



X4 Portable Gas Detection Instrument



Operators Manual
Version 1.3

EXSENS TECHNOLOGY (PTY) LTD

ExSens X4 Instrumentation

ExSens X4

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Specification

Gas Types	Flammable	Toxic x 2	Oxygen
Sensors and measuring range	CH ₄ = 0-100% LEL	CO/H ₂ S = 0-500/0-100ppm	0-25% by volume
Measuring principal	Catalytic Combustion	Electro-chemical	Electro-chemical
Calibration gasses	% = up to 50% full-scale	ppm = 20-200	Bottled / Fresh Air
Response time T90	Less than 15 seconds	Less than 35 seconds	Less than 15 sec.
Resolution	0.1%	< 6 ppm	0.1%
Long term drift	± 0.1%	2% Full scale /month	2% Full scale/month
Min & max pressure	- 10 KPa to + 50 KPa	Ambient ± 10%	Ambient ± 10%
Max relative humidity	95 % Non-condensing		
Sample velocity	20-40 liters per hour		
Operating temperature	-10 to + 40°C		
Storage temperature	0 – 20°C		
Power source	* Battery pack 3.7 Volt 2,800 mAmp/hour OR *Battery pack 3.7 Volt 3.200 mAmp/hour		
Operational time	> than 12 hours		
Real Time Clock accuracy	< 10 ppm (< 0.32%)		
Dimensions	125 x 75x 39 (mm)		
Weight	320 g		
Housing	Polycarbonate with TPE over-mold		
Warranty	* 1 (one) year on all electronic parts and workmanship * 6 (six) months on battery pack * 3 (three) months on sensors fitted by OEM		
Approval	SANS/IEC 60079 Part 0: 2005 SANS/IEC 60079 Part 11: 2007 SANS/IEC 60079 Part 29 - 1 SANS 1515– 1 SANS 1515 – 3 part 1		
User specification	SANS/IEC 60079 Part 29 - 2		

SCOPE

The document outlines the use of the ExSens X4portableGas Detection Instrument capable of detecting up to four gasses and displaying the readings on a graphic display. This document also describes the capability of responding to commands on a serial and radio interface.

DOCUMENT OVERVIEW

This document contains all of the required operational information as needed by the client. This document is intended to be the primary source of information to properly install and operate the instrument described herein.

IDENTIFICATION

The document is intended for the portable gas detection instrument model X4 manufactured by ExSens Technology. The instrument will be identified as the ExSens X4.

1.1 Safety Overview

It is imperative that the EXSENS X4 instrument be used as directed. All the “intrinsically safe” parameters must also be adhered to for proper safe use of the equipment in potentially gaseous areas. The safety of the person(s) that the instrument is protecting will be dependent on the condition and serviceability of the instrument.

It is, and remains the responsibility of the user to comply with the laws and regulations where the instrument is used, in as much as it applies to the instrument and the use thereof.

Special Conditions for Safe Use of ExSens X4 Instrument

Location	Zone 0 & 1 Gas/ Coal dust:	Underground and Surface
Hazard Frequency	---	Continuous, as could occur under normal operating conditions in hazardous area
Environment	Group I + H2	Methane and coal dust / plus Hydrogen
Limiting Temperature	450°C (Methane gas) 150°C (Coal dust)	
Ambient Temperature	-20°C to 40°C	

The use of apparatus in hazardous locations is subject to the following provisions as applicable, which shall be adhered to:

- SANS 10086 requirements;
- Any conditions mentioned in approval report, available on request;
- Codes of Practice enforced in terms of Regulations 21.17.2 of Minerals Act, by Chief Inspector of Mines;
- Any restrictions and conditions enforced by Chief Inspectors of Mines, Principal Inspector (Group I equipment) or Chief Inspector of Factories (Group II equipment);
- Any relevant requirements of the MHS Act or the OHS Act.

CONDITIONS OF CERTIFICATION:

US Market

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS.

- (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND
- (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRE OPERATION.

Warning: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

IMPORTANT NOTE: This device is considered a UWB imaging device and is subject to FCC Coordination requirements under the CFR Title 47 Chapter I, Sub chapter A, Part 15, Subpart F , Section 15.525. As such it is the responsibility of the users of these systems to submit the following information to the FCC prior to use of these systems. The users of UWB imaging devices shall supply operational areas to the FCC Office of Engineering and Technology, which shall coordinate this information with the Federal Government through the National Telecommunications and Information Administration. The information provided by the UWB operator shall include the name, address and other pertinent contact information of the user, the desired geographical area(s) of operation, and the FCC ID number and other nomenclature of the UWB device. If the imaging device is intended to be used for mobile applications, the geographical area(s) of operation may be the state(s) or county(ies) in which the equipment will be operated. The operator of an imaging system used for fixed operation shall supply a specific geographical location or the address at which the equipment will be operated. This material shall be submitted to Frequency Coordination Branch, OET, Federal Communications Commission, 445 12th Street, SW, Washington, D.C. 20554, Attn: UWB Coordination. The operator shall comply with any constraints on equipment usage resulting from this coordination.

Note 1: This ground penetrating UWB device shall be operated only when directed at the ground within one meter of the surface under analysis.

Note 2: Operation under the provisions of this section is limited to GPRs and wall imaging systems operated for purposes associated with law enforcement, fire fighting, emergency rescue, scientific research, commercial mining, or construction.

Note 3: Devices used in the US must be coordinated with the FCC prior to use. Contact ExSens Technology (Pty) Ltd for details regarding coordination.

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits for portable devices. The equipment meets the Specific Absorption Rate (SAR) exemption requirements of Part 2.1093.

When operating the device, a distance of at least 5mm shall be maintained from the body and the radiating element.

Canadian Market

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

This equipment complies with the ICES RF radiation exposure limits set forth for an uncontrolled environment.

Cet équipement est conforme aux limites d'exposition aux radiations ICES définies pour un environnement non contrôlé .

Note 1: This Ground Penetrating UWB Device shall be operated only when directed at the ground within one meter of the surface under analysis

Remarque 1: ce dispositif UWB pénétrant dans le sol ne doit être utilisé que lorsqu'il est dirigé vers le sol à un mètre de la surface analysée

Note 2: This Ground Penetrating UWB Device shall be operated only by law enforcement agencies, scientific research institutes, commercial mining companies, construction companies, and emergency rescue or fire fighting organizations.

Remarque 2: Ce dispositif UWB de pénétration au sol ne doit être utilisé que par des organismes chargés de l'application de la loi, des instituts de recherche scientifique, des sociétés minières commerciales, des entreprises de construction et des organisations de secours et de lutte contre l'incendie.

Radiation Exposure Statement:

This equipment complies with ISED radiation exposure limits and meets the exemption requirements per Section 2.5 of RSS-102. The test distance was ≤ 5 mm.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition au rayonnement ISED et aux exigences en matière d'exemption selon la section 2.5 de la norme RSS-102. La distance de test était ≤ 5 mm.

CONDITIONS OF MANUFACTURE

- The battery protection circuit must be fully encapsulated.
- The fuses must be fully encapsulated.

SPECIAL CONDITIONS OF SAFE USE (X)

- To maintain the IP rating, all screws must be fitted and tightened to the correct specification.
- Do not charge in hazardous area.

Cross Sensitivity of Flammable Sensor when calibrated for Methane

Gas/Vapor	Relative Sensitivity*	Gas/Vapor	Relative Sensitivity*
Methane	100	Carbon	110
Propane	60	Acetone	65
n-Butane	60	Methyl ethyl	50
n-Pentane	55	Toluene	45
n-Hexane	45	Ethyl acetate	50
n-Heptane	45	Hydrogen	105
n-Octane	40	Ammonia**	125
Methanol	90	Cyclohexane	55
Ethanol	70	Leaded Petrol	55
Iso-propyl alcohol	55	Unleaded petrol	55
Acetylene	80	Ethylene	90
1, 3 Butadiene	55		

Instrument functionality

NOTE: The EXSENS X4 instrument has three buttons (UP , DWN  and ENT ) to access all of the functional menus.



Figure 1: Instrument

1.2 Instrument description

The instrument housing is made of semi opaque molded polycarbonate with black TPE over-mold. The housing is held together with 6 x M3 stainless steelcap screws. The housing with its TPE over-mold will form a natural seal between the two halves of the housing.

The instrument is capable of displaying up to four different gas readings on a color graphic display.

The instrument is intended for use as a continuous measuring device for portable and handheld applications. The instrument can be worn on the waist belt of a worker by means of a leather carry pouch (sold separately, please consult with your accredited distribution agent).

1.3 Instrument Normal Operation

When placed on the charger, the instrument will initiate its boot sequence. Upon a successful boot the “logos” will be displayed and the instrument will go to charging mode.

While charging, the instrument will display the battery charging screen until removed from the charger.



Figure 2: Charging display screen

Upon removal from the charger, the instrument will re-boot and do all the required self-tests. Each check will be displayed and shown as passed or failed. If any of the tests fail the user should return the instrument to an instrument repair technician. **DO NOT USE INSTRUMENT IF ANY OF THE TESTS HAS FAILED.**

RTC / BATTERY: PASS / FAILED

SYSTEM RAM: PASS / FAILED

SYSTEM CLOCK: PASS / FAILED

AtoD CONVERTER: PASS / FAILED

SD CARD: PASS / FAILED

BATT VOLTAGE: PASS / FAILED

Once the self-test has completed the instrument will display the company logo as the start-up screen.



Figure 3: LOGO Display screen

Once the initialization is complete, the instrument will switch to the operational screen. While in the warm-up period the readings will be blanked off. Once warm-up has completed the readings will be active.

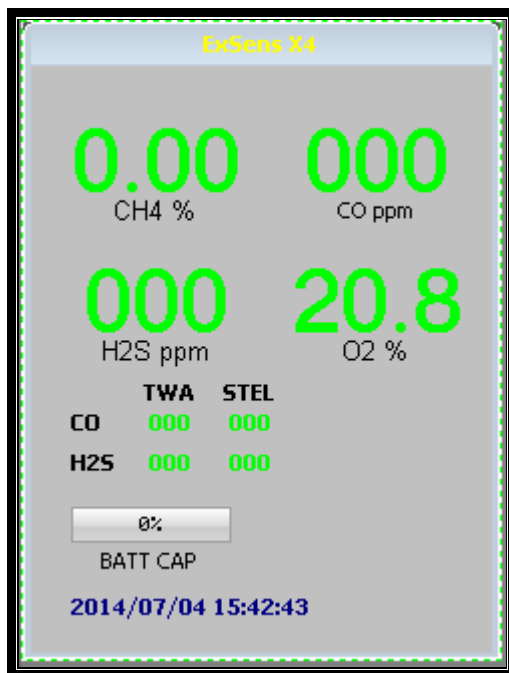


Figure 4: Normal Display

The layout of the display is as follows:

The model of Instrument is displayed on top of screen as shown in Figure 4, this will always be ExSens X4. (Model of this instrument).

The instrument is capable of detecting up to four different gasses. The Flammable gas will always be a pellistor and/or InfraRed sensor capable of detecting flammable gas in the range of 0.00% to 5.00% vol/vol. The display can also be configured to display the value from 0.0% to 99.0%LEL.


The instrument also accommodates two toxic sensors that have various ranges depending on the type of sensor and exposure limits harmful to humans. The measurement ranges are from 0ppm to 999ppm.

The last sensor port will always be an oxygen sensor that will measure from 0.0% to 25.0%.

On the display the real time TWA (Time Weighted Average) and STEL (Short Term Exposure Limit) values will be calculated and displayed.

Lastly the battery capacity with the current time and date of the instrument is displayed.

Within the first 30 minutes when the instrument is removed from the charger a calibration menu is available to the user to manually calibrate the instrument. (If configured to enable this feature).

The menu is accessed by pressing and holding the ENT  key.

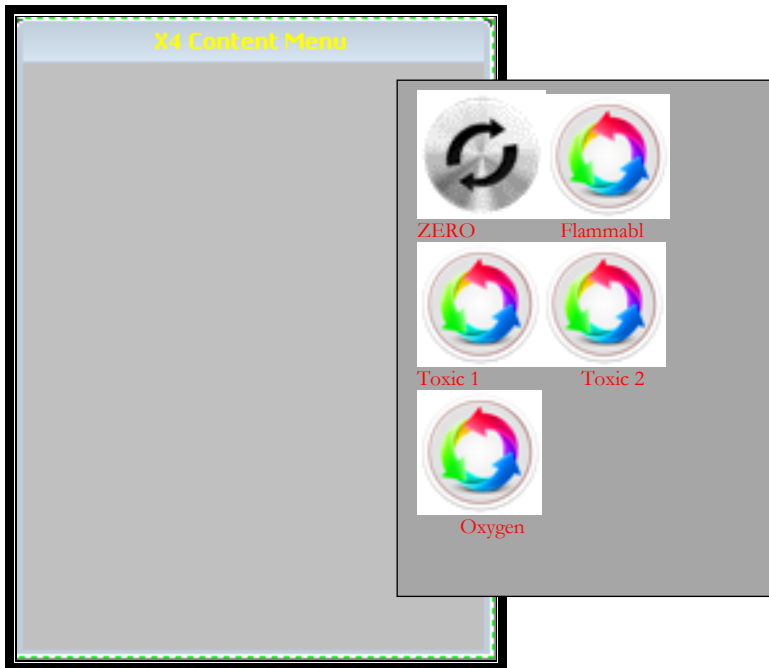





Figure 5: Calibration menu

Using the UP  and DWN  keys select the option required from the ICON menu. The option selected will be actioned once the ENT  key is pressed

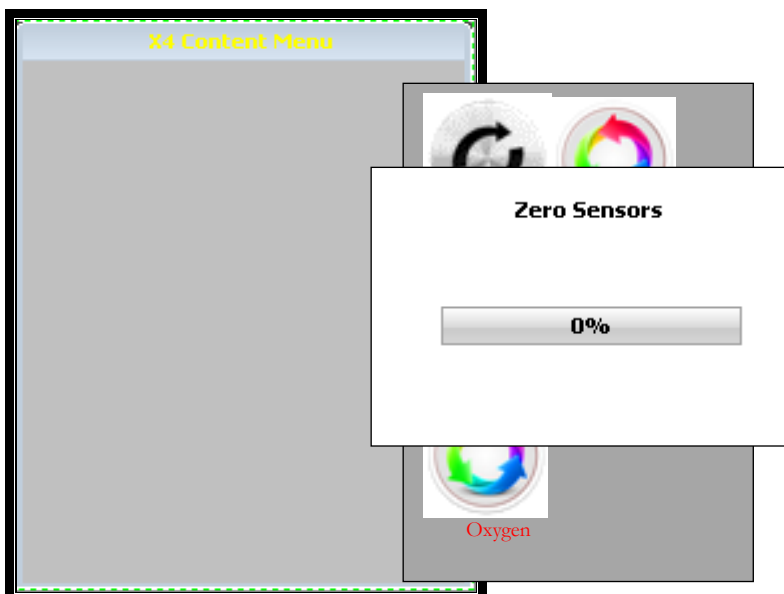


Figure 6: Sensor Zero screen

If the zero function was selected all the sensor zero values will be calculated at the same time, do not expose the instrument to any calibration gas until zeroing has been completed.




The calibration gas values are pre-programmed using the configuration software of the instrument. These are used as default values. The user can however change this to the appropriate gas concentration at the time of calibration. Scroll  UP or  DWN to the correct value and press the  ENT key to start the calibration of the selected port.



Figure 7: Calibration edit screen

The instrument will now calibrate to the selected value, do not remove instrument from calibration gas source.

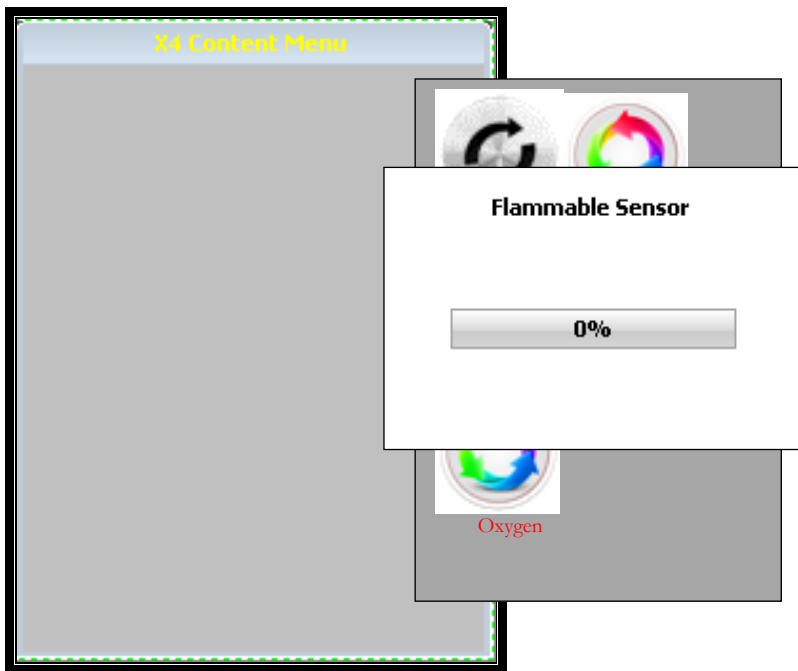


Figure 8: Calibration screen

Repeat for every sensor fitted. Each calibration will be stored in the service record file.






The manual calibration option can be enabled or disabled. If disabled, only the information menu will be available. The information menu can be accessed by pressing and holding the ENT  key.



Figure 9: Menu screen

Using the UP  and DW  keys select the option required from the ICON menu. The option selected will be actioned once  ENT  key is pressed

These menu option will give the user the required information about the setup of the instrument:

- The Setup **Info** Icon- will supply the user with all the preset alarm levels for the installed sensors
- The **Clock**Icon- will give the user the status of the onboard Real Time Clock.
- The **Battery Info** Icon- will supply the battery information, the voltage, current drawn and capacity left.
- The **Test Info** Icon – will display the tested values for each gas within the switch on time selected.
- The **Peak Info** Icon – will display the peak value for the day after the switch on time has expired.
- The **Cal Info**Icon - will display the calibration information.
- The**Download**Icon- will display the record count and size of the memory card fitted.
- The**Graph** Icon - will be a graphic display of all the sensors fitted.
- The **MeasureMesh**Icon – will enable radio link for the instrument.

1.4 Graph Screen Operation

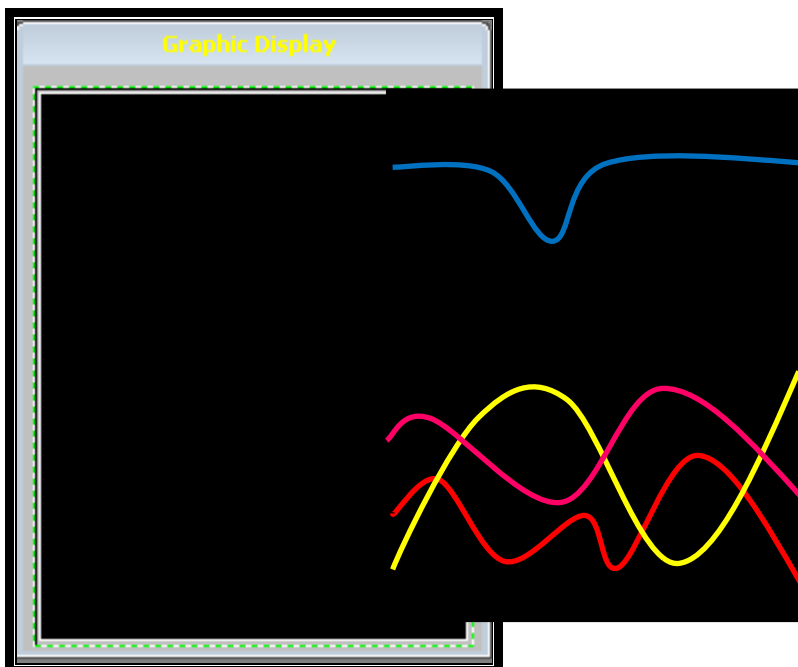



Figure 10: Graph screen

The graph will display for 15 minutes then revert back to the main screen. All alarms and indications will still be active when the graphic display is used.



The following colors on Graph screen re-present the different gas types:

- Blue – Oxygen
- Yellow – Toxic 1
- Cyan – Toxic 2
- Red – Flammable

Exit any menu by pressing the UP  and DWN  keys at the same time. All menu's when entered will timeout automatically once no key press is registered. The only exception is the Graph menu where the user must exit.

1.5 MeasureMesh Operation

MeasureMesh is a wireless networking protocol used to send sensor related information between wirelessly connected instruments. A prerequisite to use this functionality is that one instrument must be configured as a master and one as a slave. This configuration can be performed at the manufacturing facility or an accredited repair center. The link is setup automatically between a master and slave

instrument when the MeasureMesh icon  is selected from the menu on both instruments. The link will be active until one and/or both instruments are placed back on charge or the link is deactivated by selecting the MeasureMesh icon again on one or both instruments. All transmission will cease immediately when the link is deactivated via the MeasureMesh icon. While the link is active, the slave instrument will only transmit when it receives a request from a master instrument. The master instrument will send a request to the slave instrument at 1 second intervals while the link is active. The range of the link is dependent on the physical area. The tested range is in excess of 10 meters. The  icon must be displayed in the bottom right corner of the LCDs of both instruments to indicate that the link is active. Pressing the UP and ENT keys will select the remote reading screen. The screen background will change to cyan and will then be displaying the readings of the linked or remote instrument. The screen background will revert back to normal white after a 20 second timeout. Remote reading mode can be selected as many times as required as long as the link is active.

MeasureMesh Application Synopsis 1: 20-minute gas check on continuous miner

Two instruments can be linked as per the above procedure. One instrument can be fitted to the boom of the continuous miner with a special mounting bracket (sold separately, please consult with your accredited distribution agent). The second instrument can be worn on the belt of the machine operator in a leather carry pouch (sold separately, please consult with your accredited distribution agent). The machine operator can hold the belt worn unit in his hand and enter remote viewing mode every 20 minutes.

This feature can also be enabled with the configuration software to indicate to the user that the 20 minute gas check needs to be done. This will enable him to view the methane reading of the instrument mounted on the boom of the continuous miner. This will increase production, since the machine will not have to be stopped and backed up to do the 20-minute gas check.

If the 20 minute warning timer is enabled and the user acknowledges the timeout the readings of the 20 minute gas check will be saved to the SD Card as an event record.



MeasureMesh Application Synopsis 2: Manhole/confined space entry

Two instruments can be linked as per the above procedure. One instrument can be lowered into the manhole by means of a lanyard attachment or extended into a confined space by means of an extension rod attachment (sold separately, please consult with your accredited distribution agent).

The other instrument can be held by the person that must enter the manhole and/or confined space. The person can then view the remote gas readings in the manhole and/or confined space and verify that it is safe to enter. This will eliminate gas exposure risks associated with the person first entering the manhole and/or confined space in order to take the relevant measurements.

The slave instrument can also be placed in a confined area so that early warning of dangerous conditions can be read by the user at regular intervals.

1.6 Over- Range

As there are limits to the range of each sensor fitted, the software will monitor the range measured and switch the instrument automatically into a latched alarm. The user must acknowledge the latched alarm by pressing the UP  and DWN  keys at the same time.

The OVER-RANGE alarm will be indicated by that particular sensor's flashing maximum reading.

1.7 Auto Calibration

The instrument has the capability to be automatically calibrated. An auto calibrator is required to facilitate this feature. The auto calibrator is pre-programmed with the gas types and concentrations connected to the auto calibrator. The user only has to place the instrument into the auto calibrator, the instrument will match its sensors fitted to the gas types of the auto calibrator and initiate the calibration process.

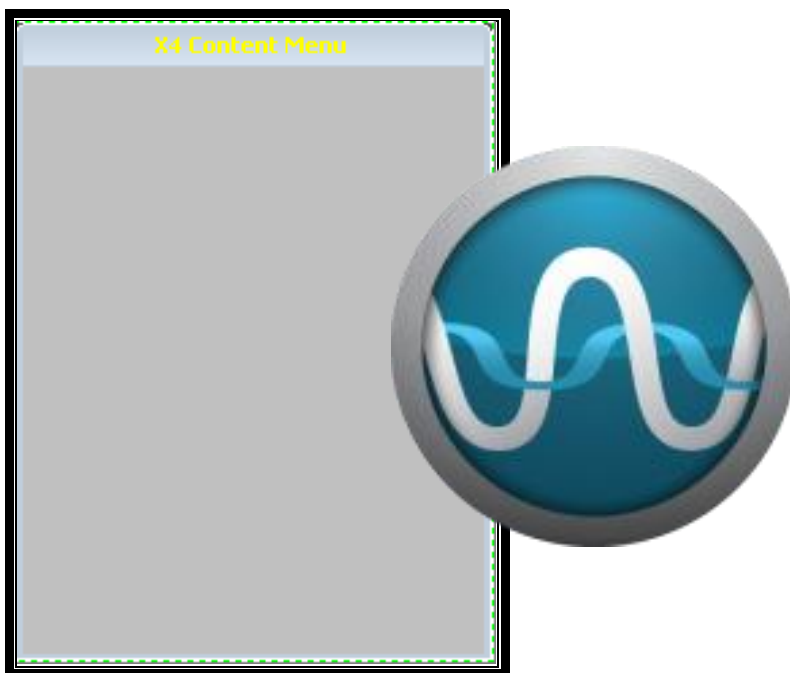



Figure 11: Auto Calibrate screen

1.8 Programmable options

DISPLAY_10_PPM_1 This option will allow the ExSens X4 Instrument to display or block-off the lower 10ppm of the measured gas value for toxic sensor 1. If blocked off, it allows for a smoother display if the sensor has a constant moving baseline. (Default = DISABLED).

- DISPLAY_5_PPM_1 This option will allow the ExSens X4 Instrument to display or block-off the lower 5ppm of the measured gas value for toxic sensor 1. If blocked off, it allows for a smoother display if the sensor has a constant moving baseline. (Default = DISABLED).
- DISPLAY_10_PPM_2 This option will allow the ExSens X4 Instrument to display or block-off the lower 10ppm of the measured gas value for toxic sensor 1. If blocked off, it allows for a smoother display if the sensor has a constant moving baseline. (Default = DISABLED).
- DISPLAY_5_PPM_2 This option will allow the ExSens X4 Instrument to display or block-off the lower 5ppm of the measured gas value for toxic sensor 2. If blocked off, it allows for a smoother display if the sensor has a constant moving baseline. (Default = DISABLED).
- DISPLAY_GRAPH This option will allow the user to view a graphic display of the current gas values detected. Each sensor port has a different color on the graphic display. (Default = DISABLED).
- CAL_SETUP_PASS This option will protect the configurable setting of the instrument with a password. When any setting is changed the user will be prompted for the password. (Default = DISABLED).
- CO_RANGE_1 This option will allow the instrument to measure toxic gas values higher than 500ppm. This setting is for toxic sensor 1. (Default = DISABLED).
- CO_RANGE_2 This option will allow the instrument to measure toxic gas values higher than 500ppm. This setting is for toxic sensor 2. (Default = DISABLED).
- DL_LIMITS This option will determine when the value for the data logging will be saved. If the option is disabled and the measured gas value moves from the zero point, it will be saved. If the option is enabled the measured gas value will only be saved once the first alarm level is exceeded. (Default = DISABLED).
- MINUTE_WARNING This option if enabled, will flash the alarm LED's at fixed intervals (Programmable from 1 minute up to 40 minutes) to draw the user's attention to the instrument. (Default = DISABLED).
- IR_VOL_VOL This option allows for the installation of an IR sensor capable of measuring methane from 0% to 99% vol/vol. The display will automatically adjust to the new format. (Default = DISABLED).
- CAL_REMINDER_180 This option will remind the user when the 180 day calibration due timer expires. (Default = DISABLED).
- CAL_REMINDER_90 This option will remind the user when the 90 day calibration due timer expires. (Default = DISABLED).
- CAL_REMINDER_30 This option will remind the user when the 30 day calibration due timer expires. (Default = DISABLED).
- CAL_REMINDER_14 This option will remind the user when the 14 day calibration due timer expires. (Default = DISABLED).

SWITCHTIME	Once an instrument is removed from the charger, a timer is started that allows the user to do a functional test on the instrument. When the timer expires the test values of each installed sensor is stored. This timer is programmable from 1 minute to 30 minutes. (Default = 30 minutes).
FLAM_LEL	This option will allow the instrument to display the flammable gas reading as a 0% to 99% LEL value. The alarm levels will also be automatically converted. (Default = DISABLED).
BUZZER_MUTE	This option will disable the buzzer for a pre-programmed time. If the alarm is still active after the timeout the buzzer will be re-enabled. (Default = DISABLED)
TEMP	This option will display the temperature on the main screen next to the battery capacity. (Default = DISABLED)
MANUAL_CAL	Manual calibration is allowed when enabled. The calibration gas values have to be programmed with the configuration software. (Default = DISABLED)
FIRE_PATROL	This option will allow the instrument to save the gas readings at a specific point within the mine. The instrument have to be presented to the fire patrol unit. (Default = DISABLED)
MEASURE_MESH	This option will allow the instrument to send the gas readings to other linked instruments in the same reception area. To link the instruments they must be in close proximity and the link icon must be selected. Once linked the instrument will display the linked icon.  (Default = DISABLED)

1.9 Warranty and liability

ExSens Technology warrants that the ExSens X4 gas detection instrument manufactured and delivered by ExSens Technology pursuant to this agreement shall be free from defects in material and workmanship, for the following periods of time:

- All plastic housings manufactured by ExSens Technology - a period of one (1) year from date of invoice.
 - All sub assembled electronic parts manufactured by ExSensTechnology - a period of one (1) year from date of invoice.
 - All sensors supplied by ExSens Technology - a period of three (3) months from date of invoice.
 - All batteries supplied by ExSens Technology - a period of three (6) months from date of invoice.
1. The extent of ExSens Technology liability under this warranty as to defects in material and/orworkmanship is limited to the repair of such defects or to the repair and/or replacement ofany accessories, equipment or part which is defective in respect thereof, as determinedsolely at the discretion of ExSens Technology.

2. All replacement parts under this warranty shall be supplied by ExSens Technology factory, unless otherwise authorised in writing.
3. ExSens Technology shall as to each defect be relieved of any and all obligation and liability under this warranty if:
 - The goods were installed using non-standard installation and/or construction details not recommended by, not approved by, not known to and/or outside of ExSens Technology's standard recommended details, unless the Purchaser furnishes evidence satisfactory to ExSens Technology that such details were not the cause of the defect;
 - The goods were installed by an installation crew not known to, not approved by, and/or not recommended by ExSens Technology, unless the Purchaser furnishes evidence satisfactory to ExSens Technology that such installation crew was not the cause of the defect;
 - The goods were installed or operated with any equipment, accessories, or parts not specifically approved by ExSens Technology, unless the Purchaser furnishes evidence satisfactory to ExSens Technology that such installation or operation was not the cause of the defect;
 - The goods were not operated, applied, and/or maintained in accordance with ExSens Technology instructions, unless the Purchaser furnishes evidence satisfactory to ExSens Technology that such operation, application, and/or maintenance was not the cause of the defect;
 - The goods were not operated and/or applied under normal industry use, unless the Purchaser furnishes evidence satisfactory to ExSens Technology that such operation and/or application was not the cause of the defect;
 - The goods were repaired, altered, or modified without ExSens Technology's prior written approval or the goods were damaged by accident, misuse or abuse, unless the Purchaser furnishes evidence satisfactory to ExSens Technology that such repair, alteration, modification, accident, misuse or abuse was not a cause of the defect;
 - The Purchaser does not forthwith upon becoming aware of any defect advise ExSens Technology and thereupon permit ExSens Technology to investigate such defect;
 - The Purchaser does not submit reasonable proof to ExSens Technology that the defect is due to faulty material or workmanship contained within ExSens Technology warranty herein;
 - The Purchaser does not permit all service work and repair work required as per ExSens Technology warranty herein to be performed by ExSens Technology or its authorized representative.
4. The warranty provided herein and the obligations of ExSens Technology are in lieu of, and the Purchaser hereby waives all other warranties, guarantees, conditions or liabilities expressed or implied by either law or otherwise (including without limitation any obligation of ExSens Technology with respect to consequential damages including but not limited to
