

SPECIFICATION

QUAD-GAS II MONITOR SYSTEM

User Instructions For The Quad-Gas II Monitor System

To completely customize the specifications to your exact application, modifications to the following paragraphs are necessary:

1. Change the first digit of the paragraph number to correspond with the correct number for your overall specification.
2. Paragraph 1.2 - Fill in the desired number of sensors. Cross out the unused ones.
3. Paragraph 1.3 - Select the desired sensors and sensor capability. Cross out the unnecessary ones and renumber the paragraphs.
4. Paragraph 1.4.1 - Fill in the number of monitors.

SPECIFICATION FOR THE QUAD-GAS II MONITOR SYSTEM

1.0 Gas Monitor Specification - Paragraphs 1.1 through 12.0 detail the specification for the Gas Monitoring System.

1.1 General - The Gas Monitoring System shall measure and display gas concentration. The system shall provide visual alarms when preset limits are exceeded. Relay outputs for alarms representing gas concentrations shall be provided.

1.2 Number and Types of Monitoring Points - The number and type of monitoring points shall be as follows:

1.2.1 The following table lists the total number of sensor/transmitters required:

| Gas | Range/Full Scale | Number of Sensor/Transmitters |
|---|------------------|-------------------------------|
| Combustible Gas - Natural Gas & H ₂ | 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 - (H ₂ S) | 0-10 ppm | _____ |
| Hydrogen Sulfide - (H ₂ S) | 0-50 ppm | _____ |
| Hydrogen Sulfide - (H ₂ S) | 0-100 ppm | _____ |
| Chlorine Dioxide - (ClO ₂) | 0-3ppm | _____ |
| Oxygen - (O ₂) | 0-25% | _____ |
| Nitric Oxide - (NO) | 0-100 ppm | _____ |
| Nitrogen Dioxide - (NO ₂) | 0-10 ppm | _____ |
| Sulfur Dioxide - (SO ₂) | 0-25 ppm | _____ |
| Chlorine- (Cl ₂) | 0-5 ppm | _____ |
| Hydrogen Cyanide - (HCN) | 0-50 ppm | _____ |
| Hydrogen Chloride - (HCl) | 0-100 ppm | _____ |

SPEC - QUAD-GAS II

1.2.2 The following table breaks down the required enclosure rating of the listed sensor/transmitters:

| Gas | Enclosure rating | | |
|---|------------------|-----------------|--------------------|
| | GP/Nema 4X | Explosion proof | Intrinsically Safe |
| Combustible Gas - Natural Gas & H ₂ | _____ | _____ | _____ |
| Combustible Gas - Petroleum vapors | _____ | _____ | _____ |
| Combustible Gas - Solvents | _____ | _____ | _____ |
| Carbon Monoxide - (CO) | _____ | _____ | _____ |
| Carbon Monoxide - (CO) | _____ | _____ | _____ |
| Hydrogen Sulfide - (H ₂ S) | _____ | _____ | _____ |
| Hydrogen Sulfide - (H ₂ S) | _____ | _____ | _____ |
| Hydrogen Sulfide - (H ₂ S) | _____ | _____ | _____ |
| Chlorine Dioxide ClO ₂ | _____ | N/A | _____ |
| Oxygen - (O ₂) | _____ | _____ | _____ |
| Nitric Oxide - (NO) | _____ | _____ | _____ |
| Nitrogen Dioxide - (NO ₂) | _____ | N/A | _____ |
| Sulfur Dioxide - (SO ₂) | _____ | N/A | _____ |
| Chlorine- (Cl ₂) | _____ | N/A | _____ |
| Cyanide - (HCN) | _____ | N/A | _____ |
| Hydrogen Chloride - (HCl) | _____ | N/A | _____ |

GP = General Purpose

1.2.3 The following table breaks down the required mounting style of the listed sensor/transmitters:

| Gas | Sensor Mounting Style | |
|---|-----------------------|---------------|
| | Single Condulet | Remote sensor |
| Combustible Gas - Natural Gas & H ₂ | _____ | _____ |
| Combustible Gas - Petroleum vapors | _____ | _____ |
| Combustible Gas - | _____ | _____ |

SPEC - QUAD-GAS II

| | | |
|---------------------------------------|-------|-------|
| Solvents | _____ | _____ |
| Carbon Monoxide - (CO) | _____ | _____ |
| Carbon Monoxide - (CO) | _____ | _____ |
| Hydrogen Sulfide - (H ₂ S) | _____ | _____ |
| Hydrogen Sulfide - (H ₂ S) | _____ | _____ |
| Hydrogen Sulfide - (H ₂ S) | _____ | _____ |
| Chlorine Dioxide ClO ₂ | _____ | _____ |
| Oxygen - (O ₂) | _____ | _____ |
| Nitric Oxide - (NO) | _____ | _____ |
| Nitrogen Dioxide - (NO ₂) | _____ | _____ |
| Sulfur Dioxide - (SO ₂) | _____ | _____ |
| Chlorine- (Cl ₂) | _____ | _____ |
| Hydrogen Cyanide - (HCN) | _____ | _____ |
| Hydrogen Chloride - (HCl) | _____ | _____ |

- 1.2.4 Number of Gas Sampling systems - The number of gas sampling systems for the above sensor/transmitters will be as follows:
 - 1.2.4.1 The following required number of Nema 4X gas sampling systems that contain a DC pump are: (NO.)
 - 1.2.4.2 The following required number of explosion proof gas sampling systems that contain a DC pump are: (NO.)
 - 1.2.4.3 The following required number of Nema 4X gas sampling systems that contain an air aspirator pump are: (NO.)
 - 1.2.4.4 The following required number of explosion proof gas sampling systems that contain a DC pump are: (NO.)
- 1.2.5 Number of Power Supplies - The number of Power supplies for the above sensor/transmitters will be (NO.).
- 1.2.6 Number of remote relay systems - The number of remote relay systems for the above sensor/transmitters will be as follows:
 - 1.2.6.1 The following required number of Nema 4X remote relay systems are: (NO.)

SPEC - QUAD-GAS II

- 1.2.6.2 The following required number of explosion proof remote relay systems are:
(NO.)
- 1.2.7 Number of automatic calibration systems - The number of automatic calibration systems for the above sensor/transmitters will be as follows:
 - 1.2.7.1 The following required number of Nema 4X automatic calibration systems are:
(NO.)
 - 1.2.7.2 The following required number of explosion proof automatic calibration systems are: (NO.)
- 1.2.8 Number of relay/automatic calibration systems - The number of relay/automatic calibration systems for the above sensor/transmitters will be as follows:
 - 1.2.8.1 The following required number of Nema 4X relay/automatic calibration systems are: (NO.)
 - 1.2.8.2 The following required number of explosion proof relay/automatic calibration systems are: (NO.)
- 1.2.9 Number of installation hardware required - The number of installation hardware for the above sensor/transmitters will be as follows:
 - 1.2.9.1 The following required number of strap assemblies are: (NO.)
 - 1.2.9.2 The following required number of hanger assemblies are: (NO.)
 - 1.2.9.3 The following required number of duct mount kits are: (NO.)
- 1.3 Sensor Unit Requirements - Sensors used as part of the monitoring system specified in Paragraph 1.2 shall be in accordance with Paragraphs 1.3.1 through 1.3.20.
 - 1.3.1 Diffusion Combustible Sensor - The diffusion combustible sensor shall be in accordance with Paragraphs 1.3.1.1 through 1.3.1.10.

SPEC - QUAD-GAS II

- 1.3.1.1 The combustible gas sensor shall be the catalytic bead type. The sensor must have a demonstrated resistance to degradation by silicones and reduced sulfur gases (Hydrogen Sulfide).
- 1.3.1.2 The interconnect wiring from the sensor to the instrument shall be 3 wire shielded cable.
- 1.3.1.3 The combustible sensor shall be in an enclosure suitable for location in Class I, Division 1, Groups C & D classified areas. The sensor units shall have provisions for mounting to a wall or similar structure.
- 1.3.1.4 Signal - To eliminate radio frequency interference (RFI) and electromagnetic interference (EMI), the signal from the sensor to the monitor shall be 4 to 20 mA.
- 1.3.1.5 Operating Voltage - The voltage supplied to the sensor shall not exceed 24 VDC.
- 1.3.1.6 The sensor units shall be capable of being located remote from the monitor/readout unit by up to 4000 feet. Sensor units shall receive power from and send signal corresponding to gas values to the monitor/readout unit.
- 1.3.1.7 Sensor to have FM (Factory Mutual), UL (Underwriters Laboratory), or CSA (Canadian Standards Agency) listing.
- 1.3.1.8 Sensing Element Warranty - All sensing elements (sensors) shall have a minimum useful life of one year. The supplier shall provide replacement sensor at no charge for any sensor that does not meet the minimum requirement.
- 1.3.1.9 The manufacturer shall be able to provide a kit that when outfitted with the combustible sensor will be able to monitor ducts or vents for combustible gas. The duct mounted combustible gas sensor shall be able to monitor gas flow rates in a duct up to sixty (60) miles per hour. The vent mounted combustible gas sensor shall be provided with a four (4) inch saddle clamp.
- 1.3.1.10 Remote Sensor Mounting of the Sensor/Transmitter

- 1.3.1.10.1 The combustible sensor shall be capable of being able to be remotely mounted from the calibration electronics. The separate sensor enclosure shall be able to be mounted fifty (50) feet from the calibration electronics.
- 1.3.1.10.2 The sensor housing shall be in an enclosure suitable for location in Class I, Division 1, Groups B, C & D classified areas.
- 1.3.1.10.3 The sensor housing and the calibration electronics shall be connected by not more than a three conductor cable.

2.0 Non-intrusive Calibration Capability

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

2.1.2 By means of a non-intrusive hand held wireless remote control unit, 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 method uses a transmitter which employs a digitally encoded infrared light beam.

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

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

2.1.2.3 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.

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

3.0 Sensor Enclosure Parameters

3.1 Nema 4X rated enclosure

3.1.1 Sensor/transmitter enclosure will also be designed to meet Nema 4X requirements.

3.2 Explosion Proof rated enclosure

3.2.1 The sensor/transmitter will be in an enclosure suitable for location in Class I, Division 1, Groups B, C & D classified areas.

3.3 Intrinsically Safe rating

3.3.1 The sensor/transmitter will be able, with appropriate electrical barriers, be used as an intrinsically safe device. The manufacturer must be able to supply the barriers

3.3.2 The manufacturer must be able to supply a listing number from a nationally recognized testing laboratory. This listing number will prove that the sensor/transmitter has passed all the requirements to be used as an intrinsically safe device.

4.0 Sensor/transmitter Output Signal

4.1 4 to 20mA Sensor/transmitter output signal

4.1.1 The signal from the sensor/transmitter to the monitoring instrument will be 4 to 20mA. 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 current loop, or 3-wire current.

5.0 Sensor/transmitter Mounting Style

5.1 Single conduit sensor/transmitter mounting

SPEC - QUAD-GAS II

- 5.1.1 The sensor/transmitter will be mounted in a single conduit. This conduit will 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 a three digit one half inch high Liquid Crystal Display (LCD).
- 5.1.2 Installation, set up and start-up of the sensor/transmitter will be in such a manner that the enclosure need not be opened during this process.

5.2 Remote sensor mounting of the sensor/transmitter

- 5.2.1 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 fifty (50) feet from the main enclosure.
- 5.2.2 The sensor housing will be in an enclosure suitable for location in Class I, Division 1, Groups B, C & D classified areas.
- 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 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 a three digit one half inch high Liquid Crystal Display (LCD).

6.0 Sensor/transmitter Gas Sampling systems

6.1 DC pump Gas Sampling for the Gas Sensor/transmitter

6.1.1 Physical requirements

- 6.1.1.1 The Gas Sampling system must be in a separate enclosure than the gas sensor mounted no more than 18 inches from the gas sensor.
- 6.1.1.2 The interconnect wiring from the gas sensor to the gas sampling system shall be 3 wire cable and supplied by the manufacturer. Shielded cable may be used where portable two-way radios, welding, or large machinery are located or used.

- 6.1.1.3 The Gas Sampling system will be capable of supplying a gas sample for up to three gas sensors.

6.1.2 Enclosure Type

- 6.1.2.1 The Gas Sampling system enclosure will be designed to meet Nema 4X requirements.
- 6.1.2.2 The Gas Sampling system will be in an enclosure suitable for locations in Class 1, Group C, & D Division 1 classified areas.
- 6.1.2.3 The Gas Sampling system's enclosure will be less than 12 inches in any dimension (mounting provisions excluded).
- 6.1.2.4 The Gas Sampling system will have provisions for mounting to a wall or similar structure.

6.1.3 Operating parameters

- 6.1.3.1 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 format or frequency format.
- 6.1.3.2 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.
- 6.1.3.3 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.
- 6.1.3.4 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.
- 6.1.3.5 The Gas Sampling system will be able to pull a gas sample from up to 100 feet.

6.2 Air aspirated pump Gas Sampling for the Gas Sensor/transmitter

6.2.1 Physical requirements

- 6.2.1.1 The Gas Sampling system must be in a separate enclosure than the gas sensor mounted no more than 18 inches from the gas sensor.
- 6.2.1.2 The interconnect wiring from the gas sensor to the gas sampling system will be 3 wire cable and be supplied by the manufacturer. Shielded cable may be used where portable two-way radios, welding, or large machinery are located or used.
- 6.2.1.3 The Gas Sampling system will be capable of supplying a gas sample for up to three gas sensors.

6.2.2 Enclosure Type

- 6.2.2.1 The Gas Sampling system enclosure will be designed to meet Nema 4X requirements.
- 6.2.2.2 The Gas Sampling system will be in an enclosure suitable for locations in Class 1, Group B, C, & D Division 1 classified areas.
- 6.2.2.3 The Gas Sampling system's enclosure will be less than 12 inches in any dimension (mounting provisions excluded).
- 6.2.2.4 The Gas Sampling system will have provisions for mounting to a wall or similar structure.

6.2.3 Operating parameters

- 6.2.3.1 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.
- 6.2.3.2 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.
- 6.2.3.3 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.

SPEC - QUAD-GAS II

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

6.2.3.4 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.

7.0 System Configuration - The system design shall conform to Paragraphs 7.1 through 9.0. Deviations are not acceptable.

7.1 Description - The system shall consist of a monitor/readout unit and separate gas sensor units. The sensor units shall be capable of being located remote from the monitor/readout unit by up to 5000 feet. Sensor units shall receive power from and send signal corresponding to gas values to the monitor/readout unit. The gas monitor system shall consist of (No.) monitor/readout units and separate gas sensor units.

7.2 Monitor/Readout Configuration - The monitor/readout shall be the enclosed wall mount type. It shall conform to Paragraphs 7.2.1 through 7.2.5.

7.2.1 Number of Sensor per Enclosure - Each monitor/readout shall have the capability of monitoring four sensors as described in Paragraph 1.2.

7.2.2 Enclosure Type - The enclosure shall be suitable for NEMA 4X type areas. 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 meters and indicator lights. **The enclosure shall not be mounted in a hazardous location as defined by the NEC (National Electrical Code).**

7.2.3 Enclosure Size - The enclosure shall be less than 14 inches in any dimension (mounting provisions excluded).

7.2.4 Mounting Provisions - Mounting brackets for the purpose of attaching the unit to a flat surface shall be provided.

7.2.5 External Controls - A sealed switch (switches) accessible from the outside of the enclosure shall be provided for the purpose of alarm relay reset and horn silence.

8.0 Monitor Unit Requirements

8.1 Readout Displays - A four digit LED readout shall be provided for the purpose of displaying the gas value from sensor and point number being displayed. The value displayed shall be a reading of concentration as specified in Paragraph 1.2. The readout must also be able to be configured to read any value between 0-999 or 0.00-9.99 or 00.0-99.9.

8.2 Visual Alarm Indicators - The monitor shall have a separate indicating light for warning, alarm and trouble for each gas sensor. The lights shall be color coded. Blue and White shall not be used.

8.3 Alarm Set Point Levels - Two separate alarm set point levels shall be provided for each sensor. 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. Alarm set points shall have the capability of providing the user a selection of latching or non-latching mode.

8.4 Relay Outputs - The alarm set point drive signals shall activate user relays as specified in Paragraphs 8.4.1 through 8.4.3.

8.4.1 Number of Relays - Common relay for alarm, horn, and trouble and discrete for warning shall be provided.

or

8.4.1 Number of Relays - Discrete relays for all warning and alarm set points with a common horn and trouble relay shall be provided.

8.4.2 Contact Rating - All relays shall be Form C, single pole, double throw minimum. Contacts shall be rated for 10 amps resistive at 125 VAC minimum.

8.4.3 Contact Selection - The contacts shall be capable of being selected normally open or normally closed and normally energized or normally de-energized.

8.5 Malfunction Indication - System trouble indication shall be provided in accordance with Paragraphs 8.5.1 and 8.5.2.

SPEC - QUAD-GAS II

8.5.1 Trouble Relay - A relay shall be provided to indicate trouble when any of the following conditions exist:

- a. System power loss
- b. Signal loss from any sensor
- c. Sensor not connected

8.5.2 Display Indication - The readout display described in Paragraph 8.1 shall display a separate unique character, if 10% or greater under range condition exists.

8.6 Audible Alarm - A audible horn, buzzer or tone shall be provided when an alarm condition occurs. The audible horn, buzzer or tone should be settable to solid on or variable per sensor point.

8.7 Controls - Controls shall be provided as specified in Paragraphs 8.7.1 and 8.7.2.

8.7.1 Operating Modes and Parameters Selection - The selections listed in this paragraph shall be accomplished by the use of keypads, jumpers or other means that does not involve the use of tools.

- a. display range value
- b. latching or non-latching mode for all alarm set point drivers
- c. increasing or decreasing alarm action for all alarm set points

8.7.2 Front Panel Controls - The functions listed in this paragraph shall be accomplished using push button type controls readily accessible.

- a. display of alarm set point level on the readout display described in Paragraph 8.1
- b. resetting any alarm set point
- c. select channel to display
- d. resetting any latching relay if alarm condition is cleared

8.8 Sensor Input Signal - The sensor input signal shall be a 4 to 20 milliamp type.

8.9 System will have a minimum 30 sec. delay on start-up or power lose to prevent false alarms.

SPEC - QUAD-GAS II

- 9.0 System Power Requirements - The system shall operate on 115 or 220 VAC, 50 or 60 Hz. Power shall not exceed 100 VA or 24 VDC.
- 10.0 Maximum System Maintenance Requirements - The system shall require no periodic maintenance other than periodic checking of sensor unit function. Periodic sensor checking or actual adjustment of the sensor units shall be capable of being accomplished by one person at the sensor unit location.
- 11.0 Manufacturer Capability Requirements - As a minimum, the Gas Monitoring Equipment manufacturer must meet the following requirements:
- a. be capable of supplying all equipment used to check or calibrate the sensor units
 - b. be capable of providing on site service with factory trained personnel
 - c. be capable of providing on site training for owner/operator
- 12.0 Gas Monitoring System shall be a Mine Safety Appliances Company Quad-Gas II Monitor or equal.