GDS Corp

Gas and Flame Detection

Operation and Maintenance Manual

GDS-68XP Process Monitor for Low O_2 Applications

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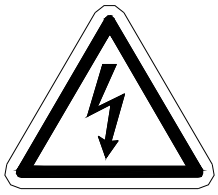


CAUTION: FOR SAFETY REASONS THIS EQUIPMENT MUST BE OPERATED AND SERVICED BY QUALIFIED PERSONNEL ONLY. READ AND UNDERSTAND INSTRUCTION MANUAL COMPLETELY BEFORE OPERATING OR SERVICING.

ATTENTION: POUR DES RAISONS DE SÉCURITÉ, CET ÉQUIPEMENT DOIT ÊTRE UTILISÉ, ENTRETENU ET RÉPARÉ UNIQUEMENT PAR UN PERSONNEL QUALIFIÉ. ÉTUDIER LE MANUE D'INSTRUCTIONS EN ENTIER AVANT D'UTILISER, D'ENTRETENIR OU DE RÉPARER L'ÉQUIPEMENT.

REVISION HISTORY

Revision 3.0	6/5/13	Initial rewrite for version 3.0
Revision 3.1	11/1/13	Update for GASMAX CX
Revision 3.2	12/15/13	Update for v2.3 sequencer firmware
Revision 3.4	1/30/14	Update for v2.4x sequencer firmware

P/N 1200-0732-05

CONTENTS

TABLE OF FIGURES

1 SAFETY INFORMATION

Important – Read Before Installation

Users should have a detailed understanding of GDS-68XP operating and maintenance instructions. Use the GDS-68XP only as specified in this manual or detection of gases and the resulting protection provided may be impaired. Read the following WARNINGS prior to use.

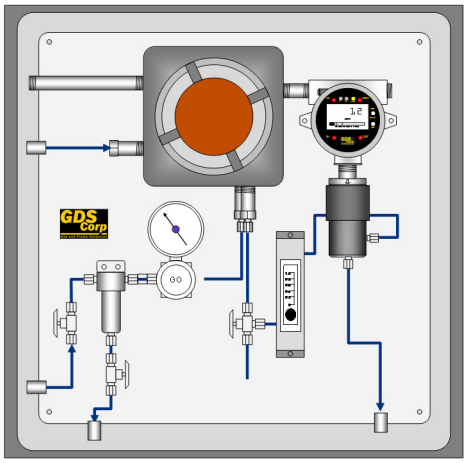
WARNINGS

- The GDS-68XP process monitor described in this manual must be installed, operated and maintained in accordance with information contained herein. Installation in any hazardous area must comply with all applicable restrictions, requirements and guidelines for said hazardous areas. It is the end user customer's final decision to ensure that the GDS-68XP is suitable for the intended use.
- The GDS-68XP is designed and constructed to measure the level of certain gases in backgrounds that contain low amounts of free oxygen. Accuracy in atmospheres containing steam or inert gases cannot be guaranteed.
- Do not paint enclosure, transmitter or sensor assembly.
- Do not operate the GDS-68XP if its enclosure is damaged or cracked or has missing components. Make sure the cover, internal PCB's and field wiring are securely in place before applying power.
- Do not expose the GDS-68XP to electrical shock or continuous severe mechanical shock. Protect the GDS-68XP from dripping liquids and high power sprays.
- Calibrate with known target gas at start-up and check on a regular schedule, at least every 90 days. More frequent inspections are encouraged to spot problems such as dirt, oil, paint, grease or other foreign materials in the sample tubing or in the sensor head.
- Periodically test for correct operation of the system's alarm events by exposing the sample extraction point to a calibration gas concentration above the High Alarm set point.
- Use only for applications described within this manual.

2 GENERAL INFORMATION

INTRODUCTION

The GDS-68XP provides a safe and reliable way to measure the level of hydrogen sulfide, mercaptan, THT and other gases in a process stream that contains low levels of oxygen. The GDS-68XP uses a programmed sequencer to alternatively apply sample and purge air to a highly sensitive and reliable electrochemical sensor. Applying purge air periodically refreshes the sensor's chemistry, significantly extends the life of the sensor and reduces the total amount of sample gas released into the atmosphere.



The GDS-68XP can be configured to draw samples from non-pressurized (ambient) sources or to accept positive pressure samples, from +5 psig to +1500 psig. Multiple filter options are available and the unit features a low-flow warning switch and long life brushless DC pump for sample and purge air.

The GDS-68XP features the new dual-channel GASMAX CX networked gas monitor. In addition to a new high visibility color display, the GASMAX CX includes an Ethernet port with built-in MODBUS/TCP interface and web server for complete integration into user networks. GDS Corp software can be used to remotely monitor the status and performance of GDS-68XP systems if a network connection is available.

EXPLOSION PROOF INSTALLATION

The GDS-68XP is designed for use in Class 1 Division 1 hazardous areas. Installation in these areas should follow best industry standard practices and all appropriate electrical codes. Generally, these codes require rigid metal conduit, poured seals and other installation elements necessary to ensure safety. For maximum protection against RF interference or electrical surge, the GDS-68XP enclosure and interconnecting conduit must be properly grounded.

INTRINSICALLY SAFE INSTALLATION

The GDS-68XP is not designed or certified for use as an Intrinsically Safe device.

3 SPECIFICATIONS

Model	GDS-68XP Process Monitor for Low Oxygen Applications
Power Input	24VDC ± 5% at < 12 watts
Display	High resolution color LCD with engineering units, bargraph and 30-minute trend
Sensor Types	Electrochemical sensors for toxic gases
Inlet Pressure Requirements	Sample draw: Ambient to +5 inches of water column Low pressure / no regulator: +5 inches water column to +25 psig (± 10% max) High pressure / standard filter: +10 psig to +1500 psig High pressure / combination filter: +10 psig to +1500 psig
Draw Distance	Demonstrated up to 100 feet of ¼" OD tubing
Accuracy	+/- 5% of full scale (typical)
Standard Output	Three-wire 4-20mA current source outputs with fault and overrange indication. Maximum loop resistance is 750 ohms with standard 24VDC supply. Ethernet RJ-45 with built-in MODBUS/TCP interface and web server Optional Relay / MODBUS interface with 3x 5A SPDT programmable alarm relays.
Temperature (operating)	0°C to +50°C standard (no enclosure) **Note**: Ambient temperature below 0°C may keep purge air pump from starting -20°C to +50°C with NEMA 4X enclosure and optional 200W AC heater. Heater thermostat is set to 50°F and is not user-adjustable.
Temperature (inert)	-20°C to +55°C In cold weather, GDS Corp recommends turning on the AC heater (if installed) for several hours before applying DC power
Memory	On-board non-volatile memory retains all user settings
Materials	Instrument housings: Aluminum Tubing & fittings 316 stainless steel
Dimensions	Painted steel plate: 21" x 21" x 8", NEMA 4x non-metallic enclosure, 24" x 24" x 8"
Approvals	GASMAX CX Gas Monitor CSA Certified Class I, Div 1 & 2 Groups B, C, D. Sequencer enclosure CSA certified for use in Class I Div 1 areas. Flame arrestors UL certified for use in Class 1 Div 1 areas.
Warranty	Two years on electronics

Type	Target Gas	Min Span	Max Span	Temp Range	Warm-Up
15	Hydrogen Sulfide	0-10 ppm	0-5000 ppm	0°C to + 50°C	2 to 4 hours
30	Mercaptan	0-15 ppm	0-30 ppm	0°C to + 40°C	4 to 8 hours
31	THT	0-15 ppm	0-30 ppm	0°C to + 40°C	12 to 24 hours
40	Odorants	0-15 ppm	0-50 ppm	0°C to + 50°C	2 to 4 hours
41	Spotleak	0-15 ppm	0-50 ppm	0°C to + 50°C	2 to 4 hours

Figure 3-1: Toxic Sensor Characteristics

SEQUENCE Switch	Sequence Time	Purge / Hold Time	Total Cycle Time (Approximate)
0	On-Demand Sequence		1 hour
1	12-15 min	40 min	1 hour
2	12-15 min	105 min	2 hours
3	12-15 min	165 min	3 hours
4	12-15 min	225 min	4 hours
5	12-15 min	285 min	5 hours
6	12-15 min	345 min	6 hours
7	12-15 min	465 min	8 hours

Figure 3-2: Sequence Timing

RECOMMENDED MINIMUM SAMPLE SEQUENCE TIMES			
	GAS TYPE	MINIMUM	COMMENTS
15	HYDROGEN SULFIDE, LOW RANGE (< 50 PPM)	1 HOUR	FOR MAXIMUM SENSOR LIFE, USE LONGEST POSSIBLE SEQUENCE
15	HYDROGEN SULFIDE (> 500 PPM)	2 HOURS	FOR MAXIMUM SENSOR LIFE, USE LONGEST POSSIBLE SEQUENCE
31	TETRAHYDROTHIOPHENE, 0-50 MG/M3	2 HOURS	TWO HOURS IS REQUIRED FOR COMPLETE SENSOR RECOVERY FROM METHANE
30	MERCAPTAN, 0-50 MG/M3 OR 0-3 LB/MCF	4 HOURS	FOUR HOURS IS REQUIRED FOR COMPLETE SENSOR RECOVERY FROM METHANE
40, 41	GENERAL ODORANTS, INCLUDING SPOTLEAK	2 HOURS	TWO HOURS IS REQUIRED FOR COMPLETE SENSOR RECOVERY FROM METHANE

Figure 3-3: Recommended Minimum Sequence Times

4 OPERATION

OVERVIEW

The GDS-68XP uses low cost, reliable electrochemical sensors to detect hydrogen sulfide, mercaptan, THT and other trace gases in process streams that contain little or no oxygen. As electrochemical sensors require oxygen to operate, the GDS-68XP alternatively exposes the sensor to the process flow and then purges the sensor with ambient air to maintain the sensor in a sensitive, oxygenated state.

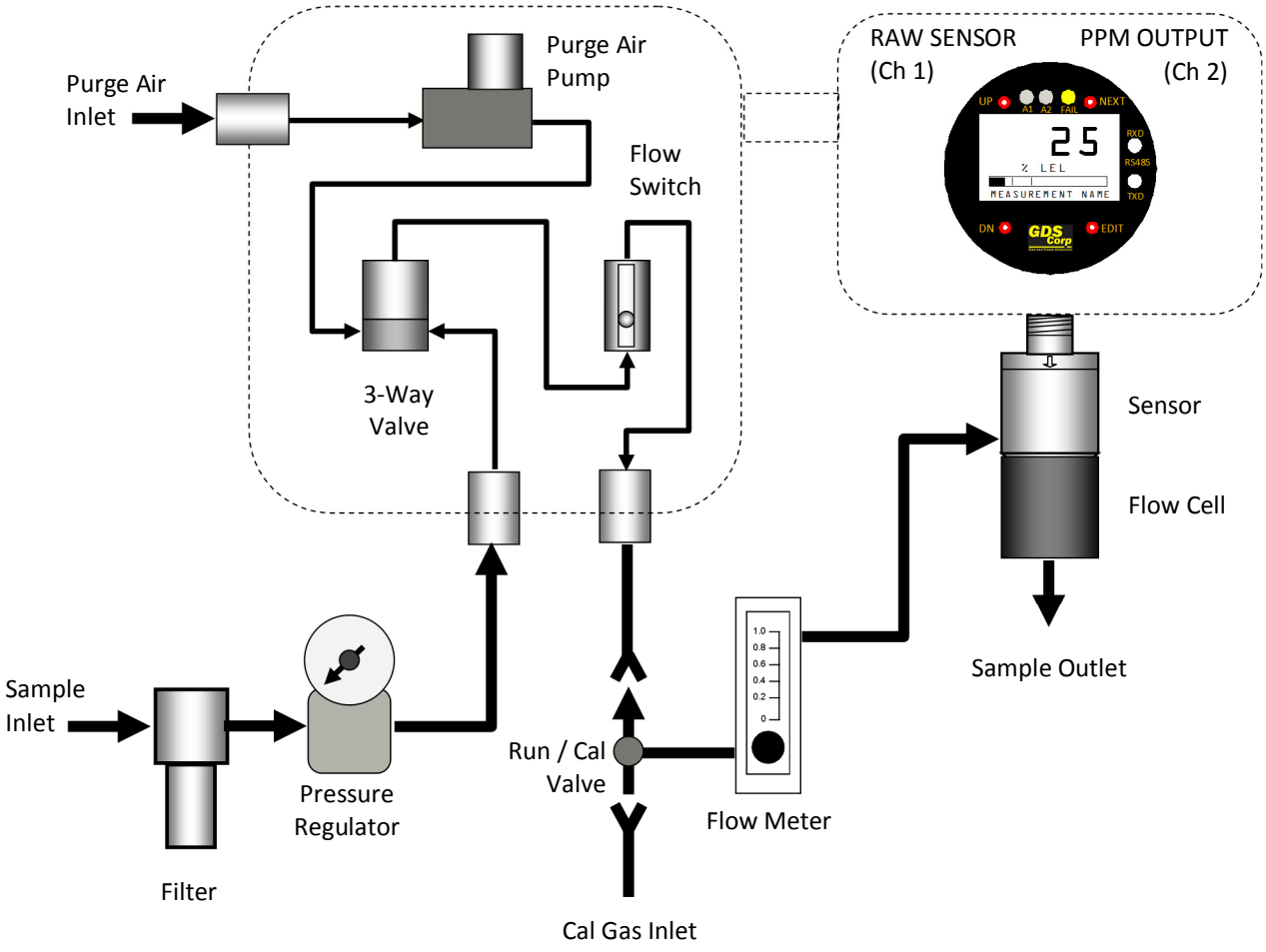


Figure 4-1: GDS-68XP Flow Diagram (Pressure)

At the beginning of each sequence, the GDS-68XP performs **Conditions the Sensor** by allowing a small sample of gas to enter the sensor flow cell, followed by a fixed 5 minute delay. The 68XP then enters **Sample Charge** during which sample gas flows into the sensor flow cell for two minutes, or until sensor output exceeds 25% of scale. Once sample pre-charge is complete, the sequencer enters **Read** mode where the sequencer processor attempts to identify a stable peak value. Once the sample value is

identified and stored, the GDS-68XP enters **Recovery** mode where purge air flows into the sample flow cell. Once the sensor output **drops below 10% of scale**, the GDS-68XP transfers the stored reading to the 4-20mA and MODBUS output. In the event that an overrange, loss of flow, peak-find algorithm fault, non-return-to-zero fault, sensor fault or calibration fault occurred during the sequence, a specific fault indication value will be output in place of the measured value. Finally, the GDS-68XP enters **Purge/Hold** mode, during which purge air is periodically passed across the sensor to prepare it for the next sequence. The length of the Purge/Hold time is determined by the SEQUENCE switch setting.

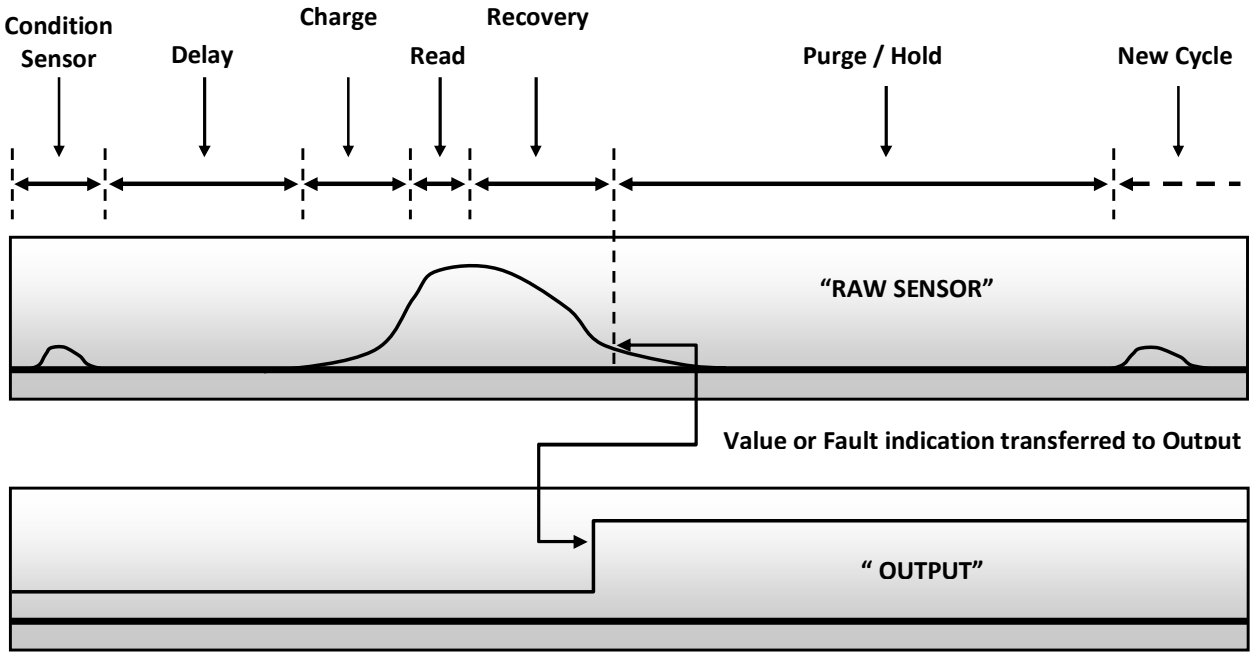


Figure 4-2: GDS-68XP Sample Timing

GDS-68XP Sequence Timing					
Condition Sensor	**Fixed Delay**	**Sample Charge**	**Sample Read**	**Sensor Recovery**	**Purge / Hold**
Valve opens, sample flows to sensor	Purge air applied to sensor	Valve opens, sample flows to sensor	Sequencer finds and stores max gas reading; valve closes	Purge air applied to sensor until output < 10% of scale	Purge air applied to sensor (intermittent)
Fixed 5-10 seconds	Fixed 5 minutes	Two minutes or value > 25%	Min: 2 seconds Max: 5 minutes	Min: 1 second Max: 10 minutes	Determined by sequence switch

Figure 4-3: GDS-68XP Maximum Timing Values

SAMPLE DRAW CONFIGURATION

In addition to low and high positive pressure versions, the GDS-68XP can be configured to draw a sample from ambient pressure sources. In this configuration the pump operates continuously to pull from both purge air and sample sources (See Fig. 4-4).

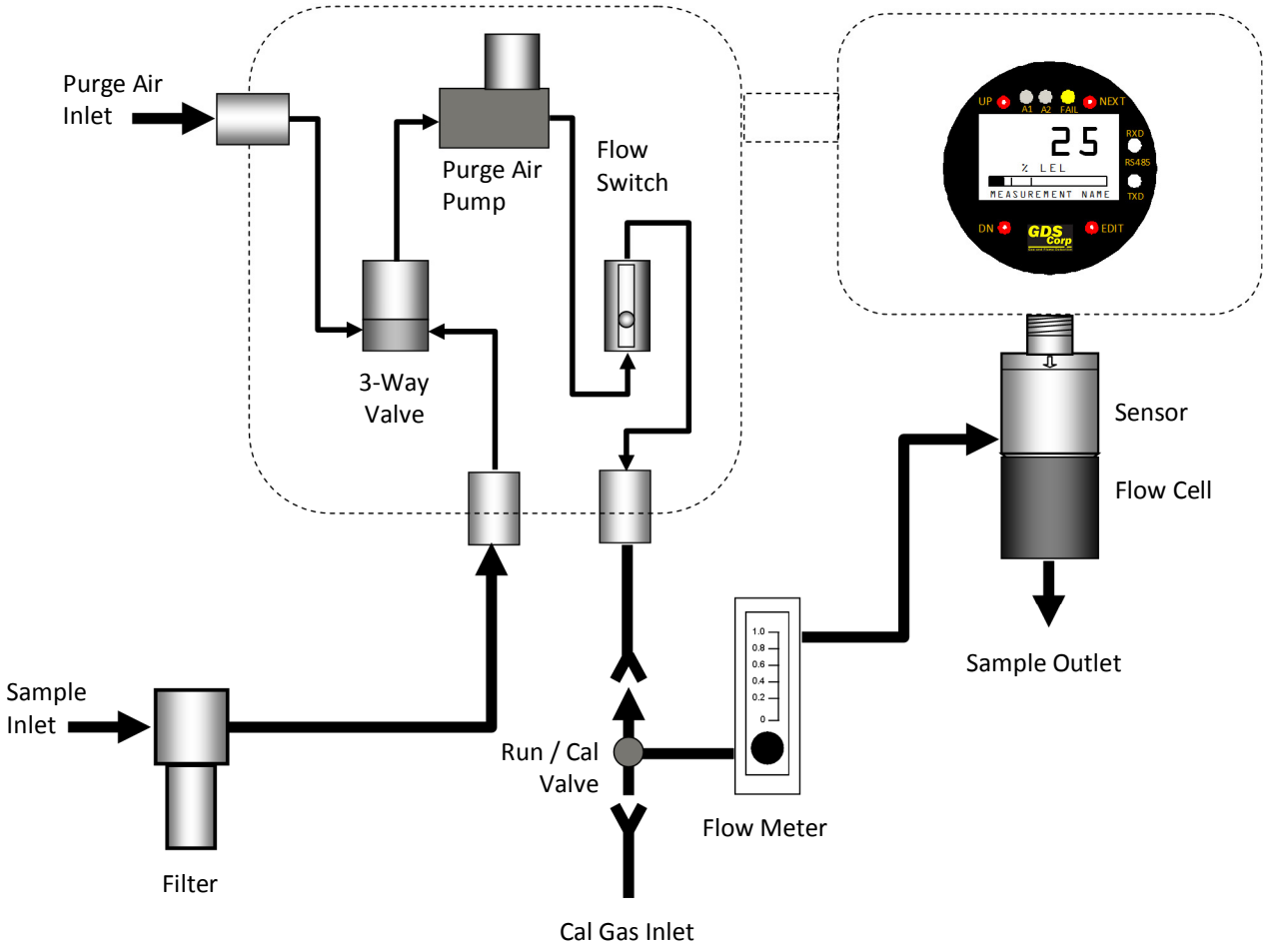


Figure 4-4: GDS-68XP Flow Diagram (Sample Draw)

SENSOR CONSIDERATIONS

The GDS-68XP supports electrochemical sensors for hydrogen sulfide, THT and mercaptan. Each sensor contains a fixed amount of chemical electrolyte that reacts with the target gas to create free electrons that are amplified and measured. Once the electrolyte is depleted, sensor output will diminish and the sensor must be replaced.

IMPORTANT: TOXIC SENSORS ARE SUBJECT TO ACCELERATED DETERIORATION IF POWER IS NOT APPLIED WITHIN 3 MONTHS OF SHIPMENT FROM GDS CORP.

5 INSTALLATION

SELECTING A LOCATION

Locate the GDS-68XP as close as practical to the source of the sample gas to minimize latency and ensure that fresh sample is available for each sequence. The GDS-68XP plate and/or enclosure feature mounting holes that can be used to securely attach the monitor to a bulkhead or wall. Make sure there is sufficient clearance below and to the left side of the GDS-68XP to allow room for power & signal cables, purge air, sample, filter bypass (if installed), filter drain and sample exhaust tubing.

If the unit is installed outside or where insects or dust may be present, be sure that the supplied purge air filter is in place and that a cover is placed over the Cal Gas Inlet port.

Always mount the GDS-68XP in a vertical position to ensure proper operation of flow switch and filter drains. The non-metallic enclosure option is strongly recommended if unit is to be installed outside or in areas where high or low temperature extremes may occur.

NOTE: TEMPERATURES BELOW 0°C MAY KEEP THE PURGE AIR PUMP FROM STARTING.

Always use recommended conduit and poured seals for signal and power wiring installation in hazardous areas. Consult local codes and regulations where appropriate.

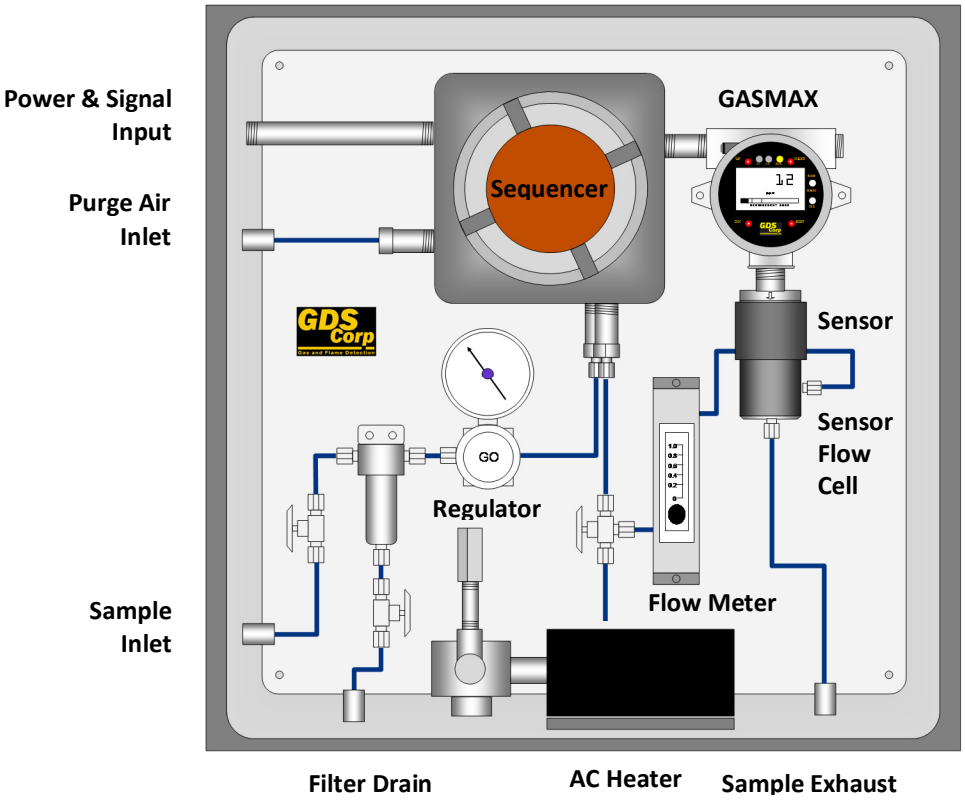


Figure 5-1: GDS-68XP (High Pressure, Standard Filter)

POWER & SIGNAL CONNECTIONS

To access the power and signal wiring, remove the cover from the explosion proof enclosure. Connect a source of +24VDC, ± 10% power to wiring terminals J1-1 (+24V) and J1-3 (GND). The 4-20mA (source) output is available at J1-2 (See Fig. 5-2).

Recommended DC Wire Gauge	
< 100 ft	#18 GA
100 to 500 ft	#16 GA
500 to 1000 ft	#14 GA

ON-DEMAND SEQUENCE INPUT

If the "on-demand' sequencer mode is selected the GDS-68XP will enter a hold mode until an external contact closure between J6-1 and J6-2 occurs. This causes the GDS-68XP to perform a single sample sequence. Upon completion, the DONE output will be pulled low to signal the remote controller that the sequence is complete.

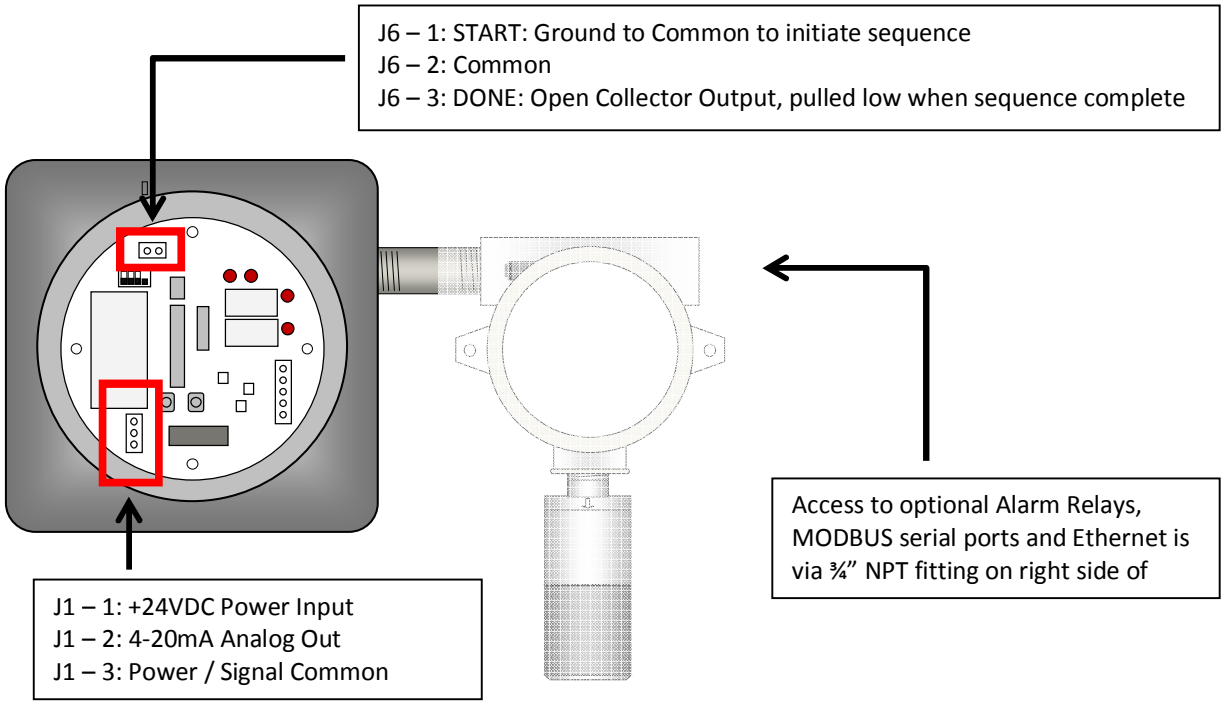


Figure 5-2: GDS-68XP Power and Signal Wiring

ETHERNET CONNECTION

The GASMAX CX gas monitor includes a standard RJ-45 Ethernet connection on the main I/O board. Both fixed IP and DHCP-based dynamic IP addressing is supported. The GASMAX CX supports a full range of MODBUS / TCP accessible register (see Chapter 10) as well as a built-in web server with data display and gas detector configuration page.

RELAY CONNECTIONS (OPTIONAL)

The optional GASMAX CX Relay / dual MODBUS RTU slave interface is connected "piggyback" to the back of the GASMAX CX Display Assembly and supplies three level alarm relays, a FAULT relay and dual RS-485 Modbus RTU serial ports.

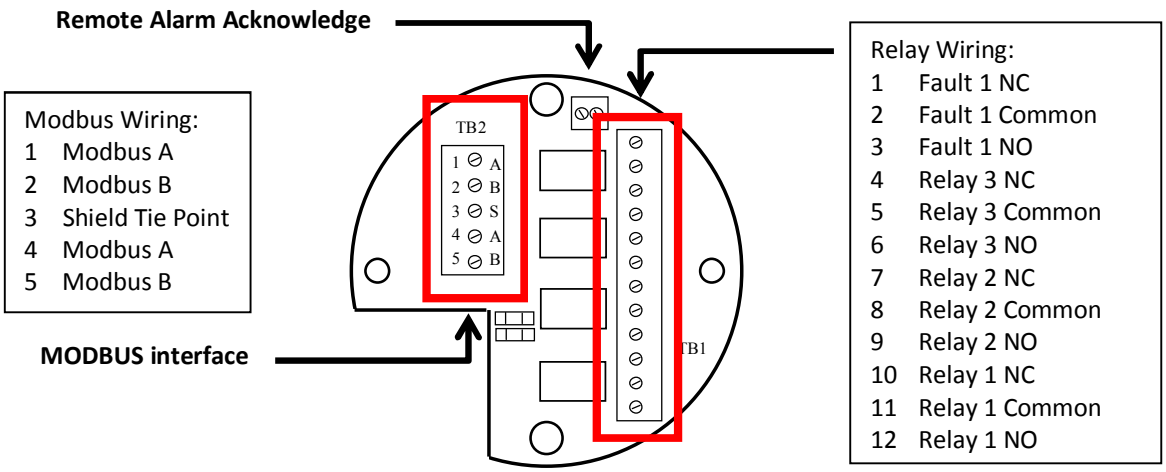


Figure 5-3: RELAY / MODBUS Connections

Relays K1, K2 and K3 provide a contact closure if the Alarm 1 ("K1") or Alarm 2 ("K2") or Alarm 3 ("K3") limits are exceeded. Alarms can be programmed to trigger above or below a certain value, work as normal or 'failsafe' and can be made to latch if desired. Relay K3 indicates a FAULT condition in the sensor, microprocessor or flow system.

Remote Alarm Reset can be used to acknowledge an Alarm 2 relay contact closure. Wiring from any remote pushbutton to TB3 should be shielded and protected from noise spikes to prevent false Alarm Reset commands.

WARNING: RELAY CONTACTS ARE RATED FOR RESISTIVE LOADS ONLY! INDUCTIVE LOADS MAY CAUSE ARCING WHICH SHORTENS LIFE AND MAY INTERFERE WITH SENSOR DATA.

MODBUS CONNECTIONS (OPTIONAL)

The dual optional GDS-68XP MODBUS RTU interface allows remote controllers or PLCs to monitor most aspects of operation, including real-time data, range and alarm setpoints and alarm and fault status bits. The GDS-68XP interface supports 9600 Baud RS-485 differential signaling only.

Access to each MODBUS RS-485 interface is via TB2 on the optional Relay / MODBUS board mounted on the back of the GASMAX CX display module (See Fig. 5-3). Separate input and output terminals for MODBUS "A" and "B" signals are available. A center terminal to tie incoming and outgoing shield connections is also provided.

MODBUS system architecture requires that the devices in any MODBUS loop be connected in a daisy-chain layout. This minimizes signal reflections and improves signal noise margin. A MODBUS Termination Jumper installs a load resistor across the MODBUS signal lines and should only be set to "A" (ON) at the last device in the string (See Fig. 5-3).

Cable selection for MODBUS systems is important for both signal integrity and power distribution. MODBUS / RS-485 transmissions use low-voltage differential signaling to achieve reasonable data rates over very long distances, up to 4000 feet without a repeater. For MODBUS data signals, GDS Corp recommends 20GA to 24GA twisted shielded cable. Daisy-chain power distribution may require larger gauge wire since it is critical that the supply voltage for the GDS-68XP at the far end of the string not fall below 22VDC during power-up.

Note that while the GDS-68XP has two sets of wiring terminals for MODBUS "A" and "B" signals, daisy-chain power wiring requires that two wires be installed in the "+24" and "GND" terminals on the GDS-68XP I/O Power Supply board. This can be difficult if wire sizes are larger than #18GA. For these reasons, if MODBUS is required GDS Corp recommends the addition of the MODBUS Wiring Junction Box (see Fig. 5-7). This option minimizes the need to access wiring inside the GDS-68XP, provides individual wire landing points for incoming and outgoing MODBUS and power wiring and shields, and makes it easy to temporarily disconnect the GDS-68XP power or MODBUS connections without affecting any other MODBUS device.

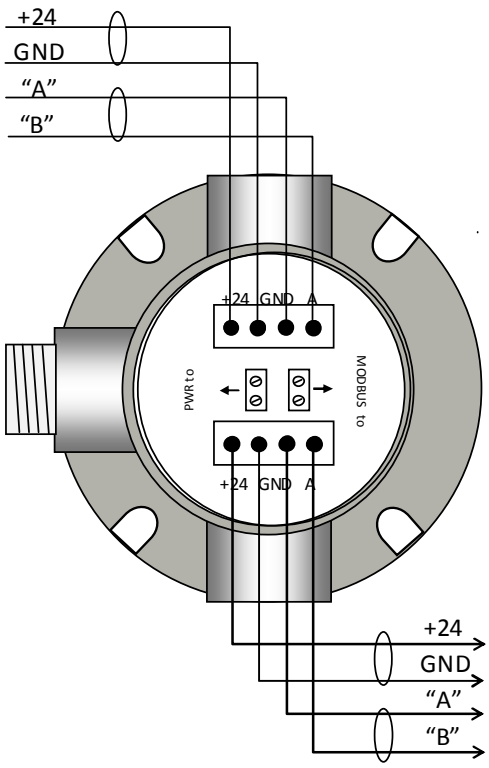


Figure 5-4: MODBUS Wiring Junction Box

AC HEATER (OPTIONAL)

The 200 watt AC-powered heater is recommended for outdoor applications where ambient temperatures may fall below freezing for extended periods of time. The heater is available in either 110VAC or 230VAC models. Access to the heater wiring is via a separate ¾" NPT fitting on the bottom of the heater junction box. Note that all high voltage AC wiring must be kept separate from lower voltage DC and signal lines.

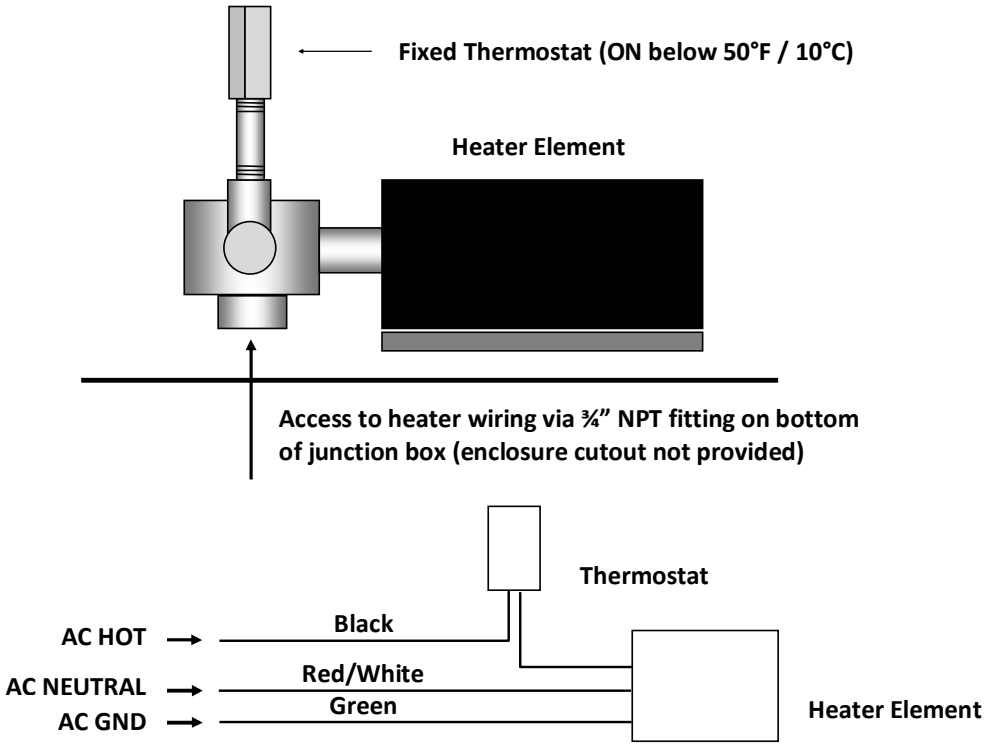


Figure 5-5: 200W AC Heater Wiring

Local codes and good wiring practice require an AC shutoff switch within sight of the heater assembly for maintenance and testing. **IMPORTANT: Keep all electrical fittings tight while circuits are alive.**

PURGE AIR INLET

Purge air should be drawn from a source of ambient air that is clean and free of significant levels of hydrogen sulfide or similar toxic gas. GDS Corp recommends placing the Purge Air inlet some distance from the GDS-68XP, in a location that is free from background gas and protected from heavy rains, water spray and snow or ice. Included with the unit is a ¼" screen fitting that **must** be placed over the open end of the purge air inlet to keep dust, dirt, water droplets and insects from entering the tubing and being drawn into the purge air pump.

SAMPLE INLET

The length of time it takes gas to flow from the sample source to the GDS-68XP inlet should not exceed 30 seconds to ensure that "fresh" sample is available at the beginning of each measurement cycle. For ¼" OD stainless steel tubing and sample flow rates of approximately 0.5 liters per minute, the maximum length should be no more than 60 feet (~20 m). Smaller diameter tubing will allow longer runs but may be subject to clogging if the sample contains particulate or moisture. Larger diameter tubing should be avoided due to the internal volume of entrained gas.

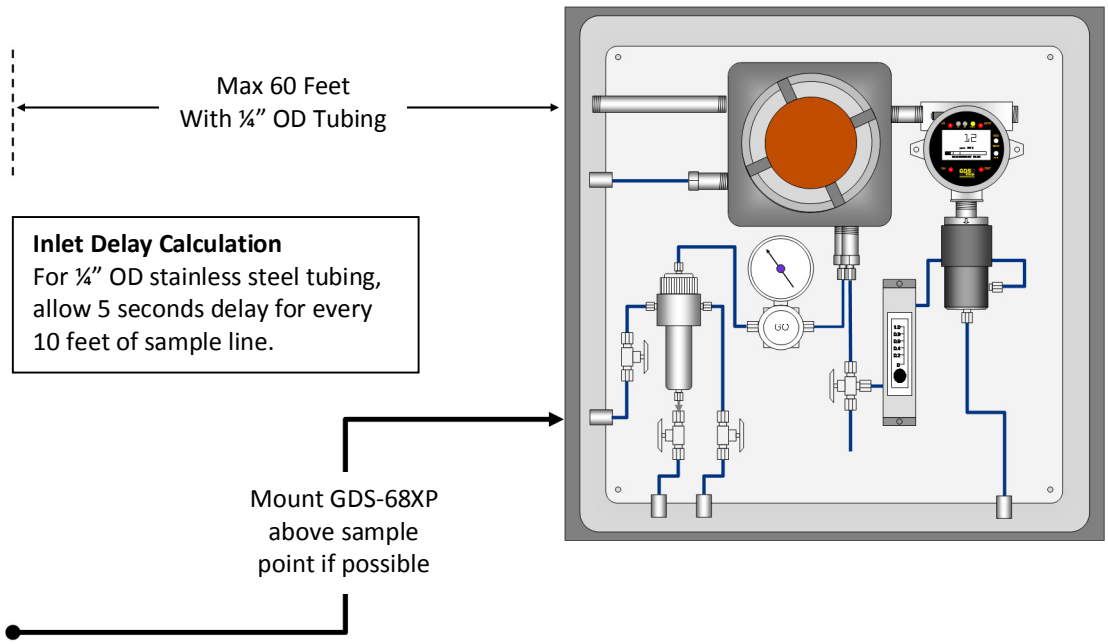


Figure 5-6: Inlet Tubing Recommendations

In the event that the GDS-68XP must be mounted at a greater distance from the sample pickup point, the combination coalescing / bypass filter is recommended. This filter includes a bypass port and bypass valve that can be opened slightly to enable a continuous flow of sample from the pickup point to the filter input, ensuring that fresh sample is always available.

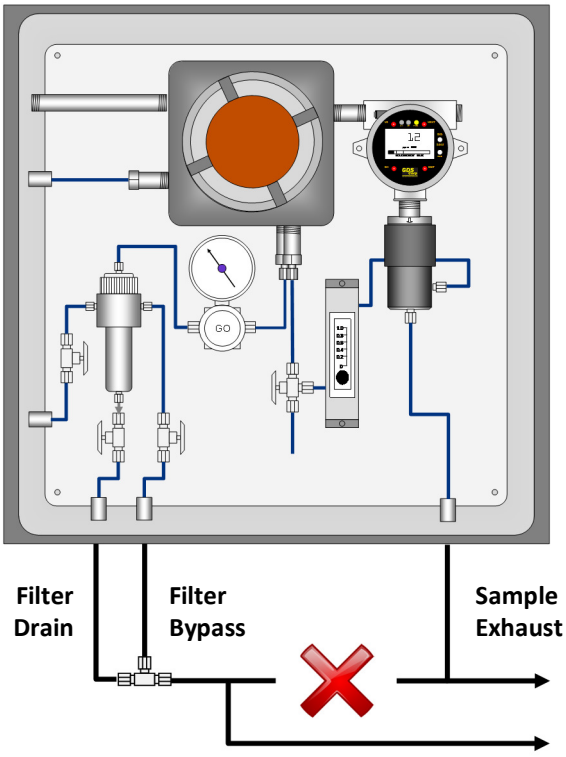
IMPORTANT: WHEN CONFIGURED FOR SAMPLE DRAW, THE GDS-68XP SAMPLE PUMP IS CAPABLE OF PULLING UP TO 7.0 PSI VACUUM, ENOUGH TO LIFT WATER OVER 15 FEET. CARE SHOULD BE TAKEN NOT TO SUBMERGE THE SAMPLE PICKUP POINT IN LIQUID. INJESTED LIQUID IS NOT COVERED UNDER WARRANTY.

If a unit that has been configured for sample draw is connected to a sample source with pressure higher than ambient, an additional low-pressure regulator or flow restriction device should be installed in the sample inlet line before the GDS-68XP. This will allow the sample flow to be adjusted to match the purge air flow.

FILTER DRAIN & FILTER BYPASS

All GDS-68XP configurations include a coalescing filter with stainless steel drain valve. For positive pressure models, the drain valve should be opened periodically to release any built-up liquid that may have been trapped inside the filter. Conversely, the filter drain valve may be left 'cracked open' to allow moisture (and sample gas) to escape on a continuous basis.

Models with the combination coalescing and membrane filter include a bypass valve that should be opened slightly to maintain a constant flow of sample across the membrane element to carry away moisture and particulates captured by the filter.



Filter Drain Recommendations

1) Including a length of clear tubing in the filter drain line makes it easy to monitor the drain for the presence of moisture
2) Filter drain and filter bypass drain can be combined in the same manifold
3) Filters in sample draw units should only be drained during sample purge or purge / hold times to keep ambient air from being drawn into the GDS-68XP by the sample pump

IMPORTANT: DO NOT TIE SAMPLE EXHAUST TO A COMMON EXHAUST MANIFOLD. MAINTAIN A SEPARATE SAMPLE EXHAUST LINE TO AMBIENT AIR.

IMPORTANT: **MAKES SURE SAMPLE EXHAUST IS DIRECTED TO A SAFE AREA**

Figure 5-7: Filter Drain & Exhaust Tubing Recommendations

NOTE: LEAVING THE FILTER DRAIN VALVE 'CRACKED' OPEN WILL ALLOW SAMPLE GAS TO FLOW FROM THE PICKUP POINT TO THE GDS-68XP ON A CONTINUOUS BASIS, ENSURING THAT FRESH SAMPLE IS ALWAYS AVAILABLE AT THE BEGINNING OF EACH NEW SAMPLE SEQUENCE.

SAMPLE EXHAUST

Changes in ambient pressure will affect the output from all electrochemical sensors, and allowing the sample to exhaust directly to atmosphere will minimize these affects. Long runs of tubing connected to the sample outlet may increase the backpressure inside the sensor flow cell and cause higher than normal readings. Hydrogen sulfide is a heavy gas and will tend to 'back up' inside sample exhaust lines that extend vertically for too great a distance.

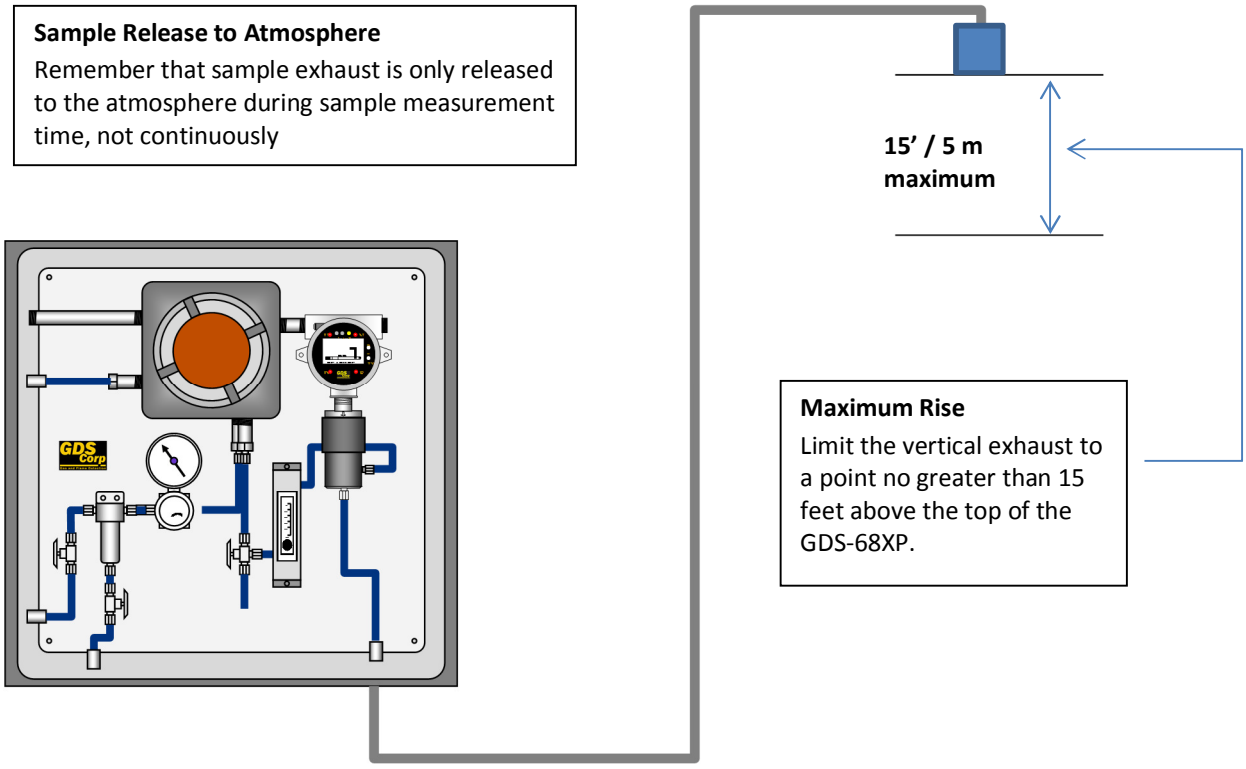


Figure 5-8: GDS-68XP Exhaust Tubing

IMPORTANT: DO NOT RESTRICT SAMPLE EXHAUST OUTLET. PRESSURE IN THE SAMPLE FLOW CELL MAY DAMAGE THE SENSOR AND WILL RESULT IN INCORRECT READINGS.

IMPORTANT: WHEN INSTALLING THE GDS-68XP OUTDOORS, MAKE SURE SAMPLE EXHAUST IS PROTECTED BY A SCREEN OR FILTER TO KEEP INSECTS FROM ENTERING THE EXHAUST PORT AND NESTING IN THE SENSOR FLOW CELL.

DANGER: MAKE SURE EXHAUST GAS IS DIRECTED AWAY FROM PERSONNEL AND EQUIPMENT, ESPECIALLY SUMPS OR LOW-LYING AREAS WHERE HEAVY GASES, SUCH AS HYDROGEN SULFIDE, CAN BUILD UP OVER TIME. **HYDROGEN SULFIDE IS DEADLY AND EXPOSURE CAN RESULT IN INJURY OR DEATH.**

INSTALLATION SUMMARY: DO'S AND DON'TS

- Select an installation location that protects the unit from shock, vibration and damage
- Always mount the GDS-68XP vertically to ensure proper operation of the low flow switch
- Make sure the power wiring is appropriate for the DC load and distance
- Keep DC signal wiring and AC heater wiring separate
- Make sure sample conditioning is appropriate to the quality of the sample
- Observe maximum inlet length recommendations
- Always provide an independent sample exhaust line
- Make sure that exhaust gas is directed away from personnel and vented to a safe area where exhaust gas can dissipate
- If mounting the unit outdoors, protect all exposed vents or intakes with screens or filters to keep insects, moisture or dirt from entering the device.

6 INITIAL SETUP

OVERVIEW

The GDS-68XP consists of an electronic sequencer that controls and monitors the sample / measurement / purge operation and a dual-channel GASMAX CX monitor that measures the raw sensor data (Channel 1) and stores and displays the captured measurement (Channel 2).

SEQUENCER CONTROLS AND INDICATORS

To access the GDS-68XP sequencer, unscrew and remove the cover of the gray explosion-proof enclosure. The length of time between samples is determined by the SEQUENCE switch setting. Sequencer control for testing and setup is managed by two pushbuttons ("BYPASS" and "RUN") located on the sequencer board, and the state of system (sampling, purging, waiting) can be determined by viewing status LEDs ("L1" and "L2", "PUMP" and "VALVE") also located on the sequencer board.

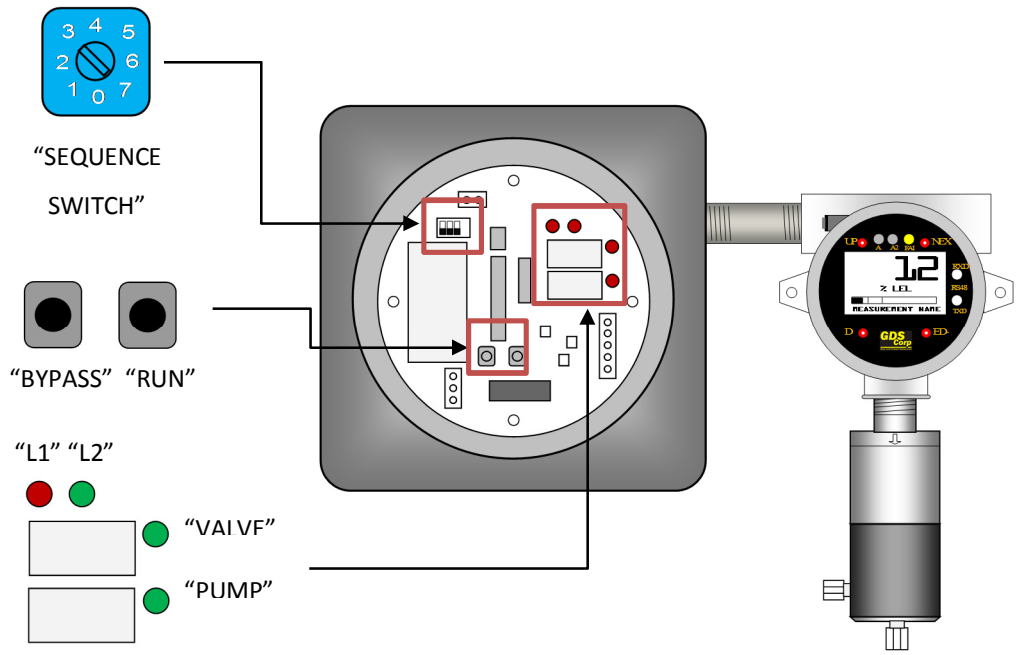


Figure 6-1: GDS-68XP User Interface

The GDS-68XP sequencer monitors the output of the GASMAX raw sensor channel and flow switch and controls the operation of the purge air pump and 3-way valve.

SEQUENCE switch setting determine the length of time between each sample cycle. There are seven preset sample times and one 'on-demand' setting that allows an external PLC or DCS to command the start of a sample cycle. Switch positions are numbered 0 to 7, clockwise starting from the bottom.

SEQUENCE Switch	Sequence Time	Purge / Hold Time	Total Cycle Time (Approximate)
0	On-Demand Sequence		1 hour
1	12-15 min	40 min	1 hour
2	12-15 min	105 min	2 hours
3	12-15 min	165 min	3 hours
4	12-15 min	225 min	4 hours
5	12-15 min	285 min	5 hours
6	12-15 min	345 min	6 hours
7	12-15 min	465 min	8 hours

Figure 6-2: Sequence Timing

BYPASS disables the sequencer and allows sample gas to flow directly into the sensor for testing purposes. To enter BYPASS mode, press and hold the BYPASS button. To exit Bypass, press and hold the RUN button. Bypass mode will automatically exit after 15 minutes of operation. *Bypass is only available during Purge/Hold sequence.*

RUN *Pressing RUN for five seconds during the Purge/Hold sequence will initiate a new cycle.*

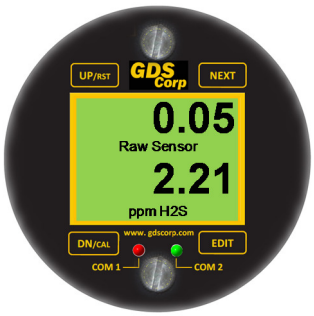
L1 AND L2 indicate the status of the sequencer processor.

MODE	L1 (RED)	L2 (GRN)	PUMP	VALVE	DESCRIPTION
START-UP	SIMULTANEOUS FLASH		OFF	OFF	FIRST 8 SECONDS ONLY
WARM-UP	ALTERNATE FLASH		ON	OFF	INITIAL WARM-UP ONLY[3]
ON-DEMAND	SLOW FLASH	OFF	ON[2]	OFF	WAITING FOR REMOTE "START"
ACTIVE SAMPLE SEQUENCE					
CONDITION	1 FLASH	OFF	OFF/ON[1]	ON	GAS APPLIED TO SENSOR FOR 10 SEC
DELAY	1 FLASH	OFF	ON	OFF	PURGE AIR FOR FIVE MINUTES
CHARGE	2 FLASHES	OFF	OFF/ON[1]	ON	GAS APPLIED TO SENSOR
READING	3 FLASHES	OFF	OFF/ON[1]	ON	IDENTIFY PEAK, STORE READING
RECOVERY	4 FLASHES	OFF	ON	OFF	PURGE AIR TO < 10% OF FULL SCALE
Purge / Hold Mode					
PURGE/HOLD	OFF	2 FLASHES	ON[2]	OFF	SENSOR AIR PURGE[2]
BYPASS MODE	ALTERNATE FLASH		OFF/ON[1]	ON	RAW SENSOR INPUT TO CHANNEL 1
CAL MODE	SLOW FLASH	OFF	ON	OFF	PURGE AIR FLOWING TO SENSOR

1) Pump is ON if sample draw, OFF if positive pressure.
2) Pump runs intermittently
3) 15 minute warm-up starts once sensor output reaches stable value (+/- 10% of scale)

Figure 6-3: L1 / L2 Indicator Operation

GASMAX CONTROLS AND DISPLAY



There are four magnetic switches on the face of the GASMAX CX, arranged in a quadrant around the LCD display. Starting in the upper left and proceeding clockwise these are labeled UP, NEXT, EDIT and DN/CAL. To activate, or "press" a magnetic switch, swipe the magnet near the switch. For the balance of this manual, the term "press" will be used to describe activation of any key via the magnetic wand. Below the LCD display, two LEDs monitor the MODBUS RS-485 or Ethernet network interface. Flashing indicates sent or received data.

The **EDIT** key activates the USER MENU mode (See Chapter 8). During USER MENU mode, the UP, DN and NEXT keys are used to select and confirm menu entries. The USER MENU allows the operator to view the Event Log and channel parameters and change system settings such as alarm levels and real time clock day and date.

Pressing the **DOWN/CAL** key, followed by the EDIT key, initiates calibration mode. For a detailed description of calibration, see Chapter 6.

Pressing the **NEXT** key momentarily causes the GDS-68XP display to sequence display screens between DUAL DISPLAY, RAW SENSOR TREND, PPM OUTPUT TREND, RAW SENSOR, and PPM OUTPUT.

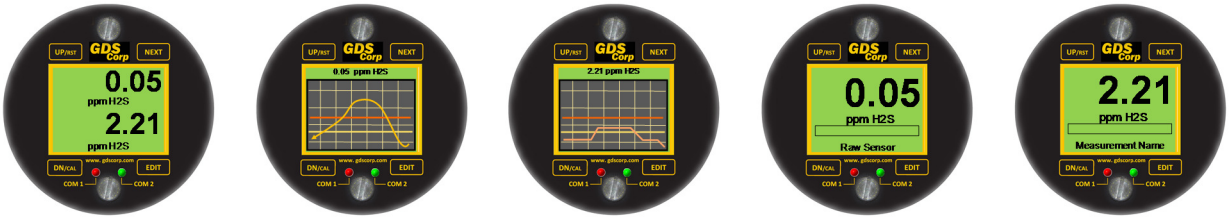


Figure 6-4: GDS-68XP GASMAX Display Sequence

RAW SENSOR displays the calibrated gas value being read by the sensor at any moment. As such, it will increase when the 3-way valve opens to allow sample gas into the unit, and will then drop back to zero during purge and purge / hold. Use the Raw Sensor Trend screen to monitor the sensor's response to sample gas.

PPM OUTPUT displays and holds the maximum value found during the most recent sample sequence. Its value is updated each time the sequencer identifies a new maximum ppm value.

DUAL DISPLAY shows both RAW SENSOR and PPM OUPTUT values on a single screen.

GDS-68XP STARTUP PROCEDURE

Before start up, review Chapter 4 ("Operation") for information on operating modes and indications as well as Chapter 6 ("Sequencer Controls and Indicators"). Figure 6-3 provides a handy reference to the red and green LEDs ("L1" and "L2") that indicate the current status of the sequencer processor.

	ITEM	NOTES
1	MAKE SURE SAMPLE OUTLET IS CONNECTED CLOSE INLET AND FILTER DRAIN VALVES	**SAMPLE GAS CAN BE DEADLY. ALWAYS MAKE SURE SAMPLE OUTLET IS DIRECTED TO A SAFE AREA**
2	SET SEQUENCE SWITCH TO "4"	SET FOR 4 HOUR SAMPLE
3	APPLY 24VDC POWER	L1, L2 FLASH GASMAX DISPLAY ACTIVE PUMP ON, PURGE AIR FLOWING
GDS-68XP WARMUP: SENSOR STABLE + 15 MINUTES DURING WARMUP, PERFORM STEPS 4-5-6 BELOW		
4	ADJUST FLOW METER VALVE FOR 0.5 LPM	ADJUST FOR ½ LPM PURGE AIR FLOW
5	CHECK TIME OF DAY CLOCK FOR TIMEZONE; SET HOST NAME AND MEASUREMENT NAME; SET ETHERNET NETWORK PARAMETERS	CHANGES TO NETWORK SETTINGS ARE NOT RECOGNIZED UNTIL NEXT POWER-UP SEQUENCE. RETURN TO STEP 3 IF CHANGED
6	OPTIONAL: VERIFY 4-20MA SIGNAL TO REMOTE DCS OR PLC	USE DIAGNOSTICS MENU TO FORCE CHANNEL 2 OUTPUT TO 4MA / 20MA AND VERIFY READING ON RECEIVING DEVICE
GDS-68XP COMPLETES FIRST SEQUENCE AND ENTERS PURGE / HOLD MODE: OUTPUT = "FLOW FAULT", L2 (GREEN) FLASHING		
7	OPEN SAMPLE INLET VALVE	VERIFY PRESSURE ON PRESSURE GAUGE
8	PRESS "BYPASS" AND *ADJUST REGULATOR* FOR 0.5 LPM SAMPLE GAS FLOW	**DO NOT RE-ADJUST FLOW METER VALVE** RAW SENSOR OUTPUT SHOULD INCREASE IF TARGET GAS PRESENT
9	PRESS "RUN" TO EXIT BYPASS	CLOSES SAMPLE VALVE AND RETURNS SEQUENCER TO PURGE/HOLD MODE
GDS-68XP COMPLETES PURGE / HOLD GDS-68XP WILL RUN NEW SAMPLE SEQUENCES APPROXIMATELY EVERY FOUR HOURS ALLOW NEW UNIT TO RUN SEVERAL SEQUENCES BEFORE PROCEEDING		
10	PERFORM SENSOR CALIBRATION	SEE CHAPTER 7
GDS-68XP INSTALLATION COMPLETE		

7 CALIBRATION

CALIBRATION OVERVIEW

Calibration is critically important to ensure correct operation of the GDS-68XP. The GASMAX CX built-in CAL MODE function is designed to make calibration quick, easy and error free; a successful ZERO and SPAN calibration requires only four keystrokes.

It is important to note that a **GASMAX calibration should only be performed during Purge/Hold mode**. During each sample sequence, the GDS-68XP sequencer checks for a number of different error conditions, including overrange, sensor fault, sample peak identification fault, and sensor non-return-to-zero. Since the sequencer expects a valid output from the GASMAX at all times, if the GASMAX CX is placed in CAL MODE at any time during the sample sequence, a CAL ERROR is generated. Always check to be sure that the L2 (GREEN) indicator LED is flashing before performing a GASMAX calibration procedure.

Calibration can be performed in one of three ways. If certified calibration gas is available, the **Cal Port Sample** calibration technique is the fastest and most convenient method. If a three-way valve is installed in the sample stream inlet, the **Inlet Port Sample** calibration technique is preferred, as the calibration gas passes through the filter, regulator, control valve, flow switch and flame arrestors, more closely simulating the path taken by the actual sample gas. Finally, if calibration gas is not available, but the stream contains a known amount of target gas, the **Stream Sample** calibration technique is available.

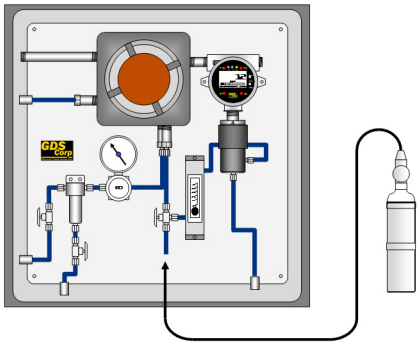
In all cases, the GDS-68XP should be calibrated at least once every three months. Furthermore, during the initial six months of operation, the GDS-68XP should be checked more often to verify that the sensor is operating properly and that some component of the sample gas mixture has not damaged the sensor or change the sensor's response to the target gas compound.

IMPORTANT: FOR MAXIMUM ACCURACY, USE CALIBRATION GAS WITH A CONCENTRATION VALUE THAT IS GREATER THAN 25% OF FULL SCALE AND LESS THAN 75% OF FULL SCALE.

Before beginning calibration, make sure you have the following items: A cylinder of calibration gas, fixed flow regulator and a length of flexible tubing.

CALIBRATION PROCEDURE (CAL PORT SAMPLE)

Calibration using the built-in calibration port is the fastest and most convenient method. When the GASMAX enters CAL MODE, the purge air pump automatically turns on to provide zero air flow from ambient air; sample air flow is provided by the fixed flow regulator connected to the calibration gas cylinder.

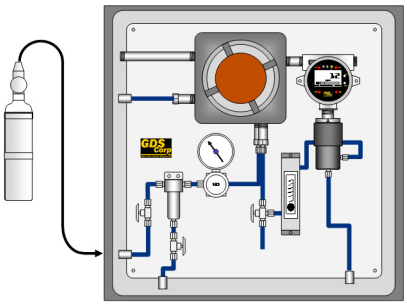


CALIBRATION PROCEDURE – CALIBRATION PORT	
OBTAIN THE FOLLOWING ITEMS: 1) CYLINDER OF CALIBRATION GAS WITH FIXED FLOW REGULATOR AND LENGTH OF FLEXIBLE TUBING 2) CYLINDER OF 'ZERO AIR' IF NECESSARY	
IF NOT PREVIOUSLY DONE: 1) VERIFY THAT THE CHANNEL 1 **CAL SPAN VALUE** MATCHES THE CALIBRATION GAS TO BE USED 2) VERIFY THAT THE CALIBRATION GAS IS NOT EXPIRED	
ENTER CAL MODE: **WAIT UNTIL THE SEQUENCER IS IN PURGE/HOLD MODE** AS INDICATED BY "L2" (GREEN) FLASH **PRESS THE "CAL" KEY FOLLOWED BY THE "EDIT" KEY**	**ATTEMPTING TO CALIBRATE THE GASMAX DURING A SAMPLE SEQUENCE WILL RESULT IN A CALIBRATION ERROR**
THE "APPLY ZERO GAS" SCREEN WILL APPEAR; L2 WILL CHANGE TO SINGLE FLASH PURGE AIR PUMP WILL TURN ON AND AMBIENT ("ZERO") AIR WILL FLOW INTO THE SENSOR FLOW CELL	
SET THE ZERO VALUE: ALLOW THE READING TO STABILIZE AND **PRESS THE "EDIT" KEY TO ACCEPT** THE CURRENT READING AS 'ZERO'	IF THERE IS A POSSIBILITY THAT TARGET GAS MAY BE PRESENT IN AMBIENT AIR, USE A CYLINDER OF ZERO AIR IN PLACE OF PURGE AIR
IF ZERO READING IS WITHIN LIMITS, THE **ZERO CAL SUCCESS** SCREEN WILL MOMENTARILY APPEAR THE "APPLY SPAN GAS" SCREEN WILL APPEAR	
SET THE SPAN VALUE: CONNECT THE SPAN GAS AS SHOWN ABOVE, SET THE RUN/CAL VALVE TO "CAL" AND TURN ON THE REGULATOR. VERIFY FLOW ON THE FLOW METER. ALLOW THE READING TO STABILIZE AND **PRESS THE "EDIT" KEY TO ACCEPT** THE CURRENT READING AS 'SPAN'	ALLOW THE GAS TO FLOW FOR ABOUT AS LONG AS IT DOES DURING A NORMAL SEQUENCE, USUALLY BETWEEN THREE AND FOUR MINUTES.
IF SPAN READING IS WITHIN LIMITS, THE **SPAN CAL SUCCESS** SCREEN WILL MOMENTARILY APPEAR THE GASMAX DUAL SCREEN WILL REAPPEAR SHOWING CHANNEL 1 IN PURPLE (CAL DELAY)	
COMPLETE CALIBRATION: DISCONNECT THE SPAN GAS CYLINDER AND SET THE RUN/CAL VALVE BACK TO "RUN"	ONCE CAL PURGE DELAY IS COMPLETE, THE SEQUENCER WILL RETURN TO THE PURGE/HOLD MODE

Figure 7-1: Calibration Procedure (Cal Port)

CALIBRATION PROCEDURE (INLET PORT SAMPLE)

Calibration using the Inlet Port will more closely approximate the actual sample gas flow path through the filter, regulator and sequencer valve. Connect the calibration gas cylinder and regulator to the input port, either directly or via a customer-supplied three-way valve such that the input can be connected to sample or calibration gas.

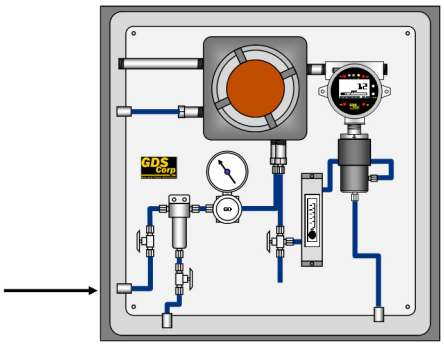


CALIBRATION PROCEDURE – INLET PORT	
OBTAIN THE FOLLOWING ITEMS: 1) CYLINDER OF CALIBRATION GAS WITH FIXED FLOW REGULATOR AND LENGTH OF FLEXIBLE TUBING 2) CYLINDER OF 'ZERO AIR' IF NECESSARY	
IF NOT PREVIOUSLY DONE: 1) VERIFY THAT THE CHANNEL 1 **CAL SPAN VALUE** MATCHES THE CALIBRATION GAS TO BE USED 2) VERIFY THAT THE CALIBRATION GAS IS NOT EXPIRED	
ENTER CAL MODE: **WAIT UNTIL THE SEQUENCER IS IN PURGE/HOLD MODE** AS INDICATED BY "L2" (GREEN) FLASH **PRESS THE "CAL" KEY FOLLOWED BY THE "EDIT" KEY**	**ATTEMPTING TO CALIBRATE THE GASMAX DURING A SAMPLE SEQUENCE WILL RESULT IN A CALIBRATION ERROR**
THE "APPLY ZERO GAS" SCREEN WILL APPEAR; L2 WILL CHANGE TO SINGLE FLASH PURGE AIR PUMP WILL TURN ON AND AMBIENT ("ZERO") AIR WILL FLOW INTO THE SENSOR FLOW CELL	
SET THE ZERO VALUE: ALLOW THE READING TO STABILIZE AND **PRESS THE "EDIT" KEY TO ACCEPT** THE CURRENT READING AS 'ZERO'	IF THERE IS A POSSIBILITY THAT TARGET GAS MAY BE PRESENT IN AMBIENT AIR, USE A CYLINDER OF ZERO AIR IN PLACE OF PURGE AIR
IF ZERO READING IS WITHIN LIMITS, THE **ZERO CAL SUCCESS** SCREEN WILL MOMENTARILY APPEAR THE "APPLY SPAN GAS" SCREEN WILL APPEAR	
SET THE SPAN VALUE: CONNECT THE SPAN GAS AS SHOWN ABOVE AND TURN ON THE REGULATOR. **PRESS "BYPASS" ON THE SEQUENCER** AND VERIFY FLOW ON THE FLOW METER. ALLOW THE READING TO STABILIZE AND **PRESS THE "EDIT" KEY TO ACCEPT** THE CURRENT READING AS 'SPAN'	PRESSING "BYPASS" ALLOWS CAL GAS TO FLOW THROUGH THE SEQUENCER. ALLOW THE GAS TO FLOW FOR ABOUT AS LONG AS IT DOES DURING A NORMAL SEQUENCE, USUALLY BETWEEN THREE AND FOUR MINUTES.
IF SPAN READING IS WITHIN LIMITS, THE **SPAN CAL SUCCESS** SCREEN WILL MOMENTARILY APPEAR THE GASMAX DUAL SCREEN WILL REAPPEAR SHOWING CHANNEL 1 IN PURPLE (CAL DELAY)	
COMPLETE CALIBRATION: PRESS "RUN" ON THE SEQUENCER AND DISCONNECT THE SPAN GAS CYLINDER	ONCE CAL PURGE DELAY IS COMPLETE, THE SEQUENCER WILL RETURN TO THE PURGE/HOLD MODE

Figure 7-2: Calibration Procedure (Inlet Port)

CALIBRATION PROCEDURE (STREAM SAMPLE)

In certain situations, calibration gas may not be available. However in some cases the target gas value may be known, either from lab tests, pull tubes or local analyzers. If the gas level is known, the following procedure can be used to adjust the output of the GDS-68XP to match the current level of target gas.



CALIBRATION PROCEDURE – STREAM SAMPLE	
OBTAIN THE FOLLOWING ITEMS: 1) CURRENT VALUE OF TARGET GAS PRESENT IN THE STREAM, MEASURED INDEPENDENTLY 2) CYLINDER OF 'ZERO AIR' IF NECESSARY	
SET CAL SPAN VALUE: SET THE CHANNEL 1 CAL SPAN VALUE TO MATCH THE PREDETERMINED LEVEL OF TARGET GAS IN THE GAS STREAM	**THIS PROCEDURE IS ONLY RECOMMENDED IF CERTIFIED CALIBRATION GAS IS UNAVAILABLE**
ENTER CAL MODE: **WAIT UNTIL THE SEQUENCER IS IN PURGE/HOLD MODE** AS INDICATED BY "L2" (GREEN) FLASH **PRESS THE "CAL" KEY FOLLOWED BY THE "EDIT" KEY**	**ATTEMPTING TO CALIBRATE THE GASMAX DURING A SAMPLE SEQUENCE WILL RESULT IN A CALIBRATION ERROR**
THE "APPLY ZERO GAS" SCREEN WILL APPEAR; L2 WILL CHANGE TO SINGLE FLASH PURGE AIR PUMP WILL TURN ON AND AMBIENT ("ZERO") AIR WILL FLOW INTO THE SENSOR FLOW CELL	
SET THE ZERO VALUE: ALLOW THE READING TO STABILIZE AND **PRESS THE "EDIT" KEY TO ACCEPT** THE CURRENT READING AS 'ZERO'	IF THERE IS A POSSIBILITY THAT TARGET GAS MAY BE PRESENT IN AMBIENT AIR, USE A CYLINDER OF ZERO AIR IN PLACE OF PURGE AIR
IF ZERO READING IS WITHIN LIMITS, THE **ZERO CAL SUCCESS** SCREEN WILL MOMENTARILY APPEAR THE "APPLY SPAN GAS" SCREEN WILL APPEAR	
SET THE SPAN VALUE: **PRESS "BYPASS" ON THE SEQUENCER** AND VERIFY FLOW ON THE FLOW METER. ALLOW THE READING TO STABILIZE AND **PRESS THE "EDIT" KEY TO ACCEPT** THE CURRENT READING AS 'SPAN'	PRESSING "BYPASS" ALLOWS TARGET GAS TO FLOW THROUGH THE SEQUENCER. ALLOW THE GAS TO FLOW FOR ABOUT AS LONG AS IT DOES DURING A NORMAL SEQUENCE, USUALLY BETWEEN THREE AND FOUR MINUTES.
IF SPAN READING IS WITHIN LIMITS, THE **SPAN CAL SUCCESS** SCREEN WILL MOMENTARILY APPEAR THE GASMAX DUAL SCREEN WILL REAPPEAR SHOWING CHANNEL 1 IN PURPLE (CAL DELAY)	
COMPLETE CALIBRATION: PRESS "RUN" ON THE SEQUENCER AND DISCONNECT THE SPAN GAS CYLINDER	ONCE CAL PURGE DELAY IS COMPLETE, THE SEQUENCER WILL RETURN TO THE PURGE/HOLD MODE

Figure 7-3: Calibration Procedure (Sample Stream)

8 OPERATION AND MAINTENANCE

NORMAL OPERATION

Once setup is complete, user intervention is not required and the GDS-68XP automatically measures and outputs the gas concentration value on an interval set by the sequence switch. When the GDS-68XP is running a sample sequence, the red LED ("L1") will be flashing. **Do not attempt to adjust any settings or perform a calibration during a sample sequence.** A complete sequence usually takes between 10 and 15 minutes to complete. To determine the current status of the sequence, count the number of L1 flashes and refer to Figure 6-3.

During purge / hold mode, the green LED ("L2") will be flashing, the gas detector can be calibrated and the sequence time can be adjusted. To change the sequence time, refer to Figure 3-2 and modify the SEQUENCE SWITCH setting as desired. Changing the sequence switch will not change the current delay time, but will set the delay for the next scheduled sample cycle. If it is desired to start a new cycle immediately, change the switch setting and then press and hold the RUN button for five seconds.

COLD WEATHER OPERATION

The GDS-68XP is designed for accurate and reliable operation across a wide range of operating conditions. Once running, the GDS-68XP generates sufficient heat to maintain operation to 0°F ambient. However, if the unit has been powered off, care should be taken during startup to make sure the purge air pump temperature is above 32°F prior to the application of DC power. To reduce the possibility of pump damage, in extremely cold weather GDS Corp recommends the 200W AC heater be turned on for several hours prior to applying DC power to the system. In addition, if the unit is to be left unpowered during extremely cold weather, GDS Corp recommends the sensor be removed and stored in a warm location.

NORMAL MAINTENANCE

Standard maintenance for the GDS-68XP consists of periodic checks on flow settings and sensor calibration. Each time a toxic sensor is calibrated, a Sensor Life reading will appear that gives an approximate indication of the remaining sensitivity. Sensor Life is not necessarily linear and a rapid reduction in the senor life reading can be due to temperature extremes, high levels of target gas, the presence of certain gases that 'poison' toxic sensors and other environmental factors.

Always check the flow meter for the presence of moisture. In the event that moisture or liquid is drawn in the GDS-68XP, the entire unit should be disassembled and cleaned. In some cases the flow meter or flow switch may need to be replaced. If liquid is drawn into the GDS-68XP, always inspect the sensor for signs of damage.

FAULT AND OVERRANGE CONDITIONS

The GDS-68XP contains multiple microprocessors that monitor flow rates and sensor readings to detect problems. In the event that a fault occurs during a sample sequence, the 4-20mA output will indicate one the following fault condition:.

POWER UP Immediately after power-up the GDS-68XP outputs 0mA (FAULT) for 8 seconds and then 4mA ("0") until the first reading is successfully recorded. This allows a remote device to determine if the GDS-68XP was forced to restart as a result of a power failure.

INPUT OVERRANGE FAULT To protect the electrochemical sensor in the event of an over-range condition during a sample measurement sequence, the sample valve will automatically and the purge air pump will be activated to force fresh air into the sensor cell.

SENSOR RECOVERY FAULT After the sensor output is monitored for a prompt return to zero. If the output does not return to a value of less than 10% of full scale during the recovery interval, the sensor may be saturated with sample gas and the GDS-68XP will indicate a "recovery fault"

PEAK ALGORITHM FAULT – During the sample sequence, the GDS-68XP looks for a level peak value. If no level peak is found, the GDS-68XP will indicate an "algorithm fault".

SAMPLE OR PURGE AIR FLOW FAULT If the sequencer senses a lack of flow for more than 10 seconds during the sample sequence, the GDS-68XP will indicate a "flow fault".

CALIBRATION FAULT – If the sensor output higher than 10% of scale, or lower than -10% of scale when a sequence starts the GDS-68XP will indicate a "calibration fault". The GDS-68XP will also indicate a "calibration fault" if the GASMAX is placed in Cal Mode at any time during a sample sequence.

SENSOR FAIL FAULT If the sensor is removed or fails in such a way as to cause a channel 1 sensor FAULT reading during a sample or sequence, the GDS-68XP will indicate a "sensor fault".

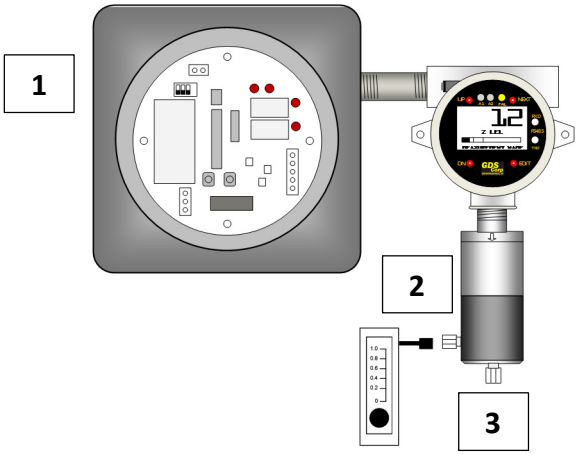
FAULT	REASON	% OF SCALE	OUTPUT (MA)	RANGE: 0-3.00	RANGE: 0-100
OVER-RANGE	INPUT EXCEEDS MAX RANGE VALUE	105%	21MA	"3.15"	"105"
RECOVERY FAULT	SENSOR FAILS TO DROP BELOW 10%	-15%	1.6 MA	"-0.45"	"-15"
PEAK FIND FAULT	PEAK FIND ALGORITHM TIMES OUT	-17.5%	1.2 MA	"-0.52"	"-17.5"
FLOW FAULT	GAS OR PURGE AIR FLOW DISRUPTED FOR > 10 SECONDS	-20%	0.8 MA	"-0.60"	"-20"
CALIBRATION FAULT	GASMAX CAL DURING SEQUENCE OR SENSOR INPUT > 10% OR < -10% OF SCALE AT START OF CYCLE	-22.5%	0.4 MA	"-0.67"	"-22.5"
SENSOR FAULT	SENSOR BAD OR IN FAULT	-25%	0.0 MA	"-0.75"	"-25"

Figure 8-1: Fault Conditions

SENSOR REPLACEMENT

If a sensor shows FAULT, does not respond to gas or can no longer be calibrated, it should be replaced.

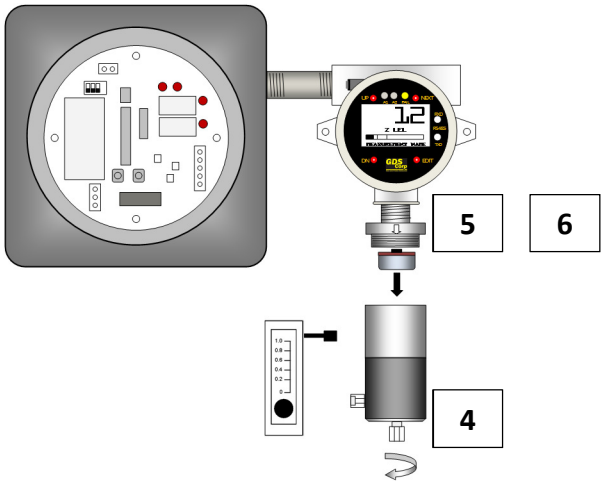
Use type 10-98XX-Ryyyy sensors, where the XX is gas type (Fig. 3-1) and yyyy is range (25 = “0025”).



Step 1: Turn off DC power.

Step 2: Disconnect the sample inlet tube at the sensor flow cell

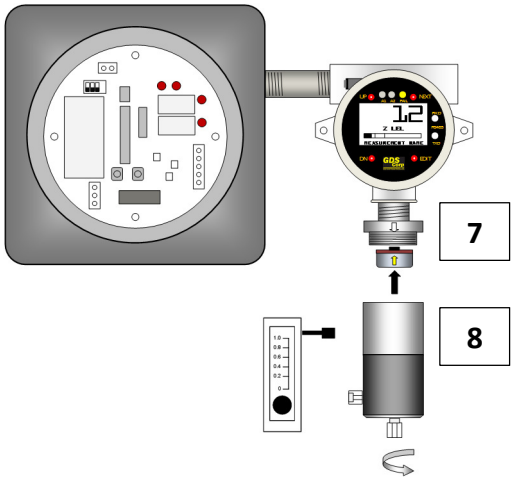
Step 3: Disconnect the sample exhaust tube at the flow cell.



Step 4: Unscrew the sensor flow cell and sensor head cover

Step 5: Pull straight down to remove the existing sensor.

Step 6: Compare the new sensor with the old sensor and verify identical part numbers



Step 7: Install the new sensor by aligning the arrow on the sensor with the arrow on the sensor head and pushing straight up.

Step 8: Reassemble the sensor head cover and flow cell and reattach the sample inlet and outlet tubing.

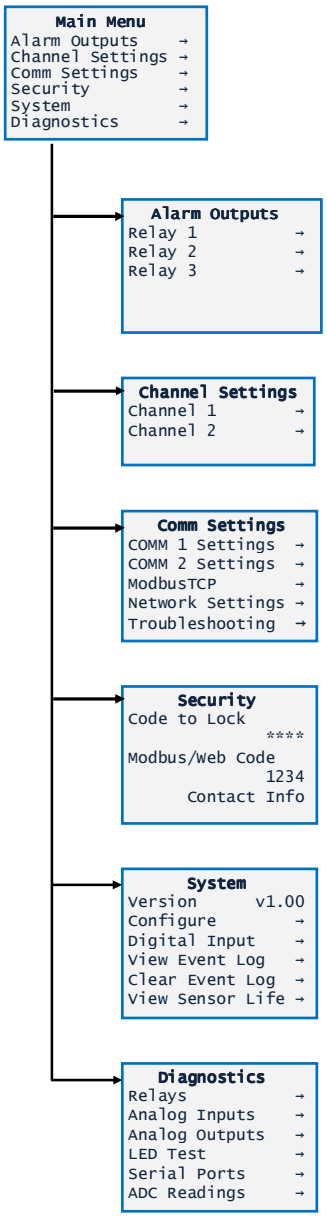
Step 9: Apply power, allow the sensor to warm up for several hours.

Step 10: Perform a complete calibration.

9 USER MENUS

The GASMAX CX gas monitor used in the GDS-68XP has a menu-driven user interface that allows the operator to review and adjust a wide range of settings. In the GDS-68XP, channel 1 of the GASMAX CX measures the "raw sensor" gas level and channel 2 provides continuous display, output and alarming on the stored value retained in the sequencer memory.

To access the Main Menu, activate the EDIT key with a magnetic wand.



Alarm Output Menu – contains settings that control the four optional alarm relays (if installed). These setting include relay programming, on and off delay, failsafe mode and specific input override.

Channel Settings Menu – contains settings specific to each channel. These include tag names, range, calibration settings and alarm levels.

Comm Settings Menu – contains settings specific to the Ethernet network interface, MODBUS/TCP interface and optional RS-485 serial ports (if installed).

Security Settings Menu – allows the user to restrict operation for some or all of the features as well as provide a programmed contact name.

System Settings Menu – contains settings that are unit specific. These include unit name. time and date, warm-up and calibration delay settings, and Event Log.

Diagnostics Menu – comprehensive set of tools that can be used to activate relays, simulate output values and test serial ports.

Figure 9-1: Main Menu Tree

ALARM OUTPUTS MENU

The Alarm Outputs Menu controls the four optional alarm relays (if installed). These setting include relay programming, acknowledge, failsafe mode and specific input override options.

NOTE: The Alarm / Modbus board containing the 3x alarm relays and 1x fault relay is optional on the GDS-68XP.

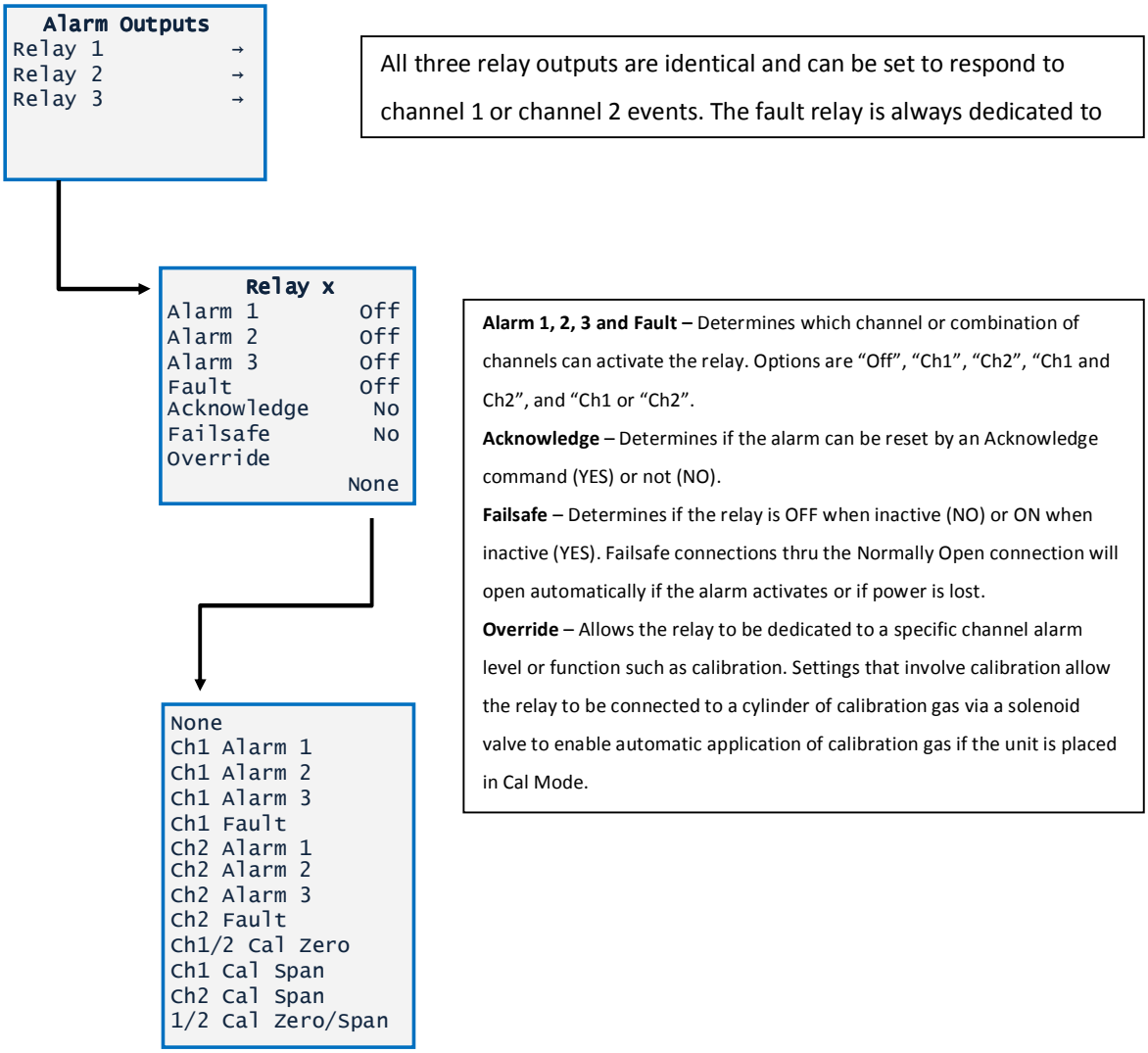
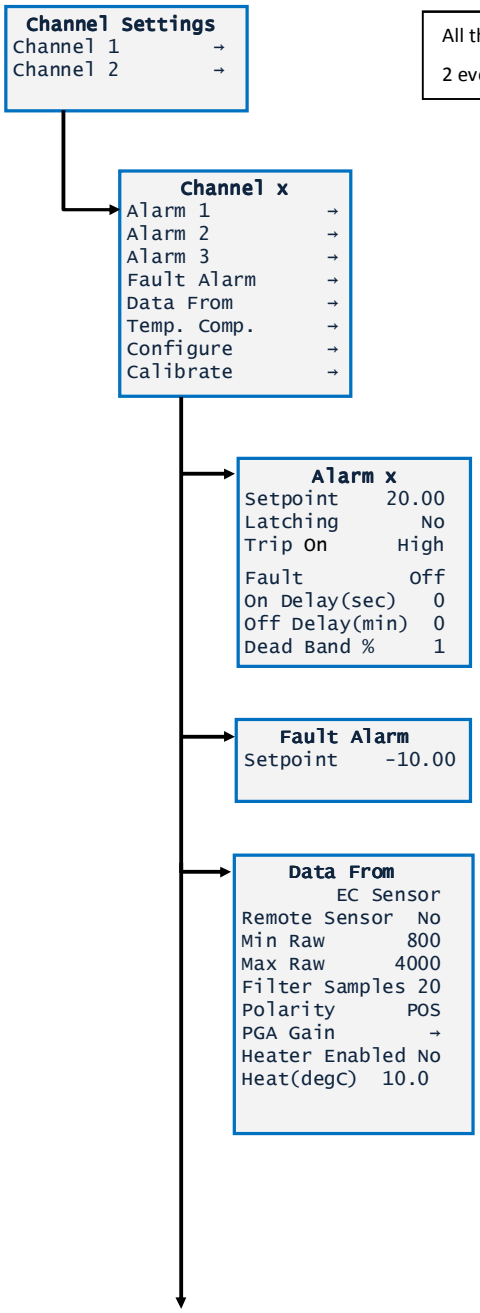


Figure 9-2: Alarm Outputs Menu Tree

CHANNEL SETTINGS MENU

The Channel Settings Menu allows the user to adjust individual channel or sensor-specific features. Data in the Channel Settings Menu is uploaded from Smart Sensors, and written back to any local Smart Sensor if changed in the menu.



All three relay outputs are identical and can be set to respond to channel 1 or channel 2 events. The fault relay is always dedicated to fault events.

Both channel setup menus are identical so only one is shown.

Alarm X menu (all three alarm setting menus are identical)

Set Point is the engineering unit value where the alarm trips. It may be negative or positive.

Latching YES causes the alarm to remain active even after the event clears. NO clears the alarm automatically.

Trip On HIGH causes the alarm to activate if the value goes above the setpoint. Trip On LOW activates the alarm if the value goes below the setpoint.

On / Off Delay adjusts the time delay between the time when the event occurs and when the alarm is activated.

Deadband prevents alarm cycling when the value is close to the alarm level.

Fault Alarm setpoint is typically set at -10% of full scale.

Data From Menu

Data From determines the source of the data for this channel.

Min Raw / Max Raw – Set the range of the input A/D converter. Normally set to 800 (min) and 4000 (max). Useful if a sensor's output does not provide a full range signal.

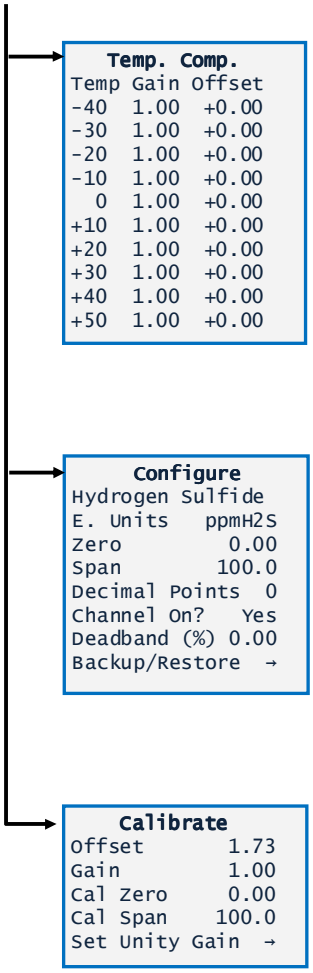
Filter Samples – Number of samples used by the smoothing filter.

PGA Gain – sets the analog amplification level in the smart sensor interface circuit. **WARNING: Changing PGA gain resets calibration data.**

Heater Enabled – Determines if the internal sensor heater is ON or OFF.

Heat(degC) – Heater thermostat setting.

Figure 9-3: Channel Settings Menu Tree (1)



Temperature Compensation compensates for changes in sensor output (gain) and zero value (offset) as sensor temperature changes. Individual values for gain and offset can be entered for eleven points ranging from minus 40C to +60C. Gain and offset values are linearly interpolated between points by the internal microprocessor.

NOTE: These values are typically set by the sensor manufacturer and should not be changed.

Configure Menu

Measurement Name – User-programmable character string to describe the channel. Otherwise called "tag name".

E. Units – User-programmable character string that describes the engineering units value.

Zero – Channel zero value, typically "0".

Span– Channel full scale value. Max value is "9999".

Decimal Points – Determines the number of displayed digits to the right of the decimal point.

Channel On? – Channel ON or OFF setting. An "OFF" channel will have no effect on any alarm or output value.

Deadband (%) – The value, around zero, for which the screen will show "0.0". Eliminates display of small values around zero due to sensor drift.

Calibrate Menu

Offset – Shows the computed offset value based on the latest calibration.

Gain – Shows the computed gain value based on the latest calibration.

Cal Zero – The value for the zero point calibration

Cal Span – The value for span calibration, typically 50% of full scale.

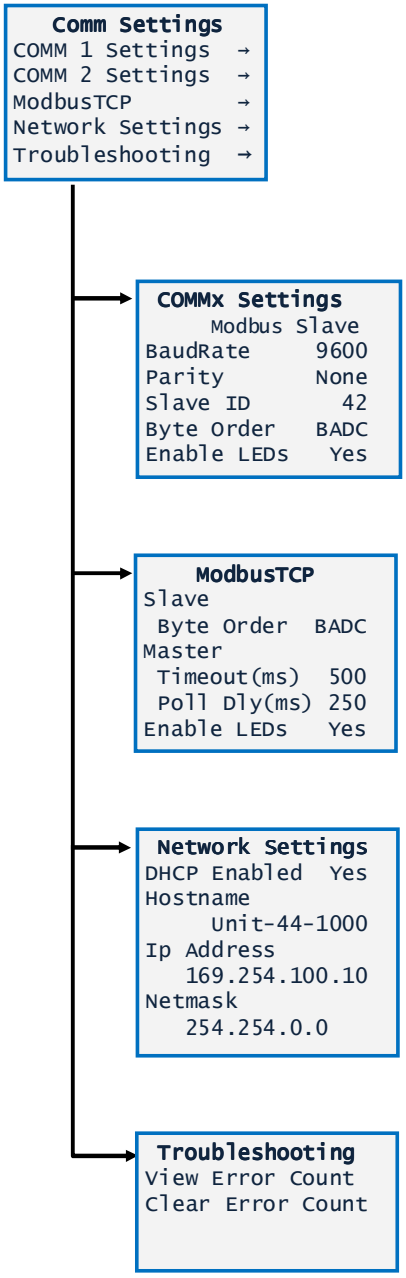
Set Unity Gain – Clears gain and offset to "1.00" and "0.00" respectively.

WARNING: Set Unity Gain resets calibration data.

Figure 9-4: Channel Settings Menu Tree (2)

COMM SETTINGS MENU

The Comm Settings Menu allows the user to configure the Ethernet interface, MODBUS/TCP slave and two optional RS-485 serial interfaces.



Comm X Menu (both comm port setting menus are identical)

Type ("Modbus Slave") determines whether the MODBUS port is a master or slave.

Baud Rate – Sets the baud rate for the serial port. Options are 9600, 19200, 38400, 57600 and 115200 baud.

Slave ID - Sets the MODBUS slave ID for the serial port.

Byte Order – sets the byte order for words larger than 16 bits.

Enable LEDs – If YES, front panel LEDs indicate MODBUS transmission.

MODBUS TCP Menu

Slave Settings:

Byte Order – sets the byte order for words larger than 16 bits.

Master Settings:

Timeout – Length of time (in mSec) that master will wait for a reply before indicating a comm timeout.

Poll Delay – Length of time (in mSec) between sequential read requests.

Enable LEDs – if YES, front panel LEDs indicate MODBUS / TCP transmission

Network Settings Menu

DHCP Enabled – If YES, uses a remote DHCP server to establish a network address. If NO, uses fixed address.

Hostname – Character string that defines device network name

IP Address – Network address. If DHCP enabled, will show address assigned by DHCP server. If DHCP disabled, is IP address programmed by user.

Net mask – Network mask value. See above.

Gateway – Network gateway value. See above.

Troubleshooting Menu

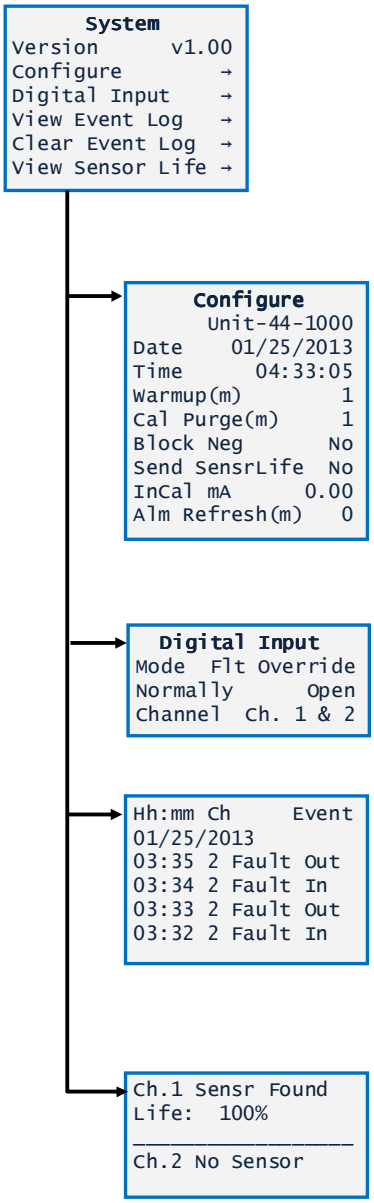
View Error Count – View a menu that tracks the number of network errors

Clear Error Count – Resets number of network errors to zero.

Figure 9-5: Comm Settings Menu

SYSTEM SETTINGS MENU

The Comm Settings Menu allows the user to configure the Ethernet interface, MODBUS/TCP slave and two optional RS-485 serial interfaces.



Configure Menu

Date & Time – Sets the system date and time. Used for display and event log entries.

Warm Up Delay – Sets length of time (in minutes) from power on to output signals active. During Warmup Delay the 4-20mA outputs are set to 4mA.

Cal Purge Delay - Sets length of time (in minutes) that outputs are disabled following a zero or span calibration

Block Negative – If YES, blocks screen from showing negative values.

Send Sensor Life – If YES, enables transmission of sensor life data across 4-20mA output (see GASMAX CX manual for more details).

InCal mA – Sets the 4-20mA output value to be transmitted during a calibration sequencer. Enables remote devices to track "In Cal" status.

Alarm Refresh – See GASMAX CX manual.

Digital Input Menu

Mode – Determines action if digital input (fault ack input) is activated.

Normally – If Normally OPEN the action will occur if the contacts close; if normally CLOSED the event will occur if the contacts open.

Channel – Determines which channel output is affected.

Event Log

Event Log Format – The event log includes the date, time and list of events that occur. Events include cold boot, system boot, alarm reset, remote alarm reset, log cleared, config edit, A1, A2 and A3 in and out, fault in and out, calibration in and out, calibration fail, communications error, config error and marker event.

Clear Event Log – Clears all entries in the event log.

View Sensor Life Menu

Life – Computed value based on initial stored 'gain' value when sensor was first calibrated. If new gain equals original gain, sensor life = 100%. If new gain equals twice original gain, sensor life = 0%.

Figure 9-6: System Settings Menu Tree

DIAGNOSTICS MENU

The Diagnostics page provides tools for use during setup or testing. Tests for optional features are not available if the feature is not installed.

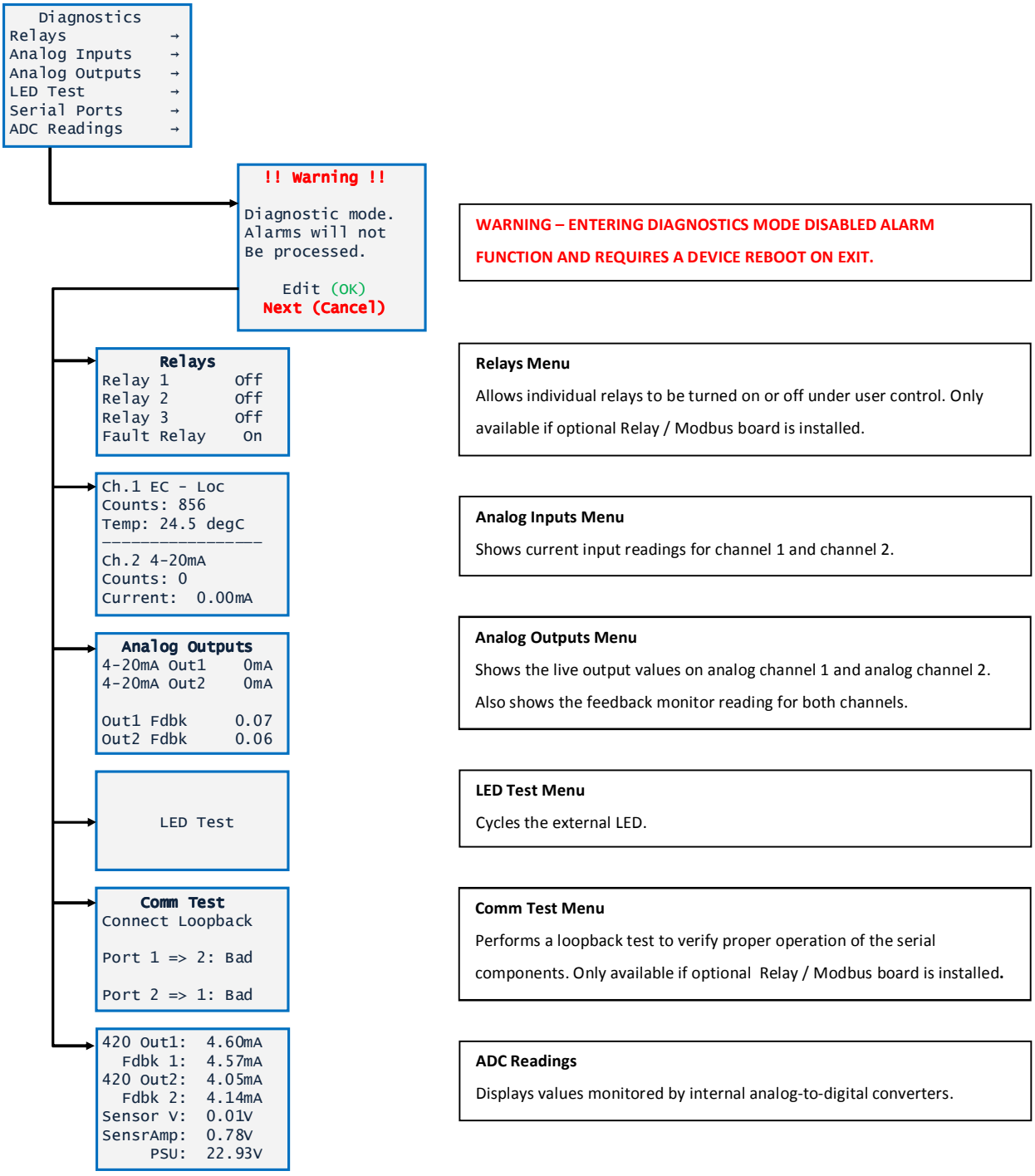


Figure 9-7: Diagnostics Menu Tree

10 MODBUS REGISTERS

The GDS-68XP features a full complement of user-accessible MODBUS registers that can provide a complete snapshot of the gas detector configuration. This includes all real-time data, preset zero, span and calibration values and user-programmable text.

LIST OF GDS-68XP MODBUS VARIABLES

Variable Name	Alias	Read	Write	Notes
Ch 1 Analog Output Raw	31001	4	N/A	12 bit value; 800 = 4mA, 4000 = 20mA
Ch 2 Analog Output Raw	31002	4	N/A	12 bit value; 800 = 4mA, 4000 = 20mA
Ch 1 A2D Raw Counts	31003	4	N/A	12 bit value from A/D converter
Ch 2 A2D Raw Counts	31004	4	N/A	12 bit value from A/D converter
Ch 1 Sensor Life	31009	4	N/A	16 bit signed integer ranging from -1 to 100 where -1 indicates Cal Required
Ch 2 Sensor Life	31010	4	N/A	16 bit signed integer ranging from -1 to 100 where -1 indicates Cal Required
Ch 1 Sensor Temp	31011	4	N/A	16 bit integer from 1 to 4095 scaled for -55°C to +125°C
Ch 2 Sensor Temp	31012	4	N/A	16 bit integer from 1 to 4095 scaled for -55°C to +125°C
Ch 1 4-20mA Out FP	31210	4	N/A	32 bit floating point
Ch 2 4-20mA Out FP	31212	4	N/A	32 bit floating point
Ch 1 Output Feedback FP	31214	4	N/A	32 bit floating point
Ch 2 Output Feedback FP	31216	4	N/A	32 bit floating point
12V Input FP	31218	4	N/A	32 bit floating point
Sensor Volts FP	31220	4	N/A	32 bit floating point
Bridge Amp FP	31222	4	N/A	32 bit floating point
Bridge Out FP	31224	4	N/A	32 bit floating point
Product ID	32001	4	N/A	Factory use only
Version	32002	4	N/A	Factory use only
Custom Feature	32003	4	N/A	Factory use only
Customer ID	32004	4	N/A	Factory use only
Lock Status	32005	4	N/A	
Boot Year	32006	4	N/A	Last power-up time & date
Boot Month	32007	4	N/A	Last power-up time & date
Boot Day	32008	4	N/A	Last power-up time & date
Boot Hour	32009	4	N/A	Last power-up time & date
Boot Minute	32010	4	N/A	Last power-up time & date
Boot Second	32011	4	N/A	Last power-up time & date
SR 1 State	32020	4	N/A	True if relay #1 active

SR 2 State	32021	4	N/A	True if relay #2 active
SR 3 State	32022	4	N/A	True if relay #3 active
FR State	32023	4	N/A	True if fault relay active
Warmup	32025	4	N/A	True if unit in warm-up
SR 1 Flashing	32026	4	N/A	True if relay #1 flashing
SR 2 Flashing	32027	4	N/A	True if relay #2 flashing
SR 3 Flashing	32028	4	N/A	True if relay #3 flashing
FR Flashing	32029	4	N/A	True if fault relay flashing
DI State	32034	4	N/A	Digital input status
Ch 1 Fixed Point	33001	4	N/A	Compatible with GASMAX II
CH 2 Fixed Point	33002	4	N/A	Compatible with GASMAX II
Ch 1 Floating Point	33010	4	N/A	32 bit IEEE 754 float
Ch 1 Value String	33012	4	N/A	6 character string, zero terminated
Ch 1 Temperature Float	33015	4	N/A	Sensor temperature
Ch 1 A1 Status	33017	4	N/A	True if alarm 1 active
Ch 1 A1 Flashing	33018	4	N/A	True if alarm 1 indicator flashing
Ch 1 A2 Status	33019	4	N/A	True if alarm 2 active
Ch 1 A2 Flashing	33020	4	N/A	True if alarm 2 indicator flashing
Ch 1 A3 Status	33021	4	N/A	True if alarm 3 active
Ch 1 A3 Flashing	33022	4	N/A	True if alarm 3 indicator flashing
Ch 1 Fault Status	33023	4	N/A	True if fault active
Ch 1 Comm Error	33024	4	N/A	True if comm error
Ch 1 Config Error	33025	4	N/A	True if config error
Ch 1 I/O Error	33026	4	N/A	True if input/output error
Ch 1 Cal Flag	33027	4	N/A	True if calibration in progress
Ch 1 Marker Flag	33028	4	N/A	True if marker active
Ch 1 Linearize	33029	4	N/A	True if linearization table active
Ch 1 Err Flashing	33030	4	N/A	True if channel error
Ch 2 Floating Point	33040	4	N/A	32 bit IEEE 754 float
Ch 2 Value String	33042	4	N/A	6 character string, zero terminated
Ch 2 Temp Float	33045	4	N/A	Sensor temperature
Ch 2 A1 Status	33047	4	N/A	True if alarm 1 active
Ch 2 A1 Flashing	33048	4	N/A	True if alarm 1 indicator flashing
Ch 2 A2 Status	33049	4	N/A	True if alarm 2 active
Ch 2 A2 Flashing	33050	4	N/A	True if alarm 2 indicator flashing
Ch 2 A3 Status	33051	4	N/A	True if alarm 3 active
Ch 2 A3 Flashing	33052	4	N/A	True if alarm 3 indicator flashing
Ch 2 Fault Status	33053	4	N/A	True if fault active
Ch 2 Comm Error	33054	4	N/A	True if comm error
Ch 2 Config Error	33055	4	N/A	True if config error

Ch 2 I/O Error	33056	4	N/A	True if input/output error
Ch 2 Cal Flag	33057	4	N/A	True if calibration in progress
Ch 2 Marker Flag	33058	4	N/A	True if marker active
Ch 2 Linearize	33059	4	N/A	True if linearization table active
Ch 2 Err Flashing	33060	4	N/A	True if channel error
Alarm Reset	40001	N/A	3	Write to acknowledge alarm
System Name	40010	4	N/A	16 character ASCII text
Date Year	40020	3	N/A	Current time & date
Date Month	40021	3	N/A	Current time & date
Date Day	40022	3	N/A	Current time & date
Date Hour	40023	3	N/A	Current time & date
Date Minute	40024	3	N/A	Current time & date
Date Second	40025	3	N/A	Current time & date
Refresh Time	40026	3	N/A	Alarm refresh (minutes)
Warmup Time	40027	3	N/A	Warm up delay (minutes)
Cal Purge Time	40028	3	N/A	Cal purge delay (minutes)
Block Negative Flag	40029	3	N/A	True if prohibit display of neg values
Comm 1 Function	40030	3	N/A	MODBUS serial port #1
Comm 1 Baud Rate	40031	3	N/A	MODBUS serial port #1
Comm 1 Parity	40032	3	N/A	MODBUS serial port #1
Comm 1 Slave ID	40033	3	N/A	MODBUS serial port #1
Comm 1 Timeout	40034	3	N/A	MODBUS serial port #1
Comm 1 Poll Delay	40035	3	N/A	MODBUS serial port #1
Comm 1 Byte Order	40036	3	N/A	MODBUS serial port #1
Comm 1 Wireless T/O	40037	3	N/A	MODBUS serial port #1
Comm 1 LED Enable	40038	3	N/A	MODBUS serial port #1
Comm 2 Function	40040	3	N/A	MODBUS serial port #2
Comm 2 Baud Rate	40041	3	N/A	MODBUS serial port #2
Comm 2 Parity	40042	3	N/A	MODBUS serial port #2
Comm 2 Slave ID	40043	3	N/A	MODBUS serial port #2
Comm 2 Timeout	40044	3	N/A	MODBUS serial port #2
Comm 2 Poll Delay	40045	3	N/A	MODBUS serial port #2
Comm 2 Byte Order	40046	3	N/A	MODBUS serial port #2
Comm 2 Wireless T/O	40047	3	N/A	MODBUS serial port #2
Comm 2 LED Enable	40048	3	N/A	MODBUS serial port #2
DHCP Enabled	40050	3	N/A	Ethernet port; DHCP or fixed address
Host Name	40051	3	N/A	Ethernet port: 16 ASCII characters
IP Address	40066	3	N/A	Ethernet port: xxx.xxx.xxx.xxx
Net Mask	40070	3	N/A	Ethernet port: xxx.xxx.xxx.xxx

Gateway IP	40074	3	N/A	Ethernet port: xxx.xxx.xxx.xxx
Modbus TCP Byte Order	40080	3	N/A	MODBUS/TCP function
Modbus TCP Timeout	40081	3	N/A	MODBUS/TCP timeout (mSec)
Modbus TCP Poll Delay	40082	3	N/A	MODBUS/TCP poll delay (mSec)
Save Config	40095	N/A	3	Write command to save local config
Config Changed	40096	3	N/A	True if config changed since last read
Security Unlock	40099	3	N/A	TBD
Relay 1 A1 Votes	40101	3	N/A	Alarm relay #1 configuration
Relay 1 A2 Votes	40102	3	N/A	Alarm relay #1 configuration
Relay 1 A3 Votes	40103	3	N/A	Alarm relay #1 configuration
Relay 1 Fault Votes	40104	3	N/A	Alarm relay #1 configuration
Relay 1 Override	40105	3	N/A	Alarm relay #1 configuration
Relay 1 Ack	40107	3	N/A	Alarm relay #1 configuration
Relay 1 Failsafe	40108	3	N/A	Alarm relay #1 configuration
Relay 2 A1 Votes	40111	3	N/A	Alarm relay #2 configuration
Relay 2 A2 Votes	40112	3	N/A	Alarm relay #2 configuration
Relay 2 A3 Votes	40113	3	N/A	Alarm relay #2 configuration
Relay 2 Fault Votes	40114	3	N/A	Alarm relay #2 configuration
Relay 2 Override	40115	3	N/A	Alarm relay #2 configuration
Relay 2 Ack	40117	3	N/A	Alarm relay #2 configuration
Relay 2 Failsafe	40118	3	N/A	Alarm relay #2 configuration
Relay 3 A1 Votes	40121	3	N/A	Alarm relay #3 configuration
Relay 3 A2 Votes	40122	3	N/A	Alarm relay #3 configuration
Relay 3 A3 Votes	40123	3	N/A	Alarm relay #3 configuration
Relay 3 Fault Votes	40124	3	N/A	Alarm relay #3 configuration
Relay 3 Override	40125	3	N/A	Alarm relay #3 configuration
Relay 3 Ack	40127	3	N/A	Alarm relay #3 configuration
Relay 3 Failsafe	40128	3	N/A	Alarm relay #3 configuration
Force Sensor Upload	40141	3	N/A	Binary
Digital Input Mode	40150	3	N/A	Alarm ack or flow switch input
Digital Input Type	40151	3	N/A	Alarm ack or flow switch input
Digital Input Mode	40152	3	N/A	Alarm ACK or flow switch input
Send Sensor Life	40153	3	N/A	True if transmit sensor life value
Contact Info String	40160	3	N/A	16 ASCII characters (2 per register)
Ch 1 Measurement Name	40401	3	N/A	16 ASCII characters (2 per register)
Ch 2 Measurement Name	40409	3	N/A	16 ASCII characters (2 per register)
Ch 1 EUNITS	40423	3	N/A	10 ASCII characters (2 per register)
Ch 2 EUNITS	40428	3	N/A	10 ASCII characters (2 per register)

Ch 1 Preamp gain	40433	3	N/A	Contact factory
Ch 2 Preamp gain	40434	3	N/A	Contact factory
Ch 1 Cal Zero	42001	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 1 Cal Span	42003	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 1 Zero Value	42005	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 1 Span Value	42007	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 1 Fault Value	42009	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 1 Alarm 1 Setpoint	42011	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 1 Alarm 2 Setpoint	42013	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 1 Alarm 3 Setpoint	42015	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 1 Manual Gain	42017	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 1 Manual Offset	42019	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 2 Cal Zero Value	42021	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 2 Cal Span Value	42023	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 2 Zero Value	42025	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 2 Span Value	42027	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 2 Fault Value	42029	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 2 Alarm 1 Setpoint	42031	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 2 Alarm 2 Setpoint	42033	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 2 Alarm 3 Setpoint	42035	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 2 Manual Gain	42037	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 2 Manual Offset	42039	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 1 Alarm 1 Latch	43001	3	N/A	False = NO, True = YES
Ch 1 Alarm 1 Trip	43002	3	N/A	False = HIGH, True = LOW
Ch 1 Alarm 1 On Delay	43003	3	N/A	Activation delay in seconds
Ch 1 Alarm 1 Off Delay	43004	3	N/A	Deactivation delay in minutes
Ch 1 Alarm 1 Hysteresis	43005	3	N/A	Percent of scale
Ch 1 Alarm 2 Latch	43011	3	N/A	False = NO, True = YES
Ch 1 Alarm 2 Trip	43012	3	N/A	False = HIGH, True = LOW
Ch 1 Alarm 2 On Delay	43013	3	N/A	Activation delay in seconds
Ch 1 Alarm 2 Off Delay	43014	3	N/A	Deactivation delay in minutes
Ch 1 Alarm 2 Hysteresis	43015	3	N/A	Percent of scale
Ch 1 Alarm 2 Color	43016	3	N/A	TBD
Ch 1 Alarm 3 Latch	43021	3	N/A	False = NO, True = YES
Ch 1 Alarm 3 Trip	43022	3	N/A	False = HIGH, True = LOW
Ch 1 Alarm 3 On Delay	43023	3	N/A	Activation delay in seconds
Ch 1 Alarm 3 Off Delay	43024	3	N/A	Deactivation delay in minutes
Ch 1 Alarm 3 Hysteresis	43025	3	N/A	Percent of scale
Ch 1 Alarm 3 Color	43026	3	N/A	TBD
Ch 1 Alarm 3 Enabled	43027	3	N/A	False = NO, True = YES

Ch 1 Data From	43031	3	N/A	Selection
Ch 1 Min Raw	43032	3	N/A	Binary (800)
Ch 1 Max Raw	43033	3	N/A	Binary (4000)
Ch 1 Remote ID	43034	3	N/A	Binary
Ch 1 Interface	43035	3	N/A	Binary
Ch 1 Byte Order	43036	3	N/A	Byte order
Ch 1 Alias	43037	3	N/A	Binary, 32 bit, 2x
Ch 1 IP Address	43039	3	N/A	Binary, 4x unsigned bytes
Ch 1 Port	43041	3	N/A	Binary, 32 bit, 2x
Ch 1 Remote Sensor	43043	3	N/A	Binary
Ch 1 DP	43079	3	N/A	Number of decimal points
Ch 1 Enable	43080	3	N/A	False = NO, True = YES
Ch 1 Deadband	43081	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 1 Marker Enable	43083	3	N/A	False = NO, True = YES
Ch 1 Marker Percent	43084	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 1 Marker Info	43086	3	N/A	6 ASCII characters
Ch 1 Marker Life	43089	3	N/A	Binary
Ch 1 Filter Count	43090	3	N/A	Binary, 0 to 60
Ch 1 Radio Reg	43091	3	N/A	Binary
Ch 1 Coefficient	43092	3	N/A	Binary
Ch 1 Bridge Voltage	43093	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 1 Balance	43095	3	N/A	Binary
Ch 1 Heater Enable	43096	3	N/A	False = NO, True = YES
Ch 1 Heater Setpoint	43097	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 1 Temp Comp -40	43099	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 1 Temp Comp -30	43103	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 1 Temp Comp -20	43107	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 1 Temp Comp -10	43111	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 1 Temp Comp 0	43115	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 1 Temp Comp +10	43119	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 1 Temp Comp +20	43123	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 1 Temp Comp +30	43127	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 1 Temp Comp +40	43131	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 1 Temp Comp +50	43135	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 1 Temp Comp +60	43139	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 1 Sensor Type	43143	3	N/A	TBD
Ch 1 Send Sensor Life	43144	3	N/A	False = NO, True = YES
Ch 1 Cal mA Setting	43145	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 1 Local Cal	43147	3	N/A	False = NO, True = YES
Ch 1 AI Range	43148	3	N/A	TBD

Ch 2 Alarm 1 Latch	43201	3	N/A	False = NO, True = YES
Ch 2 Alarm 1 Trip	43202	3	N/A	False = HIGH, True = LOW
Ch 2 Alarm 1 On Delay	43203	3	N/A	Activation delay in seconds
Ch 2 Alarm 1 Off Delay	43204	3	N/A	Deactivation delay in minutes
Ch 2 Alarm 1 Hysteresis	43205	3	N/A	Percent of scale
Ch 2 Alarm 2 Latch	43211	3	N/A	False = NO, True = YES
Ch 2 Alarm 2 Trip	43212	3	N/A	False = HIGH, True = LOW
Ch 2 Alarm 2 On Delay	43213	3	N/A	Activation delay in seconds
Ch 2 Alarm 2 Off Delay	43214	3	N/A	Deactivation delay in minutes
Ch 2 Alarm 2 Hysteresis	43215	3	N/A	Percent of scale
Ch 2 Alarm 2 Color	43216	3	N/A	TBD
Ch 2 Alarm 3 Latch	43221	3	N/A	False = NO, True = YES
Ch 2 Alarm 3 Trip	43222	3	N/A	False = HIGH, True = LOW
Ch 2 Alarm 3 On Delay	43223	3	N/A	Activation delay in seconds
Ch 2 Alarm 3 Off Delay	43224	3	N/A	Deactivation delay in minutes
Ch 2 Alarm 3 Hysteresis	43225	3	N/A	Percent of scale
Ch 2 Alarm 3 Color	43226	3	N/A	TBD
Ch 2 Alarm 3 Enabled	43227	3	N/A	False = NO, True = YES
Ch 2 Data From	43231	3	N/A	Selection
Ch 2 Min Raw	43232	3	N/A	Binary (800)
Ch 2 Max Raw	43233	3	N/A	Binary (4000)
Ch 2 Remote ID	43234	3	N/A	Binary
Ch 2 Interface	43235	3	N/A	Binary
Ch 2 Byte Order	43236	3	N/A	Byte order
Ch 2 Alias	43237	3	N/A	Binary, 32 bit, 2x
Ch 2 IP Address	43239	3	N/A	Binary, 4x unsigned bytes
Ch 2 Port	43241	3	N/A	Binary, 32 bit, 2x
Ch 2 Remote Sensor	43243	3	N/A	Binary
Ch 2 DP	43279	3	N/A	Number of decimal points
Ch 2 Enable	43280	3	N/A	False = NO, True = YES
Ch 2 Deadband	43281	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 2 Marker Enable	43283	3	N/A	False = NO, True = YES
Ch 2 Marker Percent	43284	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 2 Marker Info	43286	3	N/A	6 ASCII characters
Ch 2 Marker Life	43289	3	N/A	Binary
Ch 2 Filter Count	43290	3	N/A	Binary, 0 to 60
Ch 2 Radio Reg	43291	3	N/A	Binary
Ch 2 Coefficient	43292	3	N/A	Binary
Ch 2 Bridge Voltage	43293	3	N/A	Modbus 32 bit IEEE 754 Floating Pt

Ch 2 Balance	43295	3	N/A	Binary
Ch 2 Heater Enable	43296	3	N/A	False = NO, True = YES
Ch 2 Heater Setpoint	43297	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 2 Temp Comp -40	43299	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 2 Temp Comp -30	43303	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 2 Temp Comp -20	43307	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 2 Temp Comp -10	43311	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 2 Temp Comp 0	43315	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 2 Temp Comp +10	43319	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 2 Temp Comp +20	43323	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 2 Temp Comp +30	43327	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 2 Temp Comp +40	43331	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 2 Temp Comp +50	43335	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 2 Temp Comp +60	43339	3	N/A	32 bit FP Gain, 32 bit FP Offset
Ch 2 Sensor Type	43343	3	N/A	TBD
Ch 2 Send Sensor Life	43344	3	N/A	False = NO, True = YES
Ch 2 Cal mA Setting	43345	3	N/A	Modbus 32 bit IEEE 754 Floating Pt
Ch 2 Local Cal	43347	3	N/A	False = NO, True = YES
Ch 2 AI Range	43348	3	N/A	TBD
				Registers 45001-45022 added in V1.03
Ch 1 Value	45001	3	N/A	800 = “0”, 4000 = Full Scale
Ch 2 Value	45002	3	N/A	800 = “0”, 4000 = Full Scale
Ch 1 Value	45003/04	3	N/A	MODBUS 32 bit floating point
Ch 2 Value	45005/06	3	N/A	MODBUS 32 bit floating point
Ch 1 Alarm 1 Status	45007	3	N/A	“1” = Fault
Ch 1 Alarm 2 Status	45008	3	N/A	“1” = Fault
Ch 1 Alarm 3 Status	45009	3	N/A	“1” = Fault
Ch 1 Fault Status	45010	3	N/A	“1” = Fault
Ch 2 Alarm 1 Status	45011	3	N/A	“1” = Fault
Ch 2 Alarm 2 Status	45012	3	N/A	“1” = Fault
Ch 2 Alarm 3 Status	45013	3	N/A	“1” = Fault
Ch 2 Fault Status	45014	3	N/A	“1” = Fault
Ch 1 Sensor Life	45015	3	N/A	0-100 binary
Ch 2 Sensor Life	45016	3	N/A	0-100 binary
Ch 1 Sensor Temp	45017	3	N/A	Binary 0 - 4095
Ch2 Sensor Temp	45018	3	N/A	Binary 0 - 4095
Ch 1 Sensor Temp	45019/20	3	N/A	MODBUS 32 bit floating point
Ch 2 Sensor Temp	45021/22	3	N/A	MODBUS 32 bit floating point

11 TROUBLESHOOTING GUIDELINES

FAULT INDICATION ON OUTPUT CHANNEL (CH2)

- Value shows +105% of scale – indicates an **OVERRANGE** condition, where the sample gas caused the sensor to read more than 100% of scale.
- Value shows -15% of scale – indicates a **NON-RETURN-TO-ZERO FAULT** during recovery mode. Indicates sensor may be saturated with target gas. Increase the purge interval to allow more time for the sensor to recover.
- Value shows -17.5% of scale – indicates a **SAMPLE PEAK IDENTIFICATION ALGORITHM FAULT**; peak was not found in maximum allotted time. Check sample flow rates and sensor life.
- Values shows -20% of scale – indicates a **LOSS OF FLOW** for more than 10 seconds during sample pre-charge or sample recovery. Check sample flow or pump performance.
- Value shows -22.5% of scale – indicates a **CALIBRATION** fault – either the resting input value at the start of the last cycle was higher than 10% of scale OR a GASMAX calibration occurred during the cycle.
- Value shows -25% of scale – indicates **SENSOR FAULT** from GASMAX monitor.

FAULT INDICATION ON RAW SENSOR CHANNEL (CH1)

- Fault or Overrange on power-up. Certain toxic sensors indicate off-scale low or high at power up and quickly drift towards zero. This is normal behavior.
- Continuous Fault indication. Remove sensor and examine for moisture or discoloration. Replace sensor if wet or discolored. Fault indication generally indicates sensor useful life is exhausted.
- Sensors left unpowered for more than 3 months are subject to accelerated degradation and may demonstrate a permanent loss of sensitivity.

SENSOR FAILS CALIBRATION

- Sensor reading during zero calibration exceeds upper limit of zero – sensor is defective and should be replaced.
- Sensor reading during span calibration too low – sensor may be defective. However, it may be possible to *temporarily* continue operation by increasing PREAMP GAIN.

GDS-68XP AND RECEIVING DEVICE DISPLAYED VALUES DON'T MATCH

- Check that zero and full scale range values match between GDS-68XP and receiving device (controller). Use DIAGNOSTICS menu to force the OUTPUT channel (Ch2) to 12mA and verify half-scale reading on remote controller.
- Check for high impedance shorts to ground on 4-20mA wiring.

- If 4-20mA output is off-scale low or high and cannot be adjusted using DIAGNOSTICS mode, IO/Power Supply board may be defective and should be replaced.

CONTROLLER MODBUS DATA INCORRECT

- Verify that MODBUS master is requesting data from correct data register (31002).
- Verify that controller MIN and MAX count settings are correct. MIN counts should be "800" which corresponds to 4mA and MAX counts should be "4000" which corresponds to 20 mA.
- Verify that the GDS-68XP MODBUS address matches the address programmed into the controller's channel configuration.

CONTROLLER SHOWING MODBUS COMM ERROR

- Check for incorrect MODBUS polarity (swap "A" and "B" if unsure; no damage will occur).
- Verify that MODBUS master is requesting data from correct MODBUS address.
- Verify that MODBUS master is requesting data from register 31002.
- Verify that there are no other MODBUS slave devices with identical MODBUS address.

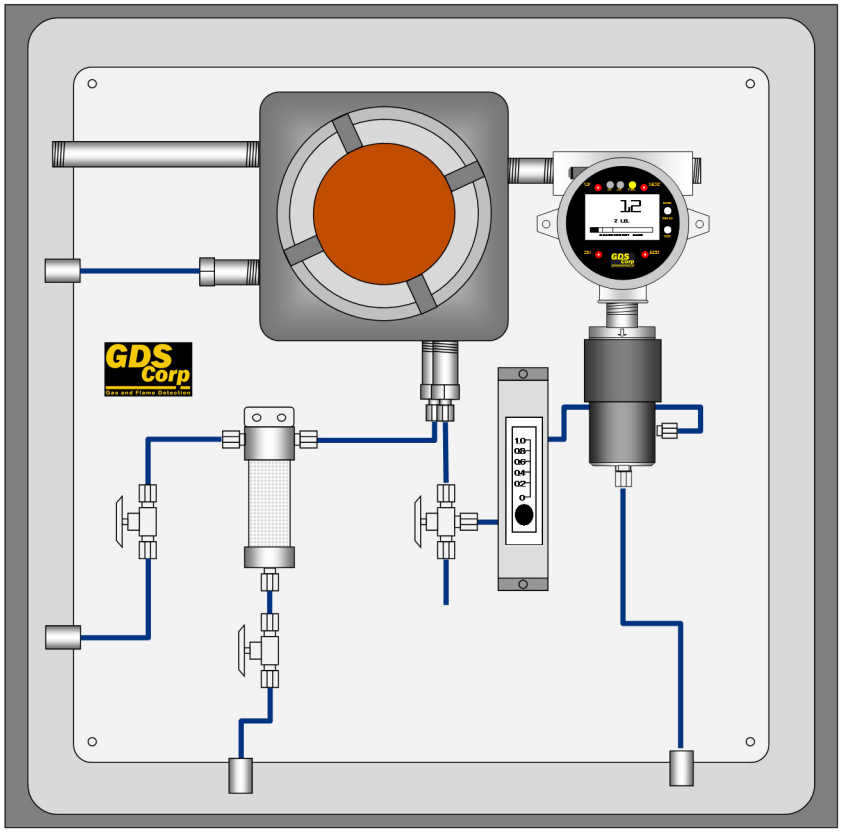
GDS-68XP DISPLAY BLANK

- Verify DC power at IO/Power Supply board, TB2, terminals 1 (+24) and 4 (Gnd).
- Verify ribbon cable connected between IO/Power Supply board and Display Assembly.

12 SPARE PARTS

Sequencer Assembly	
20-0142	Sequencer (processor PCB), sample draw
20-0143	Sequencer (actuators PCB),sample draw, includes pump, flow switch and 3-way valve, sample draw
1200-0034	Flame Arrestors (3)

Sequencer Actuators	
1200-0234	Sample Pump
1200-0047	Flow Switch
1200-0034	3-way valve



Display:

10-0387

I/O Board:

10-0390

Optional Relays & MB

10-0388

Sensor Head:

10-0247

Flow Cell:

10-0205

Filter

10-0205

Filter Element

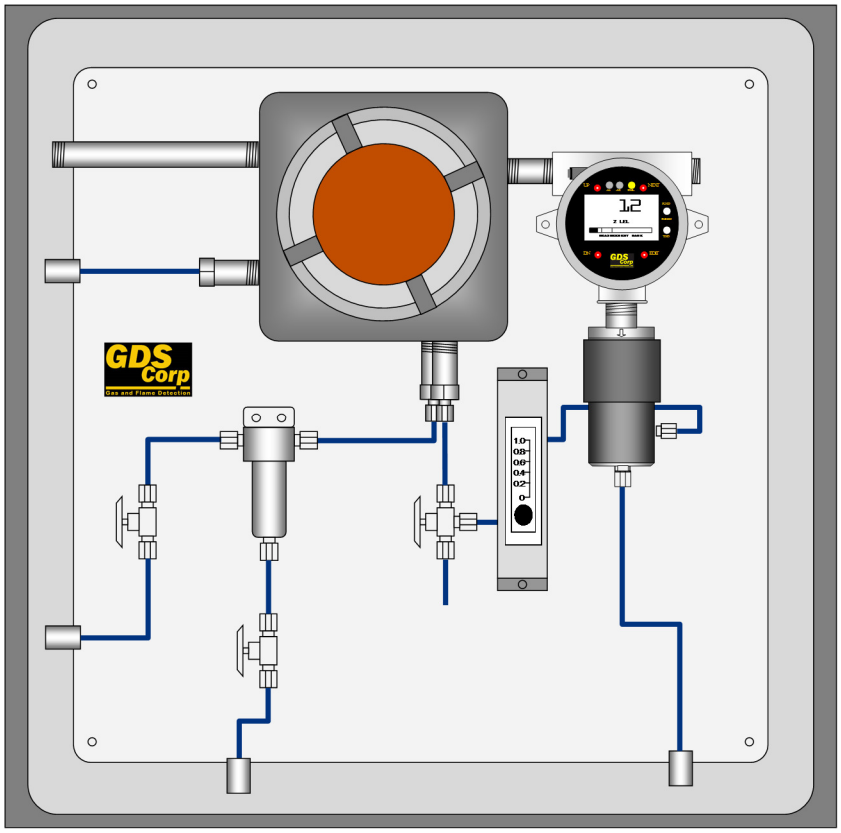
10-xxxx

1200-0056
Flow Meter

Figure 12-1: GDS-68XP Sample Draw Coalescing Filter (Spare Parts)

Sequencer Assembly	
20-0057	Sequencer (processor PCB)
20-0058	Sequencer (actuators PCB, includes pump, flow switch and 3-way valve
1200-0034	Flame Arrestors (3)

Sequencer Actuators	
1200-0234	Sample Pump
1200-0047	Flow Switch
1200-0034	3-way valve



Display:
10-0387
I/O Board:
10-0390
Optional Relays & MB
10-0388

Sensor Head:
10-0247
Flow Cell:
10-0205

Filter
10-0205
Filter Element
10-xxxx

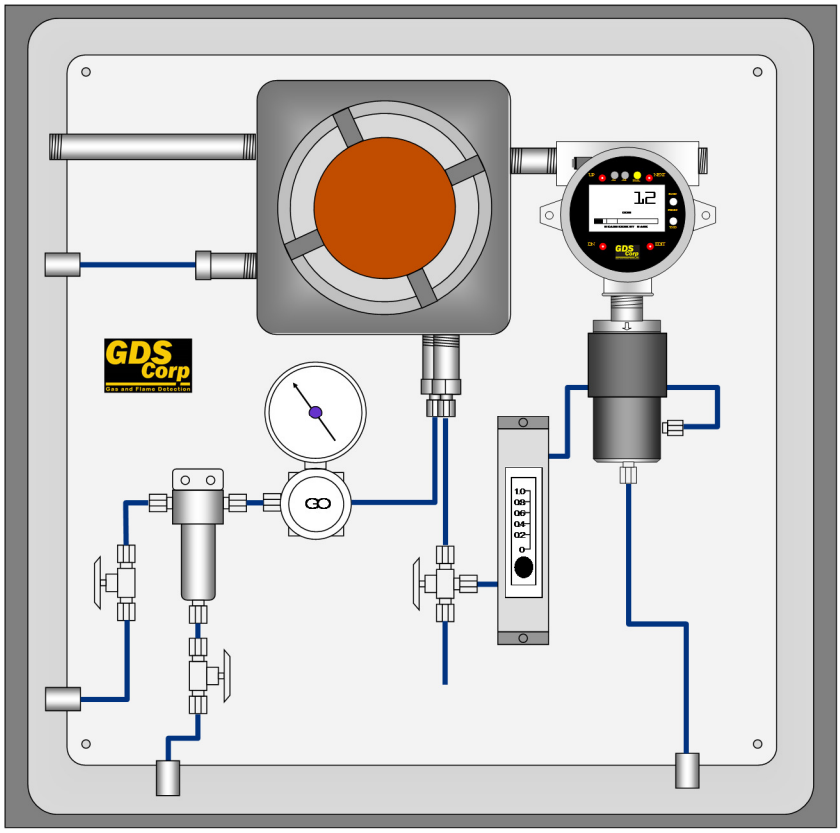
1200-0037
Run/Cal Valve

1200-0056
Flow Meter

Figure 12-2: GDS-68XP Low Pressure Coalescing Filter (Spare Parts)

Sequencer Assembly	
20-0057	Sequencer (processor PCB)
20-0058	Sequencer (actuators PCB, includes pump, flow switch and 3-way valve
1200-0034	Flame Arrestors (3)

Sequencer Actuators	
1200-0234	Sample Pump
1200-0047	Flow Switch
1200-0034	3-way valve



Display:
10-0387
I/O Board:
10-0390
Optional Relays & MB
10-0388

Sensor Head:
10-0247
Flow Cell:
10-0205

Filter
10-0205
Filter Element
10-xxxx

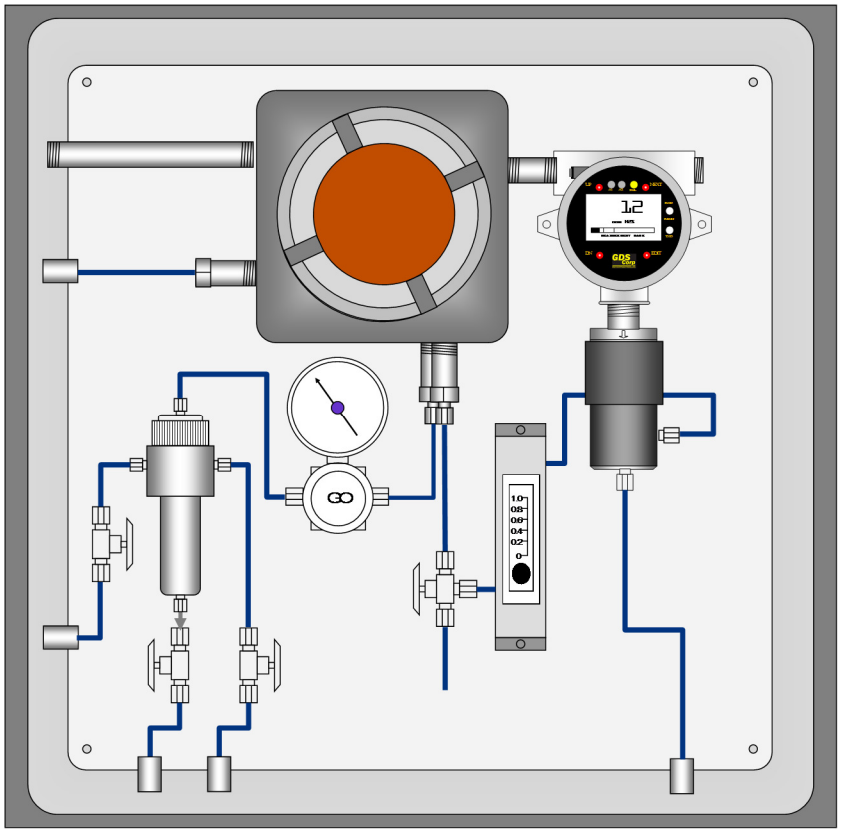
1200-0037
Run/Cal Valve

1200-0056
Flow Meter

Figure 12-3: GDS-68XP High Pressure Coalescing Filter (Spare Parts)

Sequencer Assembly	
20-0057	Sequencer (processor PCB)
20-0058	Sequencer (actuators PCB, includes pump, flow switch and 3-way valve
1200-0034	Flame Arrestors (3)

Sequencer Actuators	
1200-0234	Sample Pump
1200-0047	Flow Switch
1200-0034	3-way valve



Display:
10-0387
I/O Board:
10-0390
Optional Relays & MB
10-0388

Sensor Head:
10-0247
Flow Cell:
10-0205

Filter
10-0205
Filter Element
10-xxxx

1200-0037
Run/Cal Valve

1200-0056
Flow Meter

Figure 12-4: GDS-68XP High Pressure Bypass Filter (Spare Parts)

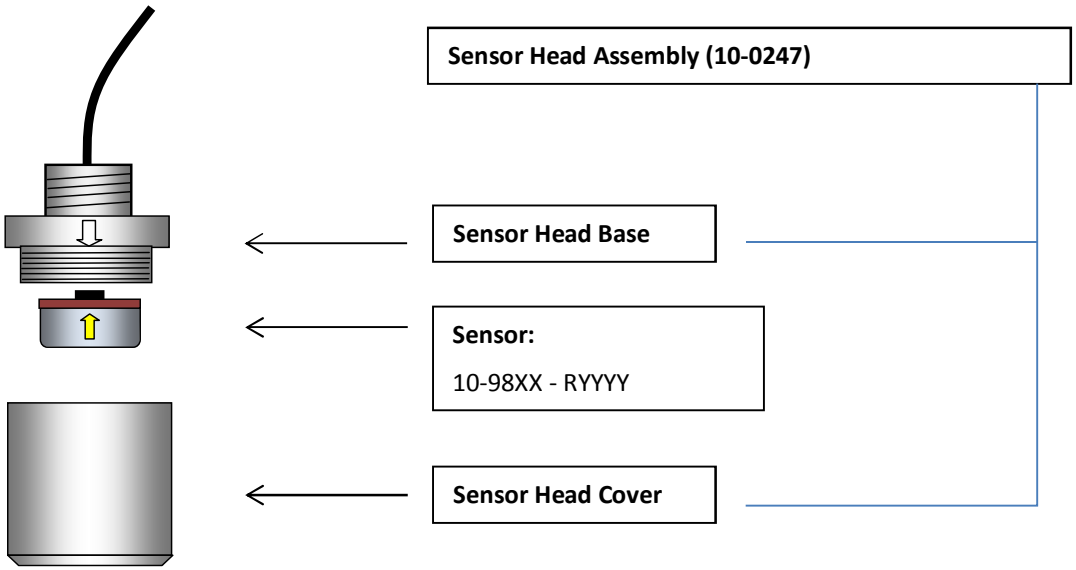


Figure 12-5: GDS-68XP Sensor Head Exploded View

13 DRAWINGS AND DIMENSIONS

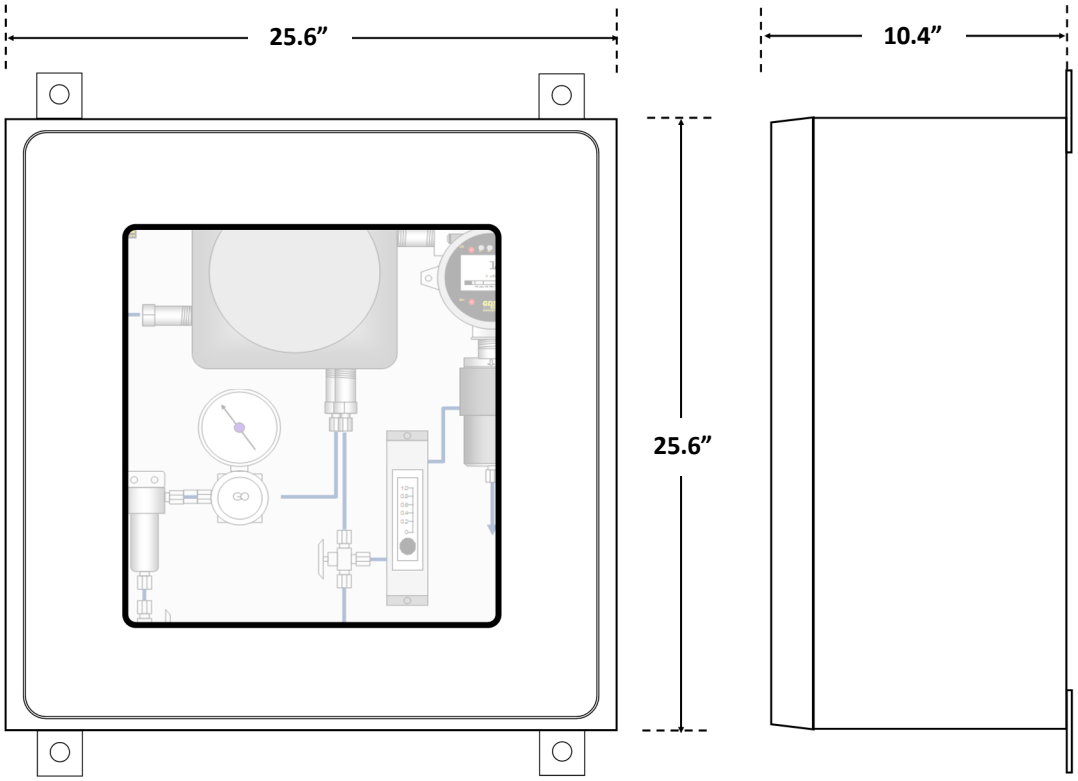


Figure 13-1: GDS-68XP Dimensions (NEMA 4X Enclosure)

14 WIRING DIAGRAMS

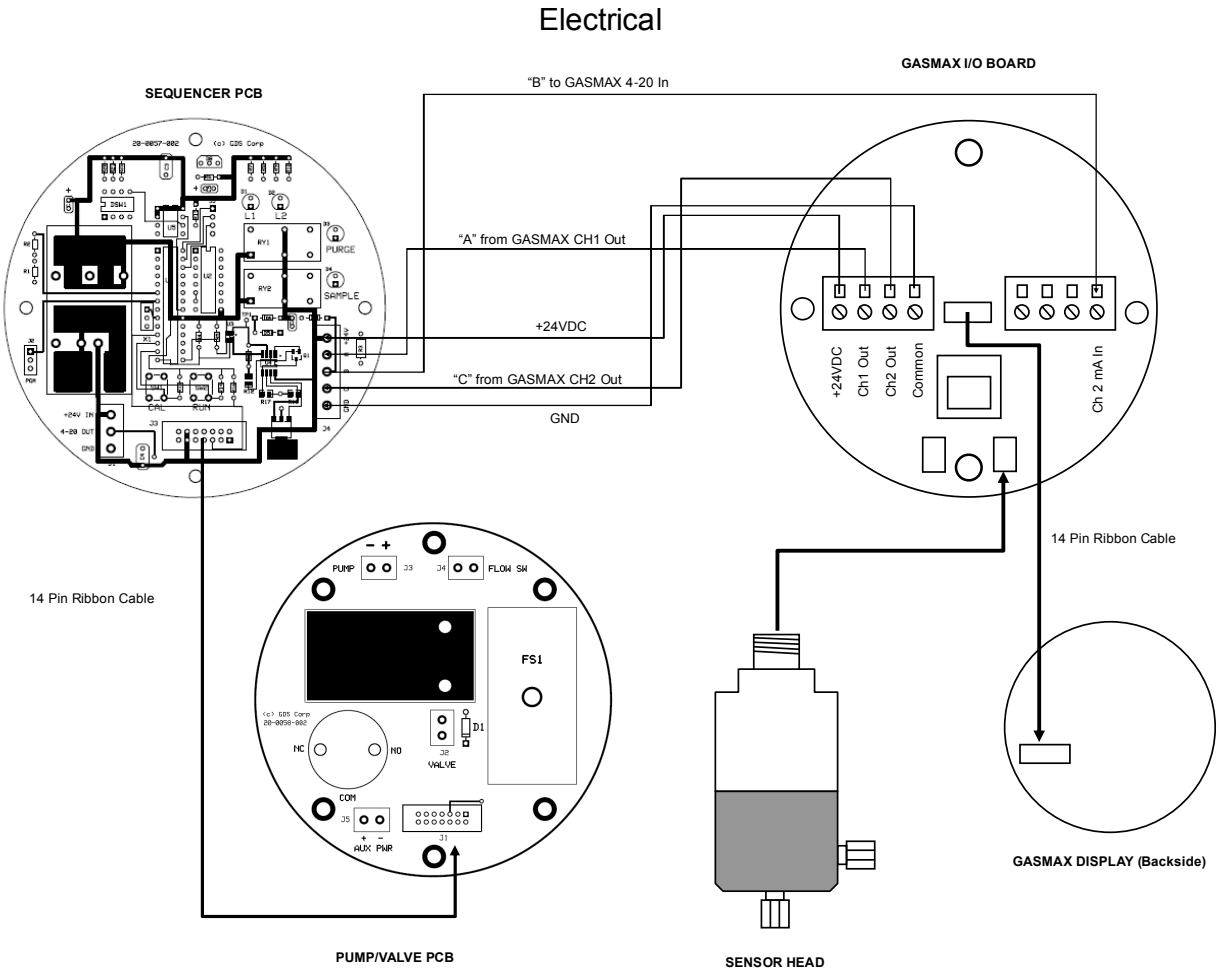


Figure 14-1: GDS-68XP Wiring Diagram

15 GASMAX CX GDS-68XP FACTORY DEFAULT SETUP

Values shown are for units configured for a range of 0-50 mg/m3. For alternative ranges, modify the SPAN, ENGINEERING UNITS, CAL SPAN VALUE and ALARM LEVEL settings as necessary.

	Menu	Setting	Value	Comment or Customer Setting	
	Alarm Outputs Menu				OK
	Relay 1	Alarm 1	Ch2		
		Alarm 2	Off		
		Alarm 3	Off		
		Fault	Off		
		Acknowledge	No		
		Failsafe	No		
		Override	None		
	Relay 2	Alarm 1	Off		
		Alarm 2	Ch2		
		Alarm 3	Off		
		Fault	Off		
		Acknowledge	No		
		Failsafe	No		
		Override	None		
	Relay 3	Alarm 1	Off		
		Alarm 2	Off		
		Alarm 3	Ch2		
		Fault	Off		
		Acknowledge	No		
		Failsafe	No		
		Override	None		
	Channel Settings Menu				OK
	Channel 1				
	Alarm 1	Setpoint	50.0	No alarms from channel 1	
		Latching	No		

		Trip On	High		
		On Delay	0		
		Off Delay	0		
		Deadband	1%		
	Alarm 2	Setpoint	50.0	No alarms from channel 1	
		Latching	No		
		Trip On	High		
		On Delay	0		
		Off Delay	0		
		Deadband	1%		
	Alarm 3	Enabled?	NO	No alarms from channel 1	
		Setpoint	50.0		
		Latching	No		
		Trip On	High		
		On Delay	0		
		Off Delay	0		
		Deadband	1%		
	Fault Alarm	Setpoint	-10% of scale	Fault alarm always enabled	
	Data From	Sensor Type	EC Sensor		
		Min Raw	800		
		Max Raw	4000		
		Filter Samples	60		
		Polarity	POS		
		PGA Gain	[Sensor Specific]	GAIN determined by sensor	
		Heater Enabled	No		
		Heat (degC)	10.00		
		Local Cal?	Yes		
	Temp Comp				
	-40	Gain / Offset	1.00 / 0.00		
	-30	Gain / Offset	1.00 / 0.00		

	-20	Gain / Offset	1.00 / 0.00		
	-10	Gain / Offset	1.00 / 0.00		
	0	Gain / Offset	1.00 / 0.00		
	+10	Gain / Offset	1.00 / 0.00		
	+20	Gain / Offset	1.00 / 0.00		
	+30	Gain / Offset	1.00 / 0.00		
	+40	Gain / Offset	1.00 / 0.00		
	+50	Gain / Offset	1.00 / 0.00		
	Configure	Tag Name	Raw Sensor		
		Eunits	mg/m3		
		Zero	0		
		Span	50		
		Decimal Points	0		
		Channel On?	Yes		
		Deadband	1%		
		In-Cal mA	1,5 mA		
		Backup/Restore	N/A		
	Calibrate	Offset	[Sensor Specific]	Calculated by calibration procedure	
		Gain	[Sensor Specific]	Calculated by calibration procedure	
		Cal Zero	0.0		
		Cal Span	[App Specific]	Set to match calibration gas	
	Channel 2				
	Alarm 1	Setpoint	20% of scale		
		Latching	No		
		Trip On	High		
		On Delay	0		
		Off Delay	0		
		Deadband	1%		
	Alarm 2	Setpoint	40% of scale		
		Latching	No		
		Trip On	High		

		On Delay	0		
		Off Delay	0		
		Deadband	1%		
	Alarm 3	Enabled?	No		
		Setpoint	60% of scale		
		Latching	No		
		Trip On	High		
		On Delay	0		
		Off Delay	0		
		Deadband	1%		
	Fault Alarm	Setpoint	-10% of scale		
	Data From	Sensor Type	AI 4-20mA		
		IO Range	0-20mA		
		Min Raw	~800	Set at factory, do not adjust	
		Max Raw	~4000	Set at factory, do not adjust	
		Filter Samples	5		
		Local Cal?	No		
		Marker Enabled	No		
		Marker %	-15.63		
		Marker As	IN CAL		
		Sensor Life	No		
	Temp Comp				
	-40	Gain / Offset	1.00 / 0.00		
	-30	Gain / Offset	1.00 / 0.00		
	-20	Gain / Offset	1.00 / 0.00		
	-10	Gain / Offset	1.00 / 0.00		
	0	Gain / Offset	1.00 / 0.00		
	+10	Gain / Offset	1.00 / 0.00		
	+20	Gain / Offset	1.00 / 0.00		
	+30	Gain / Offset	1.00 / 0.00		
	+40	Gain / Offset	1.00 / 0.00		

	+50	Gain / Offset	1.00 / 0.00		
	Configure	Tag Name	GDS-68XP		
		Eunits	Mg/m3		
		Zero	0		
		Span	50		
		Decimal Points	0		
		Channel On?	Yes		
		Deadband	1%		
		In-Cal mA	3.0		
	Comm Settings Menu				OK
	Comm 1	Type	MB Slave	Programmed by user	
		Baud Rate	9600		
		Parity	None		
		Timeout	500		
		Poll Delay	250		
		Byte Order	BADC		
		Enable LEDs	No		
	Comm 2	Type	MB Slave	Programmed by user	
		Baud Rate	9600		
		Parity	None		
		Timeout	500		
		Poll Delay	250		
		Byte Order	BADC		
		Enable LEDs	No		
	MODBUS / TCP	Slave		Programmed by user	
		Byte Order	BADC		
		Master			
		Timeout	500		
		Poll Delay	250		
		Enable LEDs	Yes		

	Network Settings	DHCP Enabled?	Yes	Programmed by user	
		Hostname	GDS-68XP		
		IP Address	N/A		
		Netmask	N/A		
		Gateway	N/A		
	Security Menu				OK
		Lock Code	****	Factory default	
		MB/Web Code	1234		
		Contact Info	Default		
	System Menu				OK
		Version	1.0		
	Configure	System name	GDS68XP	Programmed by user	
		Date	Date	Set today's date	
		Time	Time	Set current time	
		Warmup (m)	1		
		Cal Purge (m)	1		
		Block Negative	No		
		Send Sensor Life	No		
		Alarm Refresh	0		
	Digital Input	Mode	Alarm Reset		
	Event Log	Clear event log			
	View Sensor Life		N/A		

16 SEQUENCER SETTINGS (DIP SWITCH VERSIONS)

Earlier versions of the GDS-68XP sequencer board utilized a DIP SWITCH to set sequence timing values. For reference, the settings found in earlier units are shown below:

Sequence Number	DIP SWITCH Setting (1-2-3-4[1])	Sample Time	Purge / Hold Time	Total Cycle Time (Approximate)
0	**000 1**	On-Demand Sequence		30 min
1[2]	**001 1**	1-5 min	5 min	5-7 min
2[2]	**010 1**	1-5 min	10 min	15 min
3	**011 1**	1-5 min	20 min	30 min
4[3]	**100 1**	1-5 min	50 min	1 hour
5	**101 1**	1-5 min	110 min	2 hours
6	**110 1**	1-5 min	230 min	4 hours
7	**111 1**	1-5 min	350 min	6 hours

NOTE 1: DIP SWITCH #4 IS USED FOR FACTORY SETUP AND SHOULD ALWAYS BE LEFT **ON**.

NOTE 2: SEQUENCE 1 & 2 ARE FOR TEST PURPOSES AND SHOULD NOT BE USED WITH ACTUAL SAMPLES

NOTE 3: RECOMMENDED MINIMUM FOR MOST APPLICATIONS; RECOMMENDED MINIMUM SEQUENCE FOR MERCAPTANS AND THT IS FOUR HOURS (“1101”)

17 KNOWN ERRATA

GASMAX CX

Version 1.01

If more than three MODBUS/TCP devices are accessing the GASMAX CX at one time, there is a possibility that the TCP stack will overflow and cause a reboot. This is indicated by a 1 minute indication of "0" on the output channel. **Fixed in version 1.02.**

SEQUENCER

Version 2.41

If the RUN button is pressed while the sequencer is in "On Demand" wait mode, no sequence will occur. **Fixed in version V2.42.**

If the RUN button is pressed while the sequencer is set to "On Demand" mode and the RUN button is pressed during purge / hold mode, no sequence will occur. **Fixed in version 2.42.**