User Instructions
For The
Model 5200 Gas 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 and type 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
MODEL 5200 GAS MONITOR SYSTEM

1.0 Gas Monitor Specification - Paragraphs 1.1 through 2.0 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 audio and visual alarms when preset limits are exceeded. Relay outputs for alarms and analog signals 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 number of sensors are required:

<table>
<thead>
<tr>
<th>GAS</th>
<th>RANGE/FULL SCALE</th>
<th>NUMBER OF SENSORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combustible Gas</td>
<td>0-100% LEL</td>
<td></td>
</tr>
<tr>
<td>Carbon Monoxide-(CO)</td>
<td>0-100 ppm</td>
<td></td>
</tr>
<tr>
<td>Carbon Monoxide-(CO)</td>
<td>0-500 ppm</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Sulfide-(H₂S)</td>
<td>0-10 ppm</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Sulfide-(H₂S)</td>
<td>0-50 ppm</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Sulfide-(H₂S)</td>
<td>0-100 ppm</td>
<td></td>
</tr>
<tr>
<td>Oxygen-(O₂)</td>
<td>0-25%</td>
<td></td>
</tr>
<tr>
<td>Oxygen-(O₂)</td>
<td>0-10%</td>
<td></td>
</tr>
<tr>
<td>Nitric Oxide</td>
<td>0-100 ppm</td>
<td></td>
</tr>
<tr>
<td>Nitrogen Dioxide-(NO₂)</td>
<td>0-10 ppm</td>
<td></td>
</tr>
<tr>
<td>Sulfur Dioxide-(SO₂)</td>
<td>0-25 ppm</td>
<td></td>
</tr>
<tr>
<td>Chlorine-(Cl₂)</td>
<td>0-10 ppm</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Cyanide-(HCN)</td>
<td>0-50 ppm</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Chloride-(HCl)</td>
<td>0-100 ppm</td>
<td></td>
</tr>
</tbody>
</table>
1.2.2 The number of types of each external sensor shall be:

<table>
<thead>
<tr>
<th>GAS</th>
<th>DIFFUSION SENSORS</th>
<th>SAMPLE DRAW SENSORS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CALIBRAT. MODE</td>
<td>CALIBRAT. MODE</td>
</tr>
<tr>
<td></td>
<td>GP    4X  XP</td>
<td>Std. Nonintru.</td>
</tr>
</tbody>
</table>

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<th>Std. Nonintru.</th>
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</thead>
<tbody>
<tr>
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<td>___</td>
<td>___</td>
</tr>
<tr>
<td>Carbon Monoxide-(CO)</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>Hydrogen Sulfide-(H₂S)</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>Oxygen-(O₂)</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>Nitrogen Dioxide-(NO₂)</td>
<td>___</td>
<td>___</td>
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<td>___</td>
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</tr>
<tr>
<td>Hydrogen Chloride-(HCl)</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>Hydrogen Cyanide-(HCN)</td>
<td>___</td>
<td>___</td>
</tr>
</tbody>
</table>

**DUAL CONDULET SENSOR**

<table>
<thead>
<tr>
<th>GAS</th>
<th>CALIBRATION MODE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GP   4X  XP</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GAS</th>
<th>GP   4X  XP</th>
<th>Std. Nonintru.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combustible</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>Oxygen</td>
<td>___</td>
<td>___</td>
</tr>
</tbody>
</table>

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.

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 in digital format or frequency format or 4-20mA.

1.3.1.5 Operating Voltage - The voltage supplied to the sensor shall not exceed 14 VDC or be less than 7.5 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 Dual Condulet Capability

1.3.1.10.1 The combustible sensor shall be capable of being 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.

1.3.2 Nonintrusive Calibration Capability

Sensor/Transmitter Unit Requirements - Sensors used as part of the gas monitoring system specified in Paragraph 1.2 of the gas monitoring system shall be in accordance with Paragraphs 1.3.2.1 through 1.3.18.

1.3.2.1 Sensor/Transmitter

1.3.2.2 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).

1.3.2.3 The interconnect wiring from the combustible sensor/transmitter to the monitoring instrument shall be a 3-wire cable.

1.3.2.4 The toxic gas sensor/transmitter shall be the electrochemical type. The sensor shall not require the periodic addition of reagents. The oxygen sensor shall be the electrochemical fuel cell type. The sensor shall not require the periodic addition of reagents.

1.3.2.5 The interconnect wiring from the toxic gas or oxygen sensor/transmitter to the monitoring instrument shall be a 3-wire cable.

1.3.2.6 Signal - The signal from the sensor/transmitter to the monitoring instrument shall be a frequency signal in the range of 4-9 KHZ or 4-20mA.

1.3.3 Operating Voltage - The sensor/transmitter shall be able to operate on 6-15 VDC.
1.3.4 The sensor/transmitter units shall be capable of being located remote from the monitor/readout unit by up to 4000 feet.

1.3.5 The sensor/transmitter shall be in an enclosure suitable for location in Class I, Division 1, Groups B, C & D classified areas. The sensor/transmitter units shall have provisions for mounting to a wall or similar structure.

1.3.5.1 Sensor/transmitter enclosure shall also be designed to meet Nema 4X requirements.

1.3.6 There shall be a local display of the concentration of gas present. The display shall be an integral part of the sensor/transmitter enclosure. The display shall be visible from a minimum of 5 feet and shall be present at all times, and will not require being turned on or off. This readout shall be a three and one half (3½) digit Liquid Crystal Display (LCD).

1.3.7 Installation, set-up and start-up of the sensor/transmitter shall be in such a manner that the enclosure is not opened during this process.

1.3.7.1 Upon initial start-up the sensor/transmitter, by means of the front panel LCD, shall give an indication that an initial field calibration has not taken place.

1.3.8 The combustible sensor/transmitter shall have the capability to detect an over-range condition. When this occurs it must be indicated on the front panel LCD and the output shall remain locked at maximum value.

1.3.9 The sensor/transmitter shall give an indication of when sensor is nearing the end of its useful life by means of the front panel LCD.

1.3.10 Sensor/transmitter shall be capable of storing and displaying average, minimum and maximum gas concentrations over selected periods of time.

1.3.11 Sensor/transmitter to display 3 levels of alarm. Alarm levels to be adjustable by means of the hand held infrared controller.

1.3.11.1 Sensor/transmitter must have the capability to connect to relay module to provide three levels of relay outputs.

1.3.12 Sensing element shall be mounted external to main enclosure. Toxic and oxygen
sensing elements must be able to be replaced without opening main enclosure. No tools required to accomplish this task.

1.3.13 The manufacturer shall be able to provide a kit that when outfitted with the sensor/transmitter will be able to monitor ducts or vents. The duct mounted sensor/transmitter shall be able to monitor gas flow rates in a duct up to sixty (60) miles per hour. The vent mounted sensor/transmitter shall be provided with a four (4) inch saddle clamp.

1.3.14 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.

1.3.15 Dual Condulet Capability

1.3.15.1 The sensor portion of the sensor/transmitter unit shall be capable of being able to be remotely mounted from the electronics and display. The separate sensor enclosure shall be able to be mounted fifty (50) feet from the main enclosure.

1.3.15.2 The sensor housing shall be in an enclosure suitable for location in Class I, Division 1, Groups B, C & D classified areas.

1.3.15.3 The sensor housing and the calibration electronics shall be connected by a cable supplied by the manufacturer.

1.3.16 Non-intrusive Calibration Capability

1.3.16.1 The combustible sensor/transmitter shall be capable of being calibrated without opening any enclosures.

1.3.16.2 By means of a non-intrusive hand held wireless remote control unit, the sensor/transmitter shall enter into the calibration mode. The display of the sensor/transmitter shall instruct the user on when to apply zero and span gas. The sensor/transmitter shall 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 shall exit the calibration mode. Time and date stamp of last successful calibration shall 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 indicate 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.

1.3.16.3 Sensor/transmitter shall have the capability to initiate the auto-calibration process at pre-selected time/date. No manual intervention is required. Auto-calibration module may be required in conjunction with sensor/transmitter to accomplish this.

1.3.16.4 The sensor/transmitter shall not be affected by ambient light either natural or man made.

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

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

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

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

1.3.18 The combustible, toxic gas or oxygen sensor/transmitter shall be a Mine Safety Appliances Ultima Frequency Output Gas Sensor/Transmitter or equal.

1.3.19 Sample Draw Combustible Sensor - The sample draw combustible sensor shall be in accordance with Paragraphs 1.3.19.1 through 1.3.19.12.

1.3.19.1 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).

1.3.19.2 The interconnect wiring from the sensor to the instrument shall be 3 wire shielded cable.
1.3.19.3 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.

1.3.19.4 Enclosure Type - The enclosure shall be rated NEMA 4X type. Access to the inside of the enclosure 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 flow meter.

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

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

1.3.19.7 Signal - To eliminate radio frequency interference (RFI) and electromagnetic interference (EMI), the signal from the sensor to the monitor shall be in digital format or frequency format or 4-20mA.

1.3.19.8 Operating Voltage - The voltage supplied to the sensor shall not exceed 14 VDC.

1.3.19.9 The combustible sensor enclosure shall have a pump or an air aspirator to draw a gas sample to the combustible sensor.

1.3.19.10 The combustible sensor enclosure shall have a flow meter in the gas sample to show the flow rate of the sample gas.

1.3.19.11 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.

1.3.19.12 The pump type combustible sensor enclosure shall have a flow switch which will activate when the gas sample falls below the acceptable flow rate to the sensor.
1.3.20 Sample Draw Toxic Gas Sensor - The sample draw toxic gas sensor shall be in accordance with Paragraphs 1.3.20.1 through 1.3.20.12.

1.3.20.1 The toxic gas sensor shall be the electrochemical type. The sensor shall not require the periodic addition of reagents. The oxygen sensor shall be the polar graphic electrochemical fuel cell type. The sensor shall not require the periodic addition of reagents.

1.3.20.2 The interconnect wiring from the sensor to the instrument shall be 3 wire shielded cable.

1.3.20.3 The sensor units shall be capable of being located remote from the monitor/readout unit by up to 3200 feet. Sensor units shall receive power from and send signal corresponding to gas values to the monitor/readout unit.

1.3.20.4 Enclosure Type - The enclosure shall be rated NEMA 4X type. Access to the inside of the enclosure 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 flow meter.

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

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

1.3.20.7 Signal - To eliminate radio frequency interference (RFI) and electromagnetic interference (EMI), the signal from the sensor to the monitor shall be in digital format or frequency format or 4-20mA.

1.3.20.8 Operating Voltage - The voltage supplied to the sensor shall not exceed 14 VDC and not be less than 7.5 VDC.

1.3.20.9 The toxic gas sensor enclosure shall have a pump or an air aspirator to draw a gas sample to the toxic gas sensor.

1.3.20.10 The toxic gas sensor enclosure shall have a flow meter in the gas sample to show the flow rate of the sample gas.
1.3.20.11 The pump type toxic gas sensor enclosure shall have a flow switch which will activate when the gas sample falls below the acceptable flow rate to the sensor.

1.3.20.12 Nonintrusive Calibration Capability

1.3.20.12.1 The combustible sensor shall be capable of being calibrated without opening any enclosures.

1.3.20.12.2 There shall be a local display of the concentration of gas present. The display shall be an integral part of the sensor enclosure. The display shall be visible from a minimum of 5 feet and shall be present at all times, and will not require being turned on or off. This readout shall be three (3) digit Liquid Crystal Display (LCD).

1.3.20.12.3 Calibration shall be by means of a nonintrusive calibration system. Using a hand held wireless remote control unit held less than 1 foot from the sensor, the calibration values, zero and span, can be set without opening the enclosure or declassification of the area. Use of flashlight type devices, magnets or clamp-on devices to achieve calibration is not acceptable. The acceptable method uses a transmitter which employs an infrared light beam.

1.3.20.12.4 The combustible sensor shall not be affected by: ambient light either natural or man made.

1.4 System Configuration - The system design shall conform to Paragraphs 1.4 through 2.0. Deviations are not acceptable.

1.4.1 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 4000 feet. Sensor units shall receive power from and send signal corresponding to gas values to the monitor/readout unit.

1.4.2 Monitor/Readout Configuration - The monitor/readout shall be the enclosed wall mount type. It shall conform to Paragraphs 1.4.2.1 through 1.4.2.6.
1.4.2.1 Number of Sensor per Enclosure - Each monitor/readout shall have the capability of monitoring two sensors as described in Paragraph 1.2.

1.4.2.1 Type of Enclosure - 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 hinged, front facing, full length door. The door shall have a shatterproof window of sufficient size to allow the viewing of all meters and alarm indicating lights. They shall not be mounted in hazardous locations as defined by the NEC (National Electric Code).

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

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

1.4.2.5 External Controls - An external sealed switch shall be provided to allow for alarm reset and audio alarm silencing without opening the enclosure. There must be a connection for wiring an external alarm reset and audio alarm silencing switch.

1.4.2.6 The monitor/readout unit must have UL (Underwriters Laboratory) and FM (Factory Mutual) approval or certification.

1.5 Monitor Unit Requirements

1.5.1 Readout Displays - A separate three digit LED readout shall be provided for displaying the gas value from each sensor. The value displayed shall be a direct 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 0-99.9.

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

1.5.3 Alarm Set Point Levels - Three 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
At least two of the three alarm set points per sensor shall have the capability of providing the user a selection of latching or non-latching mode.

1.5.4 Relay Outputs - The alarm set point drive signals shall activate user relays as specified in Paragraphs 1.5.4.1 through 1.5.4.4.

1.5.4.1 Number of Relays - As a minimum, one relay for each set point level shall be provided.

1.5.4.2 Contact Rating - All relays shall be Form C, single pole, double throw. Contacts shall be rated for 5 amps resistive at 120 VAC.

1.5.4.3 Contact Selection - The contacts shall be capable of being selected normally open or normally closed, normally energized or normally de-energized and increasing or decreasing activation.

1.5.4.4 Set Point Drive Deselect - Buttons shall be provided to allow the user to deselect both set point drive signals from activating a relay for a maximum of two hours.

1.5.5 Malfunction Indication - System trouble indication shall be provided in accordance with Paragraphs 1.5.5.1 and 1.5.5.2.

1.5.5.1 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. Signal greater than 15% of full scale or lower than 15% below zero  
   d. Within 30 seconds of applying power  
   e. Control module malfunction or removal

1.5.5.2 Display Indication - The readout display described in Paragraph 1.5.1 shall display a separate unique character when an over range or greater than 10% under range condition exists.

1.5.6 Audible Alarm - A 75 db audible horn, buzzer or tone shall be provided when a latching alarm condition occurs. The audible horn, buzzer or tone will not sound when an alarm condition occurs on a non-latching set point.
1.5.7 Output Signals - A 4-20 mA signal representing the gas concentration shall be provided for each gas sensor in the system. The signal shall be a sourcing type capable of driving a 250 ohm load.

1.5.8 Controls - Controls shall be provided as specified in Paragraphs 1.5.8.1 and 1.5.8.2.

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

   a. display range value
   b. latching or non-latching mode for at least two alarm set point drivers
   c. relay reset time delay
   d. deselect of alarm set point driving a relay
   e. removing any point from service
   f. increasing or decreasing alarm action for at least two alarm set points
   g. display calibration value of each sensor

1.5.8.2 Front Panel Controls - The functions listed in this paragraph shall be accomplished using push button type controls readily accessible on the front panel.

   a. display of alarm set point level on the readout display described in Paragraph 1.5.1
   b. resetting any alarm set point
   c. disabling any specific sensor from affecting the system for two hours
   d. silencing of audible alarm
   e. resetting any latching relay if alarm condition is cleared
   f. lamp test

1.5.9 Sensor Input Signal - The sensor input signal shall be a digital or frequency type or 4-20mA.

1.6 System Power Requirements - The system shall operate on 115 or 220 VAC, 50 or 60 Hz. Power shall not exceed 100 VA.

1.7 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.

1.8 Approvals

1.8.1 As a minimum, the following parts of the system shall have approval by UL:
   a. all primary AC components including connectors
   b. all user relays
   c. all remote sensor unit enclosures

1.8.2 The monitor/readout unit must have FM (Factory Mutual) certification.

1.9 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 the owner/operator
   d. be capable of supplying in house service and assistance

2.0 Gas Monitoring System shall be a Mine Safety Appliances Company Model 5200 Gas Monitor System or equal.