



PRODUCT SPECIFICATION

MSA Ultima[®] X Series Sensor/Transmitter Specification

1.0 This specification details the attributes and operating characteristics of the MSA Ultima X Series sensors/transmitters. The following table can be used to identify and document gas sensing requirements:

Gas Type	Range/ Full Scale	No. of Points	Plastic-Nema4x (GP)	316SS (XP)	Single Condulet	Remote Sensor	LED's	Relays
Ammonia (NH ₃)	0-100ppm							
Ammonia (NH ₃)	0-1000ppm							
Arsine (ASH ₃)	0-2ppm							
Bromine (Br ₂)	0-5ppm							
Carbon Monoxide (CO)	0-100ppm							
Carbon Monoxide (CO)	0-500ppm							
Carbon Monoxide (CO)	0-1000ppm							
Chlorine (Cl ₂)	0-5ppm							
Chlorine (Cl ₂)	0-10ppm							
Chlorine (Cl ₂)	0-20ppm							
Chlorine Dioxide (ClO ₂)	0-3ppm							
Carbon Dioxide IR (CO ₂)	0-5000ppm							
Carbon Dioxide IR (CO ₂)	0-2%							
Carbon Dioxide IR (CO ₂)	0-5%							
Combustible Gas – Natural Gas & H ₂	0-100% LEL							
Combustible Gas – Petroleum Vapors	0-100% LEL							
Combustible Gas – Solvents	0-100% LEL							
Combustible Gas – IR Methane	0-100% LEL							
Combustible Gas – IR Non-Methane	0-100% LEL							
Diborane (B ₂ H ₆)	0-50ppm							
Ethylene Oxide (EtO)	0-10ppm							
Fluorine (F ₂)	0-5ppm							
Germane (GeH ₄)	0-3ppm							
Hydrogen (H ₂)	0-1000ppm							
Hydrogen Chloride (HCN)	0-50ppm							
Hydrogen Chloride (HCL)	0-50ppm							
Hydrogen Cyanide	0-50ppm							
Hydrogen Fluoride (HF)	0-10ppm							

Hydrogen Sulfide (H ₂ S)	0-10ppm							
Hydrogen Sulfide (H ₂ S)	0-50ppm							
Hydrogen Sulfide (H ₂ S)	0-500ppm							
Hydrogen Sulfide (H ₂ S)	0-100ppm							
Nitrogen Dioxide (NO ₂)	0-10ppm							
Nitric Oxide (NO)	0-100ppm							
Oxygen (O ₂)	0-10%							
Oxygen (O ₂)	0-25%							
Phosphine (PH ₃)	0-2ppm							
Silane (SiH ₄)	0-25ppm							
Sulfur Dioxide (SO ₂)	0-25ppm							
Sulfur Dioxide (SO ₂)	0-100ppm							

2.0 The Ultima X Series Sensors/Transmitters consist of Series Models XA and XE. The Ultima XA is contained in a plastic, general-purpose enclosure and the Ultima XE is contained in a 316 stainless steel explosion-proof enclosure. Both models have common electronics, software and optional features.

3.0 Sensor/Transmitter Requirements

3.1 Catalytic Bead Type Combustible Sensor/Transmitter

- 3.1.1 The catalytic bead type combustible sensor must have a demonstrated resistance to degradation of silicones and reduced sulfur gases.
- 3.1.2 The catalytic combustible sensor/transmitter shall detect for an above 100%LEL condition (over-range). This condition must be indicated on the front panel LCD.
- 3.1.3 The interconnect wiring from the combustible transmitter to the sensor shall be a 5-wire cable.

3.2 Infrared Combustible Sensor/Transmitter

- 3.2.1 The infrared (IR) combustible sensor must be capable of calibration without gas. The sensor/transmitter must be capable of performing a full calibration by zero adjustment only.
- 3.2.2 The IR sensor/transmitter shall detect for an above 100%LEL condition (over-range). This condition must be indicated on the front panel LCD.
- 3.2.3 The IR sensor/transmitter shall not contain a flashback arrestor / frit.
- 3.2.4 The IR sensor/transmitter must allow for a gas check without alternate calibration / gas check fittings or cap.

3.3 Electrochemical (Toxic and Oxygen) Sensors/Transmitters

- 3.3.1 The electrochemical sensor/transmitters shall not require the periodic addition of reagents.
- 3.3.2 The interconnect wiring from the electrochemical transmitter to the sensor shall be a 5-wire cable.

3.4 Sensor/Transmitter Operating Requirements

- 3.4.1 Operating Voltage - The sensor/transmitter can operate between 8-30 VDC.
- 3.4.2 Sensor/transmitter electronics shall consist of one PCB. This PCB shall offer expandability to allow for optional LED's and relays.
- 3.4.3 The single PCB shall not require tools for installation or removal.
- 3.4.4 The single PCB must be self-aligning in the enclosure.
- 3.4.5 Sensor/transmitter shall require the following wiring configurations:

- 3.4.5.1 2-wire cable for electrochemical (toxic and oxygen sensors) units configured without LED or relay options.
- 3.4.5.2 3-wire cable for electrochemical (toxic and oxygen sensors) units configured with LED and relay options.
- 3.4.5.3 3-wire cable for all combustible units (configured with or without LED or relay options).
- 3.4.6 Sensor/transmitter shall allow for optional reset connector for resetting latched alarms.
- 3.4.7 Set-up and start-up of the sensor/transmitter will be so that the enclosure need not be opened during this process.
- 3.4.8 Sensor/transmitter shall be factory calibrated, ready for use out of the box. A gas check is all that is required to ensure proper operation.
- 3.4.9 Sensor/transmitter shall contain no pots, jumpers or switches.
- 3.4.10 Sensor/transmitter output signal shall be 4 to 20mA or HART. The combustible sensor/transmitter will be a sourcing type of signal capable of operating into a 600-ohm load. The toxic gas or oxygen sensor/transmitter will operate on a 2-wire or 3-wire current loop.
- 3.5 Sensor/Transmitter Display
 - 3.5.1 There will be a local display indicating the gas type being monitored and the concentration of gas present. The display will alternate between the gas type (1 second) and gas concentration (5 seconds). The display will be an integral part of the sensor/transmitter enclosure. The display will be visible from a minimum of 5 feet and will be present always, and will not require being turned on or off. This readout will be three, one half-inch (3 1/2") digit Liquid Crystal Displays (LCD).
 - 3.5.2 Sensor/transmitter display shall indicate all diagnostic check/fault conditions with a scrolling message detailing the condition. Error codes shall not be used.
 - 3.5.3 Sensor/transmitter will display 3 levels of alarm. Alarm levels will be adjustable by means of a hand held infrared controller or a HART hand held communicator.
- 3.6 Smart Sensor Technology
 - 3.6.1 Sensors shall be contained in sensor modules mounted external to the main enclosure. All sensor modules shall have the capability of replacement while the unit is under power (hazardous areas) without the need for tools.
 - 3.6.2 Sensor modules shall contain all relevant sensor information within the module. This information shall include sensor manufacturer date, gas type, gas range, calibration data, and default relay parameters.
 - 3.6.3 Sensor module shall store all calibration data so that the module may be calibrated off site and installed in the field without the necessity of re-calibration. The sensor module shall not require a battery or power source to store this data.
- 3.7 LED / Relay Options
 - 3.7.1 Sensor/transmitter shall have optional LED's, viewable from 50 feet, minimum. The LED's shall operate as follows:

- 3.7.1.1 Solid green LED – normal operation (measure mode)
- 3.7.1.2 Solid red LED – fault condition
- 3.7.1.3 Blinking red LED – alarm condition
- 3.7.2 Sensor/transmitter shall have optional relays. Relays shall be rated at 5 amps @ 30VDC, 5 amps @ 220VAC, single-pole, double-throw and consist of three for alarm levels and one for fault. All relay contact activation will be monitored. If the relay cannot activate for any reason, the trouble relay will change state. All relays shall be field selectable through a non-intrusive hand-held wireless remote control unit (Controller) or a HART hand held communicator. Selectable features include:
 - 3.7.2.1 Alarm level
 - 3.7.2.2 Latching / Non-latching
 - 3.7.2.3 Upscale / Downscale
 - 3.7.2.4 Normally-opened / Normally-closed
 - 3.7.2.5 Energized / De-energized
- 3.8 Other Features
 - 3.8.1 Sensor/transmitter shall allow for full range scaling of the 4-20mA-output signal.
 - 3.8.2 Sensor/transmitter will be capable of storing and displaying average, minimum and maximum gas concentrations over selected periods of time.
 - 3.8.3 The sensor/transmitter will give an indication of when sensor is nearing the end of its useful life by means of the front panel LCD. This indication that the sensor is nearing its useful life will be based on the sensor output. It shall not be based on the time the sensor was in service.
 - 3.8.4 The sensor/transmitter units can be located remote from a monitor/readout unit by up to 4000 feet via properly gauge wire.
- 3.9 Sensing Element Warranty
 - 3.9.1 All electrochemical and catalytic bead sensing elements (sensors) will have a minimum useful life of one year. The supplier will provide replacement sensors at no charge for any sensor that does not meet the minimum requirement.
 - 3.9.2 The IR source in the infrared sensor will have a minimum useful life of ten (10) years. The supplier will provide replacement sensors at no charge for any sensor that does not meet the minimum requirement.
- 4.0 Sensor Enclosure Parameters
 - 4.1 General-purpose Sensor/Transmitter
 - 4.1.1 Sensor/transmitter will be a plastic enclosure designed to meet Nema 4X requirements.
 - 4.2 Explosion-proof Sensor/Transmitter
 - 4.2.1 The sensor/transmitter will be in a 316 stainless steel enclosure suitable for location in Class I, Division 1 & 2, Groups A, B, C & D classified areas.
 - 4.2.2 The enclosure shall have a minimum of four entries, allowing for flexible mounting options for sensor, power, signal, and optional relay wiring.
 - 4.2.3 The enclosure shall offer a means to mount without using an entryway.

- 5.0 Sensor/Transmitter Single Condulet Mounting
 - 5.1 General-purpose Sensor/Transmitter
 - 5.1.1 Sensor/transmitter will be mounted in a single condulet. The back portion of the enclosure shall be separate from the electronics, allowing for mounting and wiring of the unit without the electronics present.
 - 5.2 Explosion-proof Sensor/Transmitter
 - 5.2.1 Sensor/transmitter will be mounted in a single condulet. The back portion of the enclosure shall be separate from the electronics, allowing for mounting and wiring of the unit without the electronics present.

- 6.0 Sensor/Transmitter Remote Sensor Mounting
 - 6.1.1 The sensor portion of the sensor/transmitter unit will be capable of being able to be remotely mounted from the electronics and display. The separate sensor enclosure will be able to be mounted up to one hundred (100) feet from the main enclosure.
 - 6.1.2 The sensor housing for the explosion-proof Gas Monitor will be in an enclosure suitable for location in Class I, Division 1, Groups A, B, C & D, Class II, Division 1, Groups E & F, Class III classified areas.
 - 6.1.3 A two twisted pair cable will connect the sensor housing and the calibration electronics.
 - 6.1.4 The readout portion of the sensor/transmitter shall have a display of the concentration of gas present. The display will be visible from a minimum of 5 feet and will be present at all times. It will not be required to be turned on or off. This readout will be three, one half inch (3 2") digit Liquid Crystal Displays (LCD).

- 7.0 Installation and mounting hardware
 - 7.1 A mounting strap shall be used which mounts the sensor/transmitter to a wall or similar structure.
 - 7.2 The mounting strap shall attach to the sensor/transmitter via two tapped and threaded holes on the rear of the sensor/transmitter. There shall be no brackets or clamps to secure this strap to the sensor/transmitter.

- 8.0 Approvals
 - 8.1 The general-purpose monitor shall have CE approval.
 - 8.2 The explosion-proof monitor shall have Class I, Division 1 & 2, Groups A, B, C, and D; Class II, Division 1, Groups F & G; Class III approval.
 - 8.3 The explosion-proof Remote Sensor shall have Class I, Division 1 & 2, Groups A, B, C, and D, Class II, Division 1, Groups F & G; Class III approval.
 - 8.4 The explosion-proof infrared monitor shall have Class I, Division 1 & 2, Groups A, B, C, and D; Class II, Division 1, Groups F, and G, Class III approval.
 - 8.5 SIL 2 Certification
 - 8.5.1 The oxygen, catalytic combustible, or IR Gas Monitors shall be certified to SIL requirements as per IEC 61508. Random Integrity SIL 2 @ HFT=0.

8.5.2 The toxic gas monitor shall be certified to SIL requirements as per IEC 61508. Random Integrity: SIL 1 @ HFT=0, random Integrity: SIL 2 @ HFT=1.

9.0 Non-intrusive Calibration Capability

9.1.1 All sensor/transmitters can be calibrated without opening any enclosures.

9.1.2 By means of a non-intrusive hand held wireless remote control unit or a HART hand held communicator, the sensor/transmitter will enter the calibration mode. The display of the sensor/transmitter will instruct the user on when to apply zero and span gas. The sensor/transmitter will automatically adjust its internal settings to the proper calibration values without further intervention by the user. Upon completion of a successful calibration, the sensor transmitter will exit the calibration mode. Date stamp of last successful calibration will be retained in the sensor/transmitter internal memory, with capability to be displayed on LCD. If calibration is unsuccessful for any reason, the display must show an unsuccessful calibration attempt and revert to its previous calibration settings. Use of flashlight type devices, magnets or clamp-on devices to achieve calibration is not acceptable. The acceptable methods are to use a transmitter, which employs a digitally encoded infrared light beam, or a HART hand held communicator.

9.1.3 There will be two types of non-intrusive hand held wireless remote control units available:

9.1.3.1 A small non-intrusive hand held wireless remote control will let the user only perform sensor zeroing, calibration and setting the multiplex address.

9.1.3.2 A larger non-intrusive hand held wireless remote control will let the user not only do the functions of the small remote control but activate all functions and features of the sensor/transmitter.

9.1.3.3 The sensor/transmitter will not be affected by low level ambient light either natural or man-made.

10.0 Manufacturer Capability Requirements - As a minimum, the Gas Monitoring Equipment manufacturer must meet the following requirements.

10.1 The manufacturer must be capable of supplying all equipment used to check or calibrate the sensor/transmitter units.

10.2 The manufacturer must be capable of providing on site service with factory trained personnel.

10.3 The manufacturer must be capable of providing on site training for owner/operator.

11.0 The sensor/transmitter shall be a MSA Ultima X Series Gas Monitor Sensor/Transmitter or equal.