Operating Manual

ALTAIR PRO Single Gas Detector

MSA

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   **MSA ALTAIR PRO**

Complies with the provisions of the council directive 94/9/EC (ATEX).
This declaration is based on the EC-Type Examination Certificate

FTZU 06 ATEX 0134 X

FTZU, Ostrava, Czech Republic, in accordance with Annex III of the
ATEX Directive 94/9/EC.

Quality Assurance Notification issued by Ineris of France, Notified Body number
0080, in accordance with Annex IV and Annex VII of the ATEX Directive 94/9/EC.

We additionally declare that this product is in conformance with the EMC Directive
89/336/EEC in accordance with the standards

EN 50270 Type 2 and EN 61000-6-4

Dr. A. Schubert

MSA AUER GmbH
Dr. Axel Schubert
R & D Instruments   Berlin, July 2006

Contents

1. Safety Regulations

1.1. Correct Use

The ALTAIR PRO is a portable instrument for monitoring toxic gases and oxygen deficiency or excess in the workplace. It is used exclusively for monitoring and not for measuring gas concentrations in the ambient air. It must be serviced and repaired by qualified and authorised personnel.

It is imperative that this operating manual be read and observed when using this instrument. In particular, the safety instructions, as well as the information for the use and operation of the apparatus, 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.

> ⚠ **Attention!**
> 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 apparatus 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 instrument, be guaranteed.

Use instrument only for stipulated gases

The ALTAIR PRO is used for monitoring and detecting gases in the ambient air.
Thereby, it must be used only for gases for which a sensor is installed in the
instrument.

The sensor must not be blocked during use.

Observe oxygen concentration

Although the ALTAIR PRO unit will detect up to 25% oxygen, all ALTAIR PRO
versions are not certified or approfed for use in atmospheres containing more
than 21% oxygen.

Check function and alarm before each use

In case of failed function tests, the instrument must be removed from use.

Conduct additional tests after any significant impact

The instrument function should also be checked after severe mechanical stress
(dropping, impact etc.) and when the instrument or the sensors have been
exposed to silicon, silicates, lead-containing substances, hydrogen sulphide or
contaminated compounds.

Defective vibration alarm possible

At ambient temperatures < 0 °C, the vibration alarm can give a false alarm or can
fail completely. In such conditions, do no rely solely on the vibration alarm.

Observe BG information

In Germany, observe the BG information BGI 836 (5).

2.   Description

2.1.   Instrument Overview

Fig. 1   Instrument view

1	*Alarm LED*	*5*	*Button*
2	*Infrared port*	*6*	*Display with backlight*
3	*Sensor cover*	*7*	*Stipulated gas type*
4	*Acoustic alarm transmitter*		

The instrument is a portable gas meter for monitoring gases in the ambient air and in the workplace.

The instrument is available in three models:

- for monitoring oxygen
- for monitoring hydrogen sulphide and
- for monitoring carbon monoxide

> The instrument can detect up to 25% oxygen in the ambient air.
> However, all instrument models are calibrated and permitted only up to 21% oxygen-content.

The response levels for the individual gases are set at the factory and cannot be changed during operation. After commissioning the instrument, changes are possible only with the MSA FiveStar® Link™ Software version 4.4 or higher (available as option; → Description of software).

i	If the ambient air contains higher gas concentrations, the instrument ignores the Fresh Air Setup and goes directly to measuring mode after the self-test.

2.2.   On-Screen Indicators
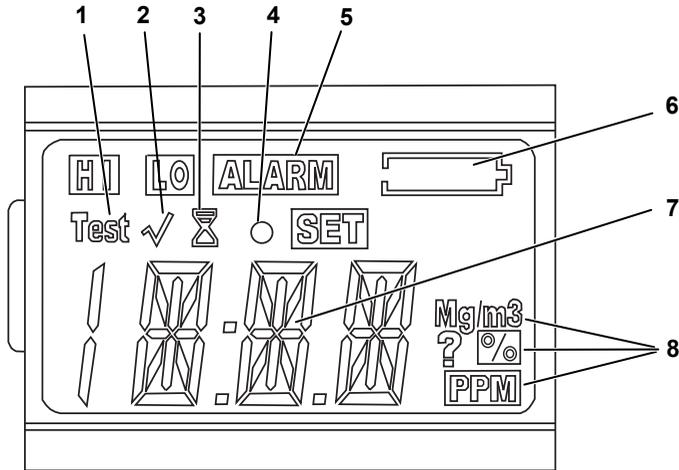
Fig. 2   Display

1   Self-test in progress

2   Bump check indicator

3   Hour glass

4   Confidence indicator

5   Alarm indicator

6   Battery life indicator

7   Numeric indicator

8   Gas concentration units

Battery Life Indicator

> ⚠ **Attention!**
> If an alarm is triggered while using the instrument as a monitor, leave the area immediately.
>
> Remaining on site under such circumstances can cause serious damage to health or can even lead to death.

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

Each battery indicator segment represents approximately 1/4 of the total battery capacity.

Battery Warning

A battery warning indicates that a nominal two days of operation remain before the instrument's battery is depleted.

> ℹ️ The duration of remaining instrument operation during battery warning depends on ambient temperature (colder temperatures may reduce battery life) and the number and duration of alarms during battery warning.

When the ALTAIR PRO goes into battery warning the:

- battery outline indicator flashes
- audible alarm sounds every 30 seconds
- alarm lights flash every 30 seconds

Battery Shut Down

> ⚠️ **Attention!**
> If a Battery Shutdown condition occurs, stop using the instrument and leave the area immediately. The instrument can no longer alert you of potential hazards since it does not have enough power to operate properly.
> Failure to follow this warning can result in serious personal injury or death.

When the battery can no longer operate the instrument, the instrument goes into Battery Shutdown mode:

- battery outline indicator flashes
- alarm icon turns ON
- alarm sounds every 30 seconds
- alarm lights flash
- no gas reading display
- display alternates between "BAT" and "ERR"
- no other instrument pages can be viewed

The instrument remains in this state until it is turned OFF or the battery is completely depleted. The alarm lights and the audible alarm can be silenced by pushing the button.

> ℹ️ When the instrument battery is running low, remove it from service and replace the battery.

Confidence indicator

The Confidence indicator flashes once every 60 seconds to notify the user that the instrument is ON and operating normally. In addition, both LEDs will flash briefly every 60 seconds.

Backlight

The backlight can be manually activated with a quick push of the button. The backlight remains ON for 10 seconds.

2.3.   Monitoring Toxic Gases

With the ALTAIR PRO, you can monitor the concentration of the following toxic gases in the ambient air:

- Carbon Monoxide (CO)
- Hydrogen Sulphide (H_2S)
- Sulfur Dioxide (SO_2)
- Nitrogen Dioxide (NO_2)
- Ammonia (NH_3)
- Phosphine (PH_3)
- Hydrogen Cyanide (HCN)
- Chlorine (Cl_2)
- Chlorine Dioxide (ClO_2).

The ALTAIR PRO Detector displays the gas concentration in parts per million (PPM) on the measuring page. The instrument remains on this page until another page is selected or the instrument is turned OFF.

⚠️ **Attention!**

If an alarm is triggered while using the instrument as a monitor, leave the area immediately.

Remaining on site under such circumstances can cause serious damage to health or can even lead to death.

There are four alarm setpoints in the instrument:

- High Alarm
- Low Alarm
- STEL Alarm
- TWA Alarm

The backlight turns ON for 20 seconds during an alarm condition.

If the gas concentration reaches or exceeds the alarm setpoint the instrument will display and flash "LO" or "HI" and "ALARM" and enter an alarm sequence.

$\mathbf{i}$	For more and detailed information → Section 3.3.

2.4.   Monitoring the Oxygen Concentration

With the ALTAIR PRO the oxygen concentration is monitored in the atmosphere. The alarm setpoints can be set to enrichment (concentration > 20.8%) or depletion (concentration < 20.8%).

⚠	**Attention!** If an alarm is triggered while using the instrument as a monitor, leave the area immediately. Remaining on site under such circumstances can cause serious damage to health or can even lead to death.

When a set value is reached, an alarm is triggered:

- an acoustic signal sounds,
- alarm LEDs flash,
- a vibration alarm is triggered and
- in the display, "ALARM" is displayed in combination with "LO" or "HI" and the corresponding oxygen concentration.

$\mathbf{i}$	For more and detailed information → Section 3.4.

$\mathbf{i}$	The LOW alarm (lower of the two %O_2 alarm settings) is latching and will not reset when O_2 concentration rises above the LOW setpoint. To reset alarm push the button False oxygen alarms can occur due to barometric pressure (altitude) changes 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 instrument is in known fresh air before performing a calibration.

2.5.   Duration of Use of the Instrument

Normal Operation

The instrument is ready for operation

- as long as the battery warning indicator (Pos. 6 in Fig. 2) does not display **and**
- the self-test is successful.

Weakening Battery

A weakening battery is indicated by

- the flashing battery warning indicator and
- the remaining operation time indicator going off.

> ⚠ **Attention!**
> You are not allowed to use the instrument even if it still shows a gas concentration.

Flat Battery

A flat battery triggers the following alarm:

- an acoustic signal sounds,
- alarm LEDs flash,
- battery warning indicator flashes and
- the display shows "ERR".

> ℹ The alarm can be turned off by pressing the button.

> ⚠ **Attention!**
> It is not permitted to continue to use the instrument!
> The instrument must be taken out of use.

3. Operation

3.1. Changing Alarm Setpoints

i	Alarm setpoints can only be changed manually during instrument setup, which can be entered after battery attachment or reattachment ($\rightarrow$ Fig. 3). Alarm setpoints can also be changed electronically using the MSA FiveStar® Link™ Software.

(1) Ensure instrument is turned OFF before proceeding.

(2) Remove and re-attach battery.

(3) Turn instrument ON. Press and hold the button for 3 seconds.

- ON displays during this time period.

i	The Steel Mill version cannot be turned OFF without removing the battery or using MSA FiveStar® Link™ Software.

- "ALARM", "SET" and "?" are displayed.

(4) To change the alarm setpoints manually, press the button once while "ALARM", "SET" and "?" are displayed.

i	If the button is not pressed, the instrument turns ON, as usual, after three seconds.

- The Software Version displays for three seconds.
- The gas type displays for three seconds.
  ["CO", "H₂S", "O₂", or "SO₂" etc.].

- The following alarm Setpoints are displayed:

Low Alarm Setpoint for three seconds, "LO" and "ALARM" icons turn ON.

(5) To change the low alarm (LO), press the button when "LO" and "ALARM" displays.

- "LO", "ALARM", "SET" and "?" are displayed.

(6) By pressing the button, increase the value for the low alarm, until the desired value is reached.

- On obtaining the maximum value, the display jumps and begins to count upwards again with minimum value.

(7) Release the button and wait for 3 seconds.

High Alarm Setpoint for three seconds, "HI" and "ALARM" icons turn ON.

(8) To change the high alarm (HI), press the button when "HI" and "ALARM" displays.

- "HI", "ALARM", "SET" and "?" are displayed.

(9) By pressing the button, increase the value for the high alarm, until the desired value is reached.

- On obtaining the maximum value, the display jumps back and begins to count upwards again from the minimum value.

(10) Release the button and wait 3 seconds.

Short Term Exposure Limits "STL" displays; then, the STEL setpoint displays for three seconds.

(11) To change the STEL setpoint, press the button when the setpoint displays.

- "ALARM", "SET" and "?" are displayed.

(12) By pressing the button, increase the value for the STEL alarm, until the desired value is reached.

- On obtaining the maximum value, the display jumps back and begins to count upwards again from the minimum value.

(13) Release the button and wait 3 seconds.

Time Weighted Average, "TWA" displays; then, the TWA setpoint displays for three seconds.

(14) To change the TWA setpoint, press the button when the setpoint displays.

- "ALARM", "SET" and "?" are displayed.

(15) By pressing the button, increase the value for the TWA alarm, until the desired value is reached.

- On obtaining the maximum value, the display jumps back and begins to count upwards again from the minimum value.

(16) Release the button and wait 3 seconds.
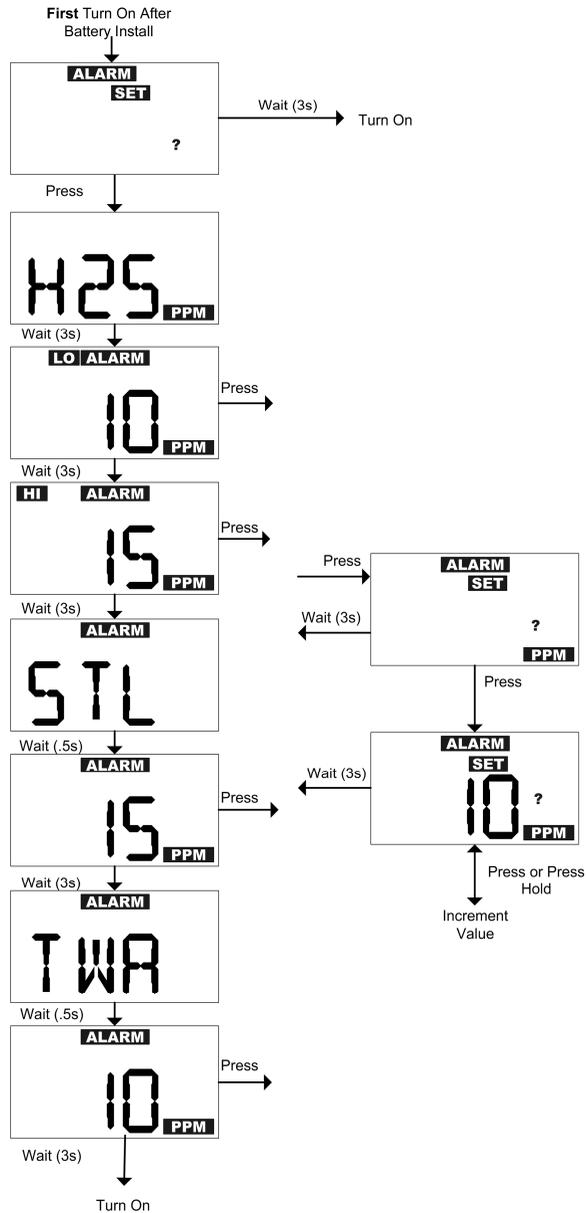
Fig. 3   ALTAIR PRO Setup

3.2.   Turning ON the Instrument

| **i** | Before the instrument can be used for monitoring possible toxic gases in the atmosphere, it must be commissioned ($\rightarrow$ Fig. 4). |

(1)   Press and hold the button for 3 seconds.

- "ON" displays during this time period.

| **i** | The Steel Mill version cannot be turned OFF without removing the battery or using MSA FiveStar® Link™ Software. |

- An LCD functional test activates all display indicators.
- Acoustic alarm sounds, alarm LEDs light up and vibration alarm is triggered.
- The software version is displayed for approx. 3 seconds.
- The gas type is displayed for approx. 3 seconds more (O_2, H_2S, CO, SO_2, NO_2, etc).
- LO and ALARM as well as HI and ALARM are displayed alternately for approx. 3 seconds.
- STL and ALARM followed by the STEL alarm setpoint are displayed for approx. 3 seconds.
- TWA and ALARM followed by the TWA alarm setpoint are displayed for approx. 3 seconds.

| **i** | During the display of LO, HI, STL, TWA and ALARM the corresponding setpoints can still be changed ($\rightarrow$ Fig. 4). |

(2)   If Calibration Due (CAL DUE) is enabled via MSA FiveStar® Link™ Software (default is OFF):

- "CAL" and the hourglass display.
- If calibration is due, "DUE" and the hourglass display for three seconds. The instrument beeps and flashes "CAL" "DUE" every minute until instrument calibration is performed.
- If calibration is not due, the hourglass, number of days to calibration, and "DAYS" display.

(3)   User is prompted for a Fresh Air Setup (FAS).

- "SET", "?" and "FAS" display.

> When performing a fresh air setup, the instrument must be in a known
> clean air. The fresh air setup has limits.
>
> If a hazardous level of gas is present, the instrument displays "`FAS/ERR`".
>
> Press the button to acknowledge the error and perform an instrument
> calibration.

(4)   If Fresh Air Setup is **desired**, immediately press the button.
   - "`HOURGLASS`", "`SET`" and "`FAS`" display.

(5)   If Fresh Air Setup is **not desired**, do **not** press the button.
   - The instrument continues the ON sequence.

(6)   If the instrument was configured for Oxygen, it displays
   - Oxygen reading,
   - % icon and
   - battery indicator.

(7)   If the instrument was configured for a toxic gas, it displays
   - gas reading,
   - ppm icon and
   - battery indicator.
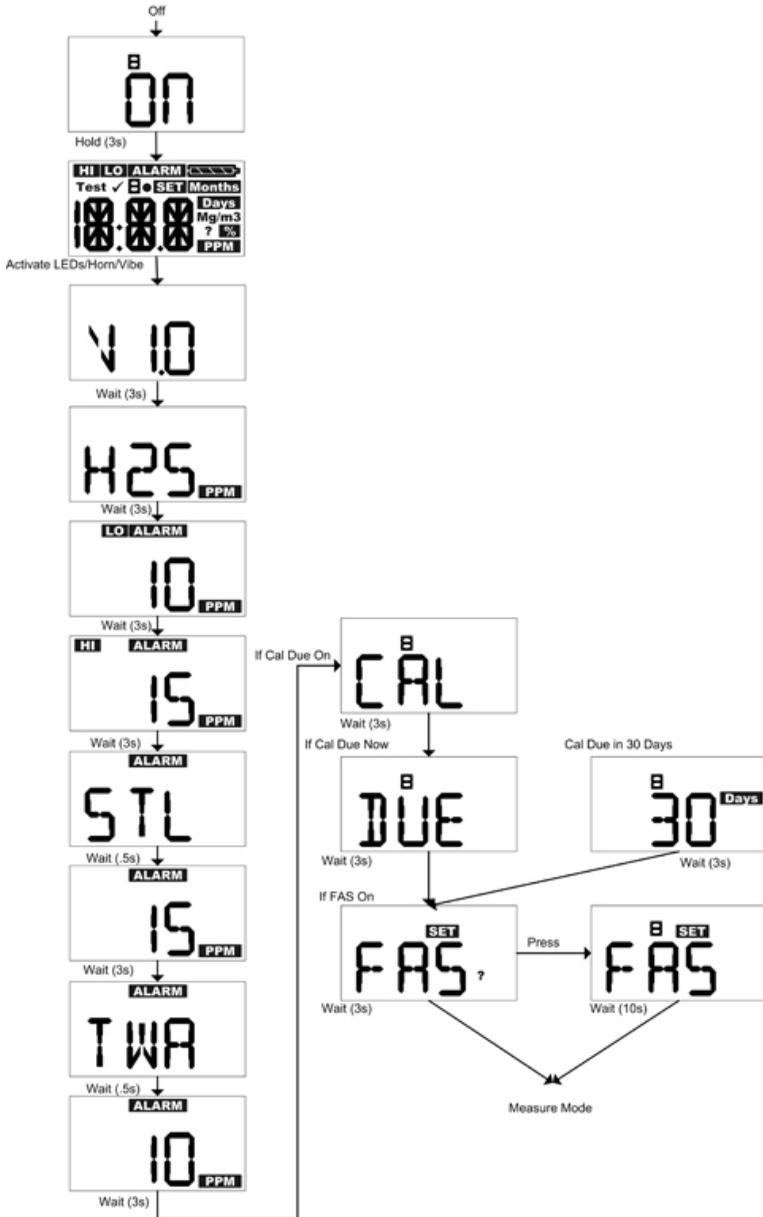
Fig. 4   Turning ON the instrument

3.3. Toxic Gas Measurements

The ALTAIR PRO can be purchased to detect the following gases in the atmosphere:

- Carbon Monoxide (CO)
- Hydrogen Sulphide (H2S)
- Sulfur Dioxide (SO2)
- Nitrogen Dioxide (NO2)
- Ammonia (NH3)
- Phosphine (PH3)
- Hydrogen Cyanide (HCN)
- Chlorine (Cl2)
- Chlorine Dioxide (ClO2).

It displays the gas concentration in parts per million (PPM) on the measuring page. The instrument remains on this page until another page is selected or the instrument is turned OFF.

⚠️ **Warning!**
If a toxic or oxygen gas alarm condition is reached while using the instrument as a personal or area monitor, leave the area immediately: the ambient condition has reached a preset alarm level.

Failure to follow this warning will cause overexposure to toxic gases, which can result in serious personal injury or death.

There are four alarm setpoints in the instrument:

- High Alarm
- Low Alarm
- STEL Alarm
- TWA Alarm

The backlight turns ON for 20 seconds during an alarm condition.

Low Alarm

If the gas concentration reaches or exceeds the low alarm setpoint the instrument will:

- display and flash "LO" and "ALARM"
- enter a low alarm sequence.

The low alarm can be silenced for five seconds by pressing the button. It automatically clears once the gas level falls below the setpoint.

High Alarm

If the gas concentration reaches or exceeds the high alarm setpoint the instrument will:

- display and flash "HI" and "ALARM"
- enter a high alarm sequence.

The high alarm can be silenced for five seconds by pressing the button while it is still in high alarm. The high alarm is latching and will not reset when gas concentration falls below the HIGH setpoint.

| $\mathbf{i}$ | To reset alarm, push the button after the gas level falls below the setpoint. |

Refer to the instrument during turn ON for factory-set alarm points.

If a gas concentration exceeds an alarm setpoint, the:

- audible alarm sounds
- alarm lights flash
- vibrator activates
- alarm type displays, alternately flashing the ALARM icon and the "LO" icon (if the low alarm setpoint was exceeded) or "HI" icon (if the high alarm setpoint was exceeded).

STEL Alarm

If the STEL (Short Term Exposure Limit) reading reaches or exceeds the STEL alarm setpoint the instrument will:

- display and flash "LO" and "ALARM"
- enter a low alarm sequence

The STEL alarm can be silenced for five seconds by pressing the button while it is still in alarm.

The STEL alarm is non-latching and will reset when STEL reading falls below the STEL setpoint. The STEL value can be cleared. (→ Fig. 5 for details.)

TWA Alarm

If the TWA (Time Weighted Average) reading reaches or exceeds the TWA alarm setpoint the instrument will:

- display and flash "LO" and "ALARM"
- enter a low alarm sequence.

The TWA alarm can be silenced for five seconds by pressing the button while it is still in alarm

The TWA alarm is latching and will not reset. The TWA value can be cleared. (→ Fig. 5 for details.)

Refer to the instrument during test mode for factory-set alarm setpoints.

3.4.   Oxygen Measurements

The ALTAIR PRO Detector can be purchased to measure the concentration of oxygen in an atmosphere. The value displayed is percent by volume of oxygen in the atmosphere.

High and low alarm setpoints can be configured to alarm in any combination of oxygen:

- enrichment (greater than 20.8%) or
- depletion (less than 20.8%).

When an alarm setpoint is reached the alarm sequence is initiated.

Low alarm indicates:

- the lower $\%O_2$ level of the two alarm settings
- a more urgent condition and the faster alarm sequence will be indicated
- "LO" "ALARM" displays.

i	The LOW alarm (lower of the two O_2 alarm settings) is latching and will not reset when O_2 concentration rises above the LOW setpoint. To reset alarm push the button.

i	False oxygen alarms can occur due to barometric pressure (altitude) changes 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 instrument is in known fresh air before performing a calibration.

3.5. Displaying the Instrument Data - excluding the Steel Mill Version

A single, quick press on the button turn ON the backlight for 10 seconds. The Information page can be accessed by pushing the button for about one second.

- The instrument beeps twice.

There are following modes:

1) Test gas mode
2) Minimum Oxygen concentration ("LO") - for oxygen only
3) Peak Reading
   - Toxic ("HI")
   - Oxygen ("HI")
   - The Peak/Hi and Min/Low values can be cleared.
     When this page is displayed, press the button to clear.
     - "CLR" is displayed
     - Value is deleted
4) Short Term Exposure Limit ("STL")

   The STL reading displays that the instrument calculated since power-ON. When this page is displayed, press the button to clear.
   - "CLR" is displayed
   - Value is deleted

   STL value is automatically reset to zero when the instrument is turned ON. STEL value is calculated over a 15-minute exposure.

   The following formula is used to calculate the STEL value:

   ```
   ((Minute #1 PPM value) + (Minute #2 PPM value) +...
   + (Minute #15 PPM value)) / (15 minutes) = PPM STEL value
   ```

   If the instrument is ON for less than 15 minutes:
   - the balance of the minute PPM values is set to zero and
   - the total is divided by 15 minutes

5) Time Weighted Average ("TWA")

   The TWA reading displays what the instrument has calculated since power-ON. When this page is displayed, press the button to clear.

   - "CLR" is displayed
   - Value is deleted

   TWA value is automatically reset to zero when the instrument is turned ON. TWA value is calculated over an eight-our exposure.

   The following formula is used to calculate the TWA value:

   ```
   Sum of 1-minute gas readings/480 minutes = PPM TWA value
   ```

   If the instrument is ON for less than 8 ours (480 minutes), the balance of the minute ppm values is set to zero.

6)   IR mode

When instrument displays "IR?", press the button to enter IR mode.

If IR communications are not detected for three minutes or the button is pressed, the instrument will exit this mode (→ Fig. 5 for additional details).

3.6.   Displaying the Instrument Data - Steel Mill Version only

A single, quick press on the button turn ON the backlight for 10 seconds. The Information page can be accessed by pushing the button for about one second.

- ▪ The instrument beeps twice.

This includes:

1)   Test gas mode
2)   Functional check of LCD, vibrator, LEDs and horn
3)   Software version displays.
4)   Gas type
5)   Low Alarm setpoint ("LO" "ALARM")
6)   High Alarm setpoint ("HI" "ALARM")
7)   STL Alarm setpoint
8)   TWA Alarm setpoint
9)   Peak Reading

- ▪ Toxic ("HI")
- ▪ The Peak/Hi and Min/Low values can be cleared.
  When this page is displayed, press the button to clear.
  - ▪ "CLR" is displayed
  - ▪ Value is deleted

10)   Short Term Exposure Limit ("STL")

The STL reading displays that the instrument calculated since power-ON. When this page is displayed, press the button to clear.

- ▪ "CLR" is displayed
- ▪ Value is deleted

STEL value is automatically reset to zero when the instrument is turned ON. STEL value is calculated over a 15-minute exposure.

The following formula is used to calculate the STEL value:

```
((Minute #1 PPM value) + (Minute #2 PPM value) +...
+ (Minute #15 PPM value)) / (15 minutes) = PPM STEL value
```

If the instrument is ON for less than 15 minutes:

- ▪ the balance of the minute PPM values is set to zero and
- ▪ the total is divided by 15 minutes

11) Time Weighted Average ("TWA")

The TWA reading displays what the instrument has calculated since power-ON. When this page is displayed, press the button to clear.

- "CLR" is displayed
- Value is deleted

TWA value is automatically reset to zero when the instrument is turned ON. TWA value is calculated over an eight-our exposure.

The following formula is used to calculate the TWA value:

```
Sum of 1-minute gas readings/480 minutes = PPM TWA value
```

If the instrument is ON for less than 8 ours (480 minutes), the balance of the minute ppm values is set to zero.

12) IR mode

When instrument displays "IR?", press the button to enter IR mode.

If IR communications are not detected for three minutes or the button is pressed, the instrument will exit this mode (→ Fig. 5 for additional details).

3.7. Turning OFF the Instrument

(1) Press and hold the button for three seconds.

- "OFF" and the hourglass display.

(2) Continue to press the button for two more seconds.

- The instrument turns OFF.

The Steel Mill version can not be turned OFF without either removing the battery or using MSA FiveStar® Link™ Software.
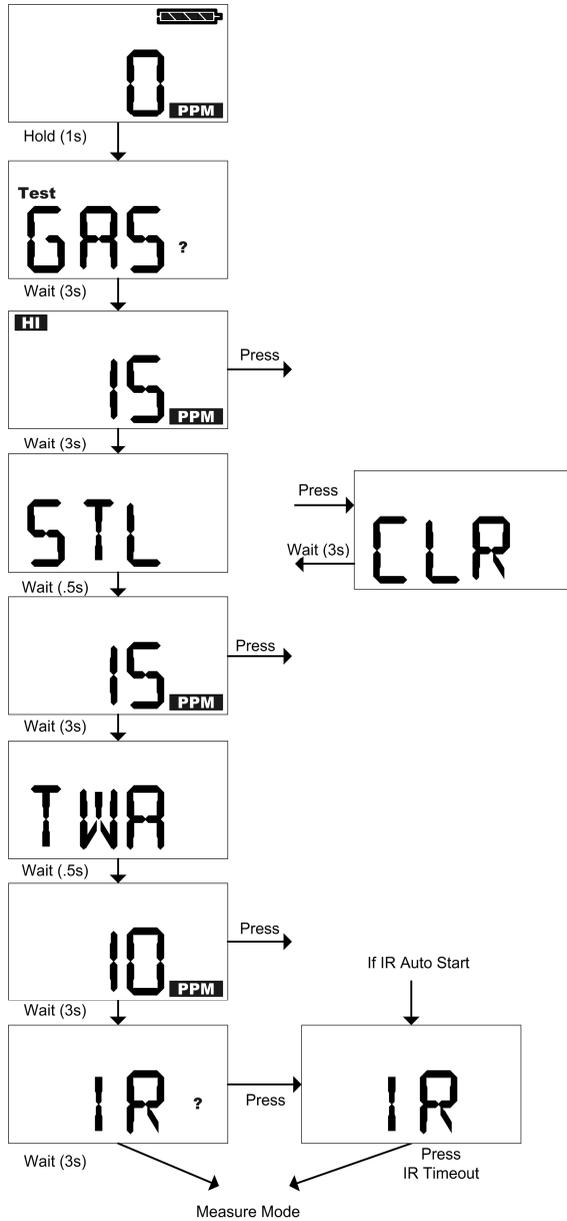

Fig. 5   Displaying instrument data (does not apply to the Steel Mill Version)

3.8. Data Logging

Session Log

The ALTAIR PRO Detector has the capability of recording 50 of the most recent events.

Hold the button for one second:

- The instrument pages begin to display.
- Events will be transferred to the PC during this sequence, if:
    - the top of the instrument is pointed toward the optional IR Receiving device
    - a PC is running MSA FiveStar®Link™ Software
    - "CONNECT" button is pressed in the PC FiveStar®Link™ Software.

Stored Events

- **Alarm**
  Alarm type - Alarm value - Time/Date
- **Alarm Clear**
  Alarm type - Alarm value - Time/Date
- **Calibration** (pass/fail)
  Time/Date
- **Self-test** (pass/fail)
  Time/Date
- **Error**
  Error type ($\rightarrow$ Troubleshooting in Section 4) - Time/Data

Periodic Log

Peak gas readings are periodically logged, based on user settings via the PC ($\rightarrow$ Section 5.4 for typical performance).

The date and time display are based on the PC time. Make sure that the date and time on the PC are correct.

Changing the instrument battery can result in lost time in the Data log.

After changing batteries, verify the Time and Date with your PC.

Connecting Instrument to PC

(1) Switch on PC and align instrument to the IR interface of the PC.
(2) Press the button on the instrument.
  - Instrument data will be displayed ($\rightarrow$ Section 3.3)
(3) Start the MSA FiveStar®Link™ Software in the PC and start connection by double-clicking "CONNECT".

3.9. Function Tests on the Instrument

Checking the Confidence indicator

The alarm LEDs and the Confidence indicator in the display must flash every 60 seconds after starting the instrument. This indicates the instrument is operating correctly

Alarm Test

i	The alarm test must be conducted before each use.
	It is part of the self-test.

(1) Turn ON the instrument.

A short alarm is triggered. These include:

- temporary display indicators;
- alarm LEDs flash;
- acoustic signal sounds briefly and
- vibration alarm is triggered briefly.

i	For the Steel Mill version only, the alarm test occurs every time the button is pressed for one second.

Bump-Test

i	The bump-test ($\rightarrow$ Fig. 6) must be conducted before each use.

(1) Press the button for two seconds.

- In the oxygen version, the set oxygen concentration is displayed. Calibration ($\rightarrow$ Section 3.10) must be carried out if the value deviates from 20.8%.
- "TEST" "GAS" "?" is displayed.
- The alarm test (see above) is triggered.

(2) Press the button again if "TEST" "GAS" "?" is displayed.

- Hour glass and "GAS" are displayed

(3) Feed test gas into the instrument (possible test gases $\rightarrow$ Section 5.3).

- If gas is detected "OK" is displayed

(4) Wait approximately five seconds.

- A "✓" is displayed for 24 hours to indicate that the self-test was successful.

If the "✓" does not appear and "ERR" is displayed, check:

- whether the sensor is dirty,
- whether the correct test gas was used,
- whether the test gas cylinder is empty or the date has expired,
- whether the test gas was fed in at the right moment,
- whether the test gas hose was connected to the sensor.

(5) Repeat the bump-test if necessary.

(6) If the self-bump-fails, calibrate the instrument (→ Section 3.10).

(7) Repeat the bump-test after the calibration.
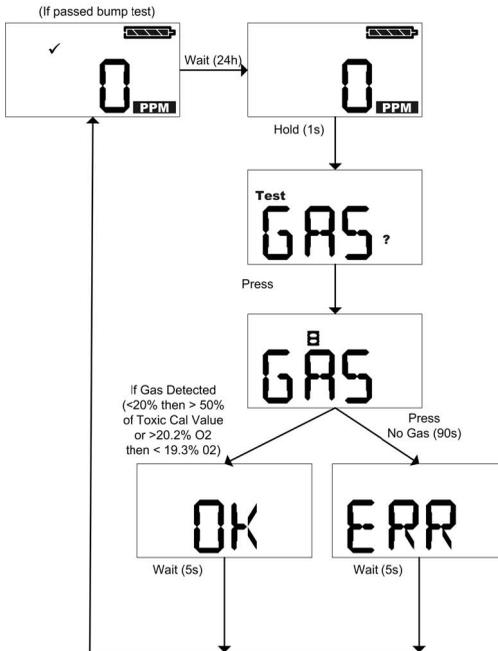
Fig. 6   Conducting the bump-test

3.10. Calibrating the Instrument

The ALTAIR PRO must be calibrated if it does not pass a bump-test.

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

For instruments used to monitor oxygen calibration must be carried out in the following cases:

- any change in the air pressure (including height above sea-level change),
- any extreme changes in the atmospheric temperature ($\rightarrow$ Section 5.1),
- if the bump-test failed,
- at certain intervals by local procedures.

For instruments used to monitor toxic gases (CO and H_2S), calibration must be carried out in the following cases:

- after major shocks,
- any extreme changes in the atmospheric temperature,
- after use under high gas concentrations,
- if the bump-test failed,
- at certain intervals by local procedures.

Calibration - Toxic Gases

⚠	**Attention!** Regulators and tubing used for bump testing and calibrating Cl_2, ClO_2, NH_3, HCN or PH_3 should be labeled by the user for that specific gas and must only be used for that gas exclusively in the future.

i	Make sure that the calibration is carried out in clean, non-contaminated ambient air.

i	Due to high reactivity of Cl_2 and ClO_2, gas, ambient humidity and calibration tubing material can react with the gas and cause the concentration reading to be lower than the actual concentration. It is, therefore, necessary to use dry tubing when calibrating or bump checking with these gases. For best calibration, use the shortest possible tubing to connect to the calibration cylinder for these gases.

Carry out the calibration as follows (also see Fig. 7and Fig. 8):

(1)   Press the button.

- ▪ "TEST" "GAS" "?" is displayed.

(2)   Press and hold the button for 3 seconds.

- ▪ "TEST" "CAL" is displayed.
- ▪ After 3 seconds, "FAS" "?" is displayed which prompts the user to do a fresh air equalisation.

(3)   During the "FAS" "?" display, press the button to do a fresh air equalisation.

> ℹ️   If no fresh air equalisation is carried out, the instrument returns to normal operating mode.

- ▪ During the equalisation, the hour glass and "FAS" are displayed.
- ▪ If the equalisation fails ("ERR" display), the instrument returns to normal operating mode after 5 s.

(4)   If the equalisation is successful ("OK" display), press the button and begin the calibration.

- ▪ "CAL" "?" is displayed.

(5)   During the "CAL" "?" display, press the button and start the calibration mode.

- ▪ The value for the test gas in ppm is displayed.

(6)   To change the value, press and hold the button, until the desired value is set.

- ▪ The new value for the test gas in ppm is displayed.
  The button can be held down to change in larger increments.
- ▪ After 3 seconds, the instrument returns to the calibration mode.

(6)   Feed test gas into the instrument (possible test gases → Section 5.3).

> ⚠️   **Attention!**
> The concentration of the test gas used must match the stipulated value in the "Test gases" table in Section 5.3 for the relevant instrument.
> Otherwise, the calibration is not carried out correctly. If there is a fault, it can lead to serious damage to health or even to death.

- ▪ The gas value, hour glass and "CAL" are displayed alternately.
- ▪ If calibration is successful, after approx. 90 s "OK" is displayed and the instrument returns to normal operating mode after 5 seconds.
- ▪ If calibration **fails**, "ERR" is displayed and the instrument returns to normal operating mode after 5 seconds.
  The current values were not changed.

(7) If calibration fails, check:
- whether the correct test gas was used,
- whether the test gas cylinder is empty or the date has expired,
- whether the test gas hose was connected to the sensor,
- whether the flow governor is set to 0.25 l/min.

(8) If necessary, repeat steps (1) to (7).
- "OK" is displayed. Otherwise ("ERR"), the instrument must be taken out of use.

(9) Conduct a self-test to confirm the calibration.
- If the self-test is successful, a "✓" is displayed.

Factory Set Default Calibration / Bump Test Values

INSTRUMENT TYPE	BUMP TEST GAS	CALIBRATION GAS
CO	60 ppm	60 ppm
H_2S	40 ppm	40 ppm
O_2 and O_2-R	<19% *	20.8%
SO_2	10 ppm	10 ppm
NO_2	10 ppm	10 ppm
NH_3	25 ppm	25 ppm
PH_3	0.5 ppm	0.5 ppm
HCN	10 ppm	10 ppm
Cl_2	10 ppm	10 ppm
ClO_2	2 ppm Cl_2	0.8 ppm ClO_2 **

* The O_2 bump test can also be performed by exhaling on the sensor inlet for approximately three to five seconds.

** MSA recommends calibration of the ClO_2 ALTAIR PRO Detector using a ClO_2 generator for most accurate calibration. This instrument has a cross-sensitivity factor to Cl_2 of:
2 ppm Cl_2 equals approximately 0.8 ppm ClO_2.
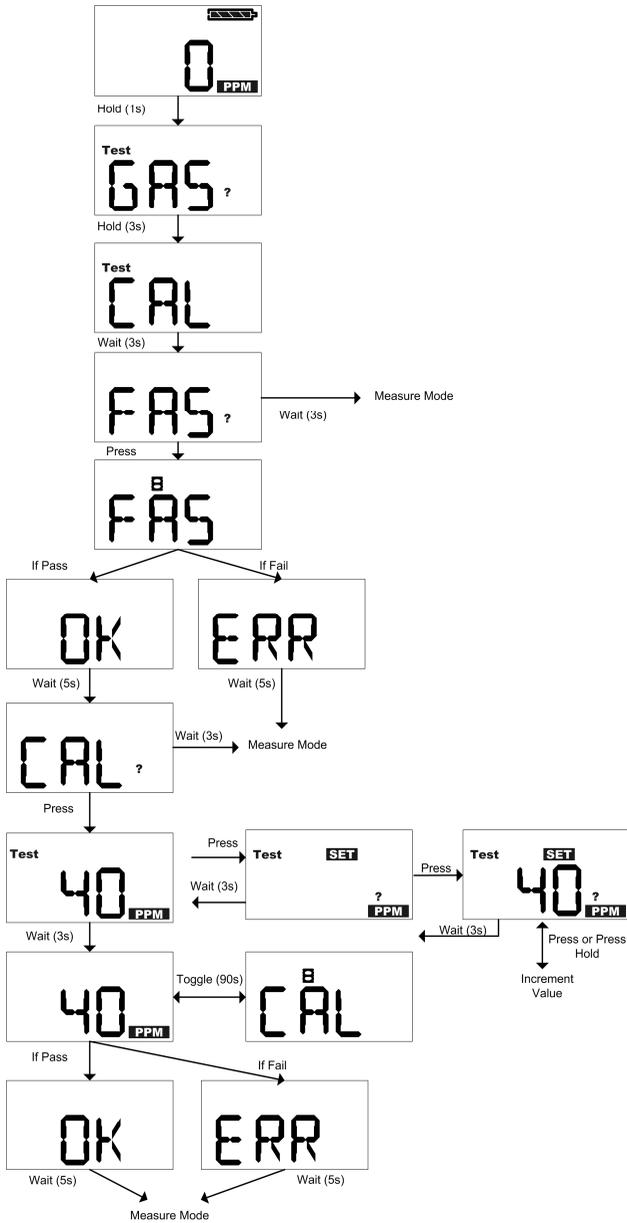
Fig. 7   Calibration - Toxic gases

Calibration - Oxygen

> ⚠️ **Attention!**
> The instrument must be calibrated if, during operation, a value different from 20.8% oxygen in the ambient air is displayed.

> ℹ️ In the event of extreme changes in the air pressure or the atmospheric temperature, false alarms can be created.
> Therefore, calibrate the instrument under the conditions of use. The calibration must be carried out in clean, non-contaminated ambient air.

The ALTAIR PRO is equipped with a feature to allow calibration at pressure and/or temperature of use.

To enter the calibration mode, make sure you are in fresh, uncontaminated air.

(1) Press the button for 2 seconds.
   - The current oxygen concentration is displayed.
   - The display switches to "TEST" "GAS" "?".
(2) During the "TEST" "GAS" "?" display, press and hold the button.
   - "GAS" "CAL" is displayed.
   - After 3 seconds, "FAS" "?" is displayed which prompts to do a fresh air setup.
(3) During the "FAS" "?" display, press the button to perform a calibration at 20.8% O_2.

> ℹ️ The fresh air equalisation must be carried out in clean, non-contaminated ambient air. During the process, do not breathe on the sensor.

> ℹ️ If no fresh air equalisation is carried out, the instrument returns to normal operating mode.

   - During the equalisation, the hour glass and "FAS" are displayed.
   - If the equalisation is successful, "OK" is displayed
   - If equalisation **fails**, "ERR" is displayed and the instrument returns to normal operating mode after 5 s.
     The current values were not changed.
(4) If calibration fails, check:
   - that the equalisation was carried out in clean ambient air,
   - that during the equalisation, you did not breathe on the sensor.
(5) If necessary, repeat the steps (1) to (4).
   - "OK" is displayed. Otherwise ("ERR"), the instrument must be taken out of use.
(6) Conduct self-test to confirm the calibration.
   - If the self-test is successful, a "✓" is displayed.
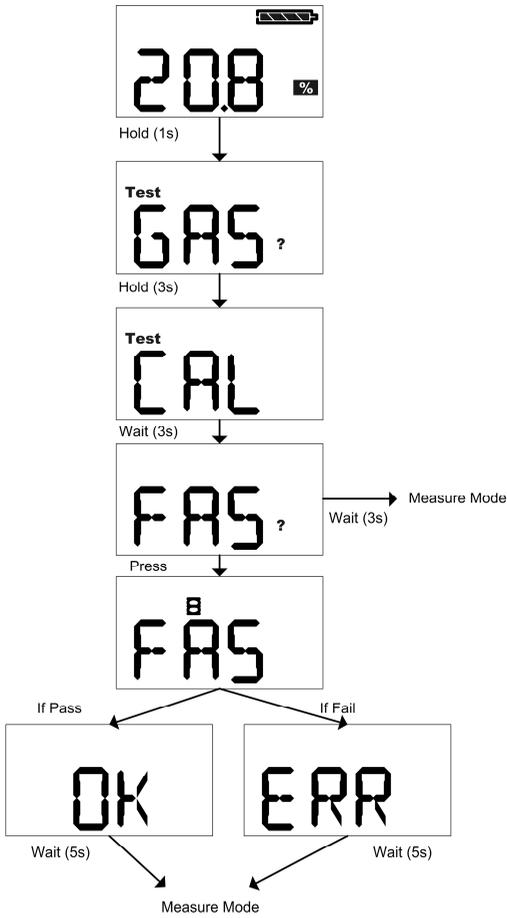
Fig. 8   Calibration – Oxygen

4.   Maintenance

If irregularities occur during operation, use the displayed error codes to determine how to proceed further.

4.1.   Troubleshooting

Problem	Description	Reaction
Alternating display		
TMP/ERR	Temperature out of range	Return instrument to normal temperature range and recalibrate. Inform MSA[*)]
AD/ERR	Sensor feedback error	Remove battery and recalibrate. Inform MSA[*)]
EE/ERR	EEPROM error	Inform MSA [*)]
MEM/RST	EEPROM Data Error	Calibrate instrument. Reconfigure any custom settings (alarm setpoints, datalog, etc...)
PRG/ERR	Memory error	Inform MSA [*)]
RAM/ERR	RAM error	Inform MSA [*)]
LED/ERR	LED error	Check alarm LEDs
VIB/ERR	Vibration alarm error	Check vibration alarm
UNK/ERR	Indefinable error	Inform MSA [*)]
🔋	Battery warning (no alarm)	Remove from service as soon as possible and replace battery
🔋 /ERR	Battery warning (with alarm – flash LEDs, horn)	Instrument is no longer sensing gas. Remove from service and replace battery.
SNS/ERR	Sensor error	Inform MSA [*)]
Instrument does not turn ON	Low battery	Replace battery

[*)] If the error occurs during the warranty period, please contact the MSA customer service. Otherwise, the instrument must be put out of operation.

4.2. Replacing the Battery
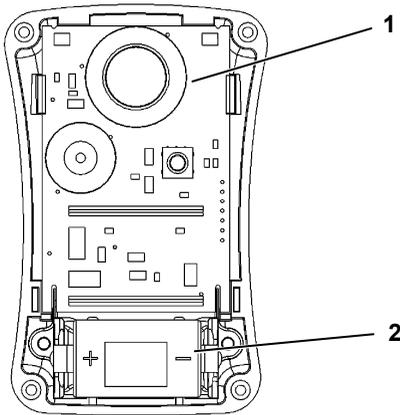
Fig. 9   Sensor and Battery Replacement

1   Sensor

2   Battery

(1) Remove the four screws securing the case halves together.

(2) Carefully remove the front cover to expose the battery.

- The circuit board will remain with the back half of the case.
- Do not touch the display connections (two blue connectors)

(3) Remove the depleted battery and replace only with one specified in section 5.1.
Be sure to observe proper polarity on the battery, as shown on the battery holder.

(4) Ensure the interface and connectors for the display are clean and free of dirt for proper operation.

If necessary, the display connectors can be cleaned with a soft, lint free cloth.

(5) Replace the front cover, making sure the sensor, horn gasket and sensor gasket are properly seated.

> ⚠ **Caution!**
> Do not over-tighten the screws; otherwise, the case may be damaged.

(6) Replace the four screws.

4.3. Replacing the Sensor

> ⚠ **Caution!**
> 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.

(1) Remove the four screws securing the case halves together.

(2) Carefully remove the front cover to expose the sensor (located near the top of the instrument, near the alarm lights → Fig. 9).

(3) Remove the sensor from its sockets.

> ⚠ **Caution!**
> The new replacement sensor must be the same part number and type as the one being replaced; otherwise, improper operation will result.

(4) Install the new sensor in the sockets on the PC board (it can only be installed one way). Fully seat the sensor against the board.

(5) Replace the front cover, making sure the sensor, horn gasket, and sensor gasket are properly seated.

(6) Ensure the interface and connectors for the display are clean and free of dirt for proper operation.

   If necessary, the display connectors can be cleaned with a soft, lint-free cloth.

> ⚠ **Caution!**
> Do not over-tighten the screws; otherwise, the case may be damaged.

(7) Replace the four screws.

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

(8) The instrument MUST be calibrated as previously described.

5. Technical Specifications/Certifications

5.1. Technical Specifications

Weight	125 g (instrument with battery and clip)
Dimensions	86 x 51 x 50 mm (L x B x T) – with fastening clip
Alarms	Two super bright LEDs with 320° viewing angle and a loud acoustic alarm
Volume of acoustic alarm	95 dB typical
Displays	Large display of measured values
Battery type	Lithium CR2 non-rechargeable. Replace with Energizer EL1CR2, VARTA CR2, Panasonic CR2 battery only
Battery life	Approx. 12 months under normal conditions
Sensor	Electrochemical

Factory alarm setpoints *	LOW * alarm (ppm)	HIGH * alarm (ppm)	STEL* (ppm)	TWA * (ppm)	Min. alarm setpoint	Max. alarm setpoint	FAS time (sec)	CAL/ SPAN time (sec)
CO & CO Fire	25	100	100	25	15	1450	<15	90
CO Steel	75	200	200	75	15	1450	<15	90
H_2S	10	15	15	10	5	175	<15	90
O_2	19.5%	23.0%	--	--	5.0	24	<15	90
SO_2	2.0	5.0	5.0	2.0	2.0	17.5	<15	90
NO_2	2.0	5.0	5.0	2.0	1.0	17.5	<15	240
NH_3	25	50	35	25	15	75	<15	180
PH_3	0.3	1.0	1.0	0.3	0.1	3.75	<15	90
HCN	4.5	10.0	10.0	4.5	1.0	20.0	<15	240
Cl_2	0.5	1.0	1.0	0.5	0.2	17.5	<15	240
ClO_2	0.10	0.30	0.30	0.10	0.10	0.75	<15	360

[*)] Other setpoints available upon request or at any time via MSA FiveStar®Link™ Software

Temperature range	Operation	:	- 20 °C to +50 °C
	Storage	:	0 °C to +40 °C
	Vibration alarm	:	to 0 °C
Humidity range	10 - 95% rel. humidity, non-condensing		
Dust and spray protection	IP 67		
Function tested gases	CO, H_2S, O_2		

*) When placing an order, you can request different alarm setpoints. The settings can be changed before commissioning with the help of the button and thereafter, with the FiveStar®Link™ Software.

Warranty - MSA warrants that this product will be free from mechanical defects and faulty workmanship for a period of 2 years from date the product is first used, provided it is maintained and used in accordance with MSA's instructions and / or recommendations. Warranty shall not exceed two years and six months from the date of manufacture. The instrument's battery is not covered under the warranty. The instrument's sensors are warranted for a period as described in the table below.

SENSORS	WARRANTY TERM
CO, CO Fire, CO Steel, H_2S, O_2, O_2-R	30 months from the date of manufacture or 24 months from the date of first use, whichever occurs first
SO_2, NO_2, NH_3, PH_3, HCN, Cl_2, ClO_2	18 months from the date of manufacture, or 12 months from the date of first use, whichever occurs first

⚠ **Attention!**
This instrument has not been approved for use in atmospheres containing >21% oxygen.

5.2. Certifications

European Community

The product ALTAIR PRO complies with the following directives, standards or standardised documents:

Directive 94/9/EC (ATEX)   : FTZU 06 ATEX 0134 X

⟨Ex⟩   II 2G EEx ia IIC T4
-20 °C ≤ Ta ≤ +50 °C
EN 50 014, EN 50 020

Directive 89/336/EC (EMC)   :   EN 50 270 Type 2, EN 61 000-6-3

C E   0080

Other countries

Country	USA	
	⟨SR⟩ c us	**Exia** Class I, Groups A, B, C, D Ambient temperature: -20 °C to +50 °C; T4
	Canada	
	⟨SR⟩ c us	**Exia** Class I, Groups A, B, C, D Ambient temperature: -20 °C to +50 °C; T4
	Australia	Ex ia IIC T4 Ambient temperature: 50 °C

5.3. Test Gases Table

Instrument version	Test gas - Self-test	Test gas - Calibration
CO	60 ppm	60 ppm
H_2S	40 ppm	40 ppm
O_2	<19% [*)]	20.8%

*) The self-test can also be conducted where the operator breathes out onto the sensor for about
   3 - 5 seconds.

5.4. Oxygen Typical Performance Specifications

Range	0 - 25% O_2
Resolution	0.1% O_2
Reproducibility	0.7% O_2 for 2 - 25% O_2
Response time	90% of final reading 30 seconds (normal temperature range *). Three minutes (extended temperature range **)

*) normal temperature range 0-40 °C
**) extended temperature range -20 °C to 0 °C and 40 °C to 50 °C

5.5. Toxic Performance Specifications

Sensor	CO or CO STEEL (Carbon Monoxide)
Range	0-1500 ppm
Resolution	1 ppm
Reproducibility	±5 ppm or 10% reading, whichever is greater (normal temperature range *
	±10 ppm CO or 20% or reading, whichever is greater (extended temp. range **)
Response time	90% of final reading in 60 seconds (normal temp. range *)
Sensor	H_2S (Hydrogen Sulphide)
Range	0-200 ppm
Resolution	1 ppm
Reproducibility	+2 ppm or 10% of reading, whichever is greater (normal temperature range *)
	+5 ppm or 20% of reading, whichever is greater (extended temp. range **)
Response time	90% of final reading < 30 seconds (normal temperature range *)

Sensor	SO_2 (Sulfur Dioxide)
Range	0-20.0 ppm
Resolution	0.1 ppm
Sensor	NO_2 (Nitrogen Dioxide)
Range	0-20.0 ppm
Resolution	0.1 ppm
Sensor	NH_3 (Ammoniac)
Range	0-100 ppm
Resolution	1 ppm
Sensor	PH_3 (Phosphine)
Range	0-5.0 ppm
Resolution	0.05 ppm
Sensor	HCN (Hydrogen Cyanide)
Range	0-30.0 ppm
Resolution	0.5 ppm
Sensor	Cl_2 (Chlorine)
Range	0-20.0 ppm
Resolution	0.1 ppm
Sensor	ClO_2 (Chlorine Dioxide)
Range	0-1.00 ppm
Resolution	0.02 ppm

*   normal temperature range 0-40 °C

** extended temperature range -20 °C to 0, 40 °C to 50 °C (NH_3 and ClO_2 only: -20 °C to 0 °C)

5.6. Data Logging Specifications

Session datalog	Number of shared events	50 (most recent occurrences)
	Data transmission method	Via MSA infrared adapter on a PC using MSA FiveStar®Link™ Software > version 4.4
	Event log information	Alarm - Alarm Type - Alarm Value - Time/Date
		Alarm Clear - Alarm Type - Alarm Value - Time/Date
		Cal (Pass/Fail) - Time/Date
		Bump (Pass/Fail) - Time/Date
		Error Non-Shutdown - Error Type (See Error List) - Time/Date
		ON/OFF - Time/Date
	Transmission time	Typically less than 60 seconds max.
Periodic datalog	Default logging interval	Three minute peak readings (configurable via PC from 15 seconds to 15 minute peaks or one minute peak average)
	Storage time estimate	Typically greater than 100 hours with default interval (storage time varies based on interval and sensor activity)
	Transmission time	Typically less than three minutes.

6.   Order Information

Description	Part No.
Test gas cylinder, 60 ppm CO (factory setting calibration gas)	10073231
Test gas cylinder, 300 ppm CO, RP (factory setting calibration gas)	10029494
Test gas cylinder, 40 ppm H_2S, RP (factory setting calibration gas)	10011727
Test gas cylinder, 10 ppm NO_2, RP	10029521
Test gas cylinder, 10 ppm SO_2, RP	10079806
Test gas cylinder, 25 ppm NH_3, RP	10079807
Test gas cylinder, 10 ppm Cl_2, RP	10011939
Test gas cylinder, 2 ppm Cl_2, RP	10028080
Test gas cylinder, 10 ppm HCN, RP	10079808
Regulator, 0.25 l/min	478359
Hose, 40 cm (16"), Not to be used for NH_3, Cl_2 or ClO_2	10030325
Hose, 40 cm (16"), Tygon (For NH_3, Cl_2, ClO_2 only)	10080534
Fastening-clip, black	10040002
Fastening-clip, stainless steel	10069894
Mobile phone-style clip	10041105
Key belt	10041107
MSA FiveStar® Link™ Software with IR (optional for event logging)	710946

Description	Part No.
Sensor, O_2	10046946
Sensor, CO, Steel Mill, H_2 resistant	10074962
Sensor, CO	711302
Sensor, H_2S	711303
Sensor HCN	10080220
Sensor Cl_2	10080221
Sensor SO_2	10080223
Sensor NO_2	10080224
Sensor NH_3	10080225
Sensor PH_3	10080226
Sensor ClO_2	10080222
Sensor gasket	10071375
Battery – CR2	10074132
Clip, Hard Hat	10073346

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