

Operating Manual
ALTAIR[®] 4X
Multigas Detector



MSA AUER GmbH
Thiemannstrasse 1
D-12059 Berlin

Germany

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The Safety Company

EC Declaration of Conformity

Manufactured by: Mine Safety Appliances Company
1000 Cranberry Woods Drive
Cranberry Township, PA 16066 USA

The manufacturer or the European Authorized Representative:

MSA AUER GmbH
Thiemannstrasse 1
D-12059 Berlin

declares that the product

ALTAIR 4X

based on the EC-Type Examination Certificate: FTZU 07 ATEX 0169 X
complies with the ATEX directive 94/9/EC, Annex III. Quality Assurance Notification
complying with Annex IV of the ATEX Directive 94/9/EC has been issued by Ineris ,
Notified Body number: 0080.

Standards: EN 60079-0:2009, EN 60079-1:2007, EN 60079-11:2012,
EN 60079-18:2009, EN 60079-26:2007, EN 50303:2000
EN 60079-29-1:2007, EN 50271:2010, EN 50104:2010

The product is in conformance with the directive 2004/108/ EC, (EMC):
EN 50270:2006 Type 2 , EN 61000 - 6 - 3:2007

The product is in conformance with the directive 2010/68 EC, (MED):
EC-Type Examination Certificate: 213.048 Notified Body number: 0736
The product is in conformance with the directive 2006/66/EC.

A handwritten signature in black ink, appearing to read 'Dr. A. Schubert'.

MSA AUER GmbH

Dr. Axel Schubert

Manager R&D Instruments

& Approvals INT-T

Berlin, April 2014

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1 Safety Regulations

1.1 Correct Use

The ALTAIR 4X Multigas Detector is intended for use by trained and qualified personnel. It is designed to be used when performing a hazard assessment to:

- assess potential worker exposure to combustible and toxic gases and vapours as well as low level of oxygen.
- determine the appropriate gas and vapour monitoring needed for a workplace.

The ALTAIR 4X Multigas Detector can be equipped to detect:

- Combustible gases and certain combustible vapours
- Oxygen-deficient or oxygen-rich atmospheres
- Oxygen for monitoring inertisation applications. The device is suitable and certified for the measurement of the oxygen concentration in gas mixtures for inertisation according to EN 50104 but without alarm function.
- Specific toxic gases for which a sensor is installed.

It is imperative that this operating manual be read and observed when using the product. In particular, the safety instructions, as well as the information for the use and operation of the product, must be carefully read and observed. Furthermore, the national regulations applicable in the user's country must be taken into account for a safe use.

The ATEX directive is only valid until 25% Vol O₂.



Danger!

This product is supporting life and health. Inappropriate use, maintenance or servicing may affect the function of the device and thereby seriously compromise the user's life.

Before use the product operability must be verified. The product must not be used if the function test is unsuccessful, it is damaged, a competent servicing/maintenance has not been made, genuine MSA spare parts have not been used.

Alternative use, or use outside this specification will be considered as non-compliance. This also applies especially to unauthorised alterations to the product and to commissioning work that has not been carried out by MSA or authorised persons.

1.2 Liability Information

MSA accepts no liability in cases where the product has been used inappropriately or not as intended. The selection and use of the product are the exclusive responsibility of the individual operator.

Product liability claims, warranties also as guarantees made by MSA with respect to the product are voided, if it is not used, serviced or maintained in accordance with the instructions in this manual.

1.3 Safety and Precautionary Measures to be Adopted



Attention!

The following safety instructions must be observed implicitly. Only in this way can the safety and health of the individual operators, and the correct functioning of the device, be guaranteed.

Check Function

Before each day's use, check the function of the device (→ chapter 3.6). MSA recommends carrying out a routine inspection prior to each day's use.

Perform a bump test

Bump test frequency is often stipulated by national or corporate regulations; however, bump testing before each day's use is generally the accepted best safety practice and is therefore MSA's recommendation. The device must pass the bump test. If it fails the test, perform a calibration before using the device.

Perform a bump test more frequently if the device is subjected to physical shock or high levels of contaminants. Also, perform a bump test more frequently if the tested atmosphere contains the following materials, which may desensitize the combustible gas sensor and reduce its readings:

- Organic silicones
- Silicates
- Lead-containing compounds
- Hydrogen sulphide exposures over 200 ppm or exposures over 50 ppm for one minute.

Check minimum concentration of a combustible gas

The minimum concentration of a combustible gas in air that can ignite is defined as the Lower Explosive Limit [LEL]. A combustible gas reading of "XXX" indicates the atmosphere is above 100 % LEL or 5.00 % vol CH₄, and an explosion hazard exists. Move away from hazardous area immediately.

Observe atmosphere

Do not use the device to test for combustible or toxic gases in the following atmospheres as this may result in erroneous readings:

- Oxygen-deficient or oxygen-rich atmospheres
- Reducing atmospheres
- Furnace stacks
- Inert environments
- Atmospheres containing combustible airborne mists/dusts.

Use the device only to detect gases/vapours for which a sensor is installed.

The device is suitable and certified for the measurement of the oxygen concentration in gas mixtures for inertisation according to EN 50104 but without alarm function.

Make sure adequate oxygen is present for accurate combustible readings with the catalytic sensor (>10% O₂).

Not to be used for gases having a flashpoint in excess of 38 °C

Do not use the device to test for combustible gases in atmospheres containing vapours from liquids with a high flash point [above 38 °C], as this may result in erroneously low readings.

Physical shock

Recheck calibration if device is subjected to physical shock.

Sensor maintenance

Do not block sensor openings as this may cause inaccurate readings. Do not press on the face of the sensors, as this may damage them and cause erroneous readings. Do not use compressed air to clean the sensor holes, as the pressure may damage the sensors.

Observe Proper Time for Display Stabilising

Allow sufficient time for device to display accurate reading. Response times vary based on the type of sensor being utilized.

Observe proper battery maintenance

Use only battery chargers made available by MSA for use with this device; other chargers may damage the battery pack and the device. Dispose of in accordance with local health and safety regulations.

Use of the GALAXY GX2 Automated Test System is an alternate approved method for charging ALTAIR 4X devices.

Be aware of environmental conditions

A number of environmental factors may affect the sensor readings, including changes in pressure, humidity and temperature.

Pressure and humidity changes also affect the amount of oxygen actually present in the atmosphere.

Be Aware of the Procedures for Handling Electrostatically Sensitive Electronics

The device contains electrostatically sensitive components. Do not open or repair the device without using appropriate electrostatic discharge (ESD) protection. The warranty does not cover damage caused by electrostatic discharges.

Be Aware of the Product Regulations

Follow all relevant national regulations applicable in the country of use.

Be Aware of the Warranty Regulations

The warranties made by Mine Safety Appliances Company with respect to the product are voided if the product is not used and maintained in accordance with the instructions in this manual. Please protect yourself and others by following them. We encourage our customers to write or call regarding this equipment prior to use or for any additional information relative to use or service.

1.4 Warranty

ITEM	WARRANTY PERIOD
Chassis and electronics	Three years
All sensors unless otherwise specified	Three years
XCell EX-H Sensor	One year

Specific battery run-time over temperature is not warranted.

This warranty does not cover filters, fuses, etc. As the battery pack ages, there will be a reduction in useable device run time. Certain other accessories not specifically listed here may have different warranty periods. This warranty is valid only if the product is maintained and used in accordance with Seller's instructions and/or recommendations.

The Seller shall be released from all obligations under this warranty in the event repairs or modifications are made by persons other than its own or authorised service personnel or if the warranty claim results from physical abuse or misuse of the product. No agent, employee or representative of the Seller has any authority to bind the Seller to any affirmation, representation or warranty concerning this product. Seller makes no warranty concerning components or accessories not manufactured by the Seller, but will pass on to the Purchaser all warranties of manufacturers of such components.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, AND IS STRICTLY LIMITED TO THE TERMS HEREOF. SELLER SPECIFICALLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

Exclusive Remedy

It is expressly agreed that Purchaser's sole and exclusive remedy for breach of the above warranty, for any tortious conduct of Seller, or for any other cause of action, shall be the replacement at Seller's option, of any equipment or parts thereof, which after examination by Seller is proven to be defective.

Replacement equipment and/or parts will be provided at no cost to Purchaser, F.O.B. Seller's Plant. Failure of Seller to successfully replace any nonconforming equipment or parts shall not cause the remedy established hereby to fail of its essential purpose.

Exclusion of Consequential Damage

Purchaser specifically understands and agrees that under no circumstances will seller be liable to purchaser for economic, special, incidental or consequential damages or losses of any kind whatsoever, including but not limited to, loss of anticipated profits and any other loss caused by reason of nonoperation of the goods. This exclusion is applicable to claims for breach of warranty, tortious conduct or any other cause of action against seller.

2 Description

2.1 Overview

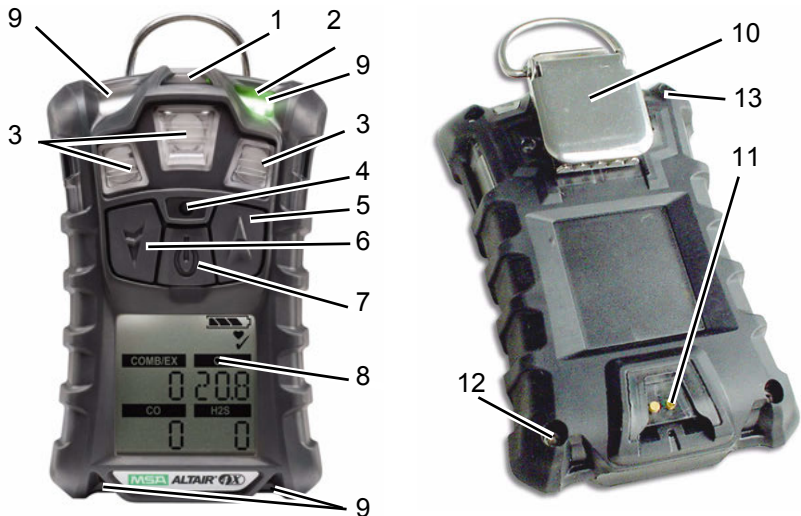



Fig. 1 Device overview

- | | | | |
|---|---|----|------------------------|
| 1 |  Communication | 8 | Display |
| 2 | Safe LED [green] and Fault LED [yellow] | 9 | Alarm LEDs [4] |
| 3 | Sensor Inlets | 10 | Belt Clip |
| 4 | Horn | 11 | Charging Connection |
| 5 | ▲ Button | 12 | Screws [4] |
| 6 | ▼ Button | 13 | Charge LED [red/green] |
| 7 | ON/OFF Button | | |

The device monitors gases in ambient air and in the workplace.

It is available with a maximum of three sensors, which can display readings for four separate gases [one Dual Toxic Sensor provides both CO and H₂S sensing capabilities in a single sensor].

The alarm levels for the individual gases are factory-set and can be changed through the Setup Menu. These changes can also be made through MSA Link soft-

ware. Ensure that the latest version of the MSA Link software has been downloaded from MSA's website www.msasafety.com.



If gas is present during Fresh Air Setup, the device will fail and enters Measure mode.

2.2 Device Hardware Interfaces

Device operation is dialog driven from the display with the aid of the three function buttons [→ Fig. 1].

The devices have three buttons for user operation. Each button can function as a "soft key", as defined directly above the button.

Button Definitions

Button	Description
ON/OFF	The ON/OFF button is used to turn device on or off and to confirm user action selections. When the ▲ button and the ON/OFF button are pressed simultaneously for device start-up, the Options Setup Mode displays.
▼	The ▼ button is used to move forward through data screens in measuring mode, or as page back and to decrease the values in set-up mode. Holding this button for 3 seconds while in Normal Measure Mode will activate the InstantAlert alarm.
▲	The ▲ button is used to reset peak, STEL TWA and acknowledge alarms [where possible] or access calibration in measuring mode. It is also used as page up or to increase the values in set-up mode.

LED Definitions

LED	Description
GREEN	The Safe LED flashes once every 15 seconds to notify the user that the device is on and operating. This option can be turned off through the MSA Link software.
RED	The red LEDs are visual indications of an alarm condition or any type of error in the device.
YELLOW	The yellow LED is a visual indication of an device fault condition. This LED will be on with the following conditions: <ul style="list-style-type: none"> - Device memory error - Sensor Missing - Sensor Error
RED/GREEN	The Charge LED is a visual indication of charge status. <ul style="list-style-type: none"> - RED: <ul style="list-style-type: none"> is charging - GREEN: complete charge

Vibrating Alarm

The device is equipped with a vibrating alarm.

Backlight

The backlight automatically activates when any button is pressed. The backlight remains on for the duration of the user-selected timeout. This on/off duration can be set through MSA Link software.

Horn

The horn provides an audible alarm.

Operating Beep

This operating beep activates every 30 seconds by momentarily beeping the horn and flashing the alarm LEDs under the following conditions:

- Operating beep is enabled
- Device is on normal Measure Gases page
- Device is not in battery warning
- Device is not in gas alarm
- Audible and visual options are enabled

2.3 On-Screen Indicators

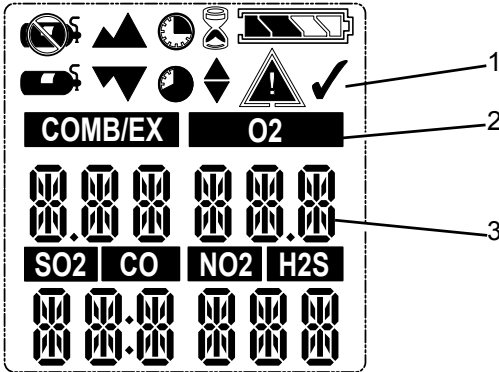


Fig. 2 Display

1 Graphic Symbols

3 Gas Concentration

2 Gas Type



Alarm Symbol – Indicates alarm state.



Motion Alert – Indicates Motion Alert is active.



Bump Check Symbol – Indicates successful bump or cal.



Indicates required interaction.



Battery Condition – Indicates the battery charge level.



Sensor Labels.








Cal Gas Cylinder – Indicates cal gas must be applied.



No Gas Cylinder – Indicates cal gas should not be applied and device must be exposed to fresh air.



Hourglass – Indicates user should wait.

	Minimum – Indicates a minimum value or low alarm.
	PEAK Symbol – Indicates a PEAK reading or high alarm.
	STEL Symbol – Indicates a STEL alarm.
	TWA Symbol – Indicates a TWA alarm.
	Sensor life Symbol – Indicates the end of sensor life

2.4 Battery Care

Battery Life Indicator

The battery condition icon is continuously displayed in the upper right-hand corner of the display. As the battery is depleted, battery icon segments blank until only the battery icon outline remains.

Each indicator segment represents approximately 25 % of the total battery capacity.

Battery Warning



Attention!

If battery warning alarm activates, stop using the device as it no longer has enough power to indicate potential hazards, and persons relying on this product for their safety could sustain serious personal injury or death.

The nominal run-time of the device at room temperature is 24 hours. Actual run-time will vary depending on ambient temperature and alarm conditions. The runtime of the device at -20 °C will be approximately 14 hours.

The alarm levels for the individual gases are factory-set and can be changed through the Setup Menu.

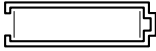
A Low Battery Warning indicates that a nominal 30 minutes of operation remain before the battery's charge is depleted.



The duration of remaining device operation during a Low Battery Warning depends on ambient temperatures.

When the device goes into Low Battery Warning, the:

- battery life indicator flashes
- alarm sounds
- alarm LEDs flash
- display shows "Low Batt" and



- device repeats this warning every 60 seconds and continues to operate until it is turned off or battery shutdown occurs.

Battery Shut Down



Attention!

If battery alarm displays, stop using the device as it no longer has enough power to indicate potential hazards, and persons relying on this product for their safety could sustain serious personal injury or death.

The device goes into battery shutdown mode 60 seconds before final shutdown [when the batteries can no longer operate the device]:

- On the display flashes "Low Batt" and



- Alarm sounds and lights flash; alarm cannot be silenced,
- No other pages can be viewed; after approximately one minute, the device automatically turns off.

When battery shutdown condition occurs:

- (1) Leave the area immediately.
- (2) Recharge the battery.

Battery Charging



Warning!

Risk of explosion: Do not recharge device in hazardous area.



Attention!

Use of any charger, other than the charger supplied with the device, may damage or improperly charge the batteries.

The charger is capable of charging a completely depleted pack in less than four hours in normal, room-temperature environments.



Allow very hot or cold devices to stabilise for one hour at room temperature before attempting to charge.

- Minimum and maximum ambient temperature to charge the device is 10 °C and 35 °C, respectively.
- For best results, charge the device at room temperature [23 °C].

To Charge the Device

- Firmly insert the device into the charging cradle.
- The battery symbol will scroll through a progressively increasing number of segments and the charge LED will be red until 90 % of full charge has been obtained. Then the battery symbol will remain fully illuminated and the charge LED will be green while the battery is trickle charged to its full capacity.
- If a problem is detected during charging, the battery symbol will flash and the charge LED will be orange. Remove, then replace the device in the charging cradle to reset the charge cycle.

2.5 Viewing Optional Displays

The Main Screen appears at device turn-on.

Optional displays can be viewed by pressing the ▼ button to move to:

Bump Mode

- (1) To select the Bump mode, press the **ON/OFF** button.
- (2) To move forward, press the ▼ button.
- (3) To move backward to the Main page, press the ▲ button.

Peak Readings [PEAK page]

The peak icon [→ chapter 2.3] shows the highest levels of gas recorded by the device since turn-on or since peak readings were reset.

To reset the peak readings:

- (1) Access the PEAK page.
- (2) Press the ▲ button.

Minimum Readings [MIN page]

This page shows the lowest level of oxygen recorded by the device since turn-on or since the MIN reading was reset.

The minimum icon [→ chapter 2.3] appears on the display.

To reset the MIN reading:

- (1) Access the MIN page.
- (2) Press the ▲ button.

Short Term Exposure Limits [STEL page]**Attention!**

If the STEL alarm activates, leave the contaminated area immediately; the ambient gas concentration has reached the preset STEL alarm level. Failure to follow this warning will cause over-exposure to toxic gases and persons relying on this product for their safety could sustain serious personal injury or death.

The STEL icon [→ chapter 2.3] appears on the display to show the average exposure over a 15 minute period.

When the amount of gas detected by the device is greater than the STEL limit:

- Alarm sounds
- Alarm LEDs flash
- STEL icon flashes.

To reset the STEL:

- (1) Access the STEL page.
- (2) Press the ▲ button.

The STEL alarm is calculated over a 15 minute exposure.

STEL calculation examples:

Assume the device has been running for at least 15 minutes:

15 minute exposure of 35 ppm:

$$\frac{[15 \text{ minutes} \times 35 \text{ ppm}]}{15 \text{ minutes}} = 35 \text{ ppm}$$

10 minute exposure of 35 ppm and 5 minutes exposure of 5 ppm:

$$\frac{[10 \text{ minutes} \times 35 \text{ ppm}] + [5 \text{ minutes} \times 5 \text{ ppm}]}{15 \text{ minutes}} = 25 \text{ ppm}$$

Time Weighted Average [TWA page]



Attention!

If the TWA alarm activates, leave the contaminated area immediately; the ambient gas concentration has reached the preset TWA alarm level. Failure to follow this warning will cause over-exposure to toxic gases and persons relying on this product for their safety could sustain serious personal injury or death.

The TWA icon [→ chapter 2.3] appears on the display to show the average exposure since the device was turned on or since the TWA reading was reset. When the amount of gas detected is greater than the eight-hour TWA limit:

- Alarm sounds
- Alarm LEDs flash
- TWA icon flashes.

To reset the TWA:

- (1) Access the TWA page.
- (2) Press the ▲ button.

The TWA alarm is calculated over an eight-hour exposure.

TWA calculation examples:

1 hour exposure of 50 ppm:

$$\frac{[1 \text{ hour} \times 50 \text{ ppm}] + [7 \text{ hours} \times 0 \text{ ppm}]}{8 \text{ hours}} = 6.25 \text{ ppm}$$

4 hour exposure of 50 ppm and 4 hour exposure of 100 ppm:

$$\frac{[4 \text{ hours} \times 50 \text{ ppm}] + [4 \text{ hours} \times 100 \text{ ppm}]}{8 \text{ hours}} = 75 \text{ ppm}$$

12 hour exposure of 100 ppm:

$$\frac{[12 \text{ hours} \times 100 \text{ ppm}]}{8 \text{ hours}} = 150 \text{ ppm}$$

Time Display

Current time appears on the display in a 12 hour format by default. A 24-hour format can be selected using MSA Link.

Date Display

Current date appears on the display in the format: **MMM-DD-YYYY**.

Last cal page

Displays the device last successful calibration date in the format: **MMM-DD-YYYY**

Cal due page

Displays the days until the device's next calibration is due [user selectable].

Motion Alert Activation

To activate or deactivate the Motion Alert feature, press the ▲ button while the Motion Alert Activation page is displayed. When the Motion Alert feature is active, the Motion Alert symbol [→ chapter 2.3] will flash every 3 seconds. The device will enter pre-alarm when no motion is detected for 20 seconds. This condition can be cleared by moving the device.

After 30 seconds of inactivity, the full Motion Alert alarm is triggered. This alarm can only be cleared by pressing the ▲ button.

2.6 Sensor Missing Alarm

The device enters the Sensor Missing alarm if the device detects the sensor is not properly installed in the device or is not functional.

If a sensor is detected as missing, the following occurs:

- "SENSOR ERROR" displays
- The flag above the sensor detected as missing flashes on the display
- Alarm sounds and lights flash.
- Yellow Fault LED is on solid.
- If there is a sensor error at startup, the device shuts off in 60 seconds.

2.7 Sensor End of Life Warning

If a sensor is nearing its end of life, the device will warn the user following a sensor calibration. The sensor is still fully functional at this point, but the warning gives the user time to plan for a replacement sensor and minimise downtime. The ♥ symbol will be continuously displayed. For more details see chapter 3.9.

2.8 Sensor End of Life Indicator

If the device cannot calibrate one or more sensors, the device will display "SPAN ERR" followed by the Alarm symbol and ♥ symbol to indicate end of sensor life. For more details see chapter 3.9.

2.9 Monitoring Toxic Gases

The device can monitor the concentration of the following toxic gases in ambient air:

- Carbon Monoxide [CO]
- Hydrogen Sulphide [H₂S]

The device displays the gas concentration in parts per million [PPM] or mg/m³ on the Measuring page until another page is selected or the device is turned off.



Attention!

If an alarm is triggered while using the device, leave the area immediately.

Remaining in the area under such circumstances can cause serious personal injury or death.

The device has four gas alarms:

- HIGH Alarm
- LOW Alarm
- STEL Alarm
- TWA Alarm

If the gas concentration reaches or exceeds the alarm set point, the device:

- backlight turns on
- provides a vibrating alarm
- displays and flashes the Alarm symbol and either the Minimum icon [LOW alarm] or the Maximum [PEAK] icon [HIGH alarm]
- enters an alarm state.

2.10 Monitoring Oxygen Concentration

The device monitors the oxygen concentration in ambient air. The alarm set points can be set to activate on two different conditions:

- Enriched - oxygen concentration > 20.8 vol. % or
- Deficient - oxygen concentration < 19.5 vol. %.



Attention!

If an alarm is triggered while using the device, leave the area immediately.

Remaining in the area under such circumstances can cause serious personal injury or death.

When the alarm set point is reached for either of the above conditions:

- an alarm sounds
- alarm LEDs flash
- a vibrating alarm triggers
- device displays and flashes the Alarm icon and either the Minimum icon [Enriched alarm] or the Maximum icon [Deficient alarm] [→ chapter 2.3] along with the corresponding oxygen concentration.



The LOW alarm [oxygen deficient] is latching and will not automatically reset when the O₂ concentration rises above the LOW set point. To reset the alarm press the ▲ button. If the alarm condition still exists, the ▲ button only silences the alarm for five seconds.

False oxygen alarms can occur due to changes in barometric pressure [altitude] or extreme changes in ambient temperature.

It is recommended that an oxygen calibration be performed at the temperature and pressure of use. Be sure that the device is in known fresh air before performing a calibration.

2.11 Monitoring Combustible Gases

The device can monitor these concentrations in ambient air:

- Methane
- Combustible gases

The device displays the gas concentration in % LEL or % CH₄ on the Measuring page until another page is selected or the device is turned off.



Attention!

If an alarm is triggered while using the device, leave the area immediately.

Remaining in the area under such circumstances can cause serious personal injury or death.

The device has two alarm set points:

- HIGH Alarm
- LOW Alarm

If the gas concentration reaches or exceeds the alarm set point, the device:

- backlight turns on
- a vibrating alarm triggers
- displays and flashes the Alarm symbol and either the Minimum icon [LOW alarm] or the Maximum [PEAK] icon [HIGH alarm]
- enters an alarm state.



When gas reading exceeds 100% LEL CH₄, the device enters a Lock Alarm state, the combustible sensor shuts down and displays “xxx” in place of the actual reading. This state can only be reset by turning the device off and on in a fresh air environment.

**Attention!**

A combustible gas reading of “100” indicates the atmosphere is above 100% LEL CH₄ and an explosion hazard exists. Move away from contaminated area immediately.

In such cases, the device LockAlarm feature activates.



Check your national standard values for 100 % LEL [EN60079-20-1].

3 Operation

3.1 Environmental Factors

A number of environmental factors may affect the gas sensor readings, including changes in pressure, humidity and temperature. Pressure and humidity changes affect the amount of oxygen actually present in the atmosphere.

Pressure Changes

If pressure changes rapidly [e.g., stepping through airlock], the oxygen sensor reading may temporarily shift and possibly cause the detector to alarm. While the percentage of oxygen may remain at or near 20.8 Vol %, the total amount of oxygen present in the atmosphere available for respiration may become a hazard if the overall pressure is reduced by a significant degree.

Humidity Changes

If humidity changes by any significant degree [e.g., going from a dry, air conditioned environment to outdoor, moisture laden air], oxygen readings can be reduced by up to 0.5 %, due to water vapour in the air displacing oxygen.

The oxygen sensor has a special filter to reduce the effects of humidity changes on oxygen readings. This effect will not be noticed immediately, but slowly impacts oxygen readings over several hours.

Temperature Changes

The sensors have built-in temperature compensation. However, if temperature shifts dramatically, the sensor reading may shift. Zero the device at the work site temperature for the least effect.

3.2 Turning on the Device

For more information, see the flow charts in [→ chapter 7].

- Turn the device on with the **ON/OFF** button.

The device performs a self test and then goes to Fresh Air Setup:

- all display segments are activated
- audible alarm sounds
- alarm LEDs light
- vibrating alarm is activated.

During the self test, the device checks for missing sensors. In the case of a missing sensor, the device displays the Sensor Missing screen and alarms until it is turned off. Otherwise, the turn-on sequence continues.

The device displays:

- Alarm & display self test
- Manufacturer name
- Device name
- Software version
- Sensor discovery
- Combustible gas type
- Toxic gas units
- Alarm set points [PEAK, MIN] [STEL, TWA]
- Calibration values
- Date and time display
- Last cal date [if activated]
- CAL due date [if activated]
- Fresh Air Setup option.

Screen Displays during Startup

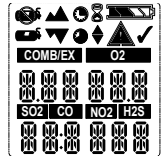


During the startup sequence, all automatic page display timeouts are preset to a range from two to four seconds.

Several sequences and screens occur during start up:

Device Self Test

The device performs a self test.



Device Name and Software version

Software version and device name display.



Combustible Gas Type

Name of Combustible Gas Type displays, e.g. BUTANE.

NOTE: Combustible gas type can be changed manually through the SENSOR SETUP menu or the MSA Link software.



Toxic Gas Units

Name of Toxic Gas Units displays [ppm or mg/m³].

NOTE: Toxic units can only be modified through the MSA Link software.

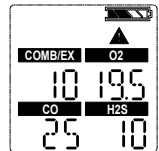


Alarm Set points

Alarm set points for all installed and activated sensors display.

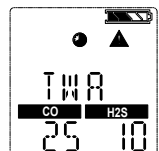
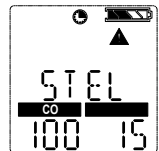
LOW alarm set points display, followed by HIGH alarm set points.

NOTE: Alarm set points can be changed manually through the Setup menu or the MSA Link software.



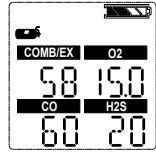
STEL and TWA Set points

The preset STEL and TWA values for installed and activated sensors display.



Calibration Values

The preset calibration values for installed and activated sensors display.



Time and Date

The date displays in a month, day and year format.

NOTE: In the event that the battery is fully discharged, the time and date reset. At startup, the user is prompted to enter the time and date.

If the time and date information is missing, they are reset to [Jan-01-2008] with time stamp [00:00].



Last CAL Date and CAL Due

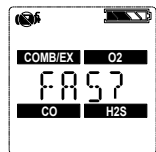
NOTE: These display options can be set by MSA Link software. If these options are not set, these screens are not displayed.

- By default Last Cal is activated.
- By default Cal Due is deactivated.



Fresh Air Setup [FAS]

The FAS screen is prompted.



Fresh Air Setup (FAS)

The FAS is for automatic Zero calibration of the device.

The Fresh Air Setup has limits. The zero of any sensor that is outside of these limits will not be adjusted by the FAS command.

**Warning!**

Do not activate the Fresh Air Setup unless you are certain you are in fresh, uncontaminated air; otherwise, inaccurate readings can occur which can falsely indicate that a hazardous atmosphere is safe. If you have any doubts as to the quality of the surrounding air, do not use the Fresh Air Setup feature. Do not use the Fresh Air Setup as a substitute for daily calibration checks. The calibration check is required to verify span accuracy. Failure to follow this warning can result in serious personal injury or death.



If a battery charging cycle is interrupted before it is completed [4 hours for a fully discharged battery], allow the device's internal temperature to stabilize for 30 minutes before performing a Fresh Air Setup.

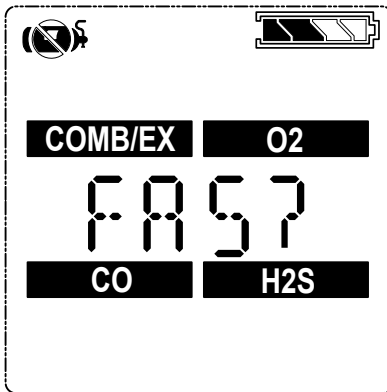


Fig. 3 Fresh Air Setup

If this option is enabled, the device displays "FAS?", prompting the user to perform a Fresh Air Setup.

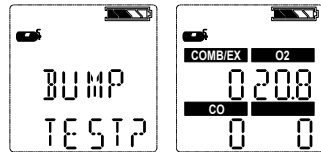
- (3) Press the ▲ button to bypass the Fresh Air Setup.
 - ▷ The Fresh Air Setup is skipped and the device goes to the Measuring page [Main page].
- (4) Press the **ON/OFF** button within 10 seconds to perform the Fresh Air Setup.
 - ▷ The device starts the FAS.
 - ▷ The screen shows a No Gas Symbol, a blinking hourglass, and all enabled gas sensor readings.
 - ▷ At the end of the FAS Calibration, the device displays "FAS OK" or "FAS ERR". along with the flags of the sensors that were outside of the FAS limits. All sensors that are within the FAS limits will be zeroed.

3.3 Measurement Mode [Normal Operation]

In Normal Operation mode, the user can check the Minimum and Peak readings prior to clearing the STEL and TWA values or performing a Span and Zero Calibration. The following options pages can be executed from the Normal Operation screen:

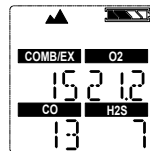
Bump Page

This page allows the user to perform a bump check.



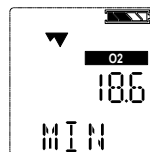
Peak Page

This page shows the peak readings for all sensors.



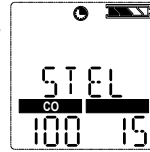
Min Page

This page shows the minimum reading for the oxygen sensor.

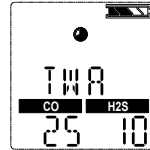


STEL Page

This page shows the calculated STEL readings of the device.

**TWA Page**

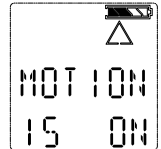
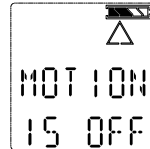
This page shows the calculated TWA readings of the device.

**Time / Date Page**

This page shows actual time and date settings of the device.

**Motion Alert [optional]**

This page allows the Motion Alert Feature to be activated or deactivated.



Using the three device buttons, the user can navigate through each sub-menu in a top/down sequence.

Refer to chapter 2.5 and in the appendix for detailed instructions on navigating through these screens.

3.4 Device Setup

The setup menus can be accessed only when the device is turned on while pressing and holding the ▲ button.

This mode can only be activated at device turn-on.

The operation is as follows:

- (1) Press and hold the ▲ button while turning the device on.
 - Use the ▲ and ▼ buttons to enter the setup password.
The default password is "672".
- (2) Press **ON/OFF** button to enter the setup menus.
 - Incorrect password: device enters the Measure mode.
 - Correct password: device continues/beeps three times.



The password can be changed through the MSA Link software.

In the Setup mode:

- Press the **ON/OFF** button to store chosen value or go to the next page.
- Press ▲ button to increase values by one or toggle a selection on or off.
- Press and hold ▲ button to increase values by 10.
- Press ▼ button to decrease values by one or toggle a selection on or off.
- Press and hold ▼ button to decrease values by 10.

The following options are available by pressing the ▼ and ▲ buttons:

- Sensor Setup [SENSOR SETUP]
- Calibration Setup [CAL SETUP]
- Alarm Setup [ALARM SETUP]
- Setup Time and Date [TIME SET]
- EXIT

Sensor Setup

Each sensor can be turned on or off.

For more information, see the flow charts in [→ chapter 8.5].

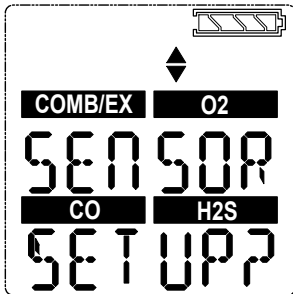


Fig. 4 Sensor Setup

- (1) To bypass this setup, press the ▼ or ▲ button; otherwise, continue as follows.
- (2) Press the **ON/OFF** button to enter the submenu.
- (3) Use the ▼ or ▲ button to change the option and confirm with the **ON/OFF** button.
- (4) Repeat this procedure for all other sensors.
- (5) After setting the last sensor, continue to Calibration Setup.

Calibration Setup

The user can change and set the calibration values for each sensor.

It is also possible to select whether the Cal Due screen is displayed and set the number of days until the next calibration is due.

For more information, see the flow charts in [→ chapter 8.5].

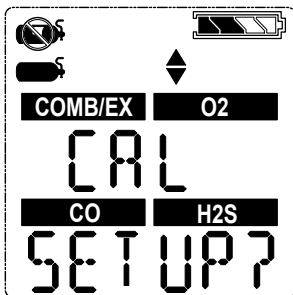


Fig. 5 Calibration Setup

- (1) To bypass this setup, press the ▼ or ▲ button; otherwise, continue as follows.
- (2) Press the **ON/OFF** button to enter the submenu.
 - ▷ The calibration gas concentration of the first sensor is shown.
- (3) Press the ▼ or ▲ button to change the value.
- (4) Press the **ON/OFF** button to store the value.
 - ▷ Setup screen for the next sensor is displayed.
- (5) Repeat the procedure for all other sensors.
 - ▷ After setting the last sensor, the user is prompted to set CALDUE.
- (6) Press the ▼ or ▲ button to enable or disable CALDUE.

Press the **ON/OFF** button to confirm the selection.
- (7) If CALDUE is set on, press the ▼ or ▲ button to select the number of days
- (8) Confirm with the **ON/OFF** button.
- (9) After confirmation, continue to Alarm setup.

Alarm Setup

The user can switch all alarms on or off and change the alarm set points for each sensor.

For more information, see the flow charts in [→ chapter 8.9].

See chapter 5.1 for alarm adjustment limits. The value of the High Alarm can only be set to a value that is higher than the Low Alarm set point.

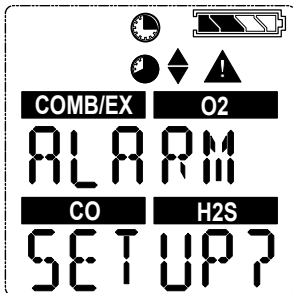


Fig. 6 Alarm Setup

- (1) To bypass this setup, press the ▼ or ▲ button; otherwise, continue as follows.
- (2) Press the **ON/OFF** button to enter the submenu.
- (3) Set alarms on or off by pressing the ▼ or ▲ button.
- (4) Press the **ON/OFF** button to confirm the selection.
 - ▷ LOW ALARM settings for the first sensor display.

- (5) Press the ▼ or ▲ button to change the value.
 - (6) Press the **ON/OFF** button to store the value.
 - ▷ HIGH ALARM settings for the first sensor display.
 - (7) Press the ▼ or ▲ button to change the value.
 - (8) Press the **ON/OFF** button to store the value.
 - ▷ STEL ALARM settings [for toxic sensors only] display.
 - (9) Press the ▼ or ▲ button to change the value.
 - (10) Press the **ON/OFF** button to store the value.
 - ▷ TWA ALARM settings [for toxic sensor only] for display.
 - (11) Press the ▼ or ▲ button to change the value.
 - (12) Press the **ON/OFF** button to store the value.
 - (13) Repeat the procedure for all other sensors.
 - (14) After setting the last sensor, continue to Time and Date setup.
60% L.E.L. or 3.0% volume of methane is the maximum High Alarm set point that can be programmed.
- The alarm can be silenced momentarily by pressing the ▲ button. However, if the gas concentration causing the alarm is still present, the device will go back into alarm.

Setup Time and Date

This submenu is for setting date and time.

For more information, see the flow charts in [→ chapter 8.10].

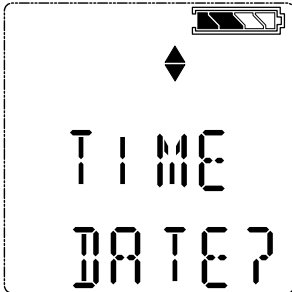


Fig. 7 Date and Time Setup

- (1) To bypass this setup, press the ▼ or ▲ button; otherwise, continue as follows.
- (2) Press the **ON/OFF** button to enter the submenu.
- (3) Set month by pressing the ▼ or ▲ button.
- (4) Press the **ON/OFF** button to confirm month.
- (5) Repeat this procedure for day, year, hours and minutes.
 - ▷ By default, time is displayed in 12 hour format.
 - ▷ The **EXIT** screen will be displayed next.
- (6) Confirming this screen with the **ON/OFF** button exits the device setup.
 - ▷ If the sensors have not warmed up yet, the countdown is displayed.
 - ▷ The device then goes to Measuring mode.

3.5 Data Logging

Connecting device to PC

- (1) Switch on the device and align the Datalink Communication port on the device to the IR interface of the PC.
- (2) Use the MSA Link software to communicate with the device.
See MSA Link documentation for detailed instructions.

3.6 Function Tests

Alarm Test

- Turn on the device. Verify that:
 - all LCD segments are activated momentarily
 - alarm LEDs flash
 - horn sounds briefly
 - vibrating alarm triggers briefly.

3.7 Safe LED

The device is equipped with a green Safe LED. This green Safe LED flashes every 15 seconds under the following conditions:

- the SAFE LED feature is enabled
- device is in Measurement Mode [Normal Operation]
- combustible reading is 0% LEL or 0.00% CH₄
- Oxygen [O₂] reading is 20.8%
- Carbon Monoxide [CO] reading is 0 ppm or mg/m³
- Hydrogen Sulphide [H₂S] reading is 0 ppm or 0 mg/m³
- no gas alarms are present [low or high]
- device is not in Low Battery warning or alarm
- CO, H₂S, STEL and TWA readings are 0 ppm or 0 mg/m³.

3.8 Bump Test



Attention!

Perform a Bump Test to verify proper device operation. Failure to perform this test can result in serious personal injury or death.

Bump test frequency is often stipulated by national or corporate regulations; however, bump testing before each day's use is generally the accepted best safety practice and is therefore MSA's recommendation.

This test quickly confirms that the gas sensors are functioning. Perform a full calibration periodically to ensure accuracy and immediately if the device fails the Bump Test. The Bump Test can be performed using the procedure below or automatically using the GALAXY GX2 Test Stand.

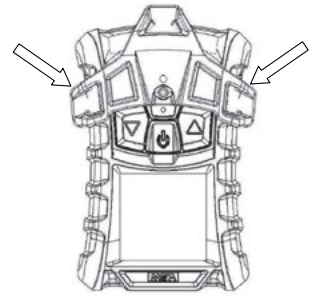
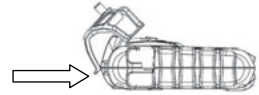
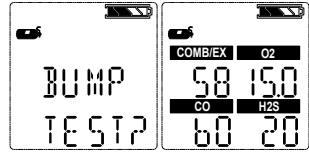
Equipment

See accessory section for ordering information for these components.

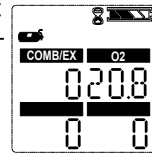
- Calibration Check Gas Cylinder
- 0.25 liters/min. Flow Regulator
- 1/8" ID Superthane Ester Tubing
- Calibration Cap

Performing a Bump Test

- (1) Connect the regulator to the Calibration Check Gas Cylinder.
- (2) From the normal measure screen press the ▼ button to display "BUMP TEST?".
- (3) Verify the gas concentrations displayed match the Calibration Check Gas Cylinder. If they do not, adjust the values through the Calibration Setup menu.
- (4) Open the pressure reducer valve on test gas cylinder.

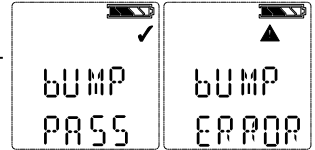


- (5) Press the **ON/OFF** button to start the bump test then open the valve on the regulator. The hour-glass will flash and the sensors will respond to the gas.



- (6) Close the valve after bump testing.

After the Bump Test completes, the device momentarily displays "BUMP PASS" or "BUMP ERROR" along with the label of any sensor that failed before returning to Measure mode. If the device fails the Bump Test, perform a calibration as described in chapter 3.9.



The ✓ symbol will be displayed in the Measure mode for 24 hours after a successful Bump Test.

3.9 Calibration

The device can be calibrated either manually using this procedure or automatically using the GALAXY GX2 Test Stand.

Calibration must be performed using a flow regulator with a flow rate set to 0.25 litres per minute.

If a battery charging cycle is interrupted before it is completed [4 hours for a fully discharged battery], allow the device's internal temperature to stabilise for 30 minutes before performing a Calibration.



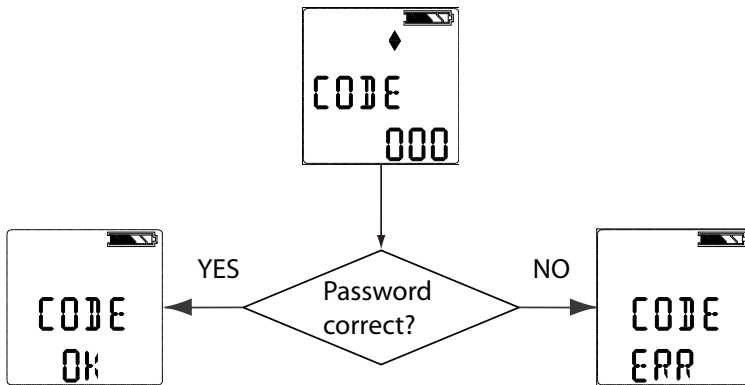
Under normal circumstances MSA recommends calibration at least every six months, however, many European countries have their own guidelines. Please check your national legislation.

Fresh Air Setup and Zero Calibration



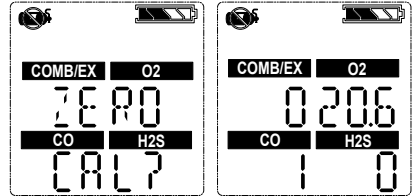
To skip the Zero procedure and move directly to the Calibration Span procedure, push the ▲ button. If no button is pushed for 30 seconds, the device prompts user to perform a Span calibration before returning to the Normal Operation mode.

- (1) Press and hold the ▲ button in Normal Operation mode for three seconds.
- (2) If calibration lockout option is selected, enter password.
 - ▷ ZERO screen is then displayed.



- If calibration lockout option is NOT selected:

▷ ZERO screen displays.

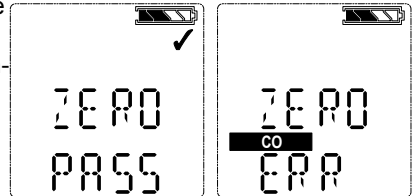


- (3) With the device exposed to fresh air, press the **ON/OFF** button to confirm the ZERO screen. A sensor refresh and Zero Calibration will occur.



Alternatively press the ▲ button to execute a Fresh Air setup [FAS]. See chapter 3.2 for more details.

After Zero calibration completes, the device momentarily displays “ZERO PASS” or “ZERO ERR” along with the flag of any sensor that failed.



During instrument zero calibration the O₂ sensor is also span calibrated to 20.8% O₂ fresh air, adjusting the calibration curve as needed. During instrument span calibration, the O₂ sensor's accuracy is checked against a known oxygen gas concentration without adjusting the calibration curve.

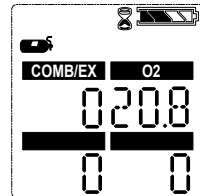
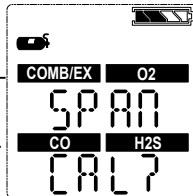
Span Calibration



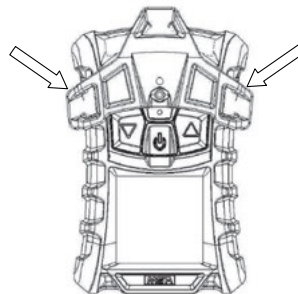
To skip the Span procedure, push the ▲ button.

If no button is pushed for 30 seconds, the device returns to the Measuring mode.

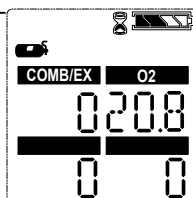
- (1) Once the Zero is set, the *SPAN* screen displays.
- (2) Connect the regulator to the Calibration Check Gas Cylinder.
- (3) Connect the appropriate calibration gas to the device.
- (4) Attach the calibration cap to the device.



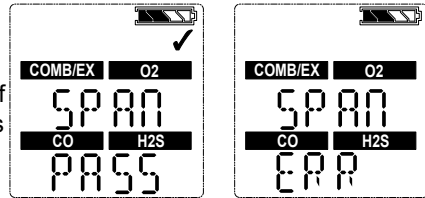
- ▷ Insert tab on calibration cap into slot on device.
- ▷ Press calibration cap as shown until it seats onto device.
- ▷ Press both side tabs down onto device until they snap in to.
- ▷ Ensure that the calibration cap is properly seated.
- ▷ Connect one end of the tubing to the calibration cap.
- ▷ Connect other end of tubing to the cylinder regulator [supplied in the calibration kit].



- (5) Open the pressure reducer valve on test gas cylinder.
- (6) Press the **ON/OFF** button to calibrate [*span*] the device.
 - ▷ LEDs flash
 - ▷ *SPAN* calibration starts.
- (7) Close the valve after *SPAN* calibration.



- After the SPAN calibration completes, the device momentarily displays "SPAN PASS" or "SPAN ERR" along with the label of any sensor that failed then returns to the Measuring mode.



If a sensor is nearing its end of life, this "SPAN PASS" indication will be followed by the end of sensor life warning [♥ symbol]. The ♥ symbol, along with the gas type of the sensor nearing its end of life, will blink for 15 seconds when the device returns to measure mode. When in measure mode, the ♥ symbol is continuously displayed.

Finishing Calibration

- (1) Close the valve on the regulator.
- (2) Remove the calibration cap.

The calibration procedure adjusts the span value for any sensor that passes the calibration test; sensors that fail calibration are left unchanged. Since residual gas may be present, the device may briefly go into an exposure alarm after the calibration sequence is completed.

Autocalibration Failure

Span calibration is unsuccessful:

- If the instrument cannot calibrate one or more sensor(s), it goes to the SPAN ERR page and remains in alarm until the ▲ button is pressed.
- A sensor life indicator is displayed [Alarm symbol and ♥ symbol] to show the sensor has reached its end of life and should be replaced.
This occurs if the span calibration is unsuccessful twice.
- The device will remain in alarm state until the ▲ button is pressed.
- The Alarm symbol and ♥ symbol will remain on the display until a successful calibration or sensor in question is replaced.



A span calibration can fail for many reasons besides sensor at the end of his life. If a span calibration failure occurs, items such as remaining gas in the calibration cylinder, gas expiration date, security of the calibration cap, etc. should be verified and calibration should be repeated prior to replacing the sensor.

4 Maintenance

If an error occurs during operation, use the displayed error codes to determine appropriate next steps. The device should be regularly checked and maintained by qualified personnel.



Warning!

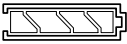




Repair or alteration of the device beyond the procedures described in this manual or by anyone other than a person authorised by MSA, could cause the unit to fail to perform properly. Use only genuine MSA replacement parts when performing any maintenance procedures described in this manual.

Substitution of components can seriously impair performance of the unit, alter intrinsic safety characteristics or void agency approvals. Failure to follow this warning can result in serious personal injury or death.



Refer to EN 60079-29-2 [Guide for the selection, installation, use and maintenance of apparatus for the detection and measurement of combustible gases or oxygen] and EN 45544-4 [Guide for the selection, installation, use and maintenance of electrical apparatus used for the direct detection and direct concentration measurement of toxic gases and vapours].

4.1 Troubleshooting

Problem	Description	Reaction
ERROR TEMP	Temperature is below -40°C or above 75°C.	Return device to normal temperature range and recalibrate. Contact MSA
ERROR EE	EEPROM Memory error	Contact MSA
ERROR PRG	Flash Memory error	Contact MSA
ERROR RAM	RAM Memory error	Contact MSA
ERROR UNK	Unknown error	Contact MSA
 LOW BATT	Battery warning repeats every 60 seconds.	Remove from service as soon as possible and recharge battery
 BATT ALARM	Battery is completely discharged.	Device is no longer sensing gas. Remove from service and recharge battery.
ERROR CHARGE	Charge error	Device must be between 10° C and 36° C to charge. Contact MSA if problem persists
SENSOR ERROR	Missing Sensor	Verify if sensor is properly installed
Device does not turn on	Low battery	Charge device
	Sensor warning	Sensor is near the end of its life
 & 	Sensor alarm	Sensor has reached the end of its life and cannot be calibrated. Replace sensor and recalibrate.

4.2 Live Maintenance Procedure - Replacing and Adding a Sensor



Warning!

Remove and reinstall sensors carefully, ensuring that the components are not damaged; otherwise device intrinsic safety may be adversely affected, wrong readings could occur, and persons relying on this product for their safety could sustain serious personal injury or death.



Attention!

Before handling the PC board, ensure you are properly grounded; otherwise, static charges from your body could damage the electronics. Such damage is not covered by the warranty. Grounding straps and kits are available from electronics suppliers.

To add a sensor to an device that is not already equipped with a full array of sensors, remove the sensor plug from in front of the formerly unused sensor housing.



While device case is open, do not touch any internal components with metallic/conductive objects or tools.

Damage to the device can occur.

- (1) Verify that the device is turned off.
- (2) Remove the four case screws, and remove the case front while carefully noting the orientation of the sensor gasket.
- (3) Gently lift out and properly discard the sensor to be replaced.
 - ▷ Using fingers only, gently remove the toxic, combustible, or oxygen sensor by gently rocking it while pulling it straight from its socket.
- (4) Carefully align the new sensor contact pins with the sockets on the printed circuit board and pressing it firmly in place.
 - ▷ Ensure tab on sensor aligns with groove at top of holder.
 - ▷ Insert the toxic sensor by placing it in the left-hand position of the sensor holder.
 - ▷ Insert the O₂ sensor by placing it in the right-hand position of the sensor holder.
 - ▷ Insert the combustible sensor by placing it in the middle position of the sensor holder.
 - ▷ If any sensor is not to be installed, ensure that a sensor plug is installed properly in its place.

- (5) Reinstall the case front.
- (6) Re-install the screws.
- (7) Turn on the device.

<p>If the sensor replaced is the same as the previous sensor:</p>	<p>If the sensor replaced is not the same as the previous sensor or this sensor channel was deactivated:</p>
<ul style="list-style-type: none"> - The device starts up normally. - The device automatically senses that a new sensor is installed and displays the "SENSOR DSCVRY" screen. 	<ul style="list-style-type: none"> - The device automatically senses the difference and displays "SENSOR CHANGE". - "ACCEPT?" appears on the display.
	<ul style="list-style-type: none"> ▷ Accept the change with ▼ button or reject with ▲ button. ▷ Go into the sensor setup and turn on the appropriate sensor (→ chapter 3.4).

- (8) Calibrate the device after the sensors have stabilised.



Danger!

Calibration is required after a sensor is installed; otherwise, the device will not perform as expected and persons relying on this product for their safety could sustain serious personal injury or death.



Allow sensors to stabilise at room temperature for at least 30 minutes before calibration (→ chapter 3.9).

4.3 Cleaning

Clean the exterior of the device regularly using only a damp cloth. Do not use cleaning agents as many contain silicones which will damage the combustible sensor.

4.4 Storage

When not in use, store the device in a safe, dry place between 18 °C and 30 °C. After storage, always recheck device calibration before use.

4.5 Scope of Delivery

Pack the device in its original shipping container with suitable padding. If the original container is unavailable, an equivalent container may be substituted.

5 Technical Data

Weight	224 g (device with battery and clip)
Dimensions (L x W x H)	112 x 76 x 33 mm – without fastening clip
Alarms	Four gas alarm LEDs, a charge status LED, an audible alarm and a vibrating alarm
Volume of audible alarm	95 dBA at 30 cm typical
Display	LCD display
Battery type	Rechargeable Li polymer battery. Li polymer battery must not be charged in Ex area.
Device run time	24 hours at 25 °C
Charging time	≤ 4 hours The maximum safe area charging voltage $U_m = 6.7$ VDC
Warm up time	2 min
Temperature range	-20°C to 60°C For measuring Carbon Monoxide & Hydrogen Sulfide -20°C to 60°C For measuring Oxygen, Methane, Propane, Pentane & Hydrogen - ATEX Certified Performance -40°C to 60°C For intrinsic safety 10 °C to 35 °C while charging battery
Humidity range	15 % – 90 % relative humidity, non-condensing, 5 % – 95 % RH intermittent
Atmospheric pressure range	800 to 1200 mbar
Ingress protection	IP 67
Measuring methods	Combustible gases: Catalytic sensor Oxygen: Electrochemical sensor Toxic gases: Electrochemical sensor

	Combustible	O ₂ *	CO	H ₂ S
Measuring range	0-100% LEL	0-30% Vol.	0-1999 ppm	0-200 ppm
	0-5.00% Vol.CH ₄		0-1999 mg/m ³	0-284 mg/m ³
	H ₂ S-LC	NO ₂	SO ₂	
	0-100 ppm	0-50 ppm	0-20 ppm	

* Certified for 0 - 25 vol.% O₂

The technical and performance specifications for the specialised EX-H and EX-M sensor are the same as for the standard EX sensor.



The ppm to mg/m³ conversion is calculated at 20° C and at atmospheric pressure.

5.1 Factory-set Alarm Thresholds and Setpoints



Check the monitor or calibration certificate for exact alarm levels as they vary depending on national regulations.

Sensor	LOW alarm	HIGH alarm	STEL	TWA
Ex	10 % LEL	20 % LEL	--	--
EX-H	10 % LEL	20 % LEL	--	--
EX-M (%vol)	0.5	1.0	--	--
H ₂ S-LC (ppm)	5	10	10	1
NO ₂ (ppm)	2	5	5	2
SO ₂ (ppm)	2	5	5	2
O ₂ (%)	19.5	23.0	--	--
CO (ppm)	25	100	100	25
H ₂ S (ppm)	10	15	15	10

Sensor	Min. alarm set point	Max. alarm set po	Auto-cal values
Ex	5 %	60 %	58 %
EX-H	5 %	60 %	58 %
EX-M (%vol)	0.1	3.0	2.5
H ₂ S-LC (ppm)	1	70	20
NO ₂ (ppm)	1	47.5	10
SO ₂ (ppm)	1	17.5	10
O ₂ (%)	5	24	15.0
CO (ppm)	10	1700	60
H ₂ S (ppm)	5	175	20

5.2 Performance Specification

Combustible Gas

Range	0 to 100 % LEL or 0 to 5 % CH ₄
Resolution	1 % LEL or 0.05 % vol CH ₄
Reproducibility	3 % LEL, 0 % to 50 % LEL reading or 0.15 % CH ₄ , 0.00 % to 2.50 % CH ₄ (normal temperature range)
	5 % LEL, 50 % to 100 % LEL reading or 0.25 % CH ₄ , 2.50 % to 5.00 % CH ₄ (normal temperature range)
	5 % LEL, 0 % to 50 % LEL reading or 0.25 % CH ₄ , 0.00 % to 2.50 % CH ₄ (extended temperature range)
	8 % LEL, 50 % to 100 % LEL reading or 0.4 % CH ₄ , 2.50 % to 5.00 % CH ₄ (extended temperature range)
Response time	90 % of final reading in less than or equal to 15 sec (pentane) and 10 sec (methane) (normal temperature range)

Combustible Gas Cross Reference Factors for General-Purpose Calibration Using Calibration Cylinder (Part No. 10053022)

Combustible Gas	Methane Calibration	Pentane Simulant Calibration
	1.45 Vol % CH ₄ Set 33% LEL	1.45 Vol % CH ₄ Set 58 %LEL
Acetone	1.09	0.62
Acetylene	1.07	0.61
Butane	1.37	0.79
Cyclohexane	1.94	1.11
Diethylether	1.43	0.82
Ethane	1.27	0.73
Ethanol	1.16	0.66
Ethylene	1.09	0.62
Gasoline	1.63	0.93

Combustible Gas	Methane Calibration	Pentane Simulant Calibration
	1.45 Vol % CH ₄ Set 33% LEL	1.45 Vol % CH ₄ Set 58 %LEL
n-Hexane	1.86	1.06
Hydrogen	0.98	0.56
Isobutane	1.63	0.93
Isopropyl Alcohol	1.55	0.88
Methane	1.00	0.57
Methanol	0.93	0.53
Methyl Ethyl Ketone	1.69	0.97
Nonane	4.48	2.56
Nonane with EX-H sensor	3.03	1.73
Pentane	1.90	1.00
Propane	1.39	0.79
Toluene	1.14	0.93
Xylene	2.09	1.19
Isobutane	4.83	2.76
Xylene with EX-H sensor	3.57	2.04

Response notes

- (1) Some compounds may reduce the sensitivity of the combustible gas sensor by poisoning or inhibiting the catalytic action or by polymerizing on the catalytic surface.
- (2) Multiply the displayed %LEL value by the conversion factor above to get the true %LEL.
- (3) These conversion factors should be used only if the combustible gas is known.
- (4) All factors are based on the IEC 100% LEL levels
 - ▷ i.e. Methane 100% LEL = 4.4 Vol%,
 - ▷ Pentane 100% LEL = 1.1 Vol%
 - ▷ Propane 100% LEL = 1.7 Vol%
- (5) These conversion factors are typical. Individual units may vary by $\pm 25\%$ from these values.

- (6) The results are intended for guidance only. For the most accurate measurements, an instrument should be calibrated using the gas under investigation.
- (7) The conversion factors for the standard EX and the specialised EX-H and EX-M sensor are the same except for EX-H and Nonane and o-Xylene. The conversion factors for these two vapours are therefore especially mentioned in the table.

Oxygen

The oxygen sensor has built-in temperature compensation. However, if temperature shifts dramatically, the oxygen sensor reading may shift. Zero the device at a temperature within 30 °C of the work place temperature for the least effect.

Range	0 to 30 vol.% O ₂ *
Resolution	0.1 vol.% O ₂
Reproducibility	0.7 vol.% O ₂ for 0 to 30 vol.% O ₂
Response time (90% of final reading)	<10 second (normal temperature range)
Sensor Cross-Sensitivity	The oxygen sensor has no common cross-sensitivities.

* Certified for 0 - 25 vol.% O₂

Carbon Monoxide



Data is presented as the indicated output in PPM which will result from the application of the test gas.

Range	0 - 1999 ppm (0 - 1999 mg/m ³) CO
Resolution	1 ppm (1.2 mg/m ³) CO for 0 to 1999 ppm
Reproducibility	±5 ppm (5.8 mg/m ³) CO or 10 % of reading, whichever is greater (normal temperature range)
	±10 ppm (11.6 mg/m ³) CO or 20 % of reading, whichever is greater
Response time	90% of final reading in less than or equal to 15 seconds (normal temperature range)

Test Gas Applied	Concentration (PPM) Applied	CO Channel % Cross-sensitivity
Hydrogen Sulfide (H ₂ S)	40	0
Carbon Monoxide (CO)	100	100
Nitric Oxide (NO)	50	84
Nitrogen Dioxide (NO ₂)	11	0
Sulfur Dioxide (SO ₂)	9	-4
Chlorine (Cl ₂)	10	0
Hydrogen Cyanide (HCN)	30	-5
Ammonia (NH ₃)	25	0
Toluene	53	0
Isopropanol	100	-8
Hydrogen (H ₂)	100	48

Hydrogen Sulphide

Range	0 - 200 ppm (0 to 284 mg/m ³) H ₂ S
Resolution	1 ppm (1.4 mg/m ³) H ₂ S, for 3 to 200 ppm (4,3 to 284 mg/m ³) H ₂ S
Reproducibility	±2 ppm (2.8 mg/m ³) H ₂ S or 10 % of reading, whichever is greater (normal temperature range) 0 to 100 ppm (0 to 142 mg/m ³) H ₂ S, ±5 ppm (7,1 mg/m ³) H ₂ S or 10 % of reading, whichever is greater
Response time	90% of final reading in less than or equal to 15 seconds (normal temperature range)

Test Gas Applied	Concentration (PPM) Applied	H ₂ S Channel % Cross-sensitivity
Hydrogen Sulfide (H ₂ S)	40	100
Carbon Monoxide (CO)	100	1
Nitric Oxide (NO)	50	25
Nitrogen Dioxide (NO ₂)	11	-1
Sulfur Dioxide (SO ₂)	9	14

Test Gas Applied	Concentration (PPM) Applied	H ₂ S Channel % Cross-sensitivity
Chlorine (Cl ₂)	10	-14
Hydrogen Cyanide (HCN)	30	-3
Ammonia (NH ₃)	25	-1
Toluene	53	0
Isopropanol	100	-3
Hydrogen (H ₂)	100	0

Hydrogen Sulphide Low Concentration (H₂S-LC)

Range	0 - 100 ppm H ₂ S
Resolution	0.1 ppm H ₂ S
Reproducibility	±0.2 ppm H ₂ S or 10 % of reading, whichever is greater (normal temperature range)
	±0.5 ppm H ₂ S or 20 % of reading, whichever is greater (extended temperature range)
Response time (typical)	90% of final reading < 15 seconds (normal temperature range)

Nitrogen Dioxide

Range	0 - 50 ppm NO ₂
Resolution	0.1 ppm NO ₂
Reproducibility	±1 ppm NO ₂ or 10 % of reading, whichever is greater (normal temperature range)
	±2 ppm NO ₂ or 20 % of reading, whichever is greater (extended temperature range)
Response time (typical)	90% of final reading < 20 seconds (normal temperature range)

Sulphur Dioxide

Range	0 - 20 ppm SO ₂
Resolution	0.1 ppm SO ₂
Reproducibility	±1 ppm SO ₂ or 10 % of reading, whichever is greater (normal temperature range)
	±2 ppm SO ₂ or 20 % of reading, whichever is greater (extended temperature range)
Response time (typical)	90% of final reading < 20 seconds (normal temperature range)

5.3 XCell Sensor Patents

Combustible sensor	Part No.10106722	Patent Pending
O ₂ sensor	Part No.10106729	Patent Pending
CO/H ₂ S sensor	Part No.10106725	Patent Pending

6 Certification

See device label for the approvals that apply to your specific device.

USA and Canada

USA



See device label for the approvals that apply to your specific device.

Canada



See device label for the approvals that apply to your specific device.

Other Countries

Australia/New Zealand

TestSafe Australia
 Ex ia sa I IP67 (Zone 0)
 Ex ia sa IIC T4 IP67 (Zone 0)
 Ta = -40 °C to +60 °C

6.1 Marking, Certificates and Approvals According to the Directive 94/9/EC (ATEX)

Manufacturer: Mine Safety Appliances Company
1000 Cranberry Woods Drive
Cranberry Township, PA 16066 USA

Product: **ALTAIR 4X**

EC-Type Examination Certificate: FTZU 07 ATEX 0169 X

Type of protection: EN 60079-0: 2009, EN 60079-1: 2007,
EN 60079-11: 2012, EN 60079-18: 2009
EN 60079-26: 2007, EN 50303: 2000

Performance: EN 60079-29-1: 2007, EN 50104:2010
EN 50271: 2010

Gas measuring range 0-100% LEL:
Methane, Propane, Pentane, Hydrogen
Oxygen: measuring range 0-25 Vol %, indication 0-30 Vol %

Marking:



II 1G Ex ia IIC T4 Ga
when combustible XCell EX sensor is not installed
II 2G Ex d ia mb IIC T4 Gb
I M1 Ex ia I Ma
 $-40\text{ °C} \leq T_a \leq +60\text{ °C}$
 $U_m \leq 6,7\text{ V DC}$

Special Conditions:

The model ALTAIR 4X shall only be charged and opened in a non-hazardous area.

The model ALTAIR 4X shall not be used in Zone 0 when the combustible XCell Ex sensor is installed.

The alarm set points are not applied for measuring oxygen inertisation and it shall be taken into account.

Quality Assurance Notification: 0080
 Year of Manufacture: see Label
 Serial Nr.: see Label

National Certification: FTZU 08 E 0034
 Performance: EN 45544-1:1999, EN 45544-2:1999
 EN 50104 : 2010
 Gas: CO: 0-1999 ppm
 H₂S: 0-200 ppm
 Oxygen: measuring range 0-25 Vol%,
 indication range 0-30 Vol %

6.2 Marking, Certificates and Approvals According to IECEx

Manufacturer: Mine Safety Appliances Company
 1000 Cranberry Woods Drive
 Cranberry Township, PA 16066 USA

Product: **ALTAIR 4X**

IECEx-Type Examination Certificate: IECEx TSA 08.0013X

Type of protection: IEC 60079-0:2004, IEC 60079-1:2003
 IEC 60079-11:2006

Performance none

Marking:



Ex ia I IP67
 EX ia mb IIC T4 IP67
 when combustible XCELL sensor is installed
 Ex ia IIC T4 IP67
 when combustible XCELL sensor is not installed
 Ta = -40 °C to +60 °C
 Um ≤ 6,7 V

7 Ordering Information

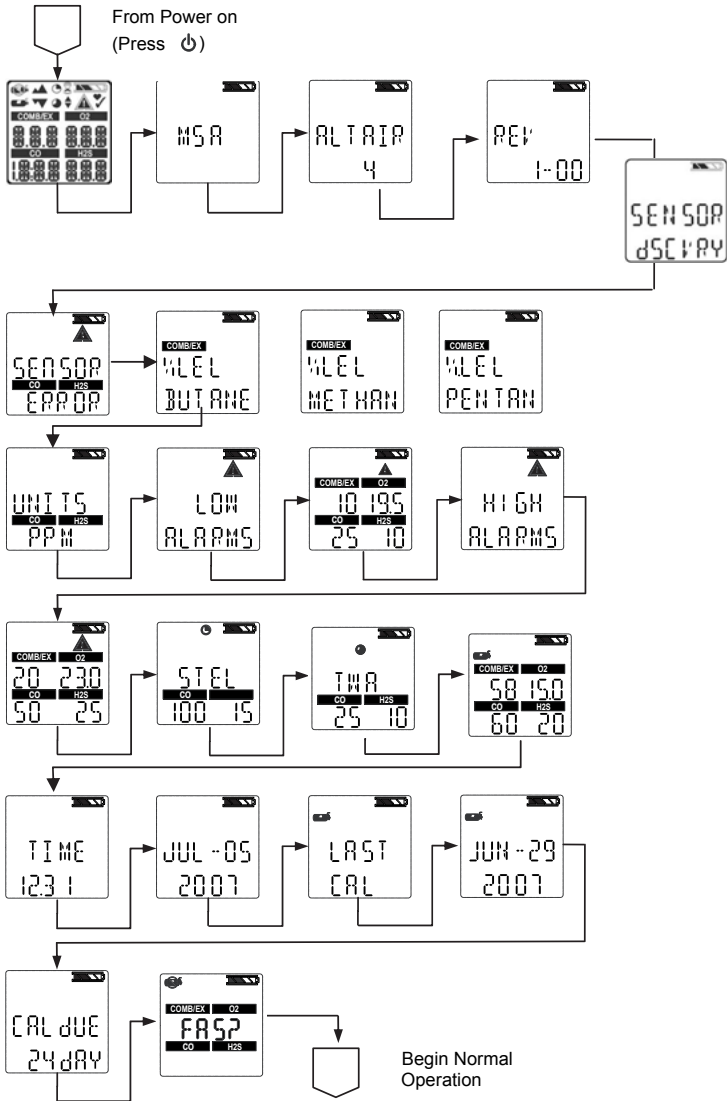
Description	Part No.
Stainless steel suspender clip	10069894
Calibration Cylinder 58L quad gas mix (1.45% CH ₄ , 15% O ₂ , 60 ppm CO, 20 ppm H ₂ S)	10053022
Universal pump probe	10047596
Pressure reducer valve 0,25 l/min	467895
Calibration assembly (cap, tube, connector)	10089321
North American Power Supply with Charge Connector	10092233
Global Power Supply with Charge Connector	10092938
Charging cradle assembly with Power supply ((North America)	10087368
Charging cradle assembly with Power supply (Australia)	10089487
Charging cradle assembly with Power supply (Europe)	10086638
Vehicle Charging cradle assembly	10095774
MSA Link Software CD-Rom	10088099
JetEye IR adapter with USB connector	10082834
Combustible sensor replacement kit	10106722
O ₂ sensor replacement kit	10106729
CO/H ₂ S Two Toxic sensor replacement kit	10106725
Front Housing with integrated dust filters (charcoal)	10110030
Front Housing with integrated dust filters (fluorescent)	10110029
Main board w/ battery pack	10106621
LCD Frame assembly (frame LCD, zebra strips, screws)	10110061
Sensors gasket, socket head cap screws (4x), self tapping (2x)	10110062
CD Manual ALTAIR 4 x	10106623
Combustible EX-M Sensor Replacement Kit	10121212
Combustible EX-H Sensor Replacement Kit	10121211
H2S-LC/CO Sensor Replacement Kit	10121213
CO/NO2 Sensor Replacement Kit	10121217
H2S/SO2 Sensor Replacement Kit	10121215



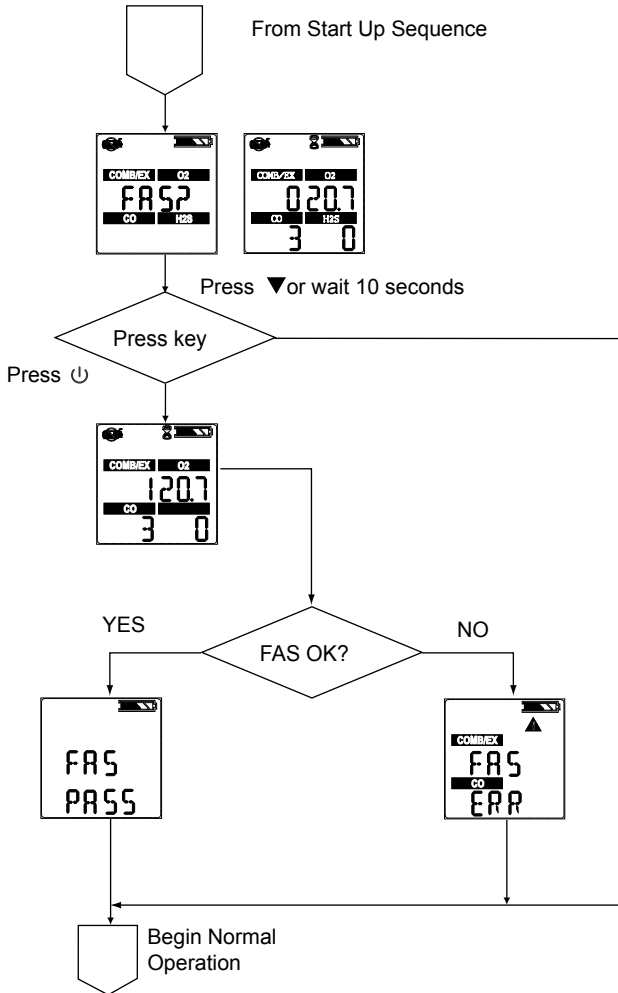
GALAXY GX2, QuickCheck and additional accessories are available on request.

8 Appendix

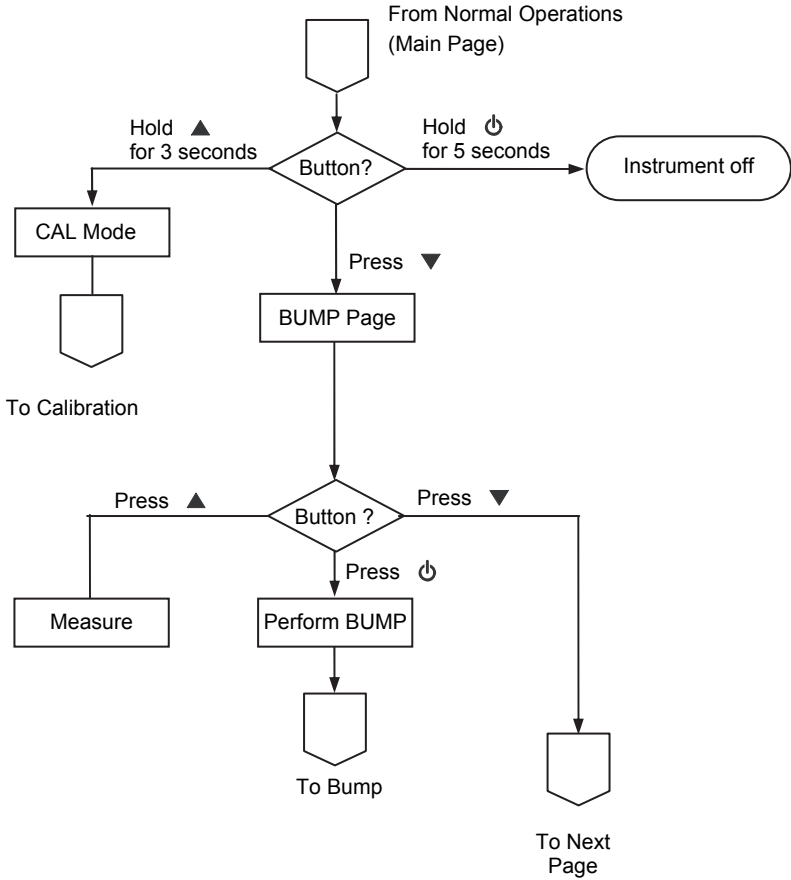
8.1 Start Up Sequence [Power on]

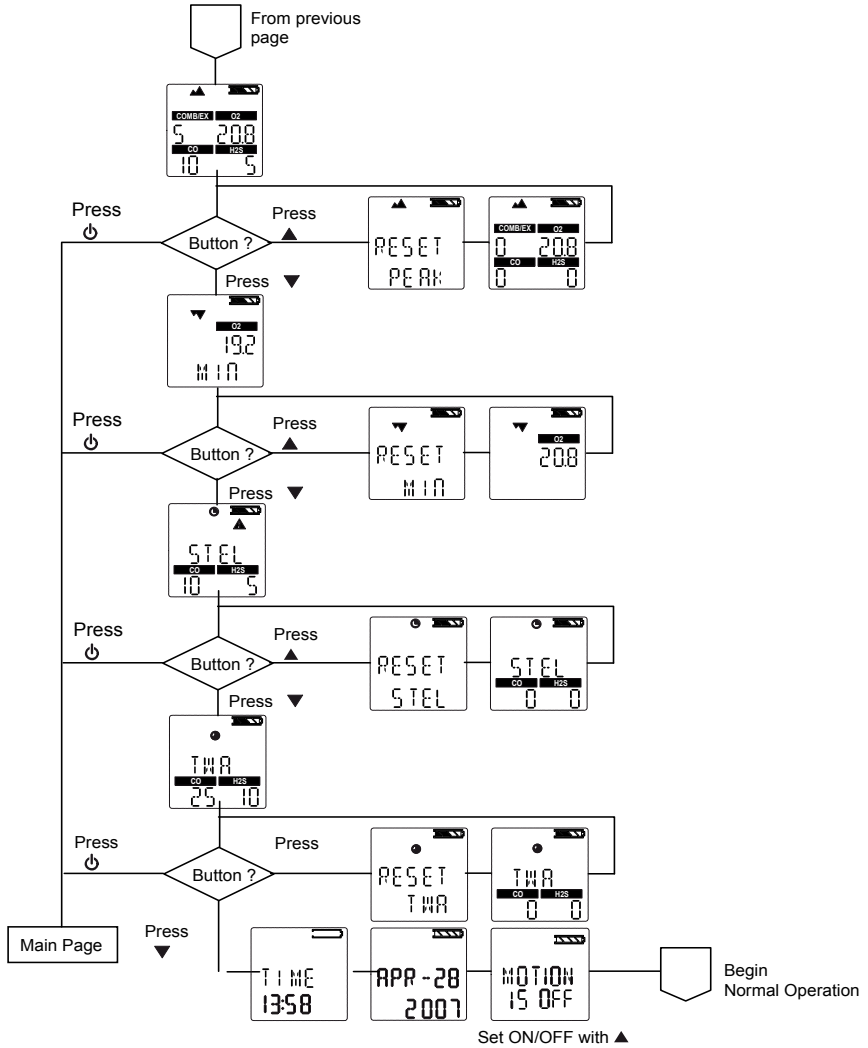


8.2 Fresh Air Setup (FAS)

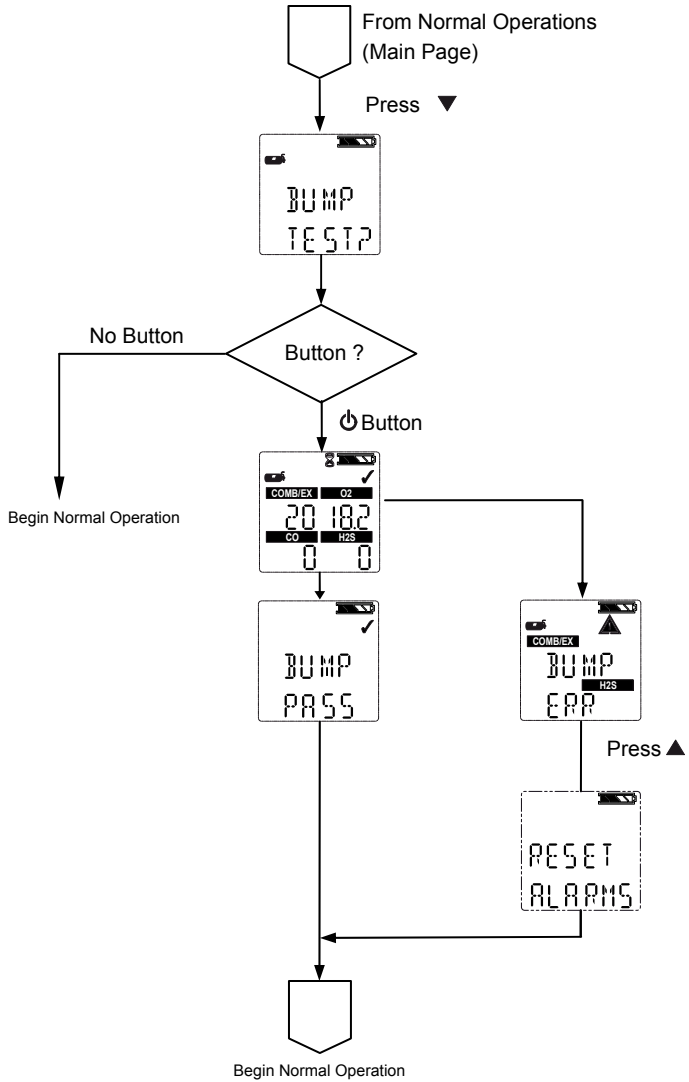


8.3 Reset Screen Controls

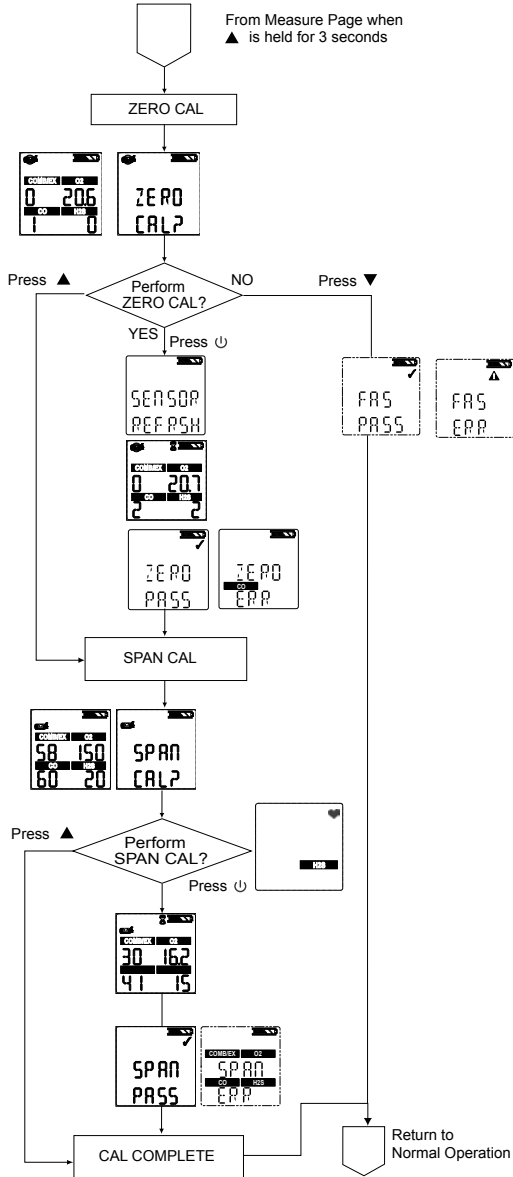




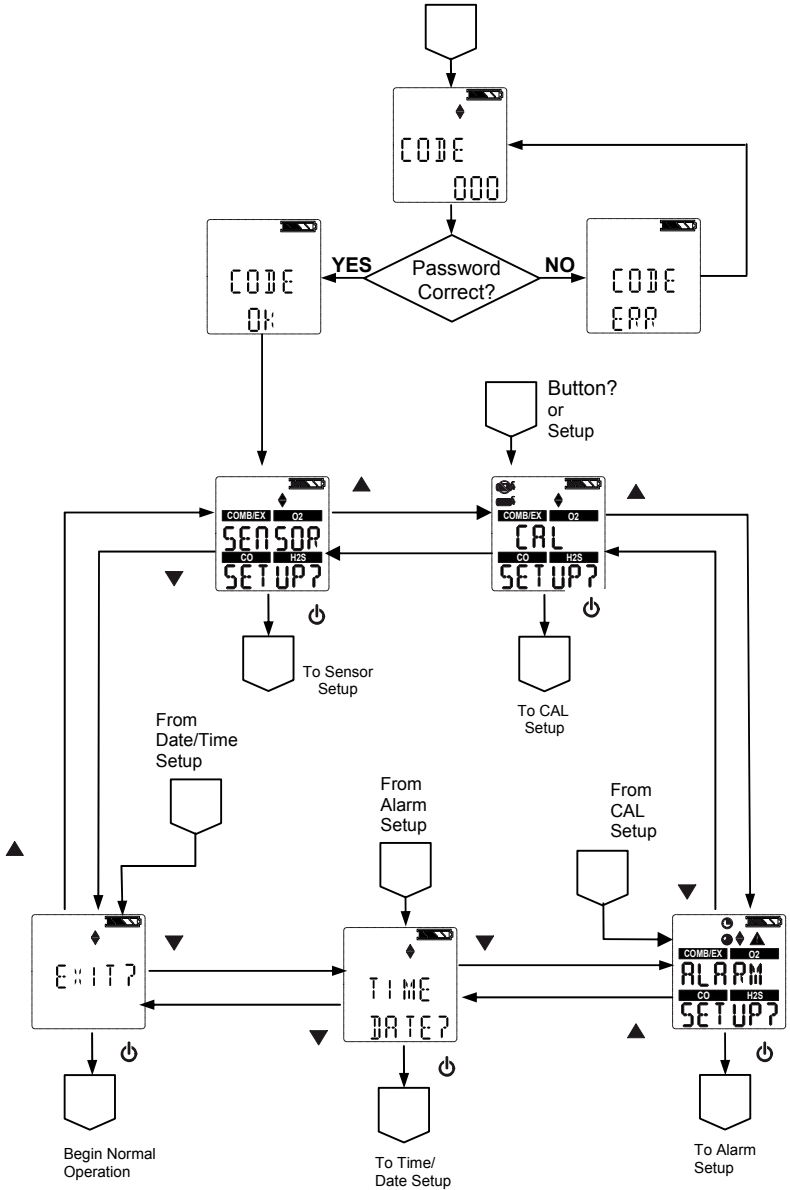
8.4 Bump Test



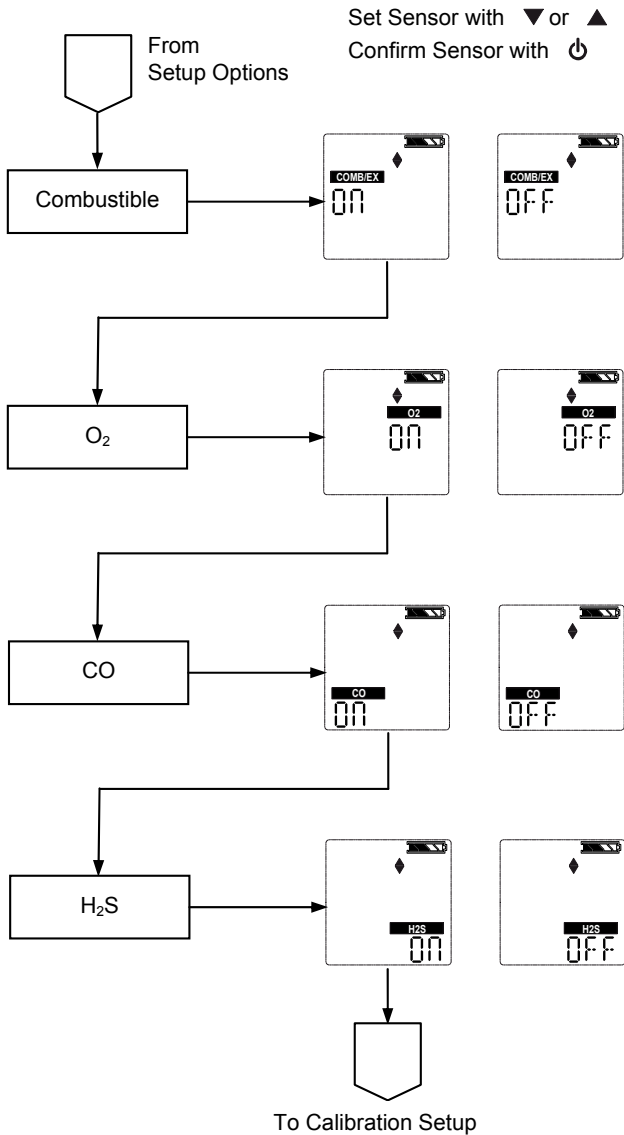
8.5 Calibrations



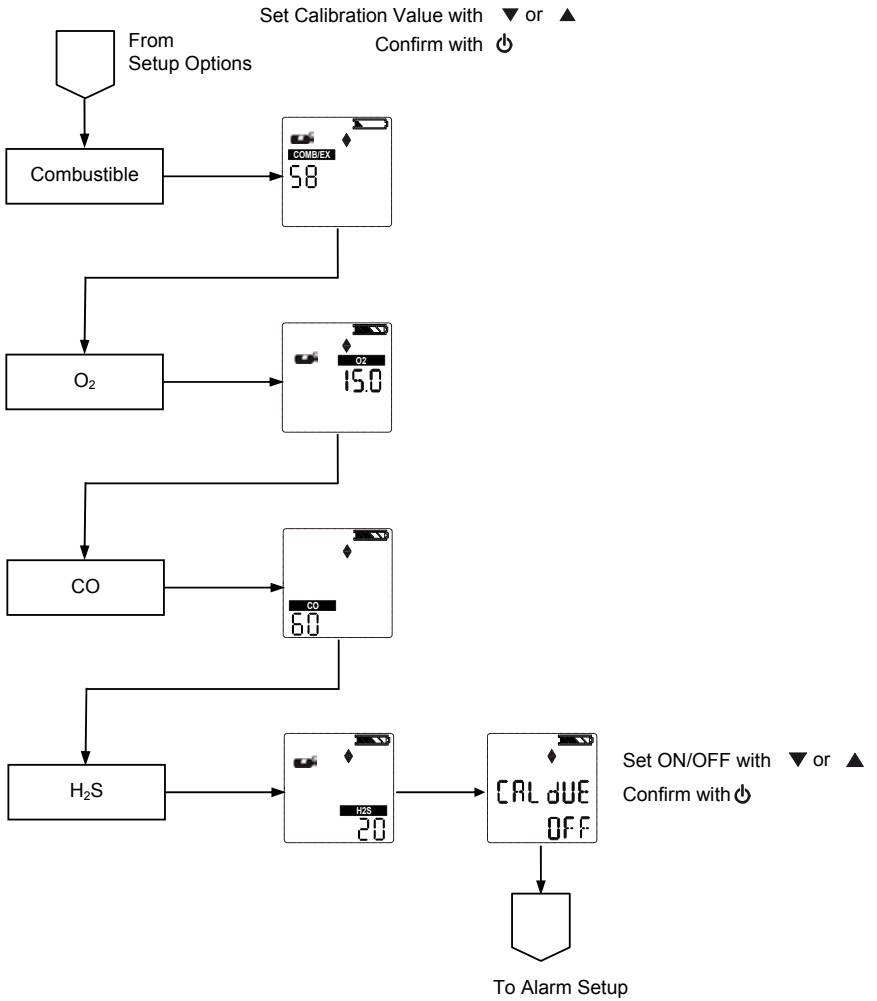
8.6 Options Setup



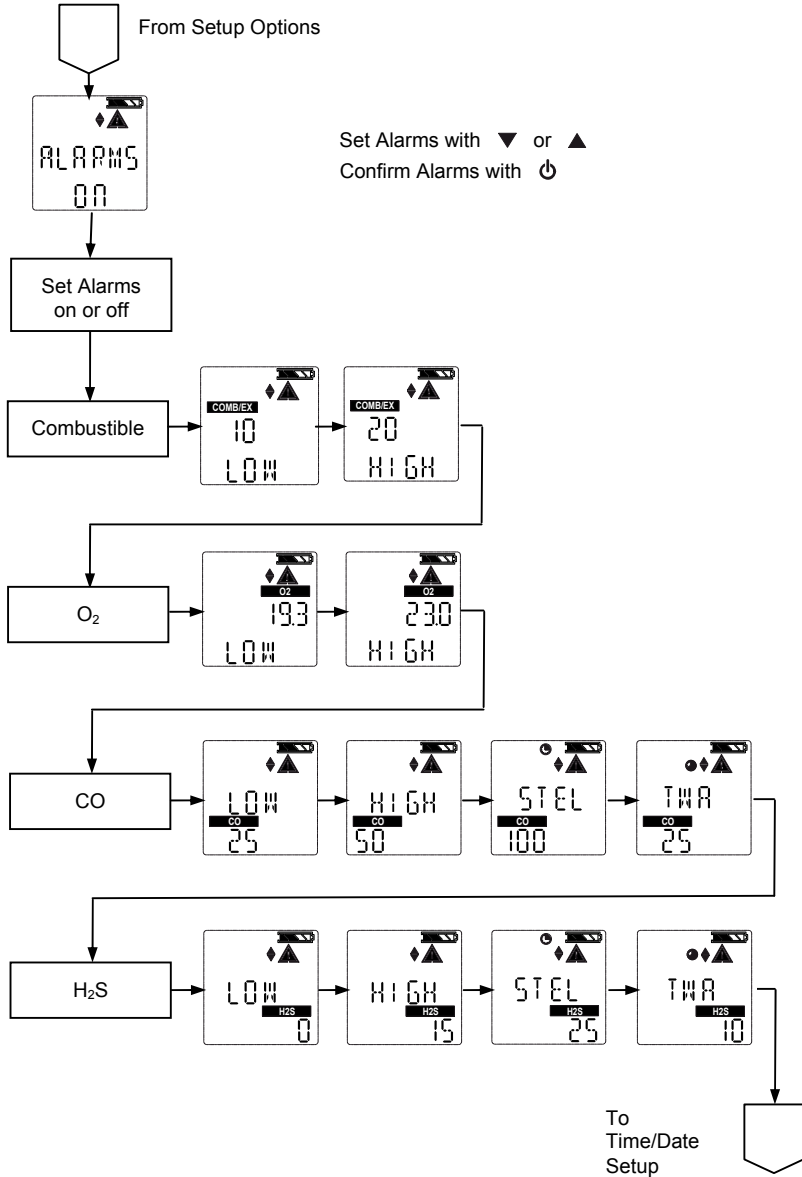
8.7 Sensor Setup



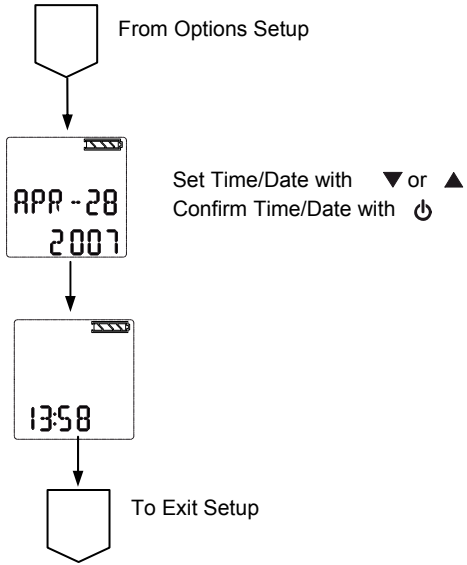
8.8 Calibration Setup



8.9 Alarm Setup



8.10 Time and Date Setup



MSA in Europe

[www.MSAafety.com]

Northern Europe

Netherlands

MSA Nederland

Kernweg 20
1627 LH Hoorn
Phone +31 [229] 25 03 03
Fax +31 [229] 21 13 40
info.nl@MSAafety.com

Belgium

MSA Belgium N.V.

Duwijkstraat 17
2500 Lier
Phone +32 [3] 491 91 50
Fax +32 [3] 491 91 51
info.be@MSAafety.com

Great Britain

MSA (Britain) Limited

Lochard House
Linnet Way
Strathclyde Business Park
BELLSHILL ML4 3RA
Scotland
Phone +44 [16 98] 57 33 57
Fax +44 [16 98] 74 01 41
info.gb@MSAafety.com

Sweden

MSA NORDIC

Kopparbergsgatan 29
214 44 Malmö
Phone +46 [40] 699 07 70
Fax +46 [40] 699 07 77
info.se@MSAafety.com

MSA SORDIN

Rörläggarvägen 8
33153 Värnamo
Phone +46 [370] 69 35 50
Fax +46 [370] 69 35 55
info.se@MSAafety.com

Southern Europe

France

MSA GALLET

Zone Industrielle Sud
01400 Châtillon sur
Chalaronne
Phone +33 [474] 55 01 55
Fax +33 [474] 55 47 99
info.fr@MSAafety.com

Italy

MSA Italiana S.p.A.

Via Po 13/17
20089 Rozzano [MI]
Phone +39 [02] 89 217 1
Fax +39 [02] 82 59 228
info.it@MSAafety.com

Spain

MSA Española, S.A.U.

Narcís Monturiol, 7
Pol. Ind. del Sudoeste
08960 Sant-Just Desvern
[Barcelona]
Phone +34 [93] 372 51 62
Fax +34 [93] 372 66 57
info.es@MSAafety.com

Eastern Europe

Poland

MSA Safety Poland Sp. z o.o.

Ul. Wschodnia 5A
05-090 Raszyn k/Warszawy
Phone +48 [22] 711 50 00
Fax +48 [22] 711 50 19
info.pl@MSAafety.com

Czech republic

MSA Safety Czech s.r.o.

Dolnojircanska 270/22b
142 00 Praha 4 - Kamyk
Phone +420 241440 537
Fax +420 241440 537
info.cz@MSAafety.com

Hungary

MSA Safety Hungaria

Francia út 10
1143 Budapest
Phone +36 [1] 251 34 88
Fax +36 [1] 251 46 51
info.hu@MSAafety.com

Romania

MSA Safety Romania S.R.L.

Str. Virgil Madgearu, Nr. 5
Ap. 2, Sector 1
014135 Bucuresti
Phone +40 [21] 232 62 45
Fax +40 [21] 232 87 23
info.ro@MSAafety.com

Russia

MSA Safety Russia

Пеходный проезд д.14.
125373 Москва
Phone +7 [495] 921 1370
Fax +7 [495] 921 1368
info.ru@MSAafety.com

Ukraine

MSA Safety Ukraine

72 Krasnoarmeyskaya Str.,
7th floor
03680 Kiev
Ukraine
Phone +380 [44] 205 -5640
Fax +380 [44] 205 -5641
E-mail :info.ua@msasafety.com

Central Europe

Germany

MSA AUER GmbH

Thiemannstrasse 1
12059 Berlin
Phone +49 [30] 68 86 0
Fax +49 [30] 68 86 15 17
info.de@MSAafety.com

Austria

MSA AUER Austria Vertriebs GmbH

Modecenterstrasse 22
MGC Office 4, Top 601
1030 Wien
Phone +43 [0] 1 / 796 04 96
Fax +43 [0] 1 / 796 04 96 - 20
info.at@MSAafety.com

Switzerland

MSA Schweiz

Eichweg 6
8154 Oberglatt
Phone +41 [43] 255 89 00
Fax +41 [43] 255 99 90
info.ch@MSAafety.com

European

International Sales

[Africa, Asia, Australia, Latin
America, Middle East]

MSA Europe

Thiemannstrasse 1
12059 Berlin
Phone +49 [30] 68 86 0
Fax +49 [30] 68 86 15 58
info.de@MSAafety.com