TOXGARD II GAS MONITOR
SPECIFICATION

USER INSTRUCTIONS FOR THE TOXGARD II GAS MONITOR

The user must modify and customize the specification to make it functional. The following should be addressed:

1. Paragraph 1.2.1 - Fill in the total number of monitoring units necessary.
    a. Copy and renumber section 2.1 for combustible monitors.
    b. Copy and renumber section 2.2 for toxic and oxygen monitors.

2. Paragraph 1.2.2 - Fill in the required outputs of the monitoring unit selected in paragraph 1.2.1.
    a. Copy and renumber section 4.1 for standard 4 to 20mA output.
    b. Copy and renumber section 4.2 for isolated 4 to 20mA.
    c. Copy and renumber section 4.3 for digital network output.

3. Paragraph 1.2.3 - Fill in the number of each mounting style of the monitoring unit selected in paragraph 1.2.1.
    a. Copy and renumber section 5.1 for side mount or bottom mount sensing of the monitor.
    b. Copy and renumber section 5.2 for remote sensor mounting of the monitor.

4. Paragraph 1.2.4 - Select one of four paragraphs and complete the number of gas sampling systems for the monitors selected in paragraph 1.2.1.
    a. Copy and renumber section 6.1 for DC pumped gas sampling systems.
    b. Copy and renumber section 6.2 for air aspirated gas sampling systems.
    c. Copy and renumber section 6.3 for airline monitor (CO only) gas sampling systems.
    d. Copy and renumber section 6.4 for ‘flow block only’ sampling systems.

5. Paragraph 1.2.5 - Enter the number of battery backups needed for the monitoring units selected in paragraph 1.2.1
    a. Copy and renumber section 7.0.

6. Paragraph 1.2.7 - Select and fill the number of automatic calibration systems for the monitoring units selected in paragraph 1.2.1.
    a. Copy and renumber section 8.1 for general purpose automatic calibration systems.
    b. Copy and renumber section 8.2 for explosion proof automatic calibration systems.

SPECIFICATION

TOXGARD II GAS SENSOR/TRANSMITTER

1.0 Gas Monitor System Specification - Paragraphs 1.1 through 11.0 detail the specification for the Gas Monitor System.

1.1. General - The Gas Monitor System will measure and display a single gas concentration. The system shall provide audio and visual alarms when preset limits are exceeded. Relay output for alarms shall be provided.

1.2. Number of system monitor units will be as follows:

1.2.1. The following table lists the total number of monitors required:

Gas	**Range/Full Scale**	**Number of Monitors**
Combustible Gas - Natural Gas & H2	0-100% LEL	_____
Combustible Gas - Petroleum vapors	0-100% LEL	_____
Combustible Gas - Solvents	0-100% LEL	_____
Carbon Monoxide - (CO)	0-100 ppm	_____
Carbon Monoxide - (CO)	0-500 ppm	_____
Hydrogen Sulfide - (H2S)	0-10 ppm	_____
Hydrogen Sulfide - (H2S)	0-50 ppm	_____
Hydrogen Sulfide - (H2S)	0-100 ppm	_____
Chlorine Dioxide - (ClO2)	0-3 ppm	_____
Oxygen - (O2)	0-25%	_____
Nitric Oxide - (NO)	0-100 ppm	_____
Nitrogen Dioxide - (NO2)	0-10 ppm	_____
Sulfur Dioxide - (SO2)	0-25 ppm	_____
Chlorine - (Cl2)	0-5 ppm	_____
Hydrogen Cyanide - (HCN)	0-50 ppm	_____
Hydrogen Chloride - (HCl)	0-100 ppm	_____

1.2.2. The following table breaks down the required output of the listed sensor/transmitters:

Gas	**Outputs** Non-Isolated 4 to 20 mA (Standard)	Isolated 4 to 20 mA (Option)	Digital Network (Option)
Combustible Gas - Natural Gas & H2	_____	_____	_____
Combustible Gas - Petroleum vapors	_____	_____	_____
Combustible Gas - Solvents	_____	_____	_____
Carbon Monoxide - (CO)	_____	_____	_____
Carbon Monoxide - (CO)	_____	_____	_____
Hydrogen Sulfide - (H2S)	_____	_____	_____
Hydrogen Sulfide - (H2S)	_____	_____	_____
Hydrogen Sulfide - (H2S)	_____	_____	_____
Chlorine Dioxide - (ClO2)	_____	_____	_____
Oxygen - (O2)	_____	_____	_____
Nitric Oxide - (NO)	_____	_____	_____
Nitrogen Dioxide - (NO2)	_____	_____	_____
Sulfur Dioxide - (SO2)	_____	_____	_____
Chlorine - (Cl2)	_____	_____	_____
Hydrogen Cyanide - (HCN)	_____	_____	_____
Hydrogen Chloride - (HCl)	_____	_____	_____

1.2.3. The following table breaks down the required mounting style of the listed monitors:

Gas	**Sensor Mounting Style**			
	Side Mounted	Bottom Mounted	Remote Sensor (Gen. Purp.)	Remote Sensor (Explos. Proof)
Combustible Gas - Natural Gas & H2	_____	_____	_____	_____
Combustible Gas - Petroleum vapors	_____	_____	_____	_____
Combustible Gas - Solvents	_____	_____	_____	_____
Carbon Monoxide - (CO)	_____	_____	_____	_____
Carbon Monoxide - (CO)	_____	_____	_____	_____
Hydrogen Sulfide - (H2S)	_____	_____	_____	_____
Hydrogen Sulfide - (H2S)	_____	_____	_____	_____
Hydrogen Sulfide - (H2S)	_____	_____	_____	_____
Chlorine Dioxide - (ClO2)	_____	_____	_____	_____
Oxygen - (O2)	_____	_____	_____	_____
Nitric Oxide - (NO)	_____	_____	_____	_____
Nitrogen Dioxide - (NO2)	_____	_____	_____	_____
Sulfur Dioxide - (SO2)	_____	_____	_____	_____
Chlorine - (Cl2)	_____	_____	_____	_____
Hydrogen Cyanide - (HCN)	_____	_____	_____	_____
Hydrogen Chloride - (HCl)	_____	_____	_____	_____

1.2.4. Number of optional Gas Sampling systems - The number of gas sampling systems for the above monitors will be as follows:
- 1.2.4.1. The following required number of gas sampling systems that contain a DC pump are: (NO). _____.
- 1.2.4.2. The following required number of gas sampling systems that contain an air aspirator pump are: (NO). _____.
- 1.2.4.3. The following required number of gas sampling systems that contain a airline monitoring system are: (NO). _____.
- 1.2.4.4. The following required number of gas sampling systems that contain a flow block only are: (NO) _____.

1.2.5. Number of optional battery power backup - The number of battery backups for the above monitors will be (NO). _____.

1.2.6. Number of System Relays - The number of internal relays for the monitor will be as follows:
- 1.2.6.1. One relay will be provided for each of the three alarm levels.
- 1.2.6.2. One relay will be provided for system fault indication.
- 1.2.6.3. One relay will be provided to engage horn functions.

1.2.7. Number of optional duct mounting installation hardware for remote sensors required - The number of duct mounting installation hardware for the above monitors will be as follows:
- 1.2.7.1. The following required number of duct mount kits are: (NO) _____.

2.0 Gas Monitor Configuration - The gas monitor design shall conform to Paragraphs 2.0 through 11.0. Deviations are not acceptable.

2.1. Description - The gas monitor system shall consist of a monitor/readout unit with an integral or remote gas sensor element.

2.2. Gas Monitor Configuration - The gas monitor shall be enclosed in a wall mount type enclosure. It shall conform to Paragraphs 2.0.2.1 through 2.0.2.4.

2.2.1. Enclosure Type - The enclosure shall be designed to meet a NEMA 4X rating. Access to the inside of the enclosure, monitor front panel and wiring connections shall be through a front facing, full length door. The door shall have a shatterproof window of sufficient size to allow the viewing of the meter and indicator lights.

2.2.2. Enclosure Size - The enclosure shall be 12 inches or less in any dimension (mounting provisions excluded).

2.2.3. Mounting Provisions - Mounting brackets for the purpose of attaching the unit to a flat surface shall be provided. External Controls - A switch accessible from the outside of the enclosure shall be provided for the purpose of alarm relay reset audible alarm silencing.

2.3. Monitoring Sensor Element Requirements - Sensors used as part of the gas monitoring system specified in Paragraph 1.2.1 will be according to Paragraphs 2.1.1 through 2.1.2.

2.3.1. Combustible Monitor Sensor - (Remote explosion-proof sensor mount only version available for combustible gases.)

2.3.1.1. The combustible gas sensor will be the catalytic bead type. The sensor must have a demonstrated resistance to degradation by silicones and reduced sulfur gases (Hydrogen Sulfide).

2.3.1.2. The interconnect wiring from the remote combustible sensor/transmitter to the monitoring unit will be a 3-wire cable which can extend up to 50 ft. between monitor and sensor.

2.3.1.3. The combustible sensor/transmitter can detect an over-range condition. When this occurs it must be shown on the front panel display on the monitoring unit.

2.4. Toxic and Oxygen Monitor Sensors

2.4.1. The toxic gas monitor sensor will be the electrochemical type. The sensor will not require the periodic addition of reagents. The oxygen monitor sensor will be the electrochemical fuel cell type. The sensor will not require the periodic addition of reagents.

2.4.2. The interconnect wiring for remote mounted versions of toxic gas or oxygen sensor/transmitter to the monitoring instrument will be a multi-conductor wire cable.

3.0 Monitor Unit Requirements

3.1. Readout Displays - A four digit LED readout shall be provided for the purpose of displaying the gas concentration. The value displayed shall be a direct reading of the gas concentration specified in Paragraph 1.2.1. System status indicators will also be provided with the LED display.

3.2. Alarm Set Point Levels - Three separate alarm set point levels shall be provided. The set points shall be independently adjustable for any value in the readout range. The set points shall provide drive signals to user interface relays. The alarm set points shall have the capability of providing the user a selection of latching or non-latching mode.

3.3. Visual Alarm Indicators - The monitor shall have separate indicating segments for three separate alarm levels. The lights shall indicate when the preset limits the “Caution”, “Warning”, and/or “Alarm” set points have been exceeded. Optional strobes shall be provided to indicate warning and/or alarm conditions.

3.4. Relay Outputs - The alarm set point drive signals shall activate user relays as specified in Paragraphs 3.4.1 through 3.4.4.

3.4.1. Number of Relays - One relay for each set point level shall be provided for each of the three alarm levels. One relay shall be provided for fault conditions. A horn relay will be provided and will work in conjunction with alarm set points.

3.4.2. Contact Rating - All alarm and fault relays shall be Form C, single pole, double throw. Contacts shall be rated for 5 amps resistive at 250 VAC or 30 VDC. The horn relay has form ‘A’ contacts and is always set as normally open and common.

3.4.3. Contact Selections - The contacts shall be capable of being selected normally open or normally closed.

3.4.4. Relay Configuration - The alarm relays shall be normally de-energized. The fault relay shall be normally energized.

3.5. Malfunction Indication Alarm - The readout display described in Paragraph 3.1 shall display a separate unique character when an over range or under range condition exists, signal from the sensor is lost, there is a set point error or monitor memory failure.

3.6. Audible Alarm - An audible piezo buzzer shall be provided when an alarm condition occurs. Provisions to replace buzzer with optional horn shall be available.

3.7. Controls - Monitor controls shall be provided as specified in Paragraph 3.7.1 and 3.7.2.

3.7.1. Operating Modes and Parameters Selection - The selections listed in this paragraph shall be accomplished by the use of switches, jumpers or remote control (not involving the use of tools).

a. display range value
b. latching or non-latching mode for the alarm set points
c. upscale or downscale acting alarms

3.7.2 Front Panel Horn/Alarm Acknowledge Switch - This push button switch shall silence audible alarm indicators when alarm points are exceeded. Visual alarms will remain on as long as alarms are exceeded. This switch will reset latched alarms if normal gas conditions exist.

3.8. System Power Requirements - The system shall operate on 115 or 220 VAC, 50 or 60 Hz. Power shall not exceed 40 Watts from its internal DC supply. An internal, push button, reset circuit breaker shall be provided.

3.9. Maximum System Maintenance Requirements - The system shall require no periodic maintenance other than periodic checking of sensor response to a known concentration of gas.

3.10. Approvals - As a minimum, the following parts of the system shall have approval by UL:

3.10.1. All primary AC components including connectors

3.10.2. All user relays

3.11. Remote Sensor Option Parameters

3.11.1. Operating Voltage - The sensor/transmitter can operate between 7-30 VDC.

3.11.2. The monitor display will give an indication of when sensor is nearing the end of its useful life by means of the front panel display. 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.

3.11.3. The monitor unit will be capable of storing and displaying average, minimum and maximum gas concentrations of the sensor over selected periods of time.

3.11.4. Sensing elements of the sensor/transmitter will be mounted external to the main enclosure. All sensing elements can be replaced without opening main enclosure. No tools will be required for replacement of the toxic and oxygen sensing elements.

3.11.5. Sensing Element Warranty - All 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.

3.11.6 The sensor/transmitter units can be located remote from the monitor unit by up to 50 feet via properly gauged wire.

3.11.7 The sensor/transmitter units will have provisions for mounting to a wall or similar structure with an available bracket.

3.12. Non-intrusive Calibration Capability

3.12.1. All monitor/sensor systems can be calibrated without opening the sensor enclosure, and monitor unit functions are adjustable via the non-intrusive hand held wireless remote control.

3.12.2. By means of a non-intrusive hand held wireless remote control unit, the monitor/sensor/transmitter will enter the calibration mode. The display of the monitor will instruct the user on when to apply zero and span gas. The system will automatically adjust its internal settings to the proper calibration values without further intervention by the user. Upon completion of a successful calibration, the system will exit the calibration mode. Date stamp of last successful calibration will be retained in the system internal memory, with capability to be displayed on display. 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 method uses a transmitter which employs a digitally encoded infrared light beam.

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

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

3.12.3.2. 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 system.

3.12.4. The monitor infrared link will not be affected by low level ambient light either natural or man-made.

4.0 Monitor Output Signal
- 4.1. 4 to 20mA output signal (non-isolated) - Standard
  - 4.1.1.1. The signal from the monitoring instrument will be 4 to 20mA. The signal will be a sourcing type of signal capable of operating into a 600 ohm load.
- 4.2. 4 to 20mA output signal (isolated) - Optional
  - 4.2.1. As an option, a fully isolated 4-20mA output signal shall be provided. The signal will be a sourcing type capable of operating into a 600 ohm load.
- 4.3. Digital output signal - Optional
  - 4.3.1. The signal from the monitor will be a digital output type. All types must utilize a two wire connection. These wires are for the digital communication.

5.0 Enclosure Mounting Style
- 5.1. Monitor unit mounting
  - 5.1.1. The monitor shall provide 4 wall mount tabs for easy mounting.
  - 5.1.2. Installation, set up and start up of the monitor unit will be in such a manner that the enclosure need not be opened during this process.
  - 5.1.3. The gas sensor shall be capable of being mounted on the side or bottom of the monitor enclosure (except for combustible gases).
- 5.2. Remote sensor mounting of the sensor/transmitter - If applicable
  - 5.2.1. The sensor portion of the monitoring system 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 fifty (50) feet from the main enclosure.
  - 5.2.2. The explosion-proof sensor housing option will be in an enclosure suitable for location in Class I, Division 1, Groups B, C & D classified areas. The general purpose housing option will be suitable for 10 location in areas rated for NEMA 4X. All sensors for combustible gases shall be enclosed in the explosion-proof remote housing.
  - 5.2.3. For toxic and oxygen units, a cable supplied by the manufacturer will connect the sensor housing and the calibration electronics.
  - 5.2.4. Mounting strap for remote sensor
    - 5.2.4.1. A mounting strap shall be available to mount the sensor/transmitter to a wall or similar structure.
  - 5.2.5. Duct Mounted Remote Sensor/Transmitter
    - 5.2.5.1. There shall be a kit to mount the sensor/transmitter into a duct.
    - 5.2.5.2. The kit to mount the sensor/transmitter on a duct must provide calibration of the sensor/transmitter without the removing of the sensor from the duct.
    - 5.2.5.3. The duct mounted sensor/transmitter shall be able to monitor gas flow rates in a duct up to sixty (60) miles per hour.

6.0 Gas Sampling System Options
- 6.1. DC pump Gas Sampling option for the Gas Monitor System
  - 6.1.1. The Gas Sampling system must be installed in the monitor enclosure.
  - 6.1.2. Signal - To eliminate radio frequency interference (RFI) and electromagnetic interference (EMI), the signal to the sensor from the Gas Sampling system will be in digital communication format.
  - 6.1.3. Operating Voltage - The Gas Sampling system will be able to operate on voltage from 7 up to 30 VDC at less than 5 Watts of power.
  - 6.1.4. The Gas Sampling system will have a flow sensor which will activate a relay when the gas sample falls below the acceptable flow rate to the gas sensor. There also will be an indication of the loss of gas flow on the front panel of the unit. A .6 Amps @ 110 Volts AC single pole, single throw relays will be provided for alarm indication.
  - 6.1.5. Introduction of the calibration gas to the gas sensor will be via an integral push button valve on the Gas Sampling system. This push button valve must return the Gas Sampling system to monitoring the sampled area when released.
  - 6.1.6. The Gas Sampling system will be able to pull a gas sample from up to 100 feet.
- 6.2. Air aspirated pump Gas Sampling option for the Gas Monitor System
  - 6.2.1. The Gas Sampling system must be installed in the monitor enclosure.

6.2.2. Signal - To eliminate radio frequency interference (RFI) and electromagnetic interference (EMI), the signal to the sensor from the Gas Sampling system shall be in digital format or frequency format.

6.2.3. The Gas Sampling system will have an air aspirator pump to draw a gas sample to the gas sensor. It will be able to pull a gas sample from up to 100 feet.

6.2.4. The Gas Sampling system will have a flow sensor which will activate a relay when the gas sample falls below the acceptable flow rate to the gas sensor. There also will be an indication of the loss of gas flow on the front panel of the unit. .6 Amps @ 110 Volts AC single pole, single throw relays will be provided for alarm indication.

6.2.5. Introduction of the calibration gas to the gas sensor will be via an integral push button valve on the Gas Sampling system. This push button valve must return the Gas Sampling system to monitoring the sampled area when released.

6.3. Airline monitor option for gas sampling - An option shall be provided to enable the measurement of a target gas from a compressed airline stream. The flow components shall be provided to facilitate connection to the airline along with pressure/flow regulation for proper gas sensing.

6.4. 'Flow Block Only' option for gas sampling - An option shall be provided to add a flow block to any sensor configuration (side mount, bottom mount, or remote mount). This flow block will provide plumbing connections for flow stream sample and a flow switch to connect calibration gas to the sensor.

7.0 Battery Backup power supply option

7.1. The monitor will have a local battery backup power supply to supply the necessary power for proper operation. It shall allow the system to continue normal operation if AC power is interrupted. The transfer to battery backup shall be automatic and shall be indicated on the display as "Batt".

7.2. The battery backup power supply will have provisions for mounting inside the monitor enclosure. The system shall be continuously charged by the monitor during normal operation.

7.3. Installation, set up and start up of the battery backup power supply will be in such a manner that no switches or jumpers need to be configured.

7.4. The expected battery life for a combustible system shall be a minimum of 1 hour to a maximum of 10 hours at 77° F. This is with strobe options present and flashing, alarm conditions asserted, and a horn sounding. For the toxic or oxygen units under the same conditions, the expected battery life will range from 0.5 hours to 24 hours.

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

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

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

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

8.4. The manufacturer must be capable of providing in-house factory service and assistance.

9.0 The Gas Monitor System shall be a Mine Safety Appliances Toxgard II Monitor System or equal.