

**Operating Manual** 

# ULTIMA/ULTIMA<sup>®</sup> X Series

# **Controller and Calibrator**







MSA AUER GmbH D-12059 Berlin Thiemannstrasse 1

Germany

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# **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

#### **MSA** Controller

based on the EC-Type Examination Certificate :

#### INERIS 03 ATEX 0130 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 of France, Notified Body number: 0080.

We further declare that this product is in conformance with the EMC directive 2004 / 108/ EC.

EN 61000 - 6 - 3 :2007

Dr. A. Schubert

Dr. Axel Schubert R&D Instruments

Berlin, May 2011



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#### **MSA** Calibrator

based on the EC Type Examination Certificate:

#### INERIS 03 ATEX 0129 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 of France, Notified Body number: 0080.

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# MSA

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# 1. Safety Regulations

## 1.1. Correct Use

The MSA ULTIMA/ULTIMA<sup>®</sup> X Series Controller and Calibrator - hereinafter referred to as Controller and Calibrator - use an Infrared (IR) LED to transmit to an IR receiver in the ULTIMA/ULTIMA<sup>®</sup> X Series Gas Monitor.

It is imperative that this operating manual be read and observed when using the apparatus. 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.

# 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 specifications will be considered as noncompliance. 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

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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.

## 2. Description

## 2.1. ULTIMA/ULTIMA X Calibrator - Instrument Overview



Fig. 1 ULTIMA/ULTIMA X Calibrator

- 1 Zero Button
- 2 Calibrate Button

- 3 Address Button
- 4 Housing

The Calibrator is a hand-held, self-contained unit powered by two internal AAA batteries that allows one person, non-intrusive calibration of an ULTIMA/ULTIMA X Series Gas Monitor, enabling the Monitor to be calibrated at the unit without opening the enclosure.

It is an intrinsically safe product for use in hazardous areas ( $\rightarrow$  Section 6.1).

Using the Calibrator it is possible to select the multiplex address of an ULTIMA/ULTIMA X Series Gas Monitor and set up in the multiplex mode (if the monitor is so equipped).

No adjustments are required; operation is simple, by three-buttons.

The Calibrator provides auto power ON/OFF.

## 2.2. ULTIMA/ULTIMA X Calibrator - Operation

The Calibrator is equipped with three buttons for the following functions.

#### 1. ZERO Button

This button performs a zero function on the ULTIMA/ULTIMA X Series Gas Monitor; periodically. The monitor may require only a zero adjustment.

#### 2. CALIBRATE Button

Performs a zero and span calibration function on the ULTIMA/ULTIMA X Series Monitor; during a complete calibration, the Gas Monitor requires both a zero and span check gas.

#### 3. ADDRESS Button

Displays or changes the multiplex address on the ULTIMA/ULTIMA X Series Monitor, if so equipped.

All Calibrator operations are performed by simply pointing the Calibrator at the ULTIMA/ULTIMA X Series Gas Monitor display from a distance of no greater than six inches.



Fig. 2 Calibrator - Operation

1 Gas Monitor

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2 Calibrator

Communication to the ULTIMA/ULTIMA X Series Gas Monitor is made via a one way, digitally encoded IR link to ensure tamper-proof and reliable non-intrusive communication.

2.3.

# ULTIMA/ULTIMA X Controller - Instrument Overview



Fig. 3 ULTIMA/ULTIMA X Controller

- 1 Display
- 2 Numeric Buttons

- 3 Operating Buttons
- 4 Housing

The Controller allows non intrusive calibration of an ULTIMA/ULTIMA X Series Gas Monitor, enabling the Monitor to be calibrated at the unit without opening the enclosure.

It is a hand-held, self-contained unit powered by two internal AA batteries. The Calibrator is an intrinsically safe product for use in hazardous areas ( $\rightarrow$  Section 6.2).

The Controller allows the following operations on an ULTIMA/ULTIMA X Gas Monitor:

- Set Monitor time and date
- Set the average interval
- Set/display span gas value
- Set/display alarms
- Display minimum, maximum, and average gas readings
- Enable calibration Output Signal
- Configure auto-calibration feature
- Display previous calibration date
- Set/display address
- Mimic Calibrator
- Set or display Range (ULTIMA X Series units only).

#### 2.3.1 Setting up the Controller



When sending a command to the ULTIMA/ULTIMA X Series Gas Monitor

- 1. The Controller must be READY prior to any key press.
- To change any function on the ULTIMA/ULTIMA X Series Gas Monitor, point the top of the Controller directly at the clear face of the sensor (→ Fig. 2) and press the desired sequence of Controller buttons. The Controller must be pointed at sensor when final button of sequence is pressed.
- 3. The top surface of the Controller must be within six inches of the sensor face to enable reception.

Each button pressed is acknowledged by a short beep.

The CLEAR button is acknowledged by a double beep.

When invalid responses are entered, the Controller resets to the READY mode or re-prompts user for a correct entry.

#### 2.3.2 Using the ID CODE Feature

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Controller operation can be password-protected to prevent peration by unauthorised personnel. All Controllers are shipped from the factory with Password ID disabled.

#### DESCRIPTION

#### 2.3.3 Setting the Password ID

- (1) With the unit OFF, press and hold the ENTER button for approximately five seconds, until the display prompts: ID KEY ####
- (2) Use the NUMBER buttons:
  - To CHANGE password ID by entering the old ID number (go to Step 3).
  - To ENABLE a password ID by entering 9999.
- (3) Press the ENTER button.
  - The display prompts: NEW KEY #####
- (4) Enter the desired four-digit ID and press the ENTER button.
  - The Controller enters the READY mode and saves the I D password required for future Operation.

#### 2.3.4 Disabling the Password ID

- (1) With the unit OFF, press and hold the ENTER button until the display prompts ID KEY ####.
- (2) Using the NUMBER buttons, enter the old ID number.
- (3) After entering the four-digit number, press the ENTER button.
  - The display prompts: NEW KEY ####
- (4) Enter 9999 and press the ENTER button.

The Controller enters the READY mode and disables the password ID function for future Operation.



If the ID password is set and forgotten, contact an MSA service representative.

#### 2.3.5 Turning the Controller ON

- (1) Press the ENTER button.
  - Unit performs a self-test and displays the firmware version for several seconds.
  - If the Controller displays the ULTIMA READY or ULTIMA X READY prompt, it is ready for use.
  - If Controller displays the ID CODE prompt, enter the user-selected password ID (→ Section 2.3.2).
- (2) Turning the Controller OFF
  - The unit turns OFF automatically approximately 100 seconds after the last button is pressed.
  - To manually turn OFF the unit, press and hold the CLEAR button for five seconds.



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A dual beep tone sounds when CLEAR button is pressed.

#### 2.3.6 Setting the Controller for an ULTIMA or ULTIMA X Series Instrument

The Controller features the capability to transmit to both the ULTIMA and ULTIMA X Series instruments.

To select the target instrument:

- (1) Turn unit ON to place into the READY mode.
  - Display prompts ULTIMA READY or ULTIMAX READY.
     (→ Section 2.3.5)
- (2) Press the DISPLAY button once.
  - Display prompts: 0=ULTIMA or 1=ULTIMA X.
- (3) Enter "0" to set the Controller for an ULTIMA instrument or "1" to set the Controller for an ULTIMA X Series instrument.
  - If your entry is valid, the Controller will display "ULTIMA READY" or "ULTIMAX READY".
  - If your entry is **invalid**, it will not be accepted. Start this procedure again to change the Controller type.

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### 2.3.7 Setting the Internal TIME of the Controller

The Controller features an internal real time clock for time stamping.



Momentarily pressing the TIME button displays the current hours and minutes.

Press the CLEAR button to return to the READY mode.

To set the real time clock:

- (1) Place unit in the READY mode
  - Display prompts: "ULTIMA READY" or "ULTIMAX READY".
     (→ Section 2.3.5).
- (2) Press and hold TIME button until the HH: MM prompt appears.
- (3) Using the NUMBER buttons, enter the current time in 24-hour format (e.g.: 4:00 P.M. = 16:00; leading zeros are required).
  - If your entry is **valid**, press ENTER button to save this time.
  - If your entry is **invalid**, it will not be accepted. Re-enter the correct time or press the CLEAR button to cancel and start the procedure again.
  - The DEL button allows for correction during entry.

#### 2.3.8 Setting the Internal DATE of the Controller

The Controller features an internal real time clock for date stamping.



Momentarily pressing the DATE button displays the current date. Press the CLEAR button to return to the READY mode.

To set the real date:

- (1) Place unit in the READY mode
  - Display prompts: "ULTIMA READY" or "ULTIMAX READY".
     (→ Section 2.3.5).
- (2) Press and hold DATE button until the MM-DD-YYYY prompt appears.
- (3) Using the NUMBER buttons, enter the current date (leading zeros are required).
  - If your entry is **valid**, press ENTER button to save this date.
  - If your entry is invalid, it will not be accepted.
     Re-enter the correct date or press the CLEAR button to cancel and start the procedure again.
  - The DEL button allows for correction during entry.

## 2.4. Resetting latched Alarms

When an ULTIMA/ULTIMA X Gas Monitor has an active latched alarm (indicated by a flashing alarm display):

- An infrared (IR) remote device (such as the Calibrator or Controller) may be used to reset this alarm.
- If an ULTIMA/ULTIMA X Series Gas Monitor has an active latched alarm, the next IR command it receives from a calibration device will reset the latched alarm (if it is not beyond the alarm threshold). The intended IR command will be ignored and interpreted as an 'alarm reset'. When the latching alarm function is inactive, other valid IR commands may be used.

## 3. Calibration

The ULTIMA/ULTIMA X Series Gas Monitor provides non-intrusive calibration through the use of the Controller/Calibrator.

When calibrating any ULTIMA/ULTIMA X Series Gas Monitor which has any accessory attached to it, refer to the accessory manual for complete calibration instructions. Some accessories for the Gas Monitor include:

- ULTIMA Sampling Module
- ULTIMA Auto-Cal Module

While factory calibration is standard practice for the ULTIMA/ULTIMA X Series Gas Monitors, it is recommended to perform an INITIAL calibration when first placing the unit into operation ( $\rightarrow$  Section 3.5.2).

It is good practice to read the appropriate calibration instructions before attempting an actual calibration. Also, identify and become familiar with all of the calibration components. During the calibration, it is necessary to quickly apply the span gas to the unit. Prior connection of the calibration components will aid in ease of unit calibration.

## 3.1. Equipment Required

Three calibration kits (numbered 40, 41, and 54  $\rightarrow$  Fig. 4, Fig. 5 and Fig. 6) are available from MSA for diffusion ULTIMA/ULTIMA X Series Gas Monitors. The kits are housed in a convenient carrying case and contain all items necessary (less gas) for a complete and accurate calibration.

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#### Warning!

These calibration kits contain zero caps to use in place of zero calibration gas. These caps cap only be used when the ambient air does not contain the gas the monitor is detecting.

If there is any doubt, use zero gas when zeroing the Gas Monitor; otherwise, improper calibration could occur.

The calibration kits do not calibrate ULTIMA Sampling Modules or an ULTIMA/ULTIMA X Series unit equipped with a flow cap. For flow or sample module Systems, refer to the ULTIMA Aspirated Sampling Module Manual (P/N 710200) or to the ULTIMA DC Pump Sampling Module Manual (P/N 710201).



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The Calibration procedure for the sample draw ULTIMA X Monitor is the same as the procedure for the diffusion version, except calibration gas is applied to the Calibration entry port of the inlet flow block and the cal kit for pumped units provides a flow matching regulator.

The check or calibration gases can also be carried in the case. See table in Section 3.3 for the appropriate zero and span gas cylinders for your ULTIMA/ULTIMA X Series Gas Monitor.

The table shows the recommended calibration kit for ULTIMA and ULTIMA X Series Gas Monitors.

Typically, Cal Kit 41 uses 0.25 LPM regulator and a calibration cap to contain the calibration gas.

Cal Kits 40 and 54 use a 1.5 LPM regulator and no calibration cap. If Cal Kit 41 is recommended and the application is such that the calibration cap cannot be used (such as for a remote sensor application), Cal Kit 40 may be used. However, any time Cal Kit 40 is used, ambient wind conditions must be minimized to avoid a calibration with increased sensitivity.



The ULTIMA XIR uses Cal Kit 40 and does require a calibration cap. This calibration cap (P/N 10041533) is shipped with the product.

#### 3.2. Span Gas Values



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#### Warning!

The span gas values of ULTIMA Gas Monitor combustible models are pre-set to one of the broad categories shown Section 3.3.

Typical gases or vapours are listed under each category given in Section 3.4.

Always calibrate for the least sensitive gas or vapour (higher number category) expected to be measured ( $\rightarrow$  tables in Section 3.4); otherwise, instrument readings may be incorrect.

The ULTIMA/ULTIMA X Monitor is factory-shipped with a preset span gas value ( $\rightarrow$  table in Section 3.3). This span gas value can be changed via the Controller; otherwise, the span gas must correspond to preset concentrations ( $\rightarrow$  Section 4 to change the span gas value).

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Gas Type	Range	Span Gas Preset Values	MSA RP Cylinder Order-No.	Calibration Kit	Warm-up time
Carbon	0-100 ppm	60 ppm	710882		15 minutes
Monoxide	0-500 ppm	300 ppm	10027938		15 minutes
	0-1000 ppm	400 ppm	10028048	•	15 minutes
Sulphur	0-25 ppm	10 ppm	10028070	-	15 minutes
Dioxide	0-100 ppm	10 ppm	10028070		15 minutes
Hydrogen	0-10 ppm	5 ppm	710414	40	15 minutes
Sulphide	0-50 ppm	10	40000000	•	15 minutes
	0-100 ppm	- 40 ppm	10028062		15 minutes
	0-500 ppm	250 ppm	10089547	•	15 minutes
Nitric Oxide	0-100 ppm	50 ppm	10028074	-	15 minutes
Nitrogen Dioxide	0-10 ppm	5 ppm	710332		30 minutes
Chlorine	0-5 ppm	2 ppm	710331	-	30 minutes
	0-10 ppm	-			30 minutes
	0-20 ppm	10 ppm	10028066	•	30 minutes
Hydrogen Cyanide	0-50 ppm	10 ppm	10028072	41	30 minutes
Hydrogen Fluoride ( <b>7</b> )	0-10 ppm	10 ppm	10053747	-	30 minutes
Chlorine Dioxide (4)	0-3 ppm	1 ppm	710331	-	30 minutes
Oxygen	0-5%	5%	493580		15 minutes
	0-25%	20.8%	10028028 (2)	•	15 minutes
Natural Gas	0-100%	25% LEL(1)	10028034	-	15 minutes
(3)	LEL				15 minutes
Petroleum Vapours ( <b>3</b> )	0-100% LEL	40% LEL(1)	-		15 minutes
(Gasoline)	-			40	15 minutes
General	0-100%	55% LEL(1)	-		15 minutes
Solvents (3)	LEL				
Non-Methane IR	0-100%	29% LEL (1)	-		
Methane IR	0-100% LEL	50% LEL (5)	10028032	-	

Gas Type	Range	Span Gas Preset Values	MSA RP Cylinder Order-No.	Calibration Kit	Gas Type
Phosphine	2.0 ppm	0.5 ppm	710533		24 hours
Arsine	2.0 ppm	1.0 ppm	-		24 hours
Germane	3.0 ppm	2.5 ppm	-		4 hours
Silane	25 ppm	5 ppm	10014897	41	4 hours
Diborane	50 ppm	15 ppm	-		30 minutes
Fluorine	5.0 ppm	4.0 ppm	710331		30 minutes
Bromine	5.0 ppm	2.5 ppm	-		30 minutes
Ammonia	0-50 ppm	25 ppm	10028076		30 minutes
	0-1000 ppm	300 ppm	10044014		30 minutes
Hydrogen	0-1000 ppm	500 ppm	10022386		30 minutes
ETO (6)	0-10 ppm	4.0 ppm	10028070	40	24 hours
Carbon Dioxide IR	0-5000 ppm	2000 ppm	479266		
	0-2%	1.5%	807386		
	0-5%	2.5%	479265		
Hydrogen Chloride	0-50 ppm	40 ppm	10028078	54	30 minutes

1) Calibrated with Propane (0.6% gas by volume)

2) Not required for standard calibration procedure

3) For combustible gas, it is good practice to calibrate unit with gas to be detected

4) CLO2 is calibrated with CL2 or use CLO2 calibrator kit (order no. 710420)^

5) Methane IR is calibrated with 50% LEL methane

6) ETO is calibrated with SO2

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7) Hydrogen Fluoride (HF) is calibrated with Suphur Dioxide (SO2) 10 ppm SO2 = 8 ppm HF

The LEL values used are based on NFPA 1997. Local regulations may require different LEL values to be used.



#### Fig. 4 Calibration Kit 40 contents

1 Tubing (P/N 711112)

- 3 Zero Cap (P/N 710535)
- 2 1.5 LPM Flow Regulator (P/N 478358)



#### Fig. 5 Calibration Kit 41 contents

- 1 Tubing (P/N 711112)
- 2 0.25 LPM Flow Regulator (P/N 478359)
- 3 Zero Cap (P/N 813774)
- 4 Zero Cap (P/N 710535)
- 5 Calibration Cap (P/N 710441)
  - Calibration Cap (P/N 10020030)

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The kit may also include one or two gas cylinders.

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Fig. 6 Calibration Kit 54 contents

- 1 Tubing (P/N 711112)
- 2 Desiccant (P/N 10064306)
- 3 1.5 LPM Flow Regulator (P/N 478358)
- 4 Zero Cap (P/N 710535)

The kit may also include one or two gas cylinders.

## 3.4. Calibration Guide for Combustible Gas Sensor



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The response factors shown in table below must not be used for applications that require ATEX approval.

For ATEX safety related applications the ULTIMA must be calibrated with the gas of interest. Please refer to the ULTIMA X Series Operating Manual for details.

## 3.4.1 Category 31 – Natural Gas

To detect the following gases, recalibrate with 0.6% Propane and set the span gas value accordingly.

Gas Type		Gas Type	
Acetaldehyde	23	Hydrogen	16
Acetylene	24	MAPP Gas	20
Butadiene. 1. 3	25	Methane	20
Carbon Monoxide	20	Methanol	20
Ethane	24	Methylene Chloride	24
Ethylene	25	Monomethyl Amine	22
Ethylene Dichloride	22	Trigonox B	22

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## 3.4.2 Category 32 – Petroleum

To detect the following gases, set span point at 40% LEL with 0.6% Propane applied to sensor.

Gas Type		Gas Type	
1.1.1 Trichloroethane	32	Ethylene Oxide	36
Acetic Acid	28	Freon 152A	28
Acetone	37	Gasoline	35
Allyl Chloride	30	Methyl Acetate	34
Acrylonitrile	26	Isoprene	33
Acrolein	28	Hexane	40
Benzene	37	Methyl Chloride	32
Butane (n)	36	Methyl Propane <sup>2)</sup>	29
Butane (iso)	32	Methyl t-Butyl Ether	35
Butanol (iso)	38	Pentane (n)	36
Butene-1	34	Pentane (iso)	36
Butene-2	37	Pentene	35
Butyl Acetate (n)	28	Propane	29
Butylene	33	Propanol (n)	36
Butyraldehyde	30	Propanol (iso)	37
Chlorobenzene	38	Propylene	33
Cyclohexane	37	Propylene Oxide	33
Dimethoxyethane	26	Tetrahydrofuran	30
Dioxane. 1. 4	39	Toluene	39
Epichlorhydrin	33	Trichloroethylene	35
Ethanol	30	Triethylamine	38
Ether. Diethyl	37	Vinyl Acetate	34
Ether. Dimethyl	30	Vinyl Chloride	32

## 3.4.3 Category 33 – Catalytc Type 1S General Solvents

To detect the following gases, recalibrate with 0.6% Propane and set the span gas value accordingly.

Gas Type		Gas Type	
Amyl alcohol	43	JP-4	41
Butanol (n)	48	Methyl Cellosolve	49
Butyl Acrylate	46	Methyl Ethyl Ketone	52
Cellosolve	42	Methyl Isobutyl Ketone	53
Di isopropylamine	42	Methyl Methacrylate	40
Diethylamine	41	Naphtha. VMSP	53
Ethyl Acetate	43	Octane (iso)	52
Ethyl Acrylate	52	Propyl Acetate	45
Ethyl Benzene	41	Styrene	42
Heptane	42	Xylene	50
Hexene	42		

#### 3.4.4 Category 34 – ULTIMA IR Methane

To detect the following gases, recalibrate with 2.5% methane and set the span gas value accordingly.

Gas Type		Gas Type	
Acetone	86	Isoproponol	25
Butadiene, 1, 3	80	MEK	53
Cyclohexane	14	Methane	50
Ethanol	17	Methanol	14
Ethyl Acetate	34	Methyl Formate	13
Ethylene	95	Propylene	39
Heptane	14	Toluene	64
Hexane	14	Xylenes	53
IsoButanol	20		

#### 3.4.5 Category 35 – ULTIMA IR Non-Methane

To detect the following gases, recalibrate with 0.6% propane and set the span gas value accordingly.

Gas Type		Gas Type	
Butane	31	IsoButane	33
Butyl Acetate	48	IsoButanol	47
Cyclohexane	37	IsoPropanol	52
Cyclopentane	32	Methanol	27
Dimethyl Ether	25	Methyl Formate	35
Ethane	30	Pentane	31
Ethanol	36	Propane	29
Ethylene Oxide	72	Propyl Acetate	51
Heptane	36	Propyl Alcohol	31
Hexane	37	Propylene Oxide	26

#### 3.4.6 Category 38 – ULTIMA XIR Methane

To detect the following gases, recalibrate with 25% methane and set the span gas value accordingly.

Methane 50	Gas Type		
	Methane	50	_

#### 3.4.7 Category 39 – ULTIMA XIR Non-Methane

To detect the following gases, recalibrate with the stated % propane and set the span gas value accordingly.

Gas Type		Gas Type	
Butane, 0.6% propane	28	Hexane, 0.6% propane	41
Cyclopentane, 0.6% propane	30	Pentane, 0.6% propane	33
Ethane, 0.6% propane	25	Propane, 0.6% propane	29
Ethylene, 0.1% propane	28		

#### 3.4.8 Example

If measuring gases or vapours that appear in table Category 32 and Category 33, you should calibrate to the Category 33 span value (55% LEL) with 0.6% Propane by volume applied.

If the gas or vapour you are measuring does not appear in the table categories, consult MSA for the proper setting. If you wish to calibrate to the specific LEL of the gas or vapour being measured, the expected span gas value of the ULTIMA/ULTIMA X Series Gas Monitor can be changed by the Controller.

# 3.5. ULTIMA/ULTIMA X Series Gas Monitor Calibration



#### Attention!

To ensure a fully functional sensor, perform calibration checks and adjustments at initial start-up and at regular intervals.

As with any type of gas monitor, the only true check of its performance is to apply gas directly to the sensor. The frequency of the calibration gas tests depends on the operating time and chemical exposures of the sensors. New sensors should be calibrated more often until the calibration records prove sensor stability. The calibration frequency can then be reduced to the schedule set by the safety officer or plant manager.

In some cases, it may be necessary to perform only a zero function of the Gas Monitor in lieu of a full zero and span procedure. Check with your safety officer or safety engineer to determine if only a zero function is necessary.

#### 3.5.1 General Notes

(GB)

- If this is the first calibration or, if the sensor element has been changed or replaced (→ Section 3.5.2).
- If this is an oxygen sensor or an XIR sensor, see the Calibration Section of the ULTIMA X Series manual for further information.
- Apply power to the unit at least 1 hour before calibrating.
- Due to the unstable nature of Chlorine Dioxide (CLO<sub>2</sub>), Chlorine gas is used as a calibration simulant. If using the MSA calibration system and gas cylinder (P/N 710331), the response ratio is 2:1. In other words, the 2 ppm sample of Chlorine should be set to read 1 ppm of CLO<sub>2</sub>. The default value for the calibration gas on the CLO<sub>2</sub> ULTIMA/ULTIMA X Series Gas Monitor is 1 ppm.
- For CL<sub>2</sub> and CLO<sub>2</sub> calibration, do not mix regulators. Use only one regulator for each of these gases. They will not work properly if one regulator is used for multiple gases.
- Due to the reactivity of HCL with flow system components the flow control regulator must only be used for HCL gas. HCL gas must be run through the flow control regulator and tubing for five minutes before attempting a calibration.

After a successful calibration, flush the flow control regulator and tubing with 100% Nitrogen for five minutes. Store the flow control regulator in the desiccated bag included in Calibration Kit 54 or equivalent dry container.

#### 3.5.2 Initial Calibration

When a new sensor is placed in the ULTIMA Gas Monitor, an Initial Calibration must be performed.

When a new sensor is placed in the ULTIMA X Gas Monitor, an Initial Calibration is also needed. This procedure enables the unit to gather data about the sensor to make accurate decisions for the CHANGE SENSOR function and the CAL FAULT function to work properly.

Additionally, Initial Calibration should only be used when a regular calibration will not clear a fault condition due to use of incorrect cal gas or other similar situation.



#### Attention!

This procedure should be initiated only when a new sensor element is installed. Otherwise, the sensor end-of-life indication may not be accurate.

Initial calibration is accomplished by:

1. Pressing the ZERO and CALIBRATE buttons simultaneously on the Calibrator.

#### OR

- 2. Pressing and holding the SPAN button on the Controller
  - The display shows "Do Init Cal 1=y"

Press button "1" while pointing the Controller at the ULTIMA/ULTIMA X Series display.

- The ULTIMA display should show "SET APPLY ZERO GAS"
- The ULTIMA X Series display should show "APPLY ZERO GAS"
- The remainder of the procedure is now the same as that for a regular calibration.
- The display leads the user through the zero and span routines as in a regular calibration.



The presence of the words "SET" (on ULTIMA units only) and "ICAL" (on both ULTIMA and ULTIMA X Series units) on the display distinguish INITIAL Calibration from a regular calibration.

If the word "ICAL" does not appear, the user may abort the calibration by pressing any button on the Calibrator while aiming at the unit; then, retry the above procedure.



The calibration process can be aborted at any time during the 30-second Countdown simply by pressing the ZERO, CAL or ADDRESS button on the Controller/Calibrator while aiming at the unit.

### 3.5.3 Regular Calibration

A regular calibration includes a "zero" and "span" as described in the following procedures.

- If the user chooses to only perform a "zero", they may do so by pressing the ZERO button instead of the CALIBRATE or CAL button as described in Step 8.
- For oxygen units, skip to Step 8.

#### Zeroing

Using Zero Gas Cylinder:

- (1) Locate the zero gas cylinder and the calibration kit flow controller.
- (2) Screw the flow controller onto the top of the zero gas cylinder.
- (3) Locate the calibration kit tube assembly.
- (4) Push the smaller end of the tube assembly over the flow controller gas outlet and ensure tubing completely covers the gas outlet.
- (5) When using Cal Kit 40, connect the other end of the tubing over the SensorGard inlet.

When using Cal Kit 41 (or Cal Kit 40 with the ULTIMA XIR), locate the Cal Cap with a hole for tubing and push the tubing through the hole in the bottom of the cap.

Then, connect the end of the tubing over the sensor inlet and push the calibration cap over the entire sensor inlet ( $\rightarrow$  Fig. 11).



The calibration cap (P/N 10041533) for the ULTIMA XIR is shipped with the product and is not contained in the calibration kit.

- (6) Turn ON the gas flow by turning the knob on the flow controller.
- (7) Point the Controller/Calibrator at the ULTIMA/ULTIMA X Monitor display and press the Controller/Calibrator CAL/CALIBRATE button.
  - The display shows:
    - a countdown from 30 to 0 seconds and
    - APPLY ZERO GAS.



The zero or calibration process can be aborted at any time during the 30-second Countdown interval; simply press the ZERO, CAL or ADDRESS button on the Controller/Calibrator while aiming it at the unit.



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The 30-second Countdown interval is omitted for oxygen units. It is electronically zeroed.

- (8) After the 30 second Countdown:
  - The display alternates between "CAL" and a value (example: 0 ppm). This value is the actual reading of the gas concentration the sensor is detecting. The engineering units (ppm, % or %LEL) are predetermined by the type of sensor installed and are not changeable.
  - Once the gas value is stable, the alternating display stops. If the calibration is successful, the display will show END.
- (9) Turn OFF the gas flow by turning the flow Controller knob.
- (10) Remove the tubing from the Flow Controller.
  - If the calibration Output Signal is enabled during calibration, it will be held at the lockout value for an additional two minutes or until after the span routine if performing a full calibration.
  - If a CAL FAULT flag appears on the unit, this indicates:
  - An unsuccessful attempt to zero or calibrate the ULTIMA/ULTIMA X Series Gas Monitor.
  - The ULTIMA/ULTIMA X Series Gas Monitor is operating with the calibration parameters defined before the calibration was attempted.
  - See Troubleshooting Guidelines found in the ULTIMA manual (P/N 10050078).

To extinguish the CAL FAULT flag, a complete successful calibration procedure must be performed.

The ULTIMA/ULTIMA X Series Gas Monitor allows automatic zero adjustment only within a pre-defined range. It cannot make corrections outside this range, such as when an empty or wrong cylinder of gas is applied or failure to begin gas flow within the allotted 30-second Countdown occurs.

If only a ZERO was performed, the procedure is complete and the user should return the calibration equipment to the cal kit. If a CAL was performed, the gas monitor will continue to the "span" sequence as described in the following section.

## Spanning

During a regular calibration, the ULTIMA/ULTIMA X Series Gas Monitor automatically begins the span countdown after a successful zeroing of the unit. The span countdown is 30 seconds ( $\rightarrow$  Fig. 7 and Fig. 8).



Fig. 7 ULTIMA Unit Apply SPAN Gas Flag



The span process can be aborted at any time during the Countdown by simply pressing the ZERO, CAL or ADDRESS button on the Controller/Calibrator while aiming it at the unit.



Fig. 8 CAL Dispaly

- (1) Locate the span gas cylinder and the Calibration Kit flow controller.
- (2) Screw the flow controller onto the top of the span gas cylinder.
- (3) Locate the Calibration Kit Tube Assembly.
- (4) Push the smaller end of the Tube Assembly over the gas outlet of the flow controller and ensure that the tubing completely covers the gas outlet.
- (5) When using:

- Cal Kit 40 connects the other end of the tubing over the SensorGard inlet (→ Fig. 9).
- Cal Kit 41 (or Cal Kit 40 with the ULTIMA XIR) locates the Cal Cap with hole for tubing and push the tubing through the hole in the bottom of the cap. Then, connect the end of the tubing over the sensor inlet and push the calibration cap over the entire sensor inlet (→ Fig. 11).
- Cal Kit 54 allows HCL gas to flow through regulator and tubing for five minutes before attempting a calibration.

(GB)

- (6) Turn ON the gas flow by turning the flow controller knob.
  - It is good practice to have all calibration components previously assembled.
  - Ensure that any calibration gases are applied during the 30-second count down period.



Fig. 9 Span Setup (ULTIMA unit shown)

1 Sensor Gard

2 Span Gas Cylinder

- If CAL FAULT displays on the ULTIMA/ULTIMA X Series Gas Monitor before the user is able to apply the gas, a stable gas condition was reached, causing the unit to use a wrong reading as a span indication.
- It is necessary to restart the calibration process to clear this condition.
- (7) After the 30 second Countdown:
  - The display alternates between "CAL" and a value. (for example: 60 ppm for 0 to 100 ppm carbon monoxide). This value is the actual reading of the gas concentration the sensor is detecting. The engineering units (ppm, % or %LEL) are predetermined by the type of sensor installed and are not changeable.
  - Once the gas value is stable, the alternating display stops. If the calibration is successful, the display will show END for approximately two seconds (→ Fig. 10).



Fig. 10 Calibration End Display

No user adjustments are necessary.

- The display will show the span gas value while the span gas is flowing to the unit. (For example, it may read 60 PPM or 25 % or 60 % LEL).
- (8) Turn OFF the gas flow by turning the knob on the flow controller.
  - If the calibration Output Signal is enabled during calibration, it will be held at the lockout value for two additional minutes after END is displayed.



Fig. 11 Span Gas Connection (ULTIMA unit shown)

- 1 Calibration Cap 3 Span Gas Cylinder
- 2 Cylinder To Gas Sensor via Splits

When the span gas is removed from the sensor, the sensor reading may take several minutes to return to zero; this is normal sensor Operation.

If a CAL FAULT flag appears on the unit, this indicates:

- An unsuccessful attempt to calibrate the ULTIMA/ULTIMA X Series Gas Monitor
- The ULTIMA/ULTIMA X Series Gas Monitor is operating with the calibration parameters defined before the calibration was attempted.

To extinguish the CAL FAULT flag, a complete calibration procedure must be performed.

The ULTIMA/ULTIMA X Series Gas Monitor allows automatic zero and span adjustments only within a pre-defined range. It cannot make corrections outside this range, such as when an empty or wrong cylinder of gas is applied or failure to begin gas flow within the allotted 30-second Countdown occurs.

(9) After a successful calibration, remove the tubing from the flow controller and remove the flow controller from the cylinder; return all items to their appropriate location in the calibration kit.



When using Cal Kit 54, after a successful calibration, flush the flow control regulator and tubing with 100% Nitrogen for five minutes. Return the flow control regulator and tubing to the desiccated bag included in Cal Kit 54 or equivalent dry container. This flow control regulator and tubing should only be used for HCL gas.

#### **Oxygen Calibration**



If this is the first calibration after the sensor element is replaced, perform an "Initial Calibration".

Oxygen calibration is slightly different from other gases. When the ZERO function is performed, the 30-second countdown is omitted because the ULTIMA/ULTIMA X Series Monitor performs the zero electronically. No calibration cap or zero gas is necessary.

To meet the specification stated, it is necessary to span the oxygen ULTIMA/ULTIMA X Series Gas Monitor with the calibration kit and an oxygen cylinder. The concentration of oxygen in air varies slightly due to changing relative humidity and pressure levels. These variations in oxygen levels are detected by the oxygen ULTIMA/ULTIMA X Series Gas Monitor.

To meet the reproducibility specification, it is necessary to use a calibration gas cylinder. This ensures the same concentration of oxygen for every calibration.

For the SPAN function, ambient air is generally adequate for the 25% oxygen ULTIMA/ULTIMA X Series Gas Monitor as the expected default span value is 20.8%. Therefore, when the display prompts "APPLY SPAN GAS" it would be adequate to simply allow the countdown to occur without applying gas.



If the sensor is located in an area of normally low or enriched oxygen, then a 20.8% oxygen sample must be applied when the display prompts "APPLY SPAN GAS" the sensor element is replaced, perform an "Initial Calibration".

#### **XIR Calibration**

Although a full calibration (zero and span) can be performed on the ULTIMA XIR Gas Monitor, a no-gas calibration is sufficient to properly calibrate the monitor. A zero adjustment is all that is required for a full calibration. Normally, any degradation of the sensor's performance is associated with slight drifts in its zero response which, in turn, will adversely affect its span performance. Restoring the sensor's zero is typically sufficient to restore its span performance. A zero adjustment is performed by pressing the ZERO button on the Calibrator or Controller and following the "Zeroing" instructions given earlier in this chapter. After completing the zeroing function, perform a span check to ensure proper operation. If the span check is unsuccessful, perform a full calibration.



For calibration of an XIR sensor operating with a flow cap, temporarily replace the flow cap with the SensorGard (packaged with the instrument) and perform the following procedure.



#### Attention!

The Calibration Cap must be removed from the XIR SensorGard after completing the Zeroing and/or Spanning procedure; otherwise, the sensor cannot perform properly.

# 4. Controller – Detailed Operation

# 4.1. Viewing the ULTIMA Gas Monitor Display

The Controller can change the monitor display to show:

Display		Default	To change see procedure #
Current gas concentration	on reading	N/A	N/A
Minimum gas concentration time average interval	tion reading over last	N/A	1
Maximum gas concentra average time interval	tion reading over last	N/A	1
Average gas concentrati average time interval	on reading over last	N/A	1
Time interval for minimu average gas reading	m, maximum &	1 HOUR	1
Zero gas concentration	/alue	N/A	N/A
Sensor Range		N/A	3
Gas Table Value		1	4
Span gas concentration	value	see Section 3.3	2
Alarm 1, 2, 3 setpoints		Disabled ULTIMA	5
		Enabled ULTIMA X	5
If enabled:			
Alarm 1	10% full-scale		5
Alarm 2	20% full-scale		5
Alarm 3	30% full-scale		5
Oxygen Alarm 1	19.5%**		5
Oxygen Alarm 2	18.0%**		5
Oxygen Alarm 3	22.0%		5
Current time		Eastern Standard Time	6
Current date		Current Date	7
Calibration signal Status	i	Off	8
Calibration interval and I	uture calibrate time	30 days at 00:00	9
Future calibrate date		Disabled *	10
Sensor address (MUX fro	equency Output only)	1	11
Viewing the previous suc	ccessful calibrate date	N/A	12
Calibrating/checking 4-2	0mA (ULTIMA X only)	N/A	13
Resetting the ULTIMA X		N/A	14
Alert Option (ULTIMA X	only)	Off	15
Setting Sensor Swap De	lay (ULTIMA X only)	On	16

\* The date is set to 12/31/94, which disables auto-calibration (ULTIMA only).

\*\* Indicates negative or downward acting alarms

Display	Default	To change see procedure #
ModBUS transmitter commands		
Viewing the Ultima X3 Gas Monitor address	N/A	17
Setting the Ultima X3 Gas Monitor address	247	18
Viewing the Ultima X3 Gas Monitor baud rate	N/A	19
To set the Ultima X3 Gas Monitor Baud Rate	19200 even parity	20
To remove a missing sensor from the Ultima X3 "scan"	N/A	21
To resend the last command to the Ultima Gas Monitor	N/A	22

#### To View the Status of the ULTIMA Gas Monitor

To view any of the display modes listed above, such as current time or date, perform the following:

- (1) Turn the unit ON by pressing the ENTER button; wait until the READY prompt displays.
- (2) Press the SEND button. The display prompts: SEND?
- (3) Press the DISPLAY button.
  - The display prompts: Sel Dsp Item ±
- (4) Press the + or button to scroll through the available list as described above.
- (5) When the desired choice appears on the display, aim the Controller at the sensor and press the ENTER button.



(GB)

These readings are displayed on the ULTIMA Gas Monitor and the ULTIMA X for only five seconds. The display then returns to the actual gas concentration.

## 4.2. Procedures for ULTIMA X Series Gas Monitors

 $(\rightarrow$  Table in Section 4.1)

#### 4.2.1 Procedure 1 – Setting the Average Time Interval

The average, minimum and maximum gas concentration values are gathered over the last time interval set by the Controller.

This procedure is used to change the time interval used for the average, minimum, and maximum gas concentration value calculations of the ULTIMA Sensor and ULTIMA X.

To change the Average Time Interval

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the AVG button.
  - The display prompts: Set Avg Term ±
- (3) Press the + or button to scroll through the available list:
  - Every 1 Hour
  - Every 8 Hours
  - Every 24 Hours
- (4) When the desired time interval is displayed, aim the Controller at the sensor and press the ENTER button.
  - The ULTIMA Gas Monitor will show the time interval selected for 5 seconds.
  - The ULTIMA Gas Monitor time interval is now set to the desired selection.
  - The ULTIMA Gas Monitor display shows the average, minimum, or maximum gas concentration reading over the selected interval. This reading is updated at the end of the selected average interval.

#### 4.2.2 Procedure 2 – Setting the Span Gas Value

The Gas Monitors are shipped with default span gas values ( $\rightarrow$  Section 3.3). MSA calibration cylinders are available for most of these pre-set span gas concentrations; if an alternate span gas value is needed, the span calibration value must be changed.

#### Changing the Span Gas Value of the ULTIMA Sensor:

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the SPAN button.
  - The display prompts: Span Gas Type ±
- (3) Press the + or button to scroll through the available gas list. One of the following gases will correspond to the range of your ULTIMA Gas Monitor. Check the sensor housing label.



If your gas type or range is not shown on the Controller display, you may use the custom range option on the menu.

- (4) When the selection matching your sensor type is found, press the ENTER button.
  - The display prompts: SpanVal ###



(GB)

If the custom range option was selected, a decimal point may be implied, since this range can be used for decimal point and nondecimal point ULTIMA units.

When sending a value to an ULTIMA unit that indicates a decimal point, enter the data assuming an implied decimal point (e.g., "009" is interpreted as "00.9").

- (5) Using the NUMBER buttons, enter the desired three-digit value (leading zeros are required).
  - Corrections can be made using the DEL button.
- (6) After the value is entered, aim the Controller at the sensor and press the ENTER button.
  - The ULTIMA Gas Monitor will show the new span gas value for 5 seconds.
  - If the span gas concentration value is higher than the full scale range of that gas, the Controller will not send that value to the ULTIMA Gas Monitor; re-enter a span gas concentration value lower than or equal to full scale value.
  - The ULTIMA Gas Monitor desired span gas value is now changed to the selected concentration.

#### Changing the Span Gas Value

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the SPAN button.
  - The display prompts: Span Option ±
- (3) Press the + or button until the display prompts: ULTIMA X SpanVal
- (4) Press the Enter button.
  - The display prompts: SpanVal ####.##
- (5) Using the NUMBER buttons, enter the desired value (ATM style, lagging zeros are required).
- (6) After the value is entered, aim the Controller at the sensor and press the ENTER button.
  - The ULTIMA X Series Gas Monitor shows the new span gas value.
  - If the span gas concentration value is higher than the full scale range, the ULTIMA X Series Gas Monitor will display the current span value setpoint.
  - The ULTIMA X Series Gas Monitor span gas value is now changed to the selected concentration.

#### 4.2.3 Procedure 3 – Setting the Range

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the SPAN button.
  - The display prompts: Span Option ±
- (3) Press the + or button until the display prompts: ULTIMA X Range
- (4) Press the Enter button.
  - The display prompts: Range ####.##
- (5) Using the NUMBER buttons, enter the desired value (ATM style, lagging zeros are required).
- (6) After the value is entered, aim the Controller at the sensor and press the ENTER button.
  - The ULTIMA X Series Gas Monitor will show the new full scale gas value.
  - If the span gas concentration value is higher than the full scale range limit or below the minimum range limit, the ULTIMA X Series Gas Monitor displays the current range value.
  - The ULTIMA X Series Gas Monitor range value is now changed to the selected limit.

#### 4.2.4 Procedure 4 – Setting the Gas Table on an ULTIMA XIR Sensor

This feature changes the response curve to the specific target gas selected. After completion of Procedure 4, the appropriate span value listed in the tables in Section 3.4 must also be reset in accordance with Procedure 2 ( $\rightarrow$  Section 4.2.2).

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the SPAN button.
  - The display prompts: Span Option ±
- (3) Press the + or button until the display prompts: ULTIMA X GasTble
- (4) Press the ENTER button.
  - The display prompts: GasTble ###
- (5) Using the NUMBER buttons, enter the desired value (leading zeros are required).

Gas Table Selection			
001	Methane		
002	Propane		
003	Ethane		
004	Butane		
005	Pentane		
006	Hexane		
007	Cyclopentane		
800	Ethylene		

- (6) After the value is entered, aim the Controller at the sensor and press the ENTER button.
  - The ULTIMA XIR Series Gas Monitor will reset after receiving a valid gas table value (otherwise, the ULTIMA X Monitor will indicate that changing the gas table value has been unsuccessful).
  - The ULTIMA XIR Gas Monitor gas table value is now changed to the selected value.

#### MSA

#### 4.2.5 Procedure 5 – Setting Alarm Setpoint Values

#### Setting the ULTIMA Gas Monitor Alarm Setpoint Values

The ULTIMA Gas Monitor has three alarm levels. The relay module can be connected directly to the ULTIMA Gas Monitor to provide three levels of relays and a normally energised trouble relay.

The three levels of alarm will also be displayed on the ULTIMA Gas Monitor LCD display even if an ULTIMA Gas Monitor relay module is not used.

- Alarm #1 must be set at a lower or equal value than Alarm #2.
- Alarm #2 must be set lower or equal than Alarm #3.

On the oxygen unit:

- Alarms #1 and #2 are negative or downward acting.
- Alarm #3 is positive or upward acting.
- Alarms #1, #2 and #3 can be set to any value; they are independent of one another.

To set the three Alarm Setpoint Values:

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the ALARM button.
  - The display prompts: 0=SetPt 1=OnOff
- (3) To set the alarm values, press the 0 button.
  - The display prompts: Alm Gas Type ±
- (4) Press the + or button to scroll through the available list.



If your gas type or range is not shown on the Controller display, you may use the custom range option on the menu.

- (5) When the selection matching your sensor type is found, press the ENTER button. (Invalid entries are ignored.)
  - The display prompts: Alm Set Point #
- (6) Using the NUMBER buttons, enter the desired alarm setpoint 1, 2 or 3; then, press the ENTER button (invalid entries are ignored).
  - The display prompts: SetPVal ###



If the custom range option was selected, a decimal point may be implied, since this range can be used for decimal point and non-decimal point ULTIMA units. When sending a value to an ULTIMA unit that indicates a decimal point, enter the data assuming an implied decimal point (e.g., "009" is interpreted as "00.9").

- (7) Enter the desired value in an appropriate range for the gas type used. (Leading zeros are required.)
  - The DEL button can be used to delete number entries before the ENTER button is pressed.
  - The ULTIMA Gas Monitor will show the new alarm setpoint value and the status of that setpoint [enabled (ON) or disabled (OFF)].



The combustible alarm setpoint value cannot be set greater than 60% LEL.

- (8) Aim the Controller at the sensor and press the ENTER button.
  - If the alarm setpoint value is greater than the full scale gas concentration value, the Controller will not change the setpoint value; re-enter an alarm setpoint value lower than or equal to the full scale gas concentration value.
  - Repeat this procedure for each alarm level.

#### Setting the ULTIMA X Series Gas Monitor Alarm Setpoint Values

The ULTIMA X Series Gas Monitor has three alarm levels.

The relay option provides:

- three levels of relays and
- a normally-energised trouble relay.

The three levels of alarm display on the ULTIMA X Series LCD display even if the relay option is not installed.

To set the three levels of alarm:

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the ALARM button.
  - The display prompts: 0=SetPt 1=OnOff.
- (3) To set the alarm values, press the 0 button.
  - The display prompts: Alm Set Point #
- (4) Using the NUMBER buttons, enter the desired alarm setpoint 1, 2 or 3; then press the ENTER button. (Invalid entries are ignored.)
  - The display prompts: SetPVal ####.##

(5) Using the NUMBER buttons, enter the desired value (ATM style, lagging zeros are required).

The DEL button can be used to delete number entries before the ENTER button is pressed.

• The ULTIMA X Series Gas Monitor will show the new alarm setpoint value and the Status of the setpoint:

- enabled (LATCH/UNLATCH, INCR/DECR, ENER/DENERG)

or

- disabled (OFF).



The combustible alarm setpoint value cannot be set greater than 60% LEL.

- (6) Aim the Controller at the sensor and press the ENTER button.
  - If the alarm setpoint value is greater than the full scale gas concentration value, the Controller will not change the setpoint value; re-enter an alarm setpoint value lower than or equal to the full scale gas concentration value.
  - Repeat this procedure for each alarm level.

#### Setting the Mode of the ULTIMA Alarm Setpoints

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the ALARM button.
  - The display prompts: 0=SetPt 1=OnOff.
- (3) Press the 1 button.
  - The display prompts: Alm Gas Type ±
- (4) Press either the + or button to scroll through the list:
- (5) When the selection matching your sensor type is found, press the ENTER button.
  - The display prompts: Alm Set Point #
- (6) Using the NUMBER buttons, enter the desired alarm setpoint 1, 2 or 3; then, press the ENTER button. (Invalid entries are ignored.)
  - The DEL button can be used to delete number entries before the ENTER button is pressed
  - The Display prompts: AlmSPnt 1=E 0=D.

MSA

- (7) To disable the chosen setpoint, aim the Controller at the sensor and press the 0 button.
  - The ULTIMA Gas Monitor will show both the Status (OFF) and the alarm setpoint value.
- (8) To enable the chosen setpoint, press the 1 button
  - The display prompts: Latched 0=N 1=Y
- (9) Aim the Controller at the sensor:

Press the 0 button to enable the alarm in unlatched mode

or

Press the 1 button to enable the alarm in latched mode.

• The ULTIMA Gas Monitor will show both the status (U if unlatched or L if latched) and the alarm setpoint value.

#### Setting the Mode of the ULTIMA X Series Alarm Setpoints

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the ALARM button.
  - The display prompts: 0=SetPt 1=OnOFF.
- (3) Press the 1 button.
  - The display prompts: Alm Set Point #
- (4) Using the NUMBER buttons, enter the desired alarm setpoint 1, 2, or 3; then, press the ENTER button. (Invalid entries are ignored.)
  - The DEL button can be used to delete number entries before the ENTER button is pressed.
  - The display prompts: AlmSPnt 1=E 0=D.
- (5) To disable the chosen setpoint, aim the Controller at the sensor and press the 0 button.
  - The ULTIMA X Series Gas Monitor will show both the Status (OFF) and the alarm setpoint value.
- (6) To enable the chosen setpoint, press the 1 button.
  - The display prompts: Latched 0=N 1=Y
- (7) To set the alarm as a latching alarm, press the 1 button; to set the alarm as unlatching, press the 0 button. (Invalid entries are ignored.)
  - The display prompts: 0=DOWN 1=UP

- (8) To set the alarm as a downward acting alarm, press the 0 button; to set the alarm as an upward acting alarm, press the 1 button. (Invalid entries will be ignored.)
  - The display prompts:
    - 0= NONEN
    - 1= ENGZD
- (9) Aim the Controller at the sensor.

Press the 0 button to enable the alarm as a non-energised alarm.

or

Press the 1 button to enable the alarm as an energised alarm.

 The ULTIMA X Series Gas Monitor will show the alarm setpoint value and the Status:

LATCH/UNLATCH, INCR/DECR, ENER/DENERG

#### 4.2.6 Procedure 6 – Setting the Current Time

The ULTIMA Gas Monitor is factory-set to Eastern Standard Time.

#### To change it in the Controller and in the ULTIMA Gas Monitor:

- (1) Press and hold the TIME button.
  - The display prompts: ##:##
- (2) Using the number keys, enter the correct time in the 24 hour format (e.g., 4:00 P.M. = 16:00). (Leading zeros required.)
- (3) Press the ENTER button.

#### To update the ULTIMA Gas Monitor internal clock:



Time and date are updated with this command.

- (1) Press the SEND button.
- (2) Aim the Controller at the sensor and press the TIME button.
  - The ULTIMA Gas Monitor will display the current time and date for 5 seconds.

## 4.2.7 Procedure 7 – Setting the Current Date

The ULTIMA Gas Monitor is factory-set to the current date.

### To change it in the Controller and in the ULTIMA Gas Monitor:

- (1) Press and hold the DATE button to enter the correct date.
  - The display prompts: MM-DD-YYYY
- (2) Use number keys to enter correct date (leading zeros required):
  - MM = Months
  - DD = Day
  - YYYY = year
- (3) Press the ENTER button

#### To update the ULTIMA Gas Monitor internal date



Time **and** date are updated with this command.

- (1) Press the SEND button.
- (2) Aim the Controller at the sensor and press the DATE button.
  - The ULTIMA Gas Monitor will display the current time and date for 5 seconds.

#### 4.2.8 Procedure 8 – Setting ULTIMA Gas Monitor Calibration Output Signal

The ULTIMA Gas Monitor is shipped with the calibration Output Signal disabled. This means that the Output Signal will track the gas concentration value during the calibration process. In some applications, it may be desirable to enable or lock the calibration Output Signal to a pre-determined Output value to prevent activation of alarm devices.

For frequency and MUX models, this value is 12 kHz, which is recognised by MSA Model 6000 Instruments as a calibration Signal. 4 - 20 mA Output Signal models are locked to 3.75 mA during this process (however, oxygen models lock at 21 mA).

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See Section 4.2.15, Setting the Alert Option on an ULTIMA X Series Sensor, for details on oxygen sensors calibration Signals.

For the MSA Model 5000 and Toxgard Instruments, manually place the Instrument in the Calibration Mode.

#### MSA

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To enable or disable the calibration Output Signal:

- (1) Press the SEND button.
  - The display prompts SEND?
- (2) Press the CAL button.
  - The display prompts: Sel Cal Action ±
- (3) Press either the + or button and scroll to the CalSIG Enable display message.
- (4) Press the ENTER button.
  - The display prompts: En Cal 0=N 1=Y
- (5) To enable calibration Signal Output, aim the Controller at the sensor and press the 1 button.

#### 4.2.9 Procedure 9 – Setting the Auto-calibration Period

#### Setting the number of days beween auto-calibration periods.

With the use of the ULTIMA Gas Monitor auto-calibration module, the ULTIMA Gas Monitor is capable of automatically applying zero and span gas to itself.

This provides a complete calibration of the sensor without operator intervention. If the ULTIMA Gas Monitor auto-calibration module is connected, the ULTIMA Gas Monitor must be programmed to calibrate itself between 1 to 128 day intervals.

- (1) Press the SEND button.
  - The display prompts: Send?
- (2) Press the CAL button.
  - The display prompts: Sel Cal Action ±
- (3) Press either the + or button and scroll to the DaysPerAutoCal display message.
- (4) Press the ENTER button.
  - The display prompts: CalTerm ### dy
- (5) Enter the three-digit period desired (from 1 day to 128 days). (Leading zeros are required.)
- (6) Aim the Controller at the sensor and press the ENTER button.
  - The ULTIMA Gas Monitor will show the number of days between autocalibrations for five seconds.
  - The ULTIMA Gas Monitor is now programmed to auto-calibrate at the desired interval.

#### Setting the Start Time of Auto-calibration Period

- (1) Press the SEND button.
  - The display prompts SEND?
- Press the CAL button.
  - The display prompts: Sel Cal Action ±
- (3) Press either the + or button and scroll to the StartHr of Cal display message.
- (4) Press the ENTER button.
  - The display prompts: CalHour HH.
- (5) Enter the two-digit hour desired (from 0 to 23 hours YPM = 16 hours). (Leading zero is required.)
- (6) Aim the Controller at the sensor and press the ENTER button.
  - The ULTIMA Gas Monitor will display the hour selected.
  - The ULTIMA Gas Monitor is now programmed to auto-calibrate at the . desired time.

#### 4.2.10 Procedure 10 – Setting the Date of the Next Scheduled Calibration

To disable the auto-calibration of the ULTIMA Gas Monitor, set the date of the next calibration to 12/31/94.

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the CAL button.
  - The display prompts: Sel Cal Action ±
- (3) Press either the + or button and scroll to the NextCal Date display message.
- (4) Press the ENTER button.
  - The display prompts: MM-DD YYYY.
- (5) Enter a valid eight-digit date (month-day-year).
- (6) Aim the Controller at the sensor and press the ENTER button. (Leading zeros are required.)
  - The ULTIMA Gas Monitor will display the future date auto-calibration will ٠ start.
  - The ULTIMA Gas Monitor is now programmed to auto-calibrate on the desired date.

#### 4.2.11 Procedure 11 – Changing the MUX Address

- (1) Viewing the current Mux Address, aim the Controller at the ULTIMA Gas Monitor.
- (2) Press the ADDRESS button.
  - The current address of the sensor is displayed.



Additional pressing of the ADDRESS button will increment the address.

#### To Change the Address

- (1) Press the SEND button.
- (2) Press the ADDRESS button.
- (3) Enter the number of the address to be set.
- (4) Aim the Controller at the ULTIMA Gas Monitor and press the ENTER button.
  - The ULTIMA Gas Monitor will display the new address for 5 seconds.

#### 4.2.12 Procedure 12 – Viewing the Previous Successful Calibration Date

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the DISPLAY button.
  - The display prompts: SeL Dsp Item +
- (3) Press the + or button to scroll and find: Prev. Cal Date.
- (4) Aim the Controller at the ULTIMA Gas Monitor and press the ENTER button.
  - The ULTIMA Gas Monitor will display the last previously successful calibration date.

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#### 4.2.13 Procedure 13 – Calibrating/Checking the 4-20 mA ULTIMA X Series Outputs

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the CAL button.
  - The display prompts: Sel Cal Action ±
- (3) Press the + or button until the display prompts: 4-20; then, press the ENTER button.
  - The display prompts: 0=4 mA 1=20 mA
- (4) To Calibrate/Check the 4 mA Output press the 0 button, to Calibrate/Check the 20 mA Output press the 1 button.
  - The display prompts:

```
0=Check
1=Adjust
```

- (5) To CHECK, aim the Controller at the sensor and press the ENTER button.
  - The display toggles between gas value and CAL.
  - The 4 20 mA Output will be set as selected (4 mA or 20 mA).
  - The 4 20 mA Output stays in a CAL Output for 1 minute.
- (6) To ADJUST, press the 1 button.
  - The display prompts: + =INC =DEC
- (7) To increase the current 4 mA or 20 mA setpoint, aim the Controller at the sensor and press the + button.

To decrease the current 4 mA or 20 mA setpoint, press the - button.

- The display toggles between gas value and CAL.
- The adjusted 4 20 mA Output will be set to the adjusted 4 mA or 20 mA Output level.
- The 4 20 mA Output stays in a CAL Output for 1 minute.
- (8) Repeat the procedure to continue to adjust the Output.



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Adjusting the 4 mA Output changes the 20 mA setting. Always readjust the 20 mA Output after adjusting the 4 mA Output. Adjusting the 20 mA Output will not change the 4 mA Output setting.

#### 4.2.14 Procedure 14 – Resetting the ULTIMA X Series Monitors



Resetting the datasheets loads the factory defaults for the attached sensor.

The user must reconfigure the Instrument for their desired settings.

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the SEND button.
  - The display prompts: 0=RstDt 1=RstSn
- (3) To reset the datasheets, press the 0 button.
  - The display prompts: RstData 0=N 1=Y

A successful calibration must also be performed after resetting the datasheets.

To reset the Instrument, press the 1 button.

- The display prompts: RstData 0=N 1=Y
- (4) Aim the Controller at the sensor and press the 0 button to cancel, or press the 1 button to reset.

#### 4.2.15 Procedure 15 – Setting the Alert Option on an ULTIMA X Series Sensor

The Alert Option allows the operator to set the ULTIMA X unit to operate as shown in the table.

	Alert Option			
	ON	OFF		
Calibration	Alert relay de-energised	Alert relay energised		
Power on RESET (Countdown)	Alert relay de-energised	Alert relay energised		
4 – 20 CAL mA (Oxygen)	3.75 mA	21 mA		
4 – 20 POR mA (Oxygen)	3.75 mA	21 mA		

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the CAL button.
  - The display prompts: Sel Cal Action ±
- (3) Press the + or button until the display prompts: Alert Option.
- (4) Press the ENTER button.
  - The display prompts: AlrtOpt 0=N 1=Y
- (5) Aim the Controller at the Sensor and press either the 0 or 1 button.
  - The ULTIMA X Series Gas Monitor Alert Option is now changed to the selected operation.

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# 4.2.16 Procedure 16 – Setting the Sensor Swap Delay on an ULTIMA X Series Sensor

The ULTIMA X Series Gas Monitor is shipped with the Sensor Swap Delay enabled. This means that the 4 20 mA Output Signal and the FAULT relay will hold off a fault indication for 60 seconds after the sensor missing indication is displayed on the instrument.

This setting allows to exchange sensor modules without a FAULT indication.

This feature can be disabled to provide an immediate FAULT error condition. To change it, use the Controller to perform the following steps:

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the CAL button.
  - The display prompts: Sel Cal Action +
- (3) Press the + or button until the display prompts: Sensor SwapDIy
- (4) Press the ENTER button.
  - The display prompts: SwapDIy 0=N 1=Y
- (5) Aim the Controller at the sensor and press either the 0 or 1 button

# 4.3. Procedures for ULTIMA X<sup>3™</sup> Gas Monitors (ModBUS Commands)

#### 4.3.1 Procedure 17 – Viewing the Ultima Gas Monitor Address

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the DISPLAY button.
  - The display prompts: SeL Dsp Item ±
- (3) Press the + or button to scroll and find: Sensor Address
- (4) Aim the Controller at the ULTIMA Gas Monitor and press the ENTER button.
  - The ULTIMA Gas Monitor will display the Sensor Address.

#### 4.3.2 Procedure 18 – Setting the Ultima Gas Monitor Address

(1) Press the SEND button.

- The display prompts: SEND?
- (2) Press the ADDRESS button.
  - The display prompts: Sel Cal Action ±
- (3) Using the number keys enter the 3 digit address.
- (6) Aim the Controller at the sensor and press the ENTER button.

#### **CONTROLLER – DETAILED OPERATION**

#### 4.3.3 Procedure 19 – Viewing the Ultima Gas Monitor Baud Rate

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the DISPLAY button.
  - The display prompts: SeL Dsp Item ±
- (3) Press the + or button to scroll and find: Baud Rate
- (4) Aim the Controller at the ULTIMA Gas Monitor and press the ENTER button.
  - The ULTIMA Gas Monitor will display the device Baud Rate.

#### 4.3.4 Procedure 20 – Setting the Ultima Gas Monitor Baud Rate

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the CAL button three times
  - The display shows Baud Rate
- (3) Press the ENTER button followed by the CAL button to display the desired Baud Rate.
- (4) Press the ENTER button followed by the CAL button to display the desired Parity Bit.
- (5) Aim the Controller at the sensor and press the ENTER button.

## 4.3.5 Procedure 21

#### Removing a Missing Sensor from the Ultima Gas Monitor "Scan"



It is not possible to remove an active sensor form the "scan". To make the sensor active again just connect an ULTIMA  $X^{3 \text{ TM}}$  Sensor to the transmitter.

- (1) Press the SEND button.
  - The display prompts: SEND?
- (2) Press the CAL button two times.
  - The display prompts: Sensor Disable
- (3) Press the ENTER button.
  - The display prompts: 1, 2 or 3
- (4) Aim the Controller at the sensor and press the ENTER button.

#### 4.3.6 Procedure 22 – Resending the Last Command to the Ultima Gas Monitor

- (1) Press the PROGRAM button.
- (2) Press the 0 button.
- (3) Aim the Controller at the sensor and press the ENTER button.

### 4.4. Programming the Controller

The Controller can be programmed to set up or group or repeat all of your ULTIMA Gas Monitors in one particular way.

There are four possible programs (1 through 4). These programs are useful to eliminate duplicate keystrokes or to ensure the same configuration at each mounting site.



A dual beep tone is heard for each entry during the Calibrator programming mode.

#### Removing Existing Programs

It is good practice to remove the existing programs before attempting to initiate a new one.

- (1) Press and hold the 0 button.
  - The display prompts: Clr Prgs 0=N 1=Y
- (2) Press 1 to remove all programs.

#### Adding a New Program

There are four programs available, 1 through 4. Each program will accept one ULTIMA Gas Monitor command. To enter a new program:

- (1) Press and hold the PROGRAM button until the display prompt reads: ENTER PRGM #
- (2) Enter the program number (1 through 4).
- (3) Press the ENTER button.
- (4) Enter the keystrokes of the single ULTIMA Gas Monitor function desired. When all of the keystrokes are entered, the Controller will save them and display: SAVING- for 3 seconds.
- (5) Repeat Steps 1 through 4, using a different program number to program additional ULTIMA Gas Monitor functions.

To Use Programs 1 through 4

- (1) Press the PROGRAM button.
  - The display will prompt: PROGRAM #
- (2) Enter the desired program number (1 through 4).
- (3) Aim the Controller at the ULTIMA Gas Monitor and press the ENTER button.
  - The ULTIMA Gas Monitor will respond immediately.

#### To use Program #0

Program #0 is used to send the previous command. Resending the last command is useful if it involved a number of keystrokes.

Program #0 will resend all of the commands except for the following:

- ZERO
- CAL
- ADDRESS
- INITIAL CAL OR INITIAL CALIBRATION
- SET TIME on the Calibrator
- SET DATE on the Calibrator

To resend any command except for those listed above:

- (1) Press the PROGRAM key.
- (2) Press the "0" key. (This is the number zero key, not the key labelled ZERO.)
- (3) Aim the Controller at the ULTIMA Gas Monitor and press ENTER.

If the last command is one of the three listed above, it will not send that command; instead, the Controller will send the preceding command.

# 5. Maintenance

## Warning!

The ULTIMA Controller and Calibrator is an intrinsically safe product for use in hazardous areas ( $\rightarrow$  Section 6).

All maintenance procedures must be performed in a non-hazardous area.

#### Attention!

The ULTIMA Controller hazardous area approval requires that the leather outer case is always fitted to the Controller.

## 5.1. Batteries

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The ULTIMA Controller is approved for use with two "AA" cells.

The ULTIMA Calibrator is approved for use with two "AAA" cells.

The approved battery types are listed in Section 6

"Marking, Certificates and Approvals according to the Directive 94/9/EC".

#### 5.1.1 Determining a Low Battery Condition on the ULTIMA Controller

To determine if battery replacement is necessary:

- (1) Turn the Controller unit ON.
  - After the unit completes its initialisation, the display shows:

ID CODE -	to ask you to enter the correct code ( $\rightarrow$ Section 2.3.2).
READY	Prompted in <b>upper</b> case letters indicates that the batteries are OK.
or	
ready	Prompted in <b>lower</b> case letters indicates that the batteries are weak and must be replaced.

#### 5.1.2 Replacing the Batteries in the ULTIMA Controller

#### Attention!

The replacing of batteries is not allowed in hazardous areas.



Changing the Controller batteries does not effect the internal real time clock or stored programs; therefore, the time and date values remain as previously set.

- (1) Turn OFF the ULTIMA Controller.
- (2) Remove the four screws from the rear of the case and carefully pull the rear cover away from the unit.
- (3) Remove the two weak batteries from the battery holder and dispose of properly.
- (4) Observing the proper polarity as shown on the plastic holder, install two new batteries in the holder.
- (5) If either end-cover was removed during removal of the back cover, reinsert it in its original location. (The dark IR lens must be at the top.)
- (6) If the dark IR lens at the top of the unit is dirty, clean with soapy water and dry before reinstalling it.
  - The lens must be clean for proper operation.
- (7) With both lenses in place, replace the rear cover and re-install the four case screws.
- (8) Turn unit ON to verify Operation.

#### 5.1.3 Determining a Low Battery Condition on the ULTIMA Calibrator

- (1) Turn unit ON by pressing any button.
  - Low battery results in a double beep for each key press.
  - Normal battery results in a single beep for each key press.

## 5.1.4 Replacing the Batteries in the ULTIMA Calibrator



#### Attention!

The replacing of batteries is not allowed in hazardous areas.

To Install New Batteries in the ULTIMA Calibrator:

- (1) Turn OFF the Calibrator and remove the four screws from the rear of the ULTIMA Calibrator unit.
- (2) Remove the two AAA batteries from their holders.
- (3) Observing the proper polarity as shown on the plastic holder, install two new batteries in the holder.
- (4) Re-install the back cover of the Calibrator.
- (5) Press any Calibrator button and listen for beep to ensure unit is operational.

#### 5.1.5 Battery Disposal

The disposal of batteries sould be according to applicable local waste regulations.

#### 5.2. Service



#### Warning!

Repair or alteration of these units, beyond the scope of these maintenance instructions or by anyone other than authorised MSA service personnel, could cause the products to fail to perform as designed.

There are no internal adjustments in the ULTIMA Controller or Calibrator. For any service work, return to the unit to MSA.

## 5.3. Troubleshooting Guidelines

Problem	Possible Cause	Possible Solution
Controller or Calibrator inoperative.	Dead batteries.	Replace batteries.
	Dirty lens	Clean the dark red lens on the front end of the controller or calibrator
	Too much ambient light	Reduce the ambient light to the ULTIMA/ULTIMA X Series Gas Monitor by creating a light shield

## MARKING, CERTIFICATES, APPROVALS

# 6. Marking, Certificates, Approvals

# 6.1. ULTIMA/ULTIMA X Calibrator

## According to the Directive 94/9/EC (ATEX)

Manufacturer	:	Mine S 1000 ( Cranb	Safety Appliances Company Cranberry Woods Drive erry Township, PA 16066 USA
Product	:	MSA (	Calibrator
Type of Protection	:	EN60	079-0:2006, EN60079-11:2007
Marking	:	Æx>	II 2G Ex ia IIC T3, T4, T5
Battery Type	:	T3:	Duracell Ultra M3 MN 2400
		T4:	Varta High Energy 4903
		T5:	Energizer Ultra + E92
EC-Type Examination Certificate	:	INERI	S 03 ATEX 0129 X
Quality Assurance Notification	:	0080	
Year of Manufacture	:	see La	abel
Serial no.	:	see La	abel

#### EMC Conformance according to the Directive 2004 / 108/ EC.

EN 61000 - 6 - 3 :2007

## 6.2. ULTIMA/ULTIMA X Controller

### According to the Directive 94/9/EC (ATEX)

Manufacturer	:	Mine Safety Appliances Company 1000 Cranberry Woods Drive Cranberry Township, PA 16066 USA
Product	:	MSA Controller
Type of Protection	:	EN60079-0:2006, EN60079-11:2007
Special Conditions of Use	:	The instrument has to be used with his leather bag.
Marking	:	Ex II 2G Ex ib IIC T4
Battery Type	:	Duracell MN 1500 AA
EC-Type Examination Certificate	:	INERIS 03 ATEX 0130 X
Quality Assurance Notification	:	0080
Year of Manufacture	:	see Label
Serial no.	:	see Label

#### EMC Conformance according to the Directive 2004 / 108/ EC.

EN 61000 - 6 - 3 :2007

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# 7. Ordering Information

Description	Part No.
ULTIMA/ULTIMA <sup>®</sup> X Calibrator	10044470
ULTIMA/ULTIMA <sup>®</sup> X Controller	10044459
Calibration Kit 40	
Tubing	711112
Zero Cap	710535
1.5 LPM Flow Controller	478358
Calibration Kit 41	
Tubing	711112
Zero Cap	710535
Zero Cap	813744
Calibration Cap	710411
Calibration Cap	10020030
0.25 LPM Flow Controller	478359
Calibration Kit 54	
Tubing	711112
Zero Cap	710535
1.5 LPM Flow Controller	478358
Desiccant	10046306

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# Notes

# **MSA in Europe**

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#### Southern Europe

#### Eastern Europe

#### Netherlands

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