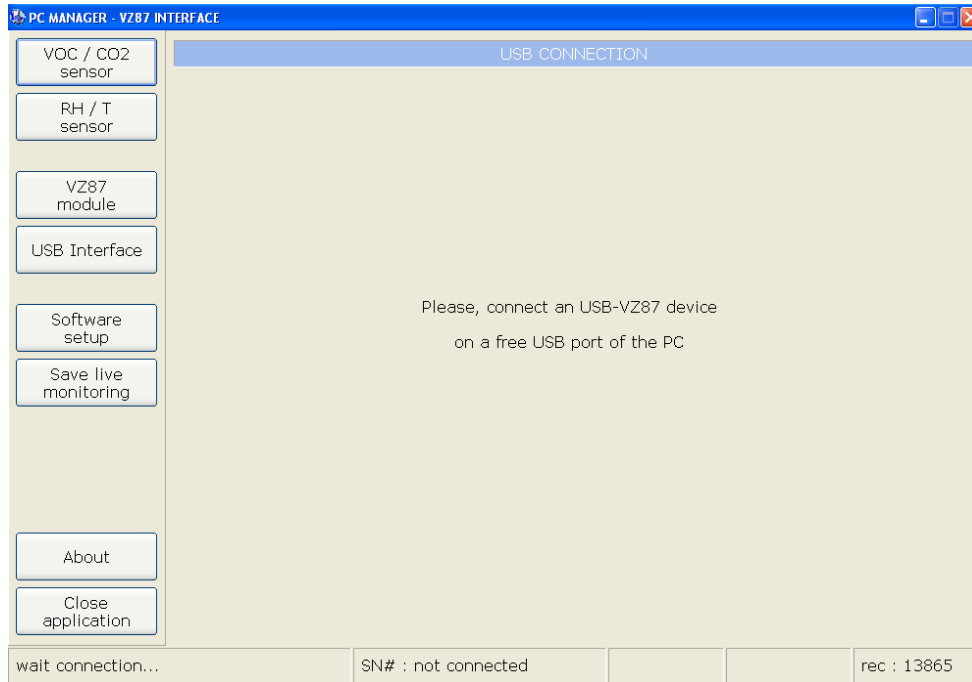
Start-up operation

Insert the VZ-87 in the connector of the USB-VZ87 board as shown here below.
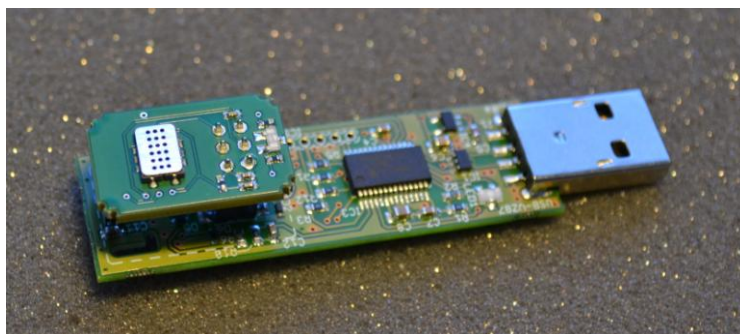
PC interface

The **"PC Manager"** application software is an executable file.

Save "PC Manager" exe-file to a specific path and then double click the icon.

After starting the software, it is necessary to detect USB-VZ87. For this, connect the board (with VZ-87 in place) to the PC with USB cable or directly in USB available slot as shown here below:

When USB-VZ87 is plugged, monitoring starts immediately and is displayed in the chart. VZ-87 module LED is blinking during one minute to show that it is in the first minute of operation. VZ-87 CO2 equ output is maintained at 400 ppm during the warm up period of 15 minutes. Refreshing data rate is 1 Hz.
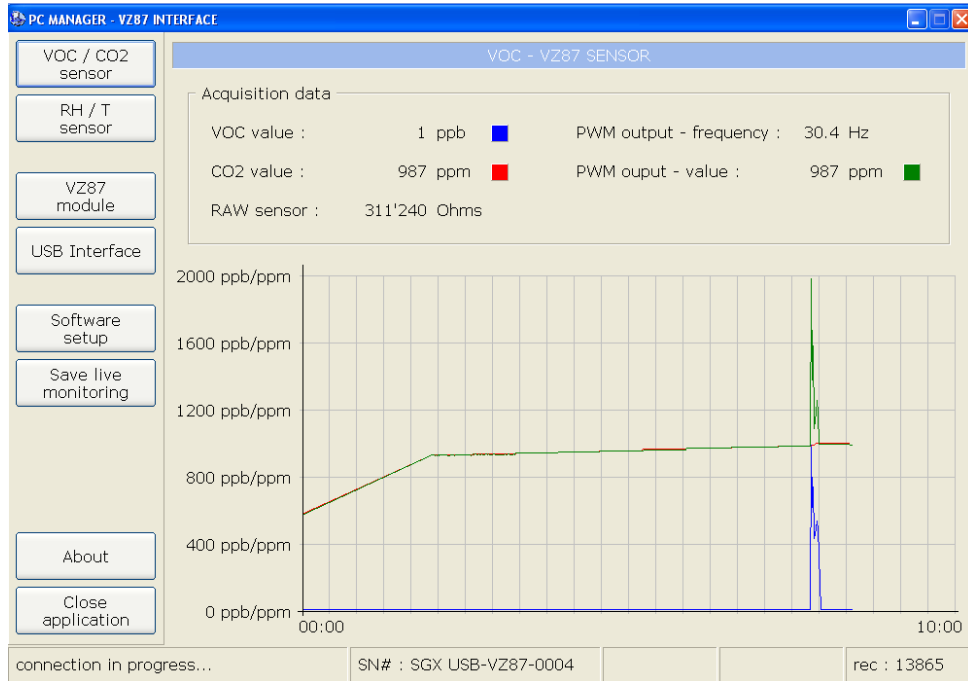
By clicking on RH/T one can see climatic values in another chart.

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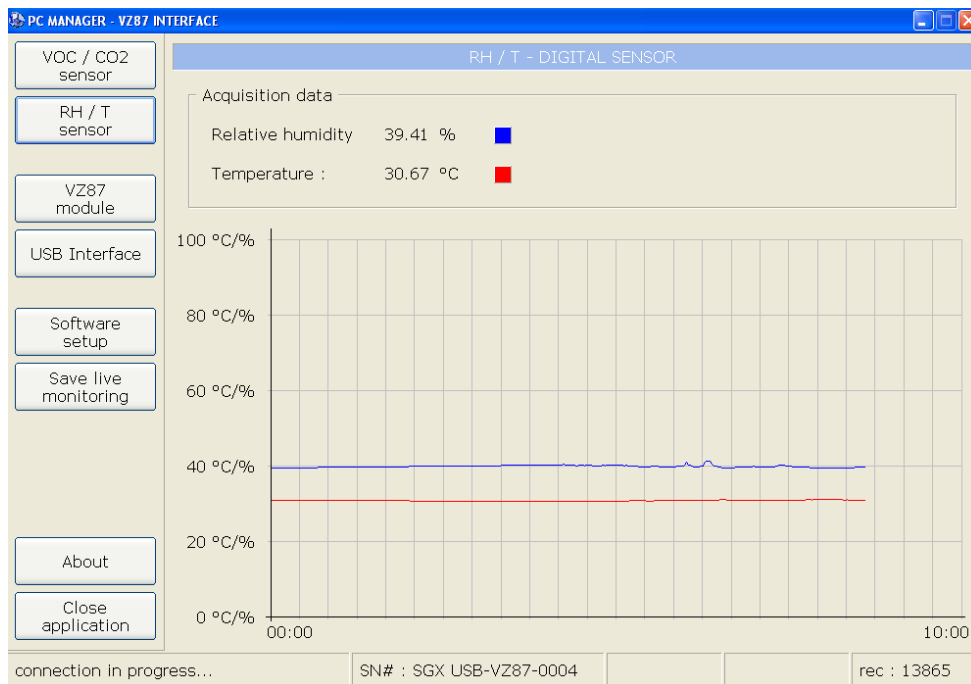
When clicking on "VZ87 module" one can enter in the VZ87 interface window where it is possible to send and receive I2C data.
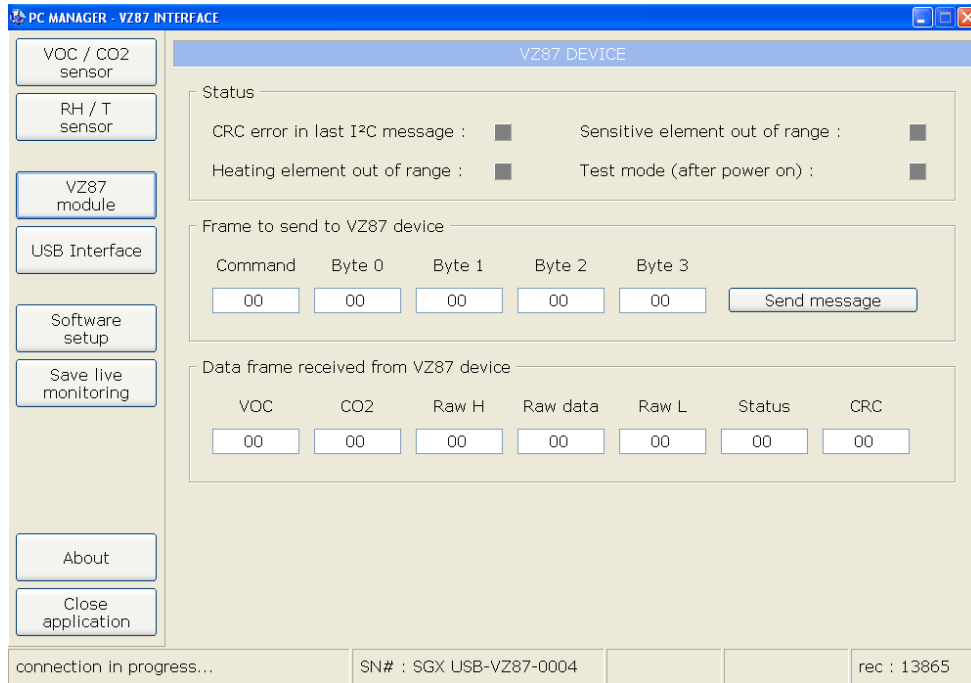
Firmware version can be obtained with command (0x0D) as shown here below with the data frame received form VZ-87 device:
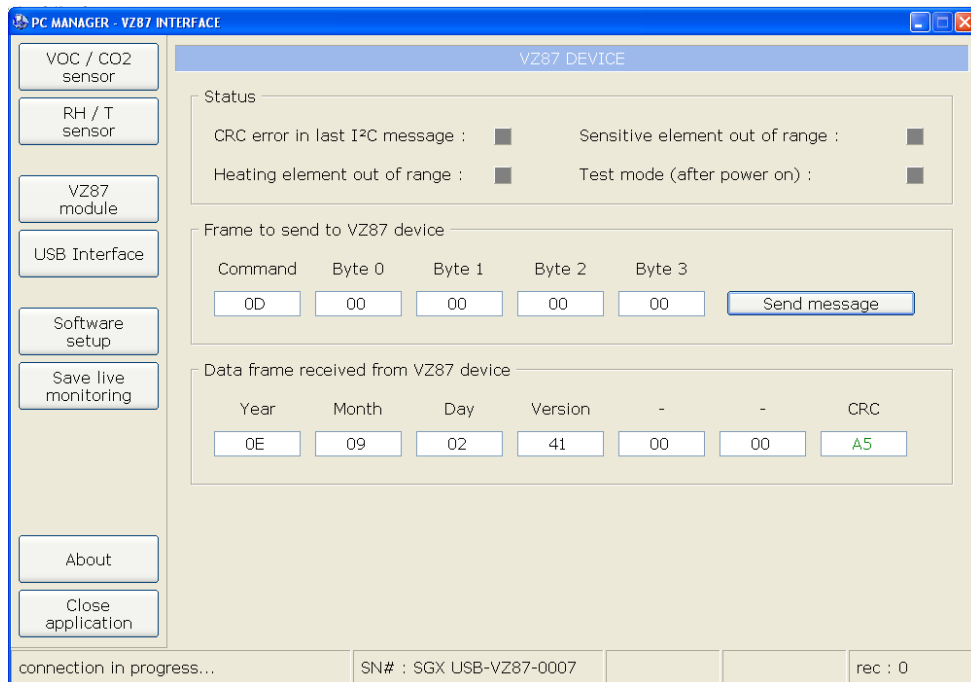
Byte1: 0E (Year): 14
Byte2: 09 (Month): 09 (September)
Byte3: 02 (Day): 02
Byte4: 41 (Index letter - ASCII value form a to Z: A is 65)
Byte5: not used
Byte6: not used
Byte 7: CRC

Comments:
Other commands will be implemented in next versions of firmware in order to extend the operating mode evaluation (cycled mode, period and duty cycle definition).

USB interface window displays the status of the communication between the components in place.
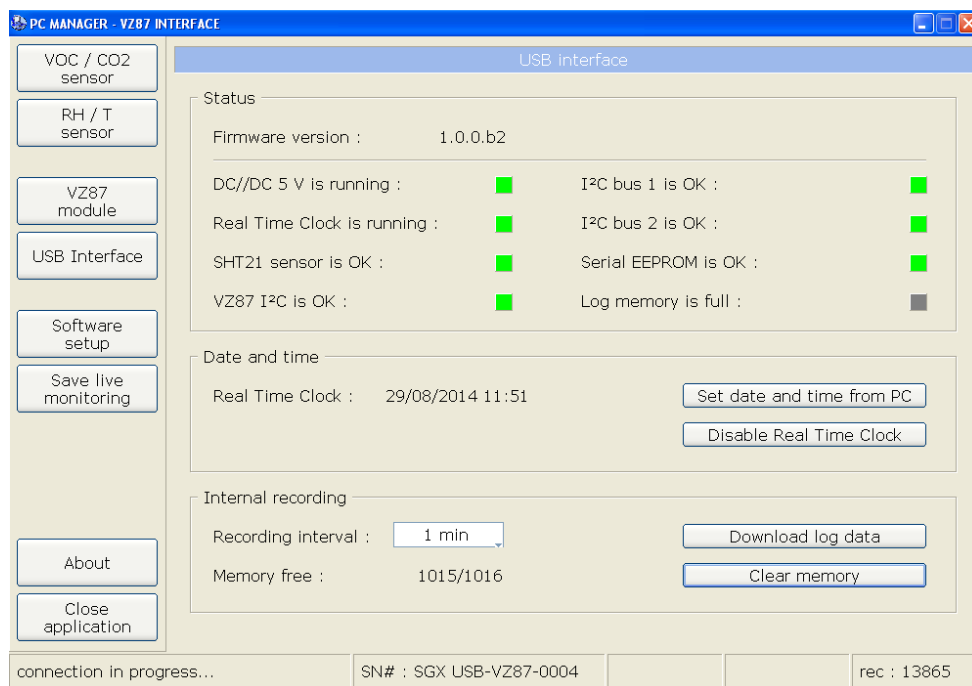
This window allows check/set internal clock of the device. It is useful to synchronise with a PC when several devices have to be used for a mapping for example. Click the **Set date and time from PC** button, internal RTC clock is then set to the computer clock.

Remark:
Before every acquisition period, it is advisable to synchronise the instrument with the PC. It is also useful to erase the instrument memory for availability of the full memory space (click on **Clear memory**)

Memory capacity is of 1016 data points with recoding intervals going from 5 seconds to 12 hours. When this capacity is exceeded, next data will not be stored.

Interval	Period covered with 1016 points
5 sec	84 min
15 sec	4.2 hours
1 min	16.9 hours
5 min	3.5 days
15 min	10.5 days
1 hour	42 days
3 hours	127 days
12 hours	508 days
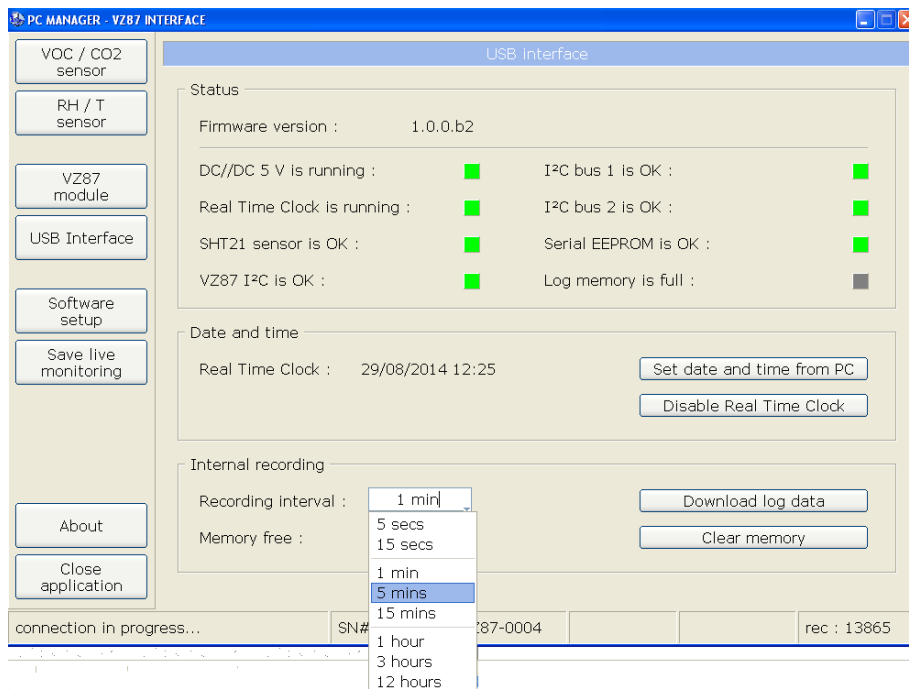
Internal interval recording period is selected by clicking on desired value.

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Once internal acquisition period is over **Log memory is full** will indicate this status by changing colour (orange).

Download of logged data is done by clicking on the button and download data status will appear. The data transfer starts automatically after having defined the destination file and whole memory is read and decompressed in .txt file.
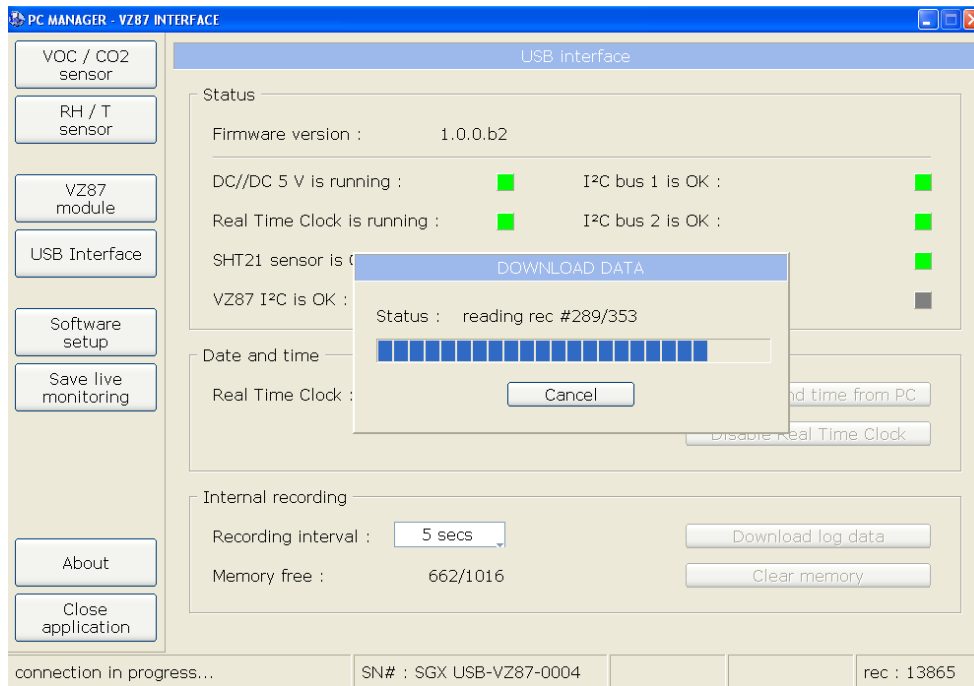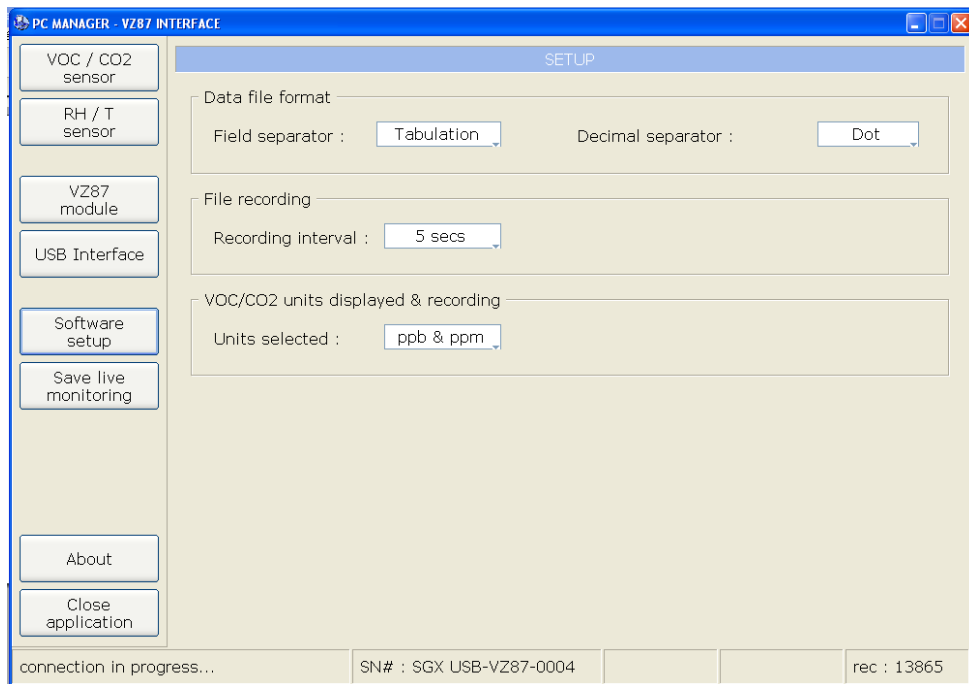
Software setup window allows defining data file format, PC recording file interval and units.
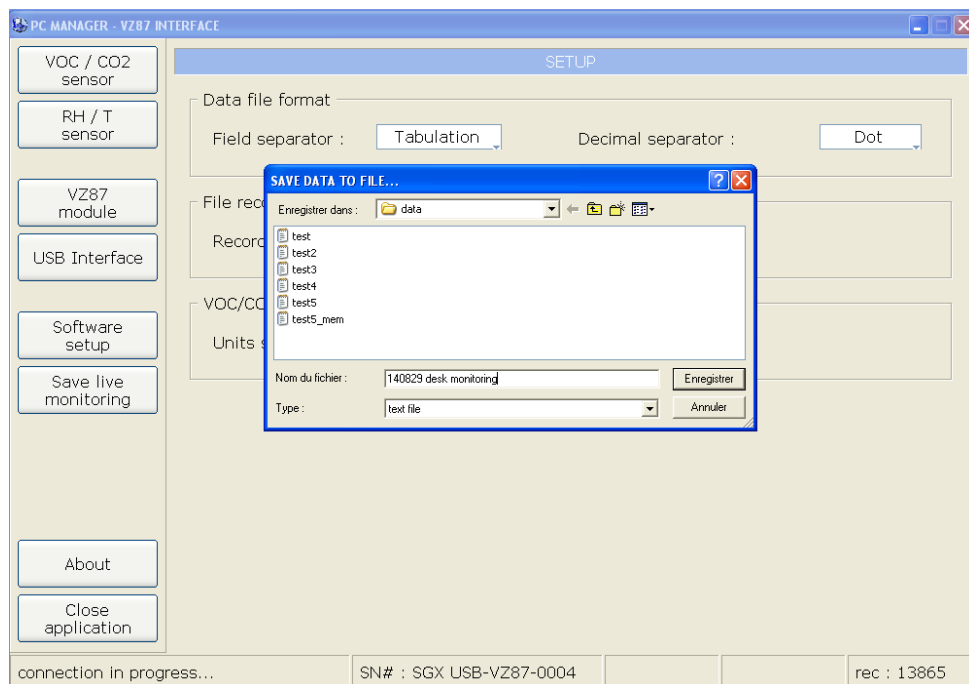
When clicking on **Save live monitoring** a **SAVE DATA TO FILE** browse window is prompted. Simply enter destination file name in a specified path. Once this is done, data will be stored in the file at defined timing interval. To stop click **Stop saving** – this option replaces **Save live monitoring** once this one is selected.

Operation with AC/DC plug

USB-V87 device can be operated in stand alone (no PC connection). The system is powered through the USB connector with 5V DC.

In this configuration, the device will start data logging once operated. The settings (internal recording interval and memory clear) are the ones defined at last operation with "PC Manager" application.

According to operation location, specific AC/DC charger can be ordered (Europe, UK, USA, see spare parts list for details).

Data file

Here below is an example of measurement file with description of each column:

Date	Time	Status	VOC (ppb)	CO2 (ppm)	Ana (mV)	Raw sensor (Ohms)	Device status	PWM frequency (Hz)	PWM value (ppm)	RH (%)	T (°C)
28.08.2014	16:40:34	ok	1	1015	1924	216040	0	30.5	1015	34.96	31.42
28.08.2014	16:41:35	ok	1	1022	1946	211240	0	30.4	1022	34.49	31.8
28.08.2014	16:42:36	ok	1	1029	1971	214110	0	30.5	1028	34.71	31.58
28.08.2014	16:43:37	ok	1	1029	1970	213140	0	30.4	1029	33.87	32.02
28.08.2014	16:44:38	ok	1	1036	1991	220000	0	30.5	1035	35.28	31.29
28.08.2014	16:45:39	ok	1	1036	1991	220000	0	30.5	1035	35.26	31.36
28.08.2014	16:46:40	ok	1	1036	1992	219000	0	30.5	1035	35.19	31.41
28.08.2014	16:47:41	ok	1	1029	1970	229260	0	30.5	1028	36.03	30.81
28.08.2014	16:48:42	ok	1	1029	1970	222010	0	30.5	1028	35.54	31.2
28.08.2014	16:49:43	ok	1	1022	1946	220000	0	30.5	1020	35.48	31.18
28.08.2014	16:50:44	ok	1	1022	1946	224050	0	30.4	1022	35.71	30.98
28.08.2014	16:51:45	ok	1	1015	1924	223020	0	30.5	1015	35.7	31.04
28.08.2014	16:52:46	ok	1	1015	1923	220000	0	30.5	1013	35.48	31.18
28.08.2014	16:53:47	ok	1	1015	1924	223020	0	30.5	1013	35.38	31.19
28.08.2014	16:54:48	ok	1	1015	1924	224050	0	30.4	1015	35.6	31.04
28.08.2014	16:55:49	ok	1	1008	1900	222010	0	30.4	1008	35.36	31.15
28.08.2014	16:56:50	ok	1	1001	1879	228200	0	30.5	1001	35.39	31.04
28.08.2014	16:57:51	ok	1	1001	1879	228200	0	30.5	1001	35.46	31.03
28.08.2014	16:58:52	ok	1	994	1857	227150	0	30.5	994	35.64	30.84
28.08.2014	16:59:53	ok	1	980	1816	230320	0	30.4	980	36.18	30.48
28.08.2014	17:00:54	ok	1	973	1793	227150	0	30.4	972	36.25	30.53
28.08.2014	17:01:55	ok	1	959	1745	232460	0	30.5	958	37.15	29.93
28.08.2014	17:02:56	ok	10	946	1702	230320	0	30.4	944	36.9	30.02
28.08.2014	17:03:57	ok	1	939	1670	233550	0	30.5	937	37	30.02
28.08.2014	17:04:58	ok	5	925	1641	237950	0	30.5	924	37.5	29.73
28.08.2014	17:05:59	ok	1	904	1569	245940	0	30.4	903	37.83	29.4
28.08.2014	17:07:00	ok	1	876	1487	244780	0	30.5	875	38.32	29.1

Date and Time:

Recording interval is set in PC Manager, the recorded data is instantaneous value requested by the I2C or measured on VZ-87 board or USB-VZ87 board (Analog out, PWM, RH, T).

Status

USB-VZ87 board status :
- "board reset" at start
- "vcc overload" if +5V is out of range (module in short circuit or current out of range – protection mode – shortage of 5V
- "comm error ' + number :
  "1" => VZ87
  "2" => RTC
  "3" => EEPROM
  "4" => SHT21
 - "ok", everything is OK

VOC [ppb]

Calculated VOC concentration in ppb based on measurement done by sensor.

CO2 [ppm]

Calculated CO2 equ. concentration in ppm based on measurement done by sensor.

Ana [mV]

Analog output value corresponding to the combined output of CO2equ+VOC (see VZ-87 data sheet for details).

Raw sensor [Ohms]
Sensor raw resistance value.

Device Status
VZ-87 board status byte:

Status_bit 4 to 7	Status_bit3	Status_bit2	Status_bit1	Status_bit0
Spare	Bit set when VZ-87 is in test-mode	Bit set with sensor sensitive element out of range	Bit set with sensor heating out of range	Bit set with CRC mismatch

PWM frequency [Hz]
Pulse width modulation frequency set at 30 Hz in VZ-87. Not changing.

PWM value [%]
PWM output value corresponding to the combined output of CO2equ+VOC (see VZ-87 data sheet for details).

RH [%]
Relative humidity measurement.

Temp [°C]
Temperature measurement. This measurement exhibits temperature offset generated by the selfheating around the sensor area.

Trouble shooting

The most likely problems and causes are listed below.

Symptom	Cause	Treatment
Instrument not detected by USB	Bad USB initialisation.	Disconnect the USB-VZ87 from USB port, close and relaunch PC_Manager, connect the instrument on the USB.
Download data blocked	USB link lost during data transfer	Close PC_Manager and relaunch the software
Power will not turn off	ON/OFF button not held long enough	Press button for approx 5 sec. (until instrument turn off)
Bad RTC reading	On-board battery end of life	Change on-board RTC battery
Instrument indicates 400 ppm CO2 equ	Warm-up phase of 15 minutes	Wait for 15 minutes after device power up to have warm-up ended.

Spare parts list

Part Number	Description
2076A01	USB-VZ87 Demo kit board
MICS VZ-87	VZ-87 VOC sensor module with CO2 equ algorithm
2076A02	AC/DC 5V charger EU
2076A03	AC/DC 5V charger US
2076A04	AC/DC 5V charger UK
2076A05	USB cable (1m)