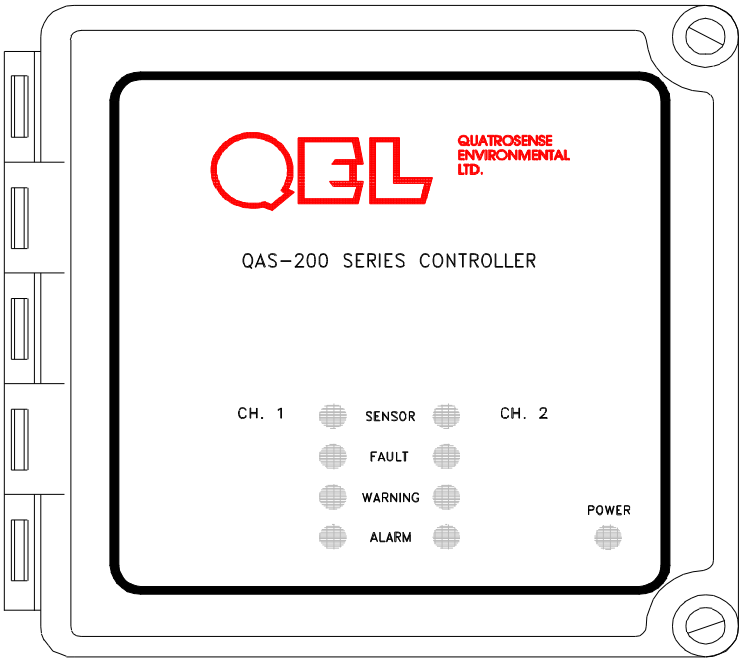
QAS-200 SERIES
DUAL CHANNEL CONTROLLER



INSTALLATION
OPERATION AND MAINTENANCE
MANUAL

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WARRANTY STATEMENT

The information contained in this manual is based upon data considered accurate; however, no warranty is expressed or implied regarding the accuracy of this data. All QEL equipment is warranted against defects in material and workmanship for a period of two years from date of shipment with the following exceptions:

Electrochemical Sensors (Toxic): Six Months

Catalytic Sensors (Combustible): One Year

During the warranty period we will repair or replace, at our discretion, any components or complete units that prove, in our opinion, to be defective. We are not liable for consequential or incidental damage to auxiliary interfaced equipment.

A returned material authorization number should be obtained from the factory prior to returning any goods. All return shipments must be shipped freight prepaid obtained and a copy of the Maintenance Records should accompany the unit concerned..

Warranty should be considered F.O.B. the factory. Labor and travel time are chargeable for any field site visits required for warranty work.

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All QEL systems shall be installed by a qualified technician/electrician and maintained in strict accordance with data provided for individual systems in the form of installation/maintenance manuals. QEL assumes no responsibility for improper installation, maintenance, etc., and stresses the importance of reading all manuals. QEL shall not be responsible for any liability arising from auxiliary interfaced equipment nor any damage resulting from the installation or operation of this equipment.

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This warranty is in lieu of all other warranties, expressed or implied, and no representative or person is authorized to represent or assume for QEL any liability in connection with the sales of our products other than that set forth herein.

NOTE: Due to on-going product development, QEL reserves the right to change specifications without notice and will assume no responsibility for any costs as a result of modifications.

For further information or assistance, contact:

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1.0 Introduction

Thank you for purchasing this quality product from Quatrosense Environmental Ltd. (QEL). We want you to enjoy many years of effective use and protection from your QAS-200 Dual Channel Controller. This manual is intended to provide you with all of the details you need to properly install, operate, and maintain your equipment.

To properly prepare to install, configure, and start-up your QAS-200 Dual Channel Controller we recommend that you read these sections of the manual before beginning the work. The sections at the beginning of the manual covering Description, Specifications, and Theory Of Operation will provide general background and reference information. Please refer to the sections at the end of the manual on 'Test and Calibration', and 'Troubleshooting' before performing these tasks.

1.1. Software Version Notice

All QAS-200 Series Controllers without display shipped after August 19, 2004 were equipped with software Version 2, which incorporates significant improvement in temperature compensation for Solid-State Sensors and a simplified calibration procedure. Several other features were added in Version 2, please refer to the 'Troubleshooting' and the 'Test and Calibration' sections for more information. Check for notes marked "**Version 2:**", which explains deviations from the Version 1 software.

Please verify the software version installed in the unit at hand by reading the software version label on the processor. The processor is the larger rectangular component with a black on white label. The processor is located in the bottom left hand corner of the circuit card assembly on the back of the lid and is marked U1.

1.2. Text Conventions

Throughout this manual your attention will be drawn to certain information in the following manner:

NOTE: This will highlight tasks or information important to the proper operation of the controller.

CAUTION This will detail steps that will cause malfunction of the unit if performed improperly.

WARNING This will indicate critical actions that could cause damage to the controller and/or associated equipment or represent a danger to personnel if performed improperly.

Version 2: These sections will indicate the deviations for units shipped (or upgraded to) the second-generation software.

1.3. Contact Information

If you have any questions, or you find any errors or omissions in your manual, please contact our customer service team at (613) 838-4005 by phone or fax us at (613) 838-4018 or look for information on our web site www.QEL.dedesco.com.

2.0 Description

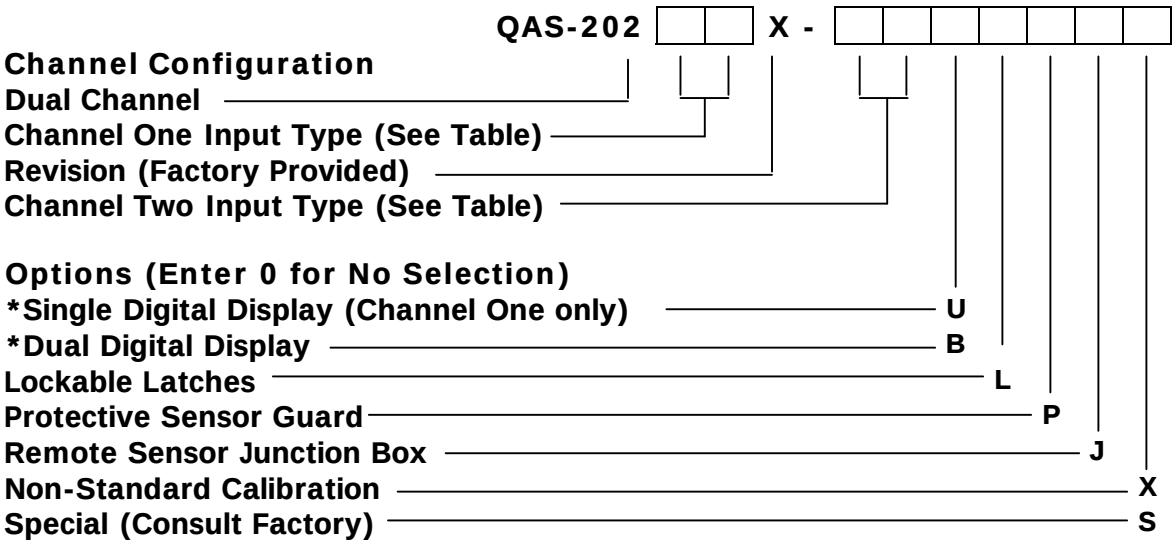
The QAS-200 Dual Channel Controller is a microprocessor based alarm monitor designed to work with any 4 to 20 mA DC transmitter or any of QEL's line of broad spectrum, semiconductor solid-state toxic or combustible gas sensors. The standard controller can be easily field configured for the sensor type on one or both inputs. The controller can be supplied with optional digital displays for both channels for use with 4 to 20 mA DC inputs only. Configuration of all functions of the QAS-200 is done through field settable DIP-switches or the digital displays when selected.

The QAS-200 will provide the appropriate power supply output to the transmitter or solid-state sensor as configured. The 4 to 20 mA DC power supply output is 24 VDC with a maximum rating of 300 mA. Temperature compensation is selectable for solid-state sensor inputs.

Each input has two independently adjustable set points for alarm or control purposes. Calibration is stored digitally in the EEPROM. Two DPDT relays are provided for alarm or control outputs. The relays are rated at 5 Amps resistive at 120 VAC or 30 VDC power. The controller can be configured for both relays to be common to either input, or for one relay to be assigned to each input. Further configuration allows fail-safe operation and time delays (both ON and OFF) to be set for each relay.

The enclosure for the QAS-200 is rated NEMA 4, 4X, 12 and 13 and is both UL and CSA listed. LED status indicator LEDs is visible at the front of the enclosure for input status, alarm status, and sensor fail for each input. A separate power indicator LED is provided for the controller. The QAS-200 requires 115 VAC, 50/60-Hertz power for operation.

2.1. Model Number Matrix



* **Note:** Digital Displays for 4 - 20 mA DC input only

Channel One & Two Selection Table			
Input Type	**Code**	**Standard Calibration Low Alarm**	**Standard Calibration High Alarm**
4 - 20 mA DC[1]	01	7.2 (20%)	10.4 (40%)
Solid-State Sensor[1]	02	No Calibration	No Calibration
Carbon Monoxide[2]	16	50 ppm	100 ppm
Combustibles[3]	17	10% LEL	20% LEL
Ammonia	22	35 ppm	300 ppm
Freon R11	26	500 ppm	1000 ppm
Freon R12	27	500 ppm	1000 ppm
Freon R22	28	500 ppm	1000 ppm
Freon R134a	30	500 ppm	1000 ppm

Notes:

1) Sensor Not Included
2) Measured in Vehicle Exhaust
3) Calibrated for Propane

3.0 Specifications

Input Power	**104 to 132 VAC, 47 to 63 Hz, 18 VA maximum**
Fuse	**1A at 250 VAC, 5 x 20 mm (Buss GDP)**
Enclosure	**Rating: NEMA/EEMAC Type 4, 4x, 12 and 13** **Colour: Grey with black faceplate label, white and red trim** **Dimensions: 165 x 165 x 108 mm (6.5" x 6.5" x 4.25")**
Temperature	**-20°C to 50°C (0°F to 110°F)**
Humidity	**0% to 99% RH, non-condensing**
Pressure	**Atmospheric +/- 10%**
Input Types	**1) 4 to 20 mA DC** **2) QEL Solid-state Semiconductor Sensors:** • **Carbon Monoxide** • **Combustibles** • **Ammonia** • **Freons R11, R12, R22, and R134a**
Sensor Life Expectancy	**5 – 7 years for Solid-state Semiconductor Sensors**
Response Time	**< 30 seconds for 85% step change (Solid-state Sensors)**
Accuracy	**+/- 0.25% (4 to 20 mA DC input)** **+/- 10% (Solid-state Sensors)**
Repeatability	**+/- 0.1% (4 to 20 mA DC input)** **+/- 2.5% (Solid-state Sensors)**
LED Status LEDs	**Green - Power On (common)** **Green - Sensor Active (each input)** **Red - Fault (each input)** **Yellow - Warning Set point (each input)** **Red - Alarm Set point (each input)**
Audible Buzzer	**85 dB at 1 foot**
Relay Outputs	**Two DPDT, rated 5A resistive at 120 VAC/30 VDC**
Relay Time Delays	**5/10/15 minutes delay on (make)** **10/15/25 minutes delay off (break)**
Digital Displays (option for 4-20 mA DC inputs only)	**3-1/2 digit red LED** **Field adjustable zero and span** **Range: -999 to +9999**
Power Supply Output	**1) 24 VDC (4 to 20 mA DC input)** **2) Constant Current (Solid-state Sensors)**
Power Supply Rating	**300 mA maximum per channel**
Field Configuration (by DIP-Switch)	**1) Sensor input type and temperature compensation** **2) Common or independent relays** **3) Relay time delays** **4) Relay standard or fail-safe operation** **5) Audible defeat on alarms**
Field Configuration (with optional digital displays only)	**1) Normal or deficiency control mode** **2) Adjustable relay hysteresis**
Calibration	**Digital to EEPROM through DIP-switch operation**
System Test	**Through DIP-switch operation; tests microprocessor, LEDs, relays and audible buzzer.**
Fault Detection	**Background program continuously tests sensor inputs including thermistor if temperature compensation enabled**
Approvals	**CSA-NRTL/C C22.2-205**

4.0 Theory Of Operation

4.1. Controller

Units are configured utilizing DIP switch selection for sensor input type, relay operation, audible and fail action. Non-acceptable settings are indicated by LED displays. If optional digital displays are included for 4 to 20 mA DC input, units are also configured for zero, span, alarm set points, alarm hysteresis and control mode. Units are fully tested and calibrated to the ordered configuration when shipped from the factory.

The input signal for each channel is monitored by the microprocessor and compared to the set points for “warning” and “alarm”. If a set point is reached or exceeded then the appropriate relay is actuated. As the input signal falls below the set point the relay is deactivated at a factory set hysteresis of 12.5% of set point.

Version 2: Hysteresis is calculated at 12.5% of the difference between set points.

Should an input signal fall below or rise above factory preset minimum and maximum levels then fail circuitry will activate, causing audible and visual alarm and relay activation if selected.

Version 2: A pattern is emitted from the on-board buzzer to indicate the type of fault. Please refer to the ‘Troubleshooting’ section below.

An 'electronic reference' is periodically performed (approximately once every minute). This activity is visible whenever a WARNING or ALARM is indicated on either channel in that the WARNING and ALARM LEDs will alternate ON and OFF between the 2 channels.

Version 2: The 'electronic reference' is performed in real-time and the activity is not visible on the front-panel LEDs as for Version 1.XX.

4.2. Solid State Sensors

Solid-state Sensors consist of a sintered tin dioxide-sensing element behind a protective screen and a diffusion barrier. The resistance element is heated when powered. At operating temperature oxygen (O2) molecules are absorbed onto the surface of the tin dioxide element, producing a resistance to electron flow. When the target gas is introduced to the element, it is adsorbed by the tin dioxide surface and causes oxidation, thus lowering the resistance of the element in a known manner.

The output of the solid-state sensor is non-linear. It is affected in clean air conditions by temperature and humidity changes. It is therefore not recommended for continuous accurate measurements below 30 ppm. Use an electrochemical sensor where applicable for these measurements.

Solid-state sensors are broad spectrum in nature, meaning they will respond to a wide range of hydrocarbon-based gases. Different sensing elements are used for different

target gases. These elements are coated with a doping compound designed to inhibit the sensors response to some gases and therefore make the sensor more gas specific.

4.2.1. Humidity

The QAS-200 sensors are somewhat affected by ambient humidity; but the gas supplied from compressed air cylinders is completely dry. Use a small humidifier when calibrating to give approximate ambient humidity. QEL's humidifying calibration caps give about 60% RH when fully wetted. Note that bubbler type humidifiers can give the reverse problem, which is fully saturated humidity.

4.2.2. Temperature

The solid-state sensors are affected by temperature and show an enhanced response to gas at higher temperatures. The QAS-200 applies compensation to the signal from the solid-state sensor, which corrects the response curve between –20°C and +50°C.

5.0 Installation

5.1. Sensors and Transmitters

For installation instructions for your 4 to 20 mA DC transmitter, please see the instruction manual provided by the manufacturer of that instrument.

A variety of broad spectrum, semiconductor solid-state sensors for use with the QAS-200 Dual Channel Controller are available from QEL for the measurement of carbon monoxide, combustibles, ammonia, and Freons R11, R12, R22, and R134a (See Table 1 below). These sensors can be integrally mounted to the QAS-200 enclosure or mounted at a remote location from the controller.

Table 1 - Solid-state Sensor Mounting Information

Hazardous Gas	Model Code	Sensor Assembly Model Number	Recommended Mounting Height
Carbon Monoxide	16	QSA-18160A	4 to 5´
Combustibles	17	QSA-18170A	1 to 1-1/2´ (*)
Ammonia	22	QSA-18220A	Ceiling
Freon R11	26	QSA-18260A	1 to 1-1/2´
Freon R12	27	QSA-18270A	1 to 1-1/2´
Freon R22	28	QSA-18280A	1 to 1-1/2´
Freon R134a	30	QSA-18300A	1 to 1-1/2´

WARNING (*) - Mounting height is shown for Propane gas. Other combustible gases may require different mounting heights.

NOTE: Mounting heights are shown in distance from floor line. “Ceiling” indicates highest point where gas could collect. Sensor should be mounted so as to be accessible for calibration and maintenance.

NOTE: Solid-state sensors have varying tolerances and therefore calibration is specific to an individual sensor. If no further calibration is done at start-up, ensure any solid-state sensors are connected to the channel indicated on their nameplate.

The solid-state sensor should be mounted in the area where the hazardous gas is most likely to first appear. The specific gas to be measured will be either lighter or heavier than air. Table 1 provides a recommended mounting height from the floor for each of the listed gases. Where the sensor location needs to be near the floor or the ceiling, it may be more convenient to mount the sensor remote from controller box. Nominal sensor coverage is 7,500 square feet. This is based on there being some air circulation present either from ventilation fans, convection current, or movement of people or vehicles.

NOTE: Care should be taken in selection of sensing locations to ensure proper coverage. Particular attention should be paid to pockets and alcoves where air circulation may be limited.

CAUTION Measured gas is introduced to the solid-state sensors by diffusion. High velocities of gas will cause false readings from the sensor. Do not mount solid-state sensors near fans or doors where high velocity drafts will occur.

WARNING Solid-state sensors can be damaged by paint. If painting in the area of these sensors, de-activate the sensor input and cover the sensor opening with masking tape or plastic.

Solid-state sensor assemblies are provided with a short length of lead wire extending out of the 3/4" NPT male fitting. The sensor should be mounted to a proper electrical junction box suitable to the environment where it will be mounted. Electrical connection to the lead wire from the controller should be by industry-accepted practice such as terminal block, marette, or soldered connections. Maximum lead length resistance is 35 Ohms. Table 2 lists maximum lead length allowable for different wire gauges.

Table 2 - Acceptable Wire Gauge

Wire Gauge	Maximum Lead Length
22 AWG (0.33 mm^2)	300 meters (1000 feet)
16 AWG (1.3 mm^2)	1,200 meters (4000 feet)

5.2. Controller

Please see the installation drawing supplied with this manual for complete mounting details. The installation drawing can be downloaded from our web site www.QEL.dedesco.com.

The QAS-200 Dual Channel Controller is provided in a NEMA 4x surface mount enclosure. The controller should be mounted where operating personnel can easily see the status indication LEDs and where maintenance personnel can access the unit for routine calibration and maintenance. Sufficient space should be provided to allow the front door of the enclosure to be fully opened.

There are four mounting tabs extending from the back for securing the enclosure to a flat surface. Proper mounting screws should be used for the surface to which the controller is to be attached. There are four conduit knock-outs provided on the QAS-200. On the top of the enclosure there are two 1/2" NPT knock-outs for external wiring. On the bottom of the enclosure there are two 3/4" NPT knock-outs for either external wiring or integral mounting of solid-state sensors. Plugs for all unused knock-outs are installed when the controller is shipped from the factory.

WARNING Drilling of additional holes in the QAS-200 enclosure will violate the NEMA 4x rating unless properly sealed. When mounted where the unit will be subjected to rain or other water environments, all conduit connections must be properly sealed with duct seal or equivalent. Failure to do this could result in water inside the enclosure, which will cause a terminal failure of the electronics.

5.3. Wiring

Please see the installation drawing shipped with this manual for complete wiring information. All wiring connections are made to the power Circuit Card Assembly (CCA) board mounted in the base of the QAS-200 enclosure.

Input power for the QAS-200 is 115 VAC, (+10%, -15%), 47 to 63 Hertz. Wiring is connected to the terminals marked "115 VAC" with hot, neutral, and ground connected as shown.

CAUTION Ensure a proper earth ground is connected in accordance with electrical code and standard safe power wiring practice.

Sensor input wiring is connected to the two sets of three terminals marked "Sensor/Tx 1" and "Sensor/Tx 2". Each set of three terminals is for input channels one and two respectively. Connections should be made at each set of terminals as per the installation drawing for a solid-state sensor, three-wire 4 to 20 mA DC transmitter, or two-wire 4 to 20 mA DC transmitter.

NOTE: The majority of start-up related problems are caused by incorrect wiring to remote mounted sensors and/or transmitters. Care should be taken to ensure the sensors are wired correctly and there are no breaks or short circuits in the remote lead wire.

Relay wiring is connected to the two sets of six terminals marked "Relay 1" and "Relay 2". Each set of six terminals shows the wiring connections for two sets of Form C contacts. Normally Open (NO) and Normally Closed (NC) indicates the state of the contact when the relay is de-energized.

NOTE: Verify whether the relay to be wired will be operating in standard or fail-safe mode. In standard mode the relay is de-energized when conditions are normal and energized when the set point is reached or exceeded. In fail-safe mode the relay is energized when conditions are normal and de-energizes when the set point is reached or exceeded. The relay operation will determine which type (NO/NC) of contacts is to be used.

WARNING Relays are rated for 5 Amp, resistive load, at 250 VAC or 30 VDC. Connections to loads drawing a higher current or operating at a higher voltage will cause terminal damage to the relays and may cause further damage to other electrical components. If a device drawing a higher current is to be switched, use an interposing relay with sufficient rating to operate the device safely.

6.0 Configuration

The QAS-200 Dual Channel Controller has been configured and calibrated at the factory as per the model number shown on the serial number label on the unit. The QAS-200 is an extremely flexible device, which can be easily reconfigured for a variety of applications. Configuration of the QAS-200 can be done either before or after installation.

NOTE: The configuration of the unit should be checked before applying power to ensure it meets the current requirements.

CAUTION Configuration of the primary DIP-switches of the QAS-200 should be performed without input power connected. Configuration of the optional digital displays must be performed with the unit powered.

WARNING Live voltages of 115 VAC may also be present at the relay contacts from a different source than the input power.

Configuration of the QAS-200 is accomplished through a series of DIP-switches and solderless jumper settings. On the processor board, mounted on the inside door of the enclosure, you will find three banks of DIP-switches with eight switches on each bank. These are labeled “DIP-1”, “DIP-2”, and “DIP-3” from top to bottom. Details on configuration of these switches follow in sections 6.1, 6.2, and 6.3.

On the power board in the base of the enclosure you will find four sets of three each solderless jumper connections. These are located in the top center of the board to the left of the Sensor/Tx input terminals. The solderless jumpers are arranged as follows:

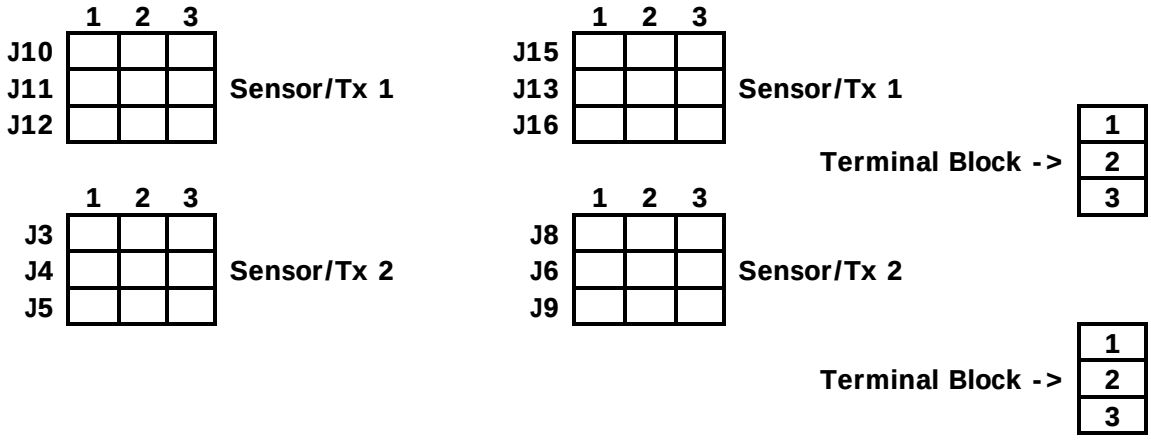


Figure 1 - Sensor Input Jumper Layout

6.1. Input Configuration

Begin configuration with the input types that are connected to the controller. This configuration is done with the solderless jumpers and the DIP-2 (middle) bank of switches (See Figure 2 below).

Version 2: When configuring a specific channel, do all the channel type selections first (e.g.: temperature compensation and 4-20mA selections then enable the channel with DIP-2 switch 1 or 5 to avoid a DIP-switch setting error indication from the buzzer.

A) If no sensor is connected to channel one, then place switches 1 through 4 in the OFF position.

B) If a sensor or transmitter is connected, then place switch 1 to ON.

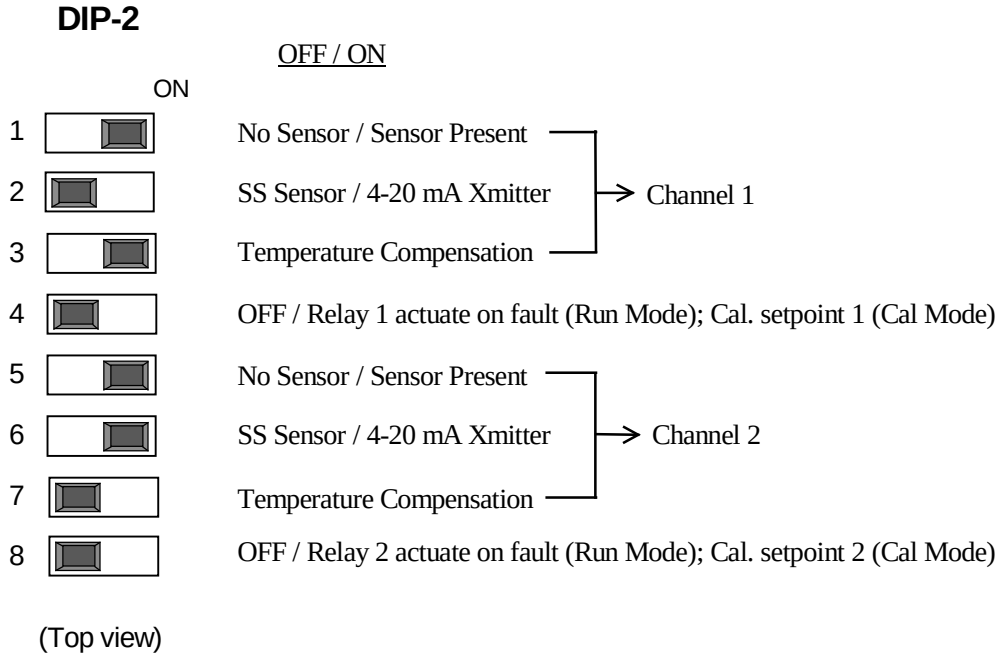
C) If it is a 4 to 20 mA DC transmitter, place switch 2 to ON and switch 3 to OFF.

D) If it is a solid-state sensor, place switch 2 to OFF and switch 3 to ON if temperature compensation is desired.

E) For a 4 to 20 mA DC transmitter input, connect jumpers J10, J11, J12 and J15, J13, J16 between pins 2 and 3.

F) For a solid-state transmitter, connect jumpers J15, J13, and J16 between pins 1 and 2. Connect jumpers J10, J11 and J12 according to Table 3 on page 11.

G) For channel two; follow the same procedures as A to E above, using switches 5 through 8 on DIP-2 and jumpers J3, J4, J5 and J8, J6, J9.



DIP-2 Example: Channel 1 set for temperature compensated solid-state sensor.
Channel 2 set for 4 to 20 mA DC transmitter

Figure 2 - DIP-2 Switch Settings

Table 3 - Solid-State Sensor Heater Voltage Jumper Positions

		Channel 1 Jumpers			Channel 2 Jumpers		
Hazardous Gas	Model Code	J10	J11	J12	J3	J4	J5
Carbon Monoxide	16	2-3	1-2	1-2	2-3	1-2	1-2
Combustibles	17	2-3	2-3	1-2	2-3	2-3	1-2
Ammonia	22	1-2	1-2	1-2	1-2	1-2	1-2
Freon R11	26	2-3	2-3	1-2	2-3	2-3	1-2
Freon R12	27	2-3	2-3	1-2	2-3	2-3	1-2
Freon R22	28	2-3	2-3	1-2	2-3	2-3	1-2
Freon R134a	30	2-3	2-3	1-2	2-3	2-3	1-2

6.2. Relay Configuration & Buzzer Disable

Relay configuration is accomplished using the DIP-3 (lower) bank of switches (See Figure 3 page 12). This configuration will determine whether the relays are common to both channels or one is independently assigned to each channel. Fail-safe operation of the relays is also set on this bank.

A) When configured for common operation of the relays, relay 1 will actuate on the warning set point of either channel and relay 2 will actuate on the alarm set point of either channel.

When configured for independent operation of the relays, relay 1 will be assigned to channel 1 and relay 2 will be assigned to channel 2. The DIP-switch settings will determine on which set point each relay will actuate as per the following table.

Table 4 - Relay Actuation Configuration

DIP-3 Switches 1 to 4	Relay 1 Actuation	Relay 2 Actuation
All switches OFF	Common Warning SP	Common Alarm SP
DIP-3 switch 1 ON	Channel 1 Warning	Channel 2 Warning
DIP-3 switch 2 ON	Channel 1 Alarm	Channel 2 Alarm
DIP-3 switch 3 ON	Channel 1 Warning	Channel 2 Alarm
DIP-3 switch 4 ON	Channel 1 Alarm	Channel 2 Warning

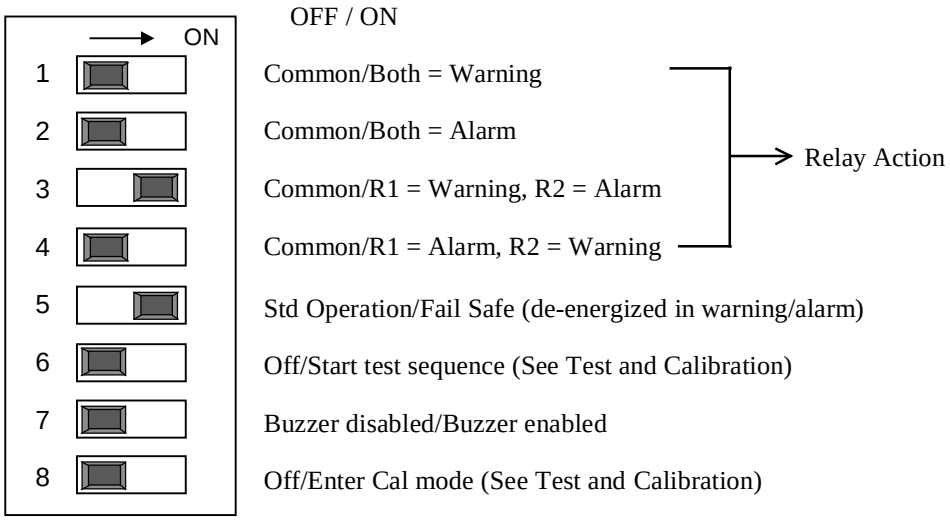
NOTE: Only one of DIP-3 switches 1 to 4 can be in the ON position for proper operation of the unit.

B) Place switch 5 in the OFF position for standard relay operation, or the ON position for Fail-Safe operation. In Fail-Safe mode, the relay will be de-energized during warning and alarm conditions.

C) Place switch 7 in the ON position if you wish to enable the audible buzzer to sound if either point reaches alarm or the unit goes into fault condition. In the OFF position no power is connected to the buzzer and it will remain silent.

D) DIP-3 switch 6 is used solely for initiate self-test. Switch 8 is used for placing the unit in calibration mode. See test and calibration section for details.

DIP-3



(Top view)

DIP-3 Example: Relay 1 energized when channel 1 at warning level.
Relay 2 energized when channel 2 at alarm level.
Relays are set for fail-safe; buzzer disabled

Figure 3 - DIP-3 Switch Settings

6.3. Relay Time Delay Configuration

Configuration of the time delays for both relays is accomplished using the DIP-1 (upper) bank of switches (See Figure 4 on page 13). Time delays are independently configurable for both delay ON (make) and delay OFF (break) for each relay.

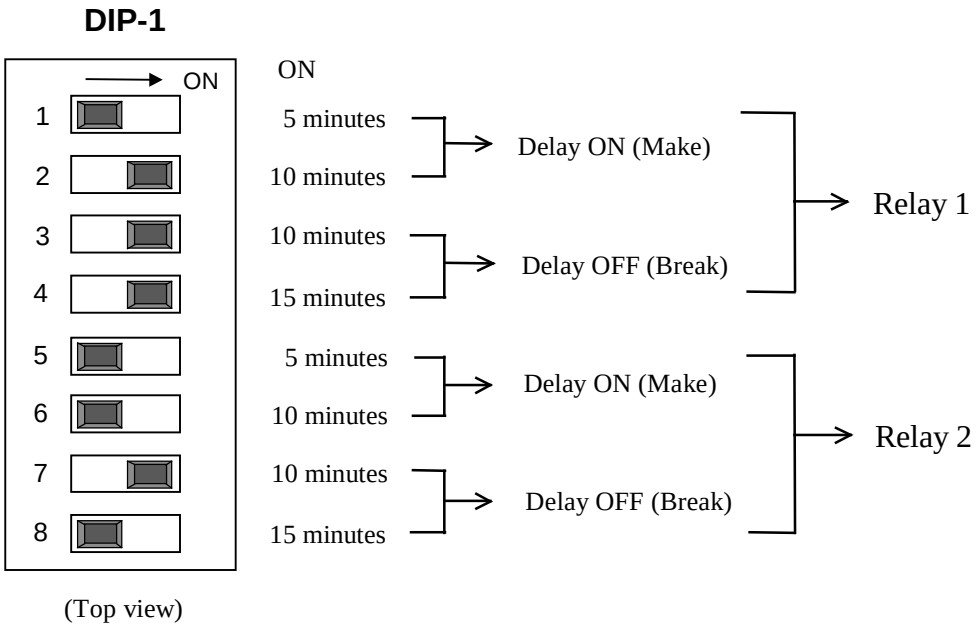
With all switches (1 through 8) OFF, there are no time delays active. Relay 1 uses switches 1 through 4. Relay 2 uses switches 5 through 8. Each switch is a time increment and these increments can be cumulative.

A) For Relay 1 delay ON, set switch 1 only to ON position for 5 minutes delay, switch 2 only to ON position for 10 minutes delay, or both switches 1 and 2 to ON for 15 minutes delay.

B) For Relay 1 delay OFF, set switch 3 only to ON position for 10 minutes delay, switch 4 only to ON position for 15 minutes delay, or both switches 3 and 4 to ON for 25 minutes delay.

C) For Relay 2 delay ON, set switch 5 only to ON position for 5 minutes delay, switch 6 only to ON position for 10 minutes delay, or both switches 5 and 6 to ON for 15 minutes delay.

D) For Relay 2 delay OFF, set switch 7 only to ON position for 10 minutes delay, switch 8 only to ON position for 15 minutes delay, or both switches 7 and 8 to ON for 25 minutes delay.



(Top view)

DIP-1 Example: Relay 1 set for 10 minutes delay on and 25 minutes (10 + 15 minutes) delay off.
Relay 2 set for 0 minutes delay on and 10 minutes delay off.

Figure 4 - DIP-1 Switch Settings

6.4. Relay Operation on Fault Condition

The QAS-200 Dual Channel Controller has circuitry that senses a failure in the sensor input, the temperature compensation sensor, or other internal circuitry. When such a failure is sensed, the red "FAULT" LED will light and the audible buzzer will cycle ON for one second and OFF for three seconds. You can configure the relays to actuate on this Fault condition. Fault condition actuation takes precedence over the standard set point alarm actuation. This configuration is done on DIP-2 (see Figure 2, Page 10), using switches 4 and 8.

A) If both switches are OFF, relays will operate as per their sensor input level.

B) If switch DIP-2 switch 4 is ON, relay one will actuate on fault.

C) If switch DIP-2 switch 8 is ON, relay two will actuate on fault.

D) It is possible to have both switches ON and have both relays actuate on fault.

Version 2: When a fault is detected that hinders the operation of the unit, the "FAULT" LED for that channel will flash and a fault code will be emitted from the buzzer with three-second intervals. The number of beeps indicates the type of fault. These beeps can be counted, and using the table in troubleshooting section, the type of fault can be determined.

6.5. Configuration of Digital Display Board

If the Digital Display(s) option has been included in your controller, there will be a display processor board sandwiched between the main processor board and the front cover of the unit. This board contains the digital display(s), microprocessor controller, and another bank of DIP-switches (designated DIP-D; see Figure 5) for configuration. On the front cover of the Controller will be two edit pushbuttons; one with an arrow pointing up and the other with an arrow pointing to the right.

Input and relay configuration of the Controller remains the same as in sections 6.1 through 6.4. The digital display(s) are functional with 4 to 20 mA DC inputs only. If a channel with a display is configured for a solid-state sensor input, the display will be blanked. The display(s), DIP-switches, and edit pushbuttons are used to configure the control mode, decimal location, display engineering units, alarm set points, and set point hysteresis.

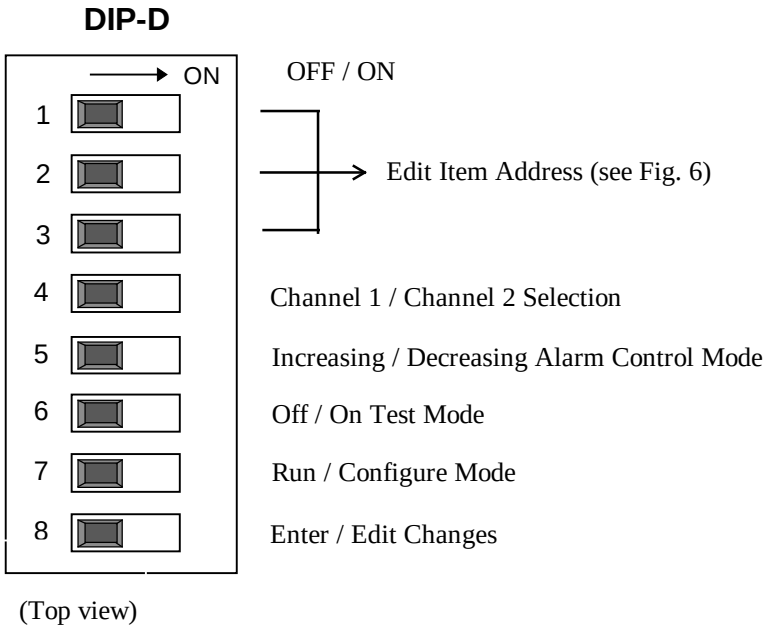


Figure 5 - DIP-D Switch Settings

A) To enter the configure mode first switch all DIP-D switches to their OFF position.

B) Switch DIP-D-7 to ON. The channel 1 display should now show "- - - -" to indicate it is in the configure mode. The channel 2 display (if present) will be blanked.

C) Select the channel you wish to configure with DIP-D-4. In the OFF position, channel 1 will be selected. In the ON position channel 2 will be selected.

D) Perform configuration as per the next sections.

E) To return to run mode, return all DIP-D switches to their OFF position except DIP-D-5. Leave this switch in the control mode position desired.

CAUTION If any DIP-D switch other than DIP-D-5 is left in the ON position when the Controller is returned to the run mode, the display may receive invalid information from the processor and WARNING and ALARM set points may not function correctly.

6.5.1. Configuring Alarm Control Mode

The alarm control mode determines whether the Controller will alarm on increasing or decreasing signals from the 4 to 20 mA DC input. In either mode, set point 1 is considered the lower value and set point 2 must be set to a value equal or higher than set point 1.

In Increasing Alarm Control Mode, the condition will be considered "SAFE" and no alarms will be present when the input value is below set point 1. When the input value is between set point 1 and set point 2 the “WARNING” LED will be on, and when the input value is above set point 2 both the “WARNING” and “ALARM” LEDs will be on. The Increasing Alarm Control Mode will be used in any application where high and high/high alarms are required, such as toxic gas measurement.

In Decreasing Alarm Control Mode, the condition will be considered "SAFE" and no alarms will be present when the input value is above set point 2. When the input value is between set point 2 and set point 1 the “WARNING” LED will be on, and when the input value is below set point 1 both the “WARNING” and “ALARM” LEDs will be on. The Decreasing Alarm Control Mode will be used in any application where low and low/low alarms are required, such as oxygen deficiency.

A) Select the desired Alarm Control Mode using DIP-D-5. In the OFF position Increasing will be selected while in the ON position Decreasing will be selected.

NOTE: Do not alter the position of this switch when returning to the run mode.

6.5.2. Configuring Edit Items

Configuration of the edit items for either or both channels determines the engineering units displayed, the set points for WARNING and ALARM, and the hysteresis (or dead band) between the on and the off points of the WARNING and ALARM conditions.

Initial configuration should include all edit items to ensure valid information is stored in memory. If an edit item does not have an initial value, an invalid number may be displayed. Edit items can be configured in any sequence; however, the following sequence will allow display of all edit items in the desired engineering units when they are configured:

1) Decimal Point Location
2) Display at Zero (4 mA)
3) Display at Span (20 mA)
4) Set point 1
5) Set point 2
6) Hysteresis (Dead band)

A) Set DIP-D-1 through DIP-D-3 to the address for the edit item to be configured. See following Figure 6 for addressing details.

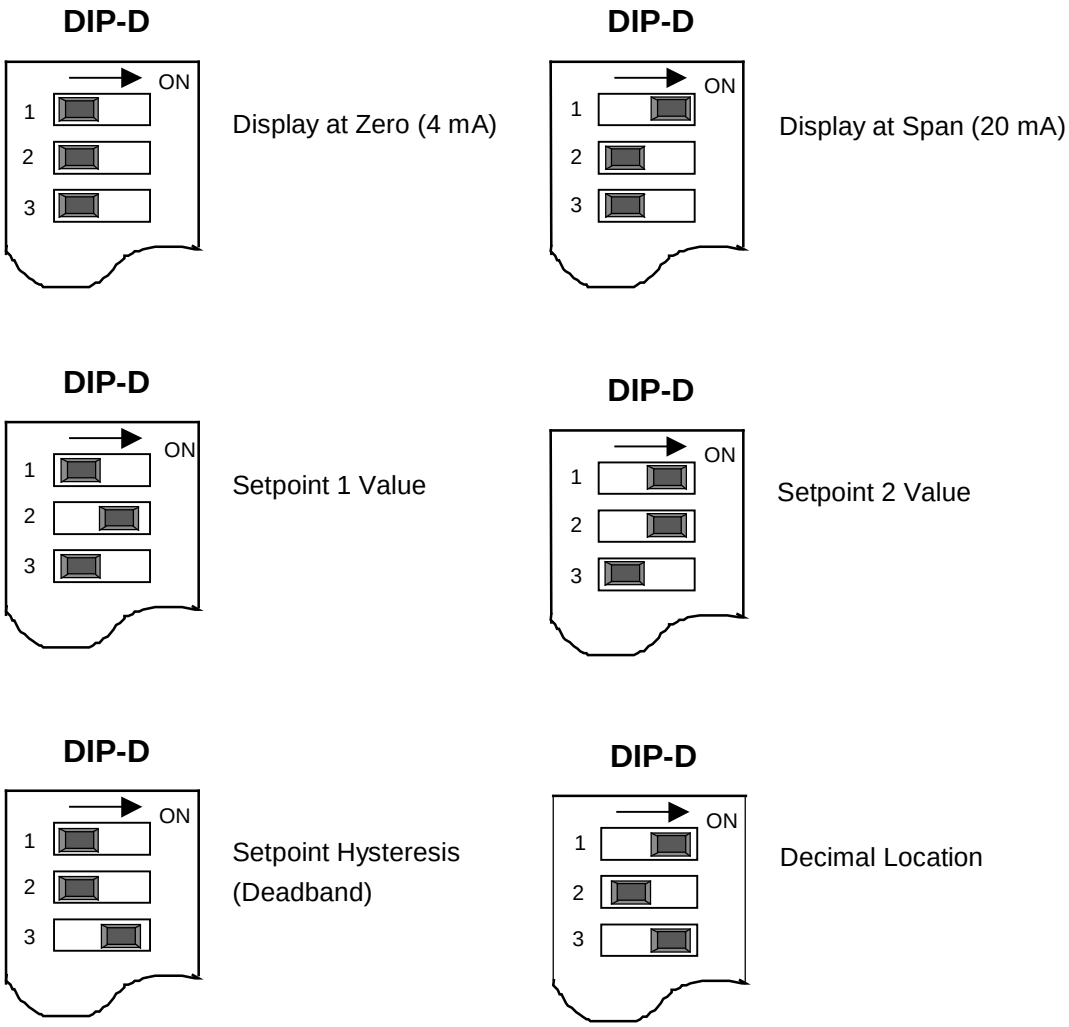


Figure 6 - DIP-D Edit Item Addresses

B) Set DIP-D-8 to ON position to enable the edit mode. The current setting for this item will be retrieved from memory and displayed. The character at the far left will be flashing.

C) Using the edit pushbuttons on the front cover of the unit, edit the display to the desired value. The pushbutton with the up arrow will edit the flashing character, stepping through from 0 to 9. After 9, the number will roll back over to 0. The pushbutton with the arrow pointing to the right will select the next character to the right for editing. When the character on the far right is flashing, the right pushbutton will next select the character on the far left.

D) For the decimal point selection item, the "Up" pushbutton is not used. The display will show "8888" on initial selection. The right pushbutton will toggle through "8.888", "88.88", "888.8", "8888.", and "8888".

E) When the display has been set to the desired value, set DIP-D-8 to the OFF position to store the value to memory. The display will show "- - - "when the value has been stored.

7.0 Start-Up

WARNING Before applying power to the QAS-200 Dual Channel Controller, check all input wiring and configuration.

Apply input power of 115 VAC, 50/60 Hertz to the QAS-200. The green "Power" LED will light. The Controller will go through a warm-up period of approximately 45 seconds where it does not look for sensor input information. When this warm-up is completed, the green "Sensor" LED should light up for each channel that is configured to have a sensor connected. If the red "Fault" LED is on then check the wiring and configuration for the channel indicated. Refer to the 'Troubleshooting' section if this does not clear the problem.

Version 2: At power-up software Version 2 is identified by two short beeps from the buzzer. During the warm-up period of approximately one minute, the channel LEDs on the front panel will flash as a lamp test and indication that the unit is active.

Solid-state sensors have a built-in heater. It is normal for these sensors to go to full scale reading on initial power-up. Where a solid-state sensor is connected to the QAS-200 you should expect to see the channel go into warning and probably alarm when power is first applied. As the sensor heats up the output will come down to normal levels, clearing both conditions. This will take from 5 to 15 minutes.

NOTE: It takes 24 to 48 hours for the solid-state sensor to fully warm-up to a normal operating condition. Calibration of these sensors should not be performed until this warm-up is complete.

Check the power supply output voltage for each channel. This can be measured using a digital voltmeter (DVM) across terminals one and three of the input terminal block for each channel. The power supply output should be 24 Volts DC +/- 15% for 4 to 20 mA DC input types. The power supply output should be between 4.80 Volts DC and 5.50 Volts DC for solid-state sensor input types. Refer to the 'Troubleshooting' section if any of these voltages are incorrect.

If there is no warning or alarm condition, your QAS-200 is fully operational when two or three green LEDs are illuminated (Powers, Sensor CH1 and/or Sensor CH2). The QAS-200 is fully calibrated at the factory prior to shipment to the sensor configuration shown on the serial number label. The unit utilizes digitally stored calibration to eliminate the drift inherent in potentiometers. It is generally recommended to check the calibration of any instrument on initial start-up. We recommend these controllers be calibrated once per year.

NOTE: Solid-state sensors have varying tolerances and therefore calibration is specific to an individual sensor. If no further calibration is done at start-up, ensure any solid-state sensors are connected to the channel indicated on their nameplate.

WARNING If the controller is configured to use a different solid-state sensor than shipped from the factory (including a replacement of the same type of sensor), the controller must be calibrated for that specific sensor to ensure accurate operation.

8.0 Test And Calibration

The QAS-200 Dual Channel Controller has been fully calibrated at the factory for the configuration as shown on the nameplate. Calibration should be performed to change set points or after reconfiguring the unit for different service. We recommend the controller be calibrated once per year to ensure proper operation of the controller and to adjust for solid-state sensor long-term drift characteristics.

Test and Calibration of the QAS-200 is performed by using switches on the DIP-2 and DIP-3 banks of eight switches each that are located on the processor board. You will find this board mounted on the inside of the enclosure door. Refer to Figure 2 and Figure 3.

8.1. System Test

DIP-3 switch 6 enables a system test sequence. This test can be performed at any time the controller is not in the Calibrate Mode. The system tests the microprocessor, energizes the relay outputs, cycles the LED indicators, and tests the audible buzzer.

WARNING This test will actuate relays. Where control outputs could cause a hazardous condition or nuisance, care should be taken to ensure proper notification of operating personnel, or disconnection of relay outputs prior to performing system test.

When DIP-3 switch 6 is placed in the ON position, the relay outputs will actuate and the audible buzzer will sound briefly. Each LED will turn ON and OFF in sequence. The unit will return to normal operation when DIP 3 switch 6 is returned to the OFF position. No LEDs will turn ON if the microprocessor fails the system test. Please refer to the 'Troubleshooting' section.

Version 2: When returning to normal run mode, software Version 2 will send two short beeps to the buzzer. This is the general indication that the unit was restarted and the status of both channels cleared.

8.2. Calibration Mode (Version 1.XX)

Version 2: See Section 8.3 below for calibration.

To calibrate the QAS-200 it must first be placed in the calibration mode. Either sensor can be selected for calibration. Either or both set points can be calibrated for the channel selected. To enter the calibration mode perform the following steps:

A) Deselect the sensors in operation by turning DIP-2 switches 1 (CH1) and 5 (CH2) OFF. The green "SENSOR" LED(s) will turn off.

B) Turn DIP-3 switch 8 ON.

C) Select channel to calibrate by turning either DIP-2 switch 1 or 5 ON. The "FAULT" LED for the channel selected will turn ON. This confirms you have entered the calibration mode for that channel.

NOTE: You cannot enter the calibration mode unless both sensor inputs have been turned OFF.

8.2.1. 4 to 20 mA DC Input Calibration (Version 1.XX)

NOTE: If optional digital display(s) are installed disregard this section. Set points are done through the display configuration as outlined in section 6.5.2. The 4 to 20 mA DC range is calibrated at the factory and held in digital memory. While it should not be necessary to re-calibrate the 4 to 20 mA DC range in the field, the following procedure would be used for this calibration using 4 mA DC as the "set point" 1 value and 20 mA DC as the "set point 2" value.

To calibrate the set points for a 4 to 20 mA DC input you would require a Digital Voltmeter (DVM) and an instrument screwdriver for adjustment of a potentiometer.

Test jacks for the DVM are located on the processor board mounted on the inside of the enclosure door. The test jacks are J5 (+) and J6 (-) and are located in the upper right hand corner of the board. To the left of the test jacks is potentiometer R4. Adjustment of the potentiometer will change the voltage reading at the test jack over a range of 0.6 to 3.0 VDC corresponding to the 4 to 20 mA DC input range.

Determine the set point levels in mA DC required for warning and alarm. Calculate the corresponding test jack voltage for these set points by multiplying the mA DC value by 0.15.

Typical settings are as follows:

Table 5 - Typical Test Jack Voltage Equivalents for DC mA Set points

mA DC Value	Test Jack Voltage	mA DC Value	Test Jack Voltage
5.6 mA (10%)	0.84	13.6 mA (60%)	2.04
7.2 mA (20%)	1.08	15.2 mA (70%)	2.25
8.8 mA (30%)	1.32	16.8 mA (80%)	2.52
10.4 mA (40%)	1.56	18.4 mA (90%)	2.76
12.0 mA (50%)	1.80	20.0 mA (100%)	3.00

A) Place the QAS-200 in the calibrate mode and select the channel to be calibrated. The “FAULT” LED for the channel being calibrated will now be lit.

B) Calibrate set point 1 (warning) by setting DIP-2 switch 4 to ON. The “WARNING” LED for the channel being calibrated will now be lit.

C) Insert DVM test leads into the test jacks. Select the lowest range on the meter that will measure 3 VDC.

D) Adjust potentiometer R4 until the desired voltage reading is measured at the test jacks.

E) Turn DIP-2 switch 4 to OFF. The "WARNING" LED will be extinguished, and the "FAULT" LED will be steady ON, verifying the value has been stored in the EEPROM.

F) Calibrate set point 2 (alarm) by setting DIP-2 switch 8 to ON. The "ALARM" LED for the channel being calibrated will now be lit.

G) Insert DVM test leads into the test jacks. Select the lowest range on the meter that will measure 3 VDC.

H) Adjust potentiometer R4 until the desired voltage reading is measured at the test jacks.

I) Turn DIP-2 switch 8 to OFF. The "ALARM" LED will be extinguished, and the "FAULT" LED will be steady ON, verifying the value has been stored in the EEPROM.

J) Turn DIP-3 switch 8 to OFF to exit the calibration mode. The audible buzzer will chirp once to indicate the unit is reset to the new calibration.

K) Re-select active inputs by turning DIP-2 switch 1 and/or switch 5 to ON as required. If input is selected while unit is in run mode, "FAULT" LED will be lit until first built in system test, approximately one minute.

NOTE: You must exit and then re-enter the calibration mode before selecting a new channel to calibrate.

NOTE: Both set points (warning and alarm) for per channel must be calibrated even if only alarm set point is used. The warning set point can be calibrated with the same value of the alarming set point.

8.2.2. Solid-state Sensor Calibration (Version 1.XX)

NOTE: There is an Auto Zero period in a 1-minute cycle. During this period, QAS-200 switches off the current source to the sensor and the sensor output voltage goes down for 1-2 seconds. During calibration of warning and/or alarm set points,

DIP-2 switch 4 or 8 must be turned off 10 - 20 seconds after Auto Zero period.

These sensors are somewhat affected by ambient humidity; but the gas supplied from compressed air cylinders is completely dry. Use a small humidifier when calibrating to give approximate ambient humidity. QEL's humidifying calibration caps give about 60% RH when fully wetted. Note that bubbler type humidifiers can give the reverse problem, which is fully saturated humidity.

To calibrate the set points for a solid-state sensor input you will require a Digital Voltmeter (DVM) and a calibration gas kit. This kit consists of calibration gas in the concentrations desired for set points and a regulator, tubing, and calibration adapter to deliver the gas to the solid-state sensor assembly.

A) Assemble calibration kit according to the instructions provided with the kit by the manufacturer, by attaching the tubing and calibration adapter to the regulator.

B) Secure calibration adapter to the solid-state gas sensor.

C) Place the QAS-200 in the calibrate mode and select the channel to be calibrated. The “FAULT” LED for the channel being calibrated will now be lit.

D) Calibrate set point 1 (warning) by setting DIP-2 switch 4 to ON. The “WARNING” LED for the channel being calibrated will be lit.

E) Attach the gas cylinder containing the appropriate concentration for the warning set point to the regulator and apply gas to the sensor.

F) Monitor the sensor output voltage at input terminals 2 and 3 (yellow and black wires).

G) When sensor output voltage is stable (approximately two to three minutes for significant gas change) turn DIP-2 switch 4 to OFF. The “WARNING” LED will be extinguished, and the “FAULT” LED will be steady ON, verifying the value has been stored in the EEPROM.

H) Calibrate set point 2 (alarm) by setting DIP-2 switch 8 to ON. The “ALARM” LED for the channel being calibrated will now be lit.

I) Attach the gas cylinder containing the appropriate concentration for the alarm set point to the regulator and apply gas to the sensor.

J) Monitor the sensor output voltage at input terminals 2 and 3 (yellow and black wires).

K) When sensor output voltage is stable (approximately two to three minutes for a significant gas change) turn DIP-2 switch 8 to OFF. The “ALARM” LED will be extinguished, and the “FAULT” LED will be steady on, verifying the value has been stored in the EEPROM.

L) Turn DIP-3 switch 8 to OFF to exit the calibration mode. The audible buzzer will chirp once to indicate the unit is reset to the new calibration.

M) Re-select active inputs by turning DIP-2 switch 1 and/or switch 5 ON as required. If input is selected while unit is in run mode, “FAULT” LED will be lit until first built in system test, approximately one minute.

NOTE: You must exit and then re-enter the calibration mode before selecting a new channel to calibrate.

NOTE: Both set points (warning and alarm) for per channel must be calibrated even if only alarm set point is used. The warning set point can be calibrated with the same value of the alarming set point.

8.3. Calibration Mode (Version 2)

Version 2.00 and later software has a slightly modified calibration procedure from the Version 1.XX software. This is true especially for calibration of channels with solid-state sensors, where the calibration procedure is simplified.

Software version 2 uses an average of several samples from the input circuit to establish a set point. Using an average of a number of samples improves the noise immunity during calibration and provides a more accurate set point.

Please note the differences in the calibration procedure if you are using software Version 2.00 or later for the first time. A DVM is **no longer required** for calibrating Solid-State sensors.

To calibrate the QAS-200 it must first be placed in the calibration mode. Either sensor can be selected for calibration. Either or both set points can be calibrated for the channel selected. To enter the calibration mode, perform the following steps:

A) Deselect the sensors in operation by turning DIP-2 switches 1 (CH1) and 5 (CH2) OFF. The green “SENSOR” LED(s) will turn off.

B) Turn DIP-3 switch 8 ON, the unit will emit three short beeps from the buzzer, which confirms that calibration mode was entered successfully.

C) Select or confirm the channel configuration switches for input type and temperature compensation (these need **not** be altered before entering into calibration mode).

D) Select the channel to calibrate by turning either DIP-2 switch 1 or 5 ON. The “SENSOR” LED for the channel selected will start flashing at a one second rate. This confirms you have entered the calibration mode for that channel.

NOTE: You cannot enter the calibration mode unless both sensor inputs have been switched OFF (deselected).

8.3.1. 4 to 20 mA DC Input Calibration (Version 2)

NOTE: If optional digital display(s) are installed disregard this section. Set points are done through the display configuration as outlined in section 6.5.2. The 4 to 20 mA DC range is calibrated at the factory and held in digital memory. While it should not be necessary to re-calibrate the 4 to 20 mA DC range in the field, the following procedure would be used for this calibration using 4 mA DC as the "set point" 1 value and 20 mA DC as the "set point 2" value.

To calibrate the set points for a 4 to 20 mA DC input you would require a Digital Voltmeter (DVM) and an instrument screwdriver for adjustment of a potentiometer.

Test jacks for the DVM are located on the processor board mounted on the inside of the enclosure door. The test jacks are J5 (+) and J6 (-) and are located in the upper right hand corner of the board. To the left of the test jacks is potentiometer R4. Adjustment of the

potentiometer will change the voltage reading at the test jack over a range of 0.6 to 3.0 VDC corresponding to the 4 to 20 mA DC input range.

Determine the set point levels in mA DC required for warning and alarm. Calculate the corresponding test jack voltage for these set points by multiplying the mA DC value by 0.15.

Examples: For 4mA => 4 x 0.15 = 0.6V, for 12mA => 12 x 0.15 = 1.80V. Refer to Table 5 above for some typical settings.

A) Place the QAS-200 in the calibration mode (as described above) and select the channel to be calibrated. The "SENSOR" LED for the channel being calibrated will now be flashing at a one second rate.

B) Insert DVM test leads into the test jacks. Select the lowest range on the meter that will measure 3 VDC.

C) Adjust potentiometer R4 until the desired voltage reading for Set Point 1 is measured at the test jacks.

D) Initiate calibration of set point 1 (warning) by setting DIP-2 switch 4 to ON. The "WARNING" LED for the channel being calibrated will flash at a half second rate.

E) Wait for the unit to calculate a stable average of samples. When an average is available for calibration, the unit will emit three short beeps and the "WARNING" LED will stop flashing.

F) Turn DIP-2 switch 4 to OFF while the "WARNING" LED is **not** flashing (If you missed it, just wait for the next one). The "WARNING" LED will be extinguished when the set point is saved.

G) Adjust potentiometer R4 until the desired voltage reading for Set Point 2 is measured at the test jacks.

H) Initiate calibration of set point 2 (alarm) by setting DIP-2 switch 8 to ON. The "ALARM" LED for the channel being calibrated will flash at a half second rate.

I) Wait for the unit to calculate a stable average of samples. When an average is available for calibration, the unit will emit three short beeps and the "ALARM" LED will stop flashing.

J) Turn DIP-2 switch 8 to OFF while the "ALARM" LED is not flashing. The "ALARM" LED will be extinguished when the set point is saved.

K) Turn DIP-3 switch 8 to OFF to exit the calibration mode (if you are done with all calibrations). The audible buzzer will chirp twice to indicate the unit is resuming normal operation.

L) Re-select active inputs by turning DIP-2 switch 1 and/or switch 5 to ON as required.

NOTE: You can select the next channel to calibrate without leaving calibration mode.

NOTE: Both set points (warning and alarm) for each channel must be calibrated even if only one set point is used.

NOTE: The warning set point **cannot** be calibrated with the same value as alarming set point. Choose an arbitrary level for the unused set point. The warning set point **must be lower** than the alarm set point.

8.3.2. Solid-state Sensor Calibration (Version 2)

The Solid-state sensors are somewhat affected by ambient humidity; but the gas supplied from compressed air cylinders is completely dry. Use a small humidifier when calibrating to give approximate ambient humidity. QEL's humidifying calibration caps give about 60% RH when fully wetted. Note that bubbler type humidifiers can give the reverse problem, which is fully saturated humidity.

To calibrate the set points for a solid-state sensor input you will require a calibration gas kit. This kit consists of calibration gas in the concentrations desired for set points and a regulator, tubing, and calibration adapter to deliver the gas to the solid-state sensor assembly.

A) Assemble calibration kit according to the instructions provided with the kit by the manufacturer, by attaching the tubing and calibration adapter to the regulator.

B) Secure calibration adapter to the solid-state gas sensor.

C) Place the QAS-200 in the calibrate mode and select the channel to be calibrated. The "SENSOR" LED for the channel being calibrated will now be flashing at a one second rate.

D) Initiate calibration of set point 1 (warning) by setting DIP-2 switch 4 to ON. The "WARNING" LED for the channel being calibrated will be start flashing at a half second rate.

E) Attach the gas cylinder containing the appropriate concentration for the warning set point to the regulator and apply gas to the sensor (ignore the three short beeps from the buzzer if you have not applied gas to the sensor yet – this means the sensor signal is stable in clean air). The "WARNING" LED will be flashing while the sensor signal is stabilizing after applying gas.

F) When the sensor output voltage is stable (approximately two to three minutes for significant gas change) the unit will emit three short beeps from the buzzer and stop flashing the "WARNING" LED.

G) Turn DIP-2 switch 4 to OFF while the "WARNING" LED is steady ON (if the LED starts flashing again, wait for the next three beeps from the buzzer). The "WARNING" LED will be extinguished when the set point has been stored in the. EEPROM.

H) Initiate calibration of set point 2 (alarm) by setting DIP-2 switch 8 to ON. The "ALARM" LED for the channel being calibrated will be start flashing at a half second rate.

I) Attach the gas cylinder containing the appropriate concentration for the alarm set point to the regulator and apply gas to the sensor (ignore the three short beeps from the buzzer if you have not applied gas to the sensor yet– this means the sensor signal is stable in clean air). The "ALARM" LED will be flashing while the sensor signal is stabilizing after applying gas.

J) When the sensor output voltage is stable (approximately two to three minutes for significant gas change) the unit will emit three short beeps from the buzzer and stop flashing the "ALARM" LED.

K) Turn DIP-2 switch 8 to OFF while the "ALARM" LED is steady ON (if the LED starts flashing again, wait for the next three beeps from the buzzer). The "ALARM" LED will be extinguished when the set point has been stored in the EEPROM.

L) Turn DIP-3 switch 8 to OFF to exit the calibration mode if you do not have any other channel to calibrate. The audible buzzer will emit two short beeps to indicate the unit is restarted with the new calibration.

M) Re-select active inputs by turning DIP-2 switch 1 and/or switch 5 ON as required.

NOTE: Both set points (warning and alarm) for per channel must be calibrated even if only one set point is used.

NOTE: The warning set point **cannot** be calibrated with the same value of the alarming set point. The warning set point must be at a **lower** concentration than the alarm set point.

9.0 Troubleshooting

The QAS-200 Dual Channel Controller has been designed and tested at the factory for the optimum in ruggedness and performance. We at QEL expect you to enjoy many years of trouble-free operation from any unit properly installed, configured, and regularly calibrated.

Should you encounter a problem with your unit, we recommend you first check and verify the configuration and wiring of the system. Next operate a system test (Section 8.1) to verify the proper operation of the microprocessor, relays, buzzer, and indicator LEDs. Should the problem still exist, please refer to the 'Troubleshooting Guide' below before contacting the factory or your local representative for assistance.

Version 2: Several audible fault indications were added to the Version 2 software. The fault indications are identified by a number of beeps from the audible buzzer. The beeps should be counted and the number looked up in the table below. While setting the unit up, some fault codes may be emitted to the buzzer. If these do not persist they can be ignored, since some switch selections will cause a temporary switch selection fault. This normally occurs while the unit is being set up and before the switch selections are complete.

9.1. Audible Fault Codes (Version 2)

Beeps	Cause	Action for Repair
1	Entry into Test Mode (DIP-3 Switch 6)	Normal, turn off for run mode.
2	Thermistor Fault (open or shorted)	Inspect thermistor wiring.
3	Line Voltage below 104 VAC	Check 115V supply Voltage.
4	Channel 1 Solid-state Sensor element failure or 4-20mA Transmitter below 2mA.	Inspect sensor wiring. Replace solid-state sensor. Inspect transmitter (in fault).
5	Channel 2 Solid-state Sensor element failure or 4-20mA Transmitter below 2mA.	Inspect sensor wiring. Replace solid-state sensor. Inspect transmitter (in fault).
6	Channel 1 Solid-state Sensor Heater failure or 4-20mA Transmitter above 32mA.	Inspect sensor wiring. Replace solid-state sensor. Inspect transmitter and wiring.
7	Channel 2 Solid-state Sensor Heater failure or 4-20mA Transmitter above 32mA.	Inspect sensor wiring. Replace solid-state sensor. Inspect transmitter and wiring.
8	Channel 1 set point failure.	Set points not calibrated. Set point 1 and set point 2 too close together. Set point 1 > set point 2.
9	Channel 2 set point failure.	
10	Channel 1 switch setting fault.	Inspect channel setup.
11	Channel 2 switch setting fault.	Inspect channel setup.
12	Relay switch setting fault.	Inspect relay switch settings.
13	Calibration switch setting fault.	Follow correct procedure.
14	EEPROM Fault	Contact factory (critical).

9.2. Troubleshooting Guide

Symptom	Possible Cause	Test Action	Corrective Action
No Power LED	Power not connected	Check for 115 VAC at power terminals	Turn on Power or repair external wiring
	Blown fuse	Check fuse continuity	Replace fuse
	Transformer failure	Check transformer secondary for DC voltage level	Return to factory for repair/replace
	Input/Power board failure	Check for DC power at inter-board connector	Return to factory for repair/replace
	Inter-Board Cable failure	Check continuity of ribbon cable between boards	Replace ribbon cable
	Processor Board failure	Check for DC power at inter-board connector	Return to factory for repair/replace
All LEDs Flashing	Unit warming up (Version 2 only)	Wait one minute	Normal Operation
No Sensor LED	Unit Warming Up (Version 1.XX only)	Wait one Minute	Normal Operation
	Not configured	Check configuration	Configure channel for active sensor
	Wrongly configured	Check configuration	Configure channel for correct type of sensor
	LED failure	Run system test	Return to factory for repair/replace
	Microprocessor failure	Turn power off for 10 seconds then turn back on	Replace microprocessor
Sensor LED Flashing	Unit in Cal Mode (Version 2 only)	Check DIP switches	Take unit out of calibration mode
FAULT LED on	Unit in Cal Mode (Version 1.XX only)	Check DIP switches	Take unit out of calibration mode
Fault LED on (flashing for Version 2)	Sensor not connected	Check wiring for proper connections, breaks or shorts	Connect proper sensor or transmitter, repair wiring
	Sensor or transmitter failure	Check transmitter output at terminals	Repair or replace sensor/transmitter
	Temperature Sensor failure	Turn off temperature compensation	Replace temperature sensor
	Input/Power board failure	Check transmitter output at terminals	Return to factory for repair/replace
Will Not Go Into Warning or Alarm	Out of Calibration	Run system test to confirm relay and light operation	Re-calibrate unit
	Microprocessor failure	Turn power off for 10 seconds then turn back on	Replace microprocessor
Warning or Alarm LED's Will Not Light	LED failure	Run system test	Return to factory for repair/replace
	Microprocessor failure	Turn off power for 10 seconds then turn back on	Replace microprocessor
Relay Will Not Actuate	Time Delays	Check configuration	Wait for time delay period or turn time delays off for test
	Relay failure	Run system test	Replace relay
	Microprocessor failure	Turn power off for 10 seconds then turn back on	Replace microprocessor
Relay Will Not De-Actuate	Time Delays	Check configuration	Wait for time delay period or turn time delays off for test
	Calibration	Check calibration	Re-calibrate
Buzzer Does Not Sound	Disabled	Check configuration	Enable buzzer DIP-3 switch 7 OFF
	Audible failure	Run system test	Replace buzzer
	Microprocessor failure	Turn power off for 10 seconds then turn back on	Replace microprocessor

9.3. Return Procedures

Should you need to return your QAS-200 Series Dual Channel Controller for repair, please contact your local representative or the customer service team at QEL direct at (613) 838-4005 by phone or (613) 838-4018 by fax. A Returned Material Authorization (RMA) number will be issued to facilitate the fast turn-around of your equipment once it is received.