NM1 - ___62_____

H_2S Prevention and Contingency Plan Request and Approval

August 23, 2022

Jones, Brad A., EMNRD

From: Peterson, Gundar <gpeterson@geo-logic.com>
Sent: Thursday, August 11, 2022 2:05 PM
To: Jones, Brad A., EMNRD
Subject: [EXTERNAL] RE: Revised Hydrogen Sulfide Prevention and Contingency Plan and Engineering Certification Report for the Evaporation Pond Liners OCD Review
Attachments: Response to Comments_OCD.pdf; H2S Plan_updated_2022.pdf

Brad-
Attached are a response to OCD's comments and an updated coy of the H2S plan. Please let me know if you need anything else at this time.

Gundar Peterson, P.E.

Daniel B. Stephens & Associates, Inc.
a Geo-Logic Company
Office: (505) 822-9400|Direct: (505) 353-9134|Mobile: (505) 730-9146
Licensed in AZ, ID, IL, NM, NV, OH, OK, TX, WA
gpeterson@geo-logic.com

From: Jones, Brad A., EMNRD <brad.a.jones@state.nm.us>
Sent: Thursday, April 14, 2022 2:25 PM
To: andy@wambsganss.com
Cc: Peterson, Gundar <gpeterson@dbstephens.com>
Subject: Revised Hydrogen Sulfide Prevention and Contingency Plan and Engineering Certification Report for the Evaporation Pond Liners OCD Review

Mr. Mussani,

Please see the attached OCD's review of the Revised Hydrogen Sulfide Prevention and Contingency Plan and Engineering Certification Report for the Evaporation Pond Liners. If you have any questions regarding this matter, please do not hesitate to contact me.

Sincerely,

Brad Jones

Brad A. Jones ● Environmental Scientist Specialist - Advanced
Environmental Bureau
EMNRD - Oil Conservation Division
1220 S. Saint Francis Drive | Santa Fe, New Mexico 87505
(505) 469-7486 | brad.a.jones@state.nm.us

www.emnrd.nm.gov

APPLICATION FOR PERMIT
SUNDANCE WEST

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 3: HYDROGEN SULFIDE (H_2S) PREVENTION AND CONTINGENCY PLAN

TABLE OF CONTENTS

LIST OF FIGURES

APPLICATION FOR PERMIT
SUNDANCE WEST

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 3: HYDROGEN SULFIDE (H_2S) PREVENTION AND CONTINGENCY PLAN

LIST OF TABLES

LIST OF ATTACHMENTS

APPLICATION FOR PERMIT
SUNDANCE WEST

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 3: HYDROGEN SULFIDE (H_2S) PREVENTION AND CONTINGENCY PLAN

1.0 INTRODUCTION

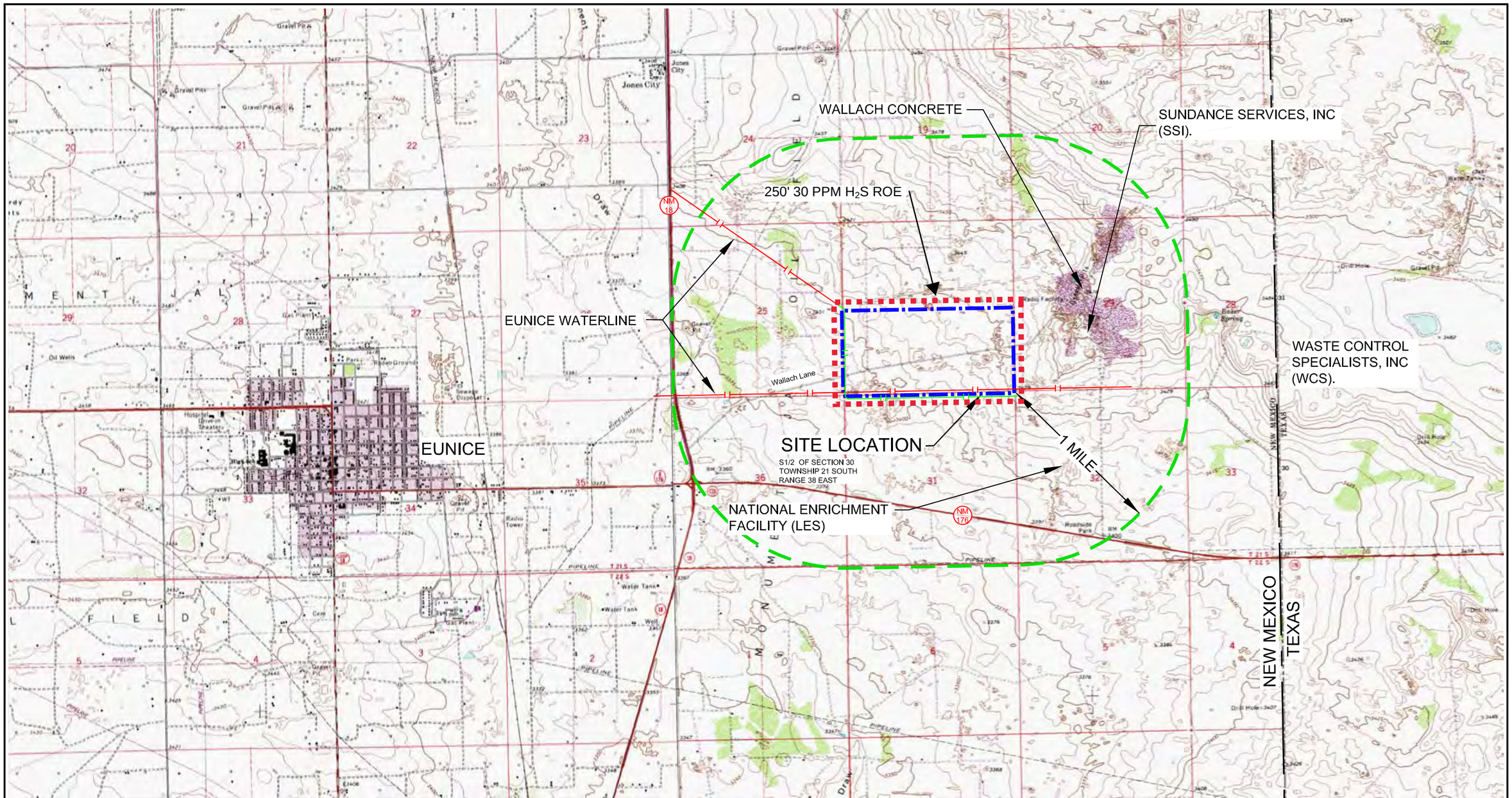
Sundance West is a commercial Surface Waste Management Facility for oil field waste processing and disposal services. The Sundance West Facility is subject to regulation under the New Mexico Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility is designed in compliance with 19.15.36 NMAC, and will be constructed and operated in compliance with a Surface Waste Management Facility Permit issued by the OCD. The Facility is owned by, and will be constructed and operated by, Sundance West, Inc.

1.1 Site Location

The Sundance West site is located approximately 3 miles east of Eunice, 18 miles south of Hobbs, and approximately 1.5 miles west of the Texas/New Mexico state line in unincorporated Lea County, New Mexico (NM). The Sundance West site is comprised of a 320-acre ± tract of land located in the South ½ of Section 30, Township 21 South, Range 38 East, Lea County, NM. Site access will be provided via NM 18 and Wallach Lane. A Site Location Map is provided as **Figure II.3.1**.

1.2 Facility Description

The Sundance West Facility is a commercial Surface Waste Management Facility that will comprise a 320-acre ± tract of land that will include two main components, a liquid oil field waste Processing Area (80 acres ±), and an oil field waste Landfill (180 acres ±). Oil field wastes are delivered to the Sundance West Facility from oil and gas exploration and production operations in southeastern NM and west Texas. The Site Plan provided as **Figure II.3.2** identifies the locations of the Processing Area and Landfill facilities. The facilities are detailed in **Table II.3.1**.



Based on Eunice NE, TX.- NM (1969) Photorevised (1979);
Eunice, NM (1969) Photorevised (1978);
Quadrangles, USGS 7.5' SERIES (1:24,000 Scale)

NOTE:

NO STREAMS, SPRINGS OR WATER COURSES WITHIN 1/2 MILE OF SITE

NORTH

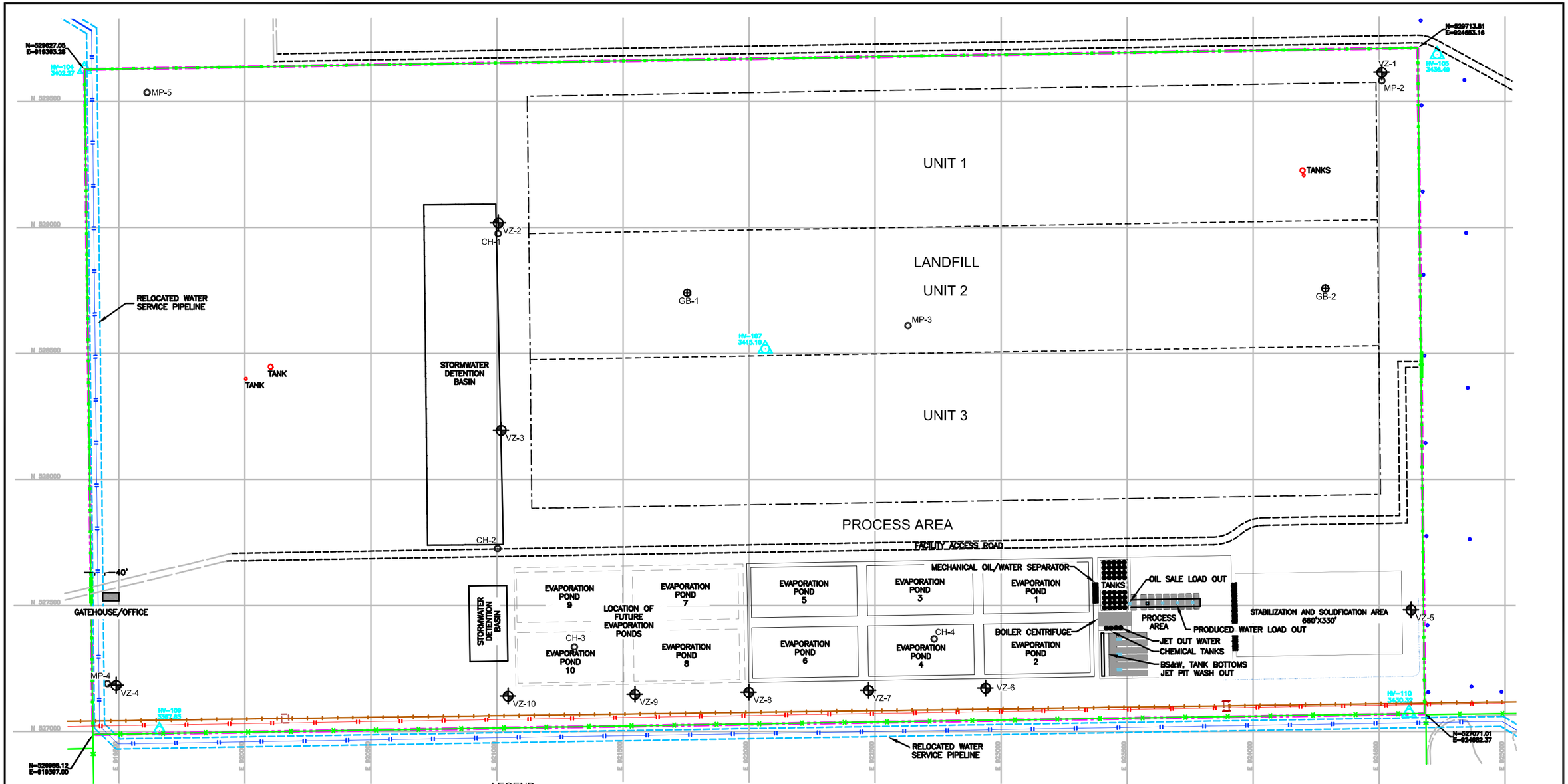
0 1500' 3000'

SITE LOCATION MAP

SUNDANCE WEST
SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 07/22/2016	CAD: DWG NAME.dwg	PROJECT #: 530.06.01
DRAWN BY: DMI	REVIEWED BY: CWF	FIGURE II.3.1
APPROVED BY: IKG	gei@gordonenvironmental.com	



NOTE

AERIAL SURVEY BY THOMAS R. MANN & ASSOCIATES AERIAL MAPPING SERVICES, 5115 COPPER NE, ALBUQUERQUE, NM 87108
DATE OF PHOTOGRAPHY: 10-01-08

LEGEND

- FACILITY BOUNDARY
- LIMIT OF WASTE BOUNDARY
- UNIT BOUNDARY
- FENCE (EXISTING)
- PROPOSED 4-STRAND BARBED WIRE FENCING
- NEW UNPAVED ROAD
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- RAILROAD TRACK
- RELOCATED WATER SERVICE PIPELINE
- EXISTING EUNICE WATERLINE
- PIPELINE EASEMENT
- LOCKING GATE
- GB-1 GEOTECHNICAL BOREHOLE
- MP-2 SOIL BORING
- CH-3 COREHOLE BORING
- VZ-1 VADOSE ZONE MONITORING WELL
- POWER POLE
- STORAGE TANK
- EXISTING BOX CULVERT
- HV-109 3387.63 SURVEY CONTROL POINT
- N 527500 / E 922000 SITE GRID

NORTH

0 200' 400'

SITE PLAN

SUNDANCE WEST
SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 07/18/2016	CAD: SITE DEV.dwg	PROJECT #: 530.06.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.3.2
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\530.06.01\REVISED FIGURES(RAI 1)\SITE DEV.dwg
Date/Time:Jul, 19, 2016-05:14:34

TABLE II.3.1
Facilities[1]
Sundance West

Description	No.
Oil field waste disposal landfill	1
Produced water load-out points	2
Produced water tanks	3
Mechanical oil/water separation unit	2
Evaporation ponds	10
Stabilization and Solidification Area	1
Oil treatment plant	1
Oil sales tanks	2
Customer jet wash	1 (6 bays)

Note:
[1]Subject to change. The facilities are based on projected waste types and volumes; therefore this list may be modified in response to changes in waste streams, technology, etc.

1.3 Purpose

The purpose of this Hydrogen Sulfide (H_2S) Prevention and Contingency Plan (the Plan) is to enhance awareness and establish measures to protect employees from occupational exposure to H_2S while allowing them to perform their assigned duties. The Plan is also designed to protect customers and visitors to the Sundance West Facility, as well as the general public and nearby land users.

This Plan prescribes measures for:

- Constant personnel monitoring.
- Stationary monitoring points at the Facility evaporation ponds.
- Augmenting the monitoring procedures in the event that H_2S is detected in excess of 10 parts per million (ppm).
- Minor, Major, and Critical Alarm levels and actions.
- Notifying Authorities and General Public in the unlikely event of a release as defined in 19.15.11.16 NMAC.

Sundance West will invite the local emergency response authorities identified in **Table II.3.2** to the site for a briefing on this Plan. During this briefing, Sundance West will discuss notification, emergency response procedures, and evacuation plans. The H_2S monitoring program will be implemented during the active life of the Facility.

TABLE II.3.2
Emergency Response Agencies and Contacts
Sundance West

Agency/Organization	Emergency Number
1. Fire	
Eunice Fire Department	911 or (575) 394-2112
2. Police	
Lea County Sheriff's Department	911 or (575) 396-3611
New Mexico State Police	911 or (575) 392-5580
3. Medical/Ambulance	
Eunice EMS	911 or (575) 394-2112
Lea Regional Medical Center 5419 N. Lovington Highway Hobbs, NM 88240	(575) 492-5000
4. Emergency Response Firm	
Phoenix Environmental, LLC. 2113 N French Drive Hobbs, NM 88240	(575) 391-9685
5. OCD Emergency Response Contacts	
Oil Conservation Division 1625 N. French Drive Hobbs, NM 88240	(575) 393-6161
Mobile Phone	(575) 370-3180
Oil Conservation Division 1220 South St. Francis Drive Santa Fe, NM 87505	(505) 476-3441
6. State Emergency Response Contacts	
Environmental Emergency 24 hr. (NMED)	(505) 827-9329
New Mexico Environment Department Solid Waste Bureau, Santa Fe	(505) 827-0197
7. Local Emergency Response Contacts	
Lea County Emergency Management	(575) 391-2983
8. Federal Emergency Response Contacts	
National Emergency Response Center (U.S. Coast Guard)	(800) 424-8802
Region VI Emergency Response Hotline (USEPA)	(214) 665-2200

1.4 Characteristics of Hydrogen Sulfide and Sulfur Dioxide

1.4.1 Hydrogen Sulfide Characteristics

H_2S is a colorless and flammable gas with a distinct odor. Being heavier than air, H_2S tends to accumulate at the floor of poorly ventilated spaces. It is found in petroleum and natural gas and is sometimes present in groundwater. The odor of hydrogen sulfide gas can be perceived at levels as low as 10 parts per billion (ppb). At levels of 50-100 ppm, it may cause the human sense of smell to fail. Limited exposure to low concentrations of H_2S can result in eye irritation, sore throat, coughing, shortness of breath, and fluid in the lungs. These symptoms usually recede in a few weeks in the absence of continued exposure. Long-term, low-level exposure may result in fatigue, loss of appetite, headaches, irritability, poor memory, and dizziness. Exposure to high concentrations of H_2S can lead to eye damage, loss of sense of smell, pulmonary edema (swelling and/or fluid accumulation in the lungs), loss of breathing and death. General risks associated with H_2S contact are summarized on **Table II.3.3**, and more detailed chemical hazard information for H_2S is provided on the material safety data sheet (MSDS) furnished in **Attachment II.3.A**.

TABLE II.3.3
H_2S Exposure Health Risk
Sundance West

H_2S EXPOSURE LEVEL[1]	**HEALTH RISK**
Low (0-10 ppm)	Eye, nose, and throat irritation; coughing, shortness of breath, fluid in the lungs
Moderate (10-50 ppm)	Headache, dizziness, nausea and vomiting, coughing and breathing difficulty, loss of sense of smell
High (50-200 ppm)[2]	Severe respiratory tract irritation, loss of sense of smell, eye damage, shock, convulsions, coma, pulmonary edema (swelling and/or fluid accumulation in the lungs), death

[1]*General data obtained from www.osha.gov/hydrogen-sulfide/hazards*
[2]*NIOSH Immediate Danger to Life or Health (IDLH) is 100 ppm*

The oil field waste types, and engineering design and operating procedures specific to the Sundance West Facility, will mitigate against the potential release of H_2S in to the environment. The measures deployed by Sundance West that minimize the potential generation of releases include:

- General screening of existing and new deliveries
- Stationary monitoring points at the Facility evaporation ponds.
- Personnel monitoring.
- Employee training.

The cornerstone of this Plan consists of routine H_2S monitoring conducted for the Facility evaporation ponds to verify that the regulatory limits for H_2S are not exceeded. This approach to monitoring has proven effective in reducing H_2S concentrations and successful in eliminating the need for H_2S Contingency Plan implementation as described in 19.15.11.9 NMAC (i.e., to address H_2S > 100 ppm). In addition, this Plan includes an Immediate Action Plan (**Table II.3.4**) for specific actions to address H_2S > 10 ppm, H_2S > 20 ppm, and H_2S > 100 ppm.

1.4.2 Sulfur Dioxide Characteristics

Sulfur dioxide (SO_2) is a colorless gas with an irritating and pungent odor. SO_2 generally forms when fuel containing sulfur is burned. Health effects of sulfur dioxide can include wheezing, shortness of breath, and chest tightness. Exposure to high levels of SO_2 at a continuous rate can cause reduced lung function. Control measures that reduce SO_2 are generally expected to reduce exposures to other sulfur oxides (SO_X). More detailed chemical hazard information for SO_2 is provided on the safety data sheet (SDS) furnished in **Attachment II.3.A**.

SO_2 can cause environmental impacts. At high concentrations, sulfur oxides can damage foliage and decrease growth. SO_2 and other sulfur oxides can contribute to acid rain which can be harmful to certain ecosystems. Sulfates, a major particulate pollutant, can form in the atmosphere from SO_2. These particulates can be visible in the form of haze or reduced visibility.

The largest sources of SO_2 are from fossil fuel combustion at power plants and other industrial facilities that process fossil fuels. SO_2 is not expected to form in significant amounts at SSWI as this is not a combustion-based facility. Transport trucks, on-site vehicles, and heavy equipment that run on diesel can be expected to emit SO_2 in small amounts.

1.5 Regulatory Requirements: 19.15.36 NMAC and 19.15.11 NMAC

The Rules for Surface Waste Management Facilities (19.15.36 NMAC) address the monitoring and management of H_2S in 19.15.36.8.C.(8):

19.15.36.8 SURFACE WASTE MANAGEMENT FACILITY PERMITS AND APPLICATION REQUIREMENTS

C. Application requirements for new facilities, major modifications and permit renewals. An applicant or operator shall file an application, form C-137, for a permit for a new surface waste management facility, to modify an existing surface waste management facility or for permit renewal with the environmental bureau in the division's Santa Fe office. The application shall include:

(8) a hydrogen sulfide prevention and contingency plan that complies with those provisions of 19.15.11 NMAC that apply to surface waste management facilities;

Additionally, requirements in 19.15.11.2 NMAC apply to this facility:

19.15.11.2 SCOPE:

19.15.11 NMAC applies to a person subject to the division's jurisdiction, including a person engaged in drilling, stimulating, injecting into, completing, working over or producing an oil, gas or carbon dioxide well or a person engaged in gathering, transporting, storing, processing or refining of oil, gas or carbon dioxide. 19.15.11 NMAC does not exempt or otherwise excuse surface waste management facilities the division permits pursuant to 19.15.36 NMAC from more stringent conditions on the handling of hydrogen sulfide required of such facilities by 19.15.36 NMAC or more stringent conditions in permits issued pursuant to 19.15.36 NMAC, nor shall the facilities be exempt or otherwise excused from the requirements set forth in 19.15.11 NMAC by virtue of permitting under 19.15.36 NMAC.

This Plan considered the applicability of the American Petroleum Institute (API) Recommended Practice 55 (RP-55), paragraph 7.6 to address H_2S >30 ppm. Should monitoring results identify unexpected concentrations of H_2S in excess of 30 ppm (RP-55 limit) in a public area, proper notification would be required. The RP-55 limit of 30 ppm will result in a radius of exposure (ROE) of 250 ft from the point of release (assuming a release rate of 100 SCFH on Figure C-2 of RP-55). This ROE is depicted on **Figure II.3.1**, and there are no "public areas" within this ROE. Additionally, an assessment of public roads was completed as required by 19.15.11.9.B(2)(a) NMAC. There are no public roads in the 30 ppm ROE and thus will not be impacted in the event of an emergency.

TABLE II.3.4
IMMEDIATE ACTION PLAN
Sundance West

Overview

Six sensors are installed to monitor H_2S concentrations around the evaporation ponds. The six sensors communicate wirelessly through radio to the GDS C2 controller installed on a steel post on the west side of the ponds. The GDS controller has an audible alarm and is outfit with a rotating red strobe. The controller is programmed to send email and text notifications whenever alarm conditions are present. Alarms will include information on the sensor (channel) producing the alarm. A site map of the ponds can be used to identify the location of the alarming sensor. Personnel monitors will also follow the same alarm conditions and actions. The alarm conditions are outlined in the table below, with concentrations listed in parts per million (ppm).

Alarm Type	Alarm Condition
Minor	10 ppm ≤ Concentration < 20 ppm
Major	20 ppm ≤ Concentration < 100 ppm
Critical	100 ppm ≤ Concentration

Wind socks were installed on the east and west ends of the northern section of chain link fence surrounding the ponds. The purpose of the wind socks is to indicate the direction of the wind so that site personnel can move away from the potential source. Wind speeds and direction will also be monitored and recorded daily when feasible.

Minor Alarm

As required of 19.15.11.9.B(2)(f) NMAC, 10 ppm or greater is the plan activation level. A minor alarm is reached when an H_2S concentration greater than or equal to 10 ppm and less than 20 ppm is observed at any of the six sensors. If a minor alarm is reached the procedures below shall be implemented:

- Evacuate and move upwind of the area. Notify the Emergency Coordinator (EC).
- Remotely monitor downwind concentrations using existing GDS stationary sensors.
- Obtain analysis of the dissolved sulfides in the ponds if feasible.
- Notify OCD upon activation of the hydrogen sulfide contingency plan as soon as possible, but no more than four hours after plan activation, recognizing that a prompt response should supersede notification.
- Submit a full report of the incident to the division on form C-141 no later than 15 days following the release.

Major Alarm

A major alarm is reached when an H_2S concentration greater than or equal to 20 ppm, and less than 100 ppm is observed. In the case of a major alarm the following procedures shall be implemented:

- Evacuate and move upwind of the area. Notify the Emergency Coordinator (EC).
- Evacuate the area following the site evacuation plan and notify the Emergency Coordinator if levels remain greater than 20 ppm for more than 10 minutes.

- Remain upwind of the release until an assessment of the conditions has been made.
- Assess the source, severity, and extent of the alarm using appropriate personal protective equipment (i.e. self-contained breathing apparatus).
- Notify authorities (NM State Police, Lea County Sheriff, Lea County Emergency Management, and OCD) if levels remain greater than 20 ppm for more than 10 minutes..
- Recordkeeping

Critical Alarm

A critical alarm is reached when an H_2S concentration greater than or equal to 100 ppm is observed. In the case of a critical alarm the following procedures shall be implemented in addition to the actions for a Major Alarm:

- Evacuate the area following the site evacuation plan and notify the Emergency Coordinator.
- Close the facility if levels reach 20 ppm at the downwind boundary.
- Notify authorities (NM State Police, Lea County Sheriff, Lea County Emergency Management, and OCD).
- Recordkeeping

SITE EVACUATION PROCEDURE

When evacuation is required, the following procedures will be followed:

1. Facility personnel will be alerted directly or using the Facility telephone, cellular telephones, or radios.
2. Vehicles delivering waste will be diverted away from the location of the emergency and routed towards the Facility exit (**Figure II.3.2**).
3. All Facility operating equipment will be shut down.
4. Personnel will be directed to proceed to the Facility Gatehouse which will be the primary meeting locations (**Figure II.3.4**). The EC will identify missing persons at that time.
5. If the emergency involves the Facility Gatehouse or its immediate environs, the intersection of NM 18 and Wallach Lane will be the secondary assembly point and evacuation routes to this location will be utilized (as applicable).
6. If the emergency precludes access to both, the Facility Gatehouse and the intersection of NM 18 and Wallach Lane, personnel will evacuate the site via an auxiliary access gate at the east end of the facility.
7. Once assembled, personnel will stand by to afford assistance and coordinate further actions.

2.0 EMERGENCY COORDINATORS

Sundance West has designated individual specialists with the responsibility and authority to implement response measures in the event of an emergency which threatens freshwater, public health, safety or the environment per 19.15.36.13.N.(3) NMAC. The Primary, Alternate, and on-site Emergency Coordinators (ECs; **Table II.3.5**) will be thoroughly familiar with all aspects of this Plan; operations and activities at the Facility; location and characteristics of waste to be managed; the repository of all records within the Facility; and the Facility layout. **Table II.3.5** provides a list of names, designations, titles, and phone numbers for each EC, who will be formally identified to OCD prior to commencing Facility operations.

TABLE II.3.5
List of Emergency Coordinators*
Sundance West

Primary Emergency Coordinator

Name: Joe Carrillo	Work Phone: (575) 394-2511
Title: Corporate Plant Manager	Mobile Phone: (575) 390-0342
Address: 605 Ave J	Home Phone: NA
Eunice, NM 88231	

Alternate Emergency Coordinator

Name: TBD	Work Phone: TBD
Title: TBD	Mobile Phone: TBD
Address: TBD	Home Phone: TBD
TBD	

Onsite Emergency Coordinator

Name: TBD	Work Phone: TBD
Title: TBD	Mobile Phone: TBD
Address: TBD	Home Phone: TBD
TBD	

**Or as designated by Sundance West.*

The ECs are responsible for coordinating emergency response measures and have the authority to commit the resources required for implementation of this Plan. A designated EC will be available to respond to emergencies 24 hours a day, 7 days a week. The Sundance West employee who identifies an emergency situation will contact an EC directly; or via phone or radio. Contact will be attempted with each EC (Primary, Alternate, and the On-site) until communication is achieved (**Table II.3.5**). Upon arrival at the scene of an emergency, the first EC to arrive will assume responsibility for initiating response measures. If more than one EC responds, authority is assigned to the highest-ranking EC.

In the rare case that an EC cannot be contacted in an emergency, the Sundance West employee who identifies the emergency will make every effort to follow the emergency procedures outlined in this Plan until an EC or emergency authority (local, state, or federal; **Table II.3.2**) arrives to assist or take charge. The term "EC" as used throughout this Plan to references the responsible Emergency Coordinator at the scene of an emergency regardless of whether that EC is the Primary, Alternate, On-site EC, or EC designee. This Plan will be amended as described in Section 8.0 if the list of ECs changes, with updates submitted in a timely manner to OCD and filed on-site.

3.0 MONITORING

3.1 Incoming loads

Sundance West personnel will wear H_2S personal monitors under circumstances where H_2S may be present. Per the specifications sheet, the monitors will issue a visual and audible signal at 10 ppm of H_2S in the ambient air that becomes more rapid at 20 ppm (Attachment II.3.F). The Immediate Action Plan shall be followed in the event of an H_2S detection of 10 ppm or greater.

3.2 Evaporation Pond Monitoring

3.2.1 Stationary Monitors

Evaporation ponds are monitored for the presence of H_2S by recording at continuous monitors maintained along the outside perimeter of the pond area as shown on **Figure II.3.3**. These monitors can be observed remotely via the internet and measurements are recorded every 5 minutes on a data logging system. Data sheets and manuals for these monitors are provided as Attachment II.3.G. Wind socks are placed at the East and West ends of the Northern fence

(shown in **Figure II.3.3**), which will be visible from all principle working areas at all times. Wind speeds and direction will be monitored and recorded regularly when feasible.

GENERAL NOTES:

1. HYDROGEN SULFIDE (H2S) MONITORING SYSTEM INCLUDES 6 H2S SENSORS (0–100 PPM).
2. BFT–44 H2S SENSOR IS CO–LOCATED WITH THE C2/TX CONTROLLER.
3. 110/220 VAC POWER REQUIRED FOR THE C2/TX CONTROLLER AND THE BFT–44 SENSOR.

KEY NOTES:

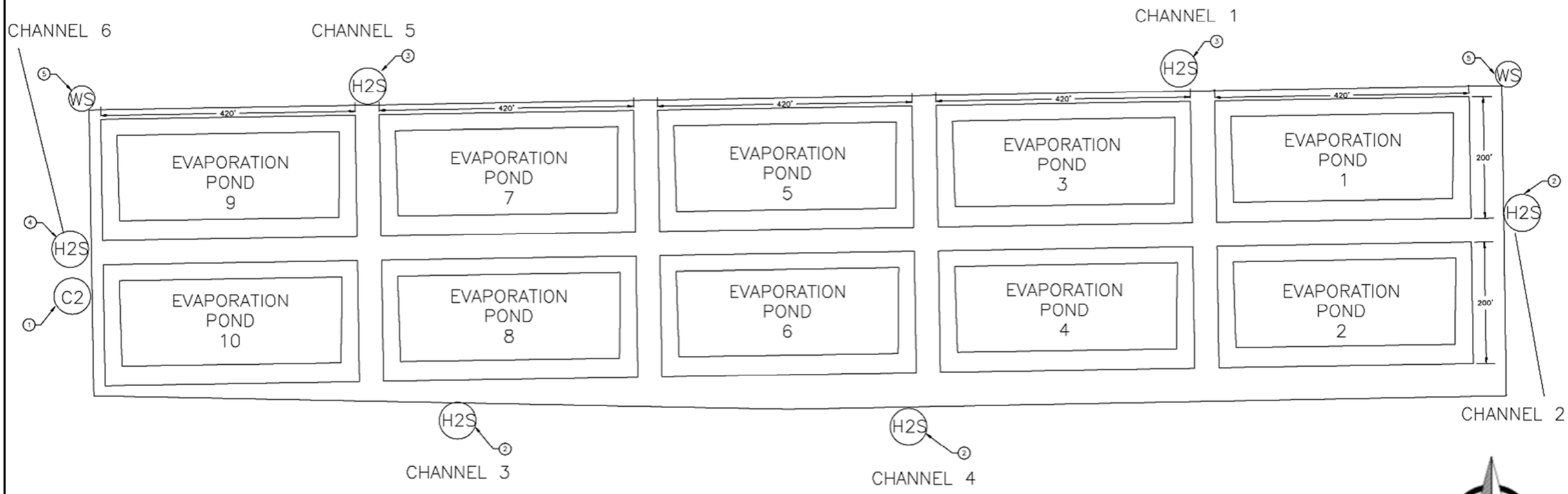
① GDS MODEL C2–TX WIRELESS CONTROLLER WITH OMNIDIRECTIONAL ANTENNA, 100 dB PIEZO BUZZER, AND RED STROBE. MOUNTED ON A POLE IN THE GROUND.

② GDS MODEL GASMAX/TX BATTERY POWERED WIRELESS GAS MONITOR W/ OMNIDIRECTIONAL ANTENNA MOUNTED ON WEIGHTED SENSOR STAND WITH MOUNTING PLATE.

③ GDS MODEL GASMAX/TX BATTERY POWERED WIRELESS GAS MONITOR W/ OMNIDIRECTIONAL ANTENNA MOUNTED ON THE EXISTING CHAIN LINK FENCE.

④ BFT–44 H2S SENSOR CONNECTED TO A GDS MODEL GM/TXDC WIRELESS TRANSMITTER MOUNTED ON THE ELECTRICAL RACK.

⑤ 18" X 60" WIND SOCK WITH SOLAR POWERED LIGHT.



DBS&A
Daniel B. Stephens & Associates, Inc.
4/27/2021 Project #DB18.1209

SUNDANCE WEST
Evaporation Ponds Stationary Monitoring
Figure II.3.3

TABLE II.3.7
DELETED

4.0 IMPLEMENTATION, ASSESSMENT, AND NOTIFICATION

The following subsections present a series of procedures for implementation, assessment, and notification of appropriate authorities in the unlikely event that a H_2S emergency develops (19.15.11.9 NMAC).

4.1 Implementation

This H_2S Contingency Plan will be implemented when an imminent or actual emergency situation develops that represents a potential impact to fresh water, public health, safety or the environment. As required of 19.15.11.9.B(2)(f) NMAC, 10 ppm or greater is the plan activation level.

Table II.3.4 lists the implementation, assessment, and notification procedures that will be followed in the event of an emergency. Assessment and notification are discussed further in Sections 4.2 and 4.3.

4.2 Assessment

In the event of a release, the EC will immediately identify the character, source, amount and extent of released materials, if possible; as well as assess the potential impact to fresh water, public health, safety or the environment. SSWI will amend this Plan, as necessary, to protect public safety, as required of 19.15.11 NMAC. The EC will also assess the circumstances of an emergency situation and determine the responses required to:

- provide notifications to appropriate agencies and the general public
- implement appropriate response and recordkeeping procedures

The assessment provides the EC with critical data needed to determine whether an evacuation is necessary, whether emergency authorities and OCD should be contacted in accordance with the reporting requirements of 19.15.11.16 NMAC, and whether Sundance West should attempt to control the release with on-site personnel and equipment. This section contains additional, detailed information regarding the Site Evacuation Plan (**Table II.3.4)**, and Section 5.0 addresses control procedures.

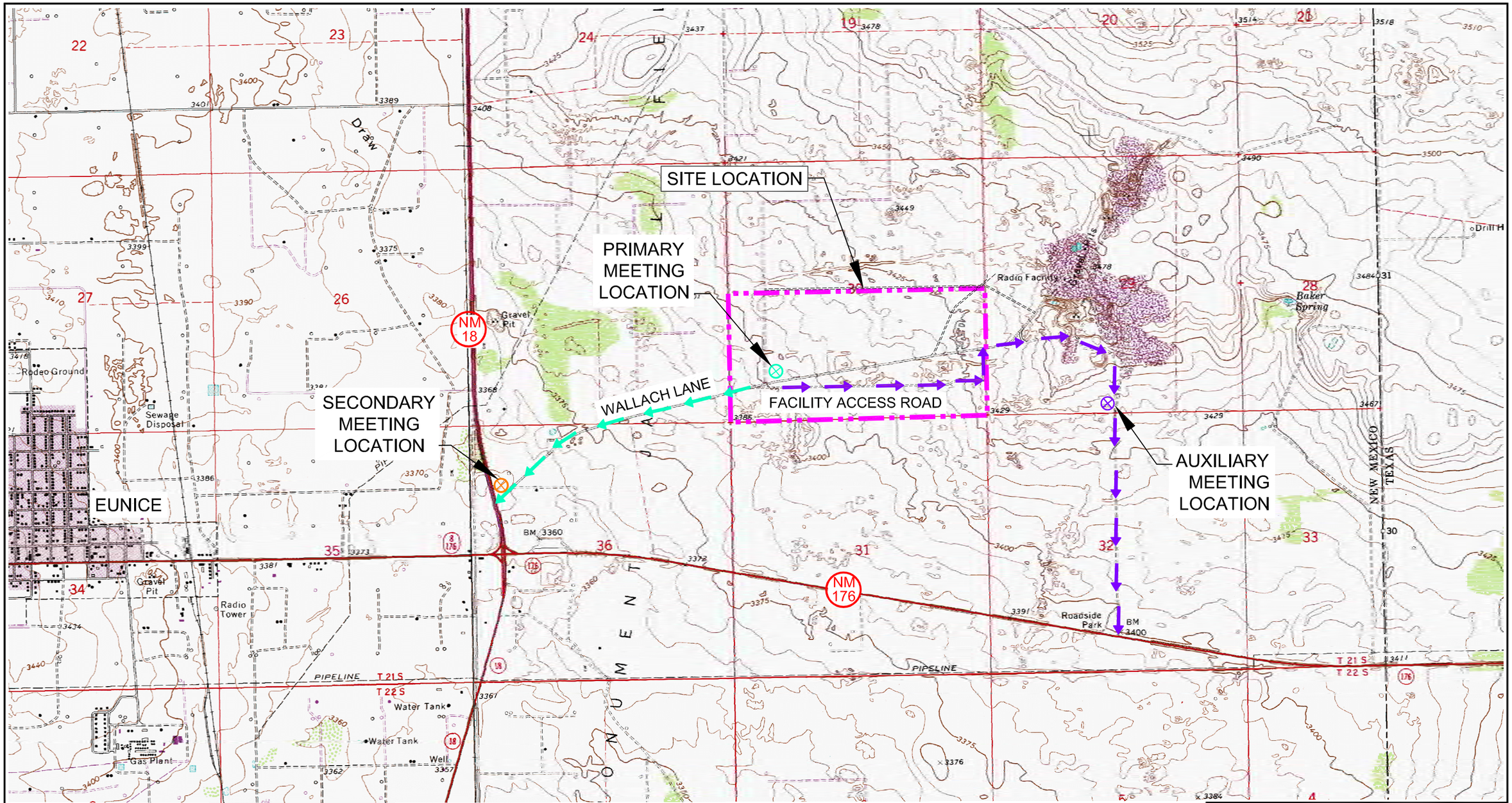
4.2.1 Site Evacuation Plan

Based upon the type of waste materials and treatment received at Sundance West, the potential for a Facility evacuation is unlikely (19.15.11.9.B.(2)(a) NMAC). However, various circumstances could arise warranting a Facility evacuation. In an emergency situation, the EC is the individual responsible for determining when evacuation of the Facility is required.

When conditions warrant immediate evacuation, on-site persons (e.g., Facility personnel, haulers, visitors, vendors, etc.) will be directed to proceed immediately to evacuate through the main gates (**Figure II.3.4**), the primary evacuation route. Sundance West Personnel will exercise good judgment and common sense in using the primary evacuation route to exit the Facility, or selecting the most appropriate alternative evacuation route, if necessary. Assembly points and primary/secondary evacuation routes are provided on **Figure II.3.4.** Driving directions to the nearest hospital are included as **Figure II.3.5**, and **Table II.3.4** provides detailed procedures for evacuating the Facility.

TABLE II.3.8
Part 11: NOTIFICATION OF THE DIVISION
Sundance West

19.15.11.16 NOTIFICATION OF THE DIVISION: The person shall notify the division upon a release of hydrogen sulfide requiring activation of the hydrogen sulfide contingency plan as soon as possible, but no more than four hours after plan activation, recognizing that a prompt response should supersede notification. The person shall submit a full report of the incident to the division on form C-141 no later than 15 days following the release.



MAP BASE:
EUNICE N. MEX. 1969, PHOTOREVISED 1979 AND EUNICE NE, TEX.-N. MEX. 1969, PHOTOREVISED 1979, 1:24000, USGS 7.5 MIN. SERIES TOPOGRAPHIC QUADRANGLES

LEGEND

- FACILITY BOUNDARY
- UNPAVED ROADS
- PRIMARY MEETING LOCATION
- PRIMARY EVACUATION ROUTE
- SECONDARY MEETING LOCATION
- AUXILIARY MEETING LOCATION
- AUXILIARY EVACUATION ROUTE

NORTH

0 1000' 2000'

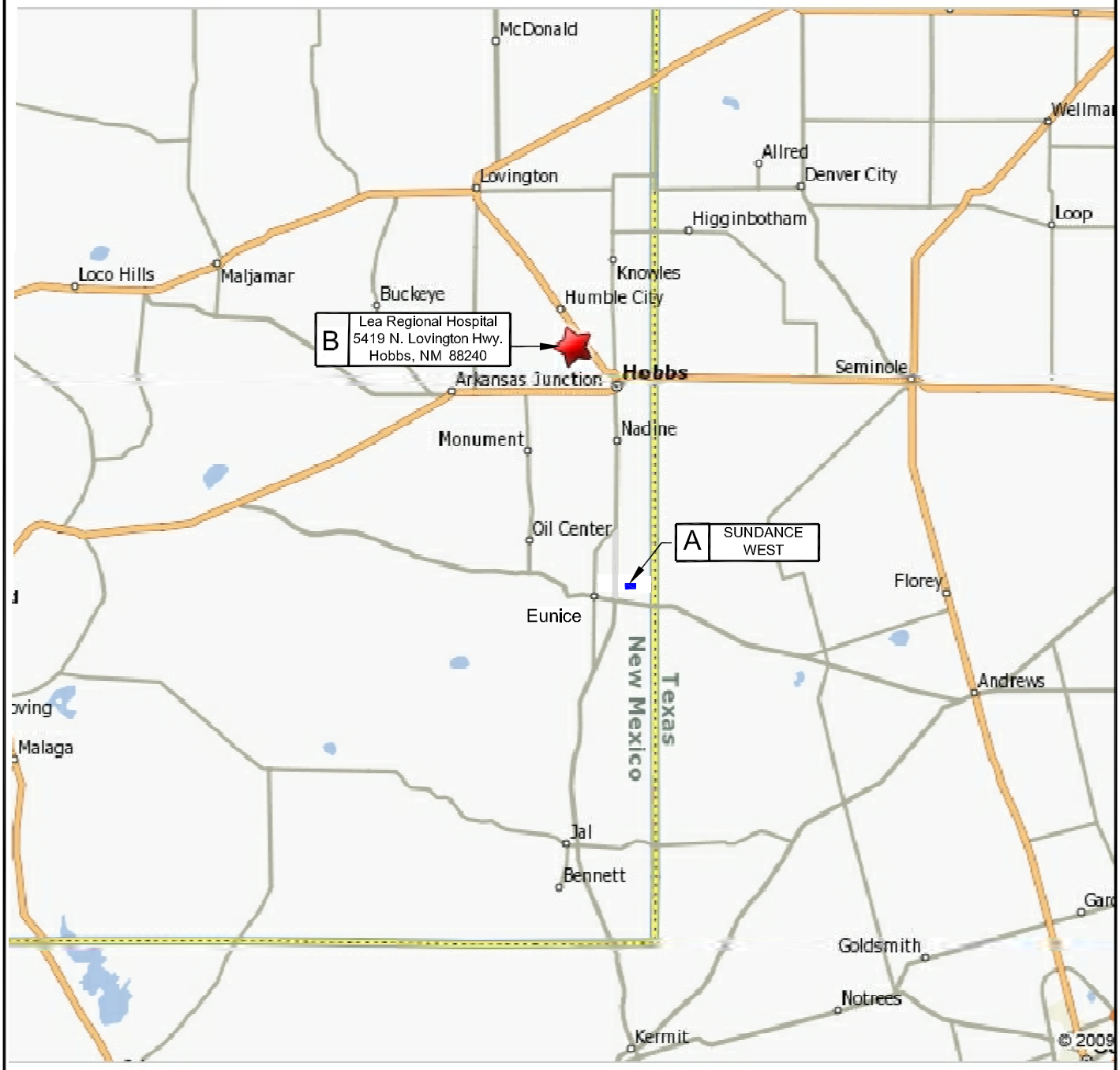
SITE EVACUATION MAP

SUNDANCE WEST
SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 07/19/2016	CAD: SITE EVAC.dwg	PROJECT #: 530.06.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.3.4
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\530.06.01\REVISED FIGURES(RAI 1)\SITE EVACUATION.dwg
Date/Time:Jul. 19, 2016-10:02:31



A: Sundance West, Wallach Lane & NM-18, Eunice, NM 88231

1. Start out going WEST on WALLACH LN toward NM-18N	0.0 mi
2. Turn RIGHT on NM-18N	18.0 mi
3. Turn LEFT onto E SANGER ST/CR-65	0.5 mi
4. Turn SLIGHT RIGHT onto N TURNER ST	1.3 mi
5. N TURNER ST becomes NM-18N	3.1 mi
6. Turn LEFT onto GERRY ST	0.1 mi
7. Arrive 5419 N LOVINGTON HWY	0.0 mi

B: Lea Regional Medical Center, 5419 N Lovington Hwy, Hobbs, NM 88240-9100

Note: A to B Travel Estimates: 35 minutes / 23.86 miles

Map downloaded from MAPQUEST, September 15, 2009
Drawing:P:\acad 2003\530.06.01\PERMIT FIGURES\HOSPITAL.dwg
Date/Time:Feb. 05, 2015-12:52:43

NORTH

NOT TO SCALE

HOSPITAL LOCATION MAP

SUNDANCE WEST
SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 02/05/2015	CAD: HOSPITAL.dwg	PROJECT #: 530.06.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.3.5
APPROVED BY: IKG	gei@gordonenvironmental.com	

TABLE II.3.9
DELETED

4.3 Notification of Authorities and General Public

This Section provides a series of procedures for implementation and notification of appropriate authorities in the event that a specific emergency develops (19.15.11.16 NMAC). Whenever there is an imminent or actual emergency, the EC will immediately contact on-site persons (Facility personnel, visitors, vendors, haulers, etc.) via on-site communication systems, as well as notify the appropriate state and local agencies (**Table II.3.2**), as necessary. OCD will be notified within 4 hours after the Contingency Plan has been activated when H_2S is detected at 10 ppm or greater.

Table II.3.2 provides a list of emergency response agencies and contacts that may need to be notified depending on the type and extent of an emergency situation. **Table II.3.2** will be posted as appropriate and near on-site telephones for easy access by Sundance West personnel. Fire, police, and medical authorities will be contacted, as necessary, in an emergency situation (**Table II.3.2**).

Table II.3.8 provides specific information regarding notification of OCD per the requirements of 19.15.11.16 NMAC in the case of a release.

Additional State, Federal, and other local emergency contact numbers are provided and should be used as deemed appropriate to the situation (**Table II.3.2**). If the EC determines that the incident could threaten fresh water, human health, public safety or the environment beyond the limits of the Facility, the EC will notify the National Response Center and USEPA at the following phone numbers (also included on **Table II.3.2**):

- National Response Center - 24 Hr. Hotline: (800) 424-8802
- Region VI Emergency Response Hotline (USEPA): (214) 665-2200

The EC's notification to authorities will include the following information, as listed on the Incident Report Form (**Attachment II.3.D**):

- name and telephone number of person reporting the incident
- name and address of Facility
- time and type of incident (e.g., hazardous material release, fire)

- name and quantity of material(s) involved, to the extent known
- extent of injuries, if any
- possible hazards to human health or the environment
- other information requested by the response entity

5.0 EMERGENCY EQUIPMENT

The following sections describe emergency equipment at Sundance West that will be available for responding to emergency situations. An Emergency Response Equipment List describing the equipment, quantity, location, and uses is provided as **Table II.3.10**.

TABLE II.3.10
Emergency Response Equipment List[1]
Sundance West

Equipment Description	Quantity	Location	Use(s)
10 lb ABC rated fire extinguisher	2	Facility Gatehouse	Firefighting
10 lb ABC rated fire extinguisher	2	Trucks	Firefighting
10 lb ABC rated fire extinguisher	1	Heavy Equipment	Firefighting
20 lb ABC rated fire extinguisher	1	Crude Oil Recovery Tanks	Firefighting
20 lb ABC rated fire extinguisher	1	Centrifuge Building	Firefighting
20 lb ABC rated fire extinguisher	1	Oil Sales Tanks	Firefighting
20 lb ABC rated fire extinguisher	1	Produced Water Tanks	Firefighting
20 lb ABC rated fire extinguisher	1	Diesel Storage Tank	Firefighting
Loader	1	Facility	Berm Repair
Oil Booms	4	NE Corner of Pond	Oil Containment
Self-contained Breathing Apparatus	1 per employee	Facility Gatehouse	Protective gear for employees
Pair leather gloves	1 per employee	Assigned to employee	Protective gear for employees
NOMEX Coveralls	7 per Employee	Assigned to Employee	Protective gear for employees
Pair safety glasses	1 per employee	All employee workstations	Protective gear for employees
Round-point wood handled shovels	2	Process Area Building	Contain spillage, putting out fires
First Aid Kit	1	Facility Gatehouse	First Aid
First Aid Kit	1 per vehicle	Facility Vehicles	First Aid
Eye Wash Station	1	Produced Water Receiving Tanks	First Aid
Emergency Shower	1	Produced Water Receiving Tanks	First Aid
Portable 2-way radio	1 per employee	Base unit at Facility Gatehouse	Communications
Cell Phones	min. 3	Facility Manager Facility Operator Facility Operator	Communications
Emergency Phone Number Pocket Cards (laminated)	1 per employee	Facility Operators	Communications
Office Phone	2	Facility Gatehouse	Communications
Mobile pressure washer	1	Mobile	Decontaminating equipment
H_2S personal monitors	1 per employee	Facility Operators	Monitoring for H_2S gas
GDS Stationary H_2S Monitors	6	Perimeter of Evaporation Ponds	Monitoring for H_2S gas
Wind Socks	1	NW & NE of Evaporation Ponds	Monitoring wind direction

Notes:

[1]*Subject to change in response to waste receipts, regulatory requirements, technology, etc.*

5.1 Internal Communications

Communications at Sundance West will be accomplished via cellular telephones, land lines, and two-way radios. These systems provide Facility personnel with immediate emergency notification capabilities, and the opportunity to receive instructions in the event of an emergency incident. Any mechanical difficulties with the communications equipment will be promptly repaired. Internal communication devices are also listed on **Table II.3.10.**

5.2 External Communications

The land-line telephones and cell phones located at Sundance West will have outside access in the event that notification of the local emergency response authorities is required (i.e., fire department, ambulance, etc.). Key Facility personnel including the ECs, Facility Manager, etc., will carry cellular telephones for contacting outside agencies. The cellular telephones also provide a backup means for contacting emergency authorities in the event they cannot be reached by conventional telephone lines. Emergency phone numbers will be posted in the Facility Gatehouse and provided to employees on laminated pocket cards. External communication devices are also listed on **Table II.3.10.**

5.3 Personnel Protection, First Aid, and Safety Equipment

Personal protective equipment (PPE) necessary for responding to a potential release of hazardous materials are maintained in on-site buildings (Facility Gatehouse and the Produced Water Facility) and/or issued to each employee (**Table II.3.10**). These items include Tyvek suits, gloves, safety glasses, hearing protection, self-contained breathing apparatus (SCBA), etc.

First aid and safety equipment are maintained at strategic locations at Sundance West as shown on **Table II.3.10**. Safety equipment located at the Facility includes industrial first aid kits, fire extinguishers, an eye wash station, etc. An emergency shower is located at the Produced Water Facility. First aid kits are placed in the Facility Gatehouse and the Produced Water Facility. In addition, first aid kits are maintained in all Facility vehicles, including heavy equipment. Prominent signs will be placed identifying the location of health and safety equipment, and emergency response items (e.g., fire extinguishers).

6.0 RECORDKEEPING

The EC will be responsible for ensuring that emergency response actions are fully documented. The Primary EC may complete the documentation requirements or delegate to another EC. The Incident Report Form (**Attachment II.3.D**) illustrates the information that will be recorded as a result of any emergency incident and related response action. This form will be signed by both the EC and the Facility Manager. Copies of the form filed for each incident will be retained for OCD review as part of the Facility Operating Record. A copy of OCD Form C-141 is provided as **Attachment II.3.E**. Copies of the Form filed for each incident will be retained on-site as part of the Facility Operating Record.

7.0 COORDINATION AGREEMENTS

A copy of this Plan will be made available to the organizations identified in **Table II.3.2**. This Plan serves to familiarize each of the identified organizations with the operations of the Facility and types of emergencies and responses that may be required. Each agency will be encouraged to visit the Facility for purposes of assessing site operations, and providing input regarding emergency response procedures (19.15.11.9.B.(2)(e) NMAC).

8.0 PLAN AMENDMENT

The EC will be responsible for assuring that updates to or amendments of this Plan are conducted and recorded in the event of any of the following (19.15.11.9.F NMAC):

1. The Facility Permit is revised or modified with potential impacts on this Plan.
2. The OCD mandates it, including responses to regulatory updates.
3. The Plan fails in an emergency.
4. Modification to the Facility design, construction, operation, maintenance or other circumstances that changes the potential circumstance or locations for fires, explosion, or releases of hazardous oil field waste constituents; or related changes in the appropriate emergency response.
5. The list of ECs changes.
6. The list of emergency equipment changes significantly.

The updated Plan will be distributed to OCD and made available to the organizations identified in **Table II.3.2** with a cover letter highlighting any substantive changes. Proposed changes will be in compliance with 19.15.36 NMAC.

9.0 TRAINING

As required of 19.15.11.9.B(2)(d) NMAC , the EC or Facility training representative will ensure all new and existing employees are trained on the H_2S Prevention and Contingency Plan at least annually; or when significant changes to the Plan have been made, whichever is more frequent. Prior to any new employee commencing work, a training session separate from the standard annual training will be conducted to provide specific proficiency in H_2S safety and procedures. Training will include both classroom drills and field exercises simulating H_2S monitoring, potential releases, and evacuation procedures. Included in this training are H_2S hazards identification and detection, personal protection, and contingency procedures.

Training will be provided to residents, as appropriate, on the proper protective measures to be taken in the event of a release. Briefings will be provided to public officials on issues such as evacuation or shelter-in-place plans.

APPLICATION FOR PERMIT
SUNDANCE WEST

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 3: HYDROGEN SULFIDE (H_2S) PREVENTION AND CONTINGENCY PLAN

ATTACHMENT II.3.A

MATERIAL SAFETY DATA SHEET FOR H_2S

MSDS Code: 001909
Status: Final

Date of Issue: 13-Oct-2005

ConocoPhillips

MATERIAL SAFETY DATA SHEET

Hydrogen Sulfide

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name:	Hydrogen Sulfide
Synonyms:	H2S Sour Gas Sulfuretted Hydrogen Hepatic Gas Hydrosulfuric Acid Alliance - Hydrogen Sulfide - 1605 Ferndale - Hydrogen Sulfide - 1605 LAR - Acid Gas LAR - Sour Gas Santa Maria - Acid gas Santa Maria - Sour Gas Trainer - Hydrogen Sulfide - S173 Wood River - Hydrogen Sulfide - 100240
Intended Use:	Refinery by-product
Chemical Family:	Inorganic Gas

Responsible Party:
ConocoPhillips
600 N. Dairy Ashford
Houston, Texas 77079-1175

MSDS Information:
800-762-0942
MSDS@conocophillips.com

Emergency Overview

24 Hour Emergency Telephone Numbers:
Spill, Leak, Fire or Accident Call CHEMTREC:
North America: (800) 424-9300
Others: (703) 527-3887 (collect)

California Poison Control System: (800) 356-3219

Health Hazards/Precautionary Measures: Poisonous hydrogen sulfide gas. Harmful if inhaled. Causes severe eye irritation. Use with ventilation adequate to keep exposure below recommended limits, if any. Do not breathe gas. Avoid contact with eyes. Wash thoroughly after handling.

Physical Hazards/Precautionary Measures: Flammable gas. Can cause flash fire. Keep away from heat, sparks, flames, static electricity or other sources of ignition. Do not enter storage areas or confined space unless adequately ventilated.

Appearance:	Colorless
Physical Form:	Gas
Odor:	Rotten egg (odorless at high concentrations or after prolonged exposure at low concentrations)

NFPA 704 Hazard Class:

Health:	4 (Extreme)
Flammability:	4 (Extreme)
Instability:	0 (Least)

2. COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS					
Component / CAS No:	**Percent (%)**	**ACGIH:**	**OSHA:**	**NIOSH:**	**Other:**
Hydrogen Sulfide 7783-06-4	100	10 ppm TWA 14 mg/m^3 TWA 15 ppm STEL 21 mg/m^3 STEL	20 ppm CEIL 50 ppm 10 min. peak	100 ppm IDLH	---

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

1%=10,000 PPM.
NE=Not Established

3. HAZARDS IDENTIFICATION

Potential Health Effects

Eye: Severe eye irritant. Contact may cause stinging, watering, redness, swelling, and eye damage.

Skin: Skin contact is unlikely. No information available on skin absorption.

Inhalation (Breathing): Toxic. May be harmful if inhaled.

Ingestion (Swallowing): This material is a gas under normal atmospheric conditions and ingestion is unlikely.

Signs and Symptoms: Effects of overexposure may include irritation of the eyes, nose, throat, and respiratory tract, blurred vision, photophobia (sensitivity to light), and pulmonary edema (fluid accumulation in the lungs). Severe exposures can result in nausea, vomiting, muscle weakness or cramps, headache, disorientation and other signs of nervous system depression, irregular heartbeats (arrhythmias), sudden collapse, respiratory failure, convulsions and death.

Cancer: There is no information available on the cancer hazard of this material.

Target Organs: No data available for this material.

Developmental: Inadequate data available for this material.

Other Comments: Hydrogen sulfide is a poisonous gas with the smell of rotten eggs. The smell disappears rapidly because of olfactory fatigue so odor may not be a reliable indicator of exposure.

Pre-Existing Medical Conditions: Conditions aggravated by exposure may include respiratory (asthma-like) disorders.

4. FIRST AID MEASURES

Eye: Immediately move victim away from exposure and into fresh air. If irritation or redness develops, flush eyes with clean water and seek immediate medical attention. For direct contact, immediately hold eyelids apart and flush the affected eye(s) with clean water for at least 20 minutes. Seek immediate medical attention.

Skin: First aid is not normally required. However, it is good practice to wash any chemical from the skin.

Inhalation (Breathing): Immediately move victim away from exposure and into fresh air. If respiratory symptoms or other symptoms of exposure develop, seek immediate medical attention. If victim is not breathing, clear airway and immediately begin artificial respiration. If breathing difficulties develop, oxygen should be administered by qualified personnel. Seek immediate medical attention.

Ingestion (Swallowing): This material is a gas under normal atmospheric conditions and ingestion is unlikely.

Notes to Physician: In high doses hydrogen sulfide may produce pulmonary edema and respiratory depression or paralysis. The first priority in treatment should be the establishment of adequate ventilation and the administration of 100% oxygen. Animal studies suggest that nitrites are a useful antidote; however, documentation of the efficacy of nitrites in humans is lacking. If the diagnosis of H2S is confirmed and the patient does not respond rapidly to supportive care, the use of nitrites is an alternative treatment. For adults the dose is 10 ml of a 3% NaNO2 solution (0.5 gm NaNO2 in 15 mL water) I.V. over 2-4 minutes. Dosage should be adjusted in children or in presence of anemia. Follow blood pressure, methemoglobin levels, arterial blood gases, and electrolytes closely in serious cases.

5. FIRE-FIGHTING MEASURES

Flammable Properties:

Flash Point:	10°F / -12°C
Test Method:	Test Method Unknown
OSHA Flammability Class:	Flammable Gas
LEL%:	4.0
UEL%:	46.0
Autoignition Temperature:	500°F / 260°C

Unusual Fire & Explosion Hazards: This material is flammable and can be ignited by heat, sparks, flames, or other sources of ignition (e.g., static electricity, pilot lights, or mechanical/electrical equipment, and electronic devices such as cell phones, computers, calculators, and pagers which have not been certified as intrinsically safe). Vapors may travel considerable distances to a source of ignition where they can ignite, flash back, or explode. Vapors are heavier than air and can accumulate in low areas. May create vapor/air explosion hazard indoors, in confined spaces, outdoors, or in sewers. If container is not properly cooled, it can rupture in the heat of a fire. Closed containers exposed to extreme heat can rupture due to pressure buildup.

Extinguishing Media: Dry chemical or carbon dioxide is recommended. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces.

Fire Fighting Instructions: For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear. When the potential chemical hazard is unknown, in enclosed or confined spaces, or when explicitly required by DOT, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area, keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. If this cannot be done, allow fire to burn. Move undamaged containers from immediate hazard area if it can be done with minimal risk. Stay away from ends of container.

Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done with minimal risk.

6. ACCIDENTAL RELEASE MEASURES

Flammable. Keep all sources of ignition and hot metal surfaces away from spill/release. The use of explosion-proof electrical equipment is recommended.

Stay upwind and away from spill/release. Notify persons down wind of the spill/release, isolate danger area and keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Wear appropriate protective equipment including respiratory protection as conditions warrant (see Section 8).

Water spray may be useful in minimizing or dispersing vapors (see Section 5).

Notify fire authorities and appropriate federal, state, and local agencies. If spill/release in excess of EPA reportable quantity (see Section 15) is made into the environment, immediately notify the National Response Center (phone number 800-424-8802).

7. HANDLING AND STORAGE

Handling: The use of explosion-proof electrical equipment is recommended and may be required (see appropriate fire codes). Refer to NFPA-704 and/or API RP 2003 for specific bonding/grounding requirements.

Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits (see Sections 2 and 8).

Use good personal hygiene practices.

Storage: Keep container(s) tightly closed. In a tank, barge, or other closed container, the vapor space above materials that contain hydrogen sulfide (H2S) may result in concentrations immediately dangerous to life or health (IDLH). Use and store this material in cool, dry, well-ventilated areas away from heat, direct sunlight, hot metal surfaces, and all sources of ignition. Post area "No Smoking or Open Flame." Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage. Outdoor or detached storage is preferred.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits (see Section 2), additional engineering controls may be required. Where explosive mixtures may be present, electrical systems safe for such locations must be used (see appropriate electrical codes).

Personal Protective Equipment (PPE):

Respiratory: Use a NIOSH approved self-contained breathing apparatus (SCBA) or equivalent operated in a pressure demand or other positive pressure mode in oxygen deficient environments (oxygen content <19.5%) or if exposure concentration is unknown or if conditions immediately dangerous to life or health (IDLH) exist.

A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use.

Skin: Not required based on the hazards of the material. However, it is considered good practice to wear gloves when handling chemicals.

Eye/Face: The use of a face shield and chemical goggles to safeguard against potential eye contact, irritation, or injury is recommended.

Other Protective Equipment: A source of clean water should be available in the work area for flushing eyes and skin. Impervious clothing should be worn as needed.

Suggestions for the use of specific protective materials are based on readily available published data. Users should check with specific manufacturers to confirm the performance of their products.

9. PHYSICAL AND CHEMICAL PROPERTIES

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm).

Appearance:	Colorless
Physical Form:	Gas
Odor:	Rotten egg (odorless at high concentrations or after prolonged exposure at low concentrations)
Odor Threshold:	0.0047 ppm
pH:	Not applicable
Vapor Pressure (mm Hg):	554.6 psia @ 100°F (38°C)
Vapor Density (air=1):	1.20
Boiling Point:	-60°F / -12°C
Melting/Freezing Point:	-86°F / -66°C
Solubility in Water:	Slight
Partition Coefficient (n-octanol/water) (Kow):	No data
Specific Gravity:	1.2 (Gas)
Heat Value (BTU):	-6552 (BTU/lb)

Percent Volatile:	100%
Evaporation Rate (nBuAc=1):	>1
Molecular Weight:	34.08
Flash Point:	10°F / -12°C
Test Method:	Test Method Unknown
LEL%:	4.0
UEL%:	46.0
Autoignition Temperature:	500°F / 260°C

10. STABILITY AND REACTIVITY

Stability: Stable under normal ambient and anticipated storage and handling conditions of temperature and pressure. Flammable gas.

Conditions to Avoid: Avoid high temperatures and all sources of ignition (see Sections 5 and 7). Toxic fumes can be released on heating.

Materials to Avoid (Incompatible Materials): Avoid contact with nitric acid, strong oxidizing agents.

Hazardous Decomposition Products: Combustion can yield sulfur oxides.

Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Chronic Data:

No definitive information available on carcinogenicity, mutagenicity, target organ, or developmental toxicity.

Acute Data:

Hydrogen Sulfide - CAS: 7783-06-4
Dermal LD50 = Not Applicable
LC50 = 600 ppm, 30 min. (Human)
Oral LD50 = Not Applicable

12. ECOLOGICAL INFORMATION

Not evaluated at this time.

13. DISPOSAL CONSIDERATIONS

This material, if discarded as produced or spilled to soil or water, would be a RCRA "listed" hazardous waste, as would any soils or waters contaminated by spills of the material. This material is listed as hydrogen sulfide (U135). Further, this material, once it becomes a waste, is subject to the land disposal restrictions at 40 CFR 268.40 and must be treated prior to disposal to meet specific standards. Consult state and local regulations to determine whether they are more stringent than the federal requirements.

Container contents should be completely used and containers should be emptied prior to discard. Container rinsate could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations. Larger empty containers, such as drums, should be returned to the distributor or to a drum reconditioner. To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

14. TRANSPORTATION INFORMATION

DOT

Note: This material normally remains in plant and does not enter the public transportation system. i.e. rail, highway, air or water.

IMDG

ICAO/IATA

	LTD. QTY.	Passenger Aircraft	Cargo Aircraft Only
Packaging Instruction #:	---	---	---
Max. Net Qty. Per Package:	---	---	---

15. REGULATORY INFORMATION

U.S. Regulations:

EPA SARA 311/312 (Title III Hazard Categories)
Acute Health: Yes
Chronic Health: No
Fire Hazard: Yes
Pressure Hazard: No
Reactive Hazard: No

SARA - Section 313 and 40 CFR 372:
This material contains the following chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372:
Hydrogen Sulfide.....7783-06-4.....100%

EPA (CERCLA) Reportable Quantity (in pounds):
Petroleum Exemption applies to this material.

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds):
This material contains the following chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372:
Hydrogen Sulfide.....7783-06-4.....500

California Proposition 65:
Warning: This material contains the following chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm, and are subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):
-- None Known --

Carcinogen Identification:
This material has not been identified as a carcinogen by NTP, IARC, or OSHA.

TSCA:
All components are listed on the TSCA inventory.

International Regulations:

Canadian Regulations:
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

Domestic Substances List: Listed
WHMIS Hazard Class:
B1 - Flammable Gases
D1A - Materials Causing Immediate and Serious Toxic Effects - Very Toxic Material
D2B - Materials Causing Other Toxic Effects - Toxic Material

16. OTHER INFORMATION

Issue Date:	13-Oct-2005
Previous Issue Date:	28-Dec-2000
Revised Sections or Basis for Revision:	Responsible party (Section 1) Added facility synonyms - SEE SECTION 1.
MSDS Code:	001909

Disclaimer of Expressed and implied Warranties:
The information presented in this Material Safety Data Sheet is based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

SAFETY DATA SHEET

Sulfur Dioxide

Airgas
an Air Liquide company

Section 1. Identification

GHS product identifier : Sulfur Dioxide

Chemical name : sulphur dioxide

Other means of identification : Sulfur dioxide; Sulfur oxide; Sulfurous oxide; Sulfurous acid anhydride; E 220; sulphurous acid anhydride; Sulfur superoxide; Sulfurous anhydride; Sulfur dioxide, anhydrous; Dioxide of sulfur; Sulphure dioxide; SULFUR DIOXIDE, LIQUID

Product type : Gas.

Product use : Synthetic/Analytical chemistry.

Synonym : Sulfur dioxide; Sulfur oxide; Sulfurous oxide; Sulfurous acid anhydride; E 220; sulphurous acid anhydride; Sulfur superoxide; Sulfurous anhydride; Sulfur dioxide, anhydrous; Dioxide of sulfur; Sulphure dioxide; SULFUR DIOXIDE, LIQUID

SDS # : 001047

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

24-hour telephone : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : GASES UNDER PRESSURE - Liquefied gas
ACUTE TOXICITY (inhalation) - Category 3
SKIN CORROSION - Category 1
SERIOUS EYE DAMAGE - Category 1

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Contains gas under pressure; may explode if heated.
Causes severe skin burns and eye damage.
Toxic if inhaled.

Precautionary statements

General : Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Always keep container in upright position.

Prevention : Wear protective gloves. Wear protective clothing. Wear eye or face protection. Use only outdoors or in a well-ventilated area. Avoid breathing gas.

Response : Immediately call a POISON CENTER or doctor. IF INHALED: Remove person to fresh air and keep comfortable for breathing. IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Storage : Store locked up. Protect from sunlight. Store in a well-ventilated place.

Section 2. Hazards identification

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : sulphur dioxide

Other means of identification : Sulfur dioxide; Sulfur oxide; Sulfurous oxide; Sulfurous acid anhydride; E 220; sulphurous acid anhydride; Sulfur superoxide; Sulfurous anhydride; Sulfur dioxide, anhydrous; Dioxide of sulfur; Sulphure dioxide; SULFUR DIOXIDE, LIQUID

Product code : 001047

CAS number/other identifiers

CAS number : 7446-09-5

Ingredient name	%	CAS number
sulphur dioxide	100	7446-09-5

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician.

Inhalation : Get medical attention immediately. Call a poison center or physician. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Get medical attention immediately. Call a poison center or physician. Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : As this product is a gas, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : Toxic if inhaled.

Skin contact : Causes severe burns.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:, pain, watering, redness

Section 4. First aid measures

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:, pain or irritation, redness, blistering may occur

Ingestion : Adverse symptoms may include the following:, stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
sulfur oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not breathe gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Immediately contact emergency personnel. Stop leak if without risk.

Section 6. Accidental release measures

Large spill : Immediately contact emergency personnel. Stop leak if without risk. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Do not get in eyes or on skin or clothing. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
Empty containers retain product residue and can be hazardous. Do not breathe gas.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F). Store locked up. Keep container tightly closed and sealed until ready for use. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
sulphur dioxide	**California PEL for Chemical Contaminants (*Table AC-1*) (United States).** PEL: 2 ppm 8 hours. STEL: 5 ppm 15 minutes. **ACGIH TLV (United States, 3/2019).** STEL: 0.25 ppm 15 minutes. **OSHA PEL 1989 (United States, 3/1989).** TWA: 2 ppm 8 hours. TWA: 5 mg/m³ 8 hours. STEL: 5 ppm 15 minutes. STEL: 10 mg/m³ 15 minutes. **NIOSH REL (United States, 10/2016).** TWA: 2 ppm 10 hours. TWA: 5 mg/m³ 10 hours. STEL: 5 ppm 15 minutes. STEL: 13 mg/m³ 15 minutes. **OSHA PEL (United States, 5/2018).** TWA: 5 ppm 8 hours. TWA: 13 mg/m³ 8 hours.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Section 8. Exposure controls/personal protection

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles and/or face shield. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Gas. {NOTE: A LIQUID BELOW 14 F. SHIPPED AS A LIQUEFIED COMPRESSED GAS.}

Color : Colorless.

Odor : Pungent.

Odor threshold : Not available.

pH : Not available.

Melting point : -72°C (-97.6°F)

Boiling point : -10°C (14°F)

Critical temperature : 156.85°C (314.3°F)

Flash point : [Product does not sustain combustion.]

Evaporation rate : Not available.

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Not available.

Vapor pressure : 34 (psig)

Vapor density : 2.25 (Air = 1)

Specific Volume (ft ^{3}/lb) : 5.9172

Gas Density (lb/ft ^{3}) : 0.169

Relative density : Not applicable.

Solubility : Not available.

Solubility in water : Not available.

Section 9. Physical and chemical properties

Partition coefficient: n-octanol/water : Not available.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Not applicable.

Flow time (ISO 2431) : Not available.

Molecular weight : 64.06 g/mole

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : No specific data.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
sulphur dioxide	LC50 Inhalation Gas.	Rat	2520 ppm	1 hours

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
sulphur dioxide	Eyes - Mild irritant	Rabbit	-	768 hours 6 ppm	-

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Classification

Product/ingredient name	OSHA	IARC	NTP
sulphur dioxide	-	3	-

Reproductive toxicity

Not available.

Teratogenicity

Section 11. Toxicological information

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : Toxic if inhaled.

Skin contact : Causes severe burns.

Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:, pain, watering, redness

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:, pain or irritation, redness, blistering may occur

Ingestion : Adverse symptoms may include the following:, stomach pains

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Route	ATE value
Inhalation (gases)	1260 ppm

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Not available.

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1079	UN1079	UN1079	UN1079	UN1079
UN proper shipping name	SULFUR DIOXIDE	SULFUR DIOXIDE; OR SULPHUR DIOXIDE	SULFUR DIOXIDE	SULPHUR DIOXIDE	SULPHUR DIOXIDE
Transport hazard class(es)	2.3 (8) 	2.3 (8) 	2.3 (8) 	2.3 (8) 	2.3 (8) 
Packing group	-	-	-	-	-
Environmental hazards	No.	No.	No.	No.	No.

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Additional information

DOT Classification : Toxic - Inhalation hazard Zone C
Limited quantity Yes.
Quantity limitation Passenger aircraft/rail: Forbidden. Cargo aircraft: Forbidden.
Special provisions 3, B14, T50, TP19

Section 14. Transport information

TDG Classification : Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.13-2.17 (Class 2), 2.40-2.42 (Class 8).
Explosive Limit and Limited Quantity Index 0
ERAP Index 500
Passenger Carrying Vessel Index Forbidden
Passenger Carrying Road or Rail Index Forbidden

IATA : **Quantity limitation** Passenger and Cargo Aircraft: Forbidden. Cargo Aircraft Only: Forbidden.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

Clean Air Act (CAA) 112 regulated toxic substances: sulphur dioxide

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

Name	%	EHS	SARA 302 TPQ (lbs)	SARA 302 TPQ (gallons)	SARA 304 RQ (lbs)	SARA 304 RQ (gallons)
sulphur dioxide	100	Yes.	500	-	500	-

SARA 304 RQ : 500 lbs / 227 kg

SARA 311/312

Classification : Refer to Section 2: Hazards Identification of this SDS for classification of substance.

State regulations

Massachusetts : This material is listed.

New York : This material is listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

California Prop. 65

⚠ **WARNING**: This product can expose you to sulfur dioxide, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

Section 15. Regulatory information

Ingredient name	No significant risk level	Maximum acceptable dosage level
sulfur dioxide	-	Yes.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Inventory list

Australia : This material is listed or exempted.

Canada : This material is listed or exempted.

China : This material is listed or exempted.

Europe : This material is listed or exempted.

Japan : **Japan inventory (ENCS)**: This material is listed or exempted.
Japan inventory (ISHL): Not determined.

New Zealand : This material is listed or exempted.

Philippines : This material is listed or exempted.

Republic of Korea : This material is listed or exempted.

Taiwan : This material is listed or exempted.

Thailand : Not determined.

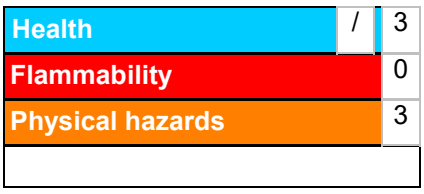
Turkey : Not determined.

United States : This material is active or exempted.

Viet Nam : This material is listed or exempted.

Section 16. Other information

Hazardous Material Information System (U.S.A.)

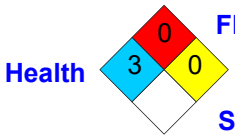


Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings and the associated label are not required on SDSs or products leaving a facility under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

The customer is responsible for determining the PPE code for this material. For more information on HMIS® Personal Protective Equipment (PPE) codes, consult the HMIS® Implementation Manual.

National Fire Protection Association (U.S.A.)

Section 16. Other information



Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
GASES UNDER PRESSURE - Liquefied gas	Expert judgment
ACUTE TOXICITY (inhalation) - Category 3	On basis of test data
SKIN CORROSION - Category 1	Expert judgment
SERIOUS EYE DAMAGE - Category 1	Expert judgment

History

Date of printing : 9/29/2021

Date of issue/Date of revision : 9/29/2021

Date of previous issue : 2/1/2018

Version : 1.02

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

References : Not available.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

APPLICATION FOR PERMIT
SUNDANCE WEST

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 3: HYDROGEN SULFIDE (H_2S) PREVENTION AND CONTINGENCY PLAN

ATTACHMENT II.3.C

DAILY AIR AND WATER INSPECTION REPORT FORM H_2S MONITOR

(TYPICAL)

ATTACHMENT II.3.C

Daily Air and Water Inspection (Typical)
Sundance West

YEAR_____ MONTH_____ WEEK BEGINNING_____

AMBIENT AIR WIND SPEED/DIRECTION
A.AM READINGS, NOTE INTIALS AND TIME
B.PM READINGS, NOTE INTIALS AND TIME
SUMP LEVELS
A. POND AND SLAB CHECKED DAILY,NOTE INTIALS AND TIME
B. PUMP SUMP CHECKED AM & PM,NOTE INTIALS AND TIME
C. LOADING AREA SUMP CHECKED AM & PM, NOTE INTIALS AND TIME

LOADING SUMP EMPTIED
A. LOADING AREA SUMP EMPTIED AT 4 PM, NOTE INTIALS AND TIME
CONCRETE SLAB EMPTIED
A.SLAB EMPTIED AT 4 PM, NOTE INTIALS AND TIME

Date	Sun	Mon	Tues	Wed	Thu	Fri	Sat
Ambient Air H2S (AM)							
H2S Reading (ppm)							
Wind Speed (mph)							
Wind Direction							
Initials and Time							
Ambient Air H2S (PM)							
H2S Reading (ppm)							
Wind Speed (mph)							
Wind Direction							
Initials and Time							
Sump Levels							
AM Pond Sump (ft)							
AM Cement Slab (ft)							
AM Loading Area (ft)							
AM Pump House Sump (ft)							
Intials and Time							
PM Loading Area (ft)							
PM Pump House(ft)							
Intials and Time							
Loading Sump Emptied							
Intials and Time							
Concrete Slab Emptied							
Intials and Time							
Pond Conditions							
Pond Level							
Overflow Color							
Pond Color							
Water Temperature							
pH							
Dissolved Oxygen							
Total Chlorine							
Dissolved H2S/Sulfides							
Bleach/Chemical							
Volume							
Time							
Initials							
Volume							
Time							
Initials							
Volume							
Time							
Initials							
Manager Verification							
Intials and Time							

APPLICATION FOR PERMIT
SUNDANCE WEST

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 3: HYDROGEN SULFIDE (H_2S) PREVENTION AND CONTINGENCY PLAN

ATTACHMENT II.3.D

INCIDENT REPORT FORM (TYPICAL)

INCIDENT REPORT FORM
Sundance West

Lea County, NM

Type of Incident and General Information

- ❑ Work Related Injury/Illness
- ❑ Property Damage
- ❑ Vehicular Accident
- ❑ Unsafe Act/Near Miss
- ❑ Vandalism/Criminal Activity
- ❑ Other _____ (i.e., spill, release, fire, explosion, hot load, etc.)

Employee Name: _____ Job Title: _____

Phone No: _____ Date of Incident: _____ Time of Incident: _____ AM/PM

Location of Incident: _____

Start of Shift:_____ Weather:_____

Date and Time Reported to Management: Date: _____ Time: _____ AM/PM

Reported to: _____ Title: _____ Reported by: _____

What was the injury category of incident at the time it was first reported to management?

[ ] N/A. Employee does not claim an injury associated with this incident
[ ] Notice Only of Injury, Declined Medical Treatment at this time
[ ] First Aid done on site, Declined Medical Treatment at this time
[ ] Medical Treatment. Transported by _____ to _____
[ ] Fatality, employee

Employee's Description of Incident / Declaración del empleado de los hechos

THIS SECTION FILLED OUT BY EMPLOYEE

Were you injured? *(Ud. se lastimó ?)* **Yes [ ]** **No [ ]**

Type of Injury: *(Tipo de lesión)* _____

Part of Body: _____ Left _____ Right _____
(Parte del cuerpo) *(Izq)* *(Der)*

Explain in your own words what happened. *(Explique en sus propias palabras lo que sucedió)*

_____

_____

_____

_____

_____

Employee Signature: (*Firma del empleado*) _____

Date: (*Fecha*) _____

P:\FILES\530.06.01\PermitApp\Volume II\II.3-H2S\II.3-Original\SWest-II.3-Att II.3.D-IncidentRptForm.docx

INCIDENT REPORT FORM
Sundance West

TO BE FILLED OUT BY EMERGENCY COORDINATOR

Describe in order of occurrence the events leading to the incident and/or injury. Reconstruct the sequence of events that led to the incident. _____

Identify possible hazards to human health or the environment: _____

Identify name and quantity of material(s) involved: _____

CORRECTIVE ACTIONS. (Equipment, Practices, Environment, Retraining) Steps that have been, or will be taken to prevent recurrence: _____

Date Corrective Action Completed: _____

- I have been briefed on the corrective actions outlined above
- *Estoy consciente de las acciones correctivas mencionadas anteriormente en esta hoja*

_____
Employee's Signature

_____
Date

Report Reviewed and Concluded By:

_____
Emergency Coordinator's Signature

_____
Date

APPLICATION FOR PERMIT
SUNDANCE WEST

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 3: HYDROGEN SULFIDE (H_2S) PREVENTION AND CONTINGENCY PLAN

ATTACHMENT II.3.E

RELEASE NOTIFICATION AND CORRECTIVE ACTION, OCD FORM C-141

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources Department

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-141
Revised August 24, 2018
Submit to appropriate OCD District office

Incident ID	
District RP	
Facility ID	
Application ID	

Release Notification

Responsible Party

Responsible Party	OGRID
Contact Name	Contact Telephone
Contact email	Incident # *(assigned by OCD)*
Contact mailing address	

Location of Release Source

Latitude _____ Longitude _____
(NAD 83 in decimal degrees to 5 decimal places)

Site Name	Site Type
Date Release Discovered	API# *(if applicable)*

Unit Letter	Section	Township	Range	County

Surface Owner: ☐ State ☐ Federal ☐ Tribal ☐ Private (*Name:* _____)

Nature and Volume of Release

Material(s) Released (Select all that apply and attach calculations or specific justification for the volumes provided below)

☐ Crude Oil	Volume Released (bbls)	Volume Recovered (bbls)
☐ Produced Water	Volume Released (bbls)	Volume Recovered (bbls)
	Is the concentration of dissolved chloride in the produced water >10,000 mg/l?	☐ Yes ☐ No
☐ Condensate	Volume Released (bbls)	Volume Recovered (bbls)
☐ Natural Gas	Volume Released (Mcf)	Volume Recovered (Mcf)
☐ Other (describe)	Volume/Weight Released (provide units)	Volume/Weight Recovered (provide units)
Cause of Release		

State of New Mexico
Oil Conservation Division

Incident ID	
District RP	
Facility ID	
Application ID	

Was this a major release as defined by 19.15.29.7(A) NMAC? ☐ Yes ☐ No	If YES, for what reason(s) does the responsible party consider this a major release?
If YES, was immediate notice given to the OCD? By whom? To whom? When and by what means (phone, email, etc)?	

Initial Response

The responsible party must undertake the following actions immediately unless they could create a safety hazard that would result in injury

☐ The source of the release has been stopped.

☐ The impacted area has been secured to protect human health and the environment.

☐ Released materials have been contained via the use of berms or dikes, absorbent pads, or other containment devices.

☐ All free liquids and recoverable materials have been removed and managed appropriately.

If all the actions described above have not been undertaken, explain why:

Per 19.15.29.8 B. (4) NMAC the responsible party may commence remediation immediately after discovery of a release. If remediation has begun, please attach a narrative of actions to date. If remedial efforts have been successfully completed or if the release occurred within a lined containment area (see 19.15.29.11(A)(5)(a) NMAC), please attach all information needed for closure evaluation.

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to OCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the OCD does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to groundwater, surface water, human health or the environment. In addition, OCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Printed Name: _____ Title: _____

Signature: _____ Date: _____

email: _____ Telephone: _____

OCD Only

Received by: _____ Date: _____

State of New Mexico
Oil Conservation Division

Incident ID	
District RP	
Facility ID	
Application ID	

Site Assessment/Characterization

This information must be provided to the appropriate district office no later than 90 days after the release discovery date.

What is the shallowest depth to groundwater beneath the area affected by the release?	_____ (ft bgs)
Did this release impact groundwater or surface water?	☐ Yes ☐ No
Are the lateral extents of the release within 300 feet of a continuously flowing watercourse or any other significant watercourse?	☐ Yes ☐ No
Are the lateral extents of the release within 200 feet of any lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark)?	☐ Yes ☐ No
Are the lateral extents of the release within 300 feet of an occupied permanent residence, school, hospital, institution, or church?	☐ Yes ☐ No
Are the lateral extents of the release within 500 horizontal feet of a spring or a private domestic fresh water well used by less than five households for domestic or stock watering purposes?	☐ Yes ☐ No
Are the lateral extents of the release within 1000 feet of any other fresh water well or spring?	☐ Yes ☐ No
Are the lateral extents of the release within incorporated municipal boundaries or within a defined municipal fresh water well field?	☐ Yes ☐ No
Are the lateral extents of the release within 300 feet of a wetland?	☐ Yes ☐ No
Are the lateral extents of the release overlying a subsurface mine?	☐ Yes ☐ No
Are the lateral extents of the release overlying an unstable area such as karst geology?	☐ Yes ☐ No
Are the lateral extents of the release within a 100-year floodplain?	☐ Yes ☐ No
Did the release impact areas **not** on an exploration, development, production, or storage site?	☐ Yes ☐ No

Attach a comprehensive report (electronic submittals in .pdf format are preferred) demonstrating the lateral and vertical extents of soil contamination associated with the release have been determined. Refer to 19.15.29.11 NMAC for specifics.

Characterization Report Checklist: ***Each of the following items must be included in the report.***

- ☐ Scaled site map showing impacted area, surface features, subsurface features, delineation points, and monitoring wells.
- ☐ Field data
- ☐ Data table of soil contaminant concentration data
- ☐ Depth to water determination
- ☐ Determination of water sources and significant watercourses within ½-mile of the lateral extents of the release
- ☐ Boring or excavation logs
- ☐ Photographs including date and GIS information
- ☐ Topographic/Aerial maps
- ☐ Laboratory data including chain of custody

If the site characterization report does not include completed efforts at remediation of the release, the report must include a proposed remediation plan. That plan must include the estimated volume of material to be remediated, the proposed remediation technique, proposed sampling plan and methods, anticipated timelines for beginning and completing the remediation. The closure criteria for a release are contained in Table 1 of 19.15.29.12 NMAC, however, use of the table is modified by site- and release-specific parameters.

Form C-141
Page 4

State of New Mexico
Oil Conservation Division

Incident ID	
District RP	
Facility ID	
Application ID	

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to OCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the OCD does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to groundwater, surface water, human health or the environment. In addition, OCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Printed Name: _____ Title: _____

Signature:_____ Date: _____

email: _____ Telephone: _____

OCD Only

Received by: _____ Date: _____

Incident ID	
District RP	
Facility ID	
Application ID	

Remediation Plan

Remediation Plan Checklist: ***Each of the following items must be included in the plan.***

- ☐ Detailed description of proposed remediation technique
- ☐ Scaled sitemap with GPS coordinates showing delineation points
- ☐ Estimated volume of material to be remediated
- ☐ Closure criteria is to Table 1 specifications subject to 19.15.29.12(C)(4) NMAC
- ☐ Proposed schedule for remediation (note if remediation plan timeline is more than 90 days OCD approval is required)

Deferral Requests Only: ***Each of the following items must be confirmed as part of any request for deferral of remediation.***

☐ Contamination must be in areas immediately under or around production equipment where remediation could cause a major facility deconstruction.

☐ Extents of contamination must be fully delineated.

☐ Contamination does not cause an imminent risk to human health, the environment, or groundwater.

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to OCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the OCD does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to groundwater, surface water, human health or the environment. In addition, OCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Printed Name: _____ Title: _____

Signature: _____ Date: _____

email: _____ Telephone: _____

OCD Only

Received by: _____ Date: _____

☐ Approved ☐ Approved with Attached Conditions of Approval ☐ Denied ☐ Deferral Approved

Signature: _____ Date: _____

Incident ID	
District RP	
Facility ID	
Application ID	

Closure

The responsible party must attach information demonstrating they have complied with all applicable closure requirements and any conditions or directives of the OCD. This demonstration should be in the form of a comprehensive report (electronic submittals in .pdf format are preferred) including a scaled site map, sampling diagrams, relevant field notes, photographs of any excavation prior to backfilling, laboratory data including chain of custody documents of final sampling, and a narrative of the remedial activities. Refer to 19.15.29.12 NMAC.

Closure Report Attachment Checklist: ***Each of the following items must be included in the closure report.***

☐ A scaled site and sampling diagram as described in 19.15.29.11 NMAC

☐ Photographs of the remediated site prior to backfill or photos of the liner integrity if applicable (Note: appropriate OCD District office must be notified 2 days prior to liner inspection)

☐ Laboratory analyses of final sampling (Note: appropriate ODC District office must be notified 2 days prior to final sampling)

☐ Description of remediation activities

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to OCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the OCD does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to groundwater, surface water, human health or the environment. In addition, OCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations. The responsible party acknowledges they must substantially restore, reclaim, and re-vegetate the impacted surface area to the conditions that existed prior to the release or their final land use in accordance with 19.15.29.13 NMAC including notification to the OCD when reclamation and re-vegetation are complete.

Printed Name: _____ Title: _____

Signature: _____ Date: _____

email: _____ Telephone: _____

OCD Only

Received by: _____ Date: _____

Closure approval by the OCD does not relieve the responsible party of liability should their operations have failed to adequately investigate and remediate contamination that poses a threat to groundwater, surface water, human health, or the environment nor does not relieve the responsible party of compliance with any other federal, state, or local laws and/or regulations.

Closure Approved by: _____ Date: _____

Printed Name: _____ Title: _____

APPLICATION FOR PERMIT
SUNDANCE WEST

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 3: HYDROGEN SULFIDE (H_2S) PREVENTION AND CONTINGENCY PLAN

ATTACHMENT II.3.F

PERSONAL MONITOR DATA SHEET

Honeywell | Gas Detection

THE POWER OF CONNECTED

BW Clip Series

Maintenance-Free Single-Gas Detectors

The most user-friendly, reliable and cost-effective way to ensure safety, compliance and productivity.

The BW Clip Series of single-gas detectors provides up to three years maintenance-free operation: Just turn on the device and it runs continuously — no need for calibration, sensor replacement, battery replacement or battery charging. That means great reliability and no downtime.

Plus, with the two-year version for H_2S or CO, you can put the device in a hibernation case when you're not using it for a week or more — and extend its life by that period of time.

Choose from two detectors; both of which are compact, lightweight and easy to handle, while tough enough for harsh environments and extreme temperatures:

- BW Clip – provides standard operation and no calibration
- BW Clip Real Time – includes a real-time gas level display and the ability to calibrate the device.

Both detectors are compatible with the IntelliDoX instrument management system.

Use our unique advanced technology for safety, compliance and productivity.

- **Surecell™**: unique dual reservoir sensor design dramatically improves instrument performance, response time, and longevity compared to traditional electrochemical sensors and consistently delivers reliable instrument performance under the harshest environmental conditions
- **Reflex Technology™**: advanced automated self-test function routinely checks the operating condition of the sensor to increase safety, up-time, and overall worker confidence
- **IntelliDoX:** instrument management system
  - The quickest bump test in the industry
  - Configuration of alarm set points and more
  - Performing different tests for up to five BW Clip detectors at once — for maximum productivity
  - Easy and accurate record-keeping

Configurable Options:

- Configuration of high and low alarm set points before the device is activated
- Adjustment of alarm set points and other parameters as needed throughout the lifespan
- Option to enable the noncompliance indicator, which flashes red when a bump test is due or a gas event occurs
- Option to display gas reading during alarm (BW Clip only)
- User settable bump test reminder
- User settable calibration reminder (BW Clip Real Time only)
- Option to display the Real Time Clock

FEATURES & BENEFITS

- Maintenance-free: no sensor or battery changes necessary
- Compact, lightweight design with one-button operation
- Designed for a range of harsh environments and extreme temperatures
- Hibernation mode with case accessory or IntelliDoX
- Automated self-test of battery, sensor and electronics
- Wide-angle flash, which alerts simultaneously with audible and vibrating alarm
- Automatic logging of the 35 most recent gas events and bump test results
- Affordable, with low cost of ownership
- Device Management with Honeywell SafetySuite

BW Clip Series Specifications

BW CLIP SERIES SPECIFICATIONS	
SIZE	1.6 x 2.0 x 3.4 in. / 4.1 x 5.0 x 8.7 cm
WEIGHT	3.2 oz. / 92 g
TEMPERATURE	H_2S: -40 to +122°F / -40 to +50°C CO: -22 to +122°F / -30 to +50°C O_2: -4 to +122°F / -20 to +50°C SO_2: -22 to +122°F / -30 to +50°C
HUMIDITY	5% - 95% RH (non-condensing)
ALARMS	Visual, vibrating, audible (95 dB) • Low, High
TESTS	Activated detectors automatically perform one internal diagnostic test every 24 hours
TYPICAL BATTERY LIFE	Two years (H_2S, CO, O_2 or SO_2) or three years (H_2S or CO) depending on the version
EVENT LOGGING	35 most recent events
INGRESS PROTECTION	IP 66/67
CERTIFICATIONS AND APPROVALS	Class I, Div. 1, Gr. A, B, C, D. Class I, Zone 0 , Gr. IIC **ATEX:** II 1G Ex ia IIC T4 Ga **IECEx:** Ex ia IIC T4 Ga CE European Conformity American Bureau of Shipping EAC Ex CU TR Ex (Customs Union)
WARRANTY	Two or three years from activation (given normal operation), plus one year shelf life (6 months for O_2). Up to three years for two-year H_2S and CO detectors when used with the hibernation feature, limited to 24 months of detector operation.

SENSOR SPECIFICATIONS

GAS	MEASURING RANGE	LOW ALARM LEVEL	HIGH ALARM LEVEL
2 OR 3 YEAR DETECTOR			
H_2S	0 -100 ppm	10 ppm	15 ppm
CO	0 - 300 ppm	35 ppm	200 ppm
2 YEAR DETECTOR			
O_2	0 - 25.0 % by vol.	19.5 %	23.5 %
SO_2	0 - 100 ppm	5 ppm	10 ppm

ALARM SETPOINTS ARE USER ADJUSTABLE BEFORE AND AFTER ACTIVATING THE DETECTOR.
SET POINTS SHOWN ARE MOST COMMON DEFAULT VALUES. ADDITIONAL DEFAULT VALUES ARE AVAILABLE.

Easy gas identification with color coded labels and LCD indication:

- H_2S
- CO
- O_2
- SO_2

Optional Accessories

- Hibernation Case
- Hard Hat Clip
- IntelliDoX instrument management system

For a complete list of kits and accessories, please contact Honeywell.

For more information
www.honeywellanalytics.com

Europe, Middle East, Africa
gasdetection@honeywell.com

Americas
detectgas@honeywell.com

Asia Pacific
analytics.ap@honeywell.com

Technical Services
EMEA: HAexpert@honeywell.com
US: ha.us.service@honeywell.com
AP: ha.ap.service@honeywell.com

Datasheet_BW Clip Series_DS20150108-04_US-EN | 04/18

Device Management with **Honeywell SafetySuite**

honeywellanalytics.com/SafetySuite

Honeywell

APPLICATION FOR PERMIT
SUNDANCE WEST

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 3: HYDROGEN SULFIDE (H_2S) PREVENTION AND CONTINGENCY PLAN

ATTACHMENT II.3.G

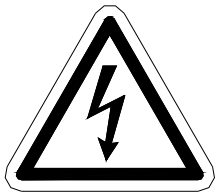
STATIONARY MONITORS DATA SHEETS AND MANUALS

GDS Corp
Gas and Flame Detection

Operation and Maintenance Manual

C2 / *TX* Wireless Site Manager for GASMAX/TX Wireless Gas Monitors

GDS Corp.
1245 Butler Road • League City, TX 77573
409-927-2980 • 409-927-4180 (Fax) • ww.gdscorp.com



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 1.0	10/1/13	Preliminary release (Updated 11/22/13)
Revision 1.1	3/11/14	Update for Version 1.02 Firmware & MODBUS Option
Revision 1.2	6/25/15	Additional information on MODBUS Communications

P/N 1200-0866-03

CONTENTS

TABLE OF FIGURES

1 SAFETY INFORMATION

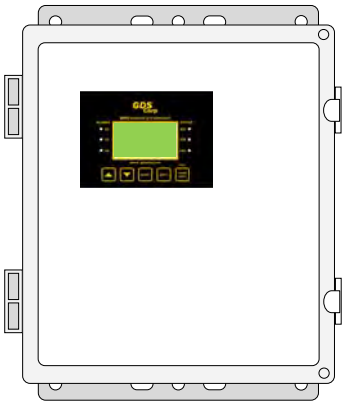
Important – Read Before Installation

Users should have a detailed understanding of C2/TX Wireless Site Manager operating and maintenance instructions. Use the C2/TX Wireless Site Manager 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

- Shock Hazard - Disconnect or turn off power before servicing this instrument.
- NEMA 4X wall mount models should be fitted with a locking mechanism after installation to prevent access to high voltages by unauthorized personnel.
- This equipment is suitable for use in Class I, Division 2, Groups A, B, C and D or non-hazardous locations only.
- WARNING- EXPLOSION HAZARD- SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.
- WARNING- EXPLOSION HAZARD- DO NOT REPLACE FUSE UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
- WARNING- EXPLOSION HAZARD- DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
- Use a properly rated CERTIFIED AC power (mains) cable installed as per local or national codes.
- For DC powered units, DC power must be from a SELV rated source.
- A certified AC power (mains) disconnect or circuit breaker should be mounted near the controller and installed following applicable local and national codes. If a switch is used instead of a circuit breaker, a properly rated CERTIFIED fuse or current limiter is required to be installed as per local or national codes. Markings for positions of the switch or breaker should state (I) for on and (O) for off.
- Clean using only a damp cloth with no solvents.
- Equipment not used as prescribed within this manual may impair overall safety.

2 GENERAL INFORMATION



The GDS Corp C2/TX Wireless Site Manager and matching GASMAX/TX Wireless Gas Monitors work together seamlessly to deliver highly reliable, cost effective, customer-friendly solutions for wireless gas detection. Featuring simplified wireless setup, advanced extended-range frequency hopping spread-spectrum technology, hardware and software data encryption and flexible output options, the C2/TX is ideal for small to medium sized wireless installations for toxic or hydrocarbon combustible gases. The C2/TX supports up to thirty-two single or sixteen dual channel GASMAX/TX wireless gas monitors.

Whereas previous generation wireless systems required users to select and coordinate channel frequencies, system and device identification codes and encryption options, the new C2/TX and GASMAX/TX wireless systems simplify the process by condensing all network settings into a single letter and device ID to a single number, making it extremely easy to configure, add to or troubleshoot a wireless system in the field.

In addition to easy setup, the C2/TX provides eight standard SPDT relays, which can be programmed to indicate alarm conditions as well as sensor fault and gas detector low battery warnings. An optional cellular modem interface and cloud software package enables the C3/TX to generate text messages or email warnings, so long as the controller is within range of a cellular communications tower.

Key features:

- Monitor up to 32 single or 16 dual channel GASMAX/TX monitors
- Automatic channel configuration based on data from each monitor
- Large LCD shows values, bar-graph and packet received info
- Eight standard 5A SPDT common relays
- Optional Wi-Fi, Data Logger and MODBUS serial interface
- Operates on either 110/220VAC or 12-24VDC; optional 50W supply
- Magnetic and touch keys for easy access to menus
- NEMA 4X polycarbonate, painted steel and stainless steel enclosures
- Suitable for use in Class I Division 2 Hazardous Areas

3 SPECIFICATIONS

Power Input	Internal AC supply: 110/220VAC, 50/60 Hz input, 20 watts steady state (40W max inrush) to TB5; If AC power, a maximum of 10 watts is available on TB3 and analog board "24VDC" terminals to power external devices External DC supply: 10-30VDC applied to TB1 (can be supplied as backup) Optional internal 50 watt AC power supply available for driving GDS-IR sensors or other high-wattage loads (requires extended enclosure)
Power Requirements	Basic controller - 3.0 watts Interface module – Add 1.5 watts
Display	64 x128 pixel LCD with alphanumeric display of alarm status and gas values
Input	Wireless – Up to 32 channel wireless 900 MHz or 2.4 GHz
Output	Standard – eight programmable SPST dry contact relays, 5A resistive six programmable SPST dry contact relays, 5A resistive (8 total)
RF Section (900 MHz)	Frequency range from 902 to 928 MHZ. Receiver sensitivity -100 dBm. Radio certified to FCC Part 15.247.
RF Section (2.4 GHz)	Frequency range from 2.406 GHz to 2.472 GHz. Receiver sensitivity -100 dBm. Radio certified to FCC Part 15.247.
Temperature	-25°C to +60°C Operating; 0 to 90% relative humidity
Altitude	Maximum operating 6200 ft / 2000 m
Housing	Aluminum housing (2) with epoxy paint standard; #316 stainless steel optional
Dimensions	Compact enclosure Extended enclosure NEMA 7
Approvals	CSA C22.2 No 1010.1 and ISA S82.02; CSA C22.2 No 152 for combustibles; UL 1604 / C22.2 No 213 (Div 2 Groups A,B,C,D); EN55011 & EN61000 (CE Mark).
Warranty	Two years on electronics

4 OPERATION

The C2/TX Wireless Site Manager is designed to receive, process, display and generate alarm and status outputs based on wireless data packets transmitted by GASMAX/TX wireless gas monitors. In addition, the C2/TX monitors each active channel and generates a “communications error” indication if a data packet is not received within a specified time.

Every five minutes or less (user configurable) each GASMAX/TX gas monitor transmits a **standard data packet** that contains information on current measured gas concentration, Alarm 1, Alarm 2, Alarm 3 status and Low Battery status bits. If the programmed Alarm 1 level is exceeded, the transmission frequency increases to **ten transmissions per minute** and remains at that rate until the gas level falls back below the alarm point. As each packet is received by the C2/TX, the alarm and battery status bits are processed by the local microprocessor and used to determine if an Alarm 1, Alarm 2 or Alarm 3 condition exists. Likewise, if a communications fault occurs, or if a Low Battery warning is received, the internal FAULT and LOW BATT status bits are set.

On power-up and periodically thereafter, each GASMAX/TX gas monitor transmits a **verbose data packet** that contains ‘static’ channel-specific information, including zero and span settings, tag name characters and engineering units characters. This information is stored by the C2/TX for display and retransmission across the optional Wi-Fi or serial MODBUS interface. The result is that channel-specific information need not be entered separately in both the gas detector and receiver, saving time and reducing the chance of programming errors.

Each of the eight programmable relays can be set to respond to Alarm 1, Alarm 2 or Alarm 3 conditions, as well as FAULT, LOW BATT or “none’. Furthermore, each relay can be set for Failsafe (“Normally open held closed”), Latching and Acknowledge operation, and can be assigned any selection of channel inputs.

An optional Communications & Data Logging Board (CDLB) provides RS-232 and RS-485 serial MODBUS, data logger with USB interface and 802.11b/g Wi-Fi connection with built-in web server.

IMPORTANT: ALARM LEVELS, TAG NAMES, ENGINEERING UNITS AND OTHER CHANNEL-SPECIFIC INFORMATION IS PROGRAMMED AT THE GASMAX/TX GAS MONITOR AND IS ***NOT*** ENTERED AT THE C2/TX WIRELESS SITE MANAGER.

5 WIRELESS SYSTEM BASICS

SYSTEM ARCHITECTURE

GDS Corp wireless uses discrete Frequency-Hopping Spread-Spectrum radios to communicate gas and alarm level information wirelessly between gas detectors and controllers. FHSS radios transmit individual data packets using different discrete frequencies in a pseudorandom sequence ("Hop Pattern") known to both transmitter and receiver. Unlike Direct-Sequence Spread Spectrum (DSSS) used for short distance 802.11 b/g "WiFi" and certain mesh networks, FHSS technology provides an ideal balance between power consumption, transmission distance and resistance to interference.

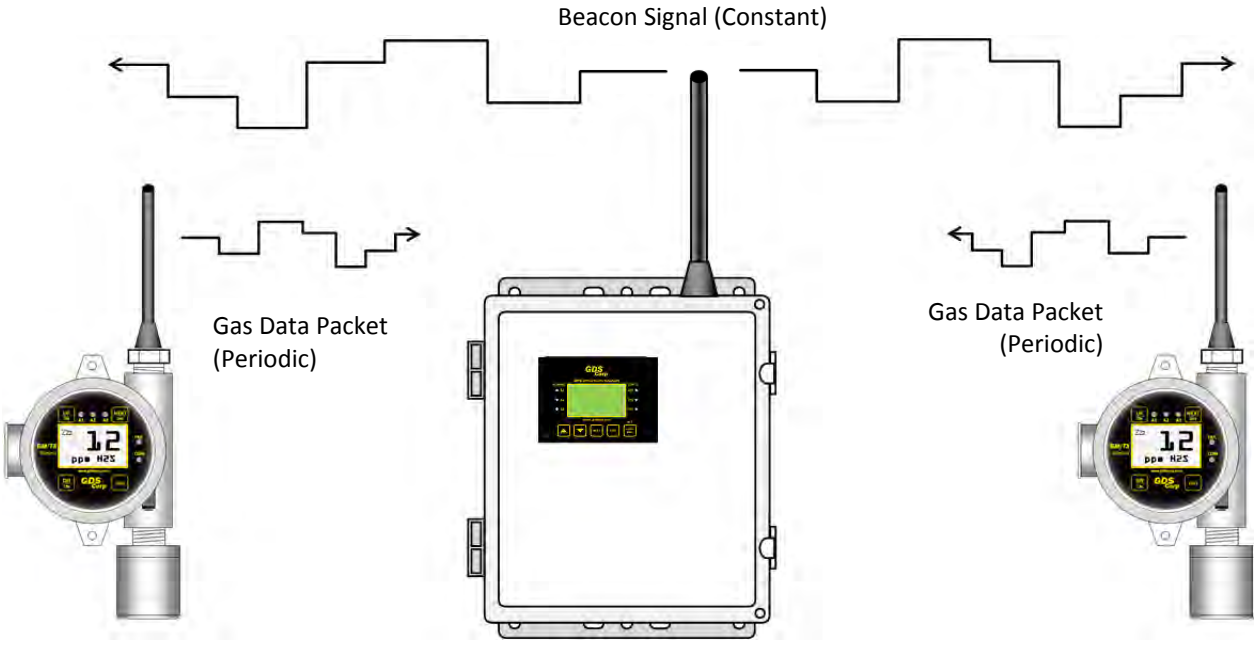


Figure 5-1: GDS Corp Wireless System Architecture

In each GDS Corp system, one device is configured as the "beacon server". This device transmits a modulated carrier signal that all other radios use to synchronize their frequency-hopping pattern. Knowledge of the selected hopping pattern programmed into the radio and synchronization data from the beacon enables each radio to know when to transmit, and on what frequency. Multiple networks can exist in the same frequency band so long as their choice of pseudorandom hopping pattern is unique. GASMAX/TX monitors support 26 unique network identifiers.

TRANSMISSION DISTANCE

In order for reliable wireless communication to occur, transmitter power output, antenna 'gain' and receiver sensitivity must exceed the 'free space loss' attenuation experienced by radio signals as they travel between transmitter and receiver. This gain or loss is measured in decibel-milliwatts (dBm) and is a function of both distance and frequency. Typical free space loss at 900 MHz is -71 dBm at 300 ft / 100 meters and -91 dBm at 3000 ft / 300 meters, and for 2.4 GHz the free space loss is -80 dBm at 300 ft/ 100 meters and -100 dBm at 3000 ft / 1000 meters.

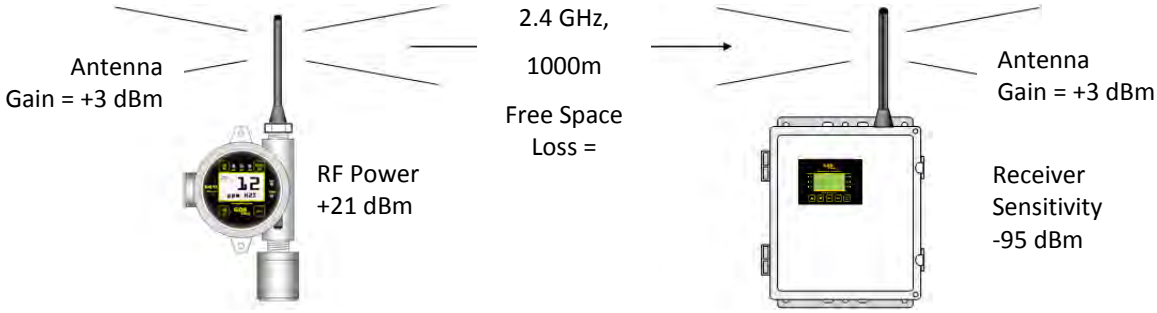


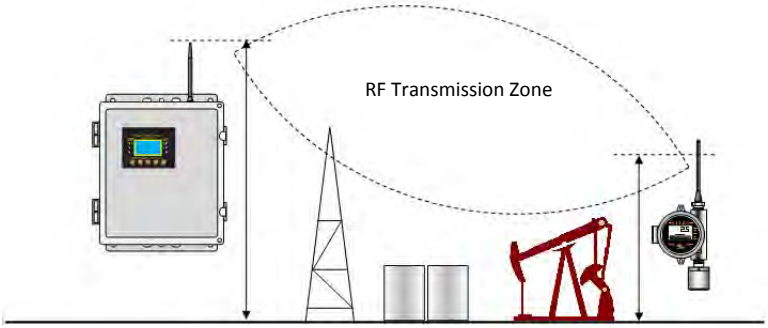
Figure 5-2: RF Transmission Margin

In a typical 2.4 GHz system shown above, for example, the transmitter power output is +21 dBm, each antenna provides an additional gain of +3 dBm and the receiver sensitivity is -95 dBm. Therefore, the total system gain is 21+3+3-(-95) = 122 dBm. Since a reliable system requires a margin of +20 dBm, this system will work if the free space loss between the transmitter and receiver is less than 102 dBm, suggesting a distance of approximately 1000 meters. However, this calculation does not take into account additional loses due to intervening structures or foliage.

To minimize free-space loss, the combined height of the transmitter antenna and receiver antenna should exceed the diameter of the "RF Transmission Zone" (see Fig. 5-3) and at least 60% of the area inside the zone should be free of obstacles. Although both 900 MHz and 2.4 GHz signals can travel around or through most towers or buildings, structures such as large metal tanks or solid metal buildings may attenuate the signal to the point where reception is marginal.

Raising the antenna at either end of the path will improve signal strength and reduce transmission errors. GDS Corp recommends placing the GASMAX/TX at least 5 feet above the surrounding terrain, and even more if possible. However, note that the standard antenna transmits its maximum signal strength in a

relatively flat 'donut-shaped' pattern which may affect the performance of GASMAX/TX monitors located in close proximity to an elevated C2/TX Site Manager or receiver/controller.



Combined Antenna Height		
Distance	900 MHz	2.4 GHz
100 Ft	10' / 3m	6' / 2m
500 Ft	22' / 7m	15' / 5m
1000 Ft	30'/ 10m	20' / 6m
3000 Ft	54' / 17m	N/A

Figure 5-3: RF Transmission Zone

GDS Corp always recommends that a wireless survey be completed at the site to ensure the integrity of the wireless communications link. Special care should be taken to account for moveable obstacles such as cranes, railroad cars, trucks, containers, and any other large 'structures' that could end up being placed – temporarily – in a location that blocks the wireless signal.

MONOPOLE AND COLLINEAR OMNI-DIRECTIONAL ANTENNAS

Monopole "rubber duck" antennas are the most commonly used antennas for portable and semi-portable equipment where extreme range or directional reception is required. When mounted vertically, they provide good 'omnidirectional' reception and transmission from all horizontal directions, and are generally rugged and when sealed properly against moisture can provide years of quality service.

Collinear antennas are more sophisticated and combine several vertical antennas that operate in parallel to increase signal gain by focusing the reception pattern in a more horizontal plane.

Rubber duck and collinear antennas provide best performance when installed with at least 1 to 2 "wavelengths" away from walls or steelwork. Since wavelength proportional to frequency, 900 MHz signals have a wavelength to approximately 12 inches and 2.4 GHz signals have a wavelength of about 3 inches**. Therefore, 900 MHZ antennas should be installed with at least 2 feet of clearance and 2.4GHz antennas at least 6 inches of clearance from walls or structures.** Antennas may be mounted with less clearance but output will be reduced; this may not matter if the distances involved are short. It is important the antenna mounting bracket to well connected to "earth" or "ground" for good lightning surge protection.

Rubber duck or collinear antennas emit RF energy in 'vertical polarization', where the electric fields oscillate in the vertical plane and the magnetic fields oscillate in the horizontal plane. Transmitting and receiving antennas should always be oriented such that the polarization is the same.

YAGI DIRECTIONAL ANTENNAS

Yagi antennas are directional along the central beam of the antenna. The folded element is towards the back and the antenna should be "pointed" in the direction of the transmission. Yagi antennas should also be mounted with at least 1 to 2 wavelengths of clearance from other objects. The polarity of the antenna is the same as the direction of the orthogonal elements. For example, if the elements are vertical the Yagi transmits with vertical polarity.

In networks spread over wide areas, it is common for a central receiver / controller to have an omni-directional antenna (such as a collinear) and the remote GAMAX/TX monitors to have Yagi directional antennas. In this case, as the omni-directional antenna will be mounted with vertical polarity, then the Yagi's must also have vertical polarity (see Fig. 5-3). Care needs to be taken to ensure the Yagi is aligned correctly to achieve optimum performance.

Two Yagi antennas can be used for a point-to-to link. In this case they can be mounted with the elements horizontally to give horizontal polarity. There is a large degree of RF isolation between horizontal and vertical polarity (~30dB) so this installation method is recommended if there is a large amount of interference from another system close by transmitting in vertical polarity.

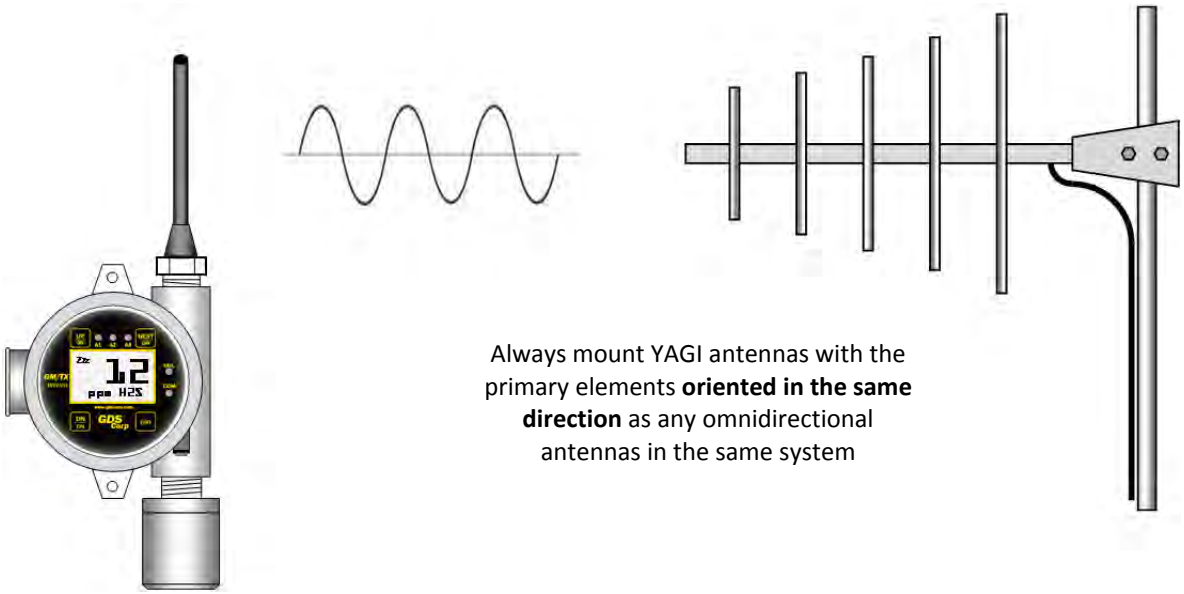


Figure 5-4: Vertically Polarized Omni-Directional and YAGI Antennas

COAXIAL CABLES

When installing a coaxial cable between the GASMAX/TX and a remote antenna, constructing a loop of cable below the antenna is always recommended. The loop allows water to drip off the bottom of the U instead of into the connection, reduces installation strain and provides spare cable length in case later the original connectors need to be replaced.

Avoid installing coax cables together in long parallel paths. Leakage from one cable to another has a similar effect as mounting an antenna near another antenna.

SURGE PROTECTION & GROUNDING

Voltage surges primarily enter the GASMAX/TX via the antenna connection as a result of electrical discharge in the atmosphere. Electrical energy follows the most direct path to earth and the best protection is achieved by “draining” the surge energy to earth via an effective earth ground. Wireless devices should have a solid connection to earth via a ground stake or ground grid if the soil has poor conductivity. Solid connection means a large capacity conductor (not a small wire) with no coils or sharp bends. All other devices connected to the GASMAX/TX, such as remote sensors, should be grounded to the same ground point is possible. There can be significant resistance between different ground points leading to very large voltage differences during lightning activity. As many wireless units are damaged by earth potential surges due to incorrect grounding as direct surge voltage.

It is very difficult to protect against direct lightning strikes but the probability of a direct strike at any one location is very small. Unfortunately, power line surges and electromagnetic energy in the air can induce high voltage surges from lightning activity several miles away.

6 HARDWARE OVERVIEW

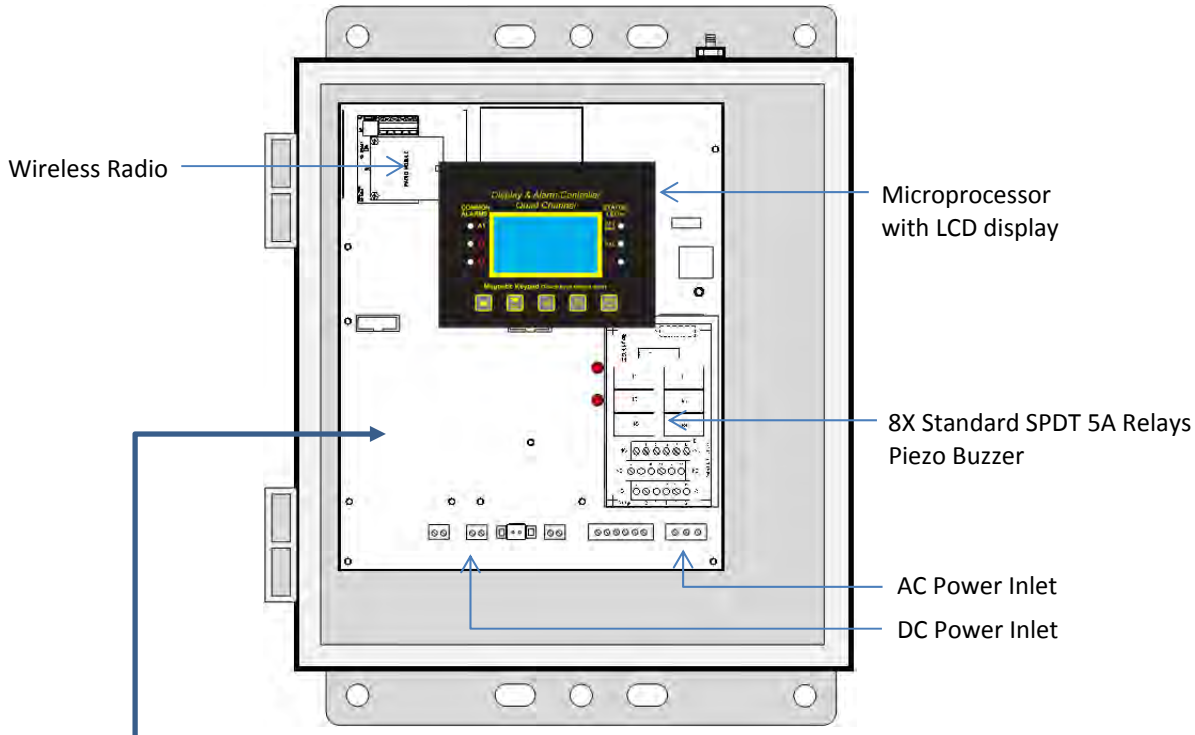


Figure 6-1: C2/TX Site Manager Overview

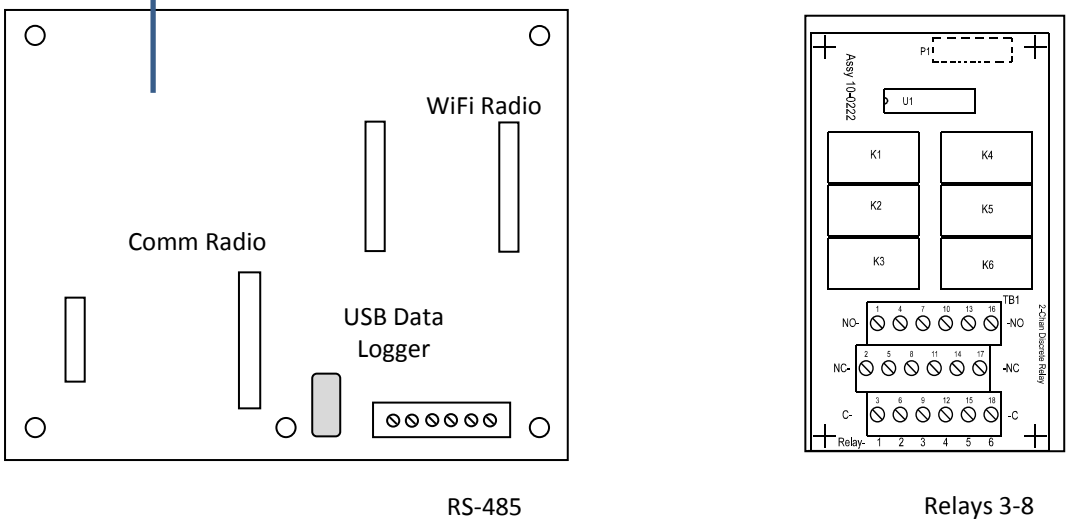


Figure 6-2: C2/TX Comm Expansion & Relay Expansion Board

MAIN SYSTEM BOARD

The C2/TX Wireless Site Manager main system board includes the radio module, power supply, AC and DC power and function expansion connectors and 8x standard relays. The CPU/Display assembly attaches to the main system board on standoffs and connects via a ribbon cable to connector S1.

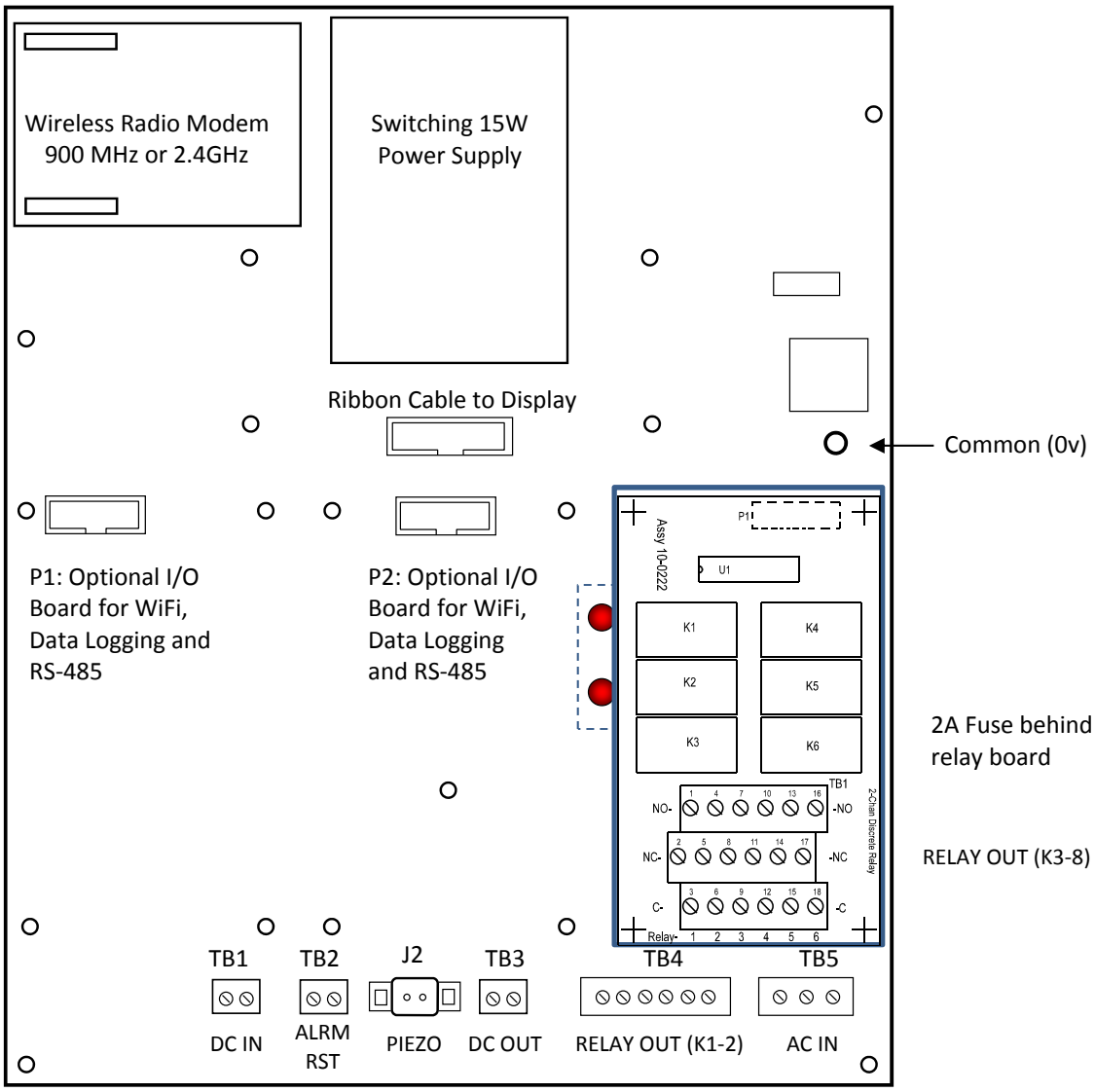


Figure 6-3: C2/TX Wireless Site Manager Motherboard

I/O CONNECTOR P1

I/O connector P2 is reserved for the optional Communications & Data Logging Expansion board. The CDLE board provides a 802.11 b/g WiFi interface, solid state data logger and RS-485 and RS-232 serial interfaces.

I/O CONNECTOR P2

I/O connector P2 is reserved for the optional Communications & Data Logging Expansion board. The CDLE board provides a 802.11 b/g WiFi interface, solid state data logger and RS-485 and RS-232 serial interfaces.

TERMINAL BLOCKS

TB1 is used when the C2/TX is powered by an external DC power supply or solar power system.

J2 is a 2-pin polarized connector for powering the audible large piezo buzzer.

TB2 offers field terminals for a remote Alarm Reset normally-open pushbutton switch.

TB3 provides a convenient connection point for external devices that require 24VDC. DC output is limited to 350 mA if using the internal DC supply. See Figure 5-1 for a more detailed description of the DC input and output options.

TB4 provides field wiring terminals for relays K1 and K2. Indicator LEDS for Relay 1 and Relay 2 are located on the main system board.

TB5 provides a connection to the onboard 100-240 VAC power supply (if the 50W optional supply is not installed).

Relay Out (Relay 3-8) provides connections to the six SPDT relays mounted on the relay expansion board.

IMPORTANT: AC OR DC POWER SUPPLIES TO RELAYS ON THE SIX-CHANNEL RELAY EXPANSION BOARD **MUST BE THE SAME FOR EACH RELAY**. EXAMPLE: 24VDC SHOULD NOT BE THE POWER SWITCHED BY ONE RELAY AND 115VAC BY OTHERS.

IMPORTANT: ALL MECHANICAL (DRY CONTACT) RELAYS ARE RATED AT 5 AMP FOR 28 VDC AND 250 ~VAC RESISTIVE LOADS. APPROPRIATE DIODE (DC LOADS) OR MOV (AC LOADS) SNUBBER DEVICES **MUST BE INSTALLED WITH INDUCTIVE LOADS** TO PREVENT RFI NOISE SPIKES.

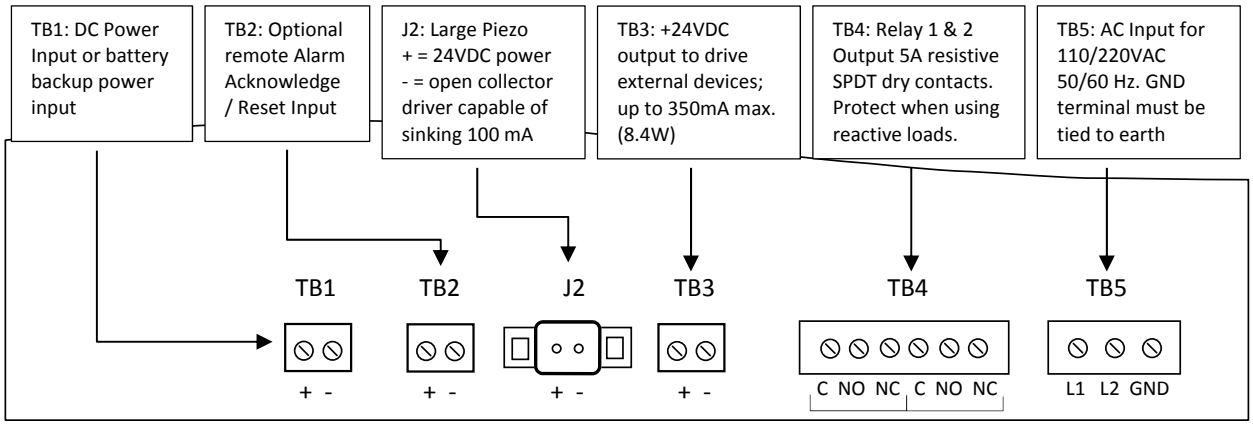


Figure 6-4: Main System Board User Connections Detail

DISPLAY / CPU MODULE

The Display & CPU module mounts on the motherboard using standoffs and connects to the system via a short ribbon cable. The display includes a 128 x 64 pixel bit-mapped LCD, six LED indicators, five physical pushbuttons and a low volume piezo buzzer. Display contrast can be adjusted via the LCD Contrast potentiometer at the lower left corner of the display PCB.

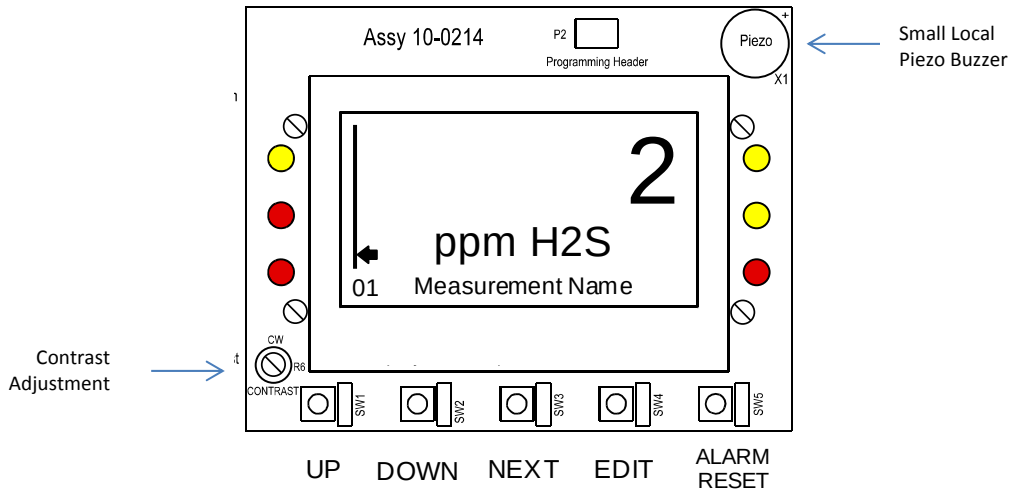


Figure 6-5: Display / CPU Module

RELAY EXPANSION BOARD

The Relay Expansion Board contains six SPDT five-amp relays that can be programmed to open or close as a result of multiple alarm conditions. Note that Relay "1" and Relay "2" are located on the motherboard and Relay "3" through Relay "8" are located on the Relay Expansion Board.

COMMUNICATIONS EXPANSION BOARD

The optional Communications Expansion Board includes an RS-232 or RS-485 serial MODBUS connection as well as hosting sites for the WiFi radio modem and second MODBUS radio modem.

Access to the on-board MODBUS interface is through TB2 as shown below. When the interface is programmed for RS-232, use the TX, RX and G connections as shown below.

IMPORTANT: TERMINATION JUMPER MUST BE SET TO "B" (W/O TERM) WHEN USING RS-232 COMM

When the interface is programmed for RS-485, use the "A" and "B" connections as shown below. Two sets of wiring terminals as well as a common shield ("S") connection are provided to facilitate daisy-chain loops. When using RS-485, a common ground wire is required if the master and slave devices operate from separately grounded AC or DC supplies.

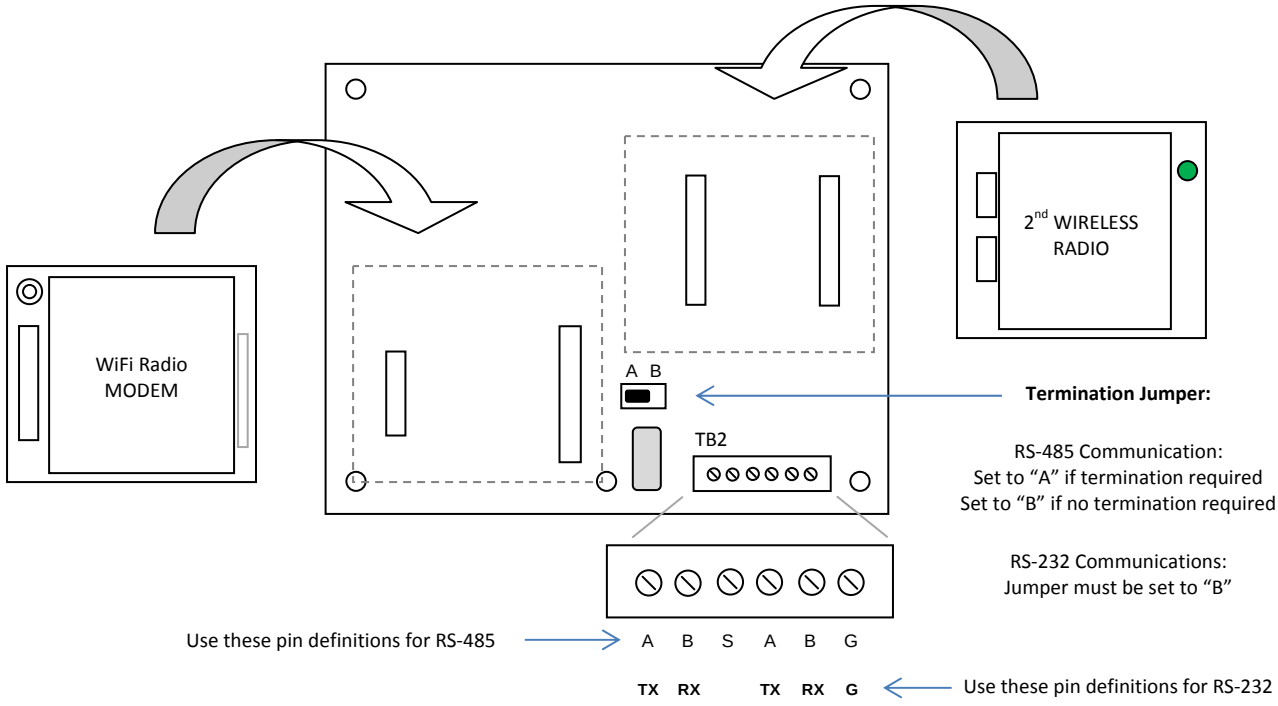


Figure 6-6 - Communications Expansion Board

OPTIONAL 50W POWER SUPPLY

Some applications may require DC power in excess of the 10 watts available from the universal power supply located on the system board. C2/TX Wireless Site Managers can be equipped with a DIN-rail mounted 50 watt DC supply rated for Class I Division 2 hazardous areas. This would be useful is the controller needs to power local strobe lights or large horn sounders.

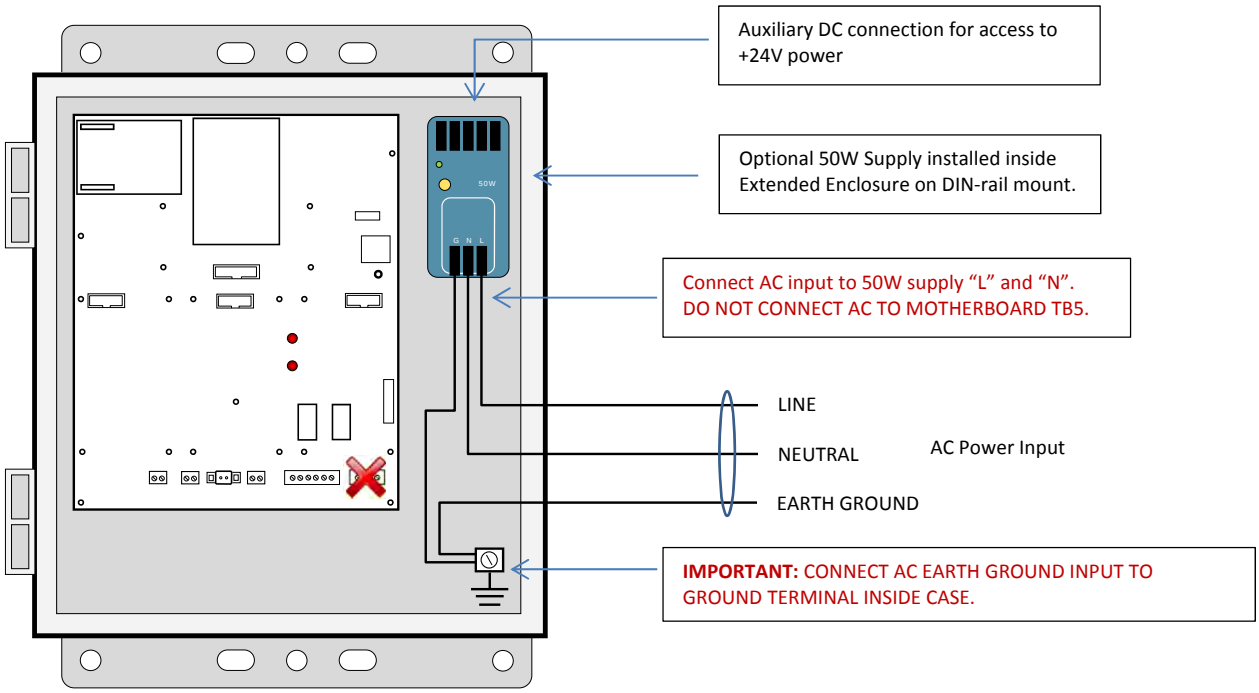


Figure 6-7: Optional 50W Power Supply Wiring

IMPORTANT: WHEN USING THE OPTIONAL 50W POWER SUPPLY, DC POWER IS **NOT** AVAILABLE FROM MOTHERBOARD CONNECTOR TB3. IF +24VDC IS REQUIRED FOR LIGHTS OR HORNS, CONNECT DC WIRING TO THE UNUSED (+) AND (-) CONNECTIONS ON THE TOP TERMINAL BLOCK OF THE 50W SUPPLY.

7 INSTALLATION

SELECTING A LOCATION

The C2/TX Wireless Site Manager should be mounted in a location with good line-of-sight access for wireless gas detectors, suitable visibility for any locally-mounted warning strobe or horn, and access to AC or DC power. Entry gates, central control rooms, outdoor instrument shelters and free-standing poles are ideal locations. Since the C2/TX Wireless Site Manager can operate on 12VDC power, it can be easily mounted to hardware supporting temporary or permanently installed solar panels. Hardware for wall mount, pole mount and magnetic mount is available. The controller should not be mounted in direct sunlight and should be kept away from sources of vibration or shock.

MOUNTING THE C2/TX WIRELESS SITE MANAGER

The C2/TX Site Manager Controller offers three types of mounting: wall mount, magnetic mount and pole mount. See Chapter 13 for detailed dimensions for each type of enclosure.

POWER & RELAY WIRING

The Motherboard PCB contains a 24 VDC universal input (100-240 VAC) switching power supply with up to 350mA available at the TB3 Auxiliary Power Output terminals. If AC power is unavailable, or if a DC battery back-up supply is needed, TB1 provides terminals for DC power input. Blocking diodes isolate internal and external DC supplies as shown in Figure 5-1.

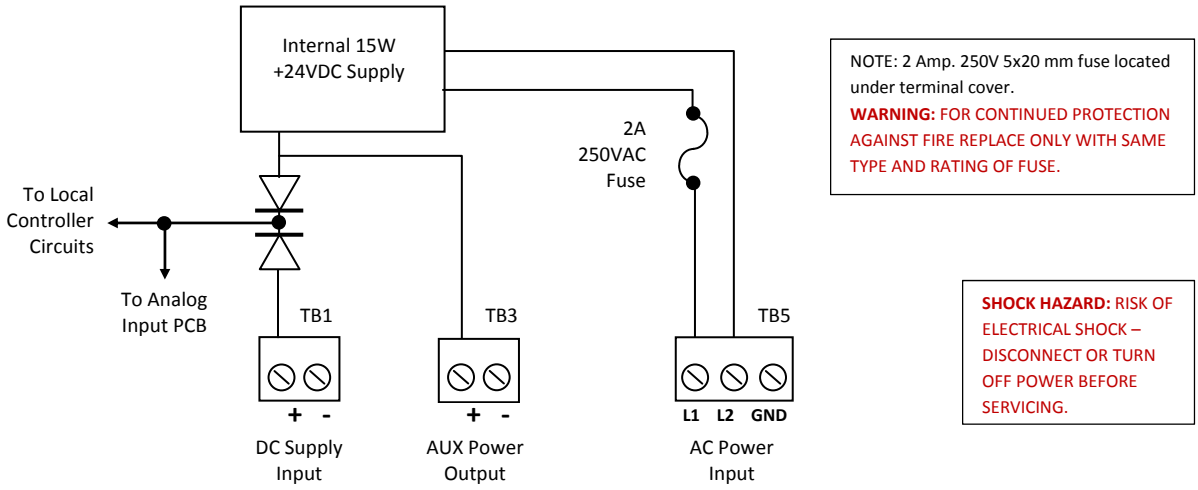


Figure 7-1: Power Supply Input Detail

NOTE: A CERTIFIED AC POWER (MAINS) DISCONNECT OR CIRCUIT BREAKER SHOULD BE MOUNTED NEAR THE CONTROLLER AND INSTALLED FOLLOWING APPLICABLE LOCAL AND NATIONAL CODES. IF A SWITCH IS USED INSTEAD OF A CIRCUIT BREAKER, A PROPERLY RATED CERTIFIED FUSE OR CURRENT LIMITER IS REQUIRED TO BE INSTALLED AS PER LOCAL OR NATIONAL CODES. MARKINGS FOR POSITIONS OF THE SWITCH OR BREAKER SHOULD STATE (I) FOR ON AND (O) FOR OFF.

ANTENNA PROTECTION

When installing a C2/TX Wireless Site Manager in an outdoor location, it is important to properly waterproof the antenna connection to keep moisture away from the RF signal path.

GDS Corp recommends a three-step process – First, wrap the antenna connection with a length of black electricians tape; second, cover the tape with approximately 20” of self-fusing ethylene-propylene insulating tape (ex: 3M type 23, p/n 1000-2314), followed by a final coat of PVC electricians tape over the entire connection. Even a small amount of moisture can completely attenuate the microvolt signals received from GASMAX/TX wireless gas monitors.

USE IN HAZARDOUS AREAS

The C2/TX Site Manager is suitable for use in Class I Division 2 hazardous areas. Certified under CSA C22.2 No 1010.1 and ISA S82.02; CSA C22.2 No 152 for combustibles; UL 1604 / C22.2 No 213 (Div 2 Groups A,B,C,D); EN55011 & EN61000 (CE Mark).

8 INITIAL SETUP

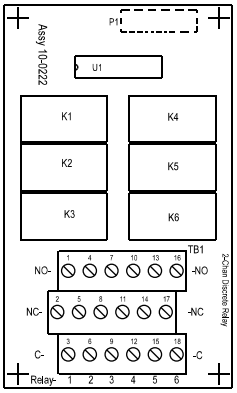
WIRELESS GAS MONITOR INPUT

To create a wireless network using GASMAX/TX wireless gas monitors, perform the following steps in order:

	GASMAX/TX Gas Monitor	C2/TX Wireless Site Manager
1		Apply AC or DC power to the C2/TX Wireless System Manager
2		Select the desired network identifier ("A" through "Z")
3		If the C2/TX is the primary or only controller in the network, select RF Mode = "Server"
4		If using 900 MHz radios, set the desired transmit power output
5		Enable the desired number of wireless channels in the C2/TX
6	Turn on the GASMAX/TX by holding a magnetic wand over UP/ON key for several seconds	
7	Configure the network identifier ("A" thru "Z") to match that chosen for the C2/TX or system controller. *Find in "Device Setup – RF Link"*	
8	Configure the RTU # (device ID) for a unique value *Find in "Device Setup – RF Link"*	
9	Program channel tag name (if desired) *Find in "Channel Setup"*	
10		Select C2/TX channel and set Remote Address to match device ID on GASMAX/TX
11	Hold magnetic wand over UP key to force initial transmission	Confirm reception of wireless transmission and valid gas detector reading
xx	Repeat for Each GASMAX/TX	Repeat for each GASMAX/TX
12		Program relays and alarm conditions for desired outputs
	Perform end-to-end test using calibration or test gas	

RELAY OUTPUT

The C2/TX Site Manager has two standard 5A SPDT relays with terminals on the motherboard (Relay 1 and 2) and six additional SPDT relays on the relay expansion board (Relays 3 thru 8). All relays can be programmable for normal or FAILSAFE ("normally open held closed") and support voting and channel & alarm specific overrides. See Relay Setup menu for more details.



1	RY3	NO
2	RY3	NC
3	RY3	COMMON
4	RY4	NO
5	RY4	NC
6	RY4	COMMON
7	RY5	NO
8	RY5	NC
9	RY5	COMMON

10	RY6	NO
11	RY6	NC
12	RY6	COMMON
13	RY7	NO
14	RY7	NC
15	RY7	COMMON
16	RY8	NO
17	RY8	NC
18	RY8	COMMON

Figure 8-1: Relay Output Board

An easy way to test a specific relay is to toggle the normal / FAILSAFE setting.

IMPORTANT: ALL MECHANICAL (DRY CONTACT) RELAYS ARE RATED AT 5 AMP FOR 28 VDC AND 250 ~VAC RESISTIVE LOADS. APPROPRIATE DIODE (DC LOADS) OR MOV (AC LOADS) SNUBBER DEVICES **MUST BE INSTALLED WITH INDUCTIVE LOADS** TO PREVENT RFI NOISE SPIKES.

IMPORTANT: AC OR DC POWER SUPPLIES TO RELAYS ON THE RELAY EXPANSION BOARD MUST BE THE SAME FOR ALL RELAYS. **DO NOT MIX +24V and 110VAC LOADS.** IT IS OK TO SWITCH 110VAC ON RELAYS 1 AND 2 AND 24VDC ON RELAYS 3-8.

COMMUNICATIONS AND DATA LOGGING EXPANSION OUTPUT

Information on the Communications & Data Logging Expansion board will be available in a future release of the C2/TX manual.

9 OPERATION & MAINTENANCE

C2/TX USER CONTROLS

The user interface for the C2/TX Site Manager consists of a high resolution LCD display, six LED indicators arranged on each side of the LCD display and five buttons arranged across the bottom of the display. From left to right, these are “UP”, “DOWN”, “NEXT”, “EDIT” and “ALARM RESET”. ***With the cover in place, a magnetic wand can be used to activate the buttons; with the cover removed there are physical pushbuttons that perform the same function.*** Press the “NEXT” key to switch display screens, or press the “EDIT” key to access the main user setup menu. Setup mode will exit automatically if no keys are pressed within 5 minutes. Press “ALARM RESET” to acknowledge an existing alarm or clear a latched alarm relay if the alarm condition is no longer valid.

Figure 9-1: C2/TX Site Manager Front Panel

A set of alarm and status indication LEDs appear on the left and right side of the LCD display. LEDs on the left indicate an alarm condition in any channel. Alarm LEDs will flash for new alarms and will become steady after an alarm RESET is commanded. Status LEDs on the right side indicate a key entry, a communications error (“COMM ERR”) condition and a sensor FAULT condition.

C2/TX DISPLAY SCREENS

When there are no alarms present, the C2/TX displays the message ALARM STATUS CLEAR. When this screen is visible, the user can be sure that no alarms are present in the received from any GASMAX/TX gas monitor.

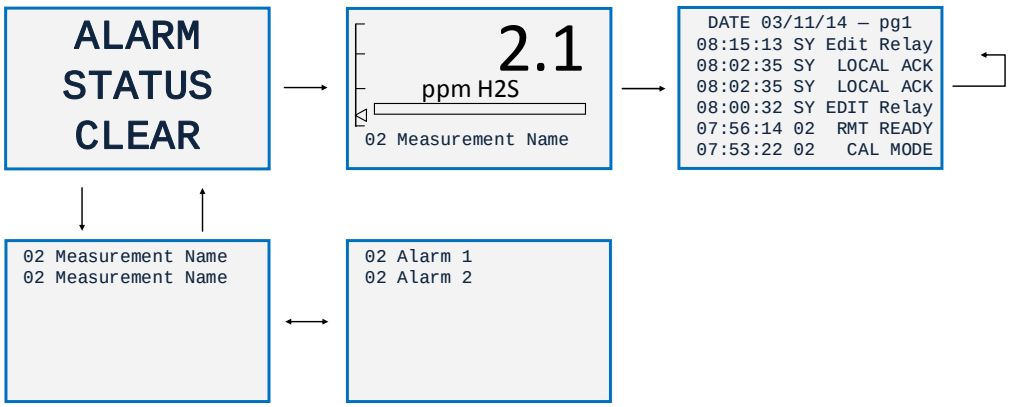


Figure 9-2: C2/TX Display Screens

Pressing the NEXT key will bring up the channel-specific Engineering Units / Bargraph display shown in Figure 8-2. The UP and DOWN keys can be used to select any enabled channel. Pressing NEXT again will display the event log, followed by the alarm screen.

If any alarms are present, the Alarm Status Clear message will be replaced by an Alarm Display screen that will alternate between the channel and tag name and specific alarm condition.

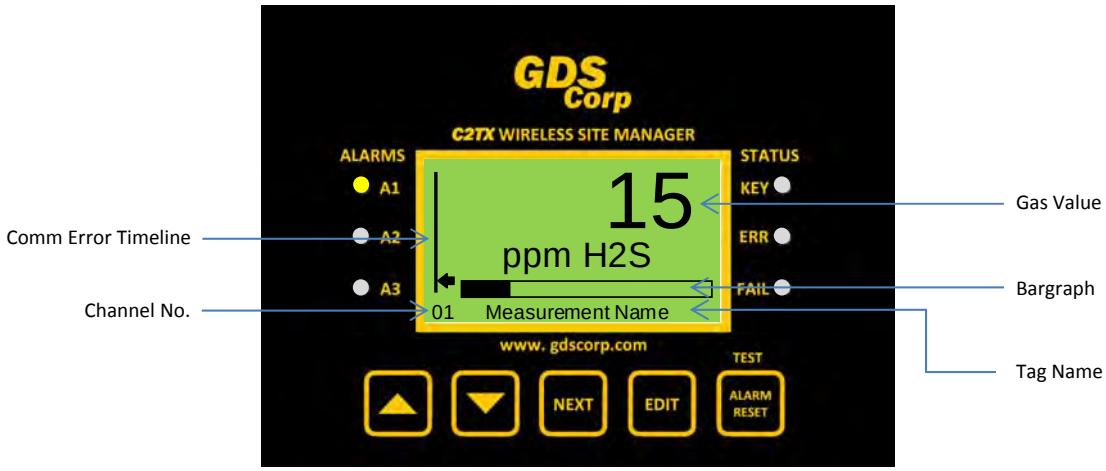


Figure 9-3: Engineering Units / Bargraph Display Screen

The Engineering Units / Bargraph display shows the current reading in calibrated engineering units, the engineering units value in text form, a bargraph that gives the current reading in percent of scale, and the Comm Error Timeline.

The Comm Error Timeline (ECT) indicates the amount time since the last received transmission. Each time a data packet is successfully received, the ECT pointer moves the bottom of the screen, and proceeds to move upwards at a fixed rate. If the pointer reaches the top of the screen, a COMM ERROR is generated for the specific channel.

Pressing the NEXT key brings up the **Channel Alarm Status Screen**. The Channel Alarm Status screen shows all active channel numbers but flashes any with an alarm condition. Use the UP/DOWN keys to point to a channel in alarm and the NEXT brings up that channel's Engineering Units / Bargraph screen to provide more detailed information about the alarm.

Pressing the NEXT key again brings up the **EVENT LOG Screen**. The Event Log shows a list of events and the time and date they occurred. These events can include Power On, Alarm IN or OUT for any programmed alarm, Relay IN or CLR, Fault, Low Battery and other. Use the UP or DOWN keys to scroll through the Event Log. Pressing NEXT again restores the Engineering Units / Bargraph screen.

NORMAL MAINTENANCE

Normal maintenance for the C2/TX Site Manager controller primarily involves checking the display for alarm or communications problems. A periodic inspection of the interior is recommended to determine if water or dust is entering the enclosure.

GDS Corp recommends a full 'end to end' test be performed periodically, where gas is applied to the sensor and the desired output strobe or horn operation is confirmed.

10 USER SETUP MENUS

The SETUP menu is reached by pressing **EDIT** with any data display present. This is the entry-level screen to ALL *Channel*, *System, Communications* and *Security* menus. Use the **UP/DOWN** keys to move the pointer to the desired menu and press the **EDIT** key to select the sub-menu.

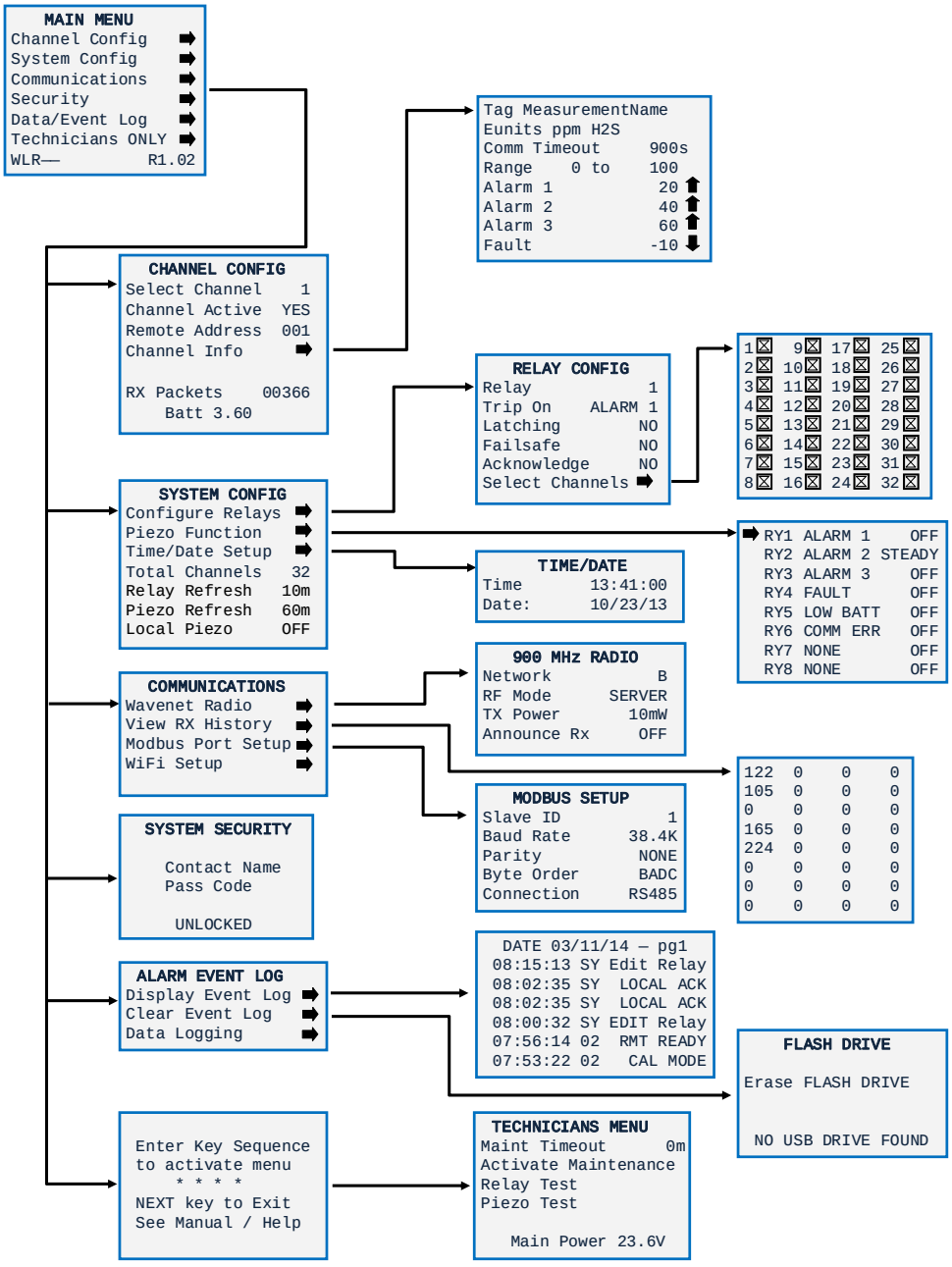


Figure 10-1: C2/TX Site Manager Controller Main Menu Tree

When entering a menu, a pointer controlled by the UP/DOWN keys indicates the selected variable. Some are simple YES/NO or ON/OFF entries and can be toggled by pressing the EDIT key. Others may have ASCII characters or numeric values. To change an ASCII or numeric value, select the entry and press the EDIT key. This places a cursor under the item; use the UP/DOWN keys to scroll through each allowed entry and use the NEXT key to move the cursor to the next position within a field. When the field is complete, press EDIT to clear the cursor and load the field into non-volatile memory. Use the NEXT key to move up the menu tree and return to display mode.

CHANNEL CONFIG MENU

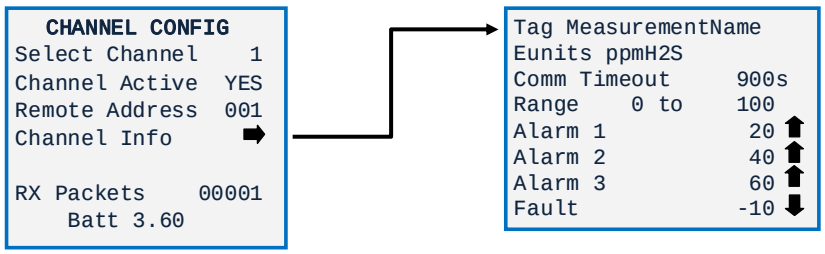


Figure 10-2: Channel Configuration Menu

Select Channel: To change the viewed channel, move the cursor to point to Select Channel and press EDIT to show the desired channel. The C2/TX supports channel values between 1 and 32.

Channel Active determines if the selected channel is enabled (YES) or disabled (NO). If a channel is enabled, and no gas detector is present, the channel will generate a COMM ERROR after the comm error timeout value expires.

Remote Address is set to the numeric address of the remote GASMAX/TX monitor assigned to this channel. Remote values can be set to any value between 0 and 240.

Channel Info: Displays the channel information received from the GASMAX/TX in the most recent verbose data packet received by the C2/TX. This information is configured at the gas detector and is not adjustable in the C2/TX menu. Values include tag name, engineering units description, zero and span values and alarm 1, 2, 3 and Fault levels.

IMPORTANT: CHANNEL TAG NAME, ENGINEERING UNITS, ZERO, SPAN, ALARM AND FAULT LEVELS ARE SET **AT THE GASMAX/TX** AND ARE NOT CONFIGURABLE ON THE C2/TX WIRELESS SITE MANAGER.

RX Packets: Displays a running count of the number of data packets received by the C2/TX. Useful for troubleshooting and setup.

Batt: Shows the most recent battery voltage value transmitted by the GASMAX / TX gas monitor assigned to the current channel.

SYSTEM CONFIG MENU

This menu covers items that are system specific instead of channel-specific and include relay setup, piezo buzzer settings and internal clock time & date.

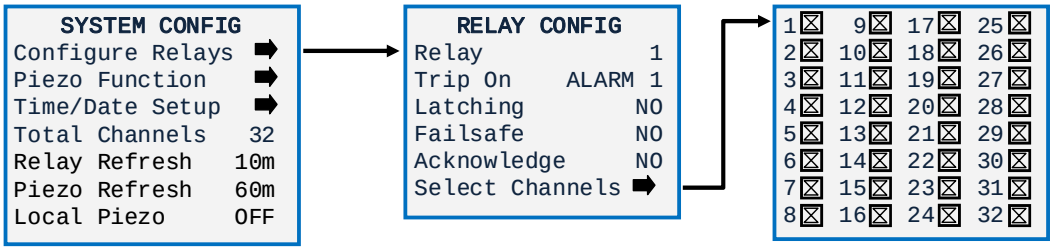


Figure 10-3: System Config – Relay Config Menu

Relay Setup Menu: The menu shown allows the user to configure the eight standard relays. Select the relay to be configured by pointing the arrow at the top menu item and pressing EDIT. The field will scroll through all eight possible choices.

Trip On: Each relay can be set to trip (activate) on Alarm 1, Alarm 2, Alarm 3, Fault, Low Battery, Communications Error or None.

Latching: If set to YES, the relay will latch on activation and remain active until acknowledged by pressing the Alarm Reset button. If the alarm condition is no longer present, the relay will deactivate. If the alarm condition is still present, pressing the Alarm Reset button will have no effect. If set to NO, the relay will activate whenever an alarm condition is present and will deactivate when the alarm condition no longer exists.

Failsafe: If set to YES, the relay to be energized when its input condition is false and will de-energize when the alarm condition is true. The primary benefit of Failsafe is that loss of power places the relay contacts into the alarm condition. Failsafe settings cause the relay to be continuously activated are not recommended when using solar or battery power.

Acknowledge: If set to YES, the relay will clear when the Alarm Reset button is pressed, irrespective of the current alarm condition. If set to NO, the alarm output cannot be silenced if the alarm condition is present. This is useful for audible warning devices that need to be silenced once the alarm is recognized. In general, audible devices should be set for ACK = YES, and visual devices set for ACK = NO.

Select Channels: Each relay can be set to monitor any combination of active channels. To assign a relay to monitor a specific channel, make sure there is an 'X' in the box associated with that channel. In the

example shown, Relay 1 is for non-latching, normal mode and is set to activate if any of the 32 channels receives a data packet from its associated gas detector with the Alarm 1 status bit set.

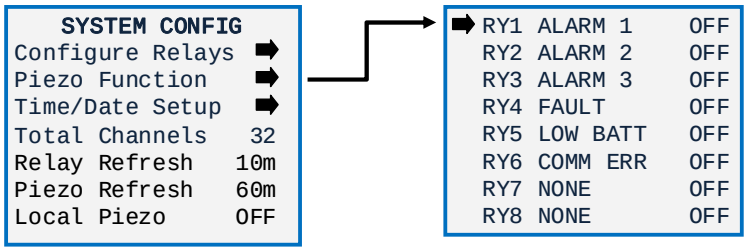


Figure 10-4: System Config - Piezo Function Menu

Piezo Function Menu: The Piezo FUNCTION group determines behavior of the 100dB front mounted piezo as related to the eight relays. Choices are OFF, Chirp, Pulse and Steady. In the example above, relays one through six have been set for Alarm 1, Alarm 2, Alarm 3, Fault, Low Batt and Comm Error. If RY5 LOW BATT were set to ON, the piezo would sound whenever RY5 would be active. The piezo can be set to activate on any or all of the programmed relay conditions.

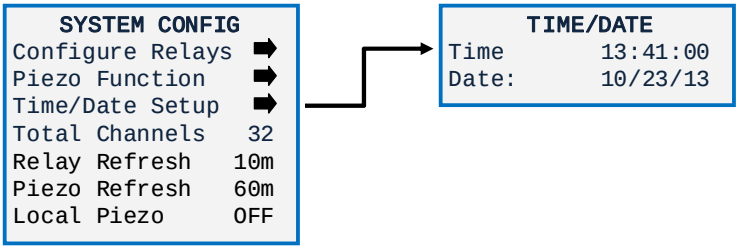


Figure 10-5: System Config – Time/Date Menu

Time & Date: The C2/TX Site Manager controller is equipped with a 24-hour clock and calendar. Time of day must be entered in 24 hour mode. For example, 6:00:00 PM = is indicated as 18:00:00. Be sure to adjust the time setting to match the current time when installing the controller for the first time, and note that the time value must be updated for changes due to Daylight Savings Time.

Total Channels: Determines total number of available channels between 1 (min) and 32 (max). For example, if this menu is set for 10, then only 10 channels are available in the CHANNEL CONFIG menu.

Relay Refresh: Time setting to ***reactivate*** alarms that have been silenced (acknowledged), even though the alarm condition is still present. It can be set from 0 to 120 minutes with 0 turning the Refresh function OFF. Refresh will re-activate the relay after this timer expires. This feature is useful for silencing audible devices but then automatically activating them again if the alarm condition remains after a period of time.

Piezo Refresh: Piezo refresh is identical to Relay Refresh. The main piezo sounder is always acknowledgeable.

Local Piezo: When set to ON, the small piezo on the Display Board will mimic the larger piezo wired to the main system board. This can be useful for testing the operation of the louder device even though it is disconnected. When set to OFF the small piezo on the Display board will only sound as keys are pressed.

COMMUNICATIONS MENU

The communications menu allows the user to setup the wireless radio, MODBUS port and WiFi radio. The menu also includes a diagnostics screen that displays a count of wireless data packets received.

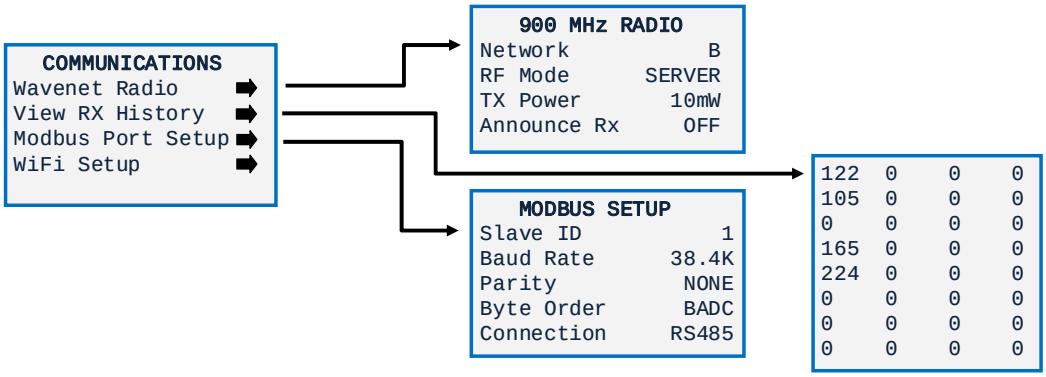


Figure 10-6: Communications - Configure Radio Menu

Network: The C2/TX and GASMAX/TX utilize frequency hopping spread spectrum (FHSS) radios to achieve maximum range while minimizing power consumption. FHSS allows multiple radios and multiple networks to share the same frequency range without creating interference or communications errors.

The C2/TX and GASMAX/TX can be set to communicate on one of 26 different “frequency hopping patterns”, each assigned a unique letter (“A” through “Z”). Each pattern uses a unique combination of frequencies, hopping channels and system identification codes to ensure that radios assigned to one network (“A”) do not interfere with radios assigned to a different network (“D”).

NOTE: IN ORDER TO COMMUNICATE, ALL DEVICES IN THE NETWORK MUST HAVE THEIR NETWORK CONFIGURED FOR THE SAME LETTER IDENTIFIER.

RF Mode: RF Mode sets the condition of the C2/TX as either SERVER or CLIENT. There should only be one wireless device configured as the SERVER in any given network. The SERVER transmits a periodic beacon signal that synchronizes each radio’s hopping pattern, thereby reducing the amount of power necessary to initiate wireless transmissions. Devices configured as a SERVER should be DC powered and not battery powered, since the beacon transmission occurs continuously.

TX Power: 900 MHz radios can be programmed to transmit at power levels of 10mW, 200mW, 400mW and 1 watt. 2.4GHz radios have a fixed 50mW transmit power and this option will not be visible if a 2.4 GHz radio is installed.

Announce RX: When set to YES, the small local piezo buzzer will beep whenever a wireless data packet is received. This is helpful during network setup and debugging.

RX History shows a count of the number of packets received from each wireless gas detector. Press ALARM RESET while viewing this screen to reset the count for all channels back to zero.

Slave ID is used to set the slave ID for the optional MODBUS serial port. Default is "1".

Buad Rate for the MODBUS serial port is adjustable and can be set for values between 9600 and 115K baud.

Parity for the MODBUS serial port is adjustable and can be set for EVEN, ODD or NONE.

Byte Order is used to adjust the order of bytes when transmitting 32 bit values. Default is "BACD", where A, B, C and D refer to the 8 bit data bytes. If a 32 bit number is organized as "ABCD", then "BACD" indicates that the upper 16 bits ("A" and "B") are sent first, followed by the second 16 bits ("C" and "D"), and inside each 16 bit word, the byte order is swapped.

Connection determines if the port used is the RS-485 two-wire interface or the RS-232 serial interface.

SECURITY MENU

A 4-digit Pass Code entered and confirmed in this menu item locks all menus. Viewing menus is not denied but attempts to edit variables flashes the Locked message on the LCD. Authorized individuals locking the system should first enter a name, phone #, or other contact information into the 12 character field on the top line of the Security screen. To lock or unlock the system the correct 4 digit authorization number must be entered into the Pass Code field. It is very important to remember the 4 digit code since the factory must be consulted if it is lost.

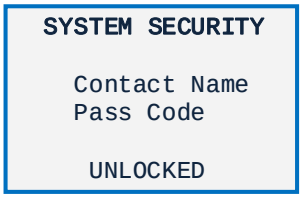


Figure 10-7: Security Menu

ALARM EVENT LOG MENU

The Event Log menu allows access to the internal time and date-stamped event log.

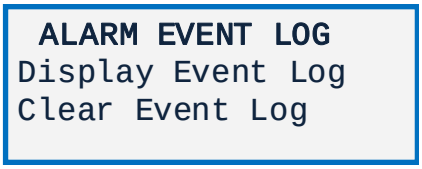


Figure 10-8: Alarm Event Log Menu

Display event log will bring up the Event Log on the LCD display. The Event Log shows date in "mm/dd/yy" format, time in "hh/mm/ss" format and the associated event. If the event is channel specific then "CHx" will precede the event. For example, "071713 16:41:31 CH1 A2I" indicates that on July 17th, 2013, at 4:16:31 pm, Channel 1 Alarm 2 was recorded as "IN".

Use the UP and DOWN keys to scroll through the Event Log. To exit the Event Log press the NEXT key.

Clear Event Log will clear all data from the Event Log. There is no 'are you sure?' message.

11 MODBUS REGISTERS

The C2/TX Site Manager optional Communications and Data Logging expansion board offers a full complement of user-accessible MODBUS registers to provide a complete snapshot of the device configuration and current status. This includes all real-time data, preset zero, span and calibration values and user-programmable text.

Variable Name	Alias	Read FC	Write FC	Notes
MODBUS Coils	TBD	1	N/A	Coil definition to be added in future release
GM/TX Output Binary []	31001-31032	4	N/A	12 bit value; 800 = 4mA, 4000 = 20mA
Product ID	32001	4	N/A	Product identifier
Firmware Version	32002	4	N/A	Product Firmware Version
WIFI Found	32030	4	N/A	Optional WiFi radio detected
USB Found	32031	4	N/A	USB interface detected
Relay Status []	32100-32107	4	N/A	Bit 0 = Relay state (1 = active)
GM/TX Battery Voltage []	33001-33064	4	N/A	MODBUS floating point
GM/TX Output Float []	33065-33128	4	N/A	MODBUS floating point
GM/TX Output ASCII []	33129-33224	4	N/A	6 character packed ASCII
GM/TX Comm Status []	33225-33256	4	N/A	Bit 0 = Comm Error Bit 1 = Connecting Bit 2 = No Config Data
GM/TX Sensor Life []	33257-33288	4	N/A	Binary, 0-100%
GM/TX Comm Timeout []	33289-33320	4	N/A	Binary, timeout in seconds
GM/TX Alarm 1 Status []	33449-33480	4	N/A	Binary, 1 = Alarm, 0 = no alarm
GM/TX Alarm 2 Status []	33481-33512	4	N/A	Binary, 1 = Alarm, 0 = no alarm
GM/TX Alarm 3 Status []	33513-33544	4	N/A	Binary, 1 = Alarm, 0 = no alarm
GM/TX Fault Status []	33545-33576	4	N/A	Binary, 1 = Alarm, 0 = no alarm
GM/TX In Cal Status []	33577-33608	4	N/A	Binary, 1 = Alarm, 0 = no alarm
GM/TX Low Battery []	33609-33640	4	N/A	Binary, 1 = Alarm, 0 = no alarm
GM/TX Cal Purge []	33641-33672	4	N/A	Binary, 1 = Alarm, 0 = no alarm
GM/TX Warmup []	33673-33704	4	N/A	Binary, 1 = Alarm, 0 = no alarm
GM/TX Edit Mode []	33705-33736	4	N/A	Binary, 1 = Alarm, 0 = no alarm
GM/TX Missing Sensor []	33737-33768	4	N/A	Binary, 1 = Alarm, 0 = no alarm
GM/TX Cal Error []	33769-33800	4	N/A	Binary, 1 = Alarm, 0 = no alarm
GM/TX Data Error []	33801-33832	4	N/A	Binary, 1 = Alarm, 0 = no alarm

GM/TX Channel Status []	33833-33864	4	N/A	Binary, 1 = Alarm, 0 = no alarm
Alarm 1 Status	34000-34001	4	N/A	A1 Status (Packed bits)
Alarm 2 Status	34002-34003	4	N/A	A2 Status (Packed bits)
Alarm 3 Status	34004/34005	4	N/A	A3 Status (Packed bits)
Fault Status	34006/34007	4	N/A	Fault Status (Packed bits)
Low Battery	34008/34009	4	N/A	Low Battery Indication (Packed bits)
Cal Mode (“IN CAL”)	34010/34011	4	N/A	Detector in cal mode (Packed bits)
Post-Calibration Delay	34012/34013	4	N/A	Detector in post-cal delay (Packed bits)
Warm-up	34014/34015	4	N/A	Detector in warm-up (Packed bits)
Edit Mode	34016/34017	4	N/A	Detector menu modified (Packed bits)
Missing Sensor	34018/34019	4	N/A	Sensor removed / missing (Packed bits)
Calibration Error	34020/34021	4	N/A	Error in last calibration (Packed bits)
Data Error	34022/34023	4	N/A	Data error (Packed bits)
Channel Status Bits (“OR”)	34024/34025	4	N/A	“OR” of all status bits (Packed bits)
Channel Enabled	34026/34027	4	N/A	Channel ON (Packed bits)
Channel Comm Error	34028/34029	4	N/A	Channel in Comm Error (Packed bits)
COM1 Mode	40030	3	N/A	TBD
COM1 Baud rate	40031	3	N/A	TBD
COM 1 Parity	40032	3	N/A	TBD
COM1 Slave ID	40033	3	N/A	TBD
COM 1 Byte Order	40034	3	N/A	TBD
COM2 Mode	40040	3	N/A	TBD
COM2 Parity	40041	3	N/A	TBD
COM2 Byte Order	40042	3	N/A	TBD
Network SSID	40050-40066	3	N/A	ASCII, Network SSID
Network Key	40067-40073	3	N/A	ASCII, Network key
Network Host Name	40074-40083	3	N/A	ASCII, Host Name
WiFi IP Address	40100-40101	3	N/A	Details available in future version
WiFi Gateway	40102-40103	3	N/A	Details available in future version
WiFi Net Mask	40104-40105	3	N/A	Details available in future version
IP Address	40106-40107	3	N/A	Details available in future version
DHCP Start Address	40108-40109	3	N/A	Details available in future version
DHCP End Address	40110-40111	3	N/A	Details available in future version

DHCP Server	40120	3	N/A	Details available in future version
DHCP Client	40121	3	N/A	Details available in future version
WiFi Band	40122	3	N/A	Details available in future version
WiFi Mode	40123	3	N/A	Details available in future version
WiFi Channel	40124	3	N/A	Details available in future version
WiFi TX Power	40125	3	N/A	Details available in future version
WiFi Data Rate	40126	3	N/A	Details available in future version
WiFi Broadcast SSID	40127	3	N/A	Details available in future version
WiFi Authorization Mode	40128	3	N/A	Details available in future version
WiFi Encryption Mode	40129	3	N/A	Details available in future version
WiFi Default Key	40130	3	N/A	Details available in future version
WiFi Key Length	40131	3	N/A	Details available in future version
WiFi Key WEP Format	40132	3	N/A	Details available in future version
WiFi Key WPA Format	40133	3	N/A	Details available in future version
GM/TX Tag Info []	40401-40656	3	N/A	ASCII string, 16 packed char per channel
GM/TX Eunits Info []	40657-40816	3	N/A	ASCII string, 10 packed char per channel
Channel Enabled []	41000-41031	3	N/A	Binary, 1 = Enabled, 0 = disabled
GM/TX Channel ID []	41032-41063	3	N/A	Binary, 1 to 32
GM/TX Decimal Points []	41064-41095	3	N/A	Binary, 0, 1 or 2
GM/TX Zero Value []	41096-41159	3	N/A	MODBUS 32 bit floating point
GM/TX Span Value []	41160-41223	3	N/A	MODBUS 32 bit floating point
GM/TX Alarm 1 Setpoint []	41224-41287	3	N/A	MODBUS 32 bit floating point
GM/TX Alarm 2 Setpoint []	41288-41351	3	N/A	MODBUS 32 bit floating point
GM/TX Alarm 3 Setpoint []	41352-41415	3	N/A	MODBUS 32 bit floating point
GM/TX Fault Setpoint []	41416-41479	3	N/A	MODBUS 32 bit floating point

12 TROUBLESHOOTING GUIDE

C2 / TX Display Blank

- Lack of AC or DC power to the C2/TX Wireless Site Manager
- Display / CPU board ribbon cable not plugged in
- Motherboard fuse blown or defective

Channel Data Readings Appear Incorrect

- Confirm that the GASMAX/TX gas detector RTU # (device ID) and C2/TX Channel Remote Address value match.

C2 / TX Comm Error for ONE Remote Wireless GASMAX Monitor

- C2/TX and GASMAX/TX network identifier do not match
- C2/TX specified channel Remote Address and GASMAX/TX RTU # (device ID) do not match
- GASMAX/TX not in range or not receiving Beacon signal transmission
- C2/TX RF Mode not set to SERVER, or no SERVER available in network
- GASMAX/TX or C2/TX antenna damaged or disconnected
- GASMAX/TX battery low or depleted

C2 / TX Comm Error for ALL Remote Wireless GASMAX Monitor

- C2/TX and GASMAX/TX monitors network identifiers do not match
- Wireless radio mode not set for SERVER, or no SERVER present in the network
- Antenna malfunction or moisture in coaxial cable connections

C2 / TX Alarm Relay Does Not Activate

- Relay programming incorrect
- Channel alarm thresholds set improperly
- Relay set for FAILSAFE

13 SPARE PARTS

Wireless Options

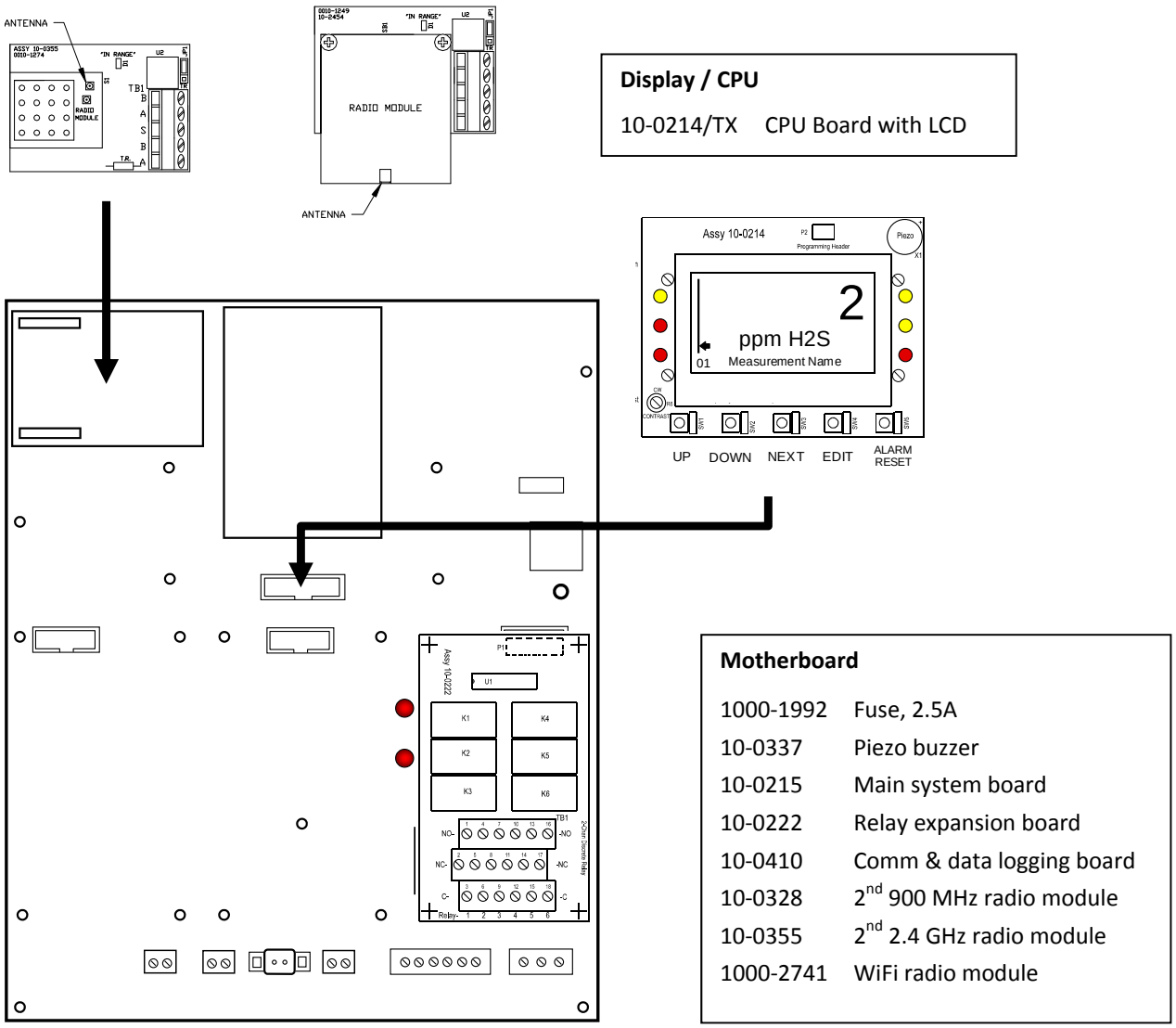
10-0328	900 MHz radio module
10-0355	2.4 GHz radio module

Antenna

1000-2189	900 MHz
1000-2300	2.4 GHz

Display / CPU

10-0214/TX	CPU Board with LCD



Motherboard

1000-1992	Fuse, 2.5A
10-0337	Piezo buzzer
10-0215	Main system board
10-0222	Relay expansion board
10-0410	Comm & data logging board
10-0328	2nd 900 MHz radio module
10-0355	2nd 2.4 GHz radio module
1000-2741	WiFi radio module

Figure 13-1: C2/TX Site Manager Spare Parts

14 DRAWINGS AND DIMENSIONS

The C2/TX Site Manager “Type 1” or “Type 5” enclosure is a NEMA 4X polycarbonate wall mount enclosure designed for medium duty applications. Type 5 includes the optional sunshield.

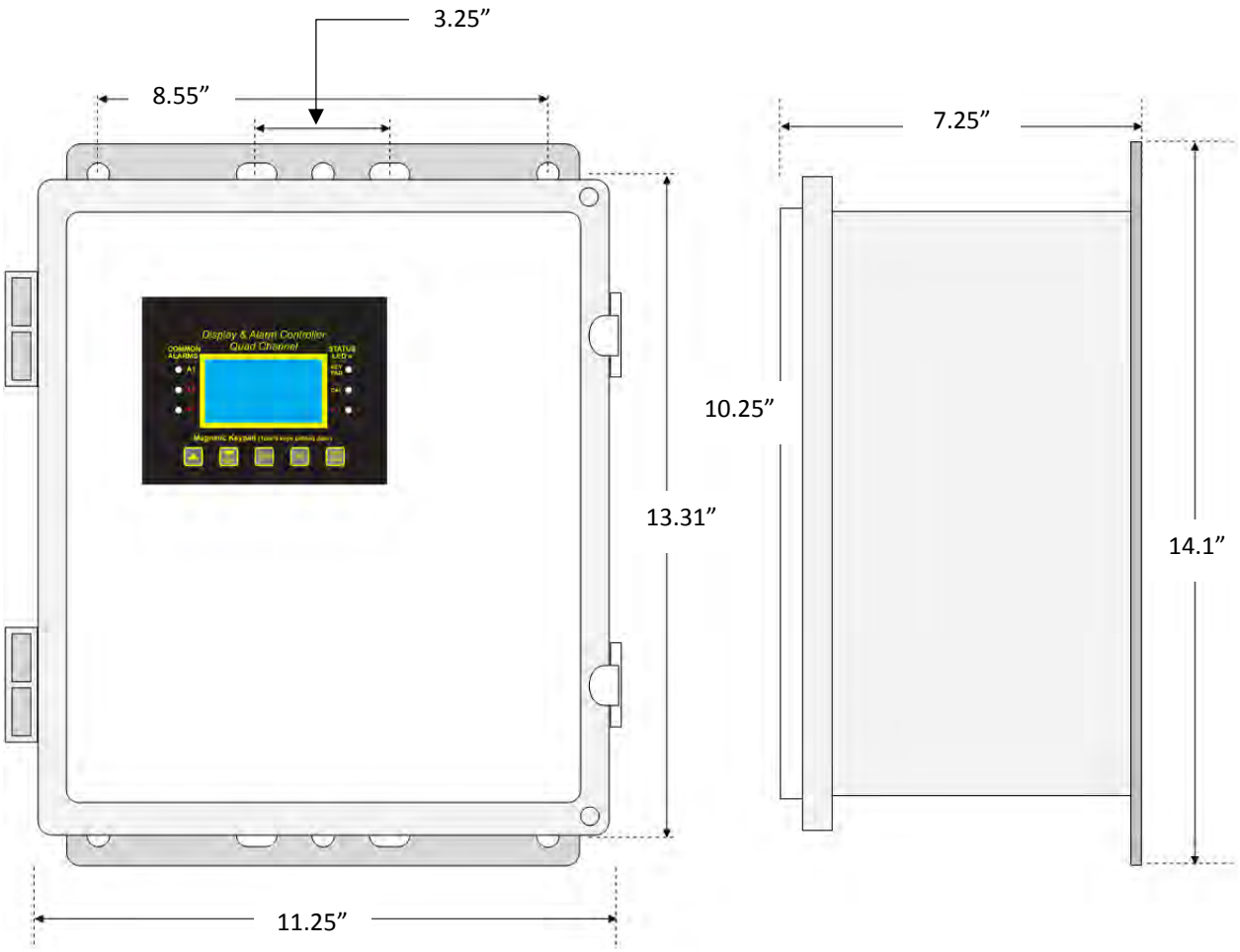


Figure 14-1: NEMA 4X Polycarbonate Enclosure

IMPORTANT: NON-METALLIC ENCLOSURES ARE NOT GROUNDED BY METAL CONDUIT. FOR INTERNAL GROUND POINTS TO BE GROUNDED TO EARTH, THE TB5 – GND TERMINAL MUST HAVE A PROPER EARTH GROUND CONNECTION.

CAUTION: NONMETALLIC ENCLOSURE DOES NOT PROVIDE GROUNDING BETWEEN CONDUIT CONNECTIONS. USE GROUNDING TYPE BUSHINGS AND JUMPER WIRES. ALL FIELD WIRING MUST HAVE INSULATION SUITABLE FOR AT LEAST 250V.

The C2/TX Site Manager “Type 2” or “Type 6” enclosure is a NEMA 4X Painted Carbon Steel wall mount extended enclosure designed for non-corrosive installations. Type 6 includes the optional sunshield.

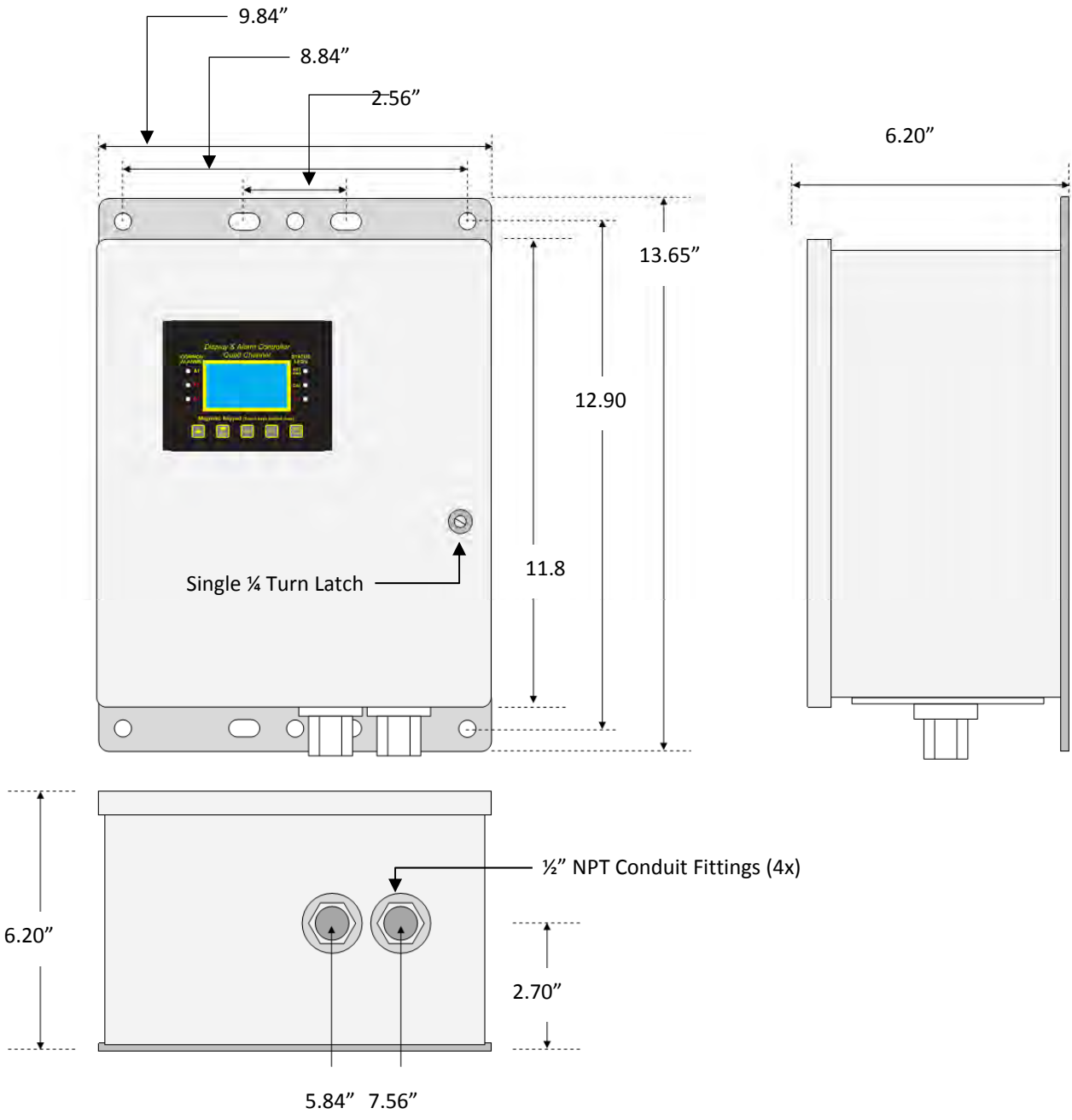


Figure 14-2: NEMA 4X Painted Steel Wall Mount

The C2/TX Site Manager “Type 3” or “Type 7” enclosure is a 316 Stainless Steel NEMA 4X wall mount extended enclosure designed for corrosive installations. Type 7 includes the optional sunshield.

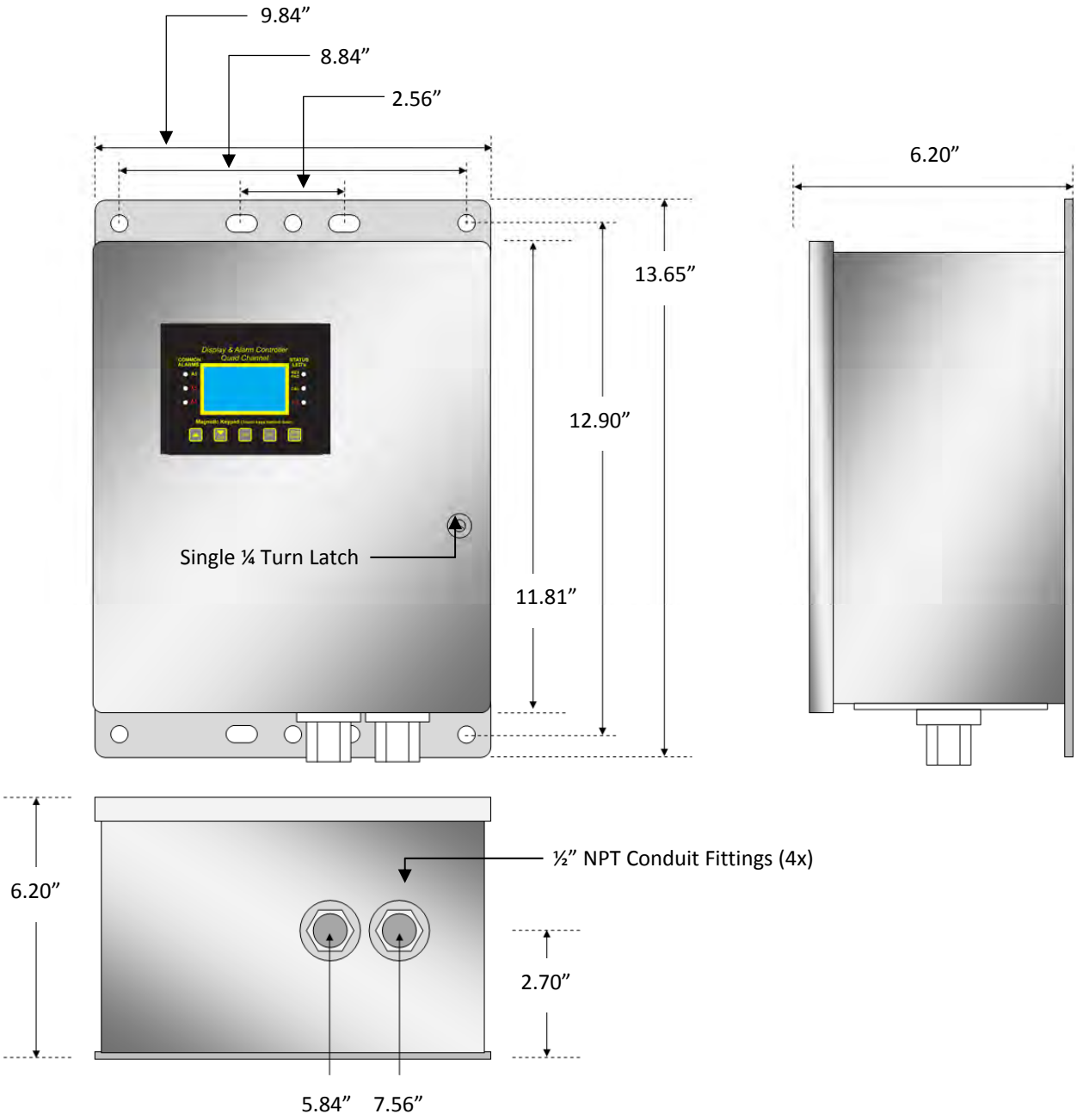


Figure 14-3: NEMA 4X Stainless Steel Enclosure

The C2/TX Site Manager “Type 4” enclosure is a cast aluminum NEMA 7 explosion-proof wall mount designed and rated for hazardous areas. Includes a Class 1 Division 1 rated antenna coupler.

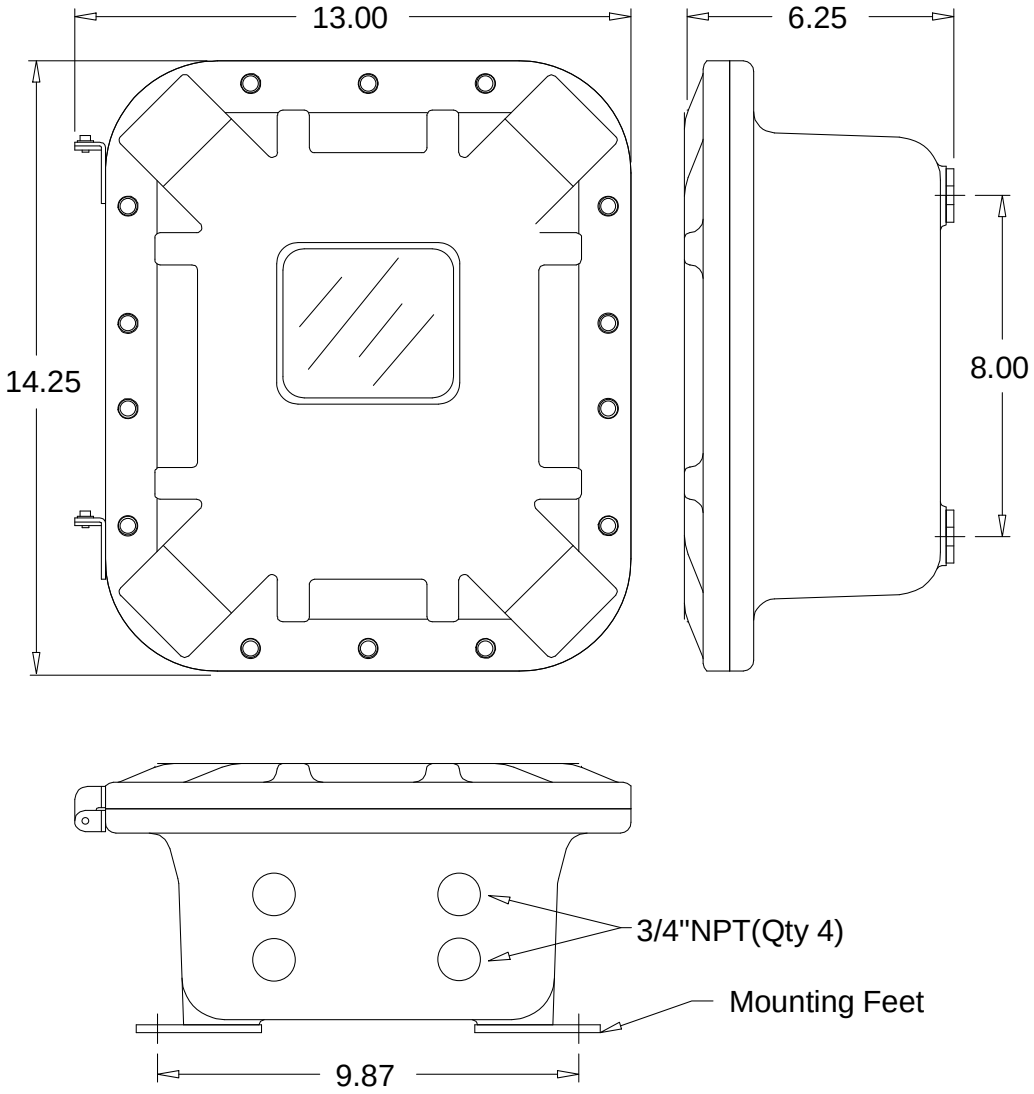


Figure 14-4: NEMA 7 Explosion Proof Enclosure

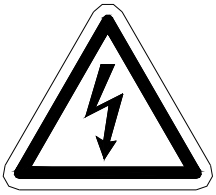
GDS Corp.
1245 Butler Road • League City, TX 77573
409-927-2980 • 409-927-4180 (Fax) • ww.gdscorp.com

GDS Corp
Gas and Flame Detection

Operation and Maintenance Manual

GASMAX TX
Battery-Powered Dual Channel Wireless Gas Monitor

GDS Corp.
1245 Butler Road • League City, TX 77573
409-927-2980 • 409-927-4180 (Fax) • ww.gdscorp.com



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 1.0	8/1/13	Initial Release (updated 11/22/13)
Revision 2.0	5/13/16	Update

P/N 1200-0863-02

CONTENTS

TABLE OF FIGURES

1 SAFETY INFORMATION

Important – Read Before Installation

Users should have a detailed understanding of GASMAX TX operating and maintenance instructions. Use the GASMAX TX 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 GASMAX TX gas 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 GASMAX TX is suitable for the intended use.
- The GASMAX TX is designed and constructed to measure the level of certain gases in ambient air. Accuracy in atmospheres containing steam or inert gases cannot be guaranteed.
- Always mount the sensor head vertically with the sensor head facing down.
- Do not paint transmitter or sensor assembly.
- Do not operate the GASMAX TX 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 GASMAX TX to electrical shock or continuous severe mechanical shock. Protect the GASMAX TX and related sensor assemblies 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 on the sensor head.
- Periodically test for correct operation of the system's alarm events by exposing the monitor to a targeted gas concentration above the High Alarm set point.
- Use only for applications described within this manual.

2 OVERVIEW

The GDS Corp GASMAX TX Wireless Gas Monitor and matching C2/TX Wireless Site Manager Controller work together seamlessly to deliver highly reliable, cost effective, customer-friendly solutions for wireless gas detection. The GASMAX TX can also be used in 'legacy mode' with existing GDS Corp Wireless Controller / Receivers such as the C1 Protector, C64 Protector or C2 Quad Protector Controller / Receiver.

The GASMAX TX wireless gas monitor is designed to detect dangerous levels of toxic or hydrocarbon combustible gases and transmit that information to a GDS Corp remote site manager or controller / receiver.

The GASMAX TX supports one or two local sensors for toxic gases, carbon dioxide or hydrocarbon combustibles. The advanced microcontroller, non-intrusive magnetic interface and superior graphic LCD display offers rapid setup, simplified operation and enhanced diagnostics not found in previous generation products.

The GASMAX TX's tightly integrated radio modem utilizes frequency hopping spread spectrum (FHSS) technology to provide reliable transmission of gas concentration data and detector status across long distances while using very little power. Battery life can be as long as one year under common circumstances. When configured as part of a system with a third-generation Wireless Site Manager Controller, all configuration and setup information programmed into the GASMAX TX is automatically transmitted to C2/TX , eliminating redundant setup and minimizing programming errors.

Key features:

- Single or dual channel, toxic and/or combustible using new Ultra-Low-Power Infrared for Combustibles and Carbon Dioxide
- Six to 12 month battery life on one replaceable 3.6VDC Lithium battery
- Tightly integrated 900MHz or 2.4 GHz radios with Frequency Hopping Spread Spectrum (FHSS) for maximum range
- Automatic sensor recognition and setup with GDS Corp Smart Sensors
- Large LCD shows values, bar-graph and RF interface
- User-prompted calibration procedure
- Power on / Power off using magnetic wand – no need to open the enclosure
- Suitable for use in Class I Division 1 Hazardous Areas with XP rated antenna coupler

OPERATION

The GASMAX TX uses the new highly integrated 10-97xx series ultra-low-power infrared or zero power electrochemical Smart Sensors that allow each sensor to be individually optimized for the target gas, range and environmental conditions.

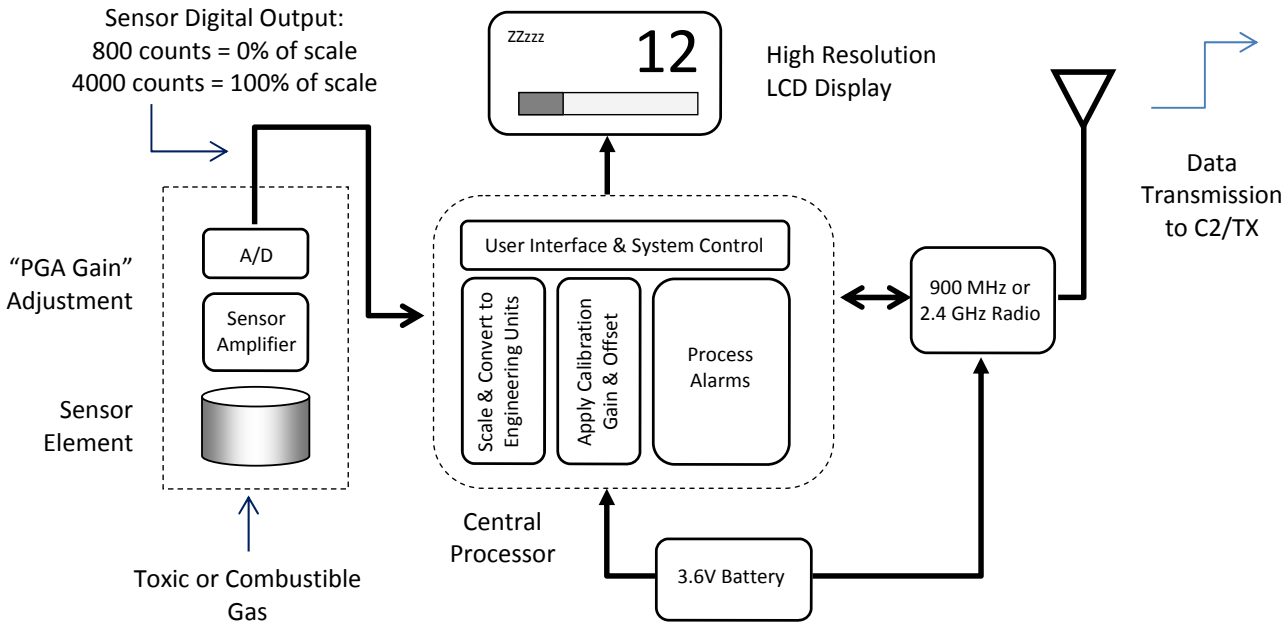


Figure 2-1: GASMAX TX Block Diagram

Toxic gases entering the sensor head react with the electrolyte in the sensor to produce a small electrical output signal. Electronics on the sensor board amplify the signal and covert the information from analog to digital using a 12-bit analog-to-digital (A/D) converter. If an ultra-low-power infrared sensor is being used, hydrocarbon gases enter the sensor and block the passage of infrared light from the IR source to the detector. An integrated microprocessor in the infrared sensor linearizes the value.

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

IMPORTANT: THE GASMAX TX INFRARED SENSOR **WILL NOT** DETECT COMBUSTIBLE LEVELS OF HYDROGEN GAS.

The GASMAX TX consists of an explosion proof enclosure with sensor head, antenna tuned for either 900 MHz or 2.4 GHz frequency bands, a display module with microprocessor and radio and I/O battery board that doubles as mounting hardware for the display. The display attaches to the I/O battery board via a short multi-pin cable and two captive thumbscrews.

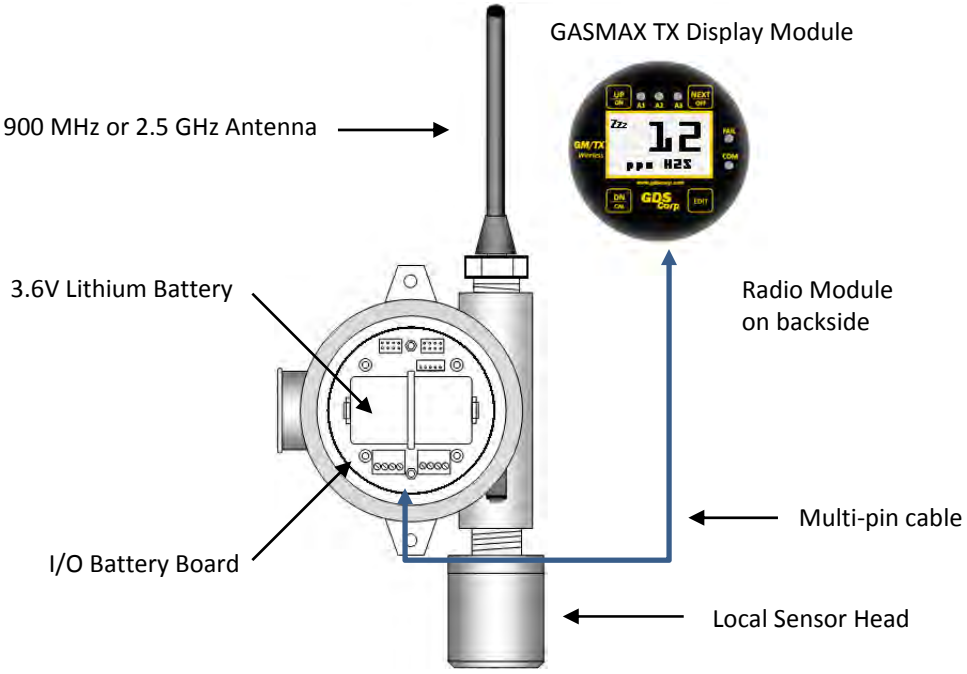


Figure 2-2: GASMAX TX with Single Local Sensor

The GASMAX TX wireless gas monitor is capable of monitoring two separate sensors. In certain cases, it is appropriate to co-locate both sensors in a 'local sensor' configuration. When doing so, the GASMAX TX is configured with the enclosure rotated 90 degrees clockwise as shown below.

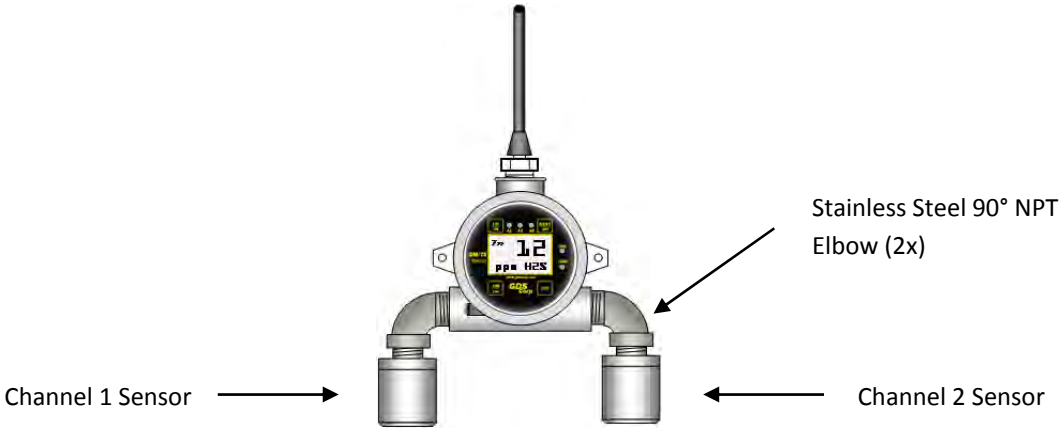


Figure 2-3: GASMAX TX with Dual Local Sensors

USING THE GASMAX TX WITH OTHER GDS CONTROLLERS

While the GASMAX TX is optimized for use with the C2/TX Wireless Site Manager Controller, the GASMAX TX can also be integrated into existing wireless networks that utilize a C1 *Protector* 16-channel controller, C64 *Protector* 64-channel controller or C2 *Quad Protector* 4-channel controller.

In "legacy mode", the required 'Hop Channel', 'System ID' and 'RTU Address' values must be programmed manually and channel settings must be loaded into both the gas detector and controller, but many of the benefits, including magnetic Power On / Power Off, advanced 10-97xx sensor technology and additional transmission modes will still offer benefit to the user.

Note that when in legacy mode, packet data that includes sensor range, tag name and engineering units is not transmitted to the controller and channel setup information must be manually entered in both the receiver/controller and gas detector

USE IN HAZARDOUS AREAS

The GASMAX TX enclosure and sensor head with integral flame arrestor are certified for use in Class 1 Division 1 hazardous areas. When combined with the optional XX Class I Division 1 antenna coupler, the entire device is suitable for use in Class 1 Division 1 areas. The standard 10-0295 antenna coupler is designed to meet Class I Division 2 hazardous area standards but is not 3rd party certified. GASMAX TX detectors with sensor heads for reactive gases (without flame arrestors) should not be installed in hazardous areas.

3 INSTALLATION

SELECTING A LOCATION

Important factors such as air movement, gas density in relation to air, emission sources and environmental variables must be considered when choosing a mounting location. In addition, air movement by fans, prevailing winds, convection and potential leak sources should be carefully evaluated to determine the best location within a given facility.

Vapor density of a gas determines if it will rise or fall in air when there are no significant currents. Even though the GASMAX TX is designed for rugged service, sensors should be protected from environmental damage from water, snow, excess humidity, shock, vibration and dust and dirt.

MOUNTING THE GASMAX TX

Orientation - The GASMAX TX standard enclosure is a cast aluminum explosion-proof (NEMA 7) enclosure and *should always be mounted with the sensor head opening facing down*. If necessary, a Splash Guard (p/n 10-0205) should be attached if there is any chance that water or liquid spray could enter the sensor opening from below.

Access for General Maintenance - Be sure to leave at least 12" below the sensor head to allow for air flow, easy access for attachment of a Calibration Cup and / or removal of the sensor head cover for sensor replacement.

Sensor Environment – When detecting heavier-than-air gases such as Hydrogen Sulfide in indoor environments, the sensor head should be placed within 18" to 24" of ground level. When installing in unprotected outdoor applications, *the sensor should be mounted at least 24" above the average grade within a 25' radius*. This will keep the sensor from being oversaturated with moisture during periods of dense fog, mist or heavy rain.

Antenna Placement - Whenever possible, the GASMAX TX should be mounted in a location that provides clear line-of-sight between the gas monitor and controller receiving antenna, and *should NOT be mounted such that the antenna is closer than 24" (900 MHz) or 6" (2.4 GHz) from the nearest vertical metallic surface.*

RF Transmission & Reception - Both 900 MHz and 2.4 GHz signals will travel through masonry or wooden structures with minimal loss; however, large metal buildings, tanks and other solid structures will block the signal or attenuate the transmission to the point where reliable wireless communications may not be possible. For 900 MHz radios, power levels can be adjusted from 10 mW up to 1.0 watt (higher power will

reduce battery life). In many cases, GDS-95 Wireless Repeaters can be used to route wireless signals around obstacles.

Height Above Ground – Increasing the antenna height above ground at either end of the path will improve signal strength and reduce transmission errors. GDS Corp recommends placing the controller antenna at least 10 feet about the surrounding terrain, and even more if possible. However, note that standard vertical dipole antennas transmit their maximum signal strength in a relatively flat 'donut-shaped' pattern which may adversely affect the performance of GASMAX TX monitors located at ground level close to an elevated central antenna.

POWER AND SIGNAL WIRING

The GASMAX TX is completely self-contained. Power is provided by the internal 3.6V battery, and output data is sent entirely via wireless transmission from the local or remote antenna.

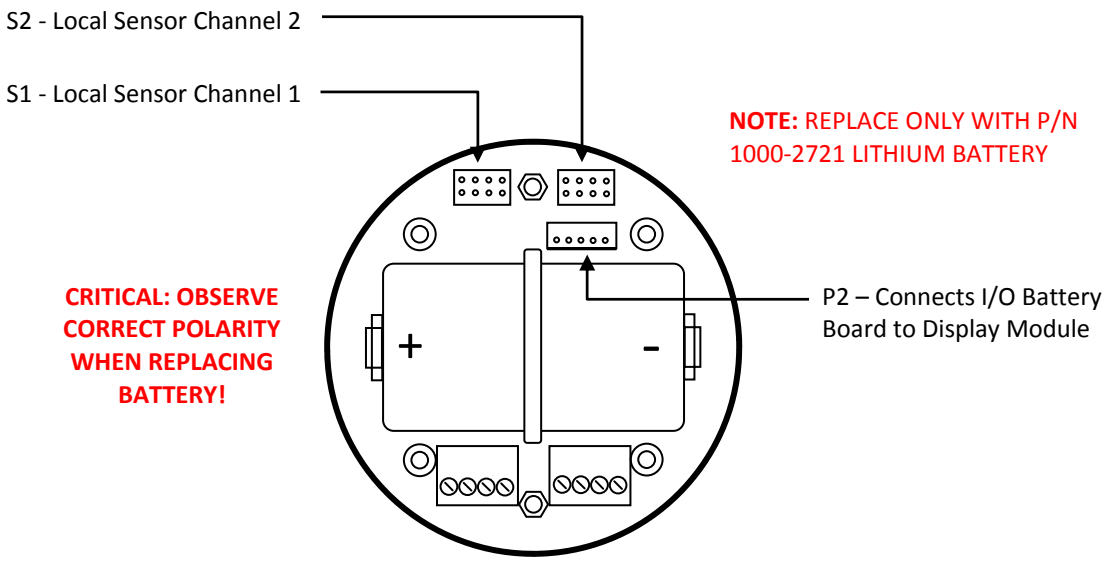


Figure 3-1: GASMAX TX I/O Battery Board

The multi-pin interface cable from local senor heads connects to "S1" for channel 1 and to "S2" for channel 2. When replacing the battery be careful to double-check the polarity before installing. Reversing the polarity will damage the internal electronics.

LOCAL OMNIDIRECTIONAL ANTENNA

The GASMAX TX includes a 3dBi 'rubber duck' antenna. All antennas are measured with respect to an "ideal isotropic radiator", a theoretical point of electromagnetic energy that radiates equally in every direction. The vertical rubber duck antenna focuses RF energy into a relatively flat donut-shaped radiation pattern that *radiates equally in all horizontal directions*. As a result, power that would have been transmitted vertically is now concentrated in the horizontal direction, increasing the apparent power output and receive sensitivity by 3 decibels (+3dB), an amount equal to doubling the power output or input sensitivity. These antennas are ideal for use between devices arranged on a common flat surface.

NOTE: BECAUSE OF THE HORIZONTAL RADIATION PATTERN, BE SURE TO ALWAYS MOUNT THE GASMAX TX SUCH THAT THE ANTENNA IS POINTING STRAIGHT UP.

CONNECTING A REMOTE DIRECTIONAL ANTENNA

A directional antenna focuses RF energy in a specific direction, and will therefore have a higher 'gain' value. The diagram below shows the GASMAX TX with Option "G" = 4, a remote YAGI directional antenna with 10' coaxial cable. The cable connects to the GASMAX TX in place of the 'rubber duck' antenna and provides a total of 9 dB gain. This is recommended if the GASMAX TX is located at some distance from the C2/TX controller, or if buildings or trees block the direct 'line of sight' path.

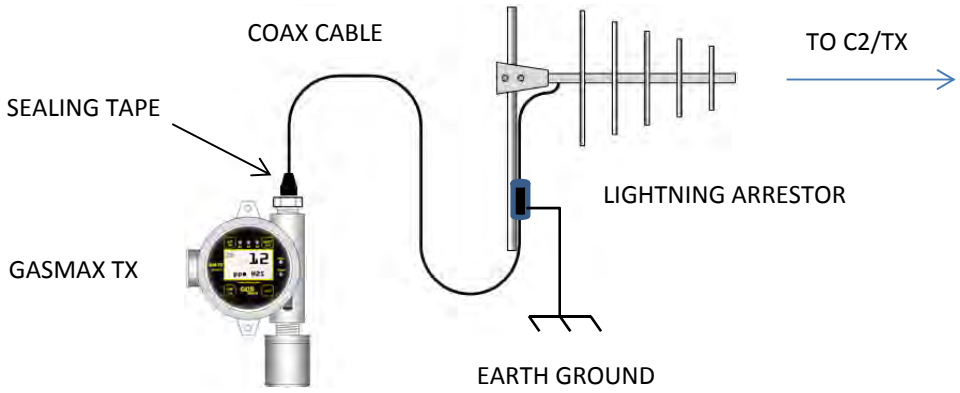


Figure 3-2: GASMAX TX WITH REMOTE YAGI ANTENNA

Depending on the location and local weather conditions, GDS Corp recommends the installation of a lightning arrestor at the antenna if the possibility of lightning strikes exists. If installed, the lightning arrestor should have a low resistance path to earth to ensure that electrical energy is bypassed to ground instead of traveling down the cable and entering the GASMAX TX.

SEALING ANTENNA AND CABLE FITTINGS

It is very important to weatherproof the antenna or coaxial cable connection using self-vulcanizing weatherproofing tape (p/n #1000-2314) or equivalent weatherproof sealing tape. Moisture ingress into an RF connection is the most common cause of problems with reception or transmission. A three layer sealing process is recommended – an initial layer of electrical PVC tape, followed by a second layer of self-vulcanizing weatherproofing tape with a final layer of electrical PVC tape.

INSTALLATION RECOMMENDATIONS SUMMARY

- When installing in outdoor applications mount the GM/TX such that the sensor head is at least 24" above average ground level to minimize water incursion and exposure to excess humidity (fog, mist, heavy rain)
- Keep the antenna at least 24" away from the nearest vertical metallic surface to maximize RF reception (900 MHz)
- Make sure that the sensor head O-ring is installed and intact
- Make sure the large O-ring around the enclosure cover is installed and intact
- Install two fresh desiccant bags before closing the cover of the yellow enclosure after installation to reduce humidity levels inside the enclosure and prolong component life

4 SOFTWARE SETUP AND PROGRAMMING

TURNING ON THE GASMAX TX

To turn on the GASMAX TX hold the magnetic wand over the UP/ON key for several seconds until the screen shows “Remove Magnet”. The welcome screen will appear, followed by the sensor information screen. The GASMAX TX will then enter a predefined warm-up delay period to allow the sensor to stabilize. If the unit does not power up properly, check for a loose battery connection or dead battery.

Figure 4-1: GASMAX TX Display

NOTE: TURNING ON THE C2/TX WIRELESS SITE MANAGER CONTROLLER ***BEFORE*** TURNING ON ANY OF THE GASMAX TX GAS MONITORS WILL SAVE BATTERY LIFE AND PROPERLY CONFIGURE THE C2/TX CHANNEL SETTINGS

The GASMAX TX will show “Warmup” and then display the current sensor reading. Most sensors may require five to fifteen minutes to stabilize once power is applied.

For the balance of this manual, the term “press” will be used to describe activation of any key via the magnetic wand. See Chapter 9 for a detailed description of the User Menu.

SELECTING THE NETWORK

To assign a GASMAX TX to a GDS Corp wireless network, press the EDIT key, select DEVICE SETUP followed by RF LINK SETUP and select the **Network Identifier (“A” thru “Z”)** to match the desired network, then assign a unique **Remote ID (“1” thru “240”)** that will be used to identify each gas monitor.

NOTE: EACH GASMAX TX IN ANY GIVEN WIRELESS NETWORK SHOULD HAVE **THE SAME NETWORK IDENTIFIER** AND HAVE A **DIFFERENT (UNIQUE) REMOTE ID**.

After power-up, allow the GASMAX TX to stabilize for one to eight hours prior to any initial calibration (see GDS Corp Electrochemical Sensor manual for more details on specific electrochemical sensors). This will allow the sensor to reach stable equilibrium with respect to environmental conditions such as ambient temperature, humidity, and barometric pressure as well as applied “reference” and “counter” voltages generated by the GASMAX TX electronics. At this point, the GASMAX TX can be calibrated and made operational.

To turn the GASMAX TX OFF, access the *Device Setup – Turn Power Off* menu, or hold the magnet over the NEXT key until the display shows "Power Down, EDIT to Accept", and then press the EDIT key.

SETTING UP THE GASMAX TX WITH THE C2/TX WIRELESS SITE MANAGER CONTROLLER

To successfully setup a wireless network, perform the following steps in order:

GASMAX TX Gas Monitor	C2/TX Wireless Site Manager Controller
	1. Apply AC or DC power to the C2/TX Wireless Site Manager Controller 2. Select the desired network identifier (select "A" through "Z") 3. If the C2/TX is the primary or only controller in the network, select RF Mode = "Server" (Beacon) 4. If using 900 MHz radios, set the desired beacon transmit power output (200 mW to 1 Watt) 5. Enable the desired total number of wireless channels to be monitored
6. Turn on each GASMAX TX by holding a magnetic wand over UP/ON key for several seconds 7. Configure the network identifier ("A" thru "Z") to match that chosen for the C2/TX or system controller. 8. Select a unique Remote ID ("RTU #") 9. Verify that the "Beacon in Range" icon is showing	
	10. Select desired C2/TX channel and set Remote Address to match Device ID from step #8
11. Hold magnetic wand over UP key to force configuration data packet transmission	12. Confirm reception of wireless transmission and valid gas detector reading and channel configuration
	13. Program relays and alarms for desired outputs
14. Perform end-to-end test using calibration or test gas	

Figure 4-2; Step-by-Step Setup Checklist

OPERATING IN LEGACY MODE

When using the GASMAX TX with previous generation controllers such as the C1 Protector, C64 Protector or C2 Quad Protector, the GASMAX TX radio must be programmed to operate in Legacy Mode. This means that RF transmissions from the GASMAX TX will be identical to those transmitted by previous generation gas detectors such as the GASMAX ECx.

To set the GASMAX TX for legacy mode: Press EDIT followed by DEVICE SETUP. Select RF LINK. The screen will say “READING RADIO” and show the RADIO PAGE menu. Scroll down to the second page and locate the RF LINK = WAVECAST menu item. Press EDIT and the entry will change to RF LINK = LEGACY. Scroll up to the previous RADIO PAGE menu page and set the Hop Channel and System ID to match the existing legacy network. Select a Remote ID setting that is unique to that network.

When in Legacy Mode, alarm settings at the GASMAX TX will only affect transmission rate and will NOT cause an alarm to occur at the remote controller. Switching to ‘transmit every time’ mode will still occur whenever the gas value exceeds the Alarm 1 setting. However, the remote controller will not indicate an alarm condition until the reported gas value exceeds the *value programmed at the remote controller.*

NOTE: A GASMAX TX PROGRAMMED IN “RF LINK = LEGACY MODE” WILL NOT OPERATE PROPERLY WITH THE C2/TX WIRELESS SITE MANAGER CONTROLLER

NOTE: A GASMAX TX PROGRAMMED IN “RF LINK = WAVECAST” MODE WILL NOT OPERATE PROPERLY WITH THE C1, C64 OR C2 QUAD PROTECTOR CONTROLLER

NOTE: WHEN OPERATING IN LEGACY MODE, THE GASMAX TX WILL OPERATE IN SINGLE CHANNEL ONLY

To switch the GASMAX TX back to normal mode, set the RF LINK settings back to RF LINK = WAVECAST and select the desired network “A” thru “Z”. The GASMAX TX does not need to be turned off and back on for the change to apply.

5 CALIBRATION

CALIBRATION OVERVIEW

Calibration is critically important to ensure correct operation of the GASMAX TX. The 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.

When entering CAL MODE, the GASMAX TX automatically transmits a data packet containing a value of 300 counts (-15.6% of scale) to enable a properly programmed GDS Corp Wireless Site Manager controller to indicate IN CAL for the current channel. Once CAL SPAN is complete, the GASMAX TX transmits a data packet containing a value of 800 counts (0% of scale) to indicate that Cal is complete. However, if an oxygen sensor is present, then the GASMAX TX will transmit a data packet with a value of 3475 counts (83.6% of scale) to simulate the typical 20.9% value found in atmospheric oxygen levels.

CAL MODE automatically exits if no keystrokes are detected after 5 minutes.

Always observe these GASMAX TX calibration guidelines:

- Use calibration gas that is tested to +/-5% accuracy. Detector accuracy is only as good as the calibration gas used. GDS Corp calibration gases are traceable to NIST (National Institute of Standards and Technology).
- NEVER USE CALIBRATION GAS THAT HAS PASSED ITS EXPIRATION DATE.
- Check the SPAN GAS VALUE setting and make sure it matches the calibration gas. (See Fig. 6-2)
- Always use a GDS Corp calibration cup that completely surrounds the sensor head.
- Be sure to use ZERO AIR, a mixture of 21% oxygen and 79% nitrogen, as a zero reference unless you are certain that no target gas exists in the area. Ambient gas may result in an ‘elevated zero’ condition that will cause a FAULT to occur once the ambient gas is no longer present.
- ALWAYS CALIBRATE A NEW SENSOR BEFORE DEPENDING ON THAT SENSOR FOR PERSONNEL OR EQUIPMENT SAFETY
- Calibrate on a regular schedule. GDS Corp recommends a full calibration every 3 months, with periodic ‘bump tests’ on a more frequent basis to ensure that the sensor has not been affected by temperature extremes or the presence of incompatible gases.

CALIBRATION PROCEDURE

Before beginning calibration, make sure you have the following items:

1. A cylinder of calibration gas
2. A cylinder of 'zero air' if the absence of target gas in the vicinity of the sensor cannot be confirmed
3. A fixed flow regulator with calibration cup connected via a length of flexible tubing. GDS Corp recommends a flow rate of 0.5 liters / minute for standard gases and a flow rate of 1.0 liters / minute for highly reactive gases such as chlorine or chlorine dioxide.

To calibrate a GASMAX TX detector:

1. To enter CAL MODE, press the DOWN / CAL key and within 5 seconds press the EDIT key.
2. The screen will display an APPLY ZERO message. Using the setup shown in Fig. 5-1, apply clean ZERO air unless it can be guaranteed that no target gas is present. After the reading stabilizes, press the EDIT key to complete the ZERO calibration.
3. If the ZERO CAL SUCCESSFUL message is displayed, an APPLY SPAN message will appear. Apply the correct SPAN gas. After the reading is stable, (approximately 1 minute) press the EDIT key to complete the SPAN GAS calibration. If the SPAN calibration is successful, the display flashes REMOVE CAL GAS and starts the CAL PURGE delay.
4. Immediately shut off the regulator and remove the calibration cup. At the end of the CAL PURGE delay, the GASMAX EC output is re-enabled and the unit is fully operational.

The flow chart shown below illustrates the calibration procedure. UP, CAL, NEXT & EDIT labels indicate keystrokes using the magnetic wand. ZERO or SPAN calibration will fail if the readings exceed built-in limits for maximum allowable zero or minimum allowable span.

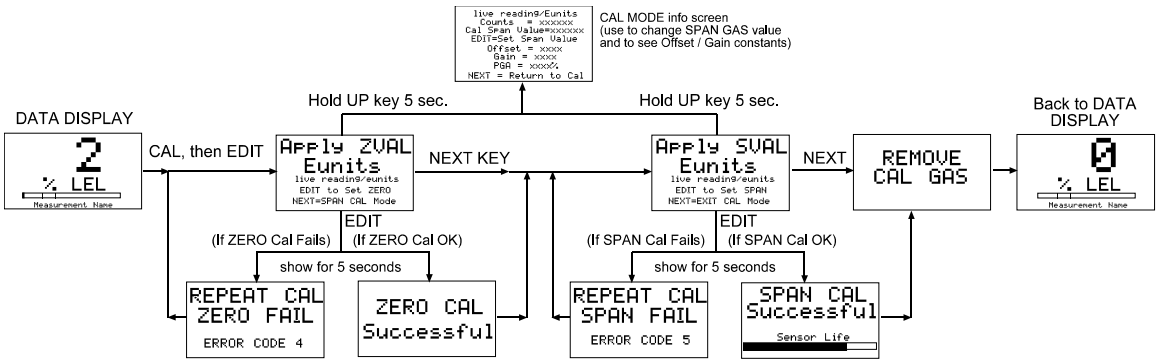


Figure 5-1: Calibration Flowchart

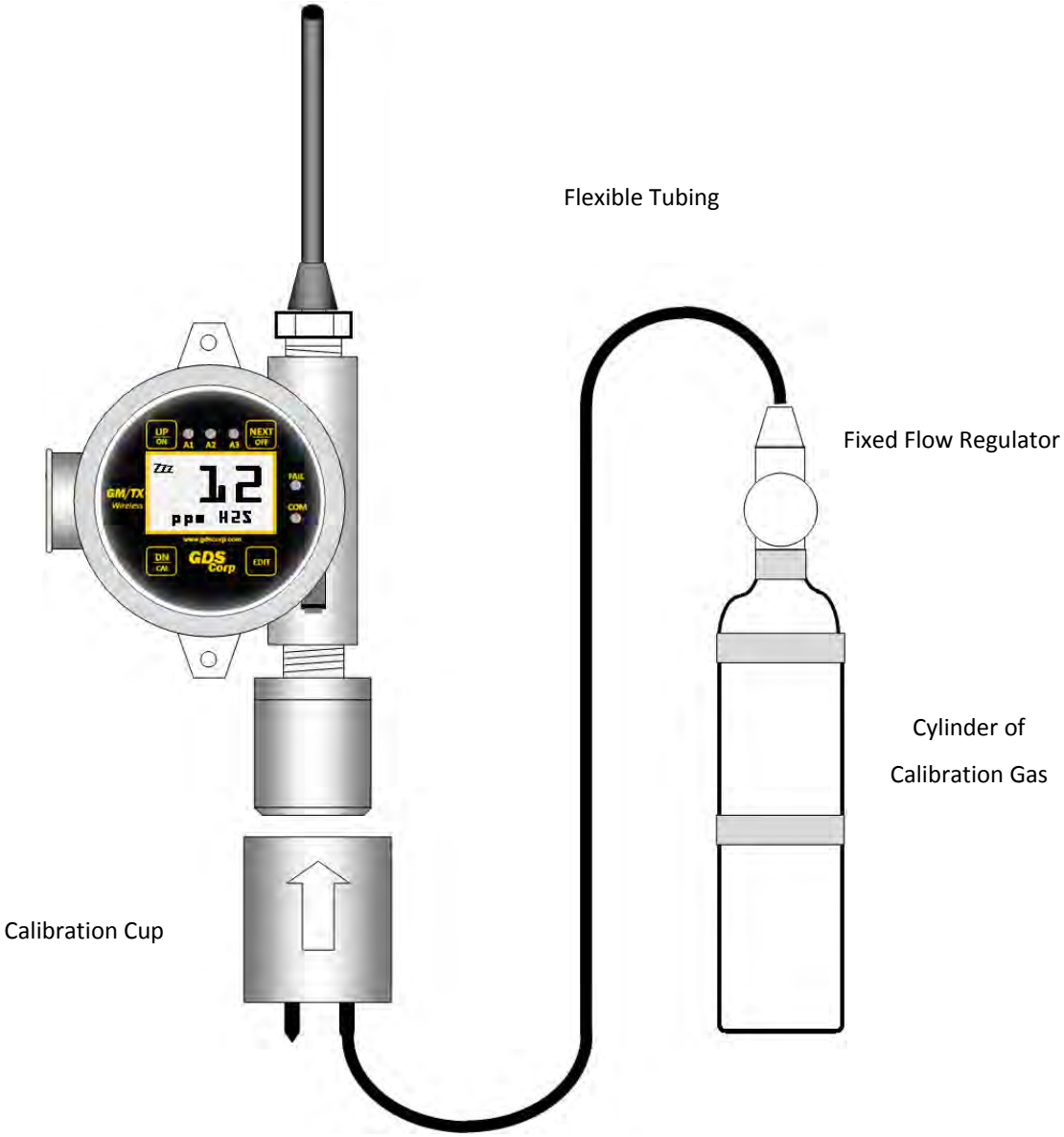


Figure 5-2: Calibration Setup

6 OPERATION

DATA DISPLAY SCREEN

The DATA display screen shows real-time measured gas concentration value information in calibrated engineering units. A horizontal bar graph tracks the current value and shows the Alarm 1 and Alarm 2 values in graphical form. In single-channel display mode, user-programmable Engineering Units ("Eunits") and Measurement Name text strings are shown below the real-time reading.

The GASMAX TX display is shown in Figure 6-1. There are four magnetic switches on the face of the GASMAX TX, arranged in a quadrant around the LCD display labeled "NEXT", "EDIT", "DOWN/CAL" and "UP/ON". To activate, or "press" a magnetic switch, move the magnet near the switch and then away ("swipe").

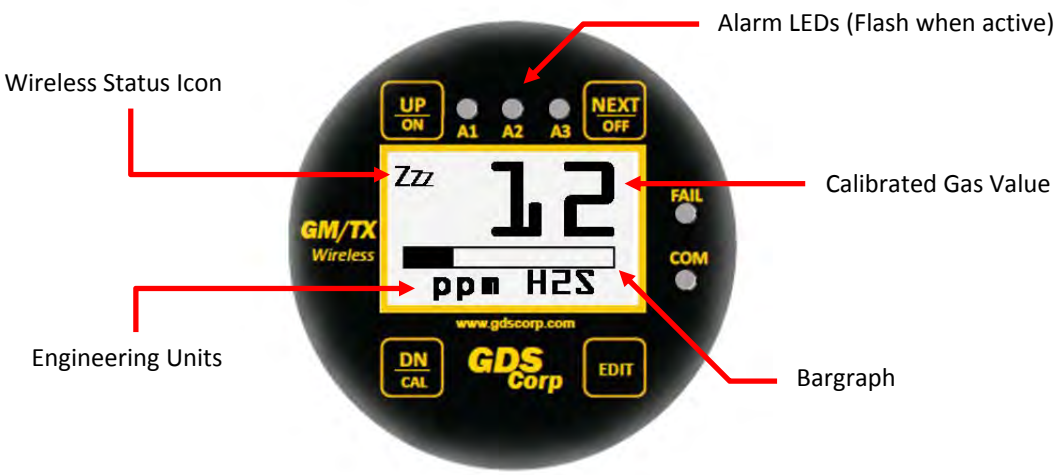


Figure 6-1: GASMAX TX Data Display Screen

The EDIT key activates the USER MENU display mode. While in USER MENU display mode, use the UP and DOWN keys to select an item, EDIT to change an item, and NEXT to exit the menu or function and return to display mode.

A "Wireless Status Icon" appears in the upper left corner of the data display screen to indicate the status of the wireless interface. The information shown includes:

ZZZ	Indicates that the GASMAX TX microprocessor is in low-power sleep mode.
SNIFF	"Sniff": Indicates that the GASMAX TX microprocessor is awake and reading the sensor data.
RNG	"Range": Indicates that the GASMAX TX is trying to synchronize with the beacon.
	"Beacon in Range": Indicates that the beacon was successfully detected and that a data transmission is in progress.
	"No Beacon": Indicates that the beacon signal was not received during the most recent attempt to transmit data. *The GASMAX TX will not attempt to transmit until a beacon signal is present.*
	"Range Warning": This icon is presented if the server was previously out of range for any reason and can be reset using the *Device Setup – Reset Range* Icon menu.
LoBat	"Low Battery": Displayed during each "sniff cycle' if the battery is near the end of its useful life.

TREND AND DUAL DATA DISPLAY SCREENS

Pressing the "NEXT" key allows the user to cycle through the available data and trend screens. In single channel mode, there are only two screens – Data Display and Trend Display. If both channels are active, there are two Data Display screens, two Trend Display screens and one Dual Data Display screen that shows both channels values and alarm status.

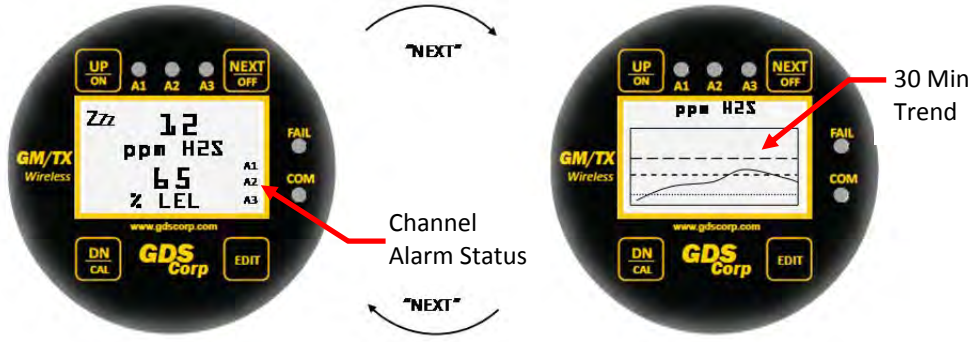


Figure 6-2: Dual Data and Trend Display Screens

NORMAL OPERATION

Every six seconds, the GASMAX TX reads the sensor's digital output, converts the reading to calibrated engineering units and displays the value on the LCD display. Based on the gas concentration level and alarm levels programmed by the user, the microprocessor determines if a compact wireless data packet should be broadcast to the site manager or wireless controller / receiver. This data packet includes the

gas value, alarm and fault status bits and battery voltage. The GASMAX TX will initiate a data packet transmission under the following specific conditions:

- Every time the ***Wakeup Timer*** expires, irrespective of the gas level present. This allows controller / receivers to confirm the presence of the gas monitor or issue a COMM ERROR is no transmission is received in a fixed interval (default is 18 minutes, but can be adjusted by the user).
- IF the new reading exceeds the **Alarm 1, Alarm 2 or Alarm 3** programmed value. A sensor FAULT reading does not initiate a transmission, but will be broadcast on the Wake-Up timer interval.
- If the reading rises or falls **by more than 2% of full scale** as compared to the last reading.
- Upon **entry into CAL mode**, a packet containing a gas value of 300 counts (-15.6% of scale) is transmitted to indicate IN CAL for the current channel.
- Upon **entry into CAL PURGE mode**, a value of 800 counts (0% of scale) is transmitted for all sensors except oxygen sensors, where a value of 3475 counts (83.6% of scale) is transmitted.
- Holding the magnetic wand **over the UP key** until the Data Transmission icon appears.
- At the **end of the initial Warm-Up** interval
- Any time **menu items are edited** and again upon returning the display to readings mode.

ALARM SETUP

To set an alarm level, press the EDIT key to view the main menu, select the desired channel using the UP or DN keys and then select ALARM SETTINGS. Each channel has three separate alarm levels; each level can be set to alarm if the reading rises above the preset value (LO TRIP = NO) or if the reading drops below a preset level (LO TRIP = YES). A DEADBAND setting causes the alarm to remain active – once triggered – until the input value drops (or rises) by a programmable percentage of the reading. This keeps the alarm from rapidly alternating between active and inactive if the measured gas level is close to the preset alarm level.

A separate FAULT alarm is used to determine if the sensor output has drifted below zero. Certain sensors will output negative values as they age beyond their usable life.

When used with third-generation products like the C2/TX Wireless Site Manager Controller and GDS-95 Alarm Station, the **alarm settings programmed into the GASMAX TX will directly trigger the alarm condition**. Alarm indicators can be set to activate above or below a given engineering units set point. Alarm processing will trigger an alarm condition when the input exceeds the programmed value, and includes hysteresis to keep the alarm from rapidly switching ON and OFF if the input remains close to the programmed alarm value.

If the GASMAX TX is used with second-generation legacy products such as the C2 *Quad Protector* Receiver / Controller, C1 *Protector* Receiver / Controller or C64 *Protector* Receiver / Controller, the remote

controllers **ignore the alarm status bits** and use **broadcast gas levels to trigger alarms**. In this case, alarm levels must be manually programmed at the receiver / controller.

OPTIMIZING BATTERY LIFE

The 3.6v lithium battery in the GASMAX TX should last between six and 12 months under normal conditions if gas is only occasionally present. To optimize battery life, consider the following options:

- **Set the Wakeup Timer to its maximum value of 5 minutes (300 seconds)** - Shortening the Wakeup Timer will increase the number of transmissions and reduce battery life. However this will also reduce the amount of time that a gas detector can become inactive before the Wireless Site Manager or receiver/controller will signal a "COMM ERROR".
- **Reduce the power output for 900MHz radios** – Transmit power at 900 MHz can be adjusted from 1 watt (max) down to 10 milliwatts (min). Since most of the power consumed by the GASMAX TX is used by the radio to transmit, reducing the power output will increase battery life. However, this will reduce the strength of the transmitted signal and may increase communications errors.
- **Setting the TX Multiples value** – The TX Multiples menu setting enables every broadcast to be repeated up to five times with a 200 mSec delay between each transmission. Increasing the TX Multiples value will increase battery usage, but may reduce communications errors in noisy environments.
- **Setting the TX Config value** – The TX Config setting determines how often the GASMAX TX transmits the large data packet that contains configuration data. The default is 60 minutes. Decreasing the TX Config interval will slightly increase battery power usage.
- **Setting RF Handshaking** – If RF Handshaking is ON, the Wireless Site Manager will actively acknowledge each transmission from the GASMAX TX. If an acknowledge signal is not received by the GASMAX TX, the transmission will be repeated up to three times. RF Handshaking ON will increase wireless reliability but may reduce battery life if transmissions must be repeated.

NOTE: RF HANDSHAKING **CAN ONLY BE USED** IF THE GASMAX TX IS TRANSMITTING TO A SINGLE C2/TX WIRELESS SITE MANAGER CONTROLLER OR RECEIVER/CONTROLLER.

7 MAINTENANCE

NORMAL MAINTENANCE

Normal maintenance for the GASMAX TX primarily involves battery replacement and periodic calibration on standard intervals. GDS Corp recommends calibration at least every three months, or more often if temperature extremes, vibration, the presence of incompatible gases or other environmental factors may accelerate the deterioration of the sensor element. Calibration should also include inspections for clogged or wet sensor heads, cracked or damaged enclosures and water incursion inside conduit or junction boxes.

BATTERY REPLACEMENT

Periodically the 3.6v lithium ion battery inside the GASMAX TX must be replaced. The batteries used are disposable and cannot be recharged. ATTEMPTING TO RECHARGE A GASMAX TX BATTERY MAY RESULT IN FIRE OR EXPLOSION!

To replace the internal battery, follow these steps:

1. Turn the GASMAX TX off by holding the magnet over the NEXT key until the display shows “Power Down, EDIT to Accept”, and then press the EDIT key
2. Unscrew the cover of the yellow enclosure. *Make sure to keep moisture from entering the enclosure!*
3. Loosen the two thumbscrews that hold the display assembly in place. Gently remove the display assembly and set it to one side (a cable between the battery board and display can remain in place)
4. Pull the existing battery out of the holder using the white plastic tie wrap tab connected to the battery.
5. Remove and discard any existing desiccant bags.
6. Inspect the O-ring that seals the cover of the yellow enclosure (p/n #12-0416). Replace if damaged.
7. Carefully inspect the enclosure and electronics for any sign of moisture or corrosion. If found, determine the source of the leak before proceeding!
8. Install the replacement battery *paying very close attention to polarity*. See Figure below. THERE IS NO PROTECTION AGAINST REVERSE POLARITY! INSTALLING A BATTERY BACKWARDS WILL DAMAGE THE ELECTRONICS IN THE GASMAX TX.
9. Place two fresh replacement desiccant bags (p/n #2000-0370) inside the GASMAX TX enclosure.
10. Reinstall the display module and tighten the thumbscrews.
11. Replace the cover of the yellow enclosure. Tighten securely.

SENSOR REPLACEMENT

If a sensor indicates FAULT, does not respond to gas or can no longer be calibrated, it should be replaced. GASMAX TX monitors use GDS Corp type 10-97xx electrochemical sensors or ultra-low-power infrared sensors, where the XX is the gas type shown in Specifications. The range value should also be specified when ordering replacement sensors. For example, a replacement H2S sensor for 0-100 ppm would be "10-9715-R0100".

To replace the sensor, follow these steps:

1. Turn off the GASMAX TX by accessing the *Device Setup – Turn Power Off* menu or holding the magnet over the NEXT key until the display shows "EDIT at Accept, then pressing the EDIT key.
2. Unscrew the sensor head cover. If unable to open the cover by hand, use a Sensor Head Replacement Tool (p/n 10-0187).
3. Remove the old sensor by pulling straight down.
   NOTE: DO NOT TRY TO UNSCREW THE SENSOR. PULL STRAIGHT DOWN.
4. Verify that the sensor head O-ring is undamaged and properly seated.
5. Carefully install the replacement sensor by aligning the arrow on the sensor with the arrow engraved on the sensor head. Push straight up until the sensor connector seats firmly into the connector.
6. Reinstall the sensor head cover by CAREFULLY screwing the cover onto the sensor head.
   NOTE: IF THE SENSOR FALLS OUT OF THE SENSOR HEAD DURING THIS STEP, IT CAN BE DAMAGED. USE CAUTION WHEN REINSTALLING THE SENSOR HEAD COVER.
7. Turn the GASMAX TX ON by holding the magnet over the UP/ON key until the welcome screen appears on the display.

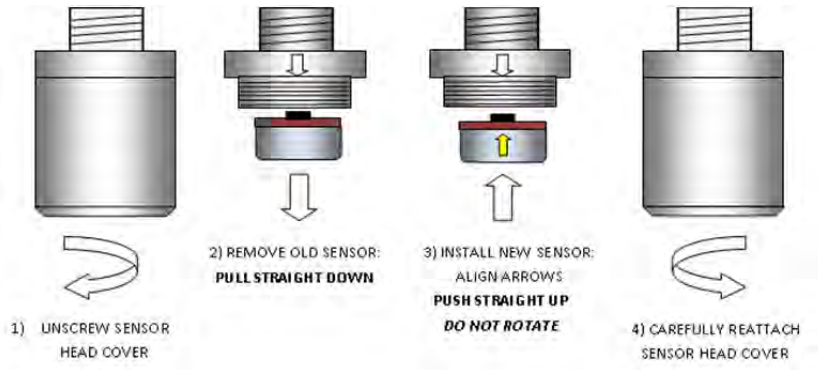


Figure 7-1: GASMAX TX Sensor Replacement

Local Smart Sensors are automatically recognized by the GASMAX TX and the Smart Sensor information screen should appear immediately after the installation of a local Smart Sensor. If the sensor is the same

gas type as was previously installed, the sensor's calibration data will be uploaded into the GASMAX TX. All other parameters stored in the GASMAX TX will be retained.

GASMAX TX units can be reconfigured for different sensors by simply installing a different type compatible sensor. If a new sensor TYPE is installed, the Smart Sensor identification screen will appear, followed by the SENSOR MISMATCH message and the user will be given the opportunity to confirm the new sensor type. If the user activates the EDIT key, all data stored in the new sensor's database – including range, tag name, cal span value, engineering units and alarm levels – will replace the current settings.

8 SPECIFICATIONS

Power	Disposable 3.6v Lithium-Ion battery (D-size)
Display	64 x128 pixel LCD with engineering units, bargraph and 30-minute trend
Ch 1 Input	Digital input from local type 10-97xx toxic or infrared sensor
Ch 2 Input	Digital input from local type 10-97xx toxic or infrared sensor
Accuracy	+/- 5% of full scale (typical) over temperate range
Output	Gas concentration represented by a wirelessly transmitted numeric value between 800 counts (0% of scale) and 4000 counts (100% of scale); one data value per channel. Alarm status bits and battery voltage information is also transmitted.
RF Section (900 MHz)	User adjustable transmit power from 10 mW ( ) to 1.0 watt (+30 dBm); frequency range from 902 to 928 MHZ. Beacon receiver sensitivity -100 dBm
RF Section (2.4 GHz)	Fixed transmit power of 50 mW. Frequency range from 2.406 GHz to 2.435 GHz (network identifier A – R) and from 2.444 GHz to 2.472 GHz (network identifier S – Z)
Temperature	-20°C to +55°C
Memory	On-board non-volatile memory retains all user settings
Housing	Aluminum housing with epoxy paint standard; #316 stainless steel optional
Dimensions	Width 5.4” (137 mm), Height 8” (203 mm), Depth 5” (127 mm) Shipping wt. 6.5 lbs. (3 kg)
Approvals	Enclosure CSA certified for Class I Division 1 hazardous areas
Warranty	Two years on electronics, one year on sensor

AVAILABLE SENSORS AND RANGES					
P/N	**Sensor**	**Range**	**P/N**	**Sensor**	**Range**
10-9750	Methane	0-100% LEL	10-9753	Carbon Dioxide	0-100%
10-9751	Propane	0-100% LEL			
10-9710	Oxygen	0-25%	10-9722	Ethylene Oxide	0-100 ppm
10-9711	Carbon Monoxide	0-300 ppm	10-9723	Arsine	0-1 ppm
10-9712	Chlorine	0-10 ppm	10-9724	Silane	0-50 ppm
10-9713	Chlorine Dioxide	0-1 ppm	10-9725	Fluorine	0-1 ppm
10-9714	Hydrogen	0-4%	10-9726	Phosgene	0-1 ppm
10-9715	Hydrogen Sulfide	0-9999 ppm	10-9727	Hydrazine	0-1 ppm
10-9716	Hydrogen Cyanide	0-30 ppm	10-9728	Nitric Oxide	0-50 ppm
10-9717	Hydrogen Chloride	0-30 ppm	10-9729	Nitrogen Dioxide	0-100 ppm
10-9718	Hydrogen Fluoride	0-5 ppm	10-9730	Mercaptan	0-50 mg/m3
10-9719	Sulfur Dioxide	0-500 ppm	10-9731	Tetrahydrothiophene	0-50 mg/m3
10-9720	Ammonia	0-1000 ppm	10-9732	Diborane	0-1 ppm
10-9721	Ozone	0-1 ppm	10-9733	Hydrogen Sulfide Low RH	0-100 ppm

9 USER MENUS

The GASMAX TX Main Menu tree is shown below. To access the Main Menu, swipe the magnetic wand over the EDIT key. Use the UP and DN keys to select an item and press EDIT. Use NEXT to exit a menu.

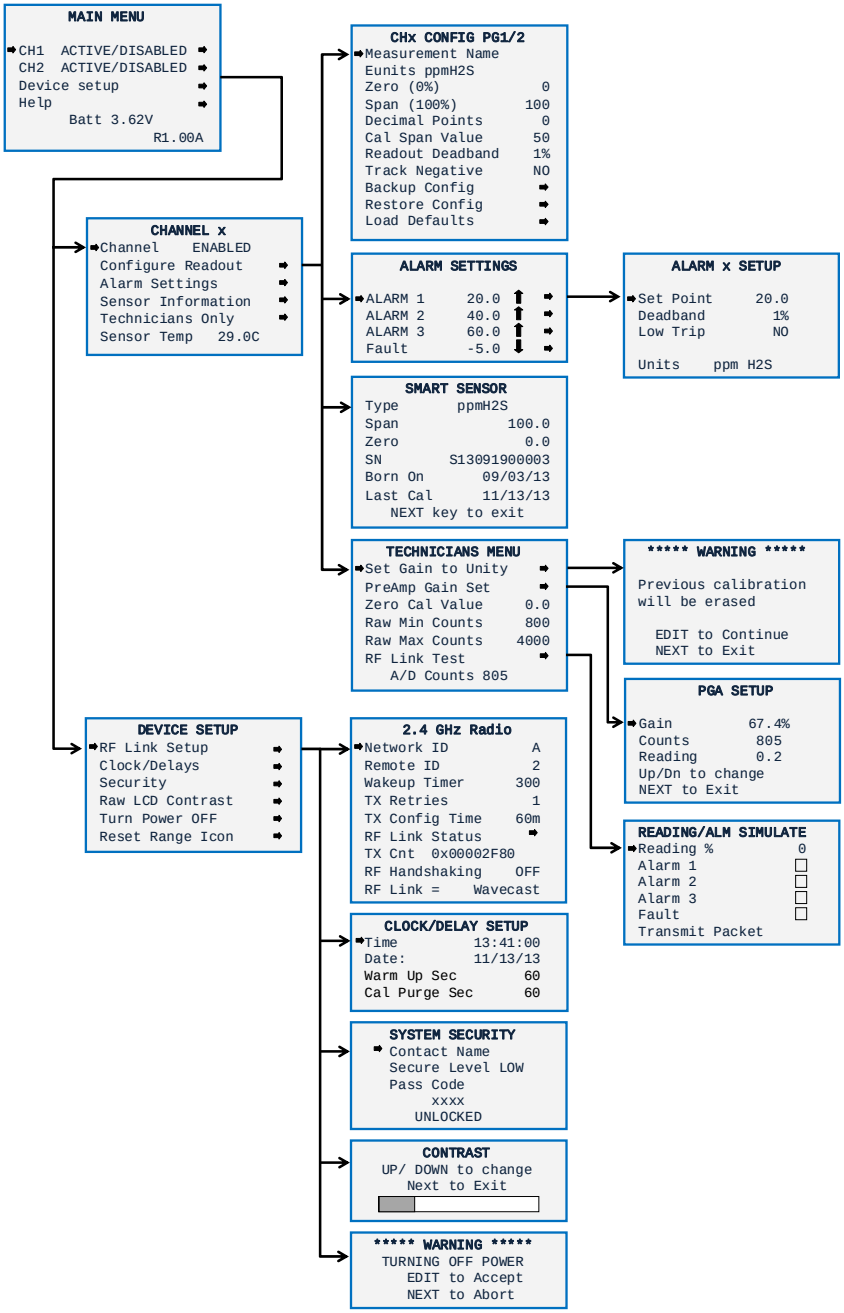


Figure 9-1: GASMAX TX Main Menu Tree

CHANNEL CONFIGURATION MENU

The Channel Configuration menu contains settings that are unique to each channel. There are two channels and each menu contains identical entries.

NOTE: WHEN EDITING CHANNEL INFORMATION, MAKE SURE TO SELECT THE CORRECT CHANNEL MENU.

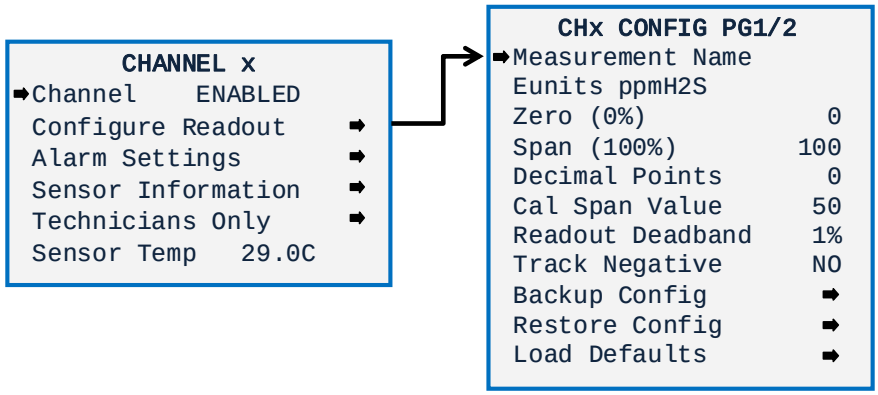


Figure 9-2: Channel Configuration Menu

CHANNEL ENABLED / DISABLED – Channels should only be enabled if a sensor is attached.

SENSOR TEMP – Shows the current sensor temperature.

MEASUREMENT NAME may be edited to contain any 16-character field and is typically used to describe the monitored point by user tag number or other familiar terminology. To modify the existing setting, press the EDIT key when the cursor is pointing to the entry. Use the UP or DN keys to change the character, and the NEXT key to move to the next character. Press EDIT again when done.

EUNITS (engineering units) may have up to a 10 character ASCII field. Many common gases have pre-configured Eunits based upon the sensor type and each may be edited in this menu.

ZERO (0%) defines the reading to be displayed when the input is at 0%.

SPAN (100%) defines the reading to be displayed when the input is at 100%. The highest reading allowed is 9999 including negative polarity sign. Polarity is only indicated for negative readings.

DECIMAL POINTS set the resolution of the LCD readings and may be set for 0, 1 or 2. For example, ZERO readings for 0, 1 & 2 decimal points displays as “0”, “0.0” & “0.00”.

CAL SPAN VALUE sets the engineering units value of the calibration gas. GDS Corp recommends that the calibration gas value be between 25% and 75% of full scale. Calibrating at 100% of scale is not recommended.

READOUT DEADBAND forces low values to continue to read zero. This is useful when there are small amounts of background gases that may cause fluctuating readouts. The highest amount of deadband allowed is 5%.

TRACK NEGATIVE allows the display to show negative values when set to "YES". This can be helpful when troubleshooting sensor problems. The default setting is "NO" and forces the display to read "0" if the sensor value drops below zero. However, negative sensor outputs will always cause the Fault alarm to trip.

BACKUP CONFIG allows users to store the entire current GASMAX TX menu database into non-volatile memory for restoration later if incorrect values are accidentally entered or uploaded.

RESTORE CONFIG restores the GASMAX TX menu database to the values from the most recent Backup Config. The special keystroke sequence of 4 consecutive UP keys is also required to perform backup and restore operations.

LOAD DEFAULTS restores factory default settings.

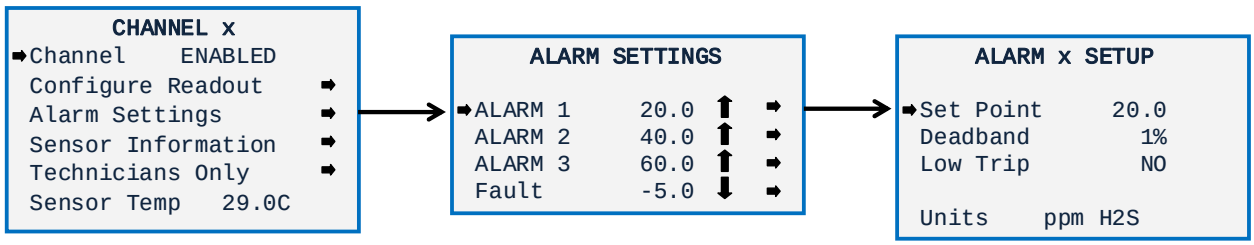


Figure 9-3: Alarm Settings Menu

The Alarm Settings page covers the Alarm 1, 2 and 3 menu items. Alarm 1, Alarm 2, Alarm 3 and Fault menus are identical and are therefore described only once in this section. For the GASMAX TX, the alarm settings not only control the status of the indicator LEDs, but also cause alarm conditions to occur in the GDS-95 Wireless Alarm Station and C2/TX Wireless Site Monitor Controller.

SET POINT enters the engineering unit value where the alarm trips. It may be negative and trip when monitored values fall out of range in this direction. Fault has a default setting of negative 10 with Low Trip set for YES. It is important to adjust this value when the transmitter's span value is set for another value other than 100. For example, a typical span setting for monitoring oxygen level is 25 therefore the fault level value should be adjusted to -2.5 which is equal to negative 10% of full scale.

DEAD-BAND has a minimum value of 1% and a maximum value of 10%. It is useful for preventing alarm cycling when the monitored value is hovering around the set point. EXAMPLE: With a range of 0-100 ppm, if deadband equals 5% and the set point is 20 ppm, after tripping at 20 ppm the value must drop below 15 ppm to reset.

LOW TRIP set to YES causes the alarm to trip as the value falls below the set point.

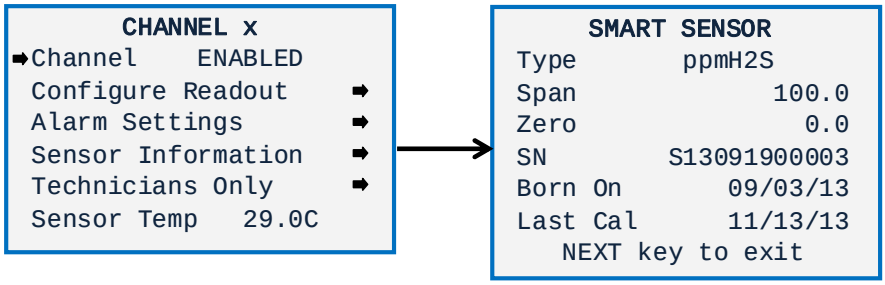


Figure 9-4: Smart Sensor Information Menu

The Sensor Information page covers settings associated with Smart sensors. Users can review information contained in the Smart Sensor database. Values cannot be user-modified.

TYPE indicates what kind of input or sensor the GASMAX TX is configured to accept and is typically pre-configured at the factory. When installed, Smart Sensors upload sensor type and other data to the GASMAX TX and this data may be viewed on the SMART SENSOR information screen.

SPAN displays the programmed value for 100% of range. Factory programmed.

ZERO displays the programmed value for 0% of range. Factory programmed.

SERIAL NUMBER - displays the unique sensor serial number.

BORN ON displays the date when the sensor was originally configured at the factory.

LAST CAL displays the date of the most recent calibration.

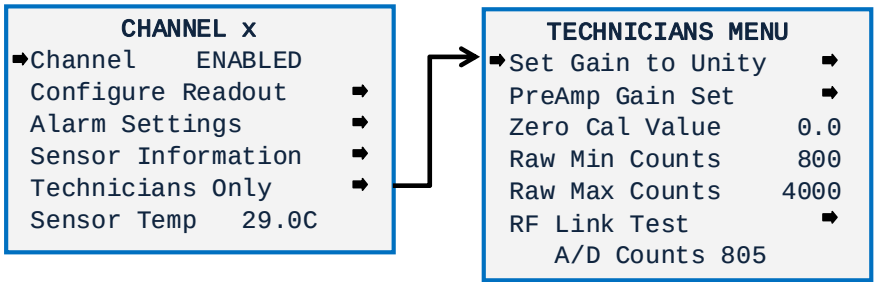


Figure 9-5: Technicians Menu

ZERO CAL VALUE should always be set to “0”.

RAW MIN / RAW MAX COUNTS – determines the range of the 12 bit analog to digital converter. Raw Min Counts represents 0% of scale and Raw Max Counts represents 100% of scale. Under certain conditions, these counts values can be adjusted to remove excessive offset or increase the apparent gain of the sensor. Raising or lowering the value of the Raw Min Counts will adjust the sensor ‘zero’ point, and reducing the Raw Max Counts will amplify the sensor’s output by reducing the range between zero and span.

NOTE: ADJUSTING THE RAW MIN OR RAW MAX COUNTS SHOULD ONLY BE DONE BY TECHNICIANS FAMILIAR WITH THE GASMAX TX GAS MONITOR.

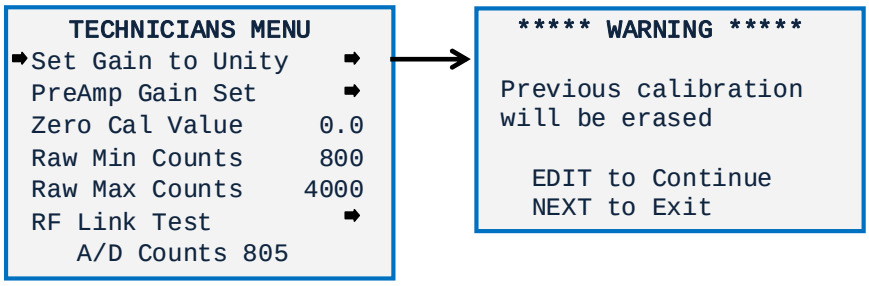


Figure 9-6: Set Unity Gain Menu

SET GAIN TO UNITY sets the Gain and Offset values to 1.000 and 0.000 respectively. This clears any previous calibration data and is useful in troubleshooting if sensor readings appear to be incorrect.

WARNING: A FULL CALIBRATION SHOULD ALWAYS BE PERFORMED AFTER A SET GAIN TO UNITY COMMAND.

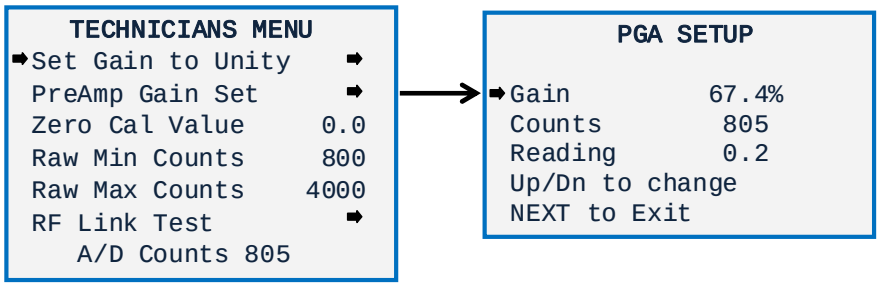


Figure 9-7: Preamp Gain Set Menu

PREAMP GAIN SET Gas sensors have a very wide range of output levels and the PGA gain parameter is used to match the sensors' output to the Smart Sensor's signal conditioning circuitry. Each type of sensor has a nominal gain value that is preset at the factory. Altering the PGA gain value resets the calibration Gain and Offset values to their default values of 1.000 and 0.000. The current PGA gain value is shown in percent and can be increased or decreased by pressing the UP or DOWN keys.

WARNING: A FULL CALIBRATION SHOULD ALWAYS BE PERFORMED AFTER ANY CHANGE IN THE PREAMP GAIN SETTING.

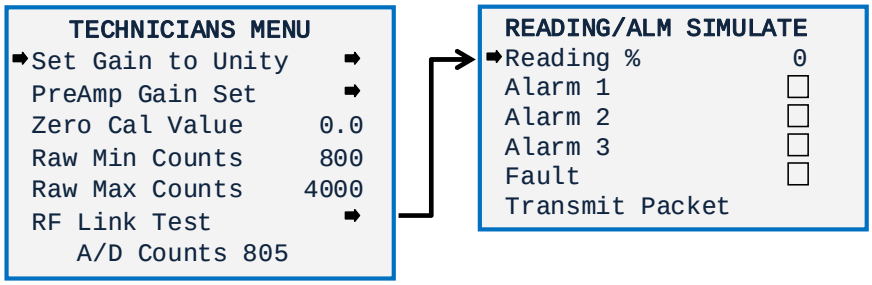


Figure 9-8: RF Link Test Menu

RF LINK TEST The RF Link Test is a diagnostics tool which allows the user to cause the GASMAX TX to transmit simulated readings of 0%, 25%, 50%, 75% and 100% of scale without actually applying gas. Checking the check box associated with each alarm setting can also be used to force the transmission of a data packet with the corresponding alarm bit set. Select the value or alarm condition and select the TRANSMIT PACKET command to perform the function.

DEVICE SETUP MENU

The Device Setup menu contains settings that are unique to the detector itself.

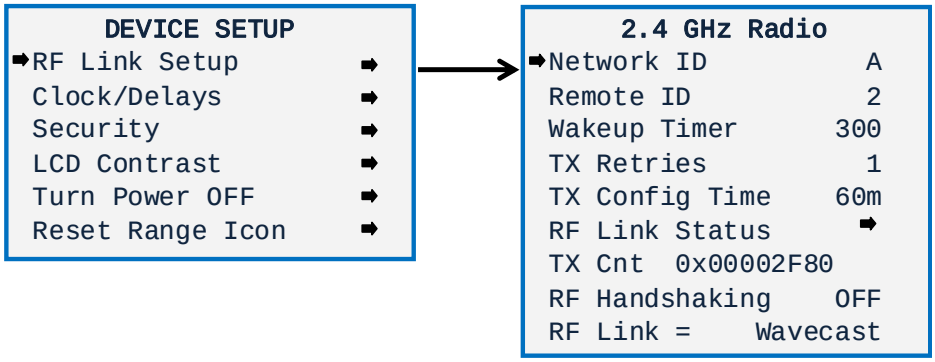


Figure 9-9: Radio Setup Menu (2.4 GHz)

The RF Link Setup menu is used to configure the radio modem in the GASMAX TX. There are two similar menus, one for 900 MHz radios and another for 2.4 GHz radios.

NETWORK ID may be set from “A” through “Z” and assigns the pseudo-random radio frequency hopping pattern and system identifier. A transmitter will not go In Range of or communicate with another transmitter operating with a different Network Identifier. Different Network Identifiers can be used to prevent radios in one network from listening to transmissions of another. Installations having more than one Server network should also have different Network Identifiers for each network

REMOTE ID may be set from 1-255 and acts as the device address for this particular GASMAX TX. Controller channels receiving this monitor's data must also be configured with this matching Remote ID address.

WAKE UP TIMER determines how often the GASMAX TX sends a small data packet when there are no alarms present and when the gas level remains constant. The interval can be set to a value between six seconds and 300 seconds (default value). Decreasing the wakeup timer will use more power and decrease battery life, but allow remote receivers to determine a loss of signal condition more rapidly.

TX RETRIES allows up to 5 consecutive repeats of every transmission. The default setting is 1 and should be increased only if there is no other way to establish a reliable transmission link.

TX CONFIG TIME determines how often the GASMAX TX transmits a large data packet that contains all the channel configuration parameters. This interval can be set for a value between 1 hour and 8 hours. Default is 8 hours.

RF LINK STATUS opens a special window that shows real-time status for battery voltage and 'in range' condition.

TX COUNT keeps track of the number of data packets sent by the GASMAX TX. The counter is 32 bit binary and can count up to 4.2 million transmissions.

RF HANDSHAKING determines whether the remote receiver is expected to return a 'data received' message. If set to "OFF", the GASMAX TX broadcasts the same packet three times in quick succession. If set to "ON" the GASMAX TX broadcasts a single copy of the data packet and waits for a reply from the system server. **NOTE**: RF HANDSHAKING SHOULD ONLY BE USED IF THERE IS JUST ONE RECEIVER IN THE NETWORK.

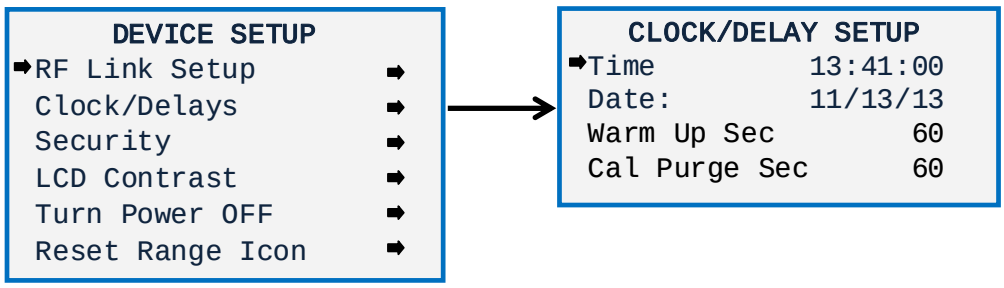


Figure 9-10: Clock / Delay Menu

The GASMAX TX is equipped with a crystal-controlled, battery-backed real-time clock that maintains local Time and Date. These values are factory preset to US Central Time and should be reset to correctly match the current time zone during installation to make sure that time-stamped Event Log entries are correct.

TIME adjusts time of day in hours, minutes and seconds. Time is entered in 24 hour format. The GASMAX TX will not adjust the clock to compensate for Daylight Savings Time.

DATE adjusts date in month, day and two-digit year.

WARM UP DELAY sets the amount of time from power-on until the 4-20mA output signal begins to track the sensor output. Default setting is 60 seconds. Maximum value is 255 seconds.

CAL PURGE DELAY sets the amount of time from the completion of span calibration until the 4-20mA output signal restarts tracking the sensor output. The default setting is 60 seconds and the maximum value is 255 seconds.

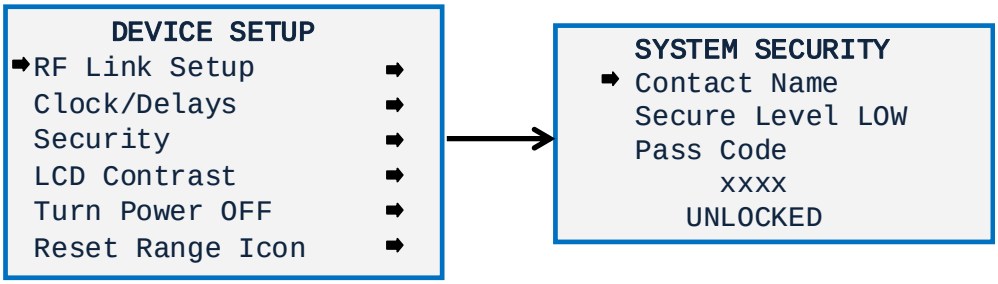


Figure 9-11: Security Menu

CONTACT NAME is a 12 character ASCII field available for displaying a phone # or name of personal who knows the Pass Code. Lost Pass Codes may be recovered by entering the locked security menu and holding the UP key for 5 seconds. The 4-digit code appears near the bottom of the screen.

SECURE LEVEL sets LOW, HIGH or OFF modes. A LOW level allows CAL MODE sensor calibrations but requires the 4-digit Pass Code prior to altering menus. HIGH level locks the entire menu database and the CAL Mode until the correct Pass Code is entered. LOW and HIGH security levels always allow static viewing of configuration menus.

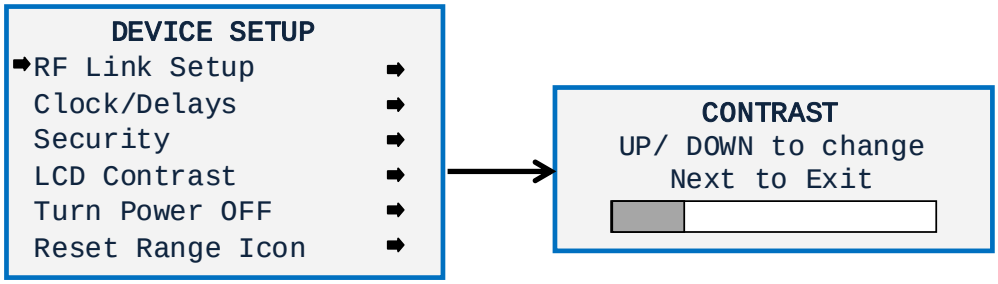


Figure 9-12: LCD Contrast Menu

LCD CONTRAST Select the LCD contrast command and use the UP or DOWN to adjust the contrast of the LCD display.

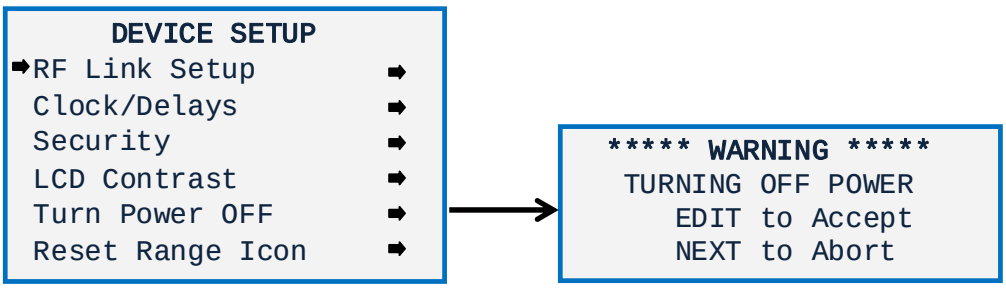


Figure 9-13: Power Off Menu

TURN POWER OFF To turn the GASMAX TX off, select the *Device Setup – Turn Power Off* menu or hold the magnet over the NEXT key until the display shows "EDIT to Accept, and then press the EDIT key.

10 TROUBLESHOOTING GUIDE

SENSOR INDICATES FAULT OR OVERRANGE

- Certain toxic sensors indicate fault or over-range at power up and quickly drift towards zero. This is normal behavior.
- Examine the sensor for moisture or discoloration. Replace sensor if wet or discolored.
- Inspect sensor cable and junction box for moisture or standing water. Replace cable or junction box interface boards if wet or damaged.
- If no moisture, discoloration or damage is found, sensor may be at the end of its useful life. Replace sensor.
- Toxic sensors left unpowered for more than 3 months are subject to accelerated degradation and may demonstrate a permanent loss of sensitivity.

SENSOR WILL NOT ZERO

- Background gas is present. Use ‘zero air’, a mixture of oxygen and nitrogen to zero the sensor.
- Sensor output drifted above calibration maximum limit or drifted below fault limit. Sensor is defective and should be replaced.

GASMAX TX REPORTS “MISSING SENSOR”

- Sensor has been removed or is not present in the sensor head.
- The pins in the sensor head connector are damaged
- The pins in the corresponding sensor board connector are damaged
- The sensor board is damaged or defective

GASMAX TX EXHIBITS UNUSUAL OR UNEXPECTED BEHAVIOR

- Perform a “Cold Boot” to re-initialize the entire system. To perform a Cold Boot, hold the magnet over the UP/ON key until the display reads “Release Key”, then move the magnet over the EDIT key.

  NOTE: COLD BOOT CLEARS ALL DEVICE SETTINGS, INCLUDING NETWORK IDENTIFIER AND REMOTE ID. BE SURE TO RECORD THESE VALUES BEFORE PERFORMING THE COLD BOOT PROCEDURE.

GASMAX TX DISPLAY BLANK

- Turn the GASMAX TX on by holding a magnetic wand over the UP/ON key
- Open enclosure and inspect battery for proper installation.

- Replace battery – NOTE: BE SURE TO OBSERVE PROPERLY POLARITY

GASMAX TX AND C2/TX CONTROLLER DISPLAYED VALUES DON'T MATCH

- Verify viewing proper channel
- Verify C2/TX "device ID" and GASMAX TX "Remote ID" match
- Verify that C2/TX has successfully received a configuration packet from the GM TX.

WIRELESS SITE MANAGER DISPLAYS COMM ERROR FOR A SINGLE GASMAX TX

- Network Identifier does not match.
- GASMAX TX Remote ID and WSM assigned channel Remote ID do not match.
- Distance between gas monitor and WSM too great for reliable communications
- WSM beacon not set for SERVER if primary network manager
- Antenna connection compromised or antenna broken.

WIRELESS SITE MANAGER DISPLAYS COMM ERROR FOR ALL GASMAX TX

- Network Identifiers do not match.
- No synchronizing beacon signal. Verify C2/TX RF Mode = SERVER and verify GASMAX TX "Server in Range" icon displayed.
- RF signal attenuated. Check C2/TX antenna connection, cable and remote antenna (if installed). Place a GASMAX TX in close proximity with the C2/TX and check for proper operation.

11WIRELESS SYSTEM BASICS

SYSTEM ARCHITECTURE

GDS Corp wireless uses discrete Frequency-Hopping Spread-Spectrum radios to communicate gas and alarm level information wirelessly between gas detectors and controllers. FHSS radios transmit individual data packets using different discrete frequencies in a pseudorandom sequence (“Hop Pattern”) known to both transmitter and receiver. Unlike Direct-Sequence Spread Spectrum (DSSS) used for short distance 802.11 b/g “WiFi” and certain mesh networks, FHSS technology provides an ideal balance between power consumption, transmission distance and resistance to interference.

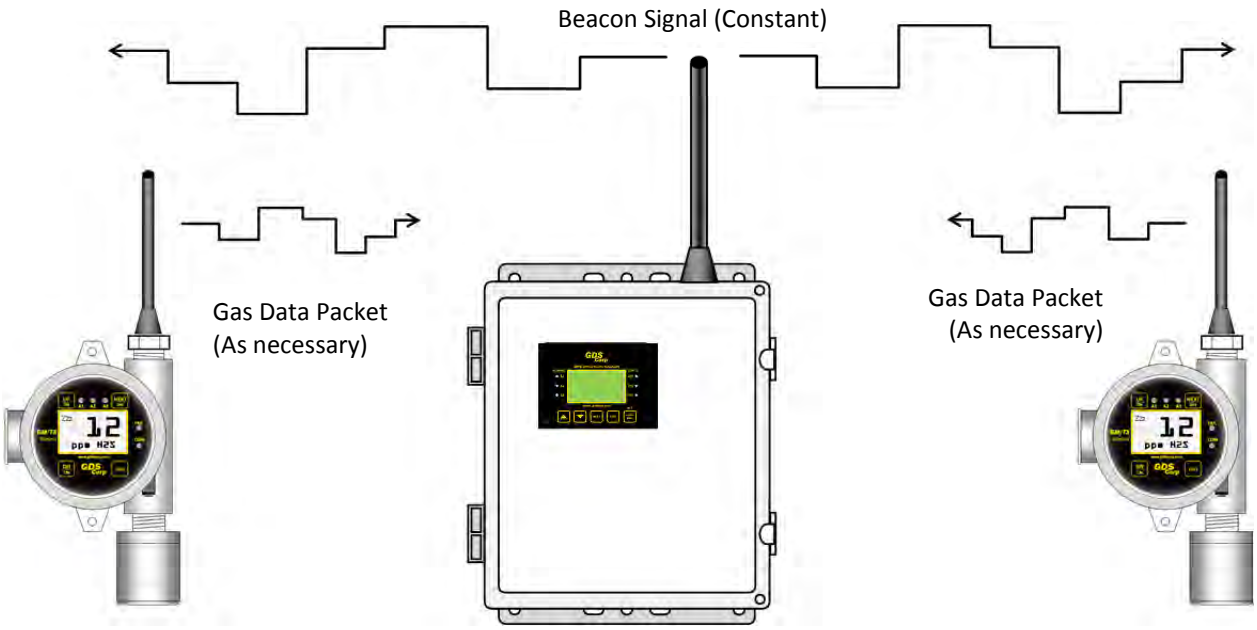


Figure 11-1: GDS Corp Wireless System Architecture

In each GDS Corp system, one device is configured as the “beacon server”. This device transmits a modulated carrier signal that all other radios use to synchronize their frequency-hopping pattern. Knowledge of the selected hopping pattern programmed into the radio and synchronization data from the beacon enables each radio to know when to transmit, and on what frequency. Multiple networks can exist in the same frequency band so long as their choice of pseudorandom hopping pattern is unique. GASMAX TX monitors support 26 unique network identifiers.

Every six seconds, the GASMAX TX central processor wakes up, reads the sensor’s digital output, scales and converts the reading to engineering units, applies correction factors based on the most recent calibration and displays the value on the LCD display. Based on the gas concentration level and alarm

levels programmed by the user, the microprocessor then determines if a wireless **data packet** should be broadcast to the site manager or wireless controller / receiver. This compact data packet includes the gas value, alarm and fault status bits and battery voltage.

At the conclusion of each "Wakeup Timer" interval, the GASMAX TX also transmits a **configuration packet** containing additional information that includes zero and span values, user-programmed tag and engineering unit values and communications timeout settings. Third-generation controllers such as the C2/TX Wireless Site Manager Controller use the configuration packet to program channel settings and eliminate the need for users to program both gas detector and controller independently.

NOTE: GDS CORP WIRELESS GAS DETECTORS **CAN ONLY** COMMUNICATE WITH PROPERLY EQUIPPED GDS CORP CONTROLLERS OR WIRELESS SYSTEM / SITE MANAGERS.

If the GASMAX TX determines that a data packet should be transmitted, the following events take place: Power is applied to the radio, the radio is placed in receive mode and listens for the synchronization beacon transmitted by the site manager or controller / receiver. If the beacon is found, the radio synchronizes to the beacon hopping pattern, transmits the data packet and returns to sleep mode. This sequence takes between 250 milliseconds and 1 second to complete. If the radio fails to synchronize with the beacon, it waits 2 seconds and tries again, then waits 2 seconds and tries once more. If the third attempt fails an "Out of Range" icon is displayed and the GASMAX TX goes to sleep until the next six second interval occurs. The "Out of Range" event will be logged in the Event Log.

FHSS radios for both 900 MHz and 2.4 GHz are available. For North America, 900 MHz is recommended due to increased power output available (up to 1 watt), greater range and ability of lower frequency signals to travel around interfering objects. Systems utilizing 2.4 GHz radios transmit at lower power levels and have corresponding less range. In addition, higher frequency 2.4 GHz signals tend to require a more direct 'line of sight' between the gas detector and controller / receiver antenna. On the other hand, 2.4 GHz systems are generally license-free world-wide and are generally less prone to interference from other radio frequency sources.

NOTE: CHOICE OF FREQUENCY IS MADE AT TIME OF ORDER. SYSTEMS DESIGNED FOR 900 MHZ CANNOT BE FIELD UPGRADED TO 2.4 GHZ AND VICE-VERSA.

Once the choice of frequency band is made, every device in the network must have a matching **Network Identifier** ("A" - "Z") that determines the radio's frequency hopping pattern and system identifier. In addition, each GASMAX TX must also have a unique **Remote ID** (1 - 240) that allows the controller to

identify the specific gas detector. Finally, there must be one device that transmits the synchronizing Beacon signal that all radios use to synchronize their transmissions.

TRANSMISSION DISTANCE

In order for reliable wireless communication to occur, transmitter power output, antenna 'gain' and receiver sensitivity must exceed the 'free space loss' attenuation experienced by radio signals as they travel between transmitter and receiver. This gain or loss is measured in decibel-milliwatts (dBm) and is a function of both distance and frequency. Typical free space loss at 900 MHz is -71 dBm at 300 ft / 100 meters and -91 dBm at 3000 ft / 300 meters, and for 2.4 GHz the free space loss is -80 dBm at 300 ft/ 100 meters and -100 dBm at 3000 ft / 1000 meters.

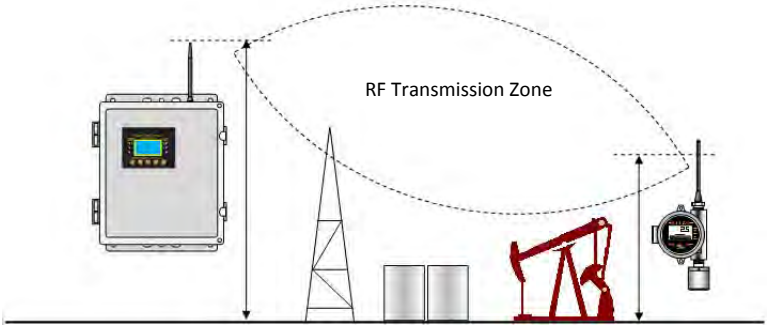
Figure 11-2: RF Transmission Margin

In a typical 2.4 GHz system shown above, for example, the transmitter power output is +21 dBm, each antenna provides an additional gain of +3 dBm and the receiver sensitivity is -95 dBm. Therefore, the total system gain is 21+3+3-(-95) = 122 dBm. Since a reliable system requires a margin of +20 dBm, this system will work if the free space loss between the transmitter and receiver is less than 102 dBm, suggesting a distance of approximately 1000 meters. However, this calculation does not take into account additional loses due to intervening structures or foliage.

To minimize free-space loss, the combined height of the transmitter antenna and receiver antenna should exceed the diameter of the "RF Transmission Zone" (see Fig. 5-3) and at least 60% of the area inside the zone should be free of obstacles. Although both 900 MHz and 2.4 GHz signals can travel around or through most towers or buildings, structures such as large metal tanks or solid metal buildings may attenuate the signal to the point where reception is marginal.

Raising the antenna at either end of the path will improve signal strength and reduce transmission errors. GDS Corp recommends placing the GASMAX TX at least 5 feet above the surrounding terrain, and even more if possible. However, note that the standard antenna transmits its maximum signal strength in a

relatively flat 'donut-shaped' pattern which may affect the performance of GASMAX TX monitors located in close proximity to an elevated C2/TX Wireless Site Manager Controller or receiver/controller.



Combined Antenna Height		
Distance	900 MHz	2.4 GHz
100 Ft	10' / 3m	6' / 2m
500 Ft	22' / 7m	15' / 5m
1000 Ft	30'/ 10m	20' / 6m
3000 Ft	54' / 17m	N/A

Figure 11-3: RF Transmission Zone

GDS Corp always recommends that a wireless survey be completed at the site to ensure the integrity of the wireless communications link. Special care should be taken to account for moveable obstacles such as cranes, railroad cars, trucks, containers, and any other large 'structures' that could end up being placed – temporarily – in a location that blocks the wireless signal.

MONOPOLE AND COLLINEAR OMNI-DIRECTIONAL ANTENNAS

Monopole "rubber duck" antennas are the most commonly used antennas for portable and semi-portable equipment where extreme range or directional reception is required. When mounted vertically, they provide good 'omnidirectional' reception and transmission from all horizontal directions, and are generally rugged and when sealed properly against moisture can provide years of quality service.

Collinear antennas are more sophisticated and combine several vertical antennas that operate in parallel to increase signal gain by focusing the reception pattern in a more horizontal plane.

Rubber duck and collinear antennas provide best performance when installed with at least 1 to 2 "wavelengths" away from walls or steelwork. Since wavelength proportional to frequency, 900 MHz signals have a wavelength to approximately 12 inches and 2.4 GHz signals have a wavelength of about 3 inches**. Therefore, 900 MHZ antennas should be installed with at least 2 feet of clearance and 2.4GHz antennas at least 6 inches of clearance from walls or structures.** Antennas may be mounted with less clearance but output will be reduced; this may not matter if the distances involved are short. It is important the antenna mounting bracket to well connected to "earth" or "ground" for good lightning surge protection.

Rubber duck or collinear antennas emit RF energy in 'vertical polarization', where the electric fields oscillate in the vertical plane and the magnetic fields oscillate in the horizontal plane. Transmitting and receiving antennas should always be oriented such that the polarization is the same.

YAGI DIRECTIONAL ANTENNAS

Yagi antennas are directional along the central beam of the antenna. The folded element is towards the back and the antenna should be "pointed" in the direction of the transmission. Yagi antennas should also be mounted with at least 1 to 2 wavelengths of clearance from other objects. The polarity of the antenna is the same as the direction of the orthogonal elements. For example, if the elements are vertical the Yagi transmits with vertical polarity.

In networks spread over wide areas, it is common for a central receiver / controller to have an omni-directional antenna (such as a collinear) and the remote GAMAX/TX monitors to have Yagi directional antennas. In this case, as the omni-directional antenna will be mounted with vertical polarity, then the Yagi's must also have vertical polarity (see Fig. 5-3). Care needs to be taken to ensure the Yagi is aligned correctly to achieve optimum performance.

Two Yagi antennas can be used for a point-to-to link. In this case they can be mounted with the elements horizontally to give horizontal polarity. There is a large degree of RF isolation between horizontal and vertical polarity (~30dB) so this installation method is recommended if there is a large amount of interference from another system close by transmitting in vertical polarity.

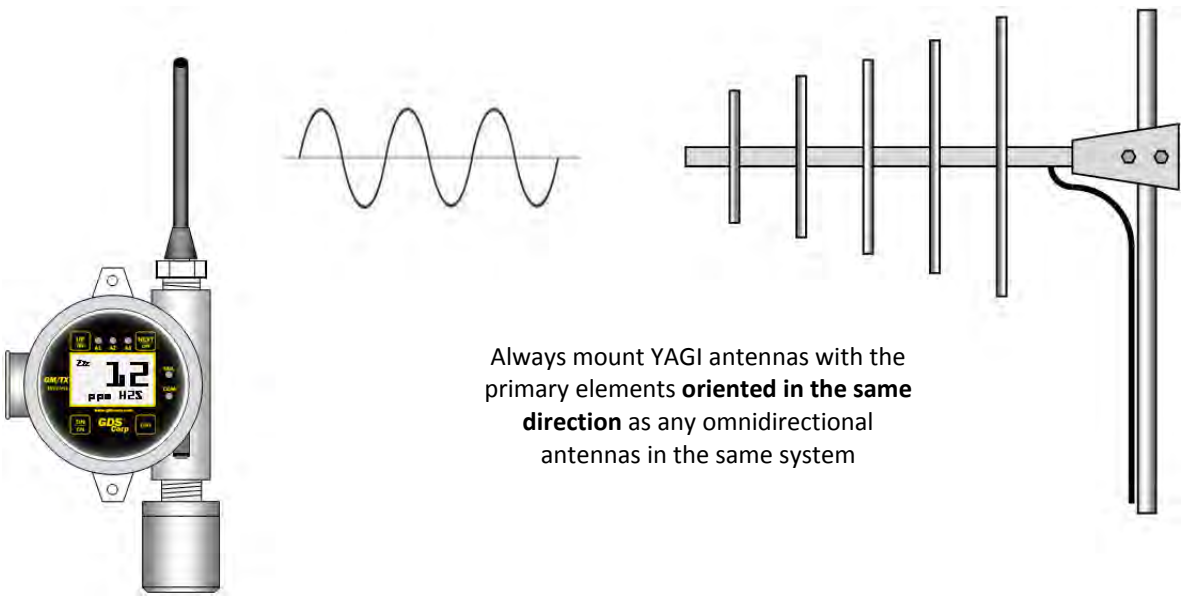


Figure 11-4: Vertically Polarized Omni-Directional and YAGI Antennas

COAXIAL CABLES

When installing a coaxial cable between the GASMAX TX and a remote antenna, constructing a loop of cable below the antenna is always recommended. The loop allows water to drip off the bottom of the U instead of into the connection, reduces installation strain and provides spare cable length in case later the original connectors need to be replaced.

Avoid installing coax cables together in long parallel paths. Leakage from one cable to another has a similar effect as mounting an antenna near another antenna.

SURGE PROTECTION & GROUNDING

Voltage surges primarily enter the GASMAX TX via the antenna connection as a result of electrical discharge in the atmosphere. Electrical energy follows the most direct path to earth and the best protection is achieved by “draining” the surge energy to earth via an effective earth ground. Wireless devices should have a solid connection to earth via a ground stake or ground grid if the soil has poor conductivity. Solid connection means a large capacity conductor (not a small wire) with no coils or sharp bends. There can be significant resistance between different ground points leading to very large voltage differences during lightning activity. As many wireless units are damaged by earth potential surges due to incorrect grounding as direct surge voltage.

It is very difficult to protect against direct lightning strikes but the probability of a direct strike at any one location is very small. Unfortunately, power line surges and electromagnetic energy in the air can induce high voltage surges from lightning activity several miles away.

12 SPARE PARTS

DISPLAY & ENCLOSURE

Display:	
10-0404	GASMAX TX Display (no radio)
1000-2188	900 MHz radio module
1000-2454	2.4 GHz radio module

Antenna Coupler:	
10-0295	Antenna coupler (RP-TNC)
1200-0482	C1D1 rated antenna coupler

Yellow Enclosure:	
10-0160	GASMAX Enclosure

Battery PCB:	
10-0407	Battery PCB
1000-2721	Replacement 3.6V Battery

Sensor Head Assembly:	
10-0247	For standard gases
10-0247F	For reactive gases
	Note: Does not include sensor

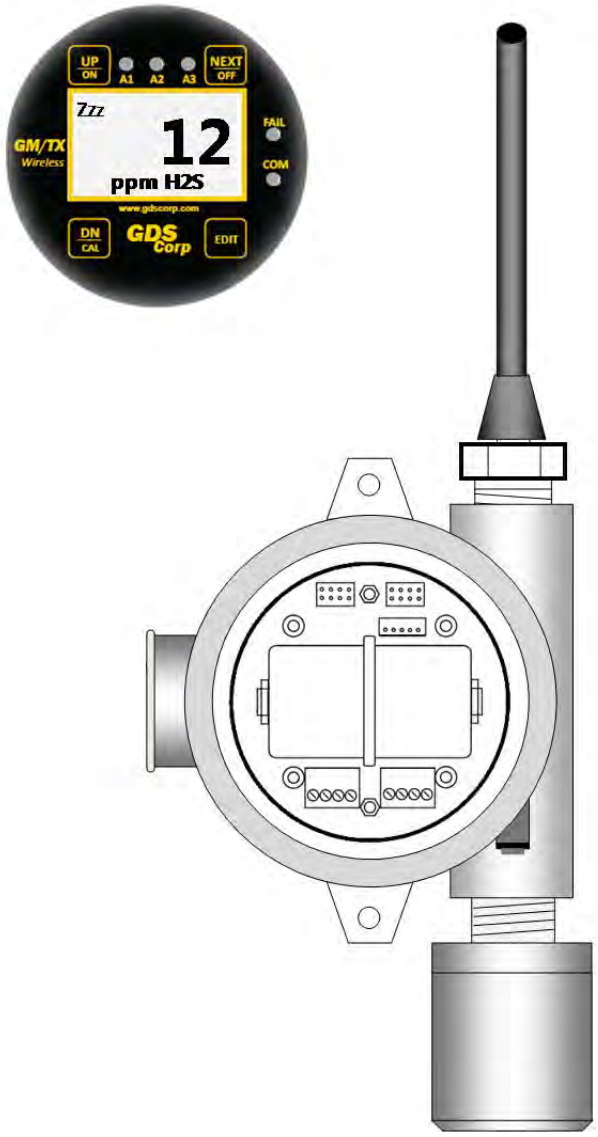
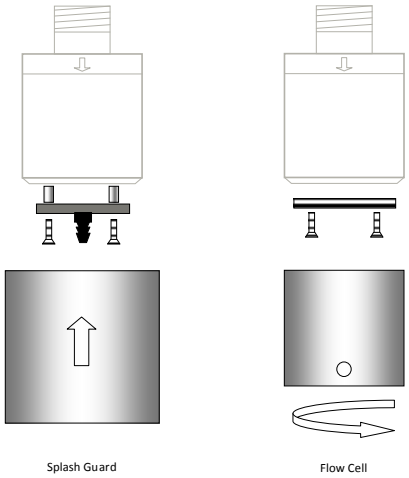


Figure 12-1: GASMAX TX + Local Sensor Spare Parts

SENSOR HEAD ACCESSORIES



Sensor Head Splash Guard	
10-0198	Splash Guard (Fits all sensor heads)

Sensor Head Flow Cell	
10-0205	Flow Cell (1/8” NPT compression fittings)
10-0205s	Other (specify)

Figure 12-2: GASMAX Sensor Head Splash Guard& Flow Cell

13 DRAWINGS AND DIMENSIONS

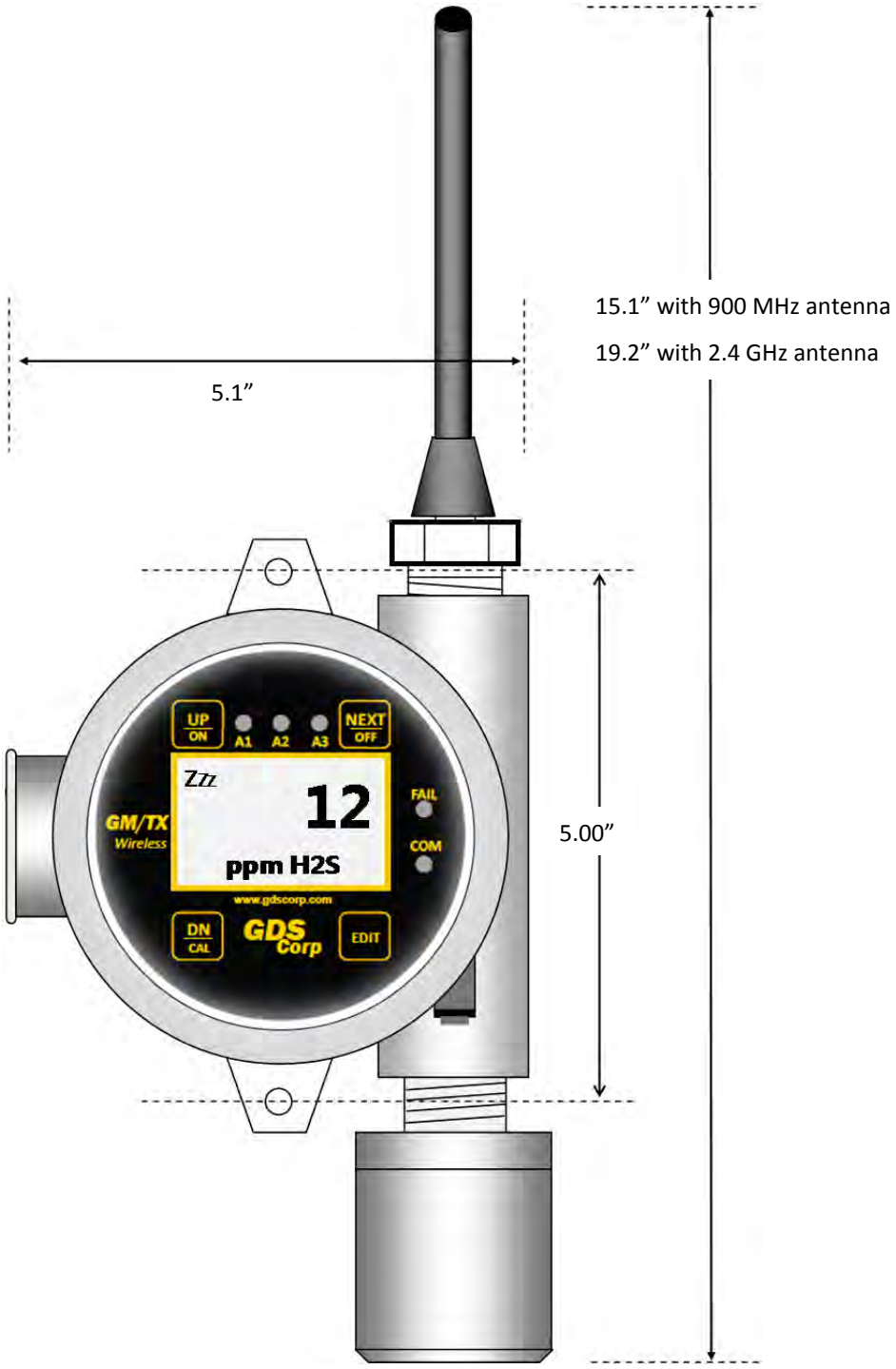


Figure 13-1: GASMAX TX Dimensions (Single Local Sensor)

14 NETWORK PARAMETERS

The set of Network Identifiers used by the GASMAX TX specify a combination of frequency hopping pattern, frequency band, System ID value and whether or not the data is encrypted using a proprietary software-based algorithm.

	Legacy Mode Only					
NETWORK ID	**Hop Channel**	**System ID**	**Data Encrypted?**	**900 MHz Band**	**2.4 GHz Band**	**Legacy Compatible?**
A	1	1	No	902-928 MHz	2.402 - 2.478 GHz	Yes
B	2	2	No	902-928 MHz	2.402 - 2.478 GHz	Yes
C	3	3	No	902-928 MHz	2.402 - 2.478 GHz	Yes
D	4	4	No	902-928 MHz	2.402 - 2.478 GHz	Yes
E	5	5	No	902-928 MHz	2.402 - 2.478 GHz	Yes
F	6	6	No	902-928 MHz	2.402 - 2.478 GHz	Yes
G	7	7	No	902-928 MHz	2.402 - 2.478 GHz	Yes
H	8	8	No	902-928 MHz	2.402 - 2.478 GHz	Yes
I	9	9	No	902-928 MHz	2.402 - 2.478 GHz	Yes
J	10	10	No	902-928 MHz	2.402 - 2.478 GHz	Yes
K	11	11	No	902-928 MHz	2.402 - 2.478 GHz	Yes
L	12	12	No	902-928 MHz	2.402 - 2.478 GHz	Yes
M	13	13	YES	902-928 MHz	2.402 - 2.478 GHz	No
N	14	14	YES	902-928 MHz	2.402 - 2.478 GHz	No
O	15	15	YES	902-928 MHz	2.402 - 2.478 GHz	No
P	16	16	YES	902-928 MHz	2.402 - 2.478 GHz	No
Q	17	17	YES	902-928 MHz	2.402 - 2.478 GHz	No
R	18	18	YES	902-928 MHz	2.402 - 2.478 GHz	No
S	19	19	YES	902-928 MHz	2.402 - 2.478 GHz	No
T	20	20	YES	902-928 MHz	2.402 - 2.478 GHz	No
U	21	21	YES	902-928 MHz	2.402 - 2.478 GHz	No
V	22	22	YES	902-928 MHz	2.402 - 2.478 GHz	No
W	23	23	YES	902-928 MHz	2.402 - 2.478 GHz	No
X	24	24	YES	902-928 MHz	2.402 - 2.478 GHz	No
Y	25	25	YES	902-928 MHz	2.402 - 2.478 GHz	No
Z	26	26	YES	902-928 MHz	2.402 - 2.478 GHz	No

Figure 14-1: GDS Corp Network Identifiers

This page intentionally left blank

GDS Corp

Gas and Flame Detection

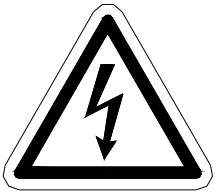
GDS Corp.
1245 Butler Road • League City, TX 77573
409-927-2980 • 409-927-4180 (Fax) • ww.gdscorp.com

GDS Corp
Gas and Flame Detection

Operation and Maintenance Manual

GASMAX TX/DC/DC
DC-Powered Dual Channel Wireless Gas Monitor

GDS Corp.
1245 Butler Road • League City, TX 77573
409-927-2980 • 409-927-4180 (Fax) • ww.gdscorp.com



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 1.0	5/1/16	Initial Release

P/N 1200-0893-01

CONTENTS

TABLE OF FIGURES

1 SAFETY INFORMATION

Important – Read Before Installation

Users should have a detailed understanding of GASMAX TX/DC operating and maintenance instructions. Use the GASMAX TX/DC 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 GASMAX TX/DC gas 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 GASMAX TX/DC is suitable for the intended use.
- The GASMAX TX/DC is designed and constructed to measure the level of certain gases in ambient air. Accuracy in atmospheres containing steam or inert gases cannot be guaranteed.
- Always mount the sensor head vertically with the sensor head facing down.
- Do not paint transmitter or sensor assembly.
- Do not operate the GASMAX TX/DC 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 GASMAX TX/DC to electrical shock or continuous severe mechanical shock. Protect the GASMAX TX/DC and related sensor assemblies 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 on the sensor head.
- Periodically test for correct operation of the system's alarm events by exposing the monitor to a targeted gas concentration above the High Alarm set point.
- Use only for applications described within this manual.

2 OVERVIEW

The GDS Corp GASMAX TX/DC Wireless Gas Monitor and matching C2/TX Wireless Site Manager Controller work together seamlessly to deliver highly reliable, cost effective, customer-friendly solutions for wireless gas detection. The GASMAX TX/DC can also be used in 'legacy mode' with existing GDS Corp Wireless Controller / Receivers such as the C1 Protector, C64 Protector or C2 Quad Protector Controller / Receiver.

The GASMAX TX/DC wireless gas monitor is designed to detect dangerous levels of toxic or hydrocarbon combustible gases and transmit that information to a GDS Corp remote site manager or controller / receiver.

The GASMAX TX/DC supports one or two local sensors for toxic gases, carbon dioxide or hydrocarbon combustibles. The advanced microcontroller, non-intrusive magnetic interface and superior graphic LCD display offers rapid setup, simplified operation and enhanced diagnostics not found in previous generation products.

The GASMAX TX/DC's tightly integrated radio modem utilizes frequency hopping spread spectrum (FHSS) technology to provide reliable transmission of gas concentration data and detector status across long distances while using very little power. Power supply life can be as long as one year under common circumstances. When configured as part of a system with a third-generation Wireless Site Manager Controller, all configuration and setup information programmed into the GASMAX TX/DC is automatically transmitted to C2/TX , eliminating redundant setup and minimizing programming errors.

Key features:

- Single or dual channel, toxic and/or combustible using new Ultra-Low-Power Infrared for Combustibles and Carbon Dioxide
- Industry standard 4-20mA input for GDS-IR or 3rd party sensors with analog output
- Tightly integrated 900MHz or 2.4 GHz radios with Frequency Hopping Spread Spectrum (FHSS) for maximum range
- Automatic sensor recognition and setup with GDS Corp Smart Sensors
- Large LCD shows values, bar-graph and RF interface
- User-prompted calibration procedure
- Power on / Power off using magnetic wand – no need to open the enclosure
- Suitable for use in Class I Division 1 Hazardous Areas with XP rated antenna coupler

OPERATION

The GASMAX TX/DC uses the new highly integrated 10-97xx series ultra-low-power infrared or zero power electrochemical Smart Sensors that allow each sensor to be individually optimized for the target gas, range and environmental conditions.

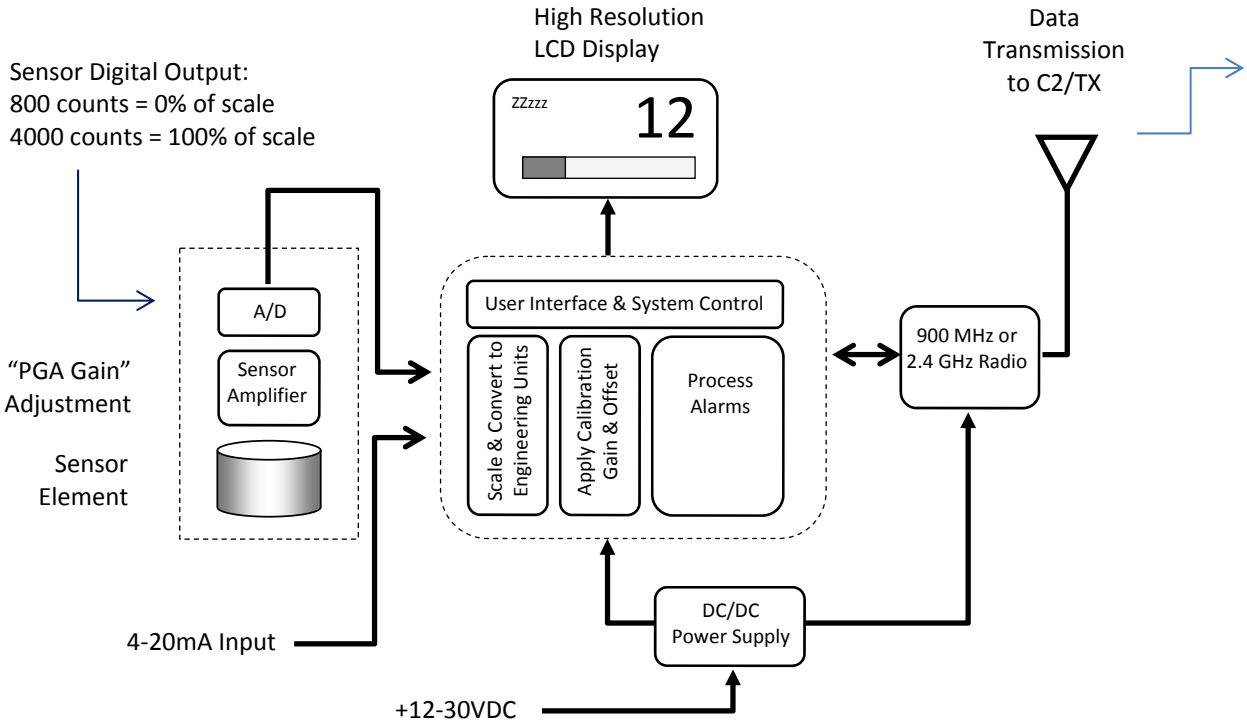


Figure 2-1: GASMAX TX/DC Block Diagram

Toxic gases entering the sensor head react with the electrolyte in the sensor to produce a small electrical output signal. Electronics on the sensor board amplify the signal and covert the information from analog to digital using a 12-bit analog-to-digital (A/D) converter. If an ultra-low-power infrared sensor is being used, hydrocarbon gases enter the sensor and block the passage of infrared light from the IR source to the detector. An A/D counts value of 800 represents a zero reading from the sensor, and a counts value of 4000 represents full scale. The internal microprocessor converts the digital readings to calibrated engineering units for display on the screen for comparison to preset alarm levels.

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

IMPORTANT: THE GASMAX TX/DC INFRARED SENSOR **WILL NOT** DETECT COMBUSTIBLE LEVELS OF HYDROGEN GAS.

In addition, the GASMAX TX/DC has a secondary 4-20mA analog input that supports any industry standard sensor or measurement device with compatible analog output. The 4-20mA input signal is converted to digital using a 12-bit analog-to-digital converter. When reading the 4-20mA input, a counts value of 800 corresponds to 4mA and a reading of 4000 corresponds to 20mA.

The GASMAX TX/DC consists of an explosion proof enclosure with sensor head, antenna tuned for either 900 MHz or 2.4 GHz frequency bands, a display module with microprocessor and radio and I/O power supply board that doubles as mounting hardware for the display. The display attaches to the I/O power supply board via a short multi-pin cable and two captive thumbscrews.

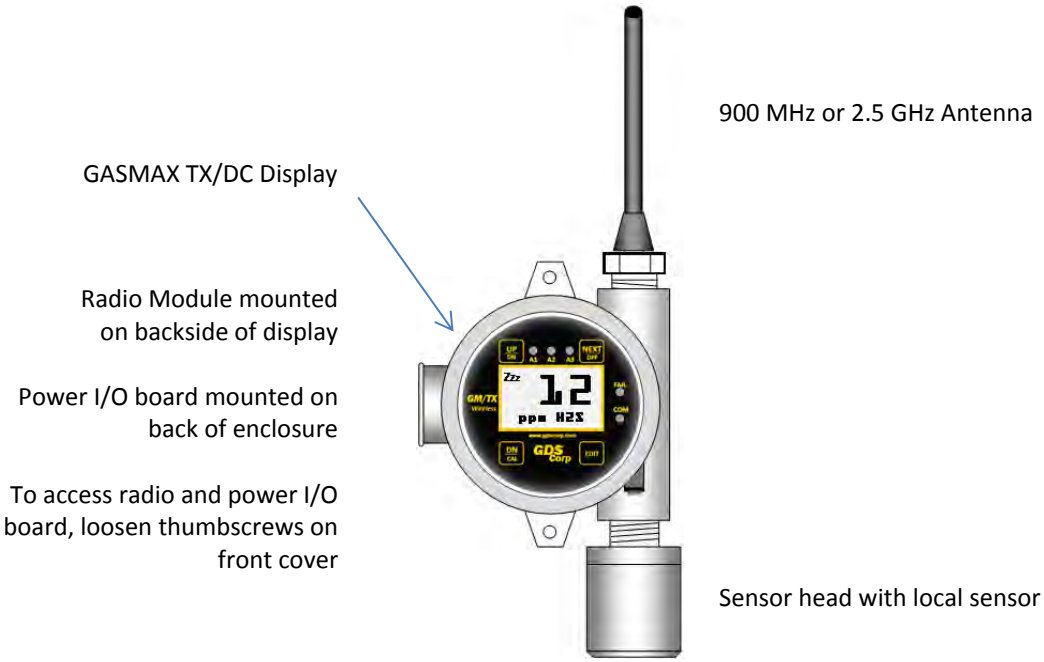


Figure 2-2: GASMAX TX/DC with Single Local Sensor

The GASMAX TX/DC wireless gas monitor is capable of monitoring two separate sensors. In certain cases, it is appropriate to co-locate both sensors in a 'local sensor' configuration. When doing so, the GASMAX TX/DC is configured with the enclosure rotated 90 degrees clockwise as shown below.

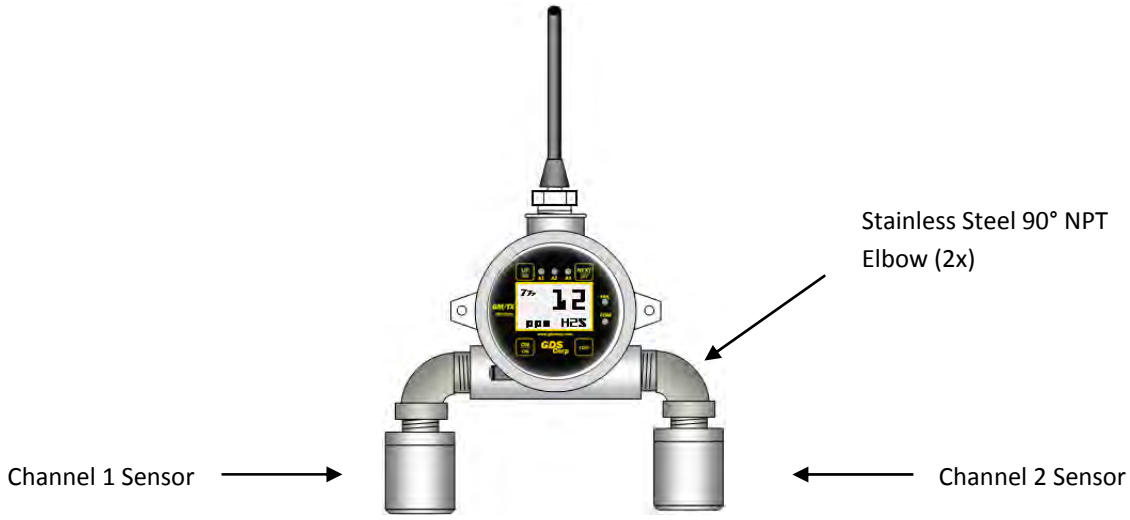


Figure 2-3: GASMAX TX/DC with Dual Local Sensors

USING THE GASMAX TX/DC WITH OTHER GDS CONTROLLERS

While the GASMAX TX/DC is optimized for use with the C2/TX Wireless Site Manager Controller, the GASMAX TX/DC can also be integrated into existing wireless networks that utilize a C1 *Protector* 16-channel controller, C64 *Protector* 64-channel controller or C2 *Quad Protector* 4-channel controller.

In "legacy mode", the required 'Hop Channel', 'System ID' and 'RTU Address' values must be programmed manually and channel settings must be loaded into both the gas detector and controller, but many of the benefits, including magnetic Power On / Power Off, advanced 10-97xx sensor technology and additional transmission modes will still offer benefit to the user.

Note that when in legacy mode, packet data that includes sensor range, tag name and engineering units is not transmitted to the controller and channel setup information must be manually entered in both the receiver/controller and gas detector

USE IN HAZARDOUS AREAS

The GASMAX TX/DC enclosure and sensor head with integral flame arrestor are certified for use in Class 1 Division 1 hazardous areas. When combined with the optional XX Class I Division 1 antenna coupler, the entire device is suitable for use in Class 1 Division 1 areas. The standard 10-0295 antenna coupler is

designed to meet Class I Division 2 hazardous area standards but is not 3rd party certified. GASMAX TX/DC detectors with sensor heads for reactive gases (without flame arrestors) should not be installed in hazardous areas.

3 INSTALLATION

SELECTING A LOCATION

Important factors such as air movement, gas density in relation to air, emission sources and environmental variables must be considered when choosing a mounting location. In addition, air movement by fans, prevailing winds, convection and potential leak sources should be carefully evaluated to determine the best location within a given facility.

Vapor density of a gas determines if it will rise or fall in air when there are no significant currents. Even though the GASMAX TX/DC is designed for rugged service, sensors should be protected from environmental damage from water, snow, excess humidity, shock, vibration and dust and dirt.

MOUNTING THE GASMAX TX/DC

Orientation - The GASMAX TX/DC standard enclosure is a cast aluminum explosion-proof (NEMA 7) enclosure and *should always be mounted with the sensor head opening facing down*. If necessary, a Splash Guard (p/n 10-0205) should be attached if there is any chance that water or liquid spray could enter the sensor opening from below.

Access for General Maintenance - Be sure to leave at least 12" below the sensor head to allow for air flow, easy access for attachment of a Calibration Cup and / or removal of the sensor head cover for sensor replacement.

Sensor Environment – When detecting heavier-than-air gases such as Hydrogen Sulfide in indoor environments, the sensor head should be placed within 18" to 24" of ground level. When installing in unprotected outdoor applications, *the sensor should be mounted at least 24" above the average grade within a 25' radius*. This will keep the sensor from being oversaturated with moisture during periods of dense fog, mist or heavy rain.

Antenna Placement - Whenever possible, the GASMAX TX/DC should be mounted in a location that provides clear line-of-sight between the gas monitor and controller receiving antenna, and *should NOT be mounted such that the antenna is closer than 24" (900 MHz) or 6" (2.4 GHz) from the nearest vertical metallic surface.*

RF Transmission & Reception - Both 900 MHz and 2.4 GHz signals will travel through masonry or wooden structures with minimal loss; however, large metal buildings, tanks and other solid structures will block the signal or attenuate the transmission to the point where reliable wireless communications may not be possible. For 900 MHz radios, power levels can be adjusted from 10 mW up to 1.0 watt (higher power will

reduce power supply life). In many cases, GDS-95 Wireless Repeaters can be used to route wireless signals around obstacles.

Height Above Ground – Increasing the antenna height above ground at either end of the path will improve signal strength and reduce transmission errors. GDS Corp recommends placing the controller antenna at least 10 feet about the surrounding terrain, and even more if possible. However, note that standard vertical dipole antennas transmit their maximum signal strength in a relatively flat 'donut-shaped' pattern which may adversely affect the performance of GASMAX TX/DC monitors located at ground level close to an elevated central antenna.

POWER WIRING

DC input power is connected to Power I/O board "TB2" located at the back of the yellow enclosure. The GASMAX TX/DC will accept DC voltages between +10 and +30VDC. Note however that the DC input is connected directly to the 4-20mA DC OUT (Exc+) pin on TB1, so if a remote 4-20mA sensor requires a specific excitation voltage, that voltage must be supplied to the GASMAX TX/DC.

For example, if a GDS-IR sensor (Vcc = +18 to +30V) is connected to the 4-20mA input, then at least +18V must be supplied to TB2.

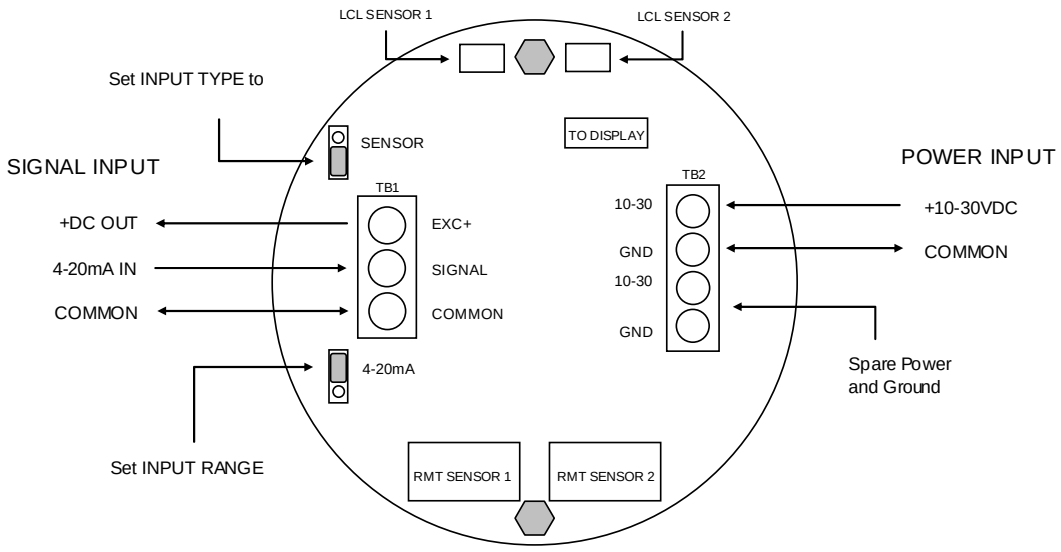


Figure 3-1: GASMAX TX/DC I/O Power supply Board

LOCAL OMNIDIRECTIONAL ANTENNA

The GASMAX TX/DC includes a 3dBi 'rubber duck' antenna. All antennas are measured with respect to an "ideal isotropic radiator", a theoretical point of electromagnetic energy that radiates equally in every direction. The vertical rubber duck antenna focuses RF energy into a relatively flat donut-shaped radiation pattern that *radiates equally in all horizontal directions*. As a result, power that would have been transmitted vertically is now concentrated in the horizontal direction, increasing the apparent power output and receive sensitivity by 3 decibels (+3dB), an amount equal to doubling the power output or input sensitivity. These antennas are ideal for use between devices arranged on a common flat surface.

NOTE: BECAUSE OF THE HORIZONTAL RADIATION PATTERN, BE SURE TO ALWAYS MOUNT THE GASMAX TX/DC SUCH THAT THE ANTENNA IS POINTING STRAIGHT UP.

CONNECTING A REMOTE DIRECTIONAL ANTENNA

A directional antenna focuses RF energy in a specific direction, and will therefore have a higher 'gain' value. The diagram below shows the GASMAX TX/DC with Option "G" = 4, a remote YAGI directional antenna with 10' coaxial cable. The cable connects to the GASMAX TX/DC in place of the 'rubber duck' antenna and provides a total of 9 dB gain. This is recommended if the GASMAX TX/DC is located at some distance from the C2/TX controller, or if buildings or trees block the direct 'line of sight' path.

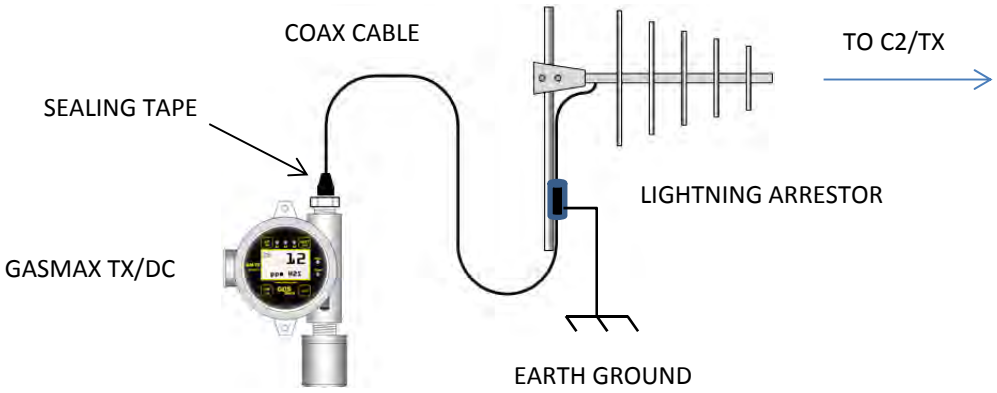


Figure 3-2: GASMAX TX/DC WITH REMOTE YAGI ANTENNA

Depending on the location and local weather conditions, GDS Corp recommends the installation of a lightning arrestor at the antenna if the possibility of lightning strikes exists. If installed, the lightning arrestor should have a low resistance path to earth to ensure that electrical energy is bypassed to ground instead of traveling down the cable and entering the GASMAX TX/DC.

SEALING ANTENNA AND CABLE FITTINGS

It is very important to weatherproof the antenna or coaxial cable connection using self-vulcanizing weatherproofing tape (p/n #1000-2314) or equivalent weatherproof sealing tape. Moisture ingress into an RF connection is the most common cause of problems with reception or transmission. A three layer sealing process is recommended – an initial layer of electrical PVC tape, followed by a second layer of self-vulcanizing weatherproofing tape with a final layer of electrical PVC tape.

INSTALLATION RECOMMENDATIONS SUMMARY

- When installing in outdoor applications mount the GM/TX such that the sensor head is at least 24" above average ground level to minimize water incursion and exposure to excess humidity (fog, mist, heavy rain)
- Keep the antenna at least 24" away from the nearest vertical metallic surface to maximize RF reception (900 MHz)
- Make sure that the sensor head O-ring is installed and intact
- Make sure the large O-ring around the enclosure cover is installed and intact
- Install two fresh desiccant bags before closing the cover of the yellow enclosure after installation to reduce humidity levels inside the enclosure and prolong component life

4 SOFTWARE SETUP AND PROGRAMMING

TURNING ON THE GASMAX TX/DC

To turn on the GASMAX TX/DC hold the magnetic wand over the UP/ON key for several seconds until the screen shows “Remove Magnet”. The welcome screen will appear, followed by the sensor information screen. The GASMAX TX/DC will then enter a predefined warm-up delay period to allow the sensor to stabilize. If the unit does not power up properly, check for a loose power supply connection or dead power supply.

Figure 4-1: GASMAX TX Display

NOTE: TURNING ON THE C2/TX WIRELESS SITE MANAGER CONTROLLER ***BEFORE*** TURNING ON ANY OF THE GASMAX TX/DC GAS MONITORS WILL PROPERLY CONFIGURE THE C2/TX CHANNEL SETTINGS

The GASMAX TX/DC will show “Warmup” and then display the current sensor reading. Most sensors may require five to fifteen minutes to stabilize once power is applied.

For the balance of this manual, the term “press” will be used to describe activation of any key via the magnetic wand. See Chapter 9 for a detailed description of the User Menu.

SELECTING THE NETWORK

To assign a GASMAX TX/DC to a GDS Corp wireless network, press the EDIT key, select DEVICE SETUP followed by RF LINK SETUP and select the **Network Identifier (“A” thru “Z”)** to match the desired network, then assign a unique **Remote ID (“1” thru “240”)** that will be used to identify each gas monitor.

NOTE: EACH GASMAX TX/DC IN ANY GIVEN WIRELESS NETWORK SHOULD HAVE **THE SAME NETWORK IDENTIFIER** AND HAVE A **DIFFERENT (UNIQUE) REMOTE ID**.

After power-up, allow the GASMAX TX/DC to stabilize for one to eight hours prior to any initial calibration (see GDS Corp Electrochemical Sensor manual for more details on specific electrochemical sensors). This will allow the sensor to reach stable equilibrium with respect to environmental conditions such as ambient temperature, humidity, and barometric pressure as well as applied “reference” and “counter” voltages generated by the GASMAX TX/DC electronics. At this point, the GASMAX TX/DC can be calibrated and made operational.

To turn the GASMAX TX/DC OFF, access the *Device Setup – Turn Power Off* menu, or hold the magnet over the NEXT key until the display shows “Power Down, EDIT to Accept”, and then press the EDIT key.

SETTING UP THE GASMAX TX/DC WITH THE C2/TX WIRELESS SITE MANAGER CONTROLLER

To successfully setup a wireless network, perform the following steps in order:

GASMAX TX/DC Gas Monitor	C2/TX Wireless Site Manager Controller
	1. Apply AC or DC power to the C2/TX Wireless Site Manager Controller 2. Select the desired network identifier (select "A" through "Z") 3. If the C2/TX is the primary or only controller in the network, select RF Mode = "Server" (Beacon) 4. If using 900 MHz radios, set the desired beacon transmit power output (200 mW to 1 Watt) 5. Enable the desired total number of wireless channels to be monitored
6. Turn on each GASMAX TX/DC by holding a magnetic wand over UP/ON key for several seconds 7. Configure the network identifier ("A" thru "Z") to match that chosen for the C2/TX or system controller. 8. Select a unique Remote ID ("RTU #") 9. Verify that the "Beacon in Range" icon is showing	
	10. Select desired C2/TX channel and set Remote Address to match Device ID from step #8
11. Hold magnetic wand over UP key to force configuration data packet transmission	12. Confirm reception of wireless transmission and valid gas detector reading and channel configuration
	13. Program relays and alarms for desired outputs
14. Perform end-to-end test using calibration or test gas	

Figure 4-2; Step-by-Step Setup Checklist

OPERATING IN LEGACY MODE

When using the GASMAX TX/DC with previous generation controllers such as the C1 Protector, C64 Protector or C2 Quad Protector, the GASMAX TX/DC radio must be programmed to operate in Legacy Mode. This means that RF transmissions from the GASMAX TX/DC will be identical to those transmitted by previous generation gas detectors such as the GASMAX ECx.

To set the GASMAX TX/DC for legacy mode: Press EDIT followed by DEVICE SETUP. Select RF LINK. The screen will say “READING RADIO” and show the RADIO PAGE menu. Scroll down to the second page and locate the RF LINK = WAVECAST menu item. Press EDIT and the entry will change to RF LINK = LEGACY. Scroll up to the previous RADIO PAGE menu page and set the Hop Channel and System ID to match the existing legacy network. Select a Remote ID setting that is unique to that network.

When in Legacy Mode, alarm settings at the GASMAX TX/DC will only affect transmission rate and will NOT cause an alarm to occur at the remote controller. Switching to ‘transmit every time’ mode will still occur whenever the gas value exceeds the Alarm 1 setting. However, the remote controller will not indicate an alarm condition until the reported gas value exceeds the *value programmed at the remote controller.*

NOTE: A GASMAX TX/DC PROGRAMMED IN “RF LINK = LEGACY MODE” WILL NOT OPERATE PROPERLY WITH THE C2/TX WIRELESS SITE MANAGER CONTROLLER

NOTE: A GASMAX TX/DC PROGRAMMED IN “RF LINK = WAVECAST” MODE WILL NOT OPERATE PROPERLY WITH THE C1, C64 OR C2 QUAD PROTECTOR CONTROLLER

NOTE: WHEN OPERATING IN LEGACY MODE, THE GASMAX TX/DC WILL OPERATE IN SINGLE CHANNEL ONLY

To switch the GASMAX TX/DC back to normal mode, set the RF LINK settings back to RF LINK = WAVECAST and select the desired network “A” thru “Z”. The GASMAX TX/DC does not need to be turned off and back on for the change to apply.

5 CALIBRATION

CALIBRATION OVERVIEW

Calibration is critically important to ensure correct operation of the GASMAX TX/DC. The 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.

When entering CAL MODE, the GASMAX TX/DC automatically transmits a data packet containing a value of 300 counts (-15.6% of scale) to enable a properly programmed GDS Corp Wireless Site Manager controller to indicate IN CAL for the current channel. Once CAL SPAN is complete, the GASMAX TX/DC transmits a data packet containing a value of 800 counts (0% of scale) to indicate that Cal is complete. However, if an oxygen sensor is present, then the GASMAX TX/DC will transmit a data packet with a value of 3475 counts (83.6% of scale) to simulate the typical 20.9% value found in atmospheric oxygen levels. CAL MODE automatically exits if no keystrokes are detected after 5 minutes.

Always observe these GASMAX TX/DC calibration guidelines:

- Use calibration gas that is tested to +/-5% accuracy. Detector accuracy is only as good as the calibration gas used. GDS Corp calibration gases are traceable to NIST (National Institute of Standards and Technology).
- NEVER USE CALIBRATION GAS THAT HAS PASSED ITS EXPIRATION DATE.
- Check the SPAN GAS VALUE setting and make sure it matches the calibration gas. (See Fig. 6-2)
- Always use a GDS Corp calibration cup that completely surrounds the sensor head.
- Be sure to use ZERO AIR, a mixture of 21% oxygen and 79% nitrogen, as a zero reference unless you are certain that no target gas exists in the area. Ambient gas may result in an ‘elevated zero’ condition that will cause a FAULT to occur once the ambient gas is no longer present.
- ALWAYS CALIBRATE A NEW SENSOR BEFORE DEPENDING ON THAT SENSOR FOR PERSONNEL OR EQUIPMENT SAFETY
- Calibrate on a regular schedule. GDS Corp recommends a full calibration every 3 months, with periodic ‘bump tests’ on a more frequent basis to ensure that the sensor has not been affected by temperature extremes or the presence of incompatible gases.

CALIBRATION PROCEDURE

Before beginning calibration, make sure you have the following items:

1. A cylinder of calibration gas
2. A cylinder of 'zero air' if the absence of target gas in the vicinity of the sensor cannot be confirmed
3. A fixed flow regulator with calibration cup connected via a length of flexible tubing. GDS Corp recommends a flow rate of 0.5 liters / minute for standard gases and a flow rate of 1.0 liters / minute for highly reactive gases such as chlorine or chlorine dioxide.

To calibrate a GASMAX TX/DC detector:

1. To enter CAL MODE, press the DOWN / CAL key and within 5 seconds press the EDIT key.
2. The screen will display an APPLY ZERO message. Using the setup shown in Fig. 5-1, apply clean ZERO air unless it can be guaranteed that no target gas is present. After the reading stabilizes, press the EDIT key to complete the ZERO calibration.
3. If the ZERO CAL SUCCESSFUL message is displayed, an APPLY SPAN message will appear. Apply the correct SPAN gas. After the reading is stable, (approximately 1 minute) press the EDIT key to complete the SPAN GAS calibration. If the SPAN calibration is successful, the display flashes REMOVE CAL GAS and starts the CAL PURGE delay.
4. Immediately shut off the regulator and remove the calibration cup. At the end of the CAL PURGE delay, the GASMAX EC output is re-enabled and the unit is fully operational.

The flow chart shown below illustrates the calibration procedure. UP, CAL, NEXT & EDIT labels indicate keystrokes using the magnetic wand. ZERO or SPAN calibration will fail if the readings exceed built-in limits for maximum allowable zero or minimum allowable span.

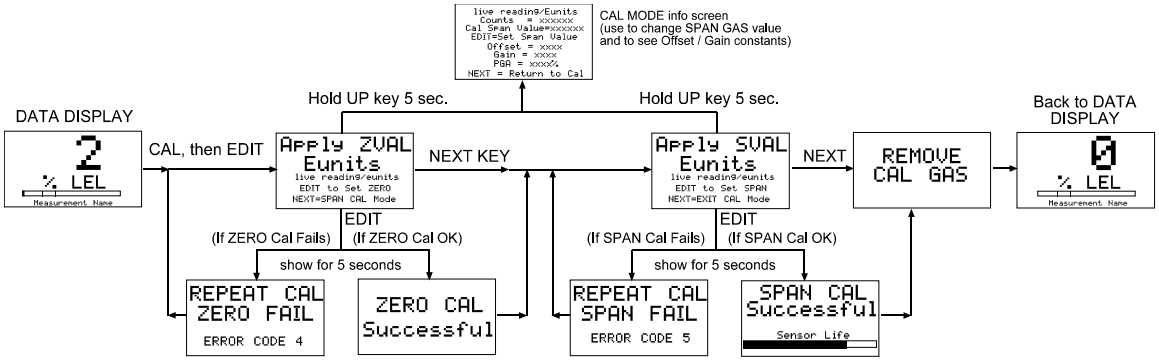


Figure 5-1: Calibration Flowchart

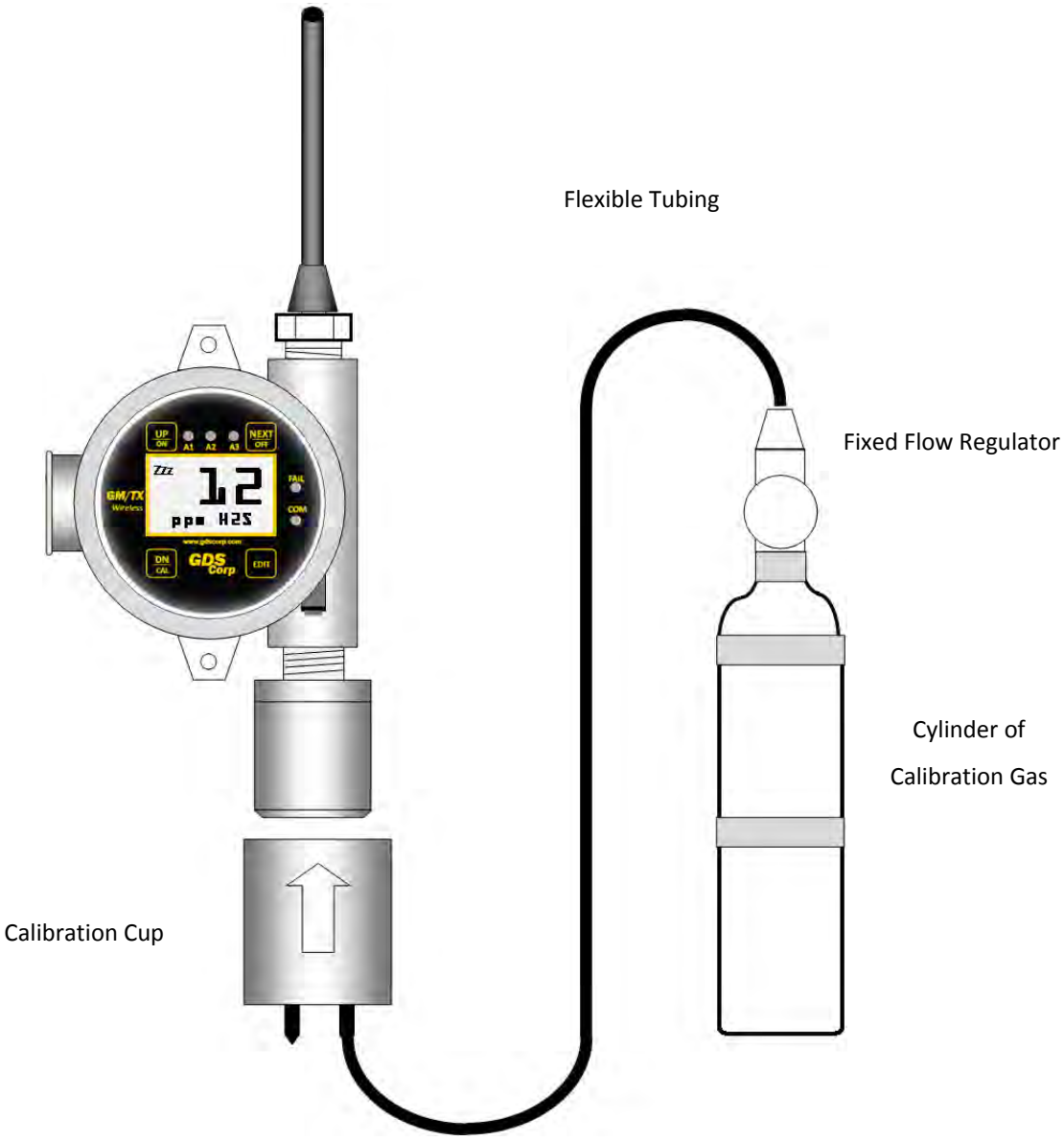


Figure 5-2: Calibration Setup

6 OPERATION

DATA DISPLAY SCREEN

The DATA display screen shows real-time measured gas concentration value information in calibrated engineering units. A horizontal bar graph tracks the current value and shows the Alarm 1 and Alarm 2 values in graphical form. In single-channel display mode, user-programmable Engineering Units ("Eunits") and Measurement Name text strings are shown below the real-time reading.

The GASMAX TX/DC display is shown in Figure 6-1. There are four magnetic switches on the face of the GASMAX TX/DC, arranged in a quadrant around the LCD display labeled "NEXT", "EDIT", "DOWN/CAL" and "UP/ON". To activate, or "press" a magnetic switch, move the magnet near the switch and then away ("swipe").

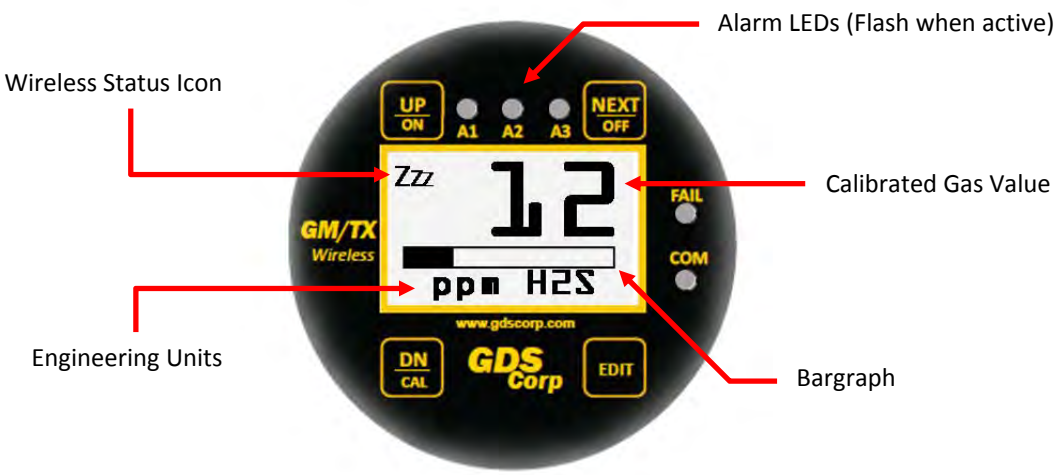


Figure 6-1: GASMAX TX/DC Data Display Screen

The EDIT key activates the USER MENU display mode. While in USER MENU display mode, use the UP and DOWN keys to select an item, EDIT to change an item, and NEXT to exit the menu or function and return to display mode.

A "Wireless Status Icon" appears in the upper left corner of the data display screen to indicate the status of the wireless interface. The information shown includes:

ZZZ	Indicates that the GASMAX TX/DC microprocessor is in low-power sleep mode.
SNIFF	"Sniff": Indicates that the GASMAX TX/DC microprocessor is awake and reading the sensor data.
RNG	"Range": Indicates that the GASMAX TX/DC is trying to synchronize with the beacon.
	"Beacon in Range": Indicates that the beacon was successfully detected and that a data transmission is in progress.
	"No Beacon": Indicates that the beacon signal was not received during the most recent attempt to transmit data. *The GASMAX TX/DC will not attempt to transmit until a beacon signal is present.*
	"Range Warning": This icon is presented if the server was previously out of range for any reason and can be reset using the *Device Setup – Reset Range* Icon menu.

TREND AND DUAL DATA DISPLAY SCREENS

Pressing the "NEXT" key allows the user to cycle through the available data and trend screens. In single channel mode, there are only two screens – Data Display and Trend Display. If both channels are active, there are two Data Display screens, two Trend Display screens and one Dual Data Display screen that shows both channels values and alarm status.

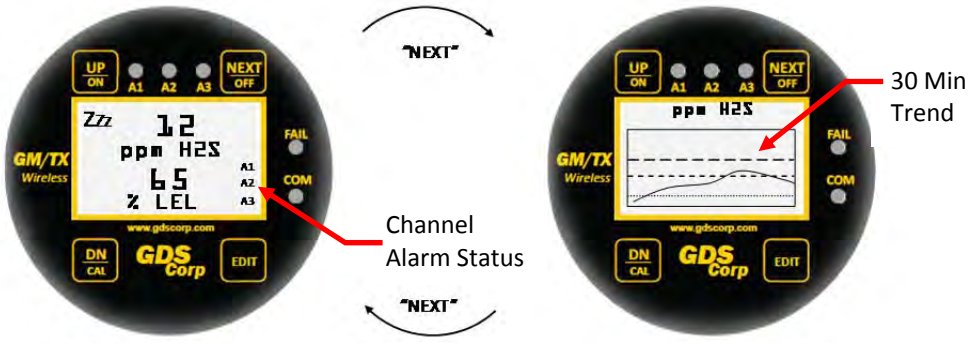


Figure 6-2: Dual Data and Trend Display Screens

NORMAL OPERATION

Every six seconds, the GASMAX TX/DC reads the sensor's digital output, converts the reading to calibrated engineering units and displays the value on the LCD display. Based on the gas concentration level and alarm levels programmed by the user, the microprocessor determines if a compact wireless data packet should be broadcast to the site manager or wireless controller / receiver. This data packet includes the

gas value, alarm and fault status bits and power supply voltage. The GASMAX TX/DC will initiate a data packet transmission under the following specific conditions:

- Every time the ***Wakeup Timer*** expires, irrespective of the gas level present. This allows controller / receivers to confirm the presence of the gas monitor or issue a COMM ERROR is no transmission is received in a fixed interval (default is 18 minutes, but can be adjusted by the user).
- IF the new reading exceeds the **Alarm 1, Alarm 2 or Alarm 3** programmed value. A sensor FAULT reading does not initiate a transmission, but will be broadcast on the Wake-Up timer interval.
- If the reading rises or falls **by more than 2% of full scale** as compared to the last reading.
- Upon **entry into CAL mode**, a packet containing a gas value of 300 counts (-15.6% of scale) is transmitted to indicate IN CAL for the current channel.
- Upon **entry into CAL PURGE mode**, a value of 800 counts (0% of scale) is transmitted for all sensors except oxygen sensors, where a value of 3475 counts (83.6% of scale) is transmitted.
- Holding the magnetic wand **over the UP key** until the Data Transmission icon appears.
- At the **end of the initial Warm-Up** interval
- Any time **menu items are edited** and again upon returning the display to readings mode.

ALARM SETUP

To set an alarm level, press the EDIT key to view the main menu, select the desired channel using the UP or DN keys and then select ALARM SETTINGS. Each channel has three separate alarm levels; each level can be set to alarm if the reading rises above the preset value (LO TRIP = NO) or if the reading drops below a preset level (LO TRIP = YES). A DEADBAND setting causes the alarm to remain active – once triggered – until the input value drops (or rises) by a programmable percentage of the reading. This keeps the alarm from rapidly alternating between active and inactive if the measured gas level is close to the preset alarm level.

A separate FAULT alarm is used to determine if the sensor output has drifted below zero. Certain sensors will output negative values as they age beyond their usable life.

When used with third-generation products like the C2/TX Wireless Site Manager Controller and GDS-95 Alarm Station, the **alarm settings programmed into the GASMAX TX/DC will directly trigger the alarm condition**. Alarm indicators can be set to activate above or below a given engineering units set point. Alarm processing will trigger an alarm condition when the input exceeds the programmed value, and includes hysteresis to keep the alarm from rapidly switching ON and OFF if the input remains close to the programmed alarm value.

If the GASMAX TX/DC is used with second-generation legacy products such as the C2 *Quad Protector* Receiver / Controller, C1 *Protector* Receiver / Controller or C64 *Protector* Receiver / Controller, the

remote controllers **ignore the alarm status bits** and use **broadcast gas levels to trigger alarms**. In this case, alarm levels must be manually programmed at the receiver / controller.

OPTIMIZING POWER CONSUMPTION

To optimize power consumption, consider the following options:

- **Set the Wakeup Timer to its maximum value of 5 minutes (300 seconds)** - Shortening the Wakeup Timer will increase the number of transmissions and reduce power consumption. However this will also reduce the amount of time that a gas detector can become inactive before the Wireless Site Manager or receiver/controller will signal a "COMM ERROR".
- **Reduce the power output for 900MHz radios** – Transmit power at 900 MHz can be adjusted from 1 watt (max) down to 10 milliwatts (min). Since most of the power consumed by the GASMAX TX/DC is used by the radio to transmit, reducing the power output will reduce power consumption. However, this will reduce the strength of the transmitted signal and may increase communications errors.
- **Setting the TX Multiples value** – The TX Multiples menu setting enables every broadcast to be repeated up to five times with a 200 mSec delay between each transmission. Increasing the TX Multiples value will increase power supply usage, but may reduce communications errors in noisy environments.
- **Setting the TX Config value** – The TX Config setting determines how often the GASMAX TX/DC transmits the large data packet that contains configuration data. The default is 60 minutes. Decreasing the TX Config interval will slightly increase power usage.
- **Setting RF Handshaking** – If RF Handshaking is ON, the Wireless Site Manager will actively acknowledge each transmission from the GASMAX TX/DC. If an acknowledge signal is not received by the GASMAX TX/DC, the transmission will be repeated up to three times. RF Handshaking ON will increase wireless reliability but may increase power consumption life if transmissions must be repeated.

NOTE: RF HANDSHAKING **CAN ONLY BE USED** IF THE GASMAX TX/DC IS TRANSMITTING TO A SINGLE C2/TX WIRELESS SITE MANAGER CONTROLLER OR RECEIVER/CONTROLLER.

7 MAINTENANCE

NORMAL MAINTENANCE

Normal maintenance for the GASMAX TX/DC primarily involves power supply replacement and periodic calibration on standard intervals. GDS Corp recommends calibration at least every three months, or more often if temperature extremes, vibration, the presence of incompatible gases or other environmental factors may accelerate the deterioration of the sensor element. Calibration should also include inspections for clogged or wet sensor heads, cracked or damaged enclosures and water incursion inside conduit or junction boxes.

PERIODIC INSPECTION

Periodically

To replace the internal power supply, follow these steps:

1. Turn the GASMAX TX/DC off by holding the magnet over the NEXT key until the display shows “Power Down, EDIT to Accept”, and then press the EDIT key
2. Unscrew the cover of the yellow enclosure. *Make sure to keep moisture from entering the enclosure!*
3. Loosen the two thumbscrews that hold the display assembly in place. Gently remove the display assembly and set it to one side (a cable between the power supply board and display can remain in place)
4. Remove and discard any existing desiccant bags.
5. Inspect the O-ring that seals the cover of the yellow enclosure (p/n #12-0416). Replace if damaged.
6. Carefully inspect the enclosure and electronics for any sign of moisture or corrosion. If found, determine the source of the leak before proceeding!
7. Place two fresh replacement desiccant bags (p/n #2000-0370) inside the GASMAX TX/DC enclosure.
8. Reinstall the display module and tighten the thumbscrews.
9. Replace the cover of the yellow enclosure. Tighten securely.

SENSOR REPLACEMENT

If a sensor indicates FAULT, does not respond to gas or can no longer be calibrated, it should be replaced. GASMAX TX/DC monitors use GDS Corp type 10-97xx electrochemical sensors or ultra-low-power infrared sensors, where the XX is the gas type shown in Specifications. The range value should also be specified when ordering replacement sensors. For example, a replacement H2S sensor for 0-100 ppm would be "10-9715-R0100".

To replace the sensor, follow these steps:

1. Turn off the GASMAX TX/DC by accessing the *Device Setup – Turn Power Off* menu or holding the magnet over the NEXT key until the display shows "EDIT at Accept, then pressing the EDIT key.
2. Unscrew the sensor head cover. If unable to open the cover by hand, use a Sensor Head Replacement Tool (p/n 10-0187).
3. Remove the old sensor by pulling straight down.

   NOTE: DO NOT TRY TO UNSCREW THE SENSOR. PULL STRAIGHT DOWN.
4. Verify that the sensor head O-ring is undamaged and properly seated.
5. Carefully install the replacement sensor by aligning the arrow on the sensor with the arrow engraved on the sensor head. Push straight up until the sensor connector seats firmly into the connector.
6. Reinstall the sensor head cover by CAREFULLY screwing the cover onto the sensor head.

   NOTE: IF THE SENSOR FALLS OUT OF THE SENSOR HEAD DURING THIS STEP, IT CAN BE DAMAGED. USE CAUTION WHEN REINSTALLING THE SENSOR HEAD COVER.
7. Turn the GASMAX TX/DC ON by holding the magnet over the UP/ON key until the welcome screen appears on the display.

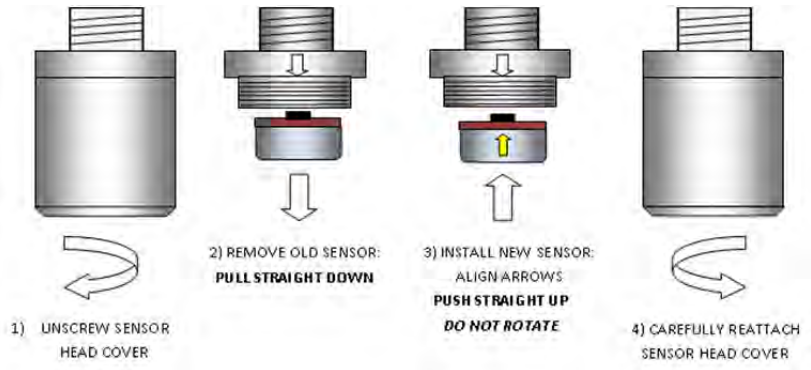


Figure 7-1: GASMAX TX/DC Sensor Replacement

Local Smart Sensors are automatically recognized by the GASMAX TX/DC and the Smart Sensor information screen should appear immediately after the installation of a local Smart Sensor. If the sensor

is the same gas type as was previously installed, the sensor's calibration data will be uploaded into the GASMAX TX/DC. All other parameters stored in the GASMAX TX/DC will be retained.

GASMAX TX/DC units can be reconfigured for different sensors by simply installing a different type compatible sensor. If a new sensor TYPE is installed, the Smart Sensor identification screen will appear, followed by the SENSOR MISMATCH message and the user will be given the opportunity to confirm the new sensor type. If the user activates the EDIT key, all data stored in the new sensor's database – including range, tag name, cal span value, engineering units and alarm levels – will replace the current settings.

8 SPECIFICATIONS

Power	DC Input, +10 to +30VDC Note: DC input provides excitation voltage to any attached 4-20mA sensor. Make sure to supply sufficient voltage if the sensor minimum voltage is greater than +10VDC
Display	64 x128 pixel LCD with engineering units, bargraph and 30-minute trend
Ch 1 Input	Digital input from local type 10-97xx toxic or infrared sensor 4-20mA analog input (3-wire connection: Excitation, Input, Common)
Ch 2 Input	Digital input from local type 10-97xx toxic or infrared sensor
Accuracy	+/- 5% of full scale (typical) over temperate range
Output	Gas concentration represented by a wirelessly transmitted numeric value between 800 counts (0% of scale) and 4000 counts (100% of scale); one data value per channel. Alarm status bits and power supply voltage information is also transmitted.
RF Section (900 MHz)	User adjustable transmit power from 10 mW ( ) to 1.0 watt (+30 dBm); frequency range from 902 to 928 MHZ. Beacon receiver sensitivity -100 dBm
RF Section (2.4 GHz)	Fixed transmit power of 50 mW. Frequency range from 2.406 GHz to 2.435 GHz (network identifier A – R) and from 2.444 GHz to 2.472 GHz (network identifier S – Z)
Temperature	-20°C to +55°C
Memory	On-board non-volatile memory retains all user settings
Housing	Aluminum housing with epoxy paint standard; #316 stainless steel optional
Dimensions	Width 5.4” (137 mm), Height 8” (203 mm), Depth 5” (127 mm) Shipping wt. 6.5 lbs. (3 kg)
Approvals	Enclosure CSA certified for Class I Division 1 hazardous areas
Warranty	Two years on electronics, one year on sensor

AVAILABLE SENSORS AND RANGES					
P/N	**Sensor**	**Range**	**P/N**	**Sensor**	**Range**
10-9750	Methane	0-100% LEL	10-9753	Carbon Dioxide	0-100%
10-9751	Propane	0-100% LEL			
10-9710	Oxygen	0-25%	10-9722	Ethylene Oxide	0-100 ppm
10-9711	Carbon Monoxide	0-300 ppm	10-9723	Arsine	0-1 ppm
10-9712	Chlorine	0-10 ppm	10-9724	Silane	0-50 ppm
10-9713	Chlorine Dioxide	0-1 ppm	10-9725	Fluorine	0-1 ppm
10-9714	Hydrogen	0-4%	10-9726	Phosgene	0-1 ppm
10-9715	Hydrogen Sulfide	0-9999 ppm	10-9727	Hydrazine	0-1 ppm
10-9716	Hydrogen Cyanide	0-30 ppm	10-9728	Nitric Oxide	0-50 ppm
10-9717	Hydrogen Chloride	0-30 ppm	10-9729	Nitrogen Dioxide	0-100 ppm
10-9718	Hydrogen Fluoride	0-5 ppm	10-9730	Mercaptan	0-50 mg/m3
10-9719	Sulfur Dioxide	0-500 ppm	10-9731	Tetrahydrothiophene	0-50 mg/m3
10-9720	Ammonia	0-1000 ppm	10-9732	Diborane	0-1 ppm

10-9721	Ozone	0-1 ppm	10-9733	Hydrogen Sulfide Low RH	0-100 ppm

9 USER MENUS

The GASMAX TX/DC Main Menu tree is shown below. To access the Main Menu, swipe the magnetic wand over the EDIT key. Use the UP and DN keys to select an item and press EDIT. Use NEXT to exit a menu.

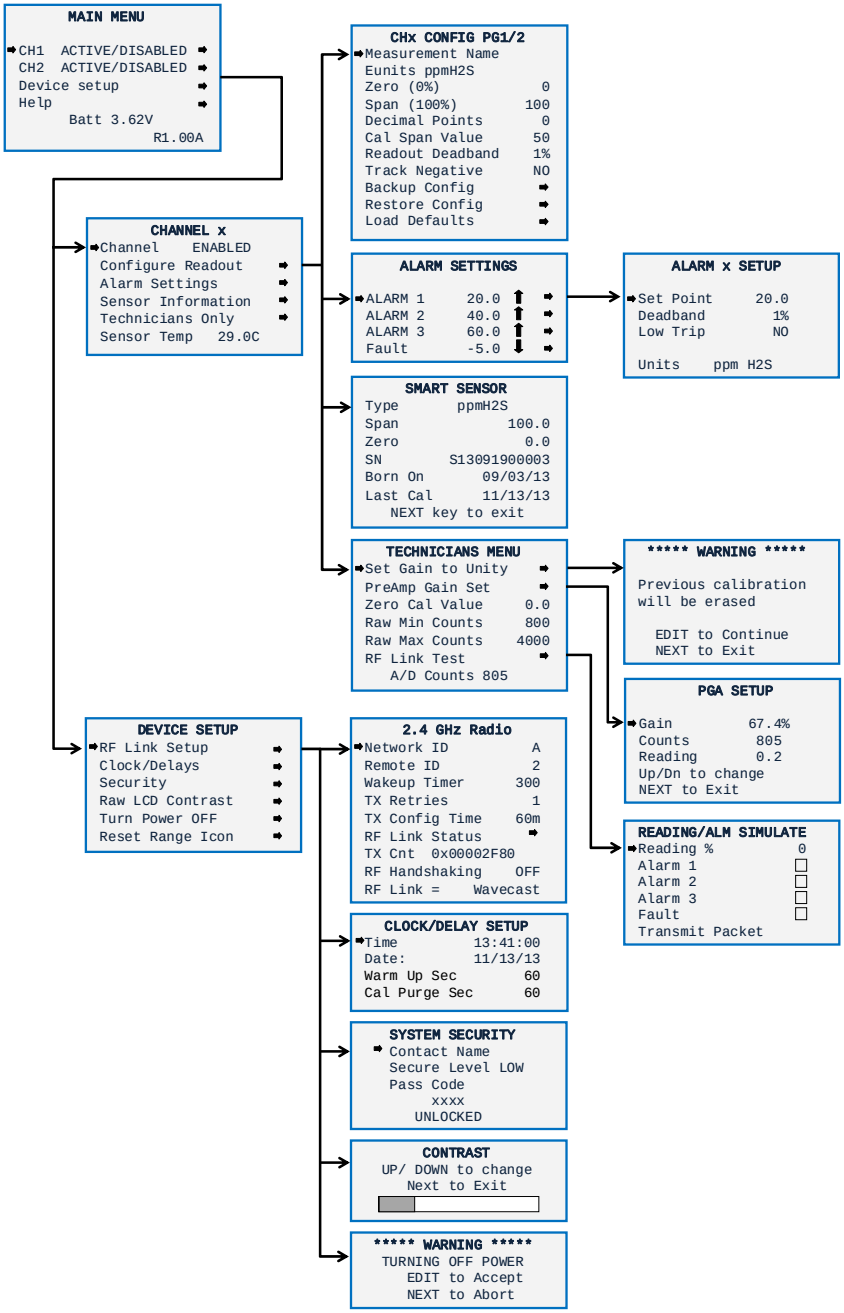


Figure 9-1: GASMAX TX/DC Main Menu Tree

CHANNEL CONFIGURATION MENU

The Channel Configuration menu contains settings that are unique to each channel. There are two channels and each menu contains identical entries.

NOTE: WHEN EDITING CHANNEL INFORMATION, MAKE SURE TO SELECT THE CORRECT CHANNEL MENU.

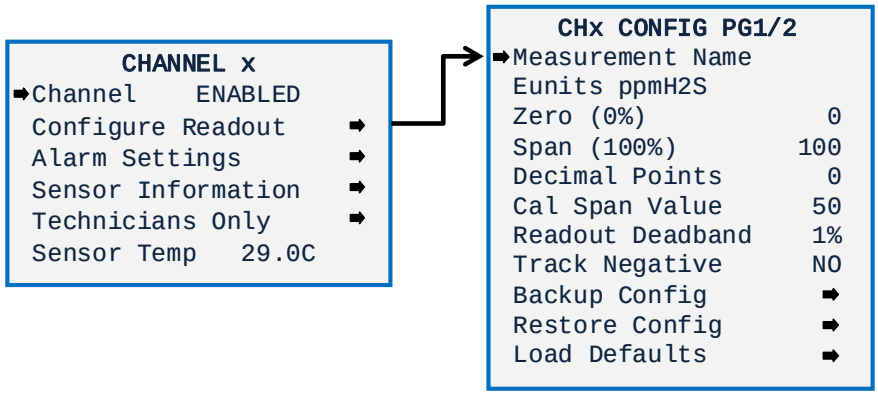


Figure 9-2: Channel Configuration Menu

CHANNEL ENABLED / DISABLED – Channels should only be enabled if a sensor is attached.

SENSOR TEMP – Shows the current sensor temperature.

MEASUREMENT NAME may be edited to contain any 16-character field and is typically used to describe the monitored point by user tag number or other familiar terminology. To modify the existing setting, press the EDIT key when the cursor is pointing to the entry. Use the UP or DN keys to change the character, and the NEXT key to move to the next character. Press EDIT again when done.

EUNITS (engineering units) may have up to a 10 character ASCII field. Many common gases have pre-configured Eunits based upon the sensor type and each may be edited in this menu.

ZERO (0%) defines the reading to be displayed when the input is at 0%.

SPAN (100%) defines the reading to be displayed when the input is at 100%. The highest reading allowed is 9999 including negative polarity sign. Polarity is only indicated for negative readings.

DECIMAL POINTS set the resolution of the LCD readings and may be set for 0, 1 or 2. For example, ZERO readings for 0, 1 & 2 decimal points displays as “0”, “0.0” & “0.00”.

CAL SPAN VALUE sets the engineering units value of the calibration gas. GDS Corp recommends that the calibration gas value be between 25% and 75% of full scale. Calibrating at 100% of scale is not recommended.

READOUT DEADBAND forces low values to continue to read zero. This is useful when there are small amounts of background gases that may cause fluctuating readouts. The highest amount of deadband allowed is 5%.

TRACK NEGATIVE allows the display to show negative values when set to "YES". This can be helpful when troubleshooting sensor problems. The default setting is "NO" and forces the display to read "0" if the sensor value drops below zero. However, negative sensor outputs will always cause the Fault alarm to trip.

BACKUP CONFIG allows users to store the entire current GASMAX TX/DC menu database into non-volatile memory for restoration later if incorrect values are accidentally entered or uploaded.

RESTORE CONFIG restores the GASMAX TX/DC menu database to the values from the most recent Backup Config. The special keystroke sequence of 4 consecutive UP keys is also required to perform backup and restore operations.

LOAD DEFAULTS restores factory default settings.

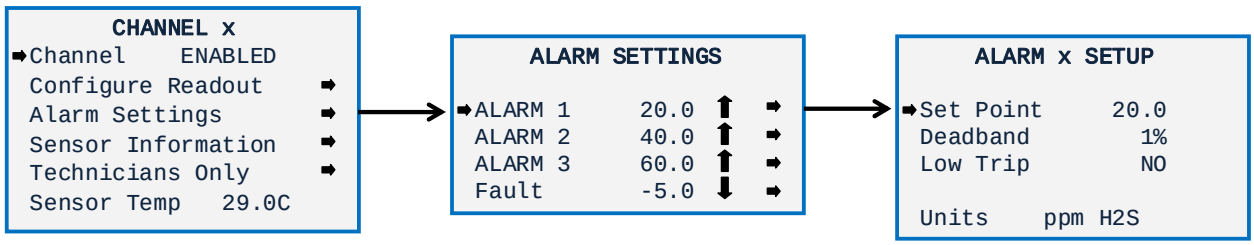


Figure 9-3: Alarm Settings Menu

The Alarm Settings page covers the Alarm 1, 2 and 3 menu items. Alarm 1, Alarm 2, Alarm 3 and Fault menus are identical and are therefore described only once in this section. For the GASMAX TX/DC, the alarm settings not only control the status of the indicator LEDs, but also cause alarm conditions to occur in the GDS-95 Wireless Alarm Station and C2/TX Wireless Site Monitor Controller.

SET POINT enters the engineering unit value where the alarm trips. It may be negative and trip when monitored values fall out of range in this direction. Fault has a default setting of negative 10 with Low Trip set for YES. It is important to adjust this value when the transmitter's span value is set for another value other than 100. For example, a typical span setting for monitoring oxygen level is 25 therefore the fault level value should be adjusted to -2.5 which is equal to negative 10% of full scale.

DEAD-BAND has a minimum value of 1% and a maximum value of 10%. It is useful for preventing alarm cycling when the monitored value is hovering around the set point. EXAMPLE: With a range of 0-100 ppm, if deadband equals 5% and the set point is 20 ppm, after tripping at 20 ppm the value must drop below 15 ppm to reset.

LOW TRIP set to YES causes the alarm to trip as the value falls below the set point.

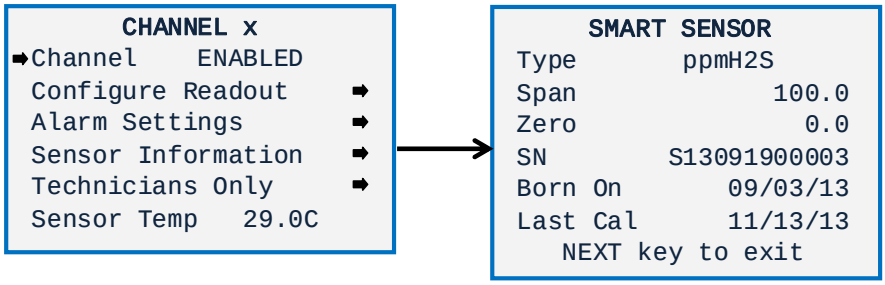


Figure 9-4: Smart Sensor Information Menu

The Sensor Information page covers settings associated with Smart sensors. Users can review information contained in the Smart Sensor database. Values cannot be user-modified.

TYPE indicates what kind of input or sensor the GASMAX TX/DC is configured to accept and is typically pre-configured at the factory. When installed, Smart Sensors upload sensor type and other data to the GASMAX TX/DC and this data may be viewed on the SMART SENSOR information screen.

SPAN displays the programmed value for 100% of range. Factory programmed.

ZERO displays the programmed value for 0% of range. Factory programmed.

SERIAL NUMBER - displays the unique sensor serial number.

BORN ON displays the date when the sensor was originally configured at the factory.

LAST CAL displays the date of the most recent calibration.

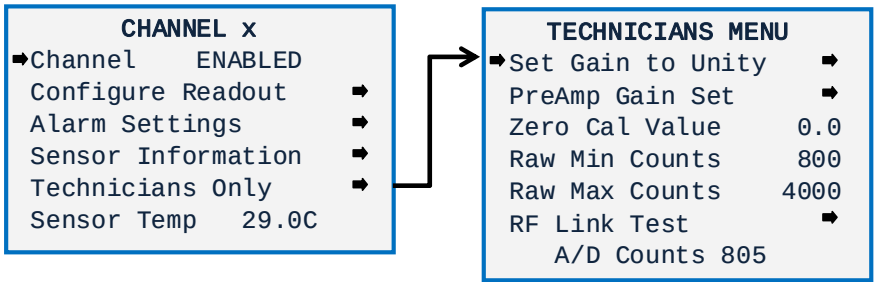


Figure 9-5: Technicians Menu

ZERO CAL VALUE should always be set to “0”.

RAW MIN / RAW MAX COUNTS – determines the range of the 12 bit analog to digital converter. Raw Min Counts represents 0% of scale and Raw Max Counts represents 100% of scale. Under certain conditions, these counts values can be adjusted to remove excessive offset or increase the apparent gain of the sensor. Raising or lowering the value of the Raw Min Counts will adjust the sensor ‘zero’ point, and reducing the Raw Max Counts will amplify the sensor’s output by reducing the range between zero and span.

NOTE: ADJUSTING THE RAW MIN OR RAW MAX COUNTS SHOULD ONLY BE DONE BY TECHNICIANS FAMILIAR WITH THE GASMAX TX/DC GAS MONITOR.

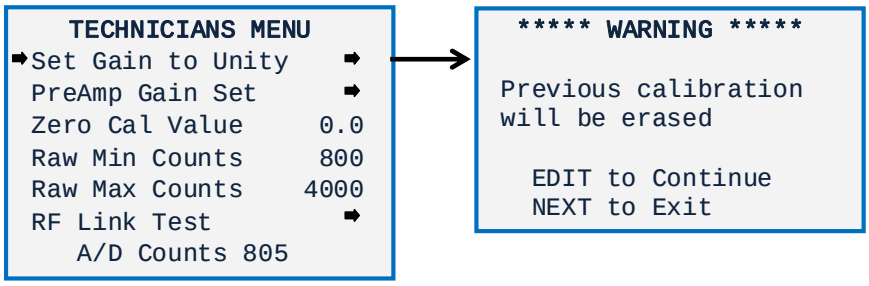


Figure 9-6: Set Unity Gain Menu

SET GAIN TO UNITY sets the Gain and Offset values to 1.000 and 0.000 respectively. This clears any previous calibration data and is useful in troubleshooting if sensor readings appear to be incorrect.

WARNING: A FULL CALIBRATION SHOULD ALWAYS BE PERFORMED AFTER A SET GAIN TO UNITY COMMAND.

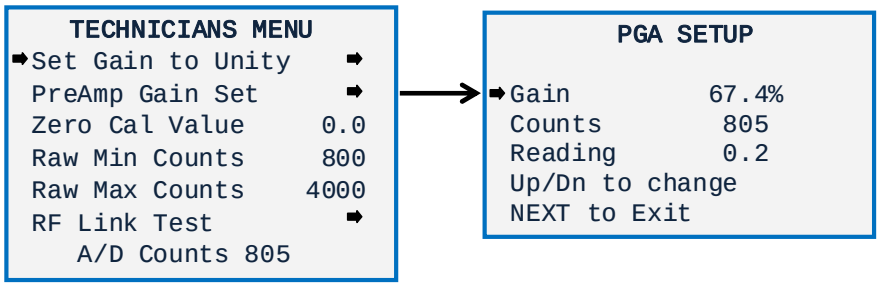


Figure 9-7: Preamp Gain Set Menu

PREAMP GAIN SET Gas sensors have a very wide range of output levels and the PGA gain parameter is used to match the sensors' output to the Smart Sensor's signal conditioning circuitry. Each type of sensor has a nominal gain value that is preset at the factory. Altering the PGA gain value resets the calibration Gain and Offset values to their default values of 1.000 and 0.000. The current PGA gain value is shown in percent and can be increased or decreased by pressing the UP or DOWN keys.

WARNING: A FULL CALIBRATION SHOULD ALWAYS BE PERFORMED AFTER ANY CHANGE IN THE PREAMP GAIN SETTING.

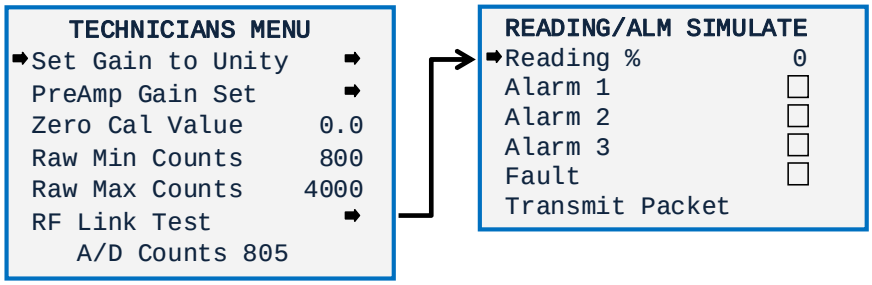


Figure 9-8: RF Link Test Menu

RF LINK TEST The RF Link Test is a diagnostics tool which allows the user to cause the GASMAX TX/DC to transmit simulated readings of 0%, 25%, 50%, 75% and 100% of scale without actually applying gas. Checking the check box associated with each alarm setting can also be used to force the transmission of a data packet with the corresponding alarm bit set. Select the value or alarm condition and select the TRANSMIT PACKET command to perform the function.

DEVICE SETUP MENU

The Device Setup menu contains settings that are unique to the detector itself.

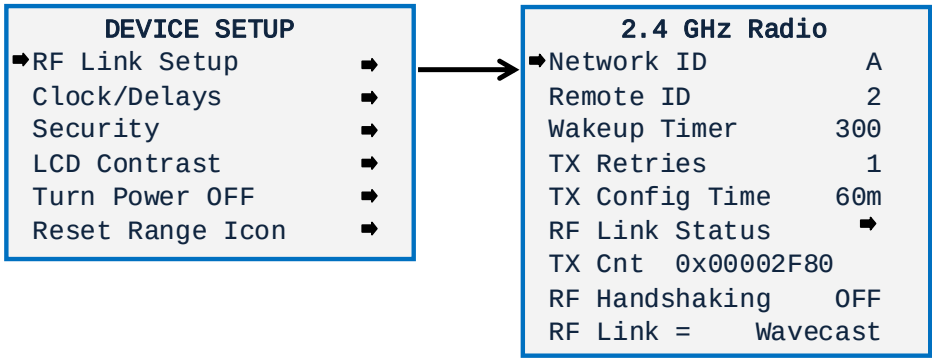


Figure 9-9: Radio Setup Menu (2.4 GHz)

The RF Link Setup menu is used to configure the radio modem in the GASMAX TX/DC. There are two similar menus, one for 900 MHz radios and another for 2.4 GHz radios.

NETWORK ID may be set from “A” through “Z” and assigns the pseudo-random radio frequency hopping pattern and system identifier. A transmitter will not go In Range of or communicate with another transmitter operating with a different Network Identifier. Different Network Identifiers can be used to prevent radios in one network from listening to transmissions of another. Installations having more than one Server network should also have different Network Identifiers for each network

REMOTE ID may be set from 1-255 and acts as the device address for this particular GASMAX TX/DC. Controller channels receiving this monitor's data must also be configured with this matching Remote ID address.

WAKE UP TIMER determines how often the GASMAX TX/DC sends a small data packet when there are no alarms present and when the gas level remains constant. The interval can be set to a value between six seconds and 300 seconds (default value). Decreasing the wakeup timer will use more power and decrease power supply life, but allow remote receivers to determine a loss of signal condition more rapidly.

TX RETRIES allows up to 5 consecutive repeats of every transmission. The default setting is 1 and should be increased only if there is no other way to establish a reliable transmission link.

TX CONFIG TIME determines how often the GASMAX TX/DC transmits a large data packet that contains all the channel configuration parameters. This interval can be set for a value between 1 hour and 8 hours. Default is 8 hours.

RF LINK STATUS opens a special window that shows real-time status for power supply voltage and 'in range' condition.

TX COUNT keeps track of the number of data packets sent by the GASMAX TX/DC. The counter is 32 bit binary and can count up to 4.2 million transmissions.

RF HANDSHAKING determines whether the remote receiver is expected to return a 'data received' message. If set to "OFF", the GASMAX TX/DC broadcasts the same packet three times in quick succession. If set to "ON" the GASMAX TX/DC broadcasts a single copy of the data packet and waits for a reply from the system server. **NOTE**: RF HANDSHAKING SHOULD ONLY BE USED IF THERE IS JUST ONE RECEIVER IN THE NETWORK.

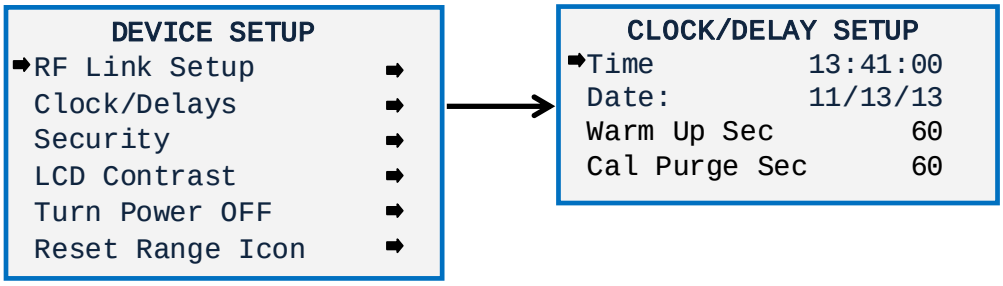


Figure 9-10: Clock / Delay Menu

The GASMAX TX/DC is equipped with a crystal-controlled, power supply-backed real-time clock that maintains local Time and Date. These values are factory preset to US Central Time and should be reset to correctly match the current time zone during installation to make sure that time-stamped Event Log entries are correct.

TIME adjusts time of day in hours, minutes and seconds. Time is entered in 24 hour format. The GASMAX TX/DC will not adjust the clock to compensate for Daylight Savings Time.

DATE adjusts date in month, day and two-digit year.

WARM UP DELAY sets the amount of time from power-on until the 4-20mA output signal begins to track the sensor output. Default setting is 60 seconds. Maximum value is 255 seconds.

CAL PURGE DELAY sets the amount of time from the completion of span calibration until the 4-20mA output signal restarts tracking the sensor output. The default setting is 60 seconds and the maximum value is 255 seconds.

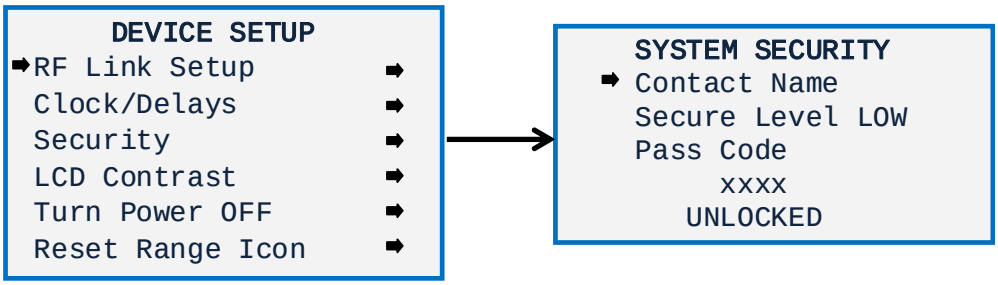


Figure 9-11: Security Menu

CONTACT NAME is a 12 character ASCII field available for displaying a phone # or name of personal who knows the Pass Code. Lost Pass Codes may be recovered by entering the locked security menu and holding the UP key for 5 seconds. The 4-digit code appears near the bottom of the screen.

SECURE LEVEL sets LOW, HIGH or OFF modes. A LOW level allows CAL MODE sensor calibrations but requires the 4-digit Pass Code prior to altering menus. HIGH level locks the entire menu database and the CAL Mode until the correct Pass Code is entered. LOW and HIGH security levels always allow static viewing of configuration menus.

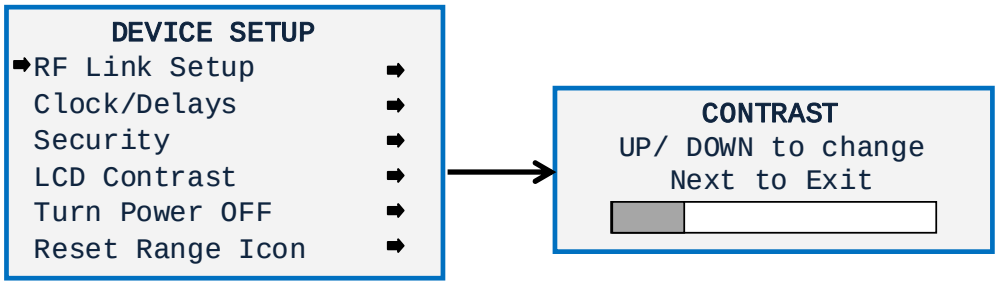


Figure 9-12: LCD Contrast Menu

LCD CONTRAST Select the LCD contrast command and use the UP or DOWN to adjust the contrast of the LCD display.

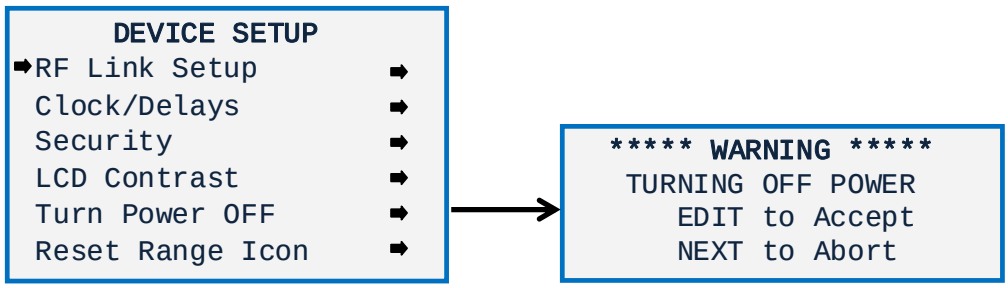


Figure 9-13: Power Off Menu

TURN POWER OFF To turn the GASMAX TX/DC off, select the *Device Setup – Turn Power Off* menu or hold the magnet over the NEXT key until the display shows "EDIT to Accept, and then press the EDIT key.

10 TROUBLESHOOTING GUIDE

SENSOR INDICATES FAULT OR OVERRANGE

- Certain toxic sensors indicate fault or over-range at power up and quickly drift towards zero. This is normal behavior.
- Examine the sensor for moisture or discoloration. Replace sensor if wet or discolored.
- Inspect sensor cable and junction box for moisture or standing water. Replace cable or junction box interface boards if wet or damaged.
- If no moisture, discoloration or damage is found, sensor may be at the end of its useful life. Replace sensor.
- Toxic sensors left unpowered for more than 3 months are subject to accelerated degradation and may demonstrate a permanent loss of sensitivity.

SENSOR WILL NOT ZERO

- Background gas is present. Use ‘zero air’, a mixture of oxygen and nitrogen to zero the sensor.
- Sensor output drifted above calibration maximum limit or drifted below fault limit. Sensor is defective and should be replaced.

GASMAX TX/DC REPORTS “MISSING SENSOR”

- Sensor has been removed or is not present in the sensor head.
- The pins in the sensor head connector are damaged
- The pins in the corresponding sensor board connector are damaged
- The sensor board is damaged or defective

GASMAX TX/DC EXHIBITS UNUSUAL OR UNEXPECTED BEHAVIOR

- Perform a “Cold Boot” to re-initialize the entire system. To perform a Cold Boot, hold the magnet over the UP/ON key until the display reads “Release Key”, then move the magnet over the EDIT key.

  NOTE: COLD BOOT CLEARS ALL DEVICE SETTINGS, INCLUDING NETWORK IDENTIFIER AND REMOTE ID. BE SURE TO RECORD THESE VALUES BEFORE PERFORMING THE COLD BOOT PROCEDURE.

GASMAX TX/DC DISPLAY BLANK

- Turn the GASMAX TX/DC on by holding a magnetic wand over the UP/ON key
- Verify proper voltage at power input pins

GASMAX TX/DC AND C2/TX CONTROLLER DISPLAYED VALUES DON'T MATCH

- Verify viewing proper channel
- Verify C2/TX "device ID" and GASMAX TX/DC "Remote ID" match
- Verify that C2/TX has successfully received a configuration packet from the GM TX.

WIRELESS SITE MANAGER DISPLAYS COMM ERROR FOR A SINGLE GASMAX TX/DC

- Network Identifier does not match.
- GASMAX TX/DC Remote ID and WSM assigned channel Remote ID do not match.
- Distance between gas monitor and WSM too great for reliable communications
- WSM beacon not set for SERVER if primary network manager
- Antenna connection compromised or antenna broken.

WIRELESS SITE MANAGER DISPLAYS COMM ERROR FOR ALL GASMAX TX/DC

- Network Identifiers do not match.
- No synchronizing beacon signal. Verify C2/TX RF Mode = SERVER and verify GASMAX TX/DC "Server in Range" icon displayed.
- RF signal attenuated. Check C2/TX antenna connection, cable and remote antenna (if installed). Place a GASMAX TX/DC in close proximity with the C2/TX and check for proper operation.

11WIRELESS SYSTEM BASICS

SYSTEM ARCHITECTURE

GDS Corp wireless uses discrete Frequency-Hopping Spread-Spectrum radios to communicate gas and alarm level information wirelessly between gas detectors and controllers. FHSS radios transmit individual data packets using different discrete frequencies in a pseudorandom sequence (“Hop Pattern”) known to both transmitter and receiver. Unlike Direct-Sequence Spread Spectrum (DSSS) used for short distance 802.11 b/g “WiFi” and certain mesh networks, FHSS technology provides an ideal balance between power consumption, transmission distance and resistance to interference.

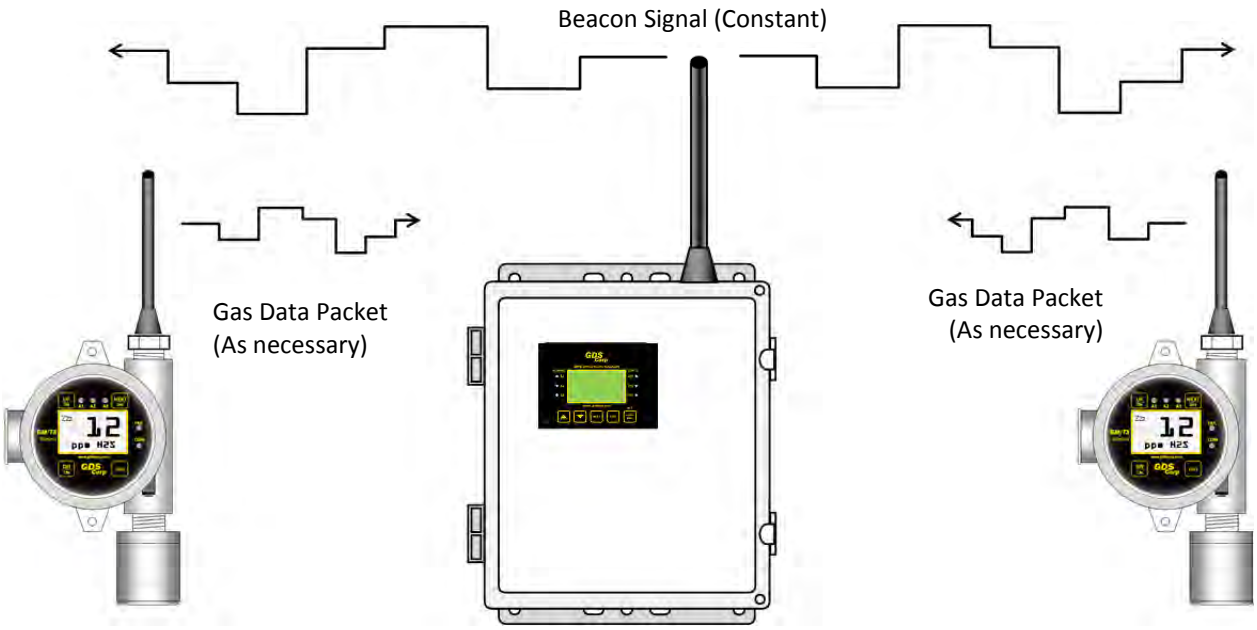


Figure 11-1: GDS Corp Wireless System Architecture

In each GDS Corp system, one device is configured as the “beacon server”. This device transmits a modulated carrier signal that all other radios use to synchronize their frequency-hopping pattern. Knowledge of the selected hopping pattern programmed into the radio and synchronization data from the beacon enables each radio to know when to transmit, and on what frequency. Multiple networks can exist in the same frequency band so long as their choice of pseudorandom hopping pattern is unique. GASMAX TX/DC monitors support 26 unique network identifiers.

Every six seconds, the GASMAX TX/DC central processor wakes up, reads the sensor’s digital output, scales and converts the reading to engineering units, applies correction factors based on the most recent calibration and displays the value on the LCD display. Based on the gas concentration level and alarm

levels programmed by the user, the microprocessor then determines if a wireless **data packet** should be broadcast to the site manager or wireless controller / receiver. This compact data packet includes the gas value, alarm and fault status bits and power supply voltage.

At the conclusion of each "Wakeup Timer" interval, the GASMAX TX/DC also transmits a **configuration packet** containing additional information that includes zero and span values, user-programmed tag and engineering unit values and communications timeout settings. Third-generation controllers such as the C2/TX Wireless Site Manager Controller use the configuration packet to program channel settings and eliminate the need for users to program both gas detector and controller independently.

NOTE: GDS CORP WIRELESS GAS DETECTORS **CAN ONLY** COMMUNICATE WITH PROPERLY EQUIPPED GDS CORP CONTROLLERS OR WIRELESS SYSTEM / SITE MANAGERS.

If the GASMAX TX/DC determines that a data packet should be transmitted, the following events take place: Power is applied to the radio, the radio is placed in receive mode and listens for the synchronization beacon transmitted by the site manager or controller / receiver. If the beacon is found, the radio synchronizes to the beacon hopping pattern, transmits the data packet and returns to sleep mode. This sequence takes between 250 milliseconds and 1 second to complete. If the radio fails to synchronize with the beacon, it waits 2 seconds and tries again, then waits 2 seconds and tries once more. If the third attempt fails an "Out of Range" icon is displayed and the GASMAX TX/DC goes to sleep until the next six second interval occurs. The "Out of Range" event will be logged in the Event Log.

FHSS radios for both 900 MHz and 2.4 GHz are available. For North America, 900 MHz is recommended due to increased power output available (up to 1 watt), greater range and ability of lower frequency signals to travel around interfering objects. Systems utilizing 2.4 GHz radios transmit at lower power levels and have corresponding less range. In addition, higher frequency 2.4 GHz signals tend to require a more direct 'line of sight' between the gas detector and controller / receiver antenna. On the other hand, 2.4 GHz systems are generally license-free world-wide and are generally less prone to interference from other radio frequency sources.

NOTE: CHOICE OF FREQUENCY IS MADE AT TIME OF ORDER. SYSTEMS DESIGNED FOR 900 MHZ CANNOT BE FIELD UPGRADED TO 2.4 GHZ AND VICE-VERSA.

Once the choice of frequency band is made, every device in the network must have a matching **Network Identifier** ("A" - "Z") that determines the radio's frequency hopping pattern and system identifier. In addition, each GASMAX TX/DC must also have a unique **Remote ID** (1 - 240) that allows the controller to

identify the specific gas detector. Finally, there must be one device that transmits the synchronizing Beacon signal that all radios use to synchronize their transmissions.

TRANSMISSION DISTANCE

In order for reliable wireless communication to occur, transmitter power output, antenna 'gain' and receiver sensitivity must exceed the 'free space loss' attenuation experienced by radio signals as they travel between transmitter and receiver. This gain or loss is measured in decibel-milliwatts (dBm) and is a function of both distance and frequency. Typical free space loss at 900 MHz is -71 dBm at 300 ft / 100 meters and -91 dBm at 3000 ft / 300 meters, and for 2.4 GHz the free space loss is -80 dBm at 300 ft/ 100 meters and -100 dBm at 3000 ft / 1000 meters.

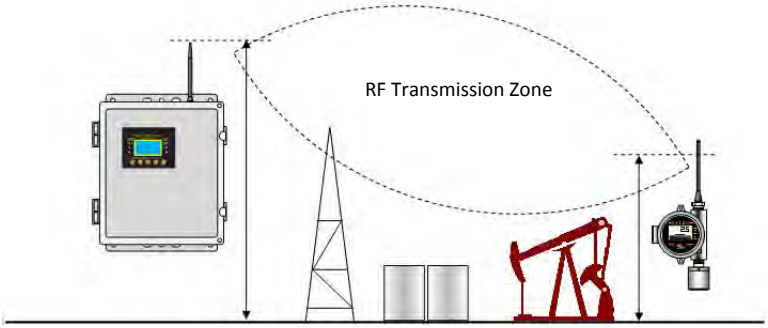
Figure 11-2: RF Transmission Margin

In a typical 2.4 GHz system shown above, for example, the transmitter power output is +21 dBm, each antenna provides an additional gain of +3 dBm and the receiver sensitivity is -95 dBm. Therefore, the total system gain is 21+3+3-(-95) = 122 dBm. Since a reliable system requires a margin of +20 dBm, this system will work if the free space loss between the transmitter and receiver is less than 102 dBm, suggesting a distance of approximately 1000 meters. However, this calculation does not take into account additional loses due to intervening structures or foliage.

To minimize free-space loss, the combined height of the transmitter antenna and receiver antenna should exceed the diameter of the "RF Transmission Zone" (see Fig. 5-3) and at least 60% of the area inside the zone should be free of obstacles. Although both 900 MHz and 2.4 GHz signals can travel around or through most towers or buildings, structures such as large metal tanks or solid metal buildings may attenuate the signal to the point where reception is marginal.

Raising the antenna at either end of the path will improve signal strength and reduce transmission errors. GDS Corp recommends placing the GASMAX TX/DC at least 5 feet above the surrounding terrain, and even more if possible. However, note that the standard antenna transmits its maximum signal strength in a

relatively flat 'donut-shaped' pattern which may affect the performance of GASMAX TX/DC monitors located in close proximity to an elevated C2/TX Wireless Site Manager Controller or receiver/controller.



Combined Antenna Height		
Distance	900 MHz	2.4 GHz
100 Ft	10' / 3m	6' / 2m
500 Ft	22' / 7m	15' / 5m
1000 Ft	30'/ 10m	20' / 6m
3000 Ft	54' / 17m	N/A

Figure 11-3: RF Transmission Zone

GDS Corp always recommends that a wireless survey be completed at the site to ensure the integrity of the wireless communications link. Special care should be taken to account for moveable obstacles such as cranes, railroad cars, trucks, containers, and any other large 'structures' that could end up being placed – temporarily – in a location that blocks the wireless signal.

MONOPOLE AND COLLINEAR OMNI-DIRECTIONAL ANTENNAS

Monopole "rubber duck" antennas are the most commonly used antennas for portable and semi-portable equipment where extreme range or directional reception is required. When mounted vertically, they provide good 'omnidirectional' reception and transmission from all horizontal directions, and are generally rugged and when sealed properly against moisture can provide years of quality service.

Collinear antennas are more sophisticated and combine several vertical antennas that operate in parallel to increase signal gain by focusing the reception pattern in a more horizontal plane.

Rubber duck and collinear antennas provide best performance when installed with at least 1 to 2 "wavelengths" away from walls or steelwork. Since wavelength proportional to frequency, 900 MHz signals have a wavelength to approximately 12 inches and 2.4 GHz signals have a wavelength of about 3 inches**. Therefore, 900 MHZ antennas should be installed with at least 2 feet of clearance and 2.4GHz antennas at least 6 inches of clearance from walls or structures.** Antennas may be mounted with less clearance but output will be reduced; this may not matter if the distances involved are short. It is important the antenna mounting bracket to well connected to "earth" or "ground" for good lightning surge protection.

Rubber duck or collinear antennas emit RF energy in 'vertical polarization', where the electric fields oscillate in the vertical plane and the magnetic fields oscillate in the horizontal plane. Transmitting and receiving antennas should always be oriented such that the polarization is the same.

YAGI DIRECTIONAL ANTENNAS

Yagi antennas are directional along the central beam of the antenna. The folded element is towards the back and the antenna should be "pointed" in the direction of the transmission. Yagi antennas should also be mounted with at least 1 to 2 wavelengths of clearance from other objects. The polarity of the antenna is the same as the direction of the orthogonal elements. For example, if the elements are vertical the Yagi transmits with vertical polarity.

In networks spread over wide areas, it is common for a central receiver / controller to have an omni-directional antenna (such as a collinear) and the remote GAMAX/TX monitors to have Yagi directional antennas. In this case, as the omni-directional antenna will be mounted with vertical polarity, then the Yagi's must also have vertical polarity (see Fig. 5-3). Care needs to be taken to ensure the Yagi is aligned correctly to achieve optimum performance.

Two Yagi antennas can be used for a point-to-to link. In this case they can be mounted with the elements horizontally to give horizontal polarity. There is a large degree of RF isolation between horizontal and vertical polarity (~30dB) so this installation method is recommended if there is a large amount of interference from another system close by transmitting in vertical polarity.

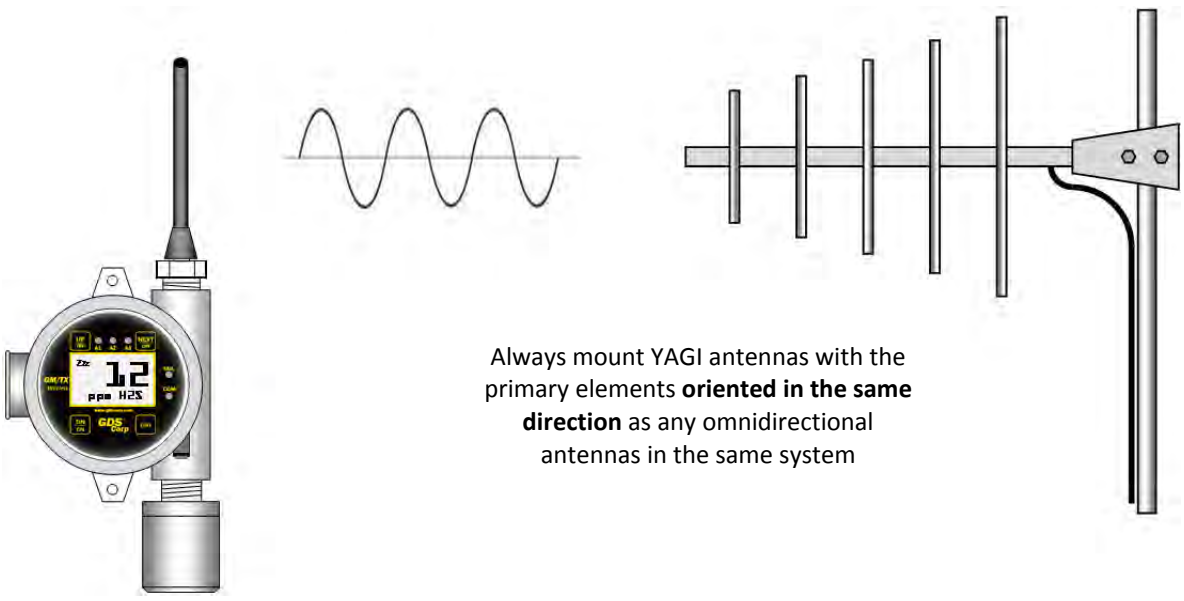


Figure 11-4: Vertically Polarized Omni-Directional and YAGI Antennas

COAXIAL CABLES

When installing a coaxial cable between the GASMAX TX/DC and a remote antenna, constructing a loop of cable below the antenna is always recommended. The loop allows water to drip off the bottom of the U instead of into the connection, reduces installation strain and provides spare cable length in case later the original connectors need to be replaced.

Avoid installing coax cables together in long parallel paths. Leakage from one cable to another has a similar effect as mounting an antenna near another antenna.

SURGE PROTECTION & GROUNDING

Voltage surges primarily enter the GASMAX TX/DC via the antenna connection as a result of electrical discharge in the atmosphere. Electrical energy follows the most direct path to earth and the best protection is achieved by “draining” the surge energy to earth via an effective earth ground. Wireless devices should have a solid connection to earth via a ground stake or ground grid if the soil has poor conductivity. Solid connection means a large capacity conductor (not a small wire) with no coils or sharp bends. There can be significant resistance between different ground points leading to very large voltage differences during lightning activity. As many wireless units are damaged by earth potential surges due to incorrect grounding as direct surge voltage.

It is very difficult to protect against direct lightning strikes but the probability of a direct strike at any one location is very small. Unfortunately, power line surges and electromagnetic energy in the air can induce high voltage surges from lightning activity several miles away.

12 SPARE PARTS

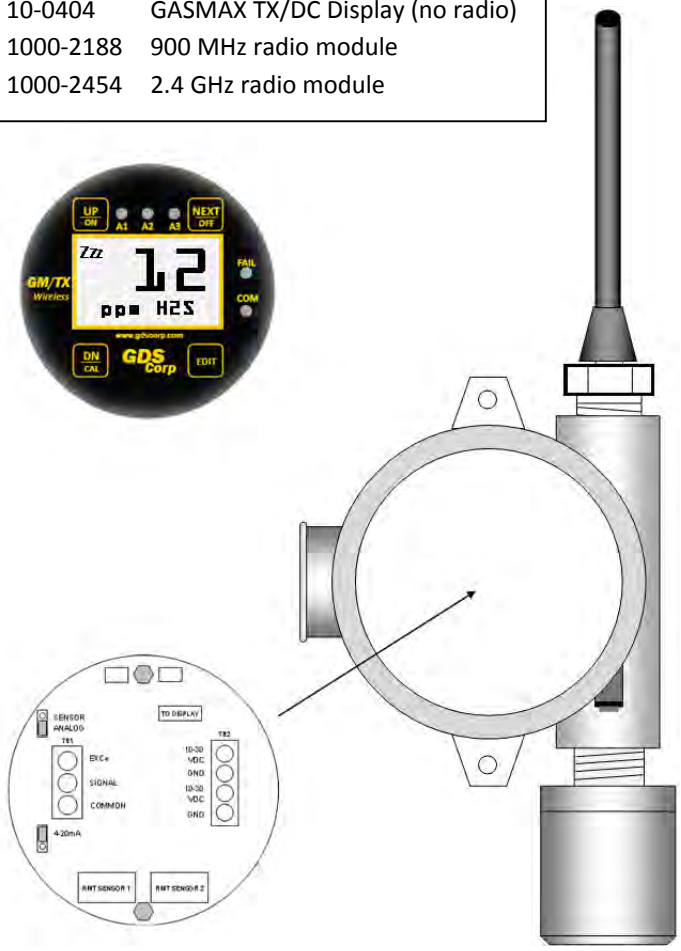
DISPLAY & ENCLOSURE

Display:

10-0404	GASMAX TX/DC Display (no radio)
1000-2188	900 MHz radio module
1000-2454	2.4 GHz radio module

Antenna Coupler:

10-0295	Antenna coupler (RP-TNC)
1200-0482	C1D1 rated antenna coupler



Yellow Enclosure:

10-0160	GASMAX Enclosure

Sensor Head Assembly:

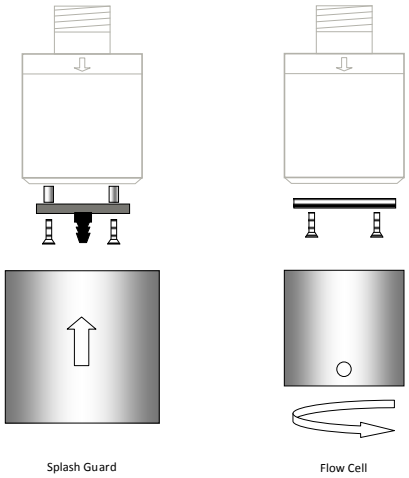
10-0247	For standard gases
10-0247F	For reactive gases
	Note: Does not include sensor

Power I/O:

10-xxxx	Battery PCB

Figure 12-1: GASMAX TX/DC + Local Sensor Spare Parts

SENSOR HEAD ACCESSORIES



Sensor Head Splash Guard	
10-0198	Splash Guard (Fits all sensor heads)

Sensor Head Flow Cell	
10-0205	Flow Cell (1/8” NPT compression fittings)
10-0205s	Other (specify)

Figure 12-2: GASMAX Sensor Head Splash Guard& Flow Cell

13 DRAWINGS AND DIMENSIONS

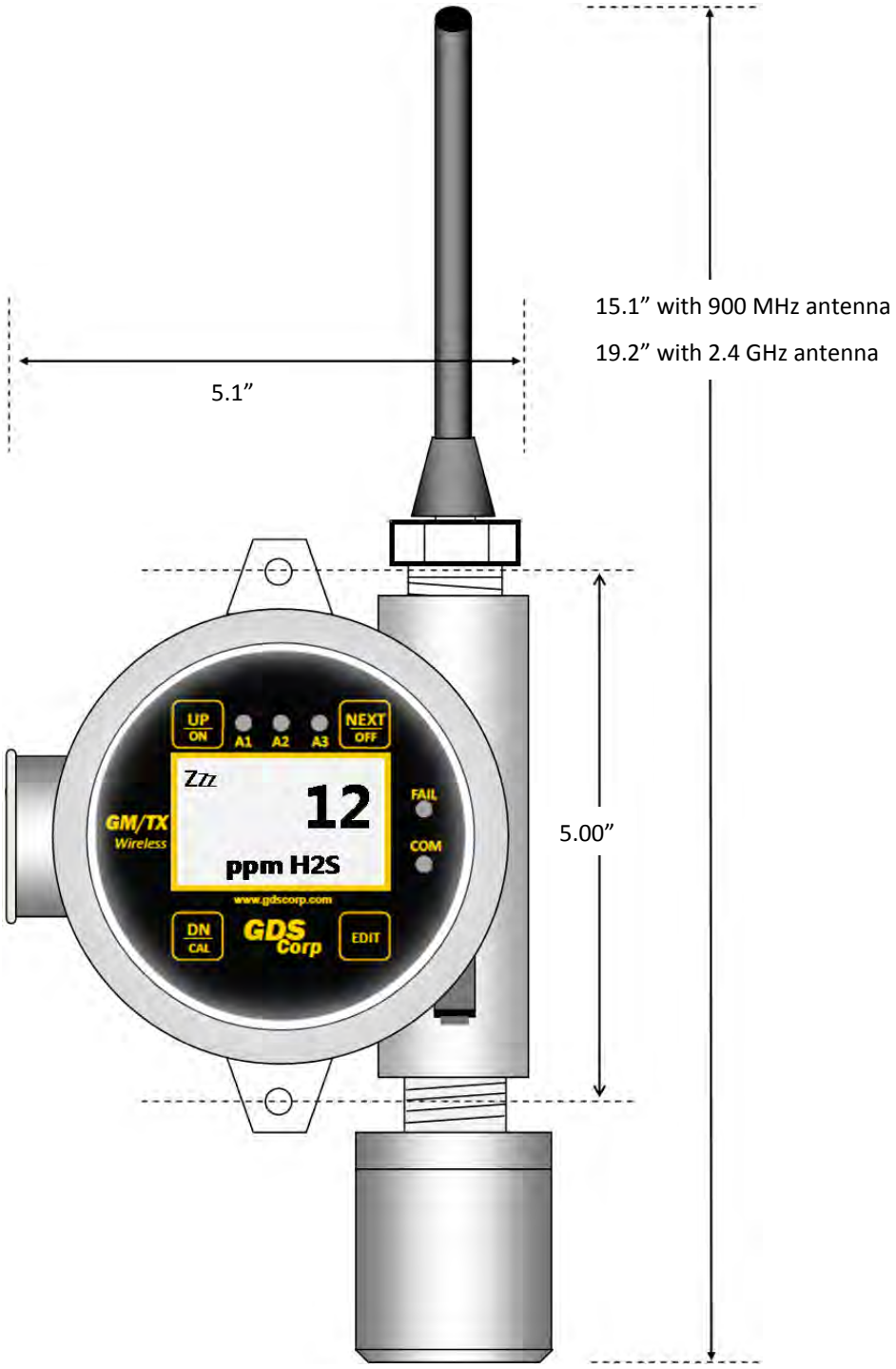


Figure 13-1: GASMAX TX/DC Dimensions (Single Local Sensor)

14 NETWORK PARAMETERS

The set of Network Identifiers used by the GASMAX TX/DC specify a combination of frequency hopping pattern, frequency band, System ID value and whether or not the data is encrypted using a proprietary software-based algorithm.

	Legacy Mode Only					
NETWORK ID	**Hop Channel**	**System ID**	**Data Encrypted?**	**900 MHz Band**	**2.4 GHz Band**	**Legacy Compatible?**
A	1	1	No	902-928 MHz	2.402 - 2.478 GHz	Yes
B	2	2	No	902-928 MHz	2.402 - 2.478 GHz	Yes
C	3	3	No	902-928 MHz	2.402 - 2.478 GHz	Yes
D	4	4	No	902-928 MHz	2.402 - 2.478 GHz	Yes
E	5	5	No	902-928 MHz	2.402 - 2.478 GHz	Yes
F	6	6	No	902-928 MHz	2.402 - 2.478 GHz	Yes
G	7	7	No	902-928 MHz	2.402 - 2.478 GHz	Yes
H	8	8	No	902-928 MHz	2.402 - 2.478 GHz	Yes
I	9	9	No	902-928 MHz	2.402 - 2.478 GHz	Yes
J	10	10	No	902-928 MHz	2.402 - 2.478 GHz	Yes
K	11	11	No	902-928 MHz	2.402 - 2.478 GHz	Yes
L	12	12	No	902-928 MHz	2.402 - 2.478 GHz	Yes
M	13	13	YES	902-928 MHz	2.402 - 2.478 GHz	No
N	14	14	YES	902-928 MHz	2.402 - 2.478 GHz	No
O	15	15	YES	902-928 MHz	2.402 - 2.478 GHz	No
P	16	16	YES	902-928 MHz	2.402 - 2.478 GHz	No
Q	17	17	YES	902-928 MHz	2.402 - 2.478 GHz	No
R	18	18	YES	902-928 MHz	2.402 - 2.478 GHz	No
S	19	19	YES	902-928 MHz	2.402 - 2.478 GHz	No
T	20	20	YES	902-928 MHz	2.402 - 2.478 GHz	No
U	21	21	YES	902-928 MHz	2.402 - 2.478 GHz	No
V	22	22	YES	902-928 MHz	2.402 - 2.478 GHz	No
W	23	23	YES	902-928 MHz	2.402 - 2.478 GHz	No
X	24	24	YES	902-928 MHz	2.402 - 2.478 GHz	No
Y	25	25	YES	902-928 MHz	2.402 - 2.478 GHz	No
Z	26	26	YES	902-928 MHz	2.402 - 2.478 GHz	No

Figure 14-1: GDS Corp Network Identifiers

This page intentionally left blank

GDS Corp

Gas and Flame Detection

GDS Corp.
1245 Butler Road • League City, TX 77573
409-927-2980 • 409-927-4180 (Fax) • ww.gdscorp.com

(http://www.buckeyedetects.com/)

BFT-44

The state-of-the-art BFT-44 transmitter further builds upon the success of the earlier BFT-48 transmitter. This versatile unit has a vivid color display which changes color to match alarm states. The unit also has an embedded webpage–enabling an intuitive remote-user interface. The webpage is accessed through a standard Ethernet connection and allows the transmission of data over existing network infrastructure to our BFC-64 controller, smartphones, PC's, and tablets.

For more detailed information, review the product tabs below.

Features

Specifications

Analog Outputs
BFT-44 Catalytic Bead / IR units have 3-4 wire 4 – 20 mA current source output with nominal 24VDC power supply.
Relays / RS-485 Modbus® (Optional)
Relays are form C 5 AMP @ 30VDC and 240VAC Resistive. RS-485 is 2-wire Modbus® RTU.
CSA Approvals
BFT-44 is Division 1 and 2 Groups A, B, C and D. Suitable for explosion proof installations.
Display
320 x 240 pixel backlit LCD displays 30 minute trend, bar graph and engineering units.
Accuracy
±1% of full scale
Ambient Temperature Range
-40˚ – 60˚ C (-40˚ – 140˚ F)
Temperature Drift
Less than 0.1% per degree C over ambient temperature range.
Power Supply
10 – 30VDC at 10 Watts max.
Housing
Instrument enclosure suitable for Class 1, Division 1 and 2, Group A,B,C,D

Literature

BFT-44

Universal Dual Channel Gas Transmitter

State of the art technology, reliable and proven detection.

FEATURES & BENEFITS

- CSA Certified for Class I, Div. 1 explosion proof Installations
- Magnetic non-intrusive interface
- High Resolution TFT color enhanced displays for highly visible alarm states
  - Green =Normal
  - Yellow = Alarm 1
  - Red = Alarm 2
- Dual sensor capable, smart sensing technology
- Multiple output options for maximum flexibility and compatibility
  - Standard Dual 4 to 20 mA output
  - (Optional) Programmable Relays (3) alarm, (1) fault
  - (Optional) RS-485, Modbus digital output
- Standard Ethernet port with built in Web server for remote access
- 2 year warranty on transmitter

GASES DETECTED

- Ammonia
- Carbon Dioxide
- Carbon Monoxide
- Chlorine
- Chlorine Dioxide
- Combustible Gases
- Ethylene Oxide
- Formaldehyde
- Hydrogen
- Hydrogen Chloride
- Hydrogen Cyanide
- Hydrogen Fluoride
- Hydrogen Sulfide
- Methyl Mercaptan
- Nitric Oxide
- Nitrogen Dioxide
- Oxygen
- Ozone
- Phosphine
- Sulfur Dioxide
- Vinyl Chloride

Consult the factory For other sensors

BFT-44 Universal Dual Gas Transmitter

GENERAL SPECIFICATIONS

Temperature Range	Operating: -40ºC to +60ºC (-40ºF to +140ºF) Ambient
Temperature Drift	Less than .1% per degree Celsius over ambient temperature
Humidity	Up to 98% non-condensing
Display	QVGA color TFT 240x320 LCD pixel display

ELECTRICAL SPECIFICATIONS

Operating Voltage	24 VDC nominal (10 - 30 VDC) @ 10 watts max
Cable Entries	2 x 3/4" - NPT conduits
Wiring	3 or 4 wire option, depending on configuration
Electromagnetic Compatibility	EMI / RFI protected
Relays	3 Alarm, 1 fault, contacts rated 5A @ 30vdc (form "C")
4 - 20 mA	3 wire current source output
RS-485	RS-485 Modbus compatible

MECHANICAL SPECIFICATIONS

Enclosure Material	Options: Aluminum, Polycarbonate, and Stainless Steel
Transmitter Dimensions	(Aluminum or Stainless Steel) 5" x 5" x 5.05" (Polycarbonate) 4.86" x 4.86" 3.40"
Transmitter Weight (single)	(Aluminum) 4.65 lb (Polycarbonate) 1.45 lb (Stainless Steel) 7.20 lb
Water and Dust	IP66 and IP67
Hazardous Area	(Aluminum or Stainless Steel) CSA, Class 1 Div. 2, Groups A,B,C, & D (Polycarbonate) CSA, Class 1 Div. 2, Groups A,B,C, & D

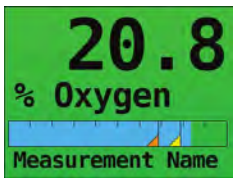
ACCESSORIES

Calibration Adapter	Part Number: BC10-0203
Splash Guard	Part Number: BT10-0198
Duct Mount (SS, & Poly)	Part Number: BT10-0270 (SS), BT10-0379 (Poly)
"Y" Adapter (for dual sensor)	Part Number: 1AYO-210000-34AL
Sensor Simulator	Part Number : BT10-0514

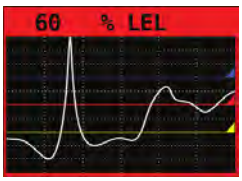
SCREENS

No Alarm | Alarm 1 | Alarm 2

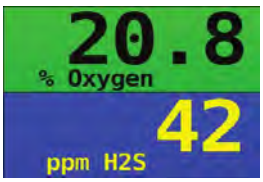
Bar Graph Screen



Trending Screen

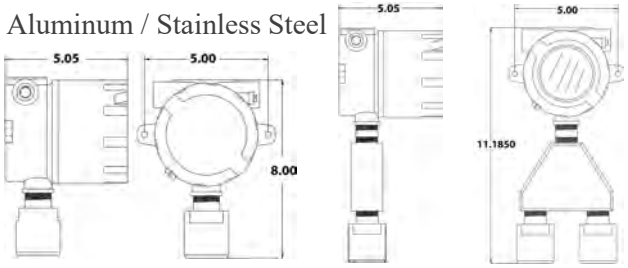


Dual Channel Split Screen



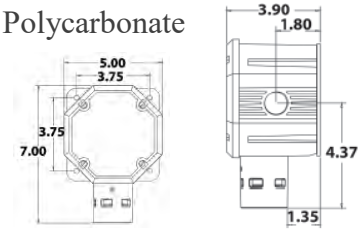
SINGLE / DUAL CONFIGURATIONS

Aluminum / Stainless Steel



SINGLE CONFIGURATION

Polycarbonate



MANUFACTURED IN THE USA. DS_BFT-44_10052017_rev.1.0

MODEL BFT-44 DUAL CHANNEL SENSOR TRANSMITTER

Warning: Read & understand contents of this manual prior to operation. Failure to do so could result in serious injury or death.

Buckeye Detection Systems
110 Kings Road
Kings Mountain, NC 28086
1-800-438-1028
www.buckeyefire.com

Chapter 1 Safety Information

1.1 SAFETY INFORMATION – READ BEFORE INSTALLATION AND APPLYING POWER

The following symbols are used in this manual to alert the user of important instrument operating issues:

This symbol is intended to alert the user to the presence of important operating and maintenance (servicing) instructions.

This symbol is intended to alert the user to the presence of dangerous voltage within the instrument enclosure that may be sufficient magnitude to constitute a risk of electric shock.

WARNINGS:

- **Shock Hazard** - Disconnect or turn off power before servicing this instrument.
- **WARNING- EXPLOSION HAZARD**- DO NOT REPLACE FUSE UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
- **WARNING- EXPLOSION HAZARD**- DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
- Use a properly rated CERTIFIED AC power (mains) cable installed as per local or national codes
- A certified AC power (mains) disconnect or circuit breaker should be mounted near the controller and installed following applicable local and national codes. If a switch is used instead of a circuit breaker, a properly rate CERTIFIED fuse or current limiter is required to be installed as per local or national codes. Markings for positions of the switch or breaker should state (I) for on and (O) for off.
- Clean only with a damp cloth without solvents.
- Equipment not used as prescribed within this manual may impair overall safety.

1.2 CONTACTING BUCKEYE DETECTION SYSTEMS

Buckeye Detection Systems
110 Kings Road
Kings Mountain, NC 28086
1-800-438-1028
bfec@buckeyef.com

Chapter 2 General Description

2.1 INTRODUCTION

The state-of-the art BFT-44 sensor transmitter is an updated version of our proven BFT-48 transmitter. This versatile unit has a bright color display and embedded web page promoting simple intuitive user interface. The web page is accessed through the standard Ethernet connection and allows the transmission of data over existing network infrastructure to computers, tablets, smart phones and Buckeye Detection Systems BFT-64, 64 channel controller.

Features include:

- QVGA color TFT display which displays engineering units and monitored data graphically as a bar graph and 30-minute trend.
- Display changes color to indicate alarm status
- Ethernet: embedded webpage for configuration and HMI, Modbus TCP master/slave
- Webpage offers offsite viewing capabilities.
- Remote sensor abilities
- Single/Dual modes standard
- Modbus TCP, Modbus RTU, EC, bridge and 4-20mA inputs
- Magnetic switches allow "one man" sensor calibration in hazardous areas without area declassification with a simple magnetic wand.

Optional features include:

- Three programmable relays and a dedicated fault relay.
- Two individually programmable RS-485 ports for Modbus master or slave.

2.2 RATINGS AND CERTIFICATIONS

NRTL CSA APPROVALS (File # 219995)
BFT-44 with BFT10-0247 is Division 1 and 2 Group A, B, C, D Exia. Suitable for explosion proof installations

EXPLOSION PROOF HOUSING
Instrument enclosure suitable for Class 1, Division 1 and 2, Groups A, B, C and D

POLYCARBONATE ENCLOSURE
Instrument enclosure suitable for Class 1, Division 2, Groups A, B, C and D (Pending)

2.3 SYSTEM DESIGN SPECIFICATIONS

ANALOG OUTPUTS
BFT-44 Bridge models have 3-wire 4-20mA current source output with nominal 24VDC power supply

BFT10-0388 Relays / RS-485 Modbus® (Optional)
Relays are Form C 5AMP @ 30VDC and 240VAC RESISTIVE
RS-485 is 2-wire Modbus® RTU

DISPLAY
240X320 pixel LCD displays 30-minute trend, bar-graph and large engineering units, LED Backlight

ACCURACY
±1% of full scale

AMBIENT TEMPERATURE RANGE
-40 – 60 degrees C

TEMPERATURE DRIFT
Less than .1% per degree Celsius over ambient temperature range

POWER SUPPLY
10 - 30 VDC at 10 Watts max

Chapter 3 Installation Instructions

3.1 SENSOR LOCATION

Factors such as air movement, gas density in relation to air, emission sources and environmental variables affect correct sensor location. Air movement by fans, prevailing winds and convection should be carefully evaluated to determine if a leak is more likely to raise gas levels in certain areas within the facility. Vapor density of a gas determines if it will rise or fall in air when there are no significant currents. Lighter than air gases should have the monitors mounted 12 – 18 inches (30 – 45 centimeters) above the potential gas leak and heavier than air gases should be this distance below. Even though the BFT-44 is designed for rugged service, sensors should be protected from environmental damage from water, snow, shock, vibration and dirt.

3.2 MOUNTING THE ENCLOSURE

The BFT-44 standard enclosure is a cast aluminum explosion-proof (NEMA 7) enclosure as shown in Figure 3-1. Figure 3-2 shows dimensions with the dual local sensor head 'Y' adaptor (BFT0010-1200) included. Figure 3-3 shows the dimensions, without the sensor head installed, of the BFT-44's polycarbonate enclosure.

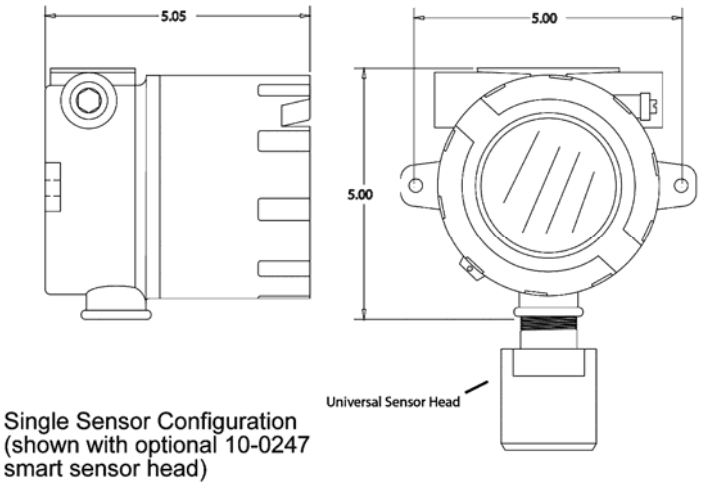


Figure 3-1 BFT-44 Explosion-Proof Housing

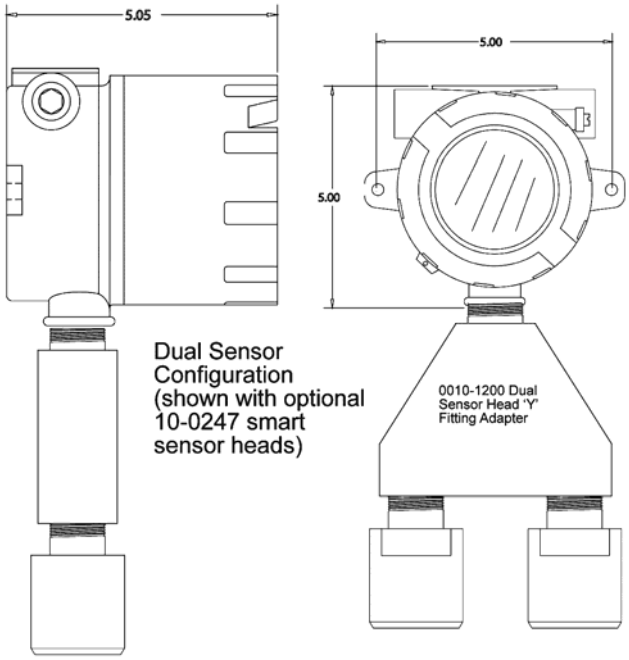


Figure 3-2 BFT-44 Explosion-Proof Housing with Dual Sensor Head Adaptor

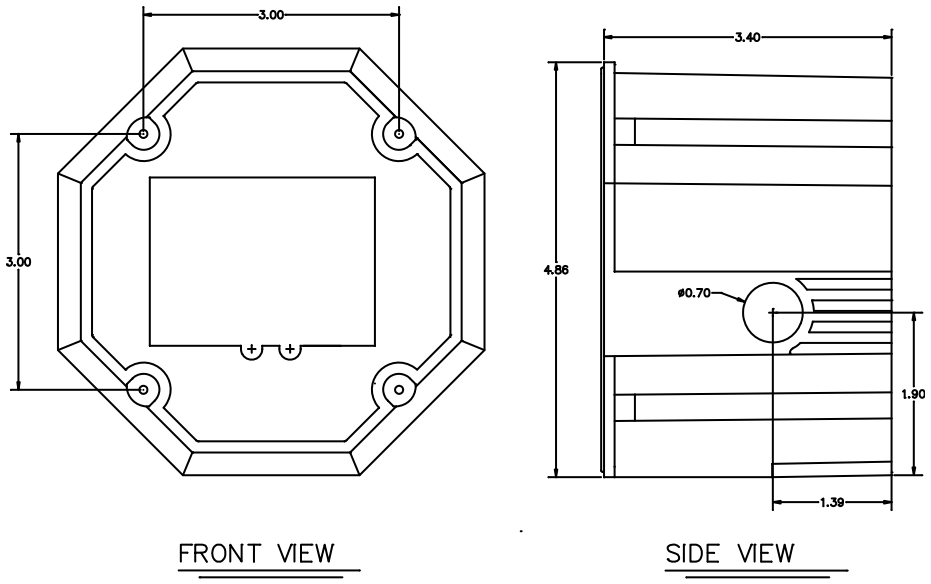


Figure 3-3 BFT-44 Poly Enclosure without Sensor Head

Modular design simplifies the installation of the BFT-44. A top Display Assembly is mounted with captive thumbscrews and is easily removed to access field-wiring terminals. An optional BFT10-0388 Alarm/RS-485 Modbus board mounts *piggyback* to the back of the Display Assembly. Wiring from simple bridge sensors terminates at the TB2 of the BFT10-0390 I/O PCB. The bottom BFT10-0390 I/O Power Supply board generates voltages needed for LCD, relays, RS-485 Modbus, Bridge and Electrochemical Smart Sensor Connections and Simple Bridge sensor.

WARNING: Qualified personnel should perform the installation according to applicable electrical codes, regulations and safety standards. Ensure correct cabling and sealing fitting practices are implemented. Do not aim the sensor pointing upward. Install the BFT-44 to a wall or bracket using the predrilled mounting flanges with I.D. 0.25 on 5 inch centers (Figure 3-2). If conduit is rigid and able to support the weight of the BFT-44, the mounting bolts may be omitted.

CAUTION: The sensor head should never be installed pointing upwards.

3.3 3-WIRE 4-20 MA MODE INSTALLATION

TB2 provides inputs for Channel 1 and Channel 2. By default it is set to provide a Simple Bridge input for Channel 1 and a 4-20mA input for Channel 2. However, a slight board modification will switch Channel 1 from a Simple Bridge input to a 4-20mA input. To switch Channel 1 to a 4-20mA input SB1 and SB2 must have their left pad and center pad connection cut and the center and right pad soldered together. This will provide 24V power to the first (leftmost) terminal of TB2 and a 4-20mA input at the terminal second from the left (Figure 3-4). J4 provides a connection for EC Smart Sensors for Channel 2 inputs. J5 provides a connection for Bridge or EC

Smart Sensors for Channel 1 inputs. J3 provides an Ethernet connection for connecting the BFT-44 to a network. TB1 provides terminals for 24V power input and common. Along with 4-20mA outputs for both Channel 1 and Channel 2.

Instructions: Remove the cover on the BFT-44. Loosen the two thumbscrews holding the display assembly in place and remove it. A 14-pin ribbon cable is attached with sufficient length to allow access to the I/O PCB mounted in the bottom of the enclosure (Figure 3-3). Power and signal connection are to TB1 where 24VDC, Signal and Common wires must be connected. A blocking diode protects the BFT-44 if polarity of the power supply is reversed, but it will not operate. Reassemble the BFT-44. Follow the procedures and recommendations in the receiver and power supply manuals to complete the installation. Be sure the BFT-44 enclosure and conduit are properly grounded. Apply power, and the BFT-44 should function.

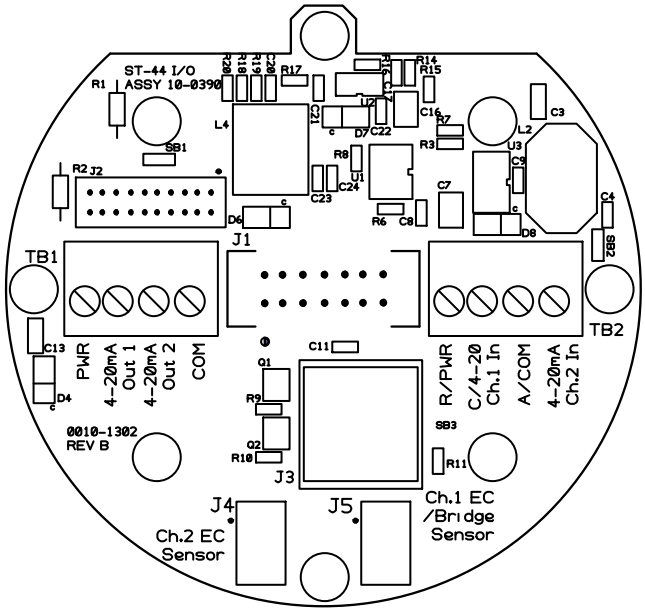


Figure 3-4 BFT10-0390 BFT-44 I/O Power Supply Board

3.4 B10-0388 RELAY / RS-485 MODBUS OPTION INSTALLATION

The optional BFT10-0388 Relay/RS-485 Modbus Option Board supplies three programmable alarm relays, a FAULT relay and two RS-485 Modbus RTU master/slave ports (Figure 3-5). This board is "piggybacked" behind the BFT10-0387 BFT-44 CPU/Display Board.

Caution: Alarm relays have dry contacts and power must be supplied from an external source. If this power source exceeds 3 amps, users should consider fusing relay wiring with 3 amp fuses. Contacts are rated for RESISTIVE loads! Inductive loads, such as contactor coils or motors, may cause contact arcing. This will shorten life and emit RFI into the sensor signals. Use appropriate arcing snubber and MOVs across inductive loads, and keep wiring away from signal wires. External wiring to TB2 should be shielded and protected from noise spikes to prevent false alarm resets or overrides.

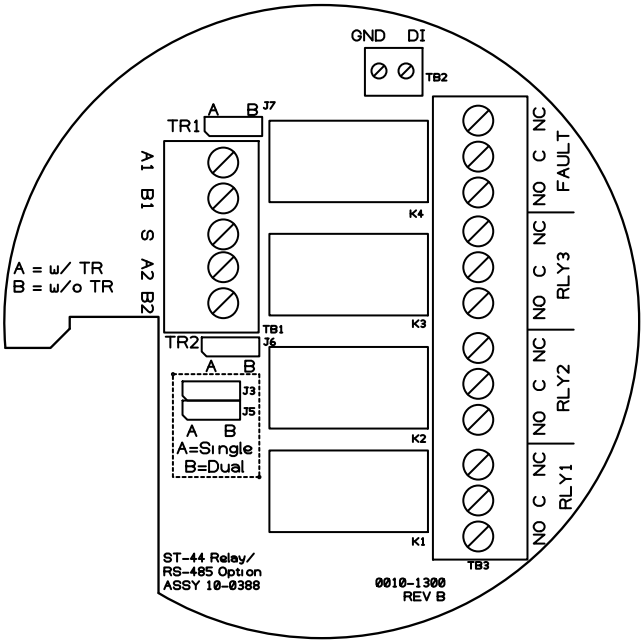


Figure 3-5 BFT10-0388 Relay/RS-485 Option Board

Remove the cover of the BFT-44 enclosure. Loosen the two thumbscrews holding the display assembly in place and remove it. A 14-pin ribbon cable is attached with sufficient length to access the back of the Display assembly where the Alarm/RS-485 Modbus board option is located. It is possible to use only the relays, only RS-485 or both. Relay terminals are labeled NO (Normally Open), NC (Normally Closed) or C (Common, or pole). These designators correspond to the shelf, or de-energized, state of the relays. The FAULT relay is always failsafe. Meaning, it is energized when there is not a fault condition, and therefore its action is reverse of the designators.

RS-485 Modbus networks should be wired as shown in Figure 3-6. Each BFT-44 represents an RTU, and must have a unique Remote ID address. Remote ID addresses are assigned in the Data From Menus discussed in Section 4.4.1.3. Cabling must be a daisy chain as opposed to a star pattern for reliable operation. The "end of line" unit should have J6 and J7 installed in the A position.

With J3 and J5 in the A position, TB1 functions as a Single communication port with A1 tied to A2 and B1 tied to B2. With J3 and J5 in the B position, TB1 functions as a Dual communication port with A1 and B1 being port 1 and A2 and B2 being port 2.

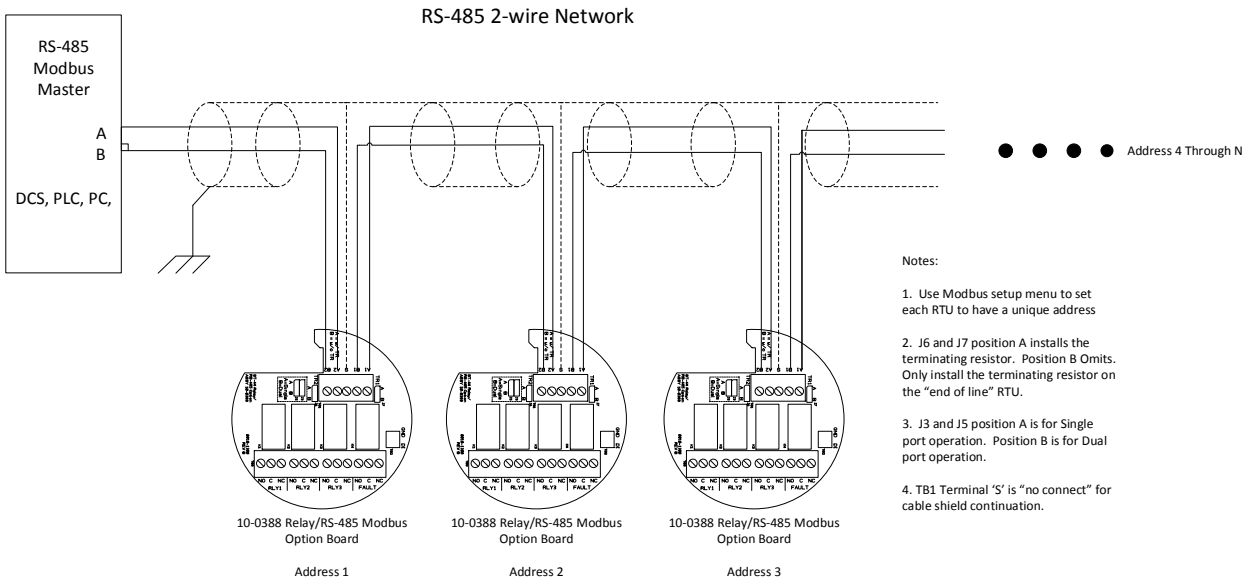


Figure 3-6 RS-485 Modbus Wiring

3.5 SENSOR INSTALLATION

Many manufacturers offer industry standard electrochemical (EC) and catalytic bead sensors for toxic/oxygen and LEL combustible gas detection. These are referred to as simple sensors in this manual. The BFT-44 design accommodates users wishing to continue use of their existing catalytic bead Simple type of sensors, however, EC Simple sensors are not supported. The BFT-44 Smart Sensor interface also uses proven EC technology for toxic/oxygen and catalytic bead for LEL combustibles, but has taken this technology a step further. A tiny memory IC is incorporated into the BFT-44 factory supplied Smart Sensors allowing them to contain the entire database of BFT-44 parameters onboard the replaceable Smart Sensor assembly.

This unique Smart Sensor Interface may be used to configure Smart Sensors and/or BFT-44s from a PC rather than entering all variables via the magnetic key pad.

EC and catalytic bead smart sensors both plug into the BFT10-0247 Smart Sensor Head, which connects to the BFT-44 with its 8-conductor Smart Sensor Interface cable (Figure 3-7).

Note: BFT10-0247 Smart Sensor Heads with EC/Oxygen sensors may connect to J4 or J5 on the BFT10-0309 I/O Board. Bridge Smart sensors can only be connected to J5.

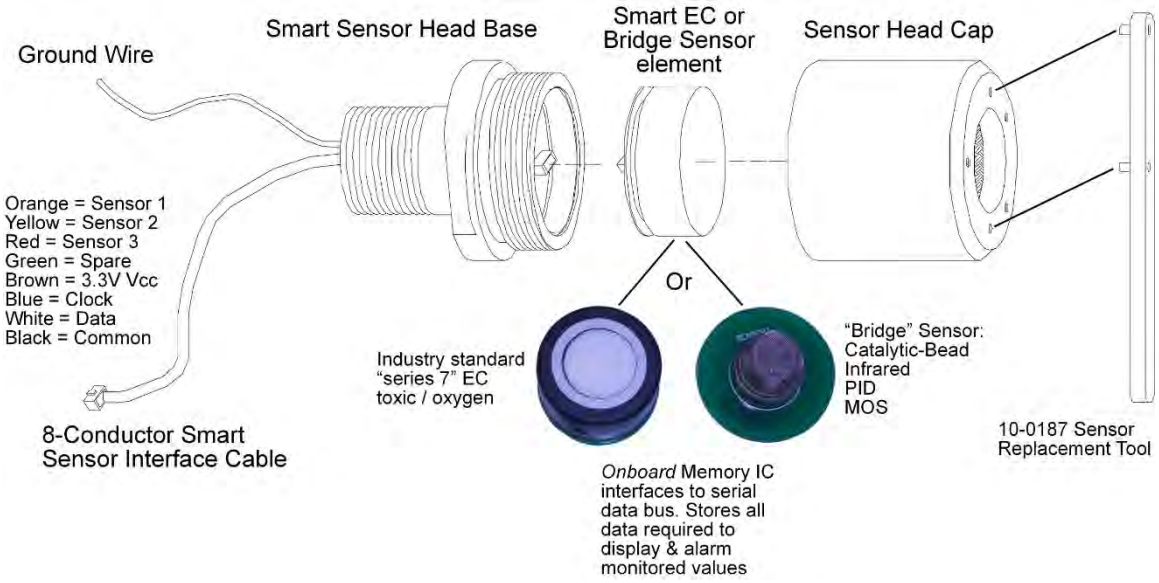


Figure 3-7 BFT10-0247 Smart Sensor Head Assembly

Chapter 4 General Operating Instructions

4.1 INTRODUCTION

Swiping a magnetic wand past the Edit key, from any of the Data Display screens, displays the Main Menu. The Up and Down keys maneuver the selection marker up and down, and Edit selects the highlighted item to enter the sub menus. All items with a submenu are indicated by a right facing arrow at the end of the line. To edit menu item values swipe the Edit key, and use the Up/Down keys to edit the value. Once the desired value is entered, swipe the Edit key again to save the value. Swipe the Next key to reverse out of a submenu.

4.2 ROUTINE SENSOR CALIBRATION

Calibration is the most important function for ensuring correct operation of the BFT-44. The CAL MODE is designed to make calibration quick, easy and error free. A successful Zero and Span calibration requires only four keystrokes. The 4-20mA output indicates Cal Mode by transmitting the InCal mA as set in Section 4.4.1.5.8 (default of 3mA). It then transmits 4mA during the subsequent Cal Purge Delay as set in Section 4.7.2.5 to prevent external alarms during calibration. Local BFT-44 alarm relays (optional BFT10-0388 BFT-44 Relay/RS-485 Board) are inhibited during Cal Mode. Cal Mode is exited automatically if no keystrokes are detected after five minutes.

Follow these BFT-44 calibration guidelines:

1. Calibration accuracy is only as good as the calibration **gas** accuracy. Buckeye Detection Systems recommends calibration gases with National Institute of Standards and Technology (NIST) traceable accuracy to increase the validity of the calibration.
2. Do not use gas cylinders beyond their expiration date.
3. Calibrate a new sensor before it is put in use.
4. Allow the sensor to stabilize before starting calibration.
5. Calibrate on a regular schedule. Buckeye Detection Systems recommends once every 3 months, depending on use and sensor exposure to poisons and contaminants.
6. Calibrate only in a clean atmosphere, free of background gas.

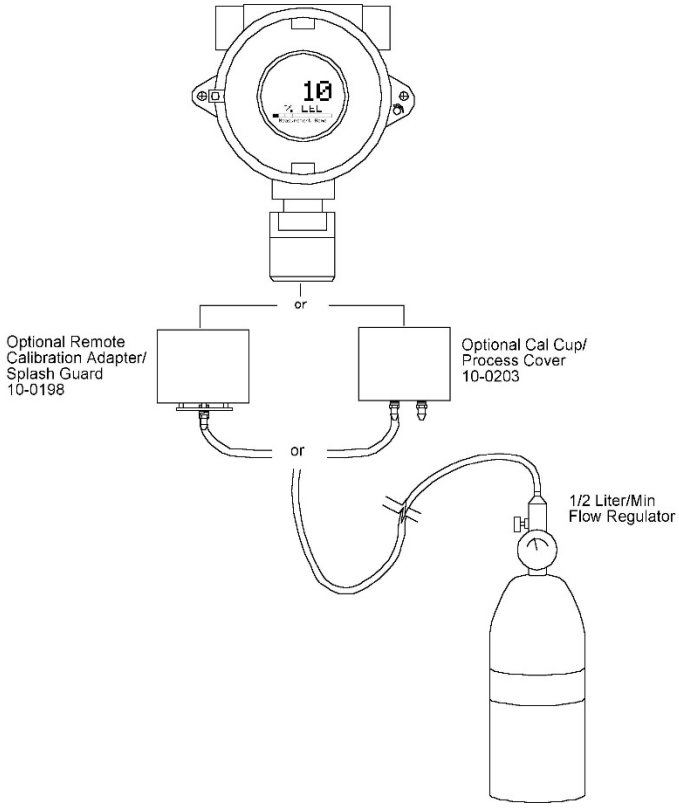


Figure 4-1 Calibration Gas Input

Use the following step-by-step procedure to perform Zero and Span calibrations (Figure 4-2 may be used for reference to the Menus.):

Note: The first three steps must be performed before the timer in the bottom right corner expires, 15 seconds, otherwise the BFT-44 will exit back to the Data Display Screen.

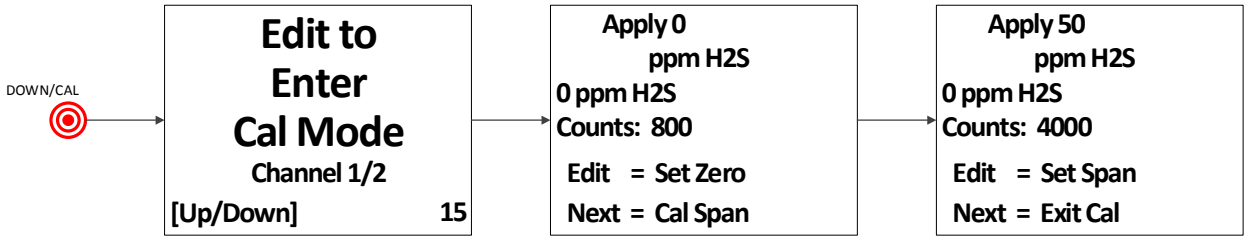


Figure 4-2 Cal Mode Flowchart and Menus

1. Enter Cal mode from any of the Data Display Screens by swiping the DOWN/CAL key.
2. Swipe the Up and/or Down key to select the Channel to be calibrated. **Note**: Only channels with Local Cal enabled, per Section 4.4.1.3, will be available for calibration.
3. Swipe the EDIT key to enter Cal Mode.

4. Apply a clean Zero Gas (Figure 4-1), using the Cal Cup, part number BFT10-0203, or be sure there is no background target gas in the monitored area. After the reading is stable (approximately one minute), swipe the EDIT key to Set the Zero Calibration. To skip the Zero calibration and go to the Span calibration swipe the NEXT key. When a message that the Zero calibration was completed successfully, proceed to the next step.
5. Apply the correct, as indicated, Span gas (Figure 4-1) at 0.5 liters/min. After the reading is stable (approximately one minute), swipe the EDIT key to Set the Span Calibration. To skip the Span Calibration swipe the NEXT key. When a message that the Span calibration was completed successfully, the ST-44 will exit back to the Data Display Screen.
6. Remove the Cal Gas. Once the Cal Purge Delay (Section 4.7.2.5) has expired, normal alarm and relay functionality will be restored.

Calibration history records are logged, and may be viewed in the Sensor Information (Section 4.4.1.3).

4.3 ALARM OUTPUTS

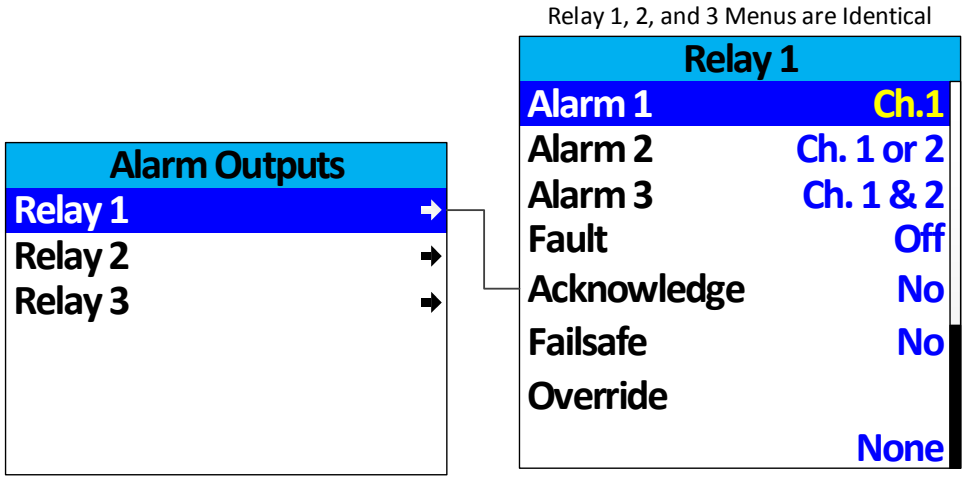


Figure 4-3 Alarm Outputs Menu Tree

The Alarm Outputs Menu is accessed via the Main Menu, and is used to configure the mapping of the three programmable relays to the alarm setpoints, and relay configuration items such as Acknowledge, Failsafe and Override.

The BFT10-0388 Relay/RS 485 Option Board has three programmable relays and a fourth relay which is dedicated to the Fault alarm.

Note: While these settings only affect relays if the BFT10-0388 BFT-44 Relay/RS 485 Option Board is installed, the menu options are always available for configuration purposes, regardless as to whether the option board is installed or not.

4.3.1 RELAY 1/2/3

Relay 1, 2, and 3 Menus are Identical

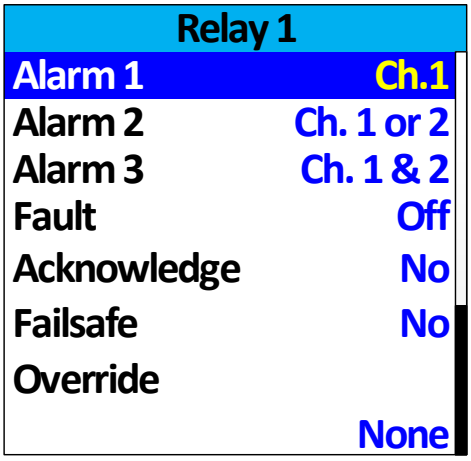


Figure 4-4 Relay Menu

From this menu, you may select one of the three programmable relays for which you would like to change the settings or mapping.

4.3.1.1 ALARM 1/2/3/FAULT

The Alarm 1, Alarm 2, Alarm 3 and Fault menu items determine the mapping of the relay to each of these alarm setpoints. The selection for each of these four items must all be met simultaneously to activate the relay. Options for each of these items are: Off, Ch.1, Ch.2, Ch.1 & 2, Ch.1 or 2.

Example: If you are in the Relay 1 menu, and have the following settings Alarm 1 set to Ch.1, Alarm 2 set to Ch.1 & 2 and Alarm 3 set to Ch.1 or 2. Relay 1 will energize in the event that the Alarm 1 setpoint for Channel 1 is reached **AND** The Alarm 2 setpoint for BOTH Channel 1 and Channel 2 are reached **AND** the setpoint for Alarm 3 is reached for either Channel 1 or Channel 2.

4.3.1.2 ACKNOWLEDGE

Set to Yes means the UP/RESET key will set the relay to the normal state even if the alarm condition still exists. This is useful for silencing an audible device driven from the relay.

4.3.1.3 FAILSAFE

Set to Yes means the relay de-energizes during alarm and energizes with no alarm. This is useful for signaling an alarm on a loss of power. The dedicated Fault alarm is always Failsafe.

4.3.1.4 OVERRIDE

Override allows the user to have an OR type of condition for energizing/de-energizing a relay. The options are:

1. None
2. Ch1 Alarm 1

3. Ch1 Alarm 2
4. Ch1 Alarm 3
5. Ch1 Fault
6. Ch2 Alarm 1
7. Ch2 Alarm 2
8. Ch2 Alarm 3
9. Ch2 Fault
10. Ch1/2 Cal Zero
11. Ch1 Cal Span
12. Ch2 Cal Span
13. 1/2 Cal Zero/Span

An Override is necessary when you want the relay to trip when either of two different setpoints are reached. For Example, if you want Relay 1 to trip when channel 1 is in Alarm 1 or Fault, you can set the **Alarm 1** setting for Ch1 and set **Override** to Ch1 Fault.

4.4 CHANNEL SETTINGS

The Channel Settings Menu is accessed via the Main Menu.

4.4.1 CHANNEL 1/2

The Channel 1 and Channel 2 Menus are accessed via the Channel Settings Menu.

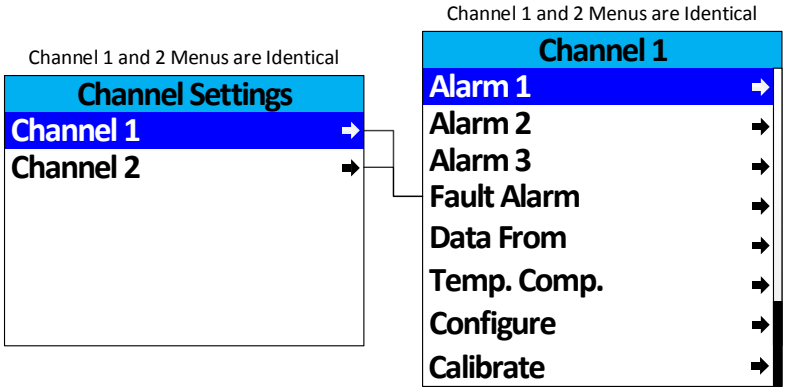


Figure 4-5 Channel 1/2 Menu Tree

4.4.1.1 ALARM 1/2/3

Alarm 1, 2 and 3 Menus may be accessed from the Channel 1 and Channel 2 Menus. Alarm 1 is always enabled and has **Setpoint**, **Latching**, **Trip On**, **On Delay**, **Off Delay** and **Dead Band** settings. Alarm 2 has the same setting options as Alarm 1, but also adds the **Color** setting. Alarm 3 is the same as Alarm 2, but may be **Enabled** or **Disabled**.

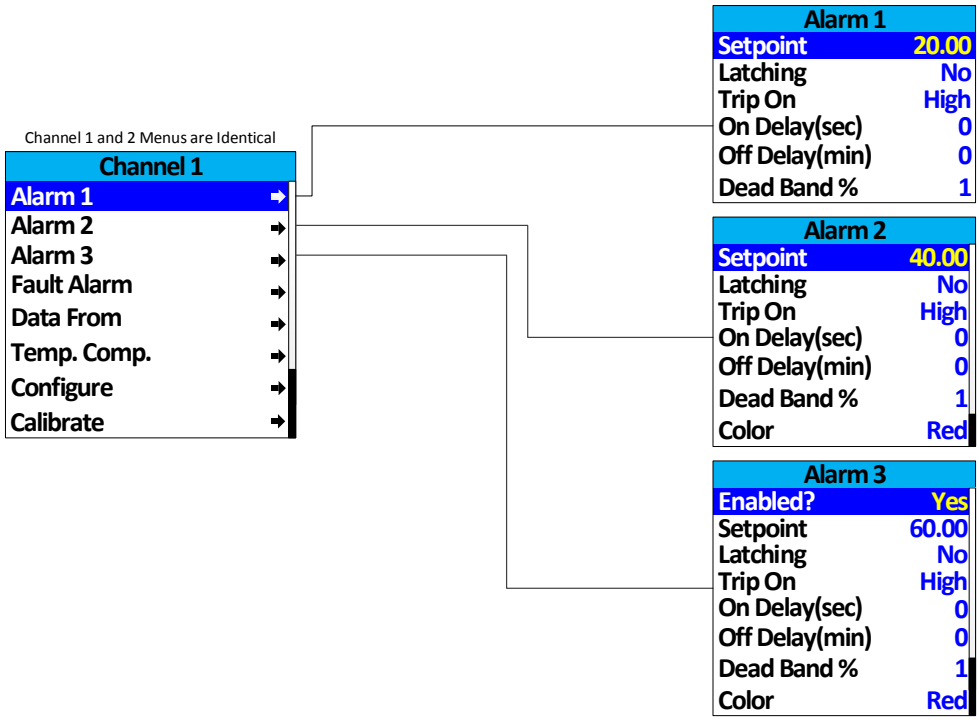


Figure 4-6 Alarm 1/2/3 Menu Tree

4.4.1.1.1 SETPOINT

Setpoint enters the engineering unit value where the alarm will trip. It may be negative and trip when monitored values fall out of range in this direction.

4.4.1.1.2 LATCHING

Setting **Latching** to YES causes the alarm to remain active even after the condition is gone, and to reset only when the UP/RESET key is swiped from a data display.

4.4.1.1.3 TRIP ON

Set **Trip On** to HIGH to have the alarm trip when the value goes above the setpoint. Set to LOW to trip when the value falls below the setpoint.

4.4.1.1.4 ON DELAY(SEC)

On Delay allows entering a maximum 10 second delay before this alarm becomes active. This is useful for preventing spurious alarms by brief spikes beyond the alarm setpoint.

4.4.1.1.5 OFF DELAY(MIN)

Off Delay allows entering a maximum 120 minute delay before clearing an alarm after the alarm condition is gone. This is useful for continuing an alarm function, such as operation of an exhaust fan, for a period of time after the alarm condition clears.

4.4.1.1.6 DEADBAND %

Deadband allows forcing low values to continue to read zero. This is useful when there are small amounts of background gases that cause fluctuating readouts above zero. The highest amount of Deadband allowed is 5%. **Note**: Deadband affects **all** outputs as well as the local reading.

4.4.1.1.7 COLOR

Selecting **Color** changes the color associated with the particular alarm. Options are Red, Blue and Orange. **Note**: Alarm 1 is always set to Yellow.

4.4.1.2 FAULT ALARM

The **Fault Alarm** is always enabled, and is accessed via the Channel 1 and Channel 2 menus.

4.4.1.2.1 SETPOINT

Fault Alarm has a default setting of negative 10 with Low Trip set for YES. This makes it function as a FAULT alarm and trip when the monitored value falls to less than negative 10. It is important to adjust this value when the transmitter's span value is set for another value other than 100. For example, a typical span setting for monitoring oxygen level is 25 therefore the fault level value should be adjusted to -2.5 which is equal to negative 10% of full scale.

4.4.1.3 DATA FROM

4.4.1.3.1 EC SENSOR

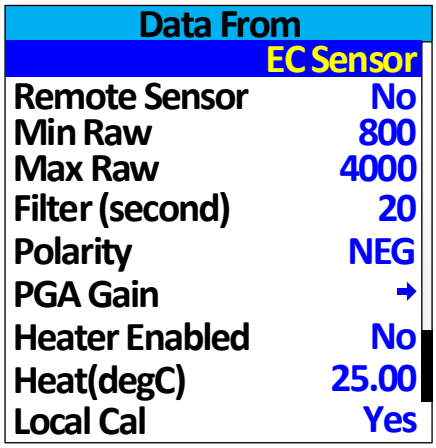


Figure 4-7 Data from EC Sensor Menu

4.4.1.3.1.1 Remote Sensor

Enable **Remote Sensor** when using the optional Remote Sensor Board BFT10-2080, see Section 5.4.

When enabled, two additional menu items appear for Remote ID and Interface. Remote ID matches the Remote ID of the Remote Sensor Board and is set between 1 and 247. Interface indicates which of the two COM ports are being used for that channel.

Note: In order to use the BFT10-2080 Remote Sensor Board, the BFT-44 must have a BFT10-0388 Relay/ RS-485 Option board installed.

4.4.1.3.1.2 Min Raw

Min Raw defines the minimum range of input counts that provide Measurement Range read-out values. This menu entry is determined by the A/D converter resolution of the channel's input. For example, if the input is 0 at 800 then Min Raw should be set to 800.

If the input device's resolution is unknown, the live counts variable on the Analog inputs menu displays actual raw A/D counts currently being read by this channel. This reading may be used to test the input device for what A/D counts are provided for zero. Forcing the input device to read zero should provide the A/D counts value needed to make this channel's display also read zero.

4.4.1.3.1.3 Max Raw

Max Raw defines the maximum range of input counts that provide Measurement Range read-out values. This menu entry is determined by the A/D converter resolution of the channel's input. For example, if the input is 100% at 4000 then Max Raw should be set to 4000.

If the input device's resolution is unknown, the live counts variable on the Analog inputs menu displays actual raw A/D counts currently being read by this channel. This reading may be used to test the input device for what A/D counts are provided for 100%. Forcing the input device to read 100% should provide the A/D counts value needed to make this channel's display also read 100%.

4.4.1.3.1.4 Filter (second)

The **Filter** setting sets the number of seconds over which samples are averaged. This may be set from 0 to 60 seconds. If a channel has a noisy input the time may be increased to filter out some of the noise by averaging it over a longer period of time. This causes the reading to react slower to a change in input.

4.4.1.3.1.5 Polarity

Polarity sets the polarity of the sensor POS for positive and NEG for negative.

4.4.1.3.1.6 PGA Gain

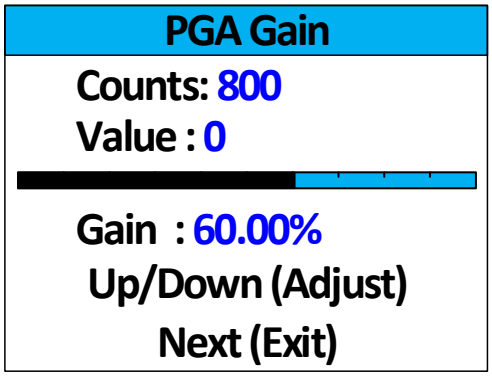


Figure 4-8 PGA Gain Menu

Depending upon the input type, BFT-44 inputs range from a few micro amps to hundreds of micro amps. **PGA Gain** is the adjustment that matches the input signal range to the BFT-44 input signal conditioning circuits. Altering the PGA Gain setting automatically resets previous calibration Offset and Gain values to Unit.

If it is determined the PGA Gain value is incorrect, apply the desired up-scale input and use the UP/DOWN keys to obtain the correct Value. Counts are the binary A/D value.

Caution: For standard installations, this is a factory adjustment. Do not use the PGA Gain menu for calibrating sensors. It should only be adjusted if a new measurement gas or input range is required.

4.4.1.3.1.7 Heater Enabled

Heater Enabled enables the locally mounted heater/ temperature controller circuit on the EC Sensor Amplifier Series 7 board BFT10-0415 and the Series 4 board BFT10-0381. **Note**: This feature should only be used in low temperature environments.

4.4.1.3.1.8 Heat (degC)

The **Heat** setting indicates the minimum temperature at which the temperature controller circuit will energize the heater if enabled. It may be set from -25 to 25C. **Note**: The Heater function should only be enabled in low temperature environments.

4.4.1.3.1.9 Local cal

Local Cal allows the sensor to be calibrated locally from the BFT-44. To configure the Calibration Settings refer to Section 4.4.1.6. For information on how to perform sensor calibration refer to Section 4.2.

4.4.1.3.1.10 View Sensor Info

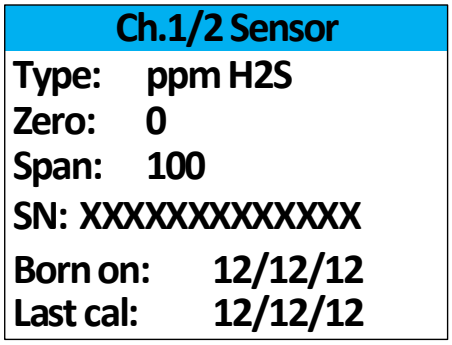


Figure 4-9 Sensor Information Screen

Sensor Info includes the sensor's Type, Zero and Span values, Serial Number, Born on Date and the Date when the last Calibration was performed.

4.4.1.3.2 BRIDGE SENSOR

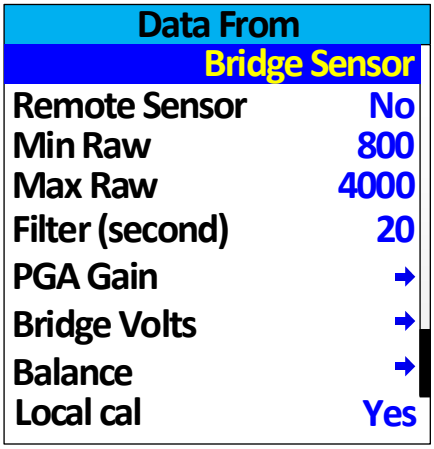


Figure 4-10 Data from Bridge Sensor Menu

4.4.1.3.2.1 Remote Sensor

Enable **Remote Sensor** when using the optional Remote Sensor Board BFT10-2080, see Section 5.4.

When enabled, two additional menu items appear for Remote ID and Interface. Remote ID matches the Remote ID of the Remote Sensor Board and is set between 1 and 247. Interface indicates which of the two COM ports are being used for that channel.

Note: In order to use the BFT10-2080 Remote Sensor Board, the BFT-44 must have a BFT10-0388 Relay/ RS-485 Option board installed.

4.4.1.3.2.2 Min Raw

Min Raw defines the minimum range of input counts that provide Measurement Range read-out values. This menu entry is determined by the A/D converter resolution of the channel's input. For example, if the input is 0 at 800 then Min Raw should be set to 800.

If the input device's resolution is unknown, the live counts variable on the Analog inputs menu displays actual raw A/D counts currently being read by this channel. This reading may be used to test the input device for what A/D counts are provided for zero. Forcing the input device to read zero should provide the A/D counts value needed to make this channel's display also read zero.

4.4.1.3.2.3 Max Raw

Max Raw defines the maximum range of input counts that provide Measurement Range read-out values. This menu entry is determined by the A/D converter resolution of the channel's input. For example, if the input is 100% at 4000 then Max Raw should be set to 4000.

If the input device's resolution is unknown, the live counts variable on the Analog inputs menu displays actual raw A/D counts currently being read by this channel. This reading may be used to test the input device for what A/D counts are provided for 100%. Forcing the input device to read 100% should provide the A/D counts value needed to make this channel's display also read 100%.

4.4.1.3.2.4 Filter (second)

The **Filter** setting sets the number of seconds over which samples are averaged. This may be set from 0 to 60 seconds. If a channel has a noisy input the time may be increased to filter out some of the noise by averaging it over a longer period of time. This causes the reading to react slower to a change in input.

4.4.1.3.2.5 PGA Gain

Depending upon the input type, BFT-44 inputs range from a few micro amps to hundreds of micro amps. **PGA Gain** is the adjustment that matches the input signal range to the BFT-44 input signal conditioning circuits. Altering the PGA Gain setting automatically resets previous calibration Offset and Gain values to Unit.

If it is determined the PGA Gain value is incorrect, apply the desired up-scale input and use the UP/DOWN keys to obtain the correct Value. Counts are the binary A/D value.

Caution: For standard installations, this is a factory adjustment. Do not use the PGA Gain menu for calibrating sensors. It should only be adjusted if a new measurement gas or input range is required.

4.4.1.3.2.6 Bridge Volts

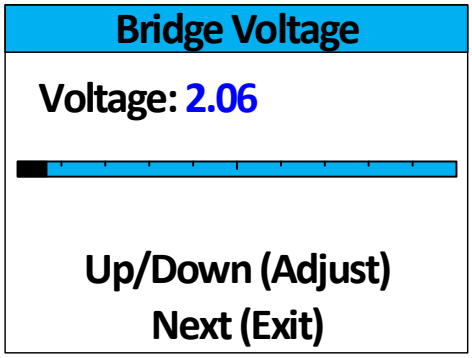


Figure 4-11 Bridge Voltage Adjust Menu

The **Bridge Voltage** is factory configured, and only requires field adjustment if the catalytic bead sensor is mounted remotely from the BFT-44 or if a new sensor is installed. BFT-44 bridge sensors may be from 2 to 6 volts excitation voltage at the sensor. This means, if the sensor is mounted a long distance away, the voltage at the BFT-44 may have to be higher in order to compensate for losses in the field wiring. Be careful not to exceed correct sensor voltage at the sensor's A and R terminals.

4.4.1.3.2.7 *Balance*

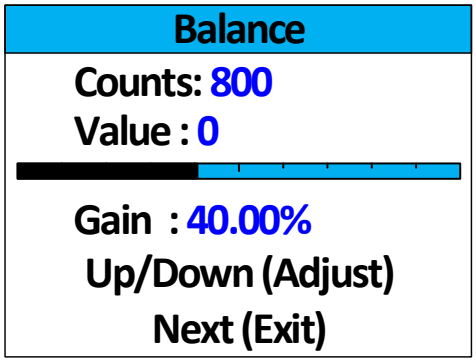


Figure 4-12 Bridge Balance Adjust Menu

The **Bridge Balance** is factory configured, and only requires field adjustment if the catalytic bead sensor is mounted remotely from the BFT-44 or if a new sensor is installed. Balance allows adjusting the balance of the catalytic bead sensor, and must only be performed with ZERO gas on the sensor. Balance is similar to a very coarse ZERO calibration, and does not need to be precise, since subsequent calibrations will correct for small errors. ZERO gas applied to the sensor should provide a reading of -3 to +3 on the Value in the Balance Menu.

4.4.1.3.2.8 *Local Cal*

Local Cal allows the sensor to be calibrated locally from the BFT-44. To configure the Calibration Settings refer to Section 4.4.1.6. For information on how to perform sensor calibration refer to Section 4.2.

4.4.1.3.2.9 *View Sensor Info*

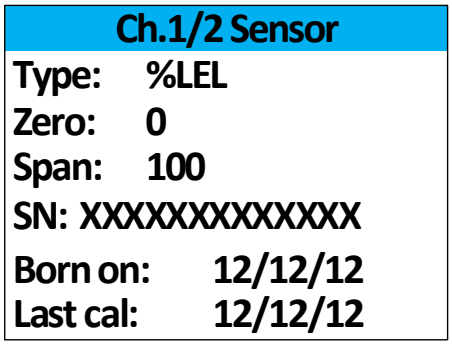


Figure 4-13 Sensor Information Screen

Sensor Info includes the sensor's Type, Zero and Span values, Serial Number, Born on Date and the Date when the last Calibration was performed.

4.4.1.3.3 AI 4-20MA

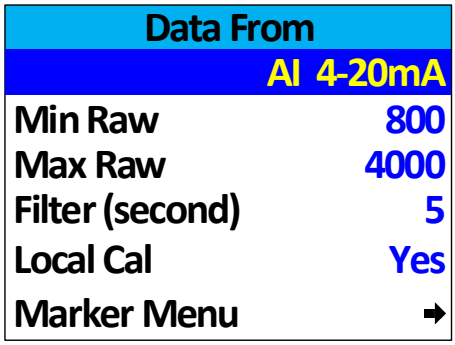


Figure 4-14 Data from Analog Input 4-20mA Menu

4.4.1.3.3.1 Min Raw

Min Raw defines the minimum range of input counts that provide Measurement Range read-out values. This menu entry is determined by the A/D converter resolution of the channel's input. For example, if the input is 0 at 800 then Min Raw should be set to 800.

If the input device's resolution is unknown, the live counts variable on the Analog inputs menu displays actual raw A/D counts currently being read by this channel. This reading may be used to test the input device for what A/D counts are provided for zero. Forcing the input device to read zero should provide the A/D counts value needed to make this channel's display also read zero.

4.4.1.3.3.2 Max Raw

Max Raw defines the maximum range of input counts that provide Measurement Range read-out values. This menu entry is determined by the A/D converter resolution of the channel's input. For example, if the input is 100% at 4000 then Max Raw should be set to 4000.

If the input device's resolution is unknown, the live counts variable on the Analog inputs menu displays actual raw A/D counts currently being read by this channel. This reading may be used to test the input device for what A/D counts are provided for 100%. Forcing the input device to read 100% should provide the A/D counts value needed to make this channel's display also read 100%.

4.4.1.3.3.3 Filter (second)

The **Filter** setting sets the number of seconds over which samples are averaged. This may be set from 0 to 60 seconds. If a channel has a noisy input the time may be increased to filter out some of the noise by averaging it over a longer period of time. This causes the reading to react slower to a change in input.

4.4.1.3.3.4 Local Cal

When enabled, this allows the sensor to be calibrated locally from the BFT-44. To configure the Calibration settings refer to Section 4.4.1.6. For information on how to perform sensor calibration refer to Section 4.2.

4.4.1.3.3.5 Marker Menu

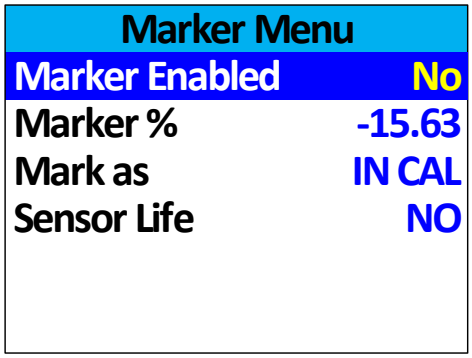


Figure 4-15 Marker Menu

Some monitors indicate special modes of operation such as Calibration or Maintenance by transmitting a special <4mA "Marker" value. The BFT-44 offers a 4-20mA **Marker Menu** for detecting inputs between -20% and 0% that represent such events. Once detected, the BFT-44 transmits a constant mA output equal to the Marker value.

Caution: Since FAULT alarms are also tripped in the < 4mA region it is important to understand that the Marker events override the FAULT alarm.

Selecting Yes in the *Marker Enabled* field activates the Marker. *Marker %* allows entering a value from -20% to 0% with up to three decimal points. *Mark as* allows entry of the up to six digit ASCII message the readout will display when the marker is detected.

4.4.1.3.4 MODBUS 16BIT

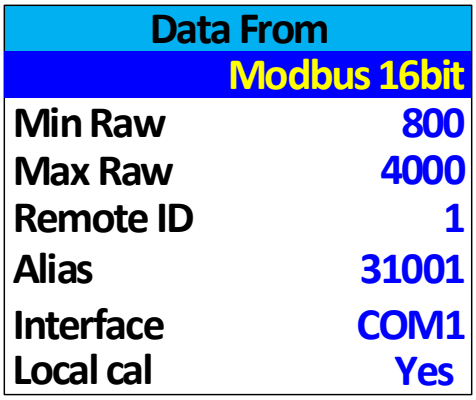


Figure 4-16 Data from Modbus 16-bit Menu

For additional information on Modbus slave configuration refer to Chapter 5.

4.4.1.3.4.1 Min Raw

Min Raw defines the minimum range of input counts that provide Measurement Range read-out values. This menu entry is determined by the A/D converter resolution of the channel's input. For example, if the input is 0 at 800 then Min Raw should be set to 800.

If the input device's resolution is unknown, the live counts variable on the Analog inputs menu displays actual raw A/D counts currently being read by this channel. This reading may be used

to test the input device for what A/D counts are provided for zero. Forcing the input device to read zero should provide the A/D counts value needed to make this channel's display also read zero.

4.4.1.3.4.2 Max Raw

Max Raw defines the maximum range of input counts that provide Measurement Range read-out values. This menu entry is determined by the A/D converter resolution of the channel's input. For example, if the input is 100% at 4000 then Max Raw should be set to 4000.

If the input device's resolution is unknown, the live counts variable on the Analog inputs menu displays actual raw A/D counts currently being read by this channel. This reading may be used to test the input device for what A/D counts are provided for 100%. Forcing the input device to read 100% should provide the A/D counts value needed to make this channel's display also read 100%.

4.4.1.3.4.3 Remote ID

Each device on a Modbus network must have a unique Remote ID. When Data From is set to Modbus, **Remote ID** is where the slave's unique ID number is entered. Remote ID numbers up to 247 are valid.

4.4.1.3.4.4 Alias

The **Alias** register numbers define the location of the variable representing the input value of the Modbus data received through the Communications ports. This number must be obtained from the manufacturer of the Modbus RTU device.

4.4.1.3.4.5 Interface

The **Interface** assigns what communication port the Modbus slave is connected to and the channel will get its data from. The communication port that is assigned here must be configured as a Modbus Master.

4.4.1.3.4.6 Local Cal

Local Cal allows the sensor to be calibrated locally from the BFT-44. To configure the Calibration Settings refer to Section 4.4.1.6. For information on how to perform sensor calibration refer to Section 4.2.

4.4.1.3.5 MODBUS 16 SIGNED

Data From	Modbus 16 Signed
Min Raw	800
Max Raw	4000
Remote ID	1
Alias	31001
Interface	COM1
Local cal	Yes

Figure 4-17 Data from Modbus 16-bit Signed Menu

For additional information on Modbus slave configuration refer to Chapter 5.

4.4.1.3.5.1 Min Raw

Min Raw defines the minimum range of input counts that provide Measurement Range read-out values. This menu entry is determined by the A/D converter resolution of the channel's input. For example, if the input is 0 at 800 then Min Raw should be set to 800.

If the input device's resolution is unknown, the live counts variable on the Analog inputs menu displays actual raw A/D counts currently being read by this channel. This reading may be used to test the input device for what A/D counts are provided for zero. Forcing the input device to read zero should provide the A/D counts value needed to make this channel's display also read zero.

4.4.1.3.5.2 Max Raw

Max Raw defines the maximum range of input counts that provide Measurement Range read-out values. This menu entry is determined by the A/D converter resolution of the channel's input. For example, if the input is 100% at 4000 then Max Raw should be set to 4000.

If the input device's resolution is unknown, the live counts variable on the Analog inputs menu displays actual raw A/D counts currently being read by this channel. This reading may be used to test the input device for what A/D counts are provided for 100%. Forcing the input device to read 100% should provide the A/D counts value needed to make this channel's display also read 100%.

4.4.1.3.5.3 Remote ID

Each device on a Modbus network must have a unique Remote ID. When Data From is set to Modbus, **Remote ID** is where the slave's unique ID number is entered. Remote ID numbers up to 247 are valid.

4.4.1.3.5.4 Alias

The **Alias** register numbers define the location of the variable representing the input value of the Modbus data received through the Communications ports. This number must be obtained from the manufacturer of the Modbus RTU device.

4.4.1.3.5.5 Interface

The **Interface** assigns what communication port the Modbus slave is connected to and the channel will get its data from. The communication port that is assigned here must be configured as a Modbus Master.

4.4.1.3.5.6 Local Cal

Local Cal allows the sensor to be calibrated locally from the BFT-44. To configure the Calibration Settings refer to Section 4.4.1.6. For information on how to perform sensor calibration refer to Section 4.2.

4.4.1.3.6 MODBUS 32BIT

Data From	Modbus 32bit
Remote ID	1
Alias	31001
Interface	COM1
Byte Order	BADC
Local cal	Yes

Figure 4-18 Data from Modbus 32-bit Menu

For additional information on Modbus slave configuration refer to Chapter 5.

4.4.1.3.6.1 Remote ID

Each device on a Modbus network must have a unique Remote ID. When Data From is set to Modbus, **Remote ID** is where the slave's unique ID number is entered. Remote ID numbers up to 247 are valid.

4.4.1.3.6.2 Alias

The **Alias** register numbers define the location of the variable representing the input value of the Modbus data received through the Communications ports. This number must be obtained from the manufacturer of the Modbus RTU device.

4.4.1.3.6.3 Interface

The **Interface** assigns what communication port the Modbus slave is connected to and the channel will get its data from. The communication port that is assigned here must be configured as a Modbus Master.

4.4.1.3.6.4 Byte Order

Byte Order determines WORD and BYTE alignment of data at the remote Modbus transmitter when sending its 4 byte IEEE Floating Point values. With the selection bar on this entry, swipe the Edit key to toggle between the four possible modes. The default setting is BADC.

4.4.1.3.6.5 Local Cal

Local Cal allows the sensor to be calibrated locally from the BFT-44. To configure the Calibration Settings refer to Section 4.4.1.6. For information on how to perform sensor calibration refer to Section 4.2.

4.4.1.4 *TEMP. COMP.*

Temp. Comp.		
Temp	Gain	Offset
-40	1.00	+0.00
-30	1.00	+0.00
-20	1.00	+0.00
-10	1.00	+0.00
0	1.00	+0.00
10	1.00	+0.00
20	1.00	+0.00
30	1.00	+0.00
40	1.00	+0.00
50	1.00	+0.00
60	1.00	+0.00

Figure 4-19 Temperature Compensation Menu

Temperature Compensation allows the user to adjust the gain and offset that is applied to sensors to compensate for temperature drift. Factory supplied sensors are preprogrammed with these values which are automatically uploaded to the BFT-44 from the smart sensor. The default values are 1.000 for gain and 0.000 for offset. With these default values entered, there is no extra gain or offset applied to the sensor. This menu is not accessible unless a smart sensor, which is equipped with the temperature sensor, is installed. From this menu, you can adjust the gain and offset applied to the sensor at 10C increments from -40 to 60C. The gain is applied to the span value, and the offset is adjusted to make the sensor read zero at different temperatures.

4.4.1.5 CONFIGURE

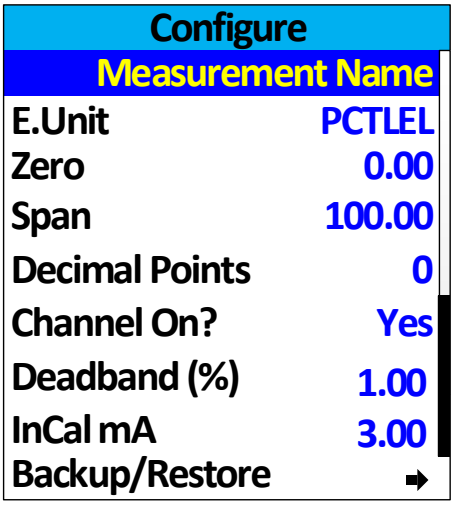


Figure 4-20 Channel Configuration Menu

4.4.1.5.1 MEASUREMENT NAME

Measurement Name may be edited to contain virtually any 16 character ASCII field. It is typically used to describe the monitored point by user tag number or other familiar terminology.

4.4.1.5.2 E.UNIT

Engineering Units (EUNIT) may have up to a 10 character ASCII field. Many common gases have preconfigured EUNITs based upon the sensor type, and each may be edited in this menu.

4.4.1.5.3 ZERO

Zero defines the reading to be displayed when 4mA (0%) is the BFT-44 output.

4.4.1.5.4 SPAN

Span defines the reading to be displayed when 20mA (100%) is the BFT-44 output. The highest reading allowed is 9999 and include a polarity sign and a decimal point.

4.4.1.5.5 DECIMAL POINTS

Decimal Points sets the resolution of the displayed reading and may be set to zero, one or two decimal points.

4.4.1.5.6 CHANNEL ON?

Channel ON determines whether or not the channel is active and being used.

4.4.1.5.7 DEADBAND (%)

Deadband allows forcing low values to continue to read zero. This is useful when there are small amounts of background gases that cause fluctuating readouts above zero. The highest amount of Deadband allowed is 5%. **Note**: Deadband affects **all** outputs as well as the local reading.

4.4.1.5.8 INCAL MA

InCal mA determines the output when the channel is in Calibration mode. It may be set from 0 to 20mA. This signal may be used by the controller to determine that the unit is in calibration.

4.4.1.5.9 BACKUP/RESTORE

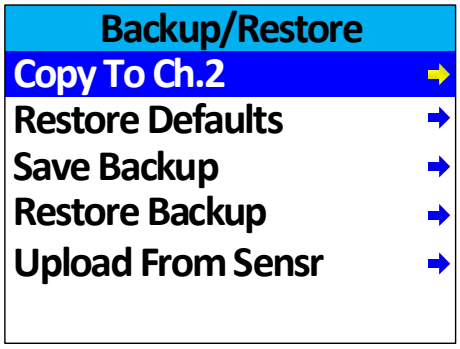


Figure 4-21 Configuration Backup/Restore Menu

The **Backup/Restore Menu** allows you to perform many operations dealing with the configuration of the BFT-44. Selecting *Copy To Ch.1/Ch.2* will copy the current channel's configuration to the other channel. *Restore Defaults* sets all configuration data back to factory defaults. *Save Backup* saves a copy of the configuration to non-volatile memory for restoration at a later time. *Restore Backup* will restore the configuration to the last saved Backup. *Upload From Sensr* will upload the sensor configuration data to the BFT-44.

4.4.1.6 CALIBRATE

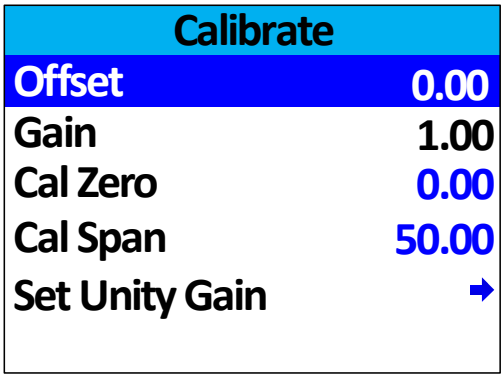


Figure 4-22 Channel Calibration Menu

The **Calibrate Menu** shows the settings for calibration. It will display any Offset or Gain currently applied, and allows you to enter the values for the zero and span gases that will be used during calibration. You may also reset the gain back to unity by selecting *Set Unity Gain*.

4.5 COMM SETTINGS

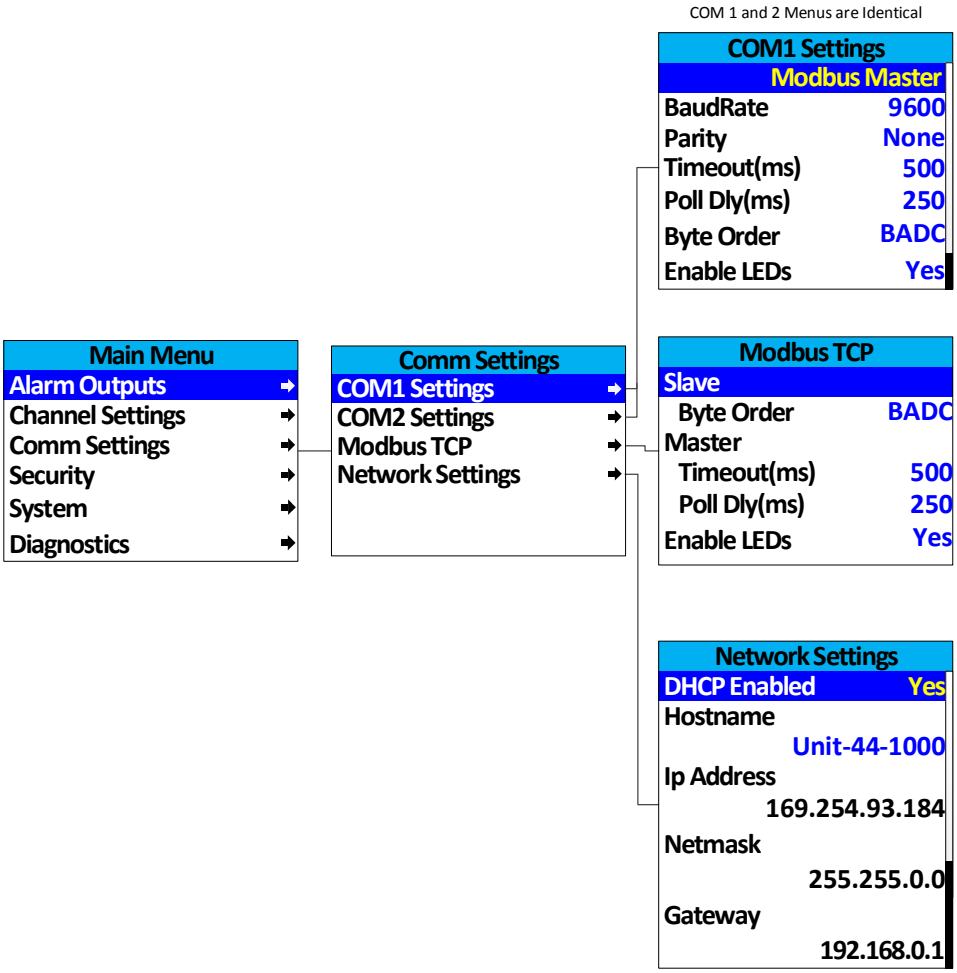


Figure 4-23 Comm Settings Menu Tree

Comm Settings Menu is accessed through the Main Menu. This menu is used to configure the two possible communication ports on the optional BFT10-0388 Relay/RS-485 Modbus Option Board.

4.5.1 COM1/COM2 SETTINGS

COM 1 and 2 Menus are Identical

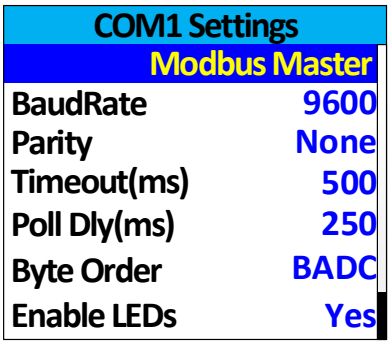


Figure 4-24 COM1 and COM2 Settings Menu

The function parameter allows the communication ports to be set to **Modbus Master**, **Modbus Slave** or **Disabled**.

Modbus Master Mode allows the communication port to poll any device using the Modbus RTU protocol.

Modbus Slave Mode allows the communication port to be polled by any Modbus Master device using the Modbus RTU protocol.

Select **Disabled** to turn the port off if not needed.

4.5.1.1 BAUDRATE

Baudrate allows users to set the data rate of the communication port. The options include 9600, 19200, 38400, 57600 and 115200.

4.5.1.2 PARITY

A **Parity** bit is a bit that is added to ensure that the number of bits with the value "1" in a set of bits is even or odd. Parity bits are used as the simplest form of error detecting within code. The default is **None**.

4.5.1.3 TIMEOUT (MS)

The **Timeout** menu item affects the BFT-44's *Master* Modbus ports. **Timeout** is the length of time, in milliseconds, the controller waits before a Modbus request fails. Three consecutive failed requests must occur before a communication error is indicated. This item is useful for optimizing throughput to the BFT-44 from other slave RTUs.

4.5.1.4 POLL DLY (MS)

Poll Dly is the time in milliseconds the unit will delay between Modbus master requests.

4.5.1.5 *BYTE ORDER*

Byte Order determines WORD and BYTE alignment of data at the remote Modbus transmitter when sending its 4 byte IEEE Floating Point values. Selecting this value cycles through four options ABCD, CDAB, BADC (default) and DCBA.

4.5.1.6 *ENABLE LEDS*

Enable LEDs enables the RX and TX LEDs to flash green on valid transmit and receive transmissions. For ports configured as master, the RX LED will flash red if there is a Comm Error or if an exception is received. Slave ports will cause the RX LED to flash red under the same conditions, but can also cause the TX LED to flash red if an invalid function code is received or if the wrong register is given.

Caution: When using the LEDs to assist with troubleshooting it is important to note that LEDs may be enabled via Comm Port settings and Modbus TCP settings. So it is important to disable the LEDs for the ports which are not being tested.

4.5.1.6 *SLAVE ID*

Slave ID is set to uniquely identify a BFT-44 in Modbus Slave mode. May be set to any value 1-247.

4.5.2 MODBUS TCP

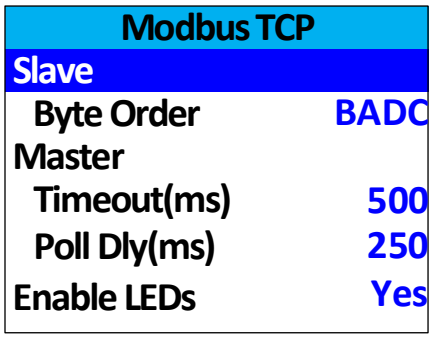


Figure 4-25 Modbus TCP Menu

4.5.2.1 *SLAVE BYTE ORDER*

If Modbus Slave is selected, **Slave Byte Order** determines WORD and BYTE alignment of data at the remote Modbus transmitter when sending its 4 byte IEEE Floating Point values. With the select bar on this entry, swiping the EDIT key toggles between the 4 possible modes. Min/Max Raw values are not used in this mode. Default is set to BADC.

4.5.2.2 *MASTER TIMEOUT (MS)*

Master Timeout is the time in milliseconds before the unit gives up on a Modbus request and moves on to the next channel. After three consecutive timeouts, the channel enters the COM Error state.

4.5.2.3 *MASTER POLL DLY (MS)*

Master Poll Dly is the time in milliseconds the unit will delay between Modbus Master requests.

4.5.2.4 *ENABLE LEDS*

Enable LEDs enables the RX and TX LEDs to flash green on valid transmit and receive transmissions. For ports configured as master, the RX LED will flash red if there is a Comm Error or if an exception is received. Slave ports will cause the RX LED to flash red under the same conditions, but can also cause the TX LED to flash red if an invalid function code is received or if the wrong register is given.

Caution: When using the LEDs to assist with troubleshooting it is important to note that LEDs may be enabled via Comm Port settings and Modbus TCP settings. So it is important to disable the LEDs for the ports which are not being tested.

4.5.3 NETWORK SETTINGS

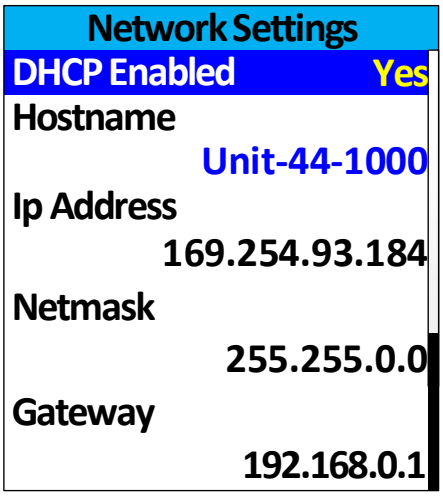


Figure 4-26 Network Settings Menu

See Section 6.2 for integrating a BFT-44 into a network.

4.5.3.1 *DHCP ENABLED*

DHCP Enabled allows the IP address to be set automatically by an external DHCP server. When this parameter is enabled, the unit can be accessed by its hostname or IP address. However, the IP address will be dependent on the DHCP server, and could potentially change.

4.5.3.2 *HOSTNAME*

Hostname identifies the BFT-44 on a network as an alternative to the IP address.

4.5.3.3 *IP ADDRESS*

IP Address identifies the BFT-44 on a network. This is automatically set when DHCP is enabled.

4.5.3.4 *NETMASK*

Specify if your network requires. **Netmask** specifies the subnet addressing scheme. This is automatically set when DHCP is enabled.

4.5.3.5 *GATEWAY*

Gateway is the IP address of the device that may connect this subnet to other networks. This is automatically set when DHCP is enabled.

4.6 SECURITY

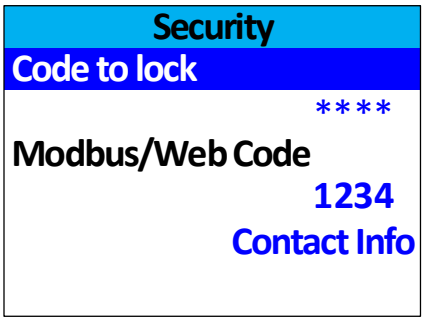


Figure 4-27 Security Menu

The **Security Menu** offers the ability to lock the BFT-44 using a four digit Code. Once enabled, the only actions that may be taken are to view the menus, view the data displays and perform calibrations. No fields may be edited without entering the Code to unlock in the Security Menu.

To enable the Security Mode, enter a four digit Code. **Note**: This is a one-time use code, which will be used to unlock the unit at a later time. Re-enter the Code to confirm and the BFT-44 will lock.

To disable the Security Mode, enter the four digit Code entered previously in the Security Menu.

The Modbus/Web Code is used on the embedded webpage to provide security by preventing inadvertent manipulation of the configuration from the webpage (See Section 6.1).

The Contact Info field is a 16 character ASCII field available for displaying a phone number or name of personnel who know the Code. Lost codes may be recovered by entering the locked security menu and entering the code 8621.

4.7 SYSTEM

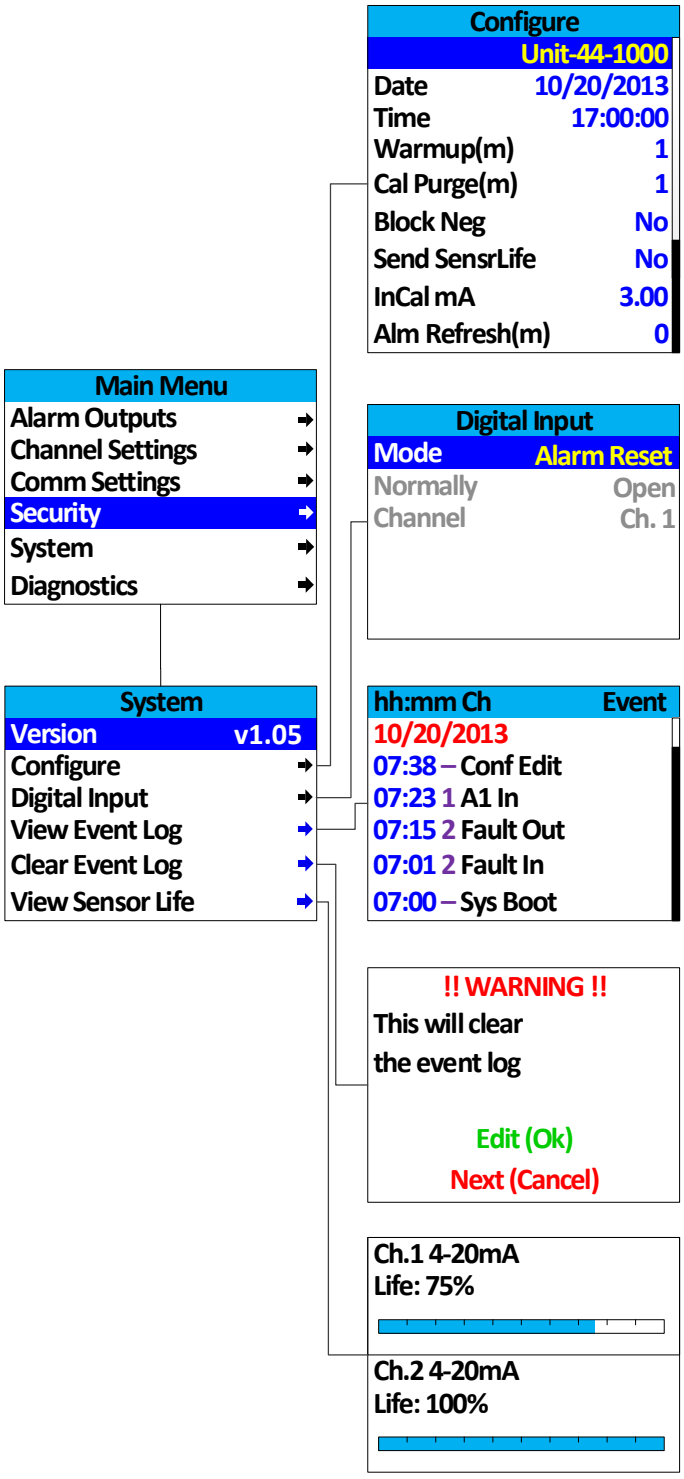


Figure 4-28 System Menu Tree

The **System Menu** is accessed through the Main Menu. System Menu items are items which effect the entire BFT-44, and are not specific to either channel. Submenus are accessed by highlighting the desired item and swiping the Edit key.

4.7.1 VERSION

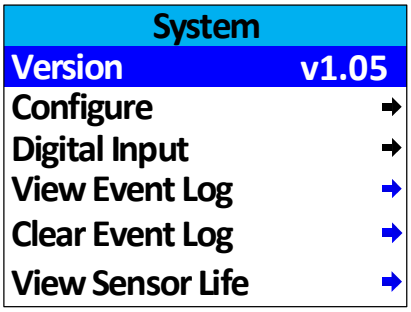


Figure 4-29 System Menu

The **Version** line in the System Menu displays the version of firmware that is programmed in the BFT-44.

4.7.2 CONFIGURE

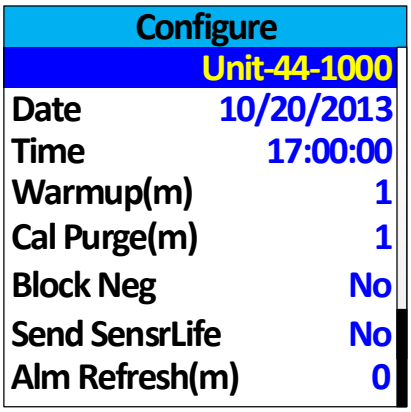


Figure 4-30 Configure System Menu

Configure Menu items are edited by highlighting the desired item and swiping Edit. Swipe UP and DOWN keys to change the value highlighted by the cursor and NEXT to move the cursor. Swipe EDIT again to save the value.

4.7.2.1 UNIT NAME

Unit Name is used to assign the transmitter a name for use in the backup configuration file name. The unit name is limited to 16 characters.

4.7.2.2 DATE

Date is used for Data and Event Logging. This is a factory setting, but may need to be adjusted for the end user's location.

4.7.2.3 TIME

Time (24 hour clock) is used for Data and Event Logging. This is a factory setting, but may need to be adjusted for the end user's location.

4.7.2.4 *WARMUP (M)*

Warmup is available to prevent unwanted alarm trips during sensor warmup. This time can be adjusted up to five minutes for sensors that take a long time to warm up.

4.7.2.5 *CAL PURGE (M)*

Cal Purge is available to prevent unwanted alarm trips during calibration purge time. This time can be adjusted up to five minutes for sensors that take a long time to drift back down after calibration.

4.7.2.6 *BLOCK NEG*

Block Neg prevents negative channel values from being displayed. It applies to both channels.

4.7.2.7 *SEND SENSRLIFE*

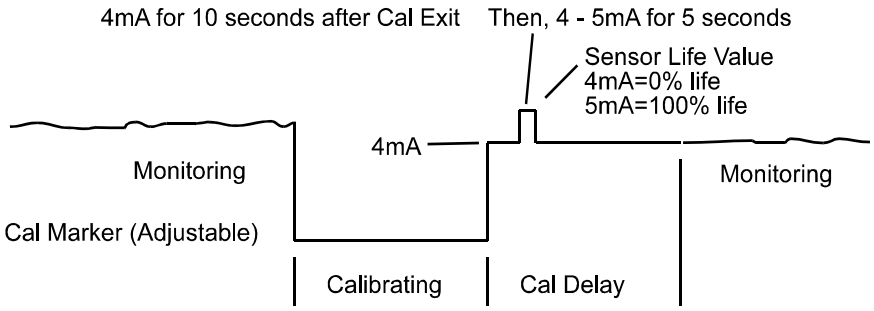


Figure 4-31 Send SensrLife Timing Diagram

Set for Yes, **Send SensrLife** causes the BFT-44 to transmit a sensor life value after successful calibrations during the Cal Purge Delay. Normal operation is the BFT-44 transmits 4mA during the Cal Purge Delay, but with Send SensrLife set to Yes it will transmit 4mA for the first 10 seconds then for 5 seconds it will transmits a value between 4mA and 5mA, with 4mA equal to 0% sensor life and 5mA equal to 100% sensor life. The output then returns to 4mA for the remainder of the Cal Purge Delay. For example, if after a calibration sensor life is 75%, the BFT-44 transmits 4.75mA during the 5 second interval.

Note: Send SensrLife should always be set for No unless the 4-20 mA receiver is capable of interpreting the sensor life signal. The Buckeye Detection Systems BFC-16 and BFC-64 are both capable of this function.

4.7.2.8 *ALM REFRESH (M)*

Alarm Refresh allows reactivation of Acknowledged alarms after the time period expires. This feature is used primarily to restart audible alarm devices after having been silenced by an acknowledge function (via serial port or swiping the Up/Reset button). An entry of 0 minutes effectively disables the Alarm Refresh function. A maximum of 60 minutes is allowed.

4.7.3 DIGITAL INPUT

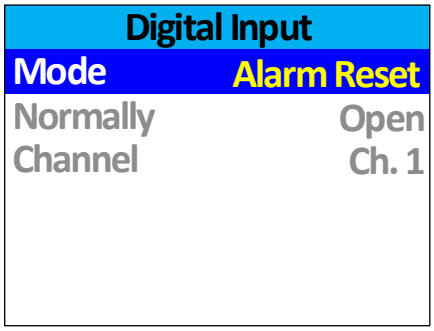


Figure 4-32 Digital Input System Menu

If a digital input is installed on the BFT10-0388 Relay/RS-485 Option Board, the Digital Input Menu can be set to one of three available configuration options:

1. *Alarm Reset* – when selected any active alarms, acknowledge enabled, will be acknowledged and reset when an input is received.
2. *A3 Override* – when selected, Alarm 3 will be activated on the selected channels when a signal is received. The *Normally* menu option refers to the type of connection to the digital input. If the input is normally a short it should be set to Normally Closed, otherwise it should be set to open (This is useful in a similar manner to the Failsafe mode mentioned in Section 4.3.1.3.)
3. *Flt Override* – when selected, the Fault Alarm will be activated on the selected channels when a signal is received. The *Normally* menu option refers to the type of connection to the digital input. If the input is normally a short it should be set to Normally Closed, otherwise it should be set to open (This is useful in a similar manner to the Failsafe mode mentioned in Section 4.3.1.3.)

4.7.4 VIEW EVENT LOG

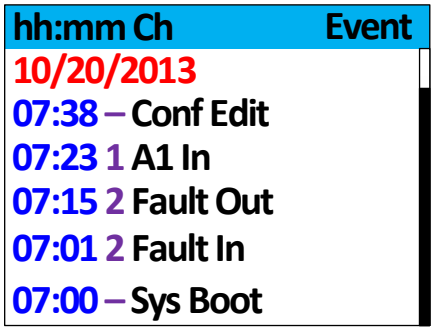


Figure 4-33 View Event Log System Menu

View Event Log displays the Event Log for the unit, which displays the last 100 events. Swipe up and down to scroll through the log. Entries have a date and time stamp followed by the channel number (or dash for system entries) and the type of event logged.

Logged events include:

1. Alarms/Fault In and Out
2. Alarm and Remote Alarm Resets

3. Alarm Refresh
4. Event Log Cleared
5. Configuration Changed
6. Calibration in and out
7. System and Cold Boots
8. Communication and Configuration Errors
9. Corrupt Sensor
10. Sensor Error
11. Configuration Edits

4.7.5 CLEAR EVENT LOG

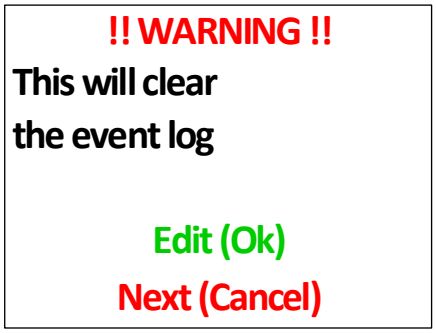


Figure 4-34 Clear Event Log System Menu

Clear Event Log clears the event log, swipe the Edit key to confirm.

4.7.6 VIEW SENSOR LIFE

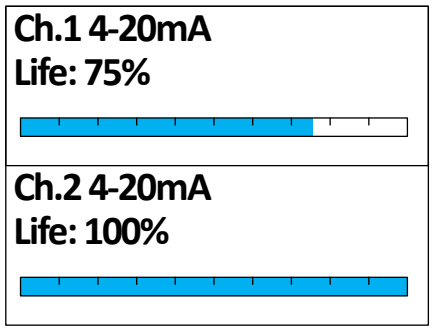


Figure 4-35 View Sensor Life System Menu

View Sensor Life provides an indication of the Sensor Life remaining. This percentage is calculated by comparing the amount of gain needed to be applied at the most recent calibration when compared to the amount of gain needed to be applied at the initial calibration.

4.8 DIAGNOSTICS

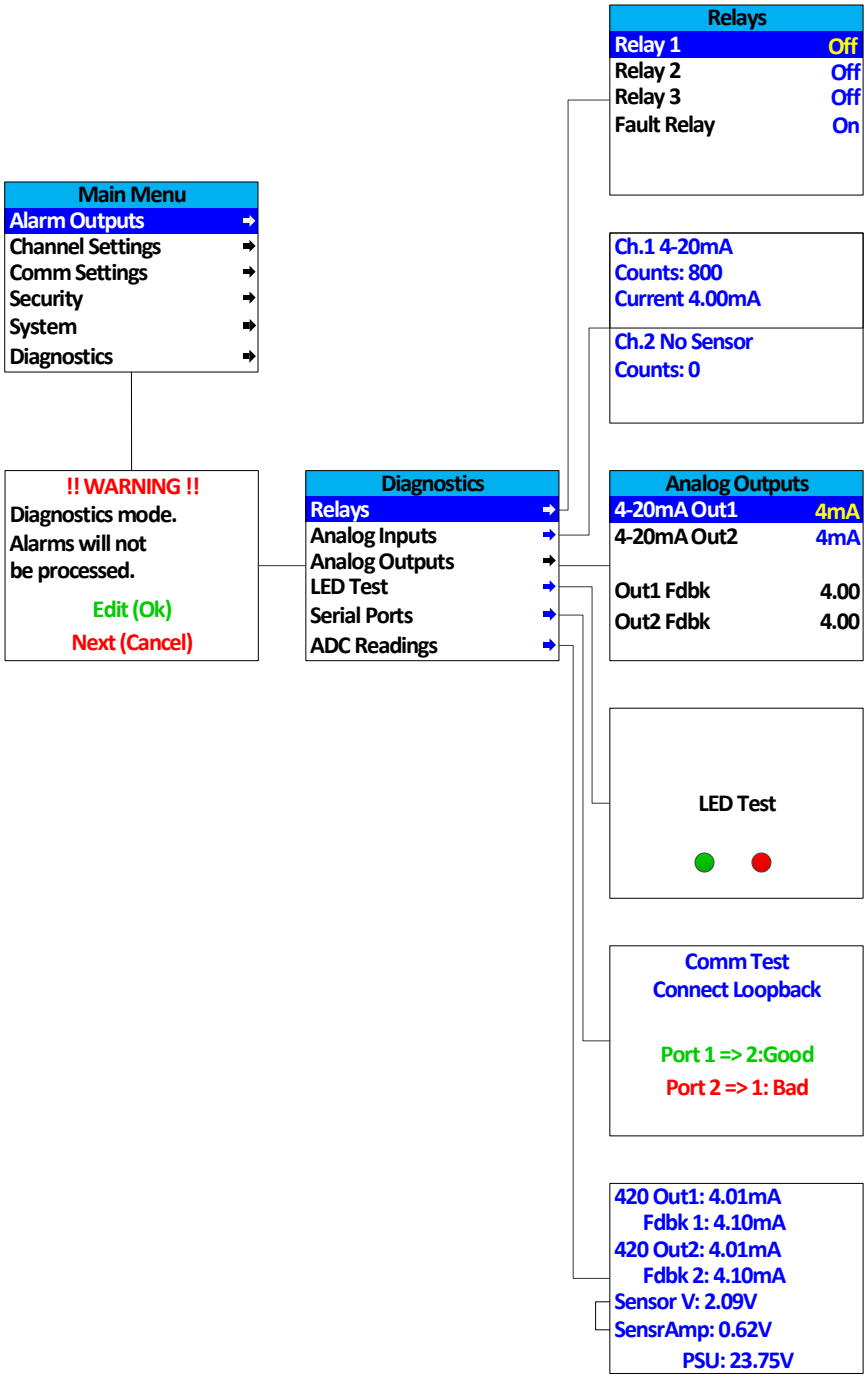


Figure 4-36 Diagnostics Menu Tree

A System Diagnostic Mode shown in Figure 4-36 may be entered during normal operation from the Main Menu. The entry menu offers useful routines for testing front panel LEDs, relays, serial ports, ADC readings and analog I/O. It is exited manually by swiping the Next key with a magnet, and automatically if no keys are swiped for five minutes.

Caution: It is very important to understand that **CHANNEL DATA IS NOT PROCESSED DURING THE SYSTEM DIAGNOSTICS MODE**. It is possible to miss important input values while utilizing this mode, and appropriate safeguards should be in place. However, the System Diagnostics Mode can prove invaluable when testing I/O since relays and analog outputs may be stimulated without driving inputs to precise levels.

4.8.1 RELAYS

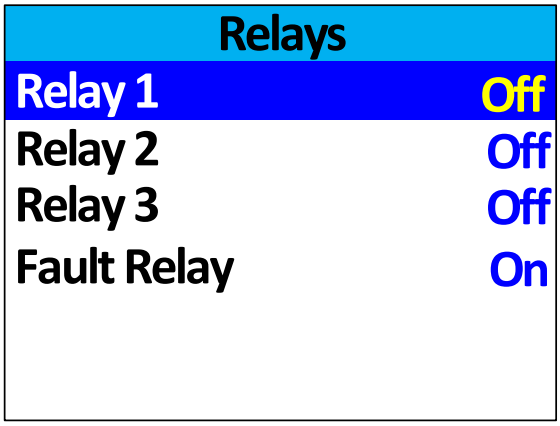


Figure 4-37 Relay Diagnostics Menu

The **Relays Menu** allows manual actuation of the Relays (optional BFT10-0388 BFT-44 Relay/RS-485 Option Board) while in the System Diagnostics Mode. Highlight the relay to be actuated and swipe Edit. Confirm relay actuation, and swipe Edit again to de-energize the relay.

4.8.2 ANALOG INPUTS

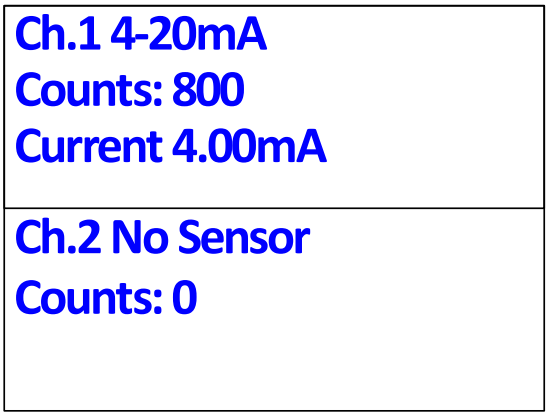


Figure 4-38 Analog Inputs Diagnostics Menu

The **Analog Inputs Menu** displays both channel's raw counts and input data.

4.8.3 ANALOG OUTPUTS

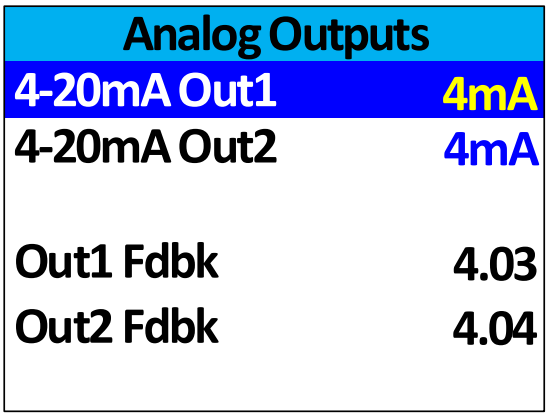


Figure 4-39 Analog Outputs Diagnostics Menu

Analog Outputs manually stimulates the 4-20mA outputs by selecting the channel and swiping EDIT. Each swipe increments the output by 4mA from 0-20mA. The Out1 Fdbk and Out2 Fdbk can be useful in determining if there are issues with the output. A circuit is installed on each of the two outputs which measures the actual current flow out of the output terminals. If this number reads zero when an output is stimulated, it could indicate that there is a cut wire or some other failure in connection with the wiring to the controller.

4.8.4 LED TEST

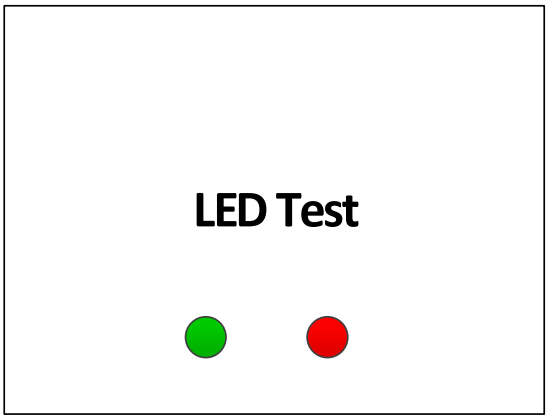


Figure 4-40 LED Test Diagnostics Menu

LED Test causes the two LEDs on the front panel to blink alternating red and green.

4.8.5 SERIAL PORTS

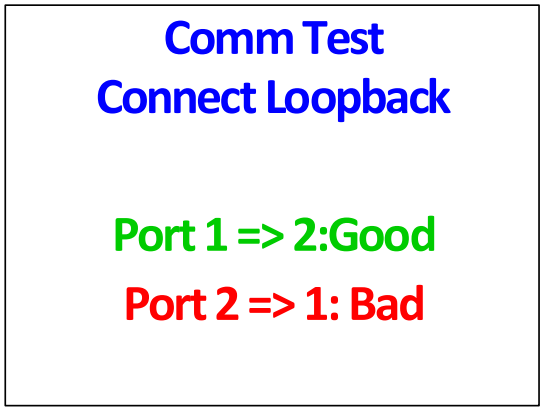


Figure 4-41 Serial Ports Diagnostics Menu

Serial Ports is used to test the two communication ports on the optional BFT10-0388 Relay/RS-485 Modbus Option Board. To test the Serial Ports connect A1 to A2 and B1 to B2, and set jumpers J3 and J5 to dual port mode, position B. The screen will then display a Good or Bad status report as shown in Figure 4-41.

4.8.6 ADC READINGS

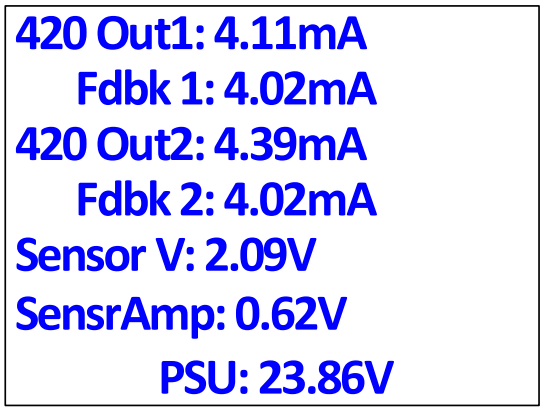


Figure 4-42 ADC Readings Diagnostics Menu

The **ADC Readings** displays Channel 1/2 4-20mA output and feedback current, sensor voltage for bridge inputs and sensor amplifier and power supply voltage as shown in Figure 4-42. These values may be useful to technicians when trying to determine whether or not a sensor is working properly.

The Fdbk1 and Fdbk2 can be useful in determining if there are issues with the output. A circuit is installed on each of the two outputs which measures the actual current flow out of the output terminals. If this number reads zero when an output is stimulated, it could indicate that there is a cut wire or some other failure in connection with the wiring to the controller.

Chapter 5 Modbus

The BFT-44 may be equipped with two optional (BFT10-0388 Relay/RS-485 Modbus Option Board) RS-485 ports which can be independently configured as Modbus master or slave. Chapter 5 defines register locations of data available via the BFT-44 slave port.

5.1 MODBUS TCP

In addition to the RS-485 ports, the BFT-44 supports both master and slave Modbus TCP. Modbus TCP is always enabled through the Ethernet port. The unit can be polled by its IP Address. When Modbus TCP slave is used, the Slave ID field of the message is ignored. Channels can be configured to poll using the BFT-44's Modbus TCP master interface. Devices are polled by IP Address.

5.2 MODBUS SLAVE WRITES

The Modbus slave ports allow function code 5(write coil), as well as function code 6, and 16 (write holding registers). These function codes can be used to write configuration parameters to the BFT-44. By default, all Modbus writes are disabled except the unlock parameter 40099. The Modbus lock code can be written to register 40099 to enable writes to other registers. The unit will be unlocked for 10 minutes after the last write occurs. After the 10 minute timeout, the unit will automatically save any parameters that have been written to. All written parameters can be saved manually by writing a value of 1 to coil 95 or register 40095.

Writing parameters that span multiple register (such as 32bit floating points) requires function code 16. All registers must be written at once.

5.3 MODBUS SLAVE REGISTER LOCATION

The following table describes the BFT-44's Modbus slave database. Any portion of this data may be read by a Modbus master device such as a PC, PLC or DCS. Since the Modbus port is RS-485, multiple BFT-44s may be multi-dropped onto the same cable.

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
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

Chapter 6 Special Features

6.1 WEBPAGE

All BFT-44 transmitters come standard with an embedded webpage. The webpage gives remote access to view and configure parameters inside the transmitter. The required login allows the user to change configuration parameters directly from the computer.

The webpage requires a modern web browser. Supported browsers include Internet Explorer 8*, Google Chrome, or Mozilla Firefox 2+. Viewing pages in an outdated browser will result in improperly drawn pages.

In order to view the webpage first the user must know the IP address or, if DHCP enabled, the transmitter's hostname. This information can be viewed from the Network Settings Menu (see Section 4.5.3). The user will be able to see channel data, event logs and configuration. If a parameter needs to be changed the user must login before the transmitter will accept the change. This login password can be changed in the Security menu under Modbus/Web Code (see Section 4.6). The default Modbus/Web Code is **1234**.

* Internet Explorer does not allow access to hostnames that contain a '_' character.

6.1.1 STATUS SCREEN

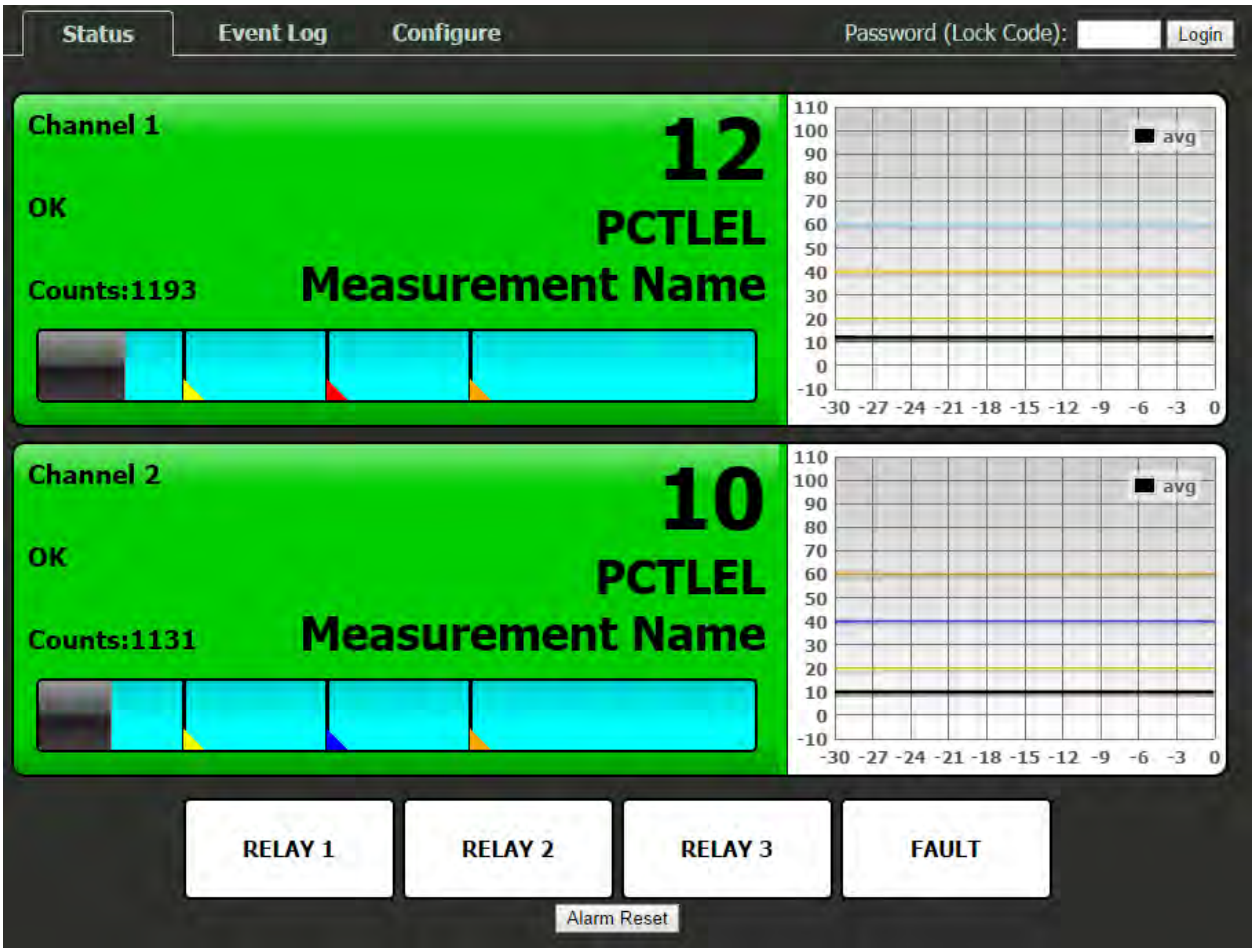


Figure 6-1 Status Screen

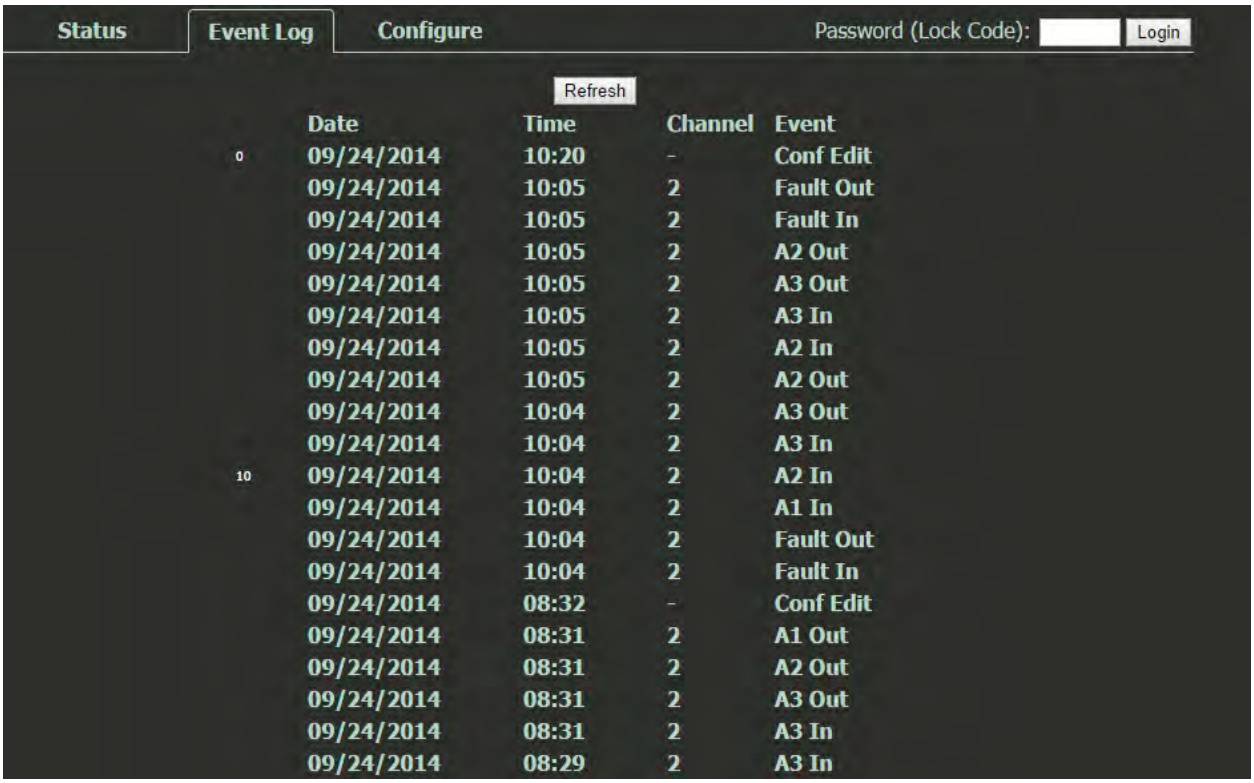
The **Status Screen** shown above (Figure 6-1) displays the active channels simultaneously depending on the transmitter's configuration. This screen, similar to the Dual Channel screen, displays the measurement name and reading, and uses colored cells that flash with new alarms to indicate alarm conditions. Once the alarms have been acknowledged by an operator, the cell will remain the appropriate color but will stop flashing, showing the alarm has been acknowledged.

The four alarm relay states are shown at the bottom of the screen. A red box indicates an energized (de-energized in fail safe) relay.

A thirty minute trend graph is viewable on the right hand side of the screen. Vertical tic marks are each 10% of full scale. Colored lines indicate alarm levels. Since each data point must be collected for several seconds before it may be displayed it is likely input values will fluctuate during this interval. In this case a light blue indicates a minimum value and a brown line indicates a maximum value.

The Status Screen is updated automatically every 15 seconds.

6.1.2 EVENT LOG SCREEN



	Date	Time	Channel	Event
0	09/24/2014	10:20	-	Conf Edit
	09/24/2014	10:05	2	Fault Out
	09/24/2014	10:05	2	Fault In
	09/24/2014	10:05	2	A2 Out
	09/24/2014	10:05	2	A3 Out
	09/24/2014	10:05	2	A3 In
	09/24/2014	10:05	2	A2 In
	09/24/2014	10:05	2	A2 Out
	09/24/2014	10:04	2	A3 Out
	09/24/2014	10:04	2	A3 In
10	09/24/2014	10:04	2	A2 In
	09/24/2014	10:04	2	A1 In
	09/24/2014	10:04	2	Fault Out
	09/24/2014	10:04	2	Fault In
	09/24/2014	08:32	-	Conf Edit
	09/24/2014	08:31	2	A1 Out
	09/24/2014	08:31	2	A2 Out
	09/24/2014	08:31	2	A3 Out
	09/24/2014	08:31	2	A3 In
	09/24/2014	08:29	2	A3 In

Figure 6-2 Event Log Screen

The **Event Log Screen** displays the last 100 events logged in the BFT-44. The events are logged in a first in first out format, in non-volatile memory.

Logged events include:

1. Alarms/Fault In and Out
2. Alarm and Remote Alarm Resets
3. Alarm Refresh
4. Event Log Cleared
5. Configuration Changed
6. Calibration in and out
7. System and Cold Boots
8. Communication and Configuration Errors
9. Corrupt Sensor
10. Sensor Error
11. Configuration Edits

The events are time and date stamped and if channel specific the number of the channel is shown in the third column in Figure 6-2 above.

6.1.3 CONFIGURE

The configuration pages allow viewing and editing of most system parameters. The exceptions are communication and security settings which must be set from the unit's magnetic switch interface. All changes made to the parameters will not be saved until the user has entered the correct login password.

6.1.3.1 RELAY CONFIG

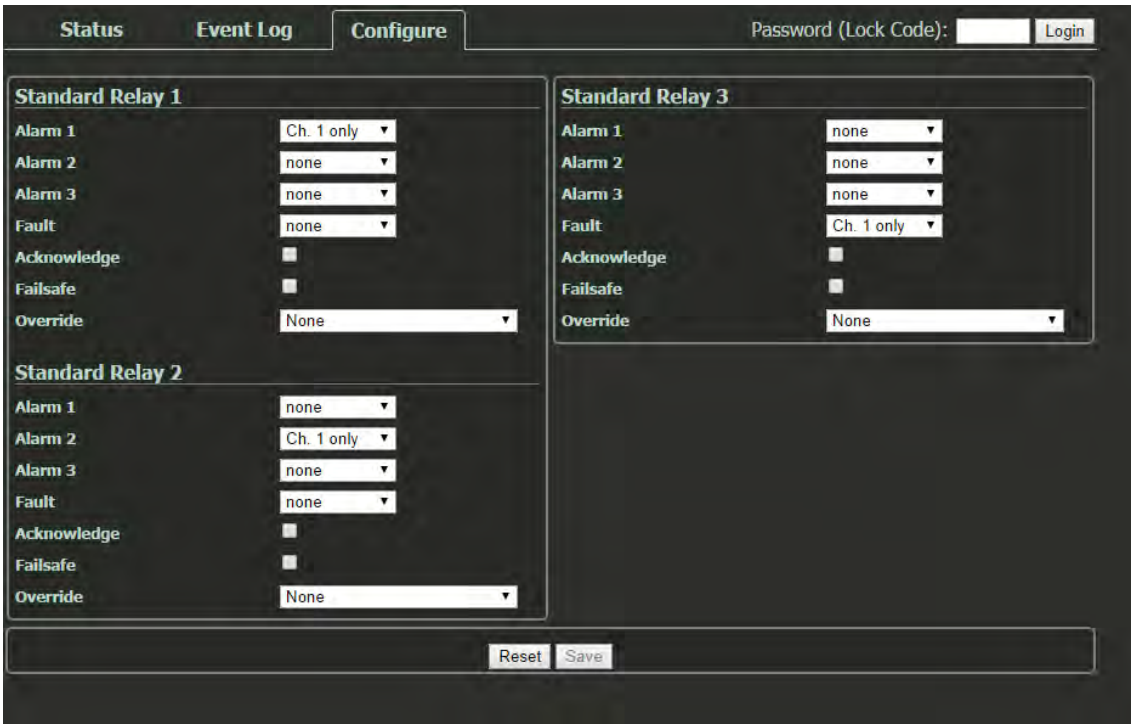


Figure 6-3 Relay Config Screen

The **Relay Config Screen** is shown in Figure 5-3. For information on how to configure the relays, refer to Section 4.3.

6.1.3.2 CHANNEL CONFIG

Figure 6-4 Channel Config Screen

The **Channel Config Screen** is shown in Figure 6-4. For information on how to configure channels refers to Section 4.4.

6.1.3.3 *SYSTEM CONFIG*

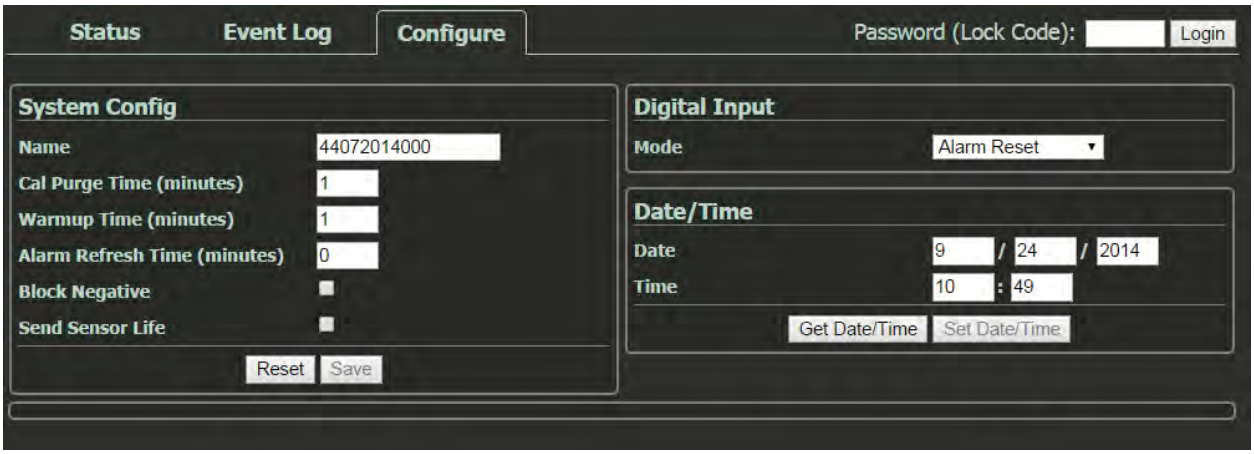


Figure 6-5 System Config Screen

The **System Config Screen** is shown in Figure 6-5. For information on how to configure the system, refer to Section 4.7.

6.1.3.4 *CONFIG TRANSFER*

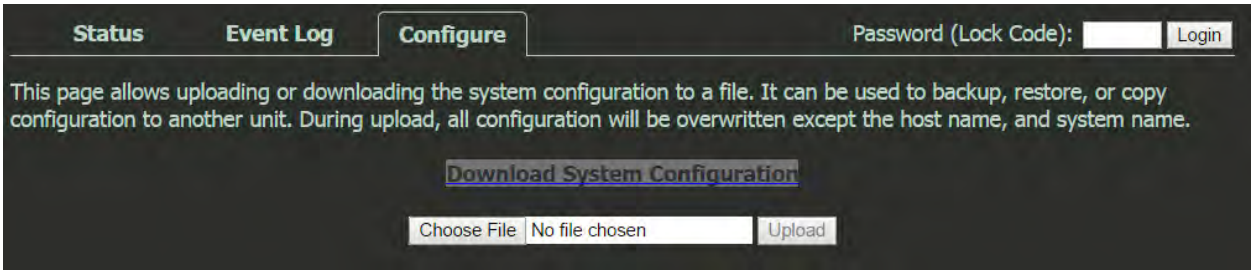


Figure 6-6 Config Transfer Screen

The **Config Transfer Screen**, Figure 6-6, allows the transferring of system configuration to or from the unit via the webpage. When the download link is clicked, the unit saves the current configuration into a file and transfers it to the user. It should be save as a .cfg file. When uploading configuration, select a .cfg file and press upload. Note that the maximum length of a filename for an uploaded file is 28 characters. After a successful upload, the unit will restart and the webpage will attempt to refresh after 30 seconds.

6.2 NETWORK CONNECTION

6.2.1 DIRECT CONNECTION WITH CROSSOVER CABLE OR HUB/SWITCH

If a network is not available, or if it is desired to keep the BFT-44 and PC(s) completely separated from other computer, a simple network can be created.

The simplest network can be created by connecting the BFT-44 to a PC directly using an Ethernet crossover cable. Many modern computers have automatic detection/switching on the port. In most cases a normal patch cable can directly connect the BFT-44 to a PC.

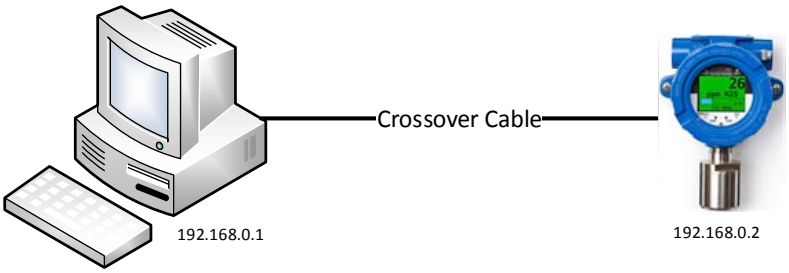


Figure 6-7 Direct Connection with Crossover Cable

If a crossover cable is not available, or if multiple computers need access to the BFT-44, a switch can be connected to the BFT-44 and one or more computer using standard patch cables.

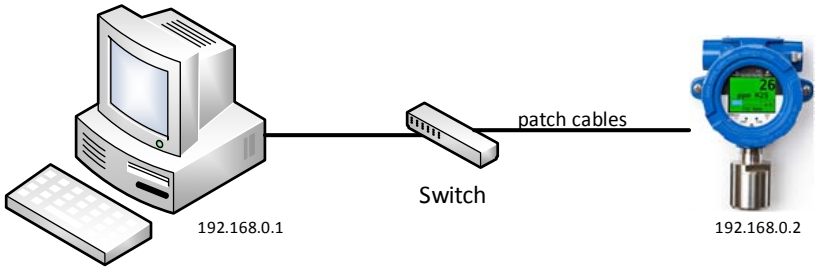


Figure 6-8 Direct Connection with Switch and Patch Cables

These simple networks will not likely have access to a DHCP server. In this case, if the BFT-44 is configured for DHCP, it will automatically select an IP address on the subnet 169.254.x.x. This subnet uses a netmask of 255.255.0.0 and is compatible with the default IP address chosen by Microsoft Windows. Simply connect the PC with a patch cable. Then view the BFT-44 'Communication Settings'->'Network Settings' Menu. The IP address field will show a value which can be entered into the web browser to view the webpage.

The recommended option for a permanent network is to set up a static IP on the BFT-44 and any other devices (or computers) on the network (See Section 6.2.4).

6.2.2 CONNECTING THE BFT-44 TO AN EXISTING LAN

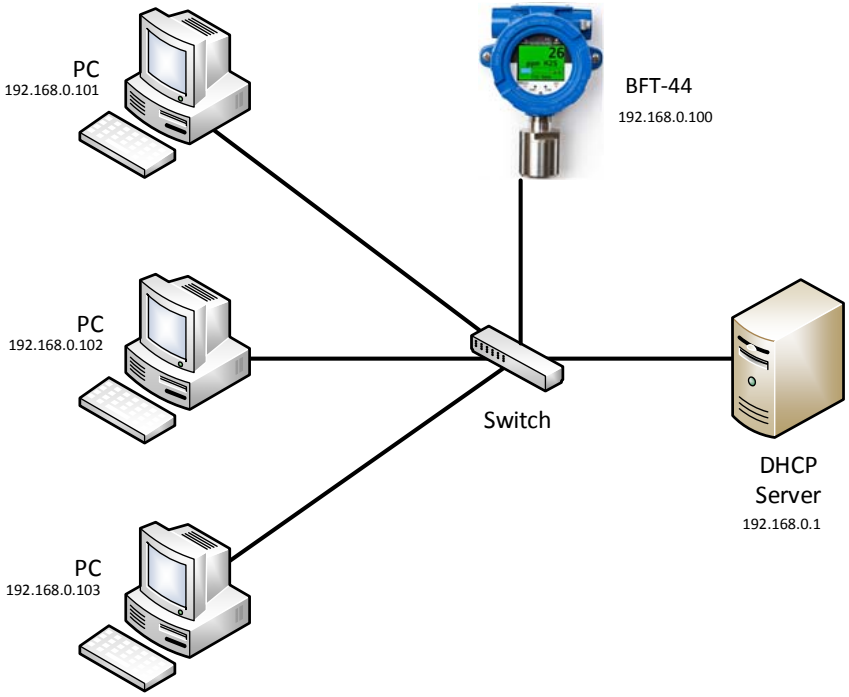


Figure 6-9 Connecting the BFT-44 to an Existing LAN

A typical network will have a DHCP server, a switch (sometimes combined) and several devices connected to that switch. An BFT-44 can normally be added to such a network simply by connecting the Ethernet port to the switch using an Ethernet patch cable. The BFT-44's default settings will allow it to obtain an IP address from the DHCP server. Once this happens, the BFT-44 can be accessed from computers and other devices on the network. Computers access the BFT-44 by hostname, or by IP address.

If more than one BFT-44 is on the network, and if they need to communicate with each other, it is recommended to use a static IP configuration (see Section 6.2.4). This is because there is a possibility that a dynamic address will be changed by the DHCP server. If the IP address is changed, communication will fail. Static configuration is necessary when using ModbusTCP master or slave mode over TCP/IP.

If accessing the BFT-44 from a computer or other device that can resolve its hostname, dynamic configuration is fine.

6.2.3 CONNECTING THE BFT-44 TO AN ISOLATED NETWORK

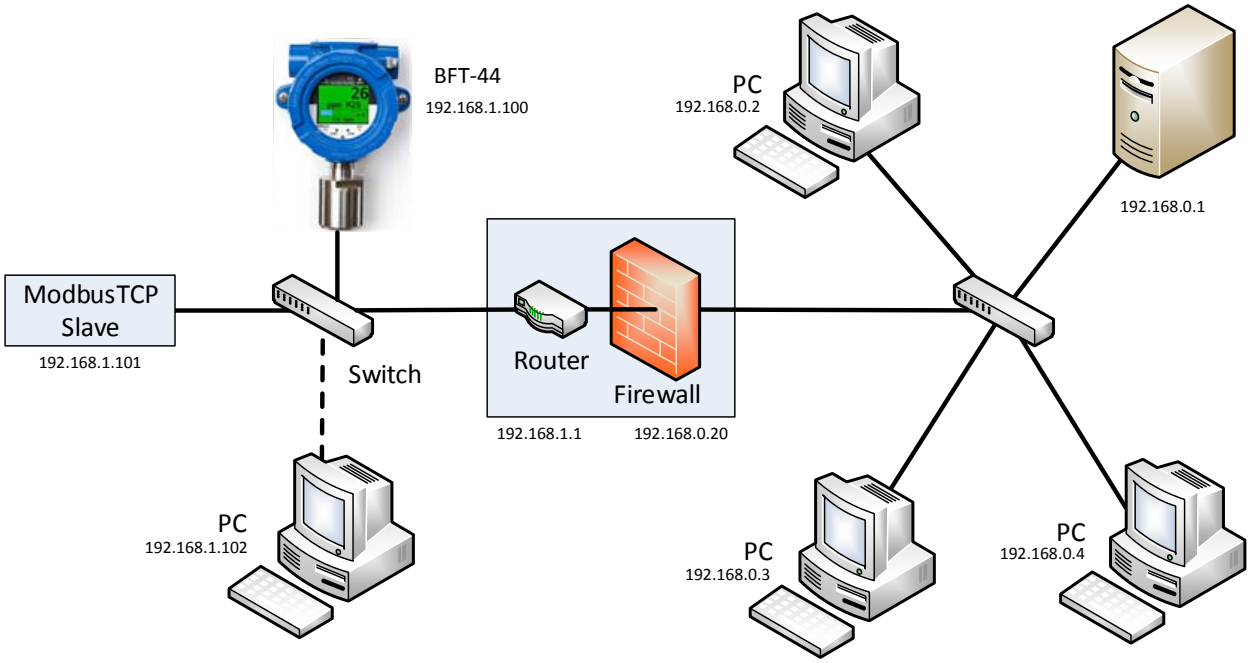


Figure 6-10 Connecting the BFT-44 to an Isolated Network

Another possible network configuration for the BFT-44 involves connecting the transmitter, with ModbusTCP slave devices, and possibly computers on a network. This network can then be isolated from a larger company network using a router/firewall. The isolated network will not see any traffic from the company network unless port forwarding rules are set up in the router. This configuration offers greater security and improved network performance when the company network has a large amount of traffic.

When creating an isolated network, make sure to use a different private IP address range than the outside network. For example, if the main network uses 192.168.0.0 – 192.168.0.255 with a netmask of 255.255.255.0, the isolated network could use 1.9.168.1.0 – 192.168.1.255 with the same netmask.

Port forwarding rules can usually be configured to only allow certain computers outside the firewall access to the BFT-44. The method for creating forwarding rules is heavily dependent on the router/firewall being used. See router documentation. The IP address or MAC address of the source (outside computer), Incoming port, destination (BFT-44) IP address, destination port, and protocol will need to be set. The source IP address should be set to allow a range or single IP address. Some firewalls can restrict access by MAC address. This can be used instead of or in addition to the source IP address. The protocols for forwarding rules should be TCP/IP. The destination ports should be 80 for access to the web server, and 502 for access to ModbusTCP.

In most cases, a router and firewall will separate the network from the internet. It is not recommended to forward ports from the internet to an BFT-44. In cases where offsite access is needed, a VPN, or tunnel, connection could be used to get inside the network.

6.2.4 STATIC IP CONFIGURATION

If you are setting up a Static IPs on a larger company network, make sure to consult your IT administrator to obtain an IP address. The IT administrator can also provide the correct netmask, and gateway. In this case, do not choose your own addresses or you could cause an address conflict with other devices on the network.

6.2.4.1 ST-44 STATIC IP CONFIGURATION

On the BFT-44, in the Network Settings Menu, disable DHCP. The IP address should be set to 192.168.0.x where 'x' is any number from 0 to 255. A typical address would be 192.168.0.76. The netmask should be set to 255.255.255.0. The gateway can be left as 0.0.0.0 unless the BFT-44 will be accessing ModbusTCP devices outside a router/firewall. If the BFT-44 needs to poll outside, devices, the gateway IP should be set. This is typically the IP address of a router.

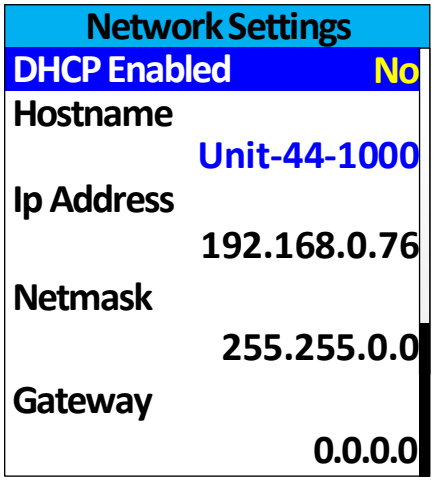


Figure 6-11 Network Settings Menu

After making changes to the Network Settings Menu, a power cycle is required. Make sure to exit the menu before cycling power so that the changes are saved.

6.2.4.2 WINDOWS XP STATIC IP CONFIGURATION

These steps are similar but not exactly the same in other versions of Windows.

To connect a PC to a BFT-44 using static IP configuration, the PC must also be configured. First, access the PCs network adapter settings. In Windows XP, this can be found in the Control Panel -> Network Connections. Open the network adapter which is usually called 'Local Area Connection'.

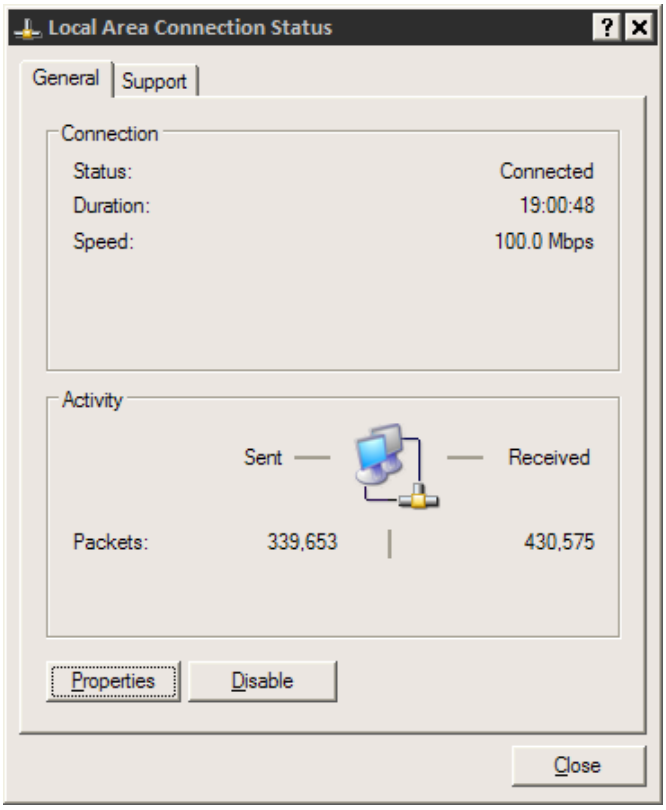


Figure 6-12 Local Area Connection

Click the Properties button.

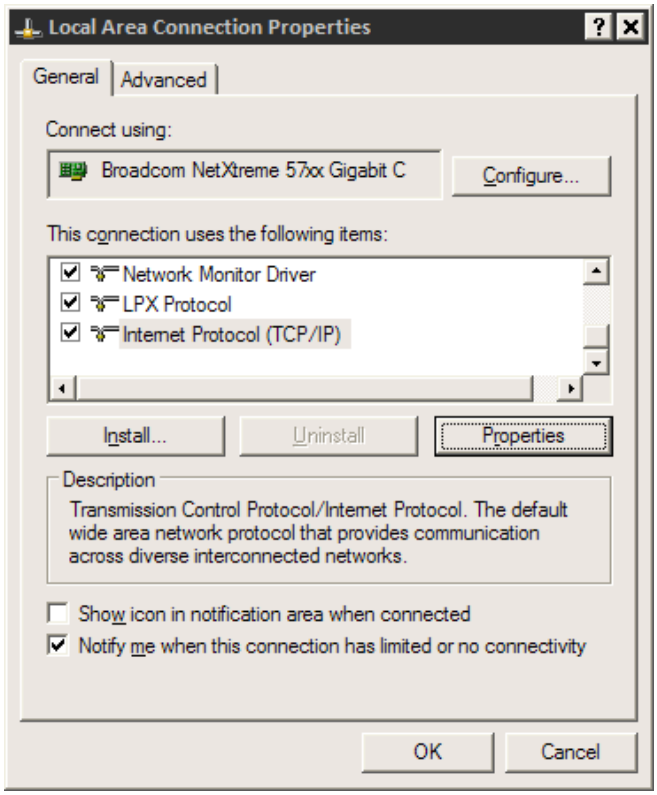


Figure 6-13 Local Area Connection Properties

Select "Internet Protocol (TCP/IP), and then click the Properties button.

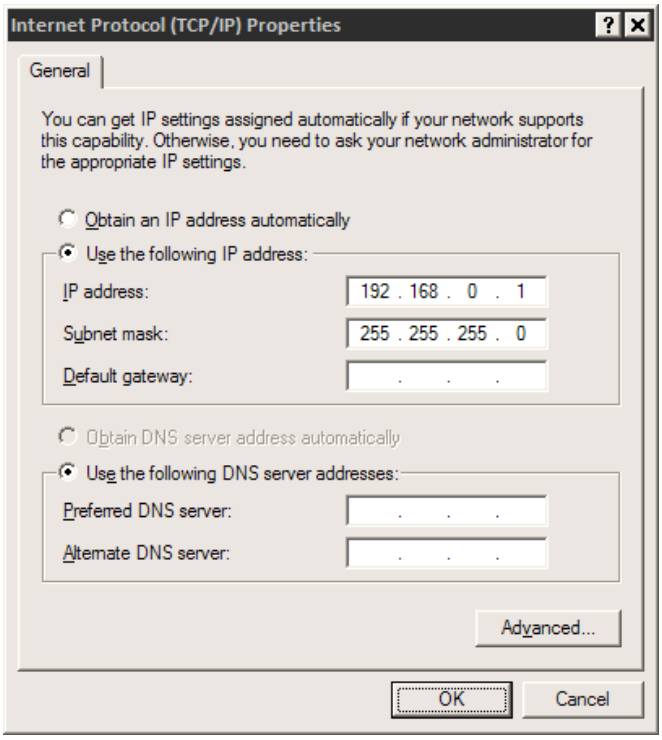


Figure 6-14 Internet Protocol (TCP/IP) Properties

Select "Use the following IP Address". The IP address should be chosen different than the one set on the BFT-44. For the network created in the 'BFT-44 Static IP Configuration', only the last digit can be changed. A typical choice is 192.168.0.1. The subnet mask is set to 255.255.255.0. If a gateway is present, its address should be set; otherwise it can be left blank. Click OK, and the OK again to apply these changes.

6.2.4.3 DYANMIC IP CONFIGURATION

The BFT-44 defaults to use a dynamic IP address. This setting may be used if a DHCP server is available on the network. It is recommended for BFT-44s unless there are multiple BFT-44s that need to communicate to each other.

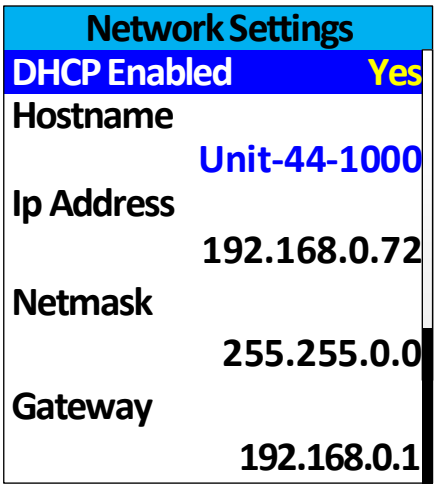


Figure 6-15 Network Settings Menu with DHCP Enabled

To enable dynamic IP, set DHCP to Yes in the Network Settings Menu. Power must be cycled before this change takes effect. Make sure to exit the menu so the settings are saved before cycling power.

A PC will normally have DHCP enabled by default. If not, follow the steps in Section 6.2.4.2, except choose "Obtain IP Address Automatically" in the last step.

6.2.5 TESTING CONNECTIONS

To verify that an BFT-44 is accessible, bring up a command prompt. In Windows, this can be found by going to 'Start' -> 'Run'. Then type 'cmd' and press ok. From the command prompt, type ping and then the IP address of the unit. Verify that the 4 reply lines are printed.

6.3 RELAY OPTION BOARD BFT10-0388

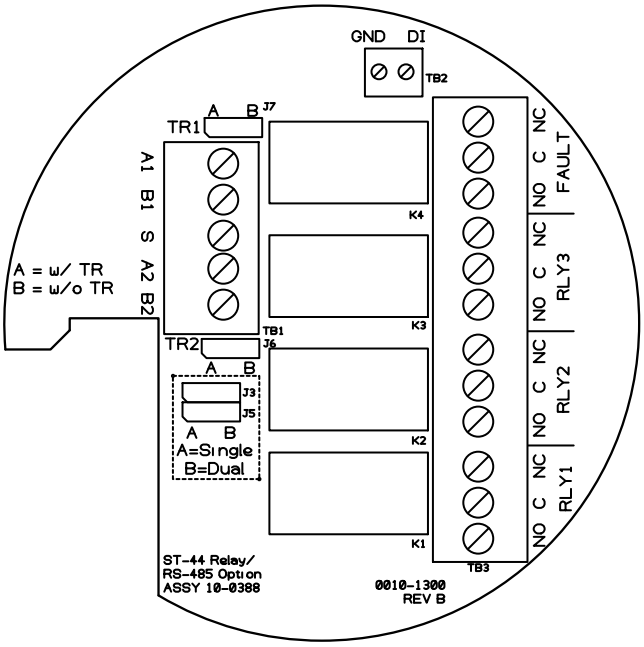


Figure 6-16 BFT10-0388 Relay/RS-485 Option Board

The BFT10-0388 Relay/RS-485 Option Board comes equipped with the following features:

1. (2) RS-485 Modbus Communication ports
2. (3) Programmable relays
3. Dedicated Fault Relay
4. Digital Input

The B10-0388 is installed as a "piggyback" board on the back of the BFT-44's BFT10-0387 CPU/Display Board.

6.3.1 RS-485 MODBUS COMMUNICATIONS PORTS

The two available Modbus Communication ports may be configured to work as a single port or two independent ports by positioning J3 and J5 to the desired position. When the jumpers are installed in the A, or "Single", position, the two ports are tied together to form a single port, e.g. A1 = A2 and B1 = B2. When the jumpers are installed in the B, or "Dual", position, the two ports function independently A1 with B1 and A2 with B2.

Each communication port is configured independently as discussed in Section 4.5.1. For details on Modbus Slave Registers refer to Chapter 5.

RS-485 Modbus networks should be wired as shown in Figure 6-17. Each BFT-44 represents an RTU, and must have a unique Remote ID address. Remote ID addresses are assigned in the Data From Menus discussed in Section 4.4.1.3. Cabling must be a daisy chain as opposed to a star pattern for reliable operation. The "end of line" unit should have J6 and J7 installed in the A position.

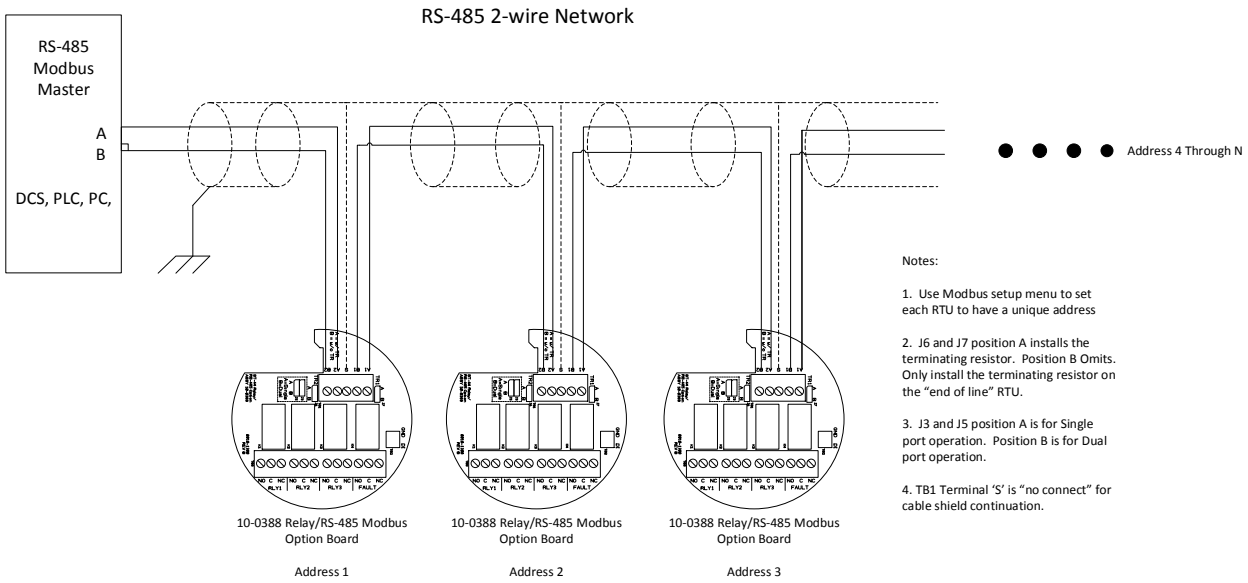


Figure 6-17 RS-485 Modbus Wiring

A convenient diagnostics tool is available to determine proper port configuration, and is discussed in Section 4.8.5.

6.3.2 PROGRAMMABLE RELAYS

Caution: Alarm relays have dry contacts and power must be supplied from an external source. If this power source exceeds 3 amps, users should consider fusing relay wiring with 3 amp fuses. Contacts are rated for RESISTIVE loads! Inductive loads, such as contactor coils or motors, may cause contact arcing. This will shorten life and emit RFI into the sensor signals. Use appropriate arcing snubber and MOVs across inductive loads, and keep wiring away from signal wires. External wiring to TB2 should be shielded and protected from noise spikes to prevent false alarm resets or overrides.

The relays installed on the BFT10-0388 are Relays are rated as form C 5AMP @ 30VDC and 240VAC RESISTIVE type relays.

Relay terminals are labeled NO (Normally Open), NC (Normally Closed) or C (Common, or pole). These designators correspond to the shelf, or de-energized, state of the relays.

The three programmable relays are configured either locally at the BFT-44 or remotely using the embedded webpage. To configure the relays locally at the BFT-44 transmitter refer to Section 4.3.1. To configure the relays via the embedded webpage refer to Section 6.1.3.1. A convenient diagnostics tool is available for testing relay wiring and operation, and is discussed in Section 4.8.1.

6.3.3 FAULT RELAY

Caution: Alarm relays have dry contacts and power must be supplied from an external source. If this power source exceeds 3 amps, users should consider fusing relay wiring with 3 amp fuses. Contacts are rated for RESISTIVE loads! Inductive loads, such as contactor coils or motors, may cause contact arcing. This will shorten life and emit RFI into the sensor signals. Use appropriate arcing snubber and MOVs across inductive loads, and keep wiring away from signal wires. External wiring to TB2 should be shielded and protected from noise spikes to prevent false alarm resets or overrides.

6.3.4 DIGITAL INPUT

6.4 REMOTE SENSOR OPTION BOARD BFT10-2080

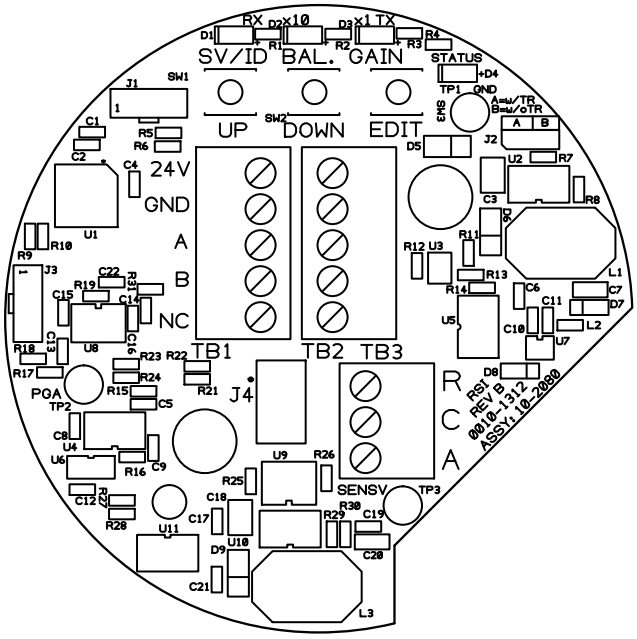


Figure 6-18 BFT `10-2080 Remote Sensor Option Board

Buckeye Detection Systems
110 Kings Road
Kings Mountain, NC 28086
1-800-438-1028
www.buckeyefire.com
bfec@buckeyef.com

BLUETICK, INC.

RMC User Manual

Version GR1.0.6_v13

Remote Monitoring and Control System

1501 Highwoods Blvd • Suite 104
Greensboro, NC 27410
Phone 877.283.3442 • Fax 336.294.8532
www.bluetickinc.com

Table of Contents

Introduction to RMC

The single most important component of Bluetick's production automation program is the Remote Monitoring and Control system (RMC).

Bluetick's Remote Monitoring and Control (RMC) solution allows you to connect directly to your wells, compressors, tanks, environmental monitors, flow meters and other field assets. The RMC system seamlessly gathers data from sensors and field equipment then transports the data to our secure servers for storage and distribution on the Network Operations Center (NOC). The information gathered by the NOC is available on the RMC Web Portal online 24/7 for you to view, process, and monitor the current status of your field assets. The RMC web portal is a unique service which functions to increase the efficiency and productivity of your operations. Its intuitive features allow you to customize and organize sets of data to fit your specific needs. A personalized alarm and notification task center automatically alerts any individual or group with specific messages for quick problem solving. The web portal also offers detailed field reports with a trending capability to generate graphs for complete data analysis. In addition, the complete administration suite allows control users to provide and deny specific viewing rights to other users. The Bluetick RMC product was designed with your needs in mind to eliminate uncertainty and maximize productivity for your field operations.

Chapter 1

User Guide

A vital aspect of the RMC product is the web portal. The web portal is your access to the information collected and organized by the RMC. The web portal is readily available 24/7 through your desktop and other mobile devices.

Google Chrome is the preferred browser for visualizing the RMC web portal. To download Google Chrome please go to http://www.google.com/chrome

1. The RMC Web Portal

Online Access URL: **https://rmc.bluetickinc.com**

Email Address: **"Provided by your Admin"**

Password: **"Provided by your Admin"**

1.1 Login to the RMC web portal

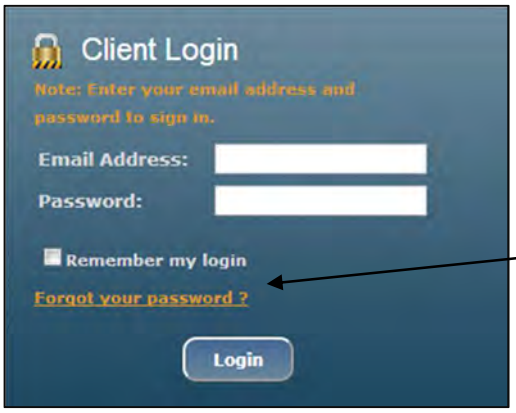
1. Go to the online access URL: https://rmc.bluetickinc.com
2. A webpage will appear like the one below.

3. Use the Client Login section of the page to enter the site.

1.2 Retrieving your password

1. Go to the online access URL: https://rmc.bluetickinc.com
2. On the bottom right of the display page is a login section.

The administrator will need to create login accounts with the company subdomain even for the personnel that do not have a company email address.

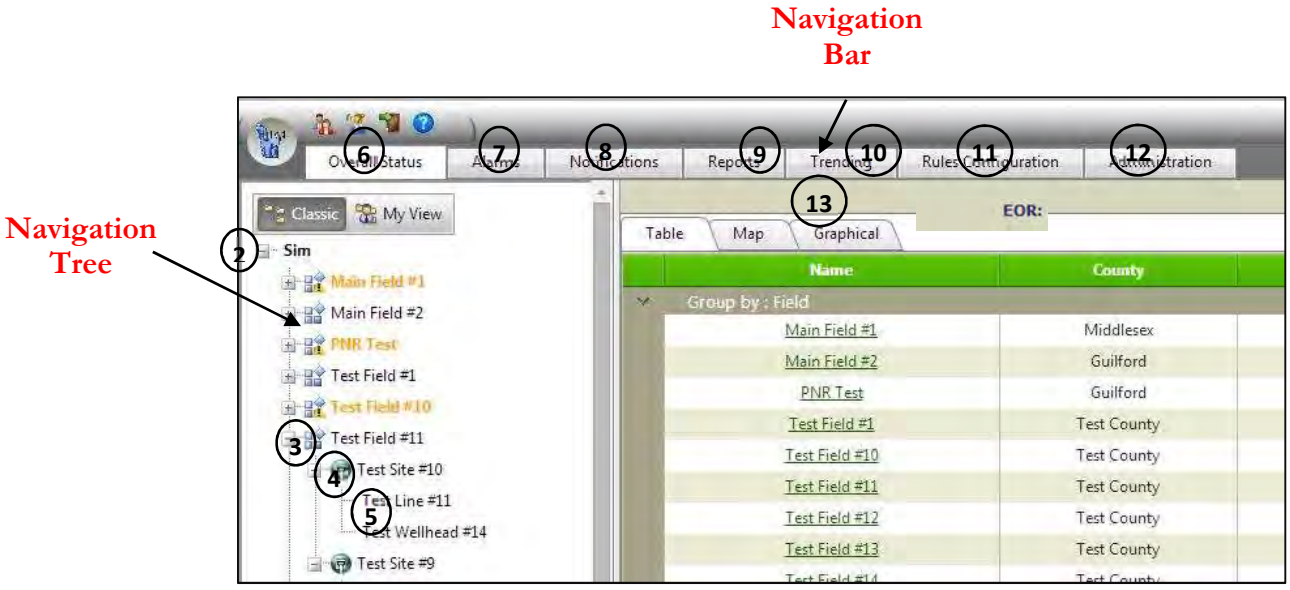


Click here to retrieve a forgotten password.

3. A message will appear and prompt you to enter in your username. Your username is also your e-mail address.

1.3 Navigating the main web portal display page

The instructions in this chapter will describe the navigation and basic functions of the online web portal. The numbers in the graph below correspond with the terms explained on the next page.



Corresponding Key Tabs:

- Diesel the Blue Dog 
  When clicked, the **Blue Dog** button activates the configuration drop box. From the drop box, you will be able to edit the look of your pages through the **Content Pane**. You can also enable/disable the **Ticker** as well as control its speed. The third point on the drop box is **Change Password**.

- My Profile 
  1st icon to the right of the Blue Dog is the **My Profile** button, which allows you to edit your name, password, password retrieval question and answer.

- Support 
  2nd icon to the right of the Blue Dog is the **Support** button, which takes you to Bluetick's support website.

- Log Out 
  3rd Icon to the right of the Blue Dog is the **Log Out** button, which allows the viewer to exit the site.

- Help 
  4th Icon to the right of the Blue Dog is the **Help** button, which directs the user to the Bluetick support phone number and website.

Clicking the company/ field site/ well site/ entity on the tree, then clicking a tab on the navigation bar will broaden or narrow the data results on the display page.

Navigation Tree

1. Blue Dog
2. Company name
3. Field site name
4. Site name
5. Line/ specific entity in the specific site listed above

A grayed out tab is used when the user was not given the privileges to access those items. The privileges are set by the system administrator.

Navigation Bar

6. Overall Status Tab
   The **Overall Status** tab on the navigation bar provides tables of data on each site for quick viewing. The **Overall Status** tab is useful for an overview of a specific or field to analyze productivity as a whole. *Refer to page 6 for more detail.*

7. Alarms

   The **Alarms** tab on the navigation bar generates a list of ***active*** and suppressed alarms as well as the ***history*** of activated alarms on the site. The ability to view all alarms on one page prevents redundancy in the alert system and helps the viewer notice specific alarm trends on a field or well site. *Refer to page 7 for more detail.*

8. Notifications

   The ***Notifications*** tab is an announcement page with separate categories for activities on the web portal. The ***Notifications*** tab is broken down into sub-pages to keep separate actions organized***: ASR, Calculation Alerts, User Request***, and ***Maintenance***. Notifications allow the Administrator to view how the web portal is being used by other viewers and stay informed on the status of the sensors. *Refer to page 9 for more detail.*

- Labels in blue indicate a sensor on the site is down.
- Labels in red indicate a critical alarm was activated on the site.
- Labels in orange indicate a major alarm was activated on the site.
- Labels in yellow indicate a minor alarm was activated on the site.

9. Reports

   The ***Reports*** tab displays the raw data and information collected from each sensor in the selected site. The reporting system allows users to develop company-wide, field wide, or specific entity reporting. Report requests are generated here and can be customized to enable automatic reporting and individual user distribution. *Refer to page 10 for more detail.*

10. Trending

    The ***Trending*** tab displays a set of graphs created from the collected field data. The graphs are useful for analyzing data over time. Reports can be generated from data collected specific time frames and then layered for comparison. *Refer to page 15 for more detail.*

11. Configuration

    The ***Configuration*** tab on the navigation bar is where the user creates rules through customized variables. Users can create simple or compound rules for any measurement on any device using the “if/then” structure provided. Each rule is then identified as minor, major, or critical severity with separate actions for alarm escalation. Alarms and rules insure that the viewer stays updated on important site activity. *Refer to page 16 for more detail.*

12. Administration

    The ***Administration*** tab on the navigation bar is an area to organize users into specific groups for different web portal actions like alarm notifications, alerts, or reports. This tab is broken down into ***individual users, groups, distribution lists,*** and ***call outs***. This page keeps all users and groups organized for quick editing and collective management. *Refer to page 22 for more detail.*

13. Ticker

The **Ticker** is a helpful feature which scrolls all active alarms for the fields, sites and entities allocated to the user. It's helpful for a user who wishes to check on an entity or site frequently. The **Ticker** can be edited under the **Blue Dog** button > **Ticker**.

Chapter 2

2. Overall Status

The Overall Status tab on the navigation bar provides a table of the latest readings on each site. The Overall Status tab is useful for an overview of a specific well or field to analyze overall productivity.

The instructions in this chapter will describe navigation and functions of the Overall Status tab on the navigation bar.

A viewer can automatically reach a specific site's page by clicking the desired site under the navigation tree, then clicking the Overall Status tab on the navigation bar.

2.1 Navigating the Overall Status Section

Starting with GR1.0.5 SP3, there are now three different ways to visualize the data collected by the RMC system.

1. Table View: This is the way the data has been presented in past releases.

2. Map View: Allow the user to see their assets overlaid on a map.

3. Graphical View: Allow the user to use gauges or static images with the measurement overlaying on top of it

You can access each one of these views by clicking the appropriate tab under overall status

Corresponding Key Tabs:

I. *Table View*
II. *Map View*
III. Graphical View

2.1.1 Table View

1. After clicking the *company* name on the tree, the main display page will organize the data into fields.
2. If clicked, the *green* name of the *field site* on the display page will direct you to the table view of the specific fields or quick stats of that field.
3. From there, clicking on the *green* name of the *well site* will bring you to the specific site page.

2.1.2 Map View

1. Click the Map Tab under overall status.
2. Clicking at the field level on the tree will set the view extent to all the sites on that field.
3. Clicking at the site level on the tree will set the view to the selected site only.

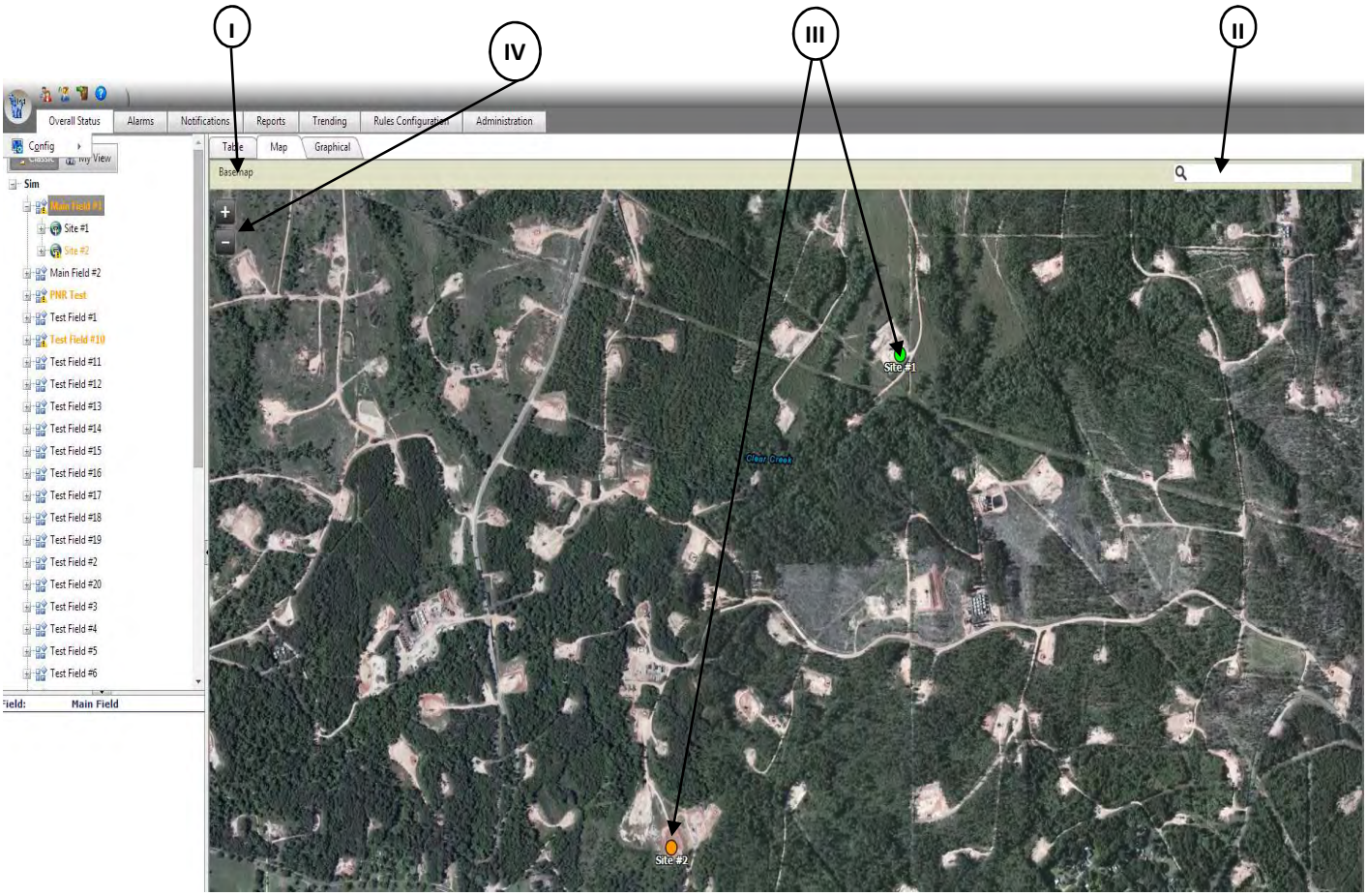
   The sites are represented by circles and are color coded based on their alarm condition. In order to see the measurements associated with the site, click the circle associated with the site.

   The user can change the base maps by clicking the base map button. Currently the following base maps are available.

   - Streets
   - Satellite
   - Hybrid
   - Topological
   - Grey

   The user can also use the search map function to quickly access site. Start typing at the site name and click the search magnifying glass.

   The user can Zoom in and Zoom Out by clicking the “+” and “-“ buttons, and can pan around the map by holding and click and moving around the mouse.



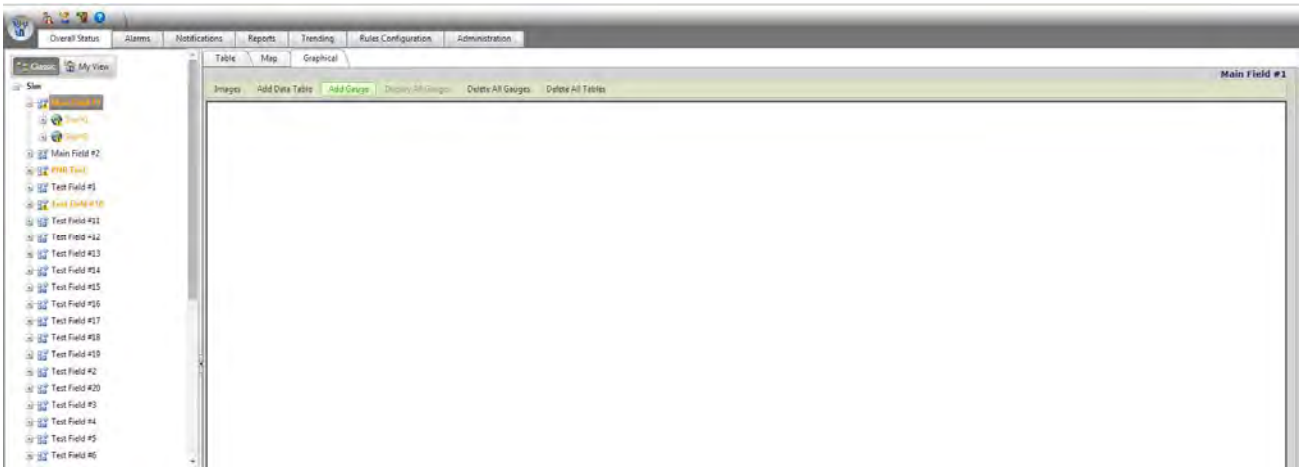
Corresponding Key Tabs:

I. *Base Map button:* Click here to select a base map.
II. *Search Function:* Type here the name of the site you want to locate.
III. Well Sites: Click the circle to get the measurements.
IV. Zoom in/Zoom Out: Click the button to change the zoom level of the map.

2.1.3 Graphical View

The graphical view allows the user to configure which measurements they would like to see by presenting them in a gauge or overlaying them over an existing image.

Once the graphical view is selected, the user will be presented with the following options as shown in the image below.



The choices are:

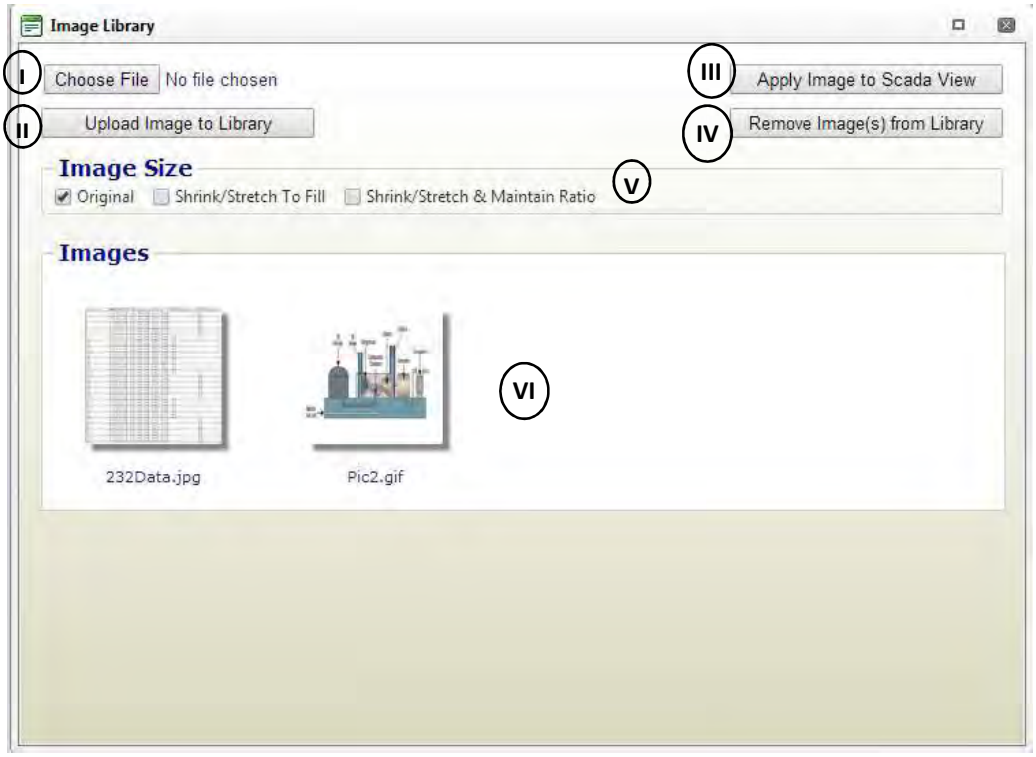
1. *Images:* This button is used to add background images (e.g your process images)
2. *Add Data Table*: This button to overlay RMC measurements over a loaded image
3. *Add Gauge:* This button is used to add a guage to the graphical view.
4. *Display All Guages*: This button is used to add gauges for all measurements for a Field/Site.
5. *Delete All Gauges*: This button is used to delete all guages associated with a Field/Site.
6. *Delete All Tables*: This button is used to delete all data table measuremets associated with a Field/Site.

2.1.3.1 Adding Background Images to the Library

The Bluetick RMC Graphical View feature allows the user to add background images at the Field/Site Level. The images are loaded to a library and can be used by all the authorized individuals in the Bluetick System. In order to add images to the library follow these steps.

1. Click the Field/Site where you would like to apply the background image
2. Click the **Graphical** tab under the **Overall Status** page.
3. Click on the **Images** button. A screen similar to the one below pops-up.
4. Click the **Choose File** button and select the image.
5. Click the **Upload Image to Library** Button. The image will be uploaded to the **Images** Section.
6. Select the image you want to apply by clicking on it

7. Click the **Apply Image to Scada View** button to set the image as the background



- The supported file formats for image upload are .bmp, .gif, .jpg, .jpeg, and .png.

Corresponding Key Tabs:

I. *Choose File:* Click here to open a dialog to select the image you want to upload. Once the file has been chosen the user has the option to apply the image, or to upload it to the library.
II. *Upload Image to Library:* Click here to upload to the Image library the image selected on step I. Once the image is uploaded to the library, it will become available for all company authorized users.
III. *Apply image to Scada View:* Click here to associate the image with a Field/Site.
IV. *Remove Image(s) from Library*: Click here to remove the selected images from the library.
V. *Image Size:* Choose one of the options for the system to determine how it should handle the image when applying it to a Field/Site.
VI. *Images:* Will contain the list of images available in the image library.

2.1.3.2 Removing Background Images from the Library

- The system will not allow the user to remove an image from the library that is currently being used by another user in the company.

The Bluetick RMC Graphical View feature allows the user to remove background images from the Field/Site Level and the Library. In order remove an image from the library follow these steps.

1. Click any Field/Site.
2. Click the **Graphical** tab under the **Overall Status** page.
3. Click on the **Images** button.
4. Select the image you want to remove by clicking on it.
5. Click the **Remove Image(s) from Library** to remove the image.

- You can also remove background images by right-clicking on the background image and selecting delete image

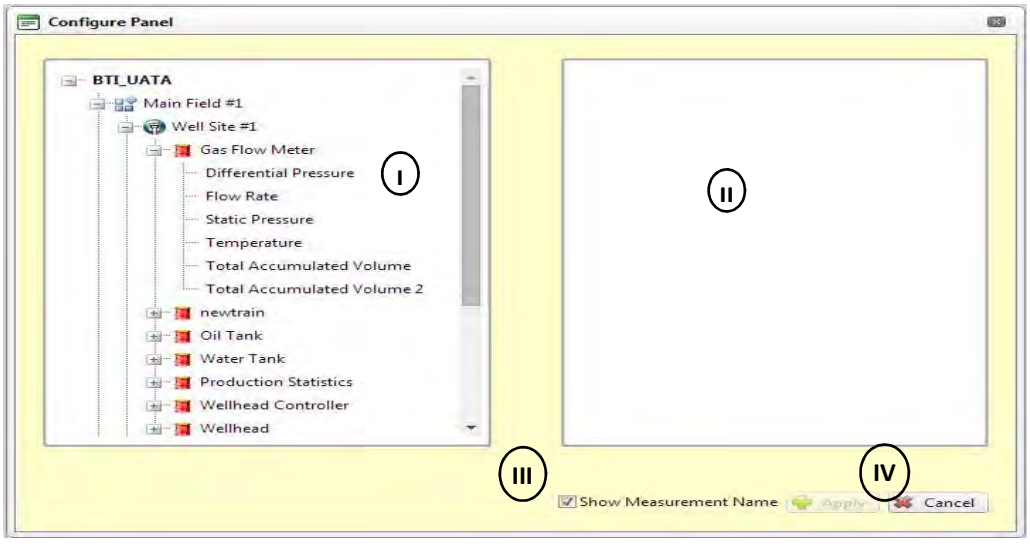
2.1.3.3 Adding Data Table Measurements

The Bluetick RMC Graphical View feature allows the user to add measurements to a blank background or image at the Field/Site Level. In order add data table measurements to an image or blank background follow these steps.

1. Click the Field or Site where you want to add the measurement.
2. Click the **Graphical** tab under the **Overall Status** page.
3. Click the **Add Data Table** Button.
4. Drag and Drop the Measurement that needs to be added.
5. Click the **Show Measurement Name** if you desire to show the measurement name in the data measurement Box.
6. Click the Apply to create the data measurement Box.
7. The measurement now appears overlaid over the image loaded or the blank background.

- You can add one or more measurements per data measurement box.

- You move the data measurements box by clicking and holding the mouse button.



You can reconfigure or delete the data measurement box by right clicking on the box.

Corresponding Key Tabs:

I. *Data Measurement Selection Block:* Drag and Drop Measurements from this box into the Data Measurement Destination Block (II).
II. *Data Measurement Destination Block: Drop the Measurements to be displayed in this Block*.
III. *Show Measurements Name: Display the measurement name in the data block*.
IV. *Apply / Cancel Buttons*

The user can quickly delete all the data tables by clicking the **Delete All Tables** button.

2.1.3.4 Adding Gauges

The Bluetick RMC Graphical View feature allows the user to display measurements via gauges and apply them to a blank background or image uploaded background at the Field/Site Level. In order to add gauges to an image or blank background follow these steps.

1. Click the Field or Site where you want to add the measurement.
2. Click the **Graphical** tab under the **Overall Status** page.
3. Click the A**dd Gauge** button.
4. Select one of the Types of Gauges.
5. Select the Measurement to associate with the gauge.
6. Configure the Settings for the Gauge.
7. Click Apply.

2.1.3.5 Display All Gauges

The Display all gauges function allows the user to quickly add a gauge for all the measurements under a well site. In order to do these follow the steps listed below.

1. Click the Site where you want to add the measurement.
2. Click the **Graphical** tab under the **Overall Status** page.
3. Click the **Display All Gauges** button.

The user can reconfigure or delete the gauges created by right clicking on the gauge, or clicking the **Delete All Gauges** Button.

2.2 Creating Quick Stats

- Quick Stats can only be created at the field level.

1. Right click the specific *field site* on the navigation tree.
2. Select **Quick Stats** from the drop box.
3. The viewer will then select the well site, specific entity, and desired measurements.
4. Enter the description/name for the **Quick Stats**.
5. Click **Apply Changes** or **Save As** before closing the box.

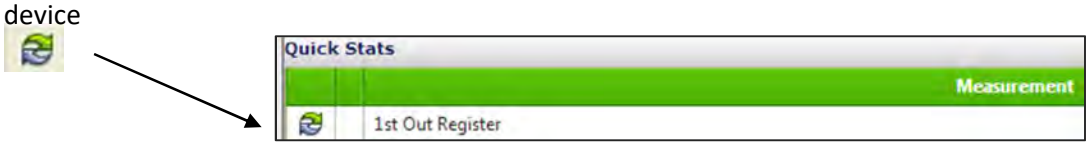
- Quick Stats allow you to see measurements from different sites under the same field on the display page.

2.3 Polling a Device

Use the polling feature to receive the latest data for a device.

1. Click the specific *field site* or *entity* on the navigation tree.
2. Click the Overall Status tab on the navigation bar to view the Quick Stats page.
3. Select the *green* and *grey arrow icon* next to a measurement to poll the device.

Click here to poll a device



Chapter 3

3. Alarms

The Alarms tab on the navigation bar displays a list of active and suppressed alarms as well as the history of the activated alarms. Click a site on the navigation tree before clicking the Alarms tab to generate specific information on the display page.

The instructions in this chapter will describe navigation and functions of the Alarms tab.

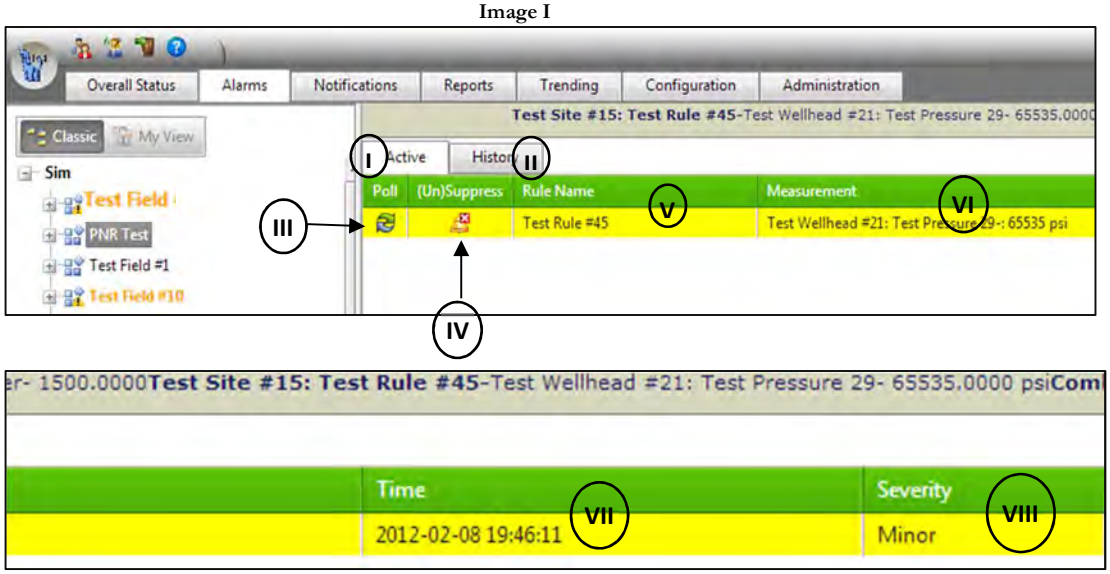
3.1 Navigating the Alarms Section

Under the Alarms tab on the navigation bar, beneath the ticker on the main display page, are two tabs: ***Active*** and ***History***.

- ***Active***: Displays current and suppressed alarms *(Image I. below)*
- ***History:*** Displays alarms that triggered in the past.

Rules that trigger alarms are created under the Configuration tab.

Image I



Corresponding Key Tabs:

V. *Active Alarms tab*
VI. *History (Past Alarms) tab*
VII. *Poll:* Contact the device to check on the alarm status and refresh the measurement value.
VIII. *(Un)Suppress/Suppress*: If the alarm was suppressed/Unsuppressed, or is still active

IX. *Rule Name:* The name of the rule which trigged the alarm
X. *Measurement:* The measurement used in the rule
XI. *Time:* The time the alarm was activated
XII. *Severity:* The severity of the alarm

3.2 Alarms Description

Alarms are identified by color

- Red: A critical alarm
- Orange: A major alarm
- Yellow: A minor alarm

Alarm Escalation

Alarm escalation is a unique feature built into the alarm system. Once a rule is created, it is saved as a predefined rule that can be edited in the future. Each rule can be modified to have different values, sample rates, and priority levels and notifications options.

Being able to edit and add rules allows a user to create their own ladder for alarm notifications.

Example:

Rule 1 is created and set to activate when the wellhead's pressure is greater than 4,500 psi after 1 sample. It is a low priority alarm and notifies Distribution List 1.

That same rule (Rule #1) was used again, and saved under a different name, with the modification that the alarm is activated when the same wellhead's pressure is greater than 5,000 psi and after 1 samples. It is a high priority alarm and notifies Distribution List 2.

This way, if the pressure continues to rise and the first notification to Distribution List 1 doesn't take care of the problem, Distribution List 2 will be notified soon after.

There are many ways to modify rules to create alarm escalation. The above example is only one way to make sure your well sites are protected.

Refer to section 7.2 for information on how to configure a rule.

Chapter 4

4. Notifications

The Notifications tab on the navigation bar is an announcement page with separate categories for actions on the web portal. Notifications allow the control user to view how the web portal is being used by other viewers and stay updated on the health of specific site entities.

The *Filter by* drop box in the right corner beneath the ticker can be used to adjust the time period of visible notifications on the display page.

The instructions in this chapter will describe navigation and functions of the Notifications tab.

Click a site on the navigation tree before clicking the Notifications tab to generate specific information on the display page. Under the Notifications tab on the navigation bar, beneath the ticker, are five tabs: ***ASR, Calculation Alerts, User Request and Maintenance.***

- ***ASR:*** Displays a history of ASR events. Each ASR event listed can be clicked to create a graph depicting a timeline of when the alarm was triggered.
- ***Calculation Alerts:*** This tab is specifically for alerts that were created from rules based on calculated results.
- ***User Request:*** History of any operations that users requested from the sensors.
- ***Maintenance:*** History of sites that were put into maintenance mode.

Chapter 5

5. Reports

The Reports tab on the navigation bar displays the measurements collected from each sensor on your site. The reporting system allows users to develop company-wide, field level, or specific entity reporting. Report requests are generated here and can be customized to enable automatic reporting and individual user distribution.

Reports are private to the report creator. Only the creator of the report is able to see that report.

The instructions in this chapter will describe navigation and functions of the Reports tab.

5.1 Navigating the Reports Section

To delete a report, click the *red* beneath the ticker.

Click a site on the navigation tree before clicking the Reports tab to generate specific information on the display page. The display page will have a list of different data reports.

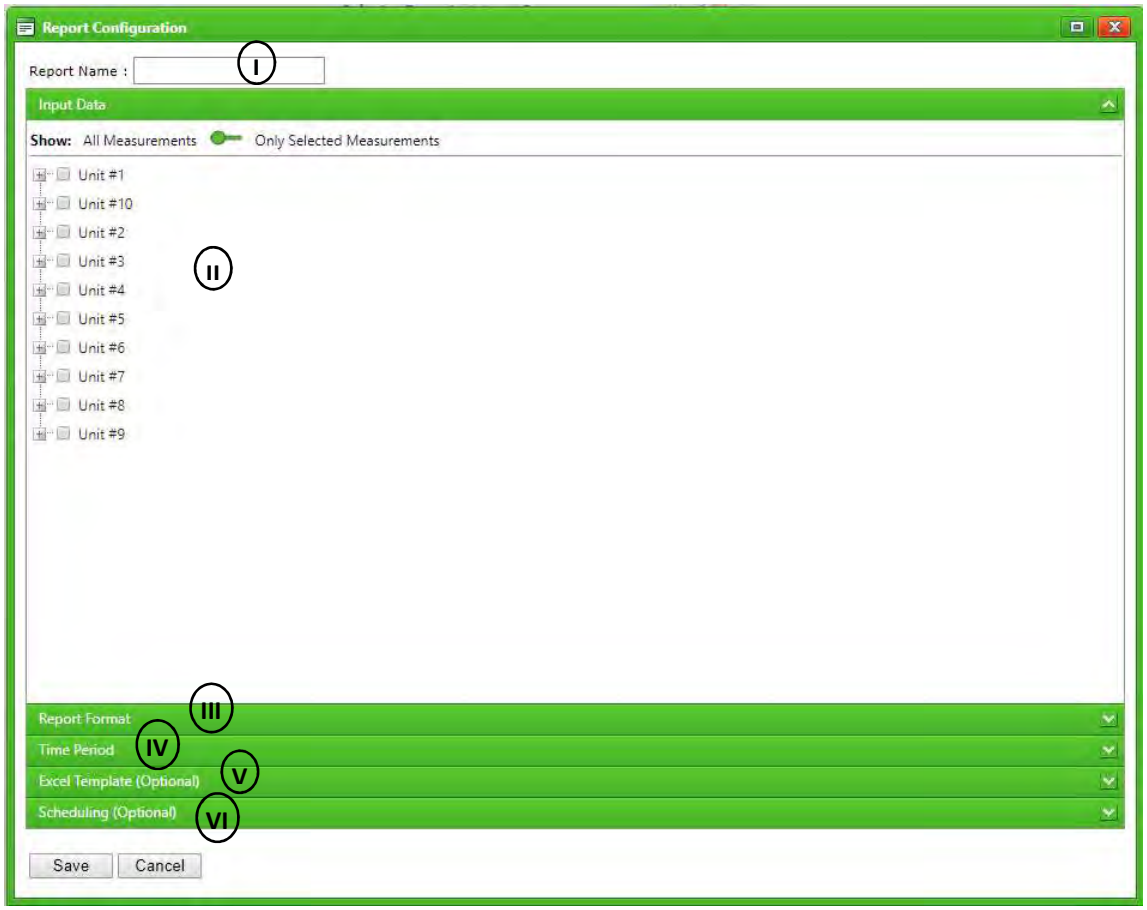
5.2 How to Generate a Report

To add a report, click the *green plus sign*.

1. Go to the ***Reports*** tab.
2. Click the *green plus sign* located underneath the ticker on the display page.
3. A box will appear like the one below with five sections: ***Input Data, Report Format, Time Period, Excel Templating and Scheduling*.**
4. Complete each section accordingly.
5. Click **Save** before exiting.

You can save a default report selection by clicking

Remember?



To select/unselect all measurements click the "Toggle Selected" link under the Measurements label

Corresponding Key Tabs:

The ***Input Data*** tab is used to customize what information will be provided in the report.

I. *Name:* Title of the report

II. *Input Data*: Click the field(s) you want the report on, Select the Sites, Entity and Measurements to be reported

III. *Report Format:* Click the format for the data in the report.

- Averages: Averages of the data over a period of time.

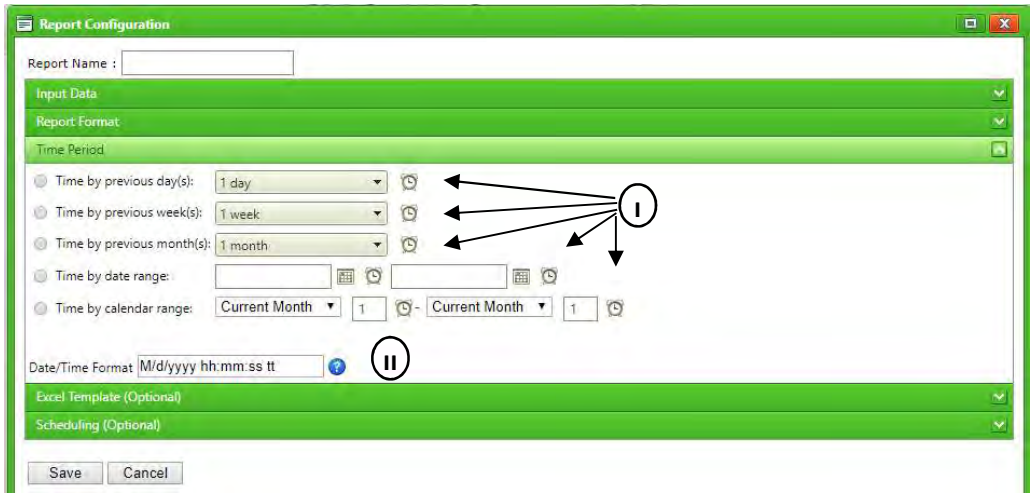
If you want to swap columns for rows, click the pivoted function under *Report Format*.

- Raw: Complete set of data without an average.
- Last Measured: Reports the last measured value for the period of time selected.
- Pivoted: Information is displayed in columns.
- Interpolation Method: Use “Repeat Last” to repeat the last value for the missing data, Use “Linear” to use a linear value between the missing data, Use “No Interpolation” to not add missing values to the data. The number of seconds between each pivoted data point is used to specify the sampling interval of the data uploaded. For example if the data uploaded is based on 1 second samples, that field should be populated with a “1”.
- Duration Analysis: Reports on values beyond that threshold.

◆ Pivoting is a resource intensive function. Reports may take longer to complete when pivoting large amounts of data

IV. *Options:* Click the Options data in the report.

- Hide Site Name: Does not output the site name when generating the report.
- Hide Entity Name: Does not output the entity name when generating the report.
- Download instead of Display Data: If selected, the system generates an output file rather than displaying the data on the screen. The file can then be downloaded. The following formats are supported. Text, Comma Separated Values, and native Fracpro DBS (Available only if feature is enabled)



Corresponding Key Tabs:

The ***Time*** tab has four separate options for the time intervals of the report. Select one option.

I. Time range of the data for the report.
- *Time by previous days(s):* Report data for previous days as specified.
- *Time by previous weeks(s):* Report data for previous weeks as specified.
- *Time by previous month(s):* Report data for previous months as specified.
- *Time by date range:* Report data within the range specified.
- *Time by calendar range:* Report data within the calendar range specified.

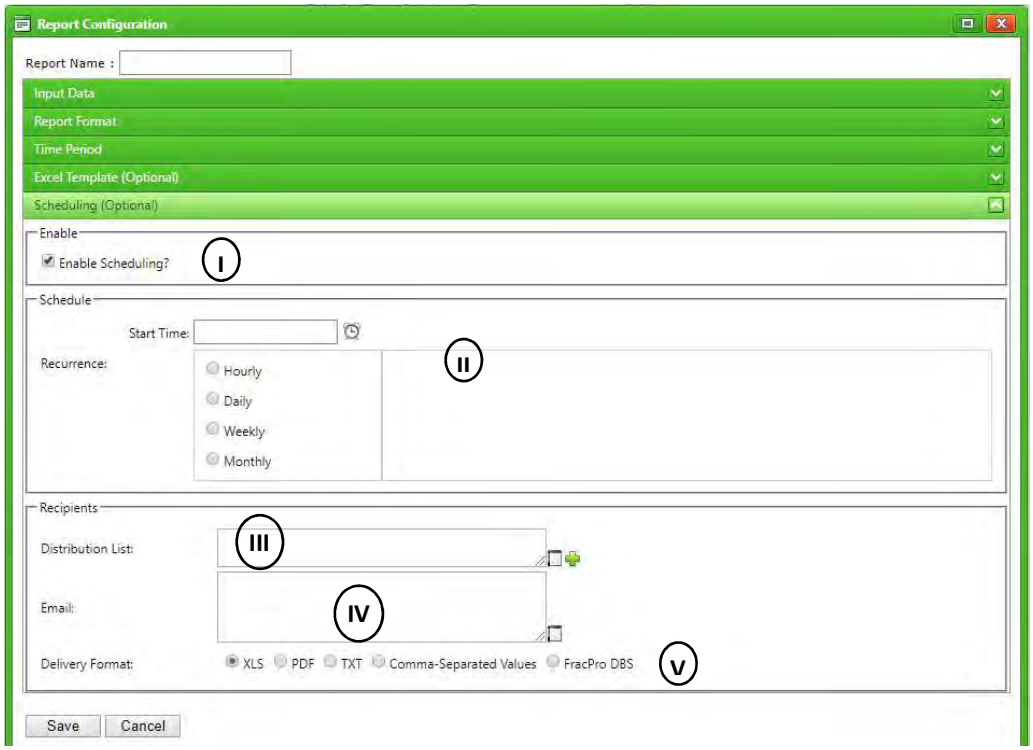
You can see the date/time format options by clicking the 

II. *Date/Time Format:* Allow the user to configure the way the time should be displayed in the report.

Corresponding Key Tabs:

The ***Templating*** is used to enable the report template function.

I. *Enable templating*: By clicking this checkbox the output of the report will be dumped into a customer provided template. See "How to use an existing report template" Section for more details.



- Recipients section can be used to send single reports to specific users.

Corresponding Key Tabs:

The ***Scheduling*** tab is used to create a list of users that will receive the report. It can also be used to generate automatic reporting.

I. *Enable Scheduling:* Enables/Disables the report scheduling feature.

II. *Schedule:* When and how often the scheduled report is sent.

III. *Recipients Option 1*: Who will receive the report; add a distribution list by clicking the *green plus sign or select an existing distribution list by clicking the paper icon.*

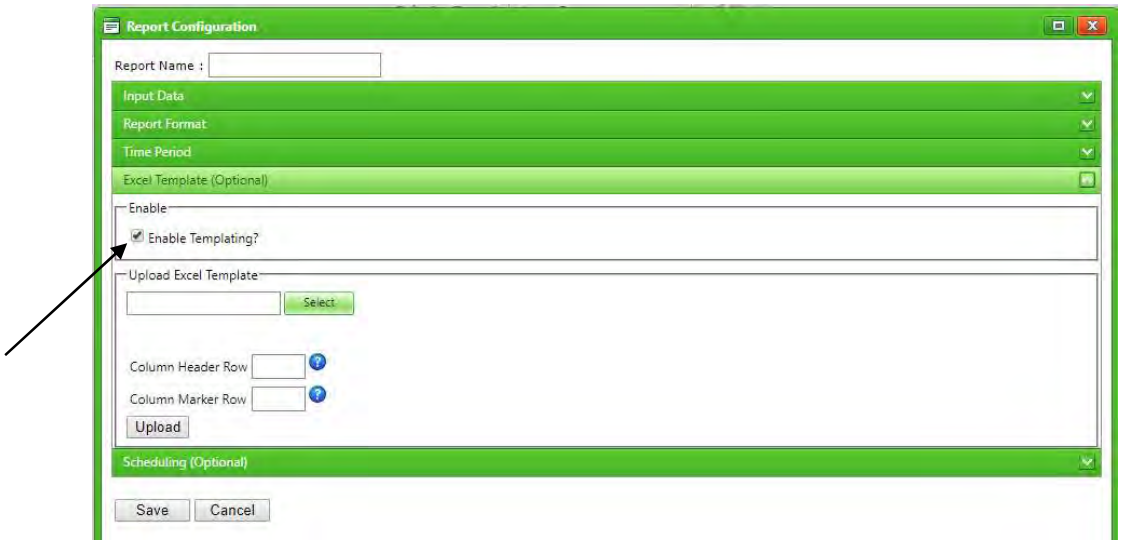
IV. *Recipients Option 2:* List of emails that receive the report; add an unlisted e-mail address by typing it into the box provided. Multiple email addresses need to be separated by a semi-colon.

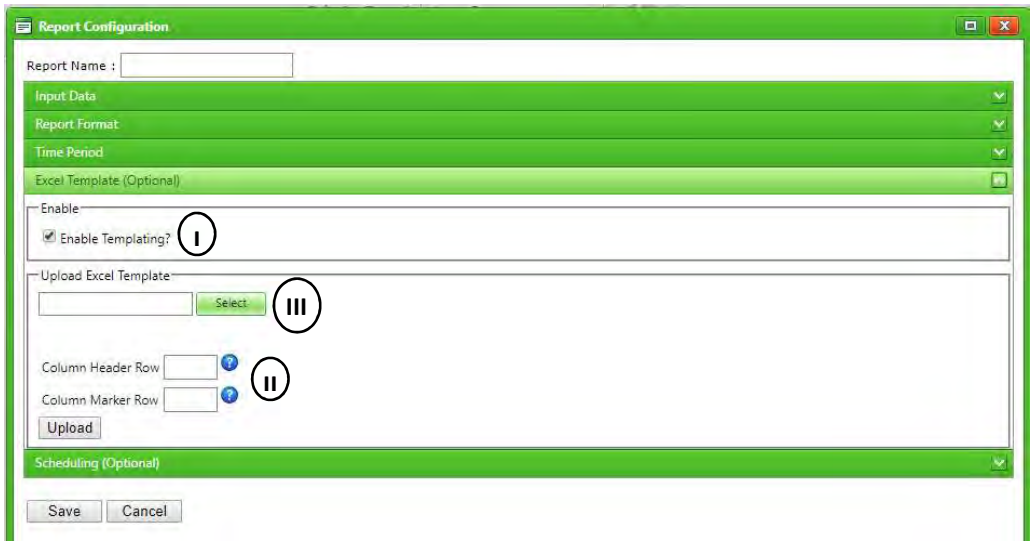
V. *Delivery Format:* The emailed report can be presented in either excel (xls) file format, an Adobe PDF file format, a Text file format, a Comma Separated Value (CSV) file format, or a FracPro DBS file format. The FracPro DBS file will only be available if the feature is enabled.

5.3 How to Use an Existing Report Template

Use the report template function to insert the system collected data into your existing report templates.

1. Go to the ***Reports*** tab.
2. Select the report that you would like to get into an existing template.
3. Click on the  to edit the report.
4. The ***Report Configuration*** has 5 sections. Click on the ***Excel Template*** section.
5. Click the ***Enabling Templating?*** checkbox.





Once the template has been uploaded the user will have the option to delete or download the loaded template by clicking the links under the uploaded template header.

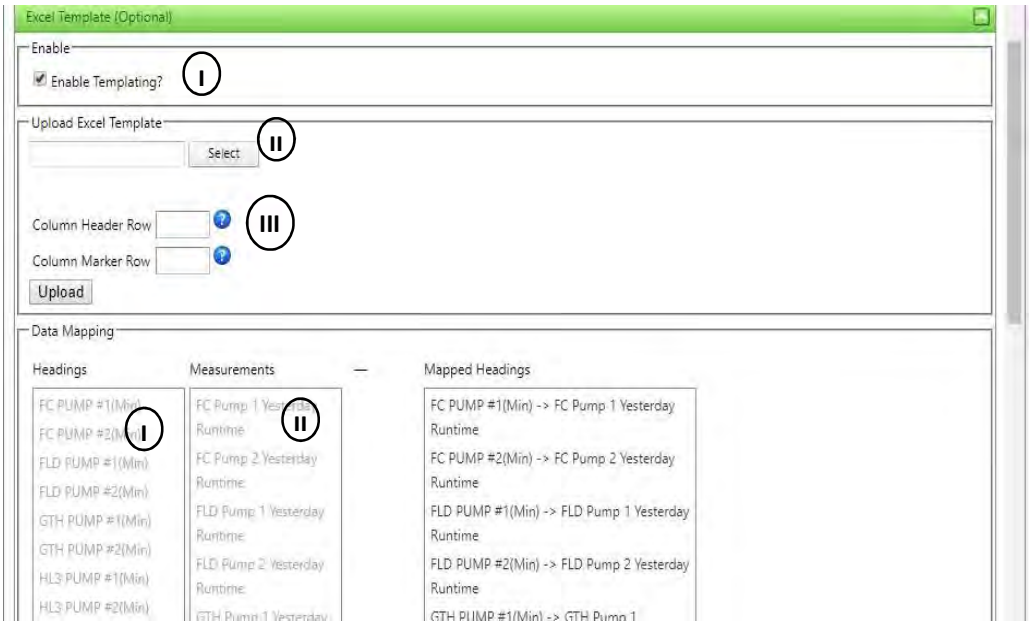
Corresponding Key Tabs:

I. *Enable Templating*

II. *Upload Excel Template: Clicking the Select button allows the user to choose the excel template where the data will be inserted.*

III. *Column Header/Marker Row:* These fields are mandatory and allow the Bluetick system to determine the starting points for headers and row.

6. Click the ***Select*** button to upload the template you wish to apply.
7. Enter the Row # from the excel sheet that lists the measurement types in the Column Header Row.
8. Enter the Row # from the excel sheet where the data should begin to shoe in the Column Marker Row.
9. Click the ***Upload*** button. The screen will refresh and the following options now become available.

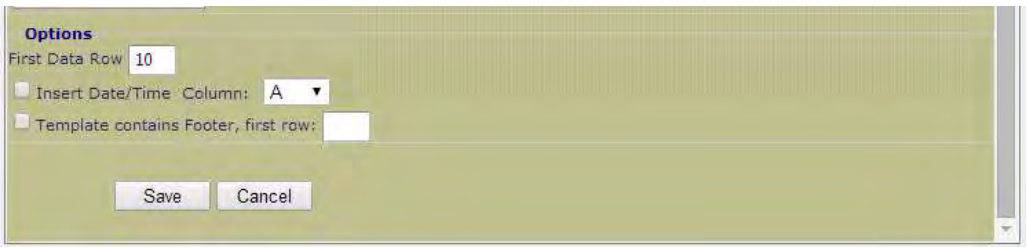


Corresponding Key Tabs:

I. These are the column names that were identified by software and are located in row # that was specified in the Column Header Row box on the previous screen

II. These are the measurements that are available to be mapped to the named columns.

10. Select the Heading name by clicking on it.
11. Select the measurement that will be set under that column by clicking on it.
12. Click the ***Map*** button. A new section will appear showing the mappings
13. Scroll down to the ***Options*** section.



Corresponding Key Tabs:

- First data row is always one value higher than the column marker row.

I. *First Data Row: Indicates where the data will start.*
II. *Insert Date/Time Column:* Indicates what column should date and time be set
III. *Template contains Footer, first row:* Indicates what row the footer starts (if available)

14. Click ***Save***. At this point the template is configuration is complete.
15. Click the ***Click Here to Download Report*** link to access the template report.

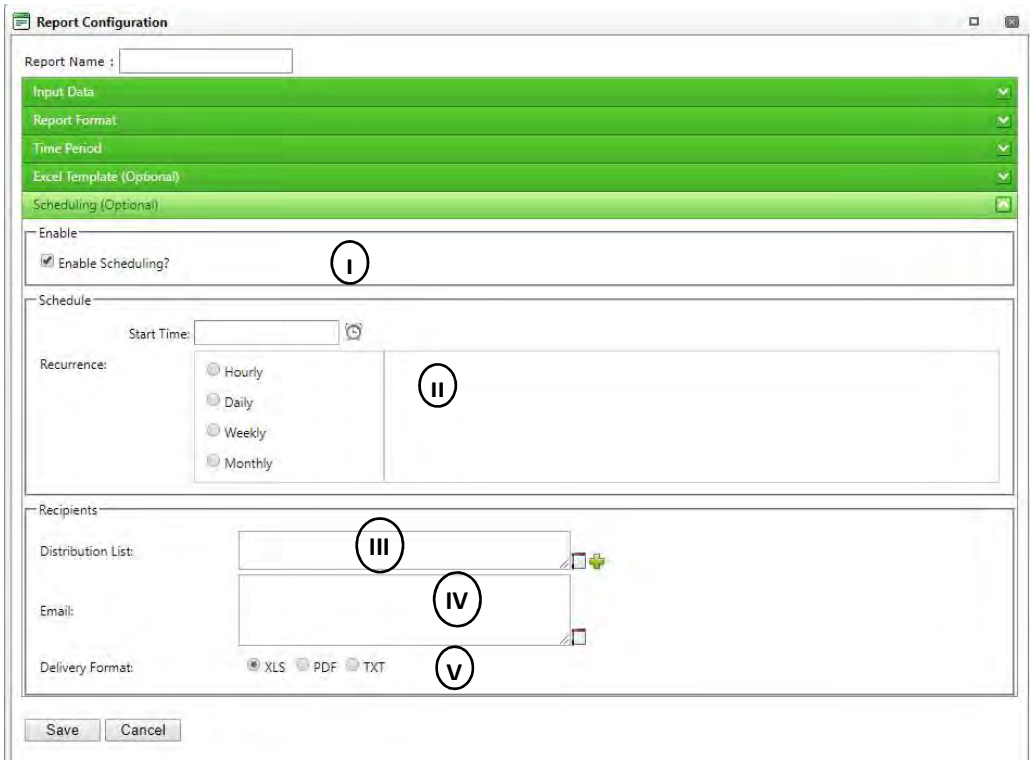
The template report can also be scheduled so that the end user receives the report in the template format at the scheduled time.

5.4 How to Generate a Scheduled Report

Use an automatic report to stay up to date with specific reports and information on your operations.

1. Repeat "How to Generate a Report" steps 1-4.
2. Click the ***Scheduling*** tab.
3. Click **Enable Scheduling**. *(Image I. below)*
4. Decide what time the schedule reports should generate and how often. *(Image II. below)*
5. Include a distribution list or unlisted email to receive the automatic report.

Image I. Scheduling Tab Display Page



Corresponding Key Tabs:

I. *Enable Scheduling:* Enables/Disables the report scheduling feature.

II. *Schedule:* When and how often the scheduled report is sent.

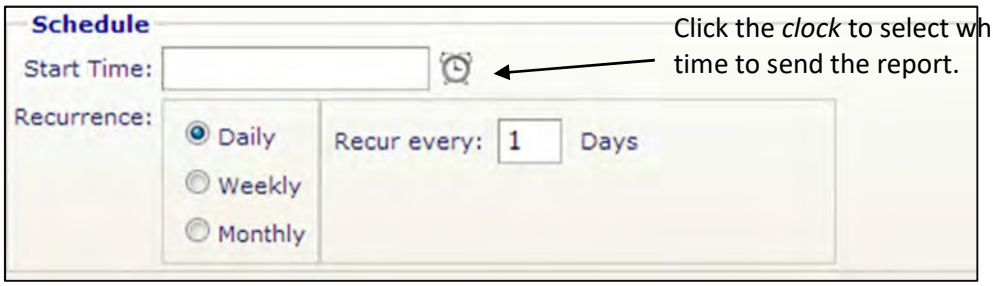
III. *Recipients Option 1*: Who will receive the report; add a distribution list by clicking the *green plus sign or select an existing distribution list by clicking the paper icon.*

IV. *Recipients Option 2:* List of emails that receive the report; add an unlisted e-mail address by typing it into the box provided. Multiple email addresses need to be separated by a semi-colon.

V. *Delivery Format:* Define if the report should generate an excel file, pdf output file, Comma Separated Value file, Text file, or FracPro DBS file.

Image II. Expanded

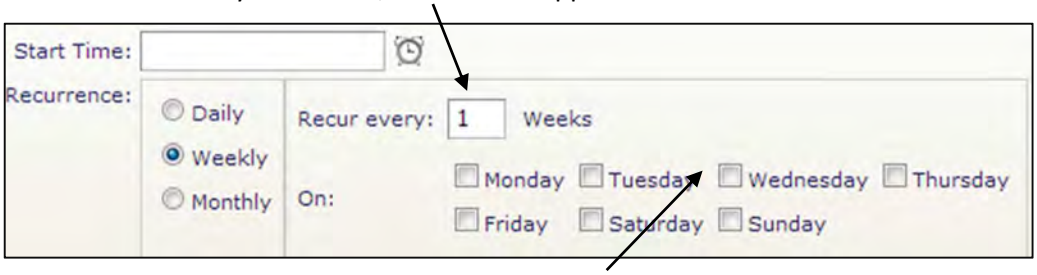
Start time is when the automatic reports will start being sent out.



Click the *clock* to select what time to send the report.

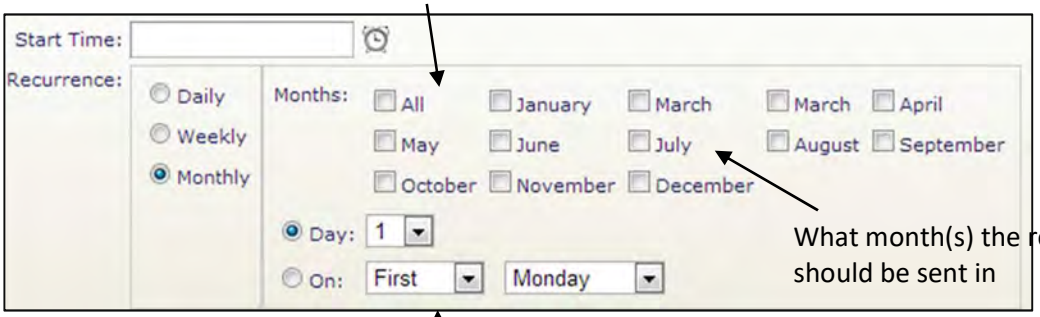
- Under Recurrence: click an interval, such as daily, weekly, or monthly

If weekly is selected, this box will appear.



What day of the week the report will be sent.
EX: Every Tuesday, the automatic report will be sent.

If monthly is selected, this box will appear.



What month(s) the report should be sent in

You can also have the report sent on specific days by clicking here.
EX: The report will be sent On: The first Monday of the month.

Chapter 6

6. Trending

The Trending tab on the navigation bar displays a set of graphs created from the data collected. The Trending report is useful for analyzing data reports over time. Data can be configured into specific time frames or averages then layered for comparison.

The instructions in this chapter will describe navigation and functions of the Trending tab.

6.1 Navigating the Trending Section

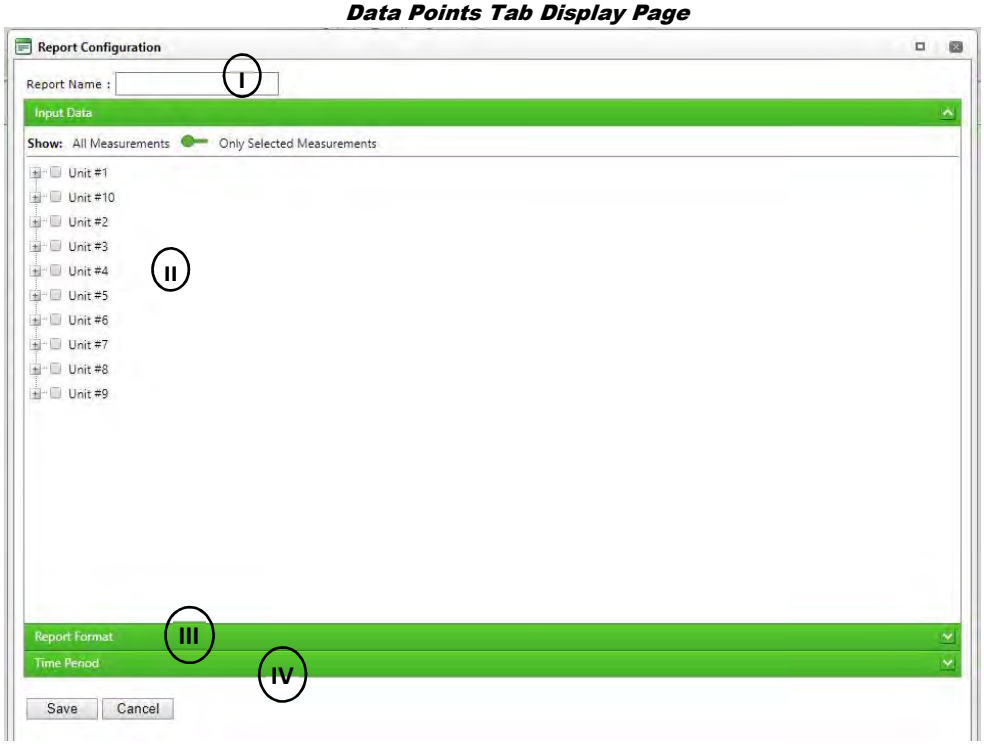
Go to the Trending tab to see specific information on the display page.

6.2 How to Generate a Trend Graph

1. Go to the **Trending** tab.
2. Click the *green plus sign* located underneath the ticker on the display page.
3. A box will appear with three sections: ***Input Data, Report Format, and Time.***
4. The first ***Input Data sectopm*** will have six distinct sections that must be completed to request a trending report.

To delete a report, click the *red* beneath the ticker.

Data Points Tab Display Page



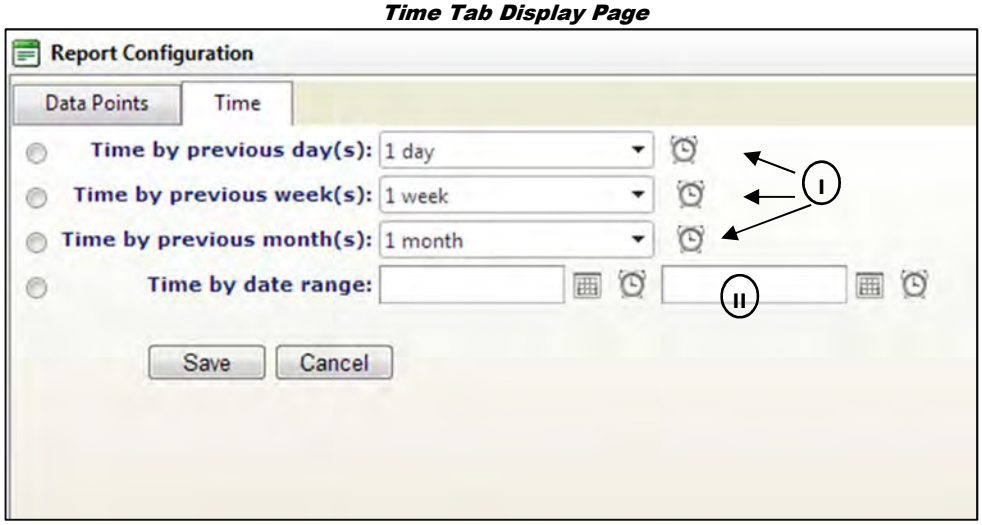
Corresponding Key Tabs:

The ***Data Points*** tab is used to customize what information will be provided in the report.

- To export or print a trend, click *Configuration* on the top left corner then select *Export to PDF*.

I. *Name:* Name of the trending report
II. *Input Data*: Click the field(s) you want the report on. Select the Sites, the entity and measurement you want to trend
III. *Report Format:* Click the format for the data in the report. Click the format for the data in the report.
   - Averages: Averages of the data over a period of time.
   - Raw: Complete set of data without an average.
   - Last Measured: Reports the last measured value for the period of time selected.
IV. *Time Period:* Select the time period for the trend.

Time Tab Display Page



- Previously created reports can be edited by using the buttons on the top left corner of the display page.

Corresponding Key Tabs:

The ***Time*** tab has four separate options for the time intervals of the report. Select one option.

I. Time range of the data for the report.
   Ex: 1 day ago, 1 week ago, 1 month ago
II. Specific date ranges for the report.

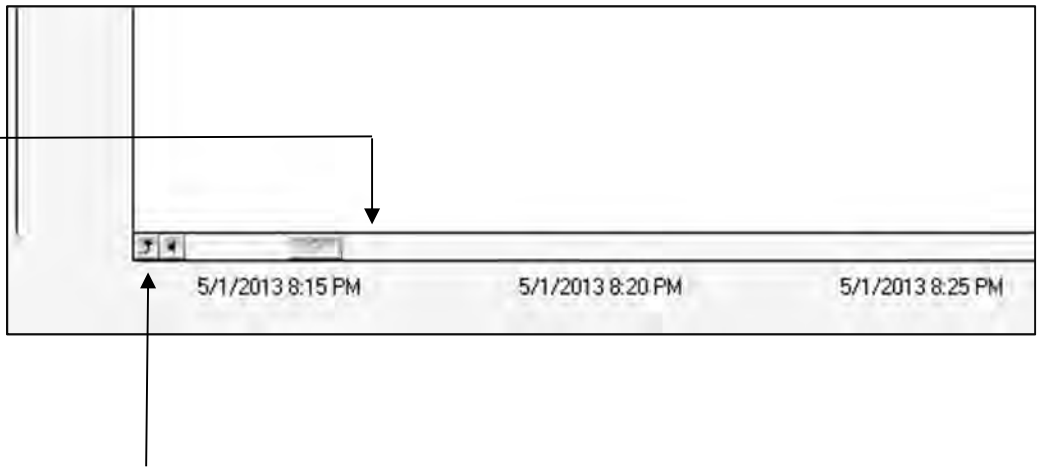
5. Click **Save** before exiting.

6.3 Navigating the Trend Graph

Use your mouse to narrow in on a graph to view a specific time or data entry.

1. Repeat steps for "How to Generate a Trending Graph".
2. Click and hold your mouse over the trending graph.
3. Drag your arrow and a gray box will appear. Whatever data is included in the box will be highlighted when you release the mouse.

Trending Report Navigation



Chapter 7

7. Configuration

The Configuration tab on the navigation bar is where the user creates rules that would trigger alarms for each site. Users can create simple or compound rules for any measurement on any device using the "if/then" structure. Each rule is then identified with a minor, major, or critical severity and with associated actions for alarm escalation. The alarms and rules insure that the viewer stays updated on important site activity.

The instructions in this chapter will describe navigation and functions of the Configuration tab.

7.1 Navigating the Configuration Section

Click a well site on the navigation tree before clicking the Configuration tab to generate specific information on the display page. Under the Configuration tab on the navigation bar, beneath the ticker, are two tabs: ***Configuration*** and ***Current***.

- ***Configuration***: Displays all active, pending and marked for deletion rules for the site
- ***Current***: Displays all active rules for the site

7.2 How to Create a Rule

1. Click the ***black triangle*** next to the *green plus sig*n at the bottom on the left side of the display page.

2. Select either *simple* or *compound* from the drop box.

- ***Simple:*** A rule based on one measurement.
- ***Compound***: A rule based on two measurements, joined by a logical operator.

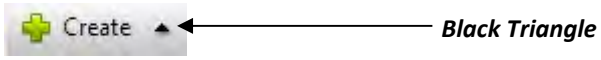
Note:
Once a simple rule is created and saved, it can be used again for a compound rule or alarm escalation. Using a predefined rule for compound rules and alarm escalation is a quicker and easier method than recreating the same rule for multiple purposes.

Once configured, a predefined rule is available by selecting the name of the rule from the *Existing Rule* drop box provided.

To delete a rule click the rule on the display page, then the *red X Delete* button the bottom of the display page on the left.

7.2.1 Creating a Simple Rule

1. Click the ***black triangle*** next to the *green plus sign* at the bottom on the left side of the display page.

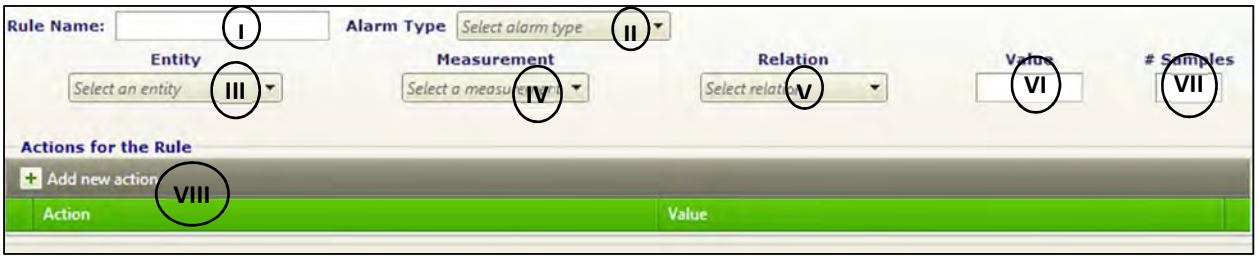


2. Select ***Simple*** from the drop box.

The rule name will be included in the SMS/ email notifications.

A box will appear with eight sections that must be completed to configure a rule.

Simple Rule Display Page



Corresponding Key Tabs:

I. ***Rule Name***: Title of the rule
II. ***Alarm Type*:** Select what severity the alarm should be
III. ***Entity****:* Select what entity the rule will correspond to
IV. ***Measurement****:* Select the measurement for the rule
V. ***Relation*:** Select equal than, greater than, etc. statement to define the rule
VI. ***Value:*** Enter the numerical value that corresponds with the relation and measurement
VII. ***# Samples:*** How many times the value is reached before the alarm is triggered. *(refer to # Sample Notes below)*
VIII. ***Add new action:*** Used for rule notification and ASR.

To modify a rule that has already been created click the rule, then the *pencil* on the bottom of the display page on the left.

3. Click **Add new action**. *(Image VII. above)*

4. Use the drop box to click **ASR** or **Notification.** *(Display examples below)*

5. Either the ASR or Notification must be completed.

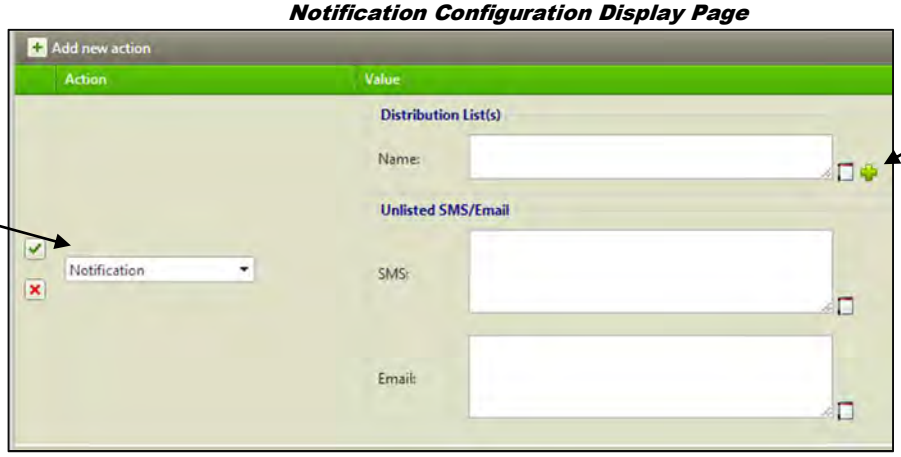
Notification: When the alarm is triggered, it will notify people with 3 options.

- *Distribution list*: Click the page icon to add an existing distribution list, or the *green plus sign* to create a new distribution list.
- *SMS*: Phone numbers of individuals who will receive text messages when the alarm is sounded
- *Email*: E-mail addresses of people who will receive emails when the alarm is sounded

Important Note:

- The ***# Samples*** number is directly related to how often the device is polled and uploaded to the server. It is recommended that if a device isn't uploaded frequently, that the # of Samples to activate the alarm is low for early detection of a potential problem.

Notification Configuration Display Page



Use this drop box to select ASR or Notification.

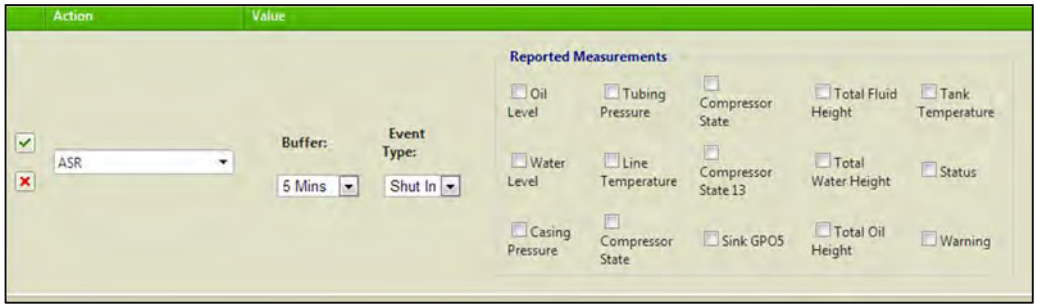
Click the *green plus sign* to create new a distribution list

ASR: Advanced Sampling Rate: If the alarm is triggered, to have a better understanding of what caused the firing of that alarm, ASR provides more measurements for specific entities related to the rule.

- *Buffer*: How far back into the past you would like report to go *(Image I. below)*
  Ex: Past 5 minutes of data history before the alarm was triggered
- *Event Type:* Automatically set to *Shut in (Image II. below)*
- *Reported Measurements:* Check any entity you would like the report on.

Rules marked for deletion are still active until downloaded.

ASR Configuration Display Page



Click the measurements that need to be captured.

6. Click the **Green Checkmark, Save** and **Download** on the bottom left corner of the display page to update and activate the rules.

7.2.2 Creating a Compound Rule

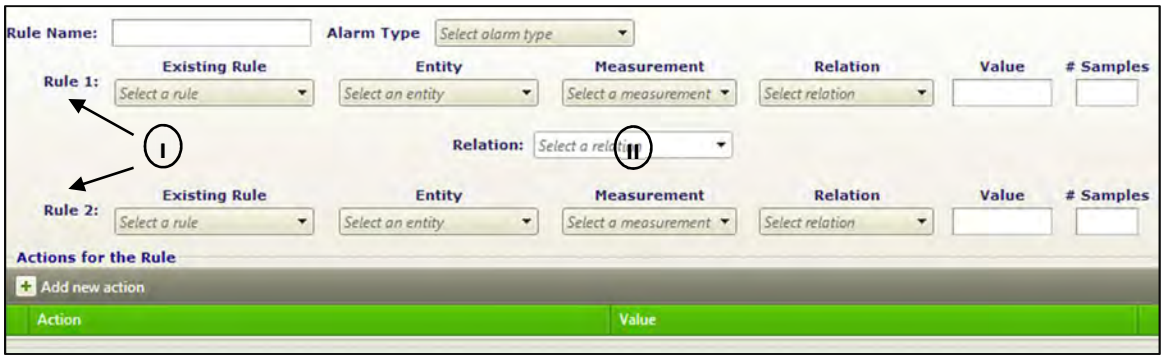
1. Click the ***black triangle*** next to the *green plus sig*n at the bottom on the left side of the display page.

2. Select Compound from the drop box.

3. A box will appear like the one below with two duplicate sections identical to the ones used to configure a simple rule. <u>All sections must be completed</u> to configure a rule. Both rules are configured separately, refer to "How to Create a Simple Rule" above for clarification on how to create individual rules. (See I)

4. Use the *Relation* drop box *(Image IX. below)* to decide how the two rules should relate to one another. (See II)

Compound Rule Display Page



Rule Relationship Examples:

And	*Both* rules conditions must be exceeded before the alarm is triggered.	Ex: Alarm triggers if the water level measurement is greater than 11,000 *AND* the compressor state measurement equals 11,000.
Or	Either rule condition is exceeded before the alarm is triggered.	Alarm triggers if the water level measurement is greater than 11,000 *OR* the compressor state measurement equals 11,000.

5. Complete "How to Create a Simple Rule" Steps 3-5 **ASR** and **Notifications**

6. Click the **Green Checkmark**, **Save** and **Download** on the bottom left corner of the display page to update and activate the rules.

Chapter 8

8. Administration

The Administration tab on the navigation bar is an area to organize users into specific groups, distribution lists, and call outs for alarms, alerts, and viewing functions. This page keeps all users and groups organized for quick editing and collective management.

The instructions in this chapter will describe navigation and functions of the Administration tab.

Only a few designated personnel have access to the Administrator Module.

8.1 Navigating the Administration Section

Under the Administration tab on the navigation bar, beneath the ticker, are four tabs: ***User, Groups, Distribution List, and Callout.***

- ***User:*** Individual users who have access to the online web portal.
- ***Groups:*** An established set of user right and sites.
- ***Distribution List:*** An established list of user notifications.
- ***Call Out****:* Spreadsheet loaded by the user for voice callout for triggered alarms.

The best way to keep the web portal organized is to first create a group with viewing rights, and then add users to those groups.

8.2 How to Add a New User

1. Click the **Administration** tab.
2. Click the ***User*** tab under the ticker.
3. Click the *green plus sign* on the bottom of the display page on the left side.
4. Fill in each blank with the correct information for the new user.
5. Click **Next** to select what kind of viewing rights the user will have.
6. Click **Done.**

8.3 How to Add a New Group

Add users to groups to easily organize viewer privileges, notification alerts and reports.

1. Click the **Administration** tab.
2. Click the ***Groups*** tab under the ticker.
3. Click the *green plus sign* on the bottom of the display page on the left side.
4. Title the group and confirm the viewing rights by checking the desired boxes. *(group viewing options on next page)*
5. Click **Save**.

Group Viewing Rights

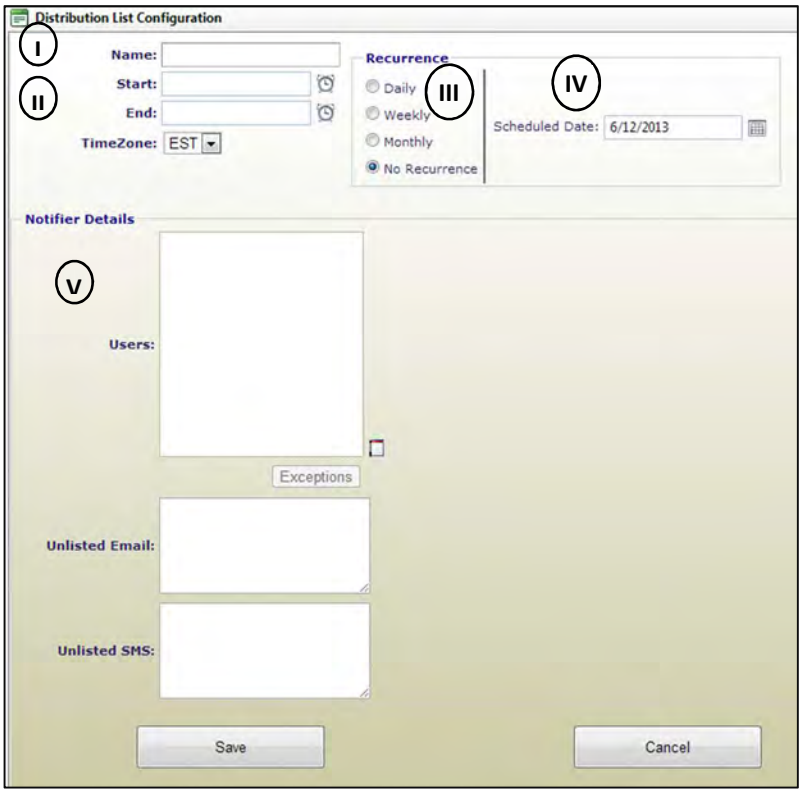
Option	*Function*	*Section*
Manage % Site Allocation	Reserved for future use	n/a
Allow Control	Allow the user to perform manual control options for analog/ digital devices.	9.4
Configure Reports	Allow the user to create, edit, and remove a report.	5.2
Configure Trending Reports	Allows the user to create, edit, and remove a trending report.	6.2
View Rules	Allow the user to view rules.	7
Configure Distribution List	Allow the user to create, edit, view, and remove a distribution list.	8.4
Measurement Entry	Allow the user to enter measurements for devices manually.	9.5
Maintenance	Allow the user to put a measurement into maintenance mode.	9.7
Manage User Accounts	Allow the user to create, edit, view, and remove other user accounts.	8
Allow Polling	Allow the user to poll a measurement on a device for real-time data.	2.3
View Reports	Allow the user to view reports.	5.1
View Trending	Allow the user to view a trending report.	6.1
Manage Rules	Allow the user to create, edit, view, and remove rules.	7
Configure Quick Stats	Allow the user to create a personalized status page at the field level.	2.2
Callout	Allow the user to upload/remove a callout list.	8.5
POC	Allow the user to view and pull data cards from a Pump Off Controller device.	9.9
Down Configuration	Allow the user to set down notification for devices and measurements.	9.6

8.4 How to Create a Distribution List

Distribution lists are used for different notifications like alarms, alerts, and reports. Pre-configured lists make the distribution of information quick and easy. Distribution lists also make users and contact information manageable and organized.

1. Click the **Administration** tab.
2. Click the ***Distribution List*** tab under the ticker.
3. Click the **Add** button on the gray navigation bar beneath the ticker.
4. A box will appear like the one below. Enter in all available information.
5. Click **Save**.

Distribution List Configuration



Corresponding Key Tabs:

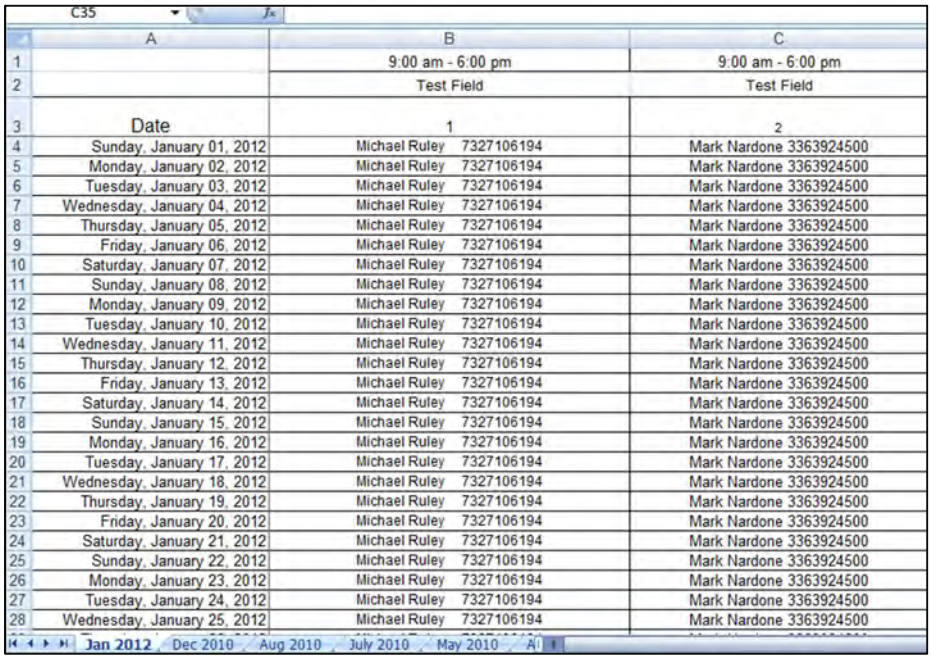
I. *Name:* Name of the new distribution list
II. *Start/ End:* Controls when the people listed under the **Notifier Details** section should be notified
III. *Recurrence*: The schedule for when the list is active. The list makes it easy to set up shifts or rotations to keep notifications prompt and useful for the right people.
IV. *Scheduled Date*: An exact date the distribution list will be used. ***(See scheduling of reports for more information on recurrence)***
V. *Notifier Details*: List specific users already on the web portal in the Users section.
    - Both unlisted SMS and Email are for individual users without access to the online system, or users with different email address/SMS numbers than the ones registered.

8.5 How to Create and Upload a Callout List

Callout lists allow for alarm voice notification and is constructed through rotations and organized by shifts. This unique response system makes the problem impossible to ignore unlike with SMS messages and e-mails. Callouts work in a rotation, if the first person doesn't acknowledge the alarm, the second contact is called. The rotation will continue until someone acknowledges the alarm. The lists themselves are organized by working shifts to maximize effectiveness. The call out will automatically call the correct person on duty.

1. Open the excel template that you received specifically for call out lists. An example of what the template looks like is provided below.

Callout List Template



	A	B	C
1		9:00 am - 6:00 pm	9:00 am - 6:00 pm
2		Test Field	Test Field
3	Date	1	2
4	Sunday, January 01, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
5	Monday, January 02, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
6	Tuesday, January 03, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
7	Wednesday, January 04, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
8	Thursday, January 05, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
9	Friday, January 06, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
10	Saturday, January 07, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
11	Sunday, January 08, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
12	Monday, January 09, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
13	Tuesday, January 10, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
14	Wednesday, January 11, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
15	Thursday, January 12, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
16	Friday, January 13, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
17	Saturday, January 14, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
18	Sunday, January 15, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
19	Monday, January 16, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
20	Tuesday, January 17, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
21	Wednesday, January 18, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
22	Thursday, January 19, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
23	Friday, January 20, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
24	Saturday, January 21, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
25	Sunday, January 22, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
26	Monday, January 23, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
27	Tuesday, January 24, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
28	Wednesday, January 25, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500

Jan 2012 | Dec 2010 | Aug 2010 | July 2010 | May 2010

Columns

- Column A is the date for the call out list.
- Column B is the first contact in the rotation that would be called for the call out list.
- Column C, if it has the same site name as Row #2 in Column B, will be the second contact that will be called for the call out list.

Rows

- Row #1 is the shift time. The time is your local time as when the spreadsheet is uploaded the time zone is selected. There can be any number of shifts and rotations in those shifts.
- Row #2, under Column B is the site name. It must be <u>exactly</u> the same as it shows on the navigation tree, including spaces and punctuation. Any change to the name on the navigation tree requires the same change on the spreadsheet and for the spreadsheet to be re-loaded. Multiple sites can be set by listing them separated by a comma.
- Row #3, under Column B & C are identifiers which show how the list is going to be read in rotation.

  Ex: The person in Row #4 in Column B would be called first for an alarm.
  - Each call out row <u>must</u> have the name <space> number for the spreadsheet to upload correctly.

◆ Each month needs its own tab. The month and year must be fully spelled out. Ex: July 2013.

◆ A new tab can be created by clicking the page icon located next to the last month tab on the bottom of the display page.

- Callout lists are set at the field level.

2. Fill all sections as indicated above.
3. Once finished, save the template.
4. Return to the ***Administration Tab***> ***Callout Lists*** and click the **Upload** button on the bottom left of the display page.
5. A window will appear. Select the field you are uploading the spreadsheet for then click the file that you wish to upload using the select button. Also, select the time zone that matches the times used on the spreadsheet.
6. A success or fail message should appear. A fail message means that there is a mistake in the format of you spreadsheet. If a fail message appears - check the spelling and punctuation of all dates and names, then try to upload the document again.

- A site configured for callout will trigger a call for every alarm regardless of the severity.
- The callout details can be accessed by clicking the Details link under the Alarm History tab.

8.6 Callout List Example

This section will give a detailed explanation of a call out list scenario and why it's important to your well site.

Michael and Mark are both on the schedule from 9AM-6PM. The hours of 6:01PM-8:59AM are not covered by the callout list.

Callout List Example

	A	B	C
1		9:00 am - 6:00 pm	9:00 am - 6:00 pm
2		Test Field	Test Field
3	Date	1	2
4	Sunday, January 01, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
5	Monday, January 02, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
6	Tuesday, January 03, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
7	Wednesday, January 04, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
8	Thursday, January 05, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
9	Friday, January 06, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
10	Saturday, January 07, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
11	Sunday, January 08, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
12	Monday, January 09, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
13	Tuesday, January 10, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
14	Wednesday, January 11, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
15	Thursday, January 12, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
16	Friday, January 13, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
17	Saturday, January 14, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
18	Sunday, January 15, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
19	Monday, January 16, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
20	Tuesday, January 17, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
21	Wednesday, January 18, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
22	Thursday, January 19, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
23	Friday, January 20, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
24	Saturday, January 21, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
25	Sunday, January 22, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
26	Monday, January 23, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
27	Tuesday, January 24, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500
28	Wednesday, January 25, 2012	Michael Ruley 7327106194	Mark Nardone 3363924500

Jan 2012 | Dec 2010 | Aug 2010 | July 2010 | May 2010

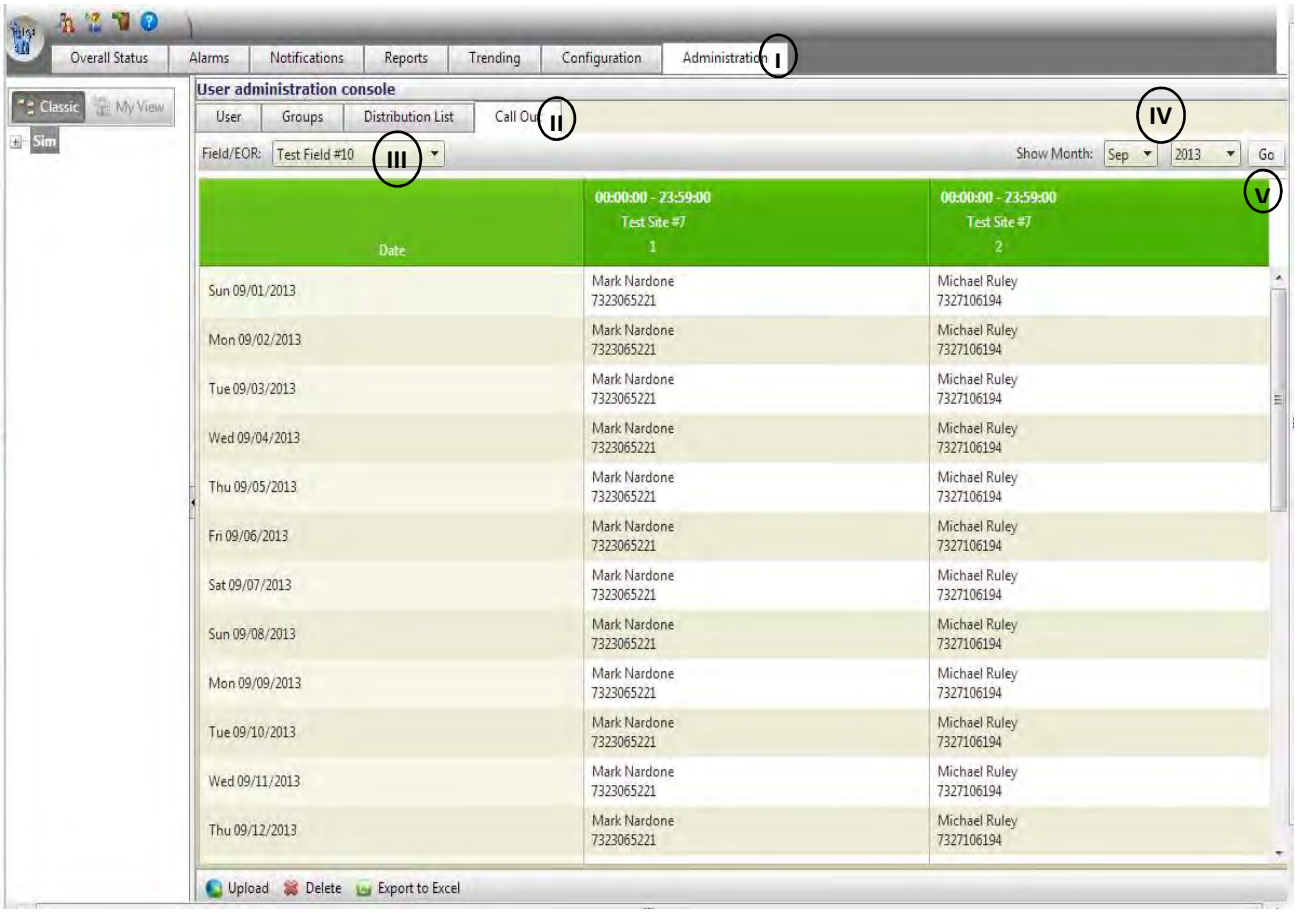
On Sunday, January 21, 2012 at 10:30AM an alarm was activated on the Test Field. Immediately, a call was placed to the *first* individual on the contact sheet, Michael Ruley. However, Michael did not answer the phone call. According to the call out list, Mark Nardone is the *second* person to be called from 9:00 am- 6:00PM. Mark Nardone was contacted directly after. Mark answered and acknowledged the alarm.

On Tuesday, January 24, 2012 at 7:00PM an alarm was activated on the Test Field. According to this chart, there is no one that should be contacted after 6:00 PM therefore the alarm notifications that were sent out were for SMS and email as setup on that rule.

8.7 How to View an Existing Callout List

This section will give a detailed explanation on how to view an already configured callout list.

1. Click on the ***Administration*** tab
2. Click on the ***Call Out*** sub tab
3. Select a Field from the ***Field/EOR*** dropdown
4. Select the ***Month/Year*** that needs to be viewed
5. Click ***Go***



Corresponding Key Tabs:

I. Administration Tab
II. Callout Sub-Tab
III. Field/EOR Section
IV. Month/Year Selection
V. Go Button

Chapter 9

9. Advanced Functions

This section of the manual will teach you how you can further customize the web portal to make it quicker, easier to use and better meet your needs as a user.

9.1 Creating "My View"

My view allows the user to configure the system to see measurements across fields.

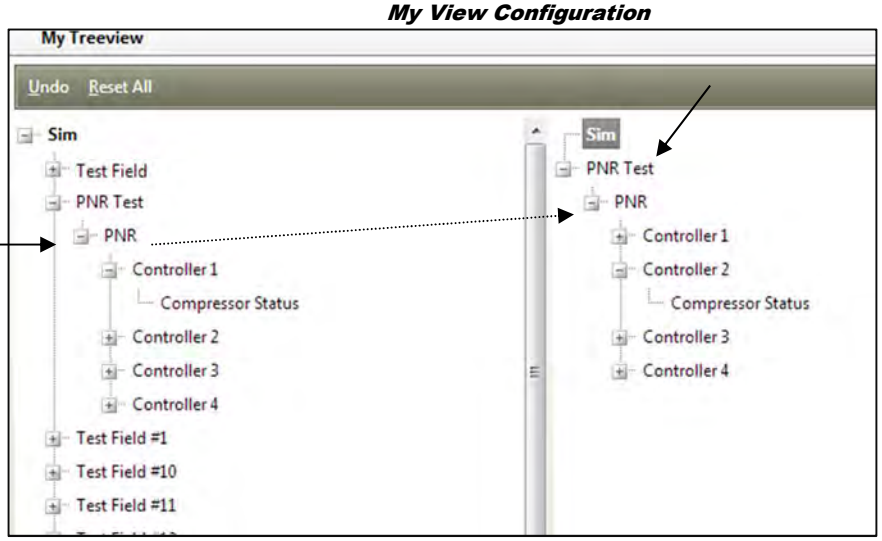
Each user can customize how the navigation tree looks to highlight important information and specific functions.

1. Right click your company on the navigation tree.
2. Use the drop box menu and select **Configure My View**.
3. Expand or shrink each field, well site, or entity to find specific information.
4. Select the item to add to your "my view" then drag it to the right.
5. To remove an item, simply drag it back to the left side.
6. Click **Save**.

Click between Classic and My View to see the different navigation trees.

My View Configuration

Click box, then drag desired entity to the right.



9.2 Customize Quick Stats

Enable quick stats to easily compare specific measurements from different well sites on one page. Ex: Production Statistics: Oil Production

1. Right click on a field site on the navigation tree.
2. Use the drop box menu and select **Quick Stats.**
3. Once the box appears, you will see wells sites listed in the box on the top left.
4. Double click the well site in the box and a message will appear "*Do you wish to group your well site based on measurement*?" Click **OK**.

5. A second box will appear: ***Split Site Configuration Wizard.***
6. Scroll to find the first entity *Ex: Wellhead 1 Oil Production.*
7. Click the *pencil* next to the name of the entity.
    - New Display Name: Choose the name which will appear on Quick Stats.
      Ex: Wellhead 1 Oil Production
    - Group Name: Choose the name of the group which will appear on Quick Stats.
      Ex: Oil Production
    - Label similar entities with the same group name so they are displayed on the same graph.
    - Each row must be filled with the appropriate group name and display name.

8. Click **Done**.
9. Click **Apply Changes**.

9.3 Adding a Note

This application allows you to add a message to a particular field or well site for other users to view.

1. Right click your field site or well on the navigation tree.
2. Use the drop box menu to scroll to **Notes**.
3. A box will appear, click *blue* **Add Note** on the top left corner.
4. Write note.
5. Click **Save**.

The Notes can also be seen by enabling three-pane view under Overall Status. In order to enable three-pane view follow these steps.

1. Click on **Diesel the dog** on the top left corner of your screen.
2. Select **Config**.
3. Select **Content Pane**.
4. Select **Three Pane**.
5. Now the notes will appear on the bottom right of your browser.

9.4 Manual Control

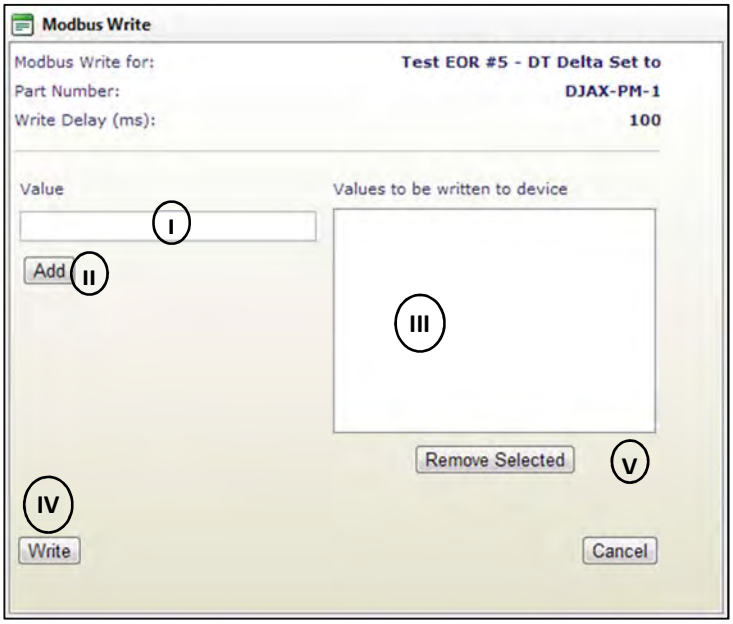
9.4.1 Controlling Serial Devices

This application allows the user to write values to a specific register of a device.

Only measurments that are enabled for Manual control will display the icon.

1. Click a field, site or entity on the ***Overall Status*** tab.
2. Click the **Modbus Write** icon.
3. A box will appear like the one below.
4. Enter in the desired value. *(Image I. below)*
5. Click **Add**. *(Image II. below*) The value will appear in box 2. *(Image III. below)*
6. Click **Write**. *(Image IV. below)*

Display Page



How to Remove a value

1. Select the value. *(Image III. above)*
2. Click **Remove Selected**. *(Image V. above)*

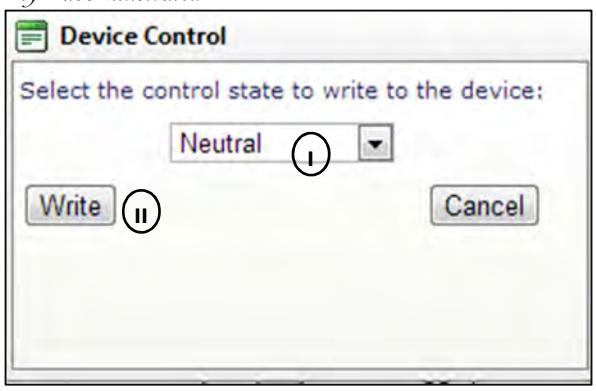
9.4.2 Controlling Analog/ Digital devices

This application allows the user to remotely control the state of a device.

1. Click a field, site or entity on the ***Overall Status*** tab.
2. Click the **Control Device** icon.
3. A box will appear like the one below.
4. Use the drop box to select the control state to write to the device *(Image I. below)*
5. Click **Write**. *(Image II. below)*

Display Page

Key Tabs Illustrated



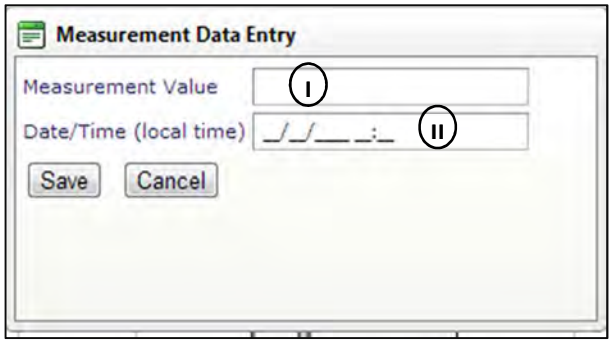
9.5 Manual Measurement Data Entry

This application allows the user to enter in a value for a measurement manually as the device is not currently connected to the RMC field equipment.

Only measurments that are enabled for Manual Measurement data entry will display the icon.

1. Click a field, site or entity on the ***Overall Status*** tab.
2. Click the **Measurement Data** icon.
3. A box will appear like the one below.
4. Enter in the desired measurement value. *(Image I. below)*
5. Enter in the Date/ Local Time *(Image II. below)*
   - Must be entered as shown MM/DD/YYYY & HH:MM
6. Click **Save**.

Display Page



9.6 Down Configuration

- Device Down configuration can only be set at the field and site level.

- The user can set Device Down and Measurement Down independently of each other. Both do not need to be setup at the same time.

- Setting up Device Down or Measurement Down at the site level will override the configuration set at the field level

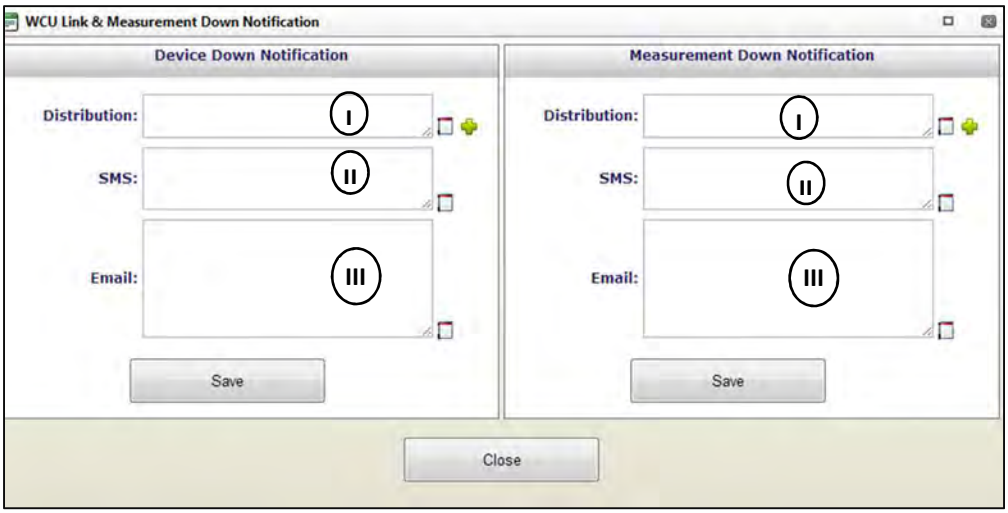
Down Configuration is a type of notification. An alert will be sent through a distribution list or to individual if a device is not reporting data. Down Configuration is useful for pinpointing a problem due to a faulty device connected to a specific measurement.

Device Down
A break in the link between the Bluemax on the well site and the Bluetick NOC. The break in the link would mean that the communication is impaired between the Bluetick NOC and the site where the Bluemax is taking measuremts.

Measurement Down
A break in the link between the Bluemax and a specific sensor on the well site. The break in the link would mean no communication between the Bluemax and that specific sensor on the site.

1. Right click your field, site or entity on the navigation tree.
2. Use the drop box menu to scroll to **Down Configuration**.
3. A box will appear like the one below.
4. Fill in the appropriate boxes with desired contacts.
   - Click the *green plus sign* to add a distribution list. *(Image I. below)*
   - Enter individual phone numbers for SMS messages. *(Image II. below)*
   - Enter individual email addresses. *(Image III. below)*
5. Click **Save**.

Device and Measurement Down Configuration



◆ At least one of the 3 boxes must have and entry to be valid for notification but the user can enter information on all 3 if needed (Distribution, SMS and Email).

9.7 Maintenance

If a device is being worked on in the field, putting the devices measurements into maintenance will prevent any rules attached for that device from activating.

9.7.1 How to put a measurement into maintenance mode

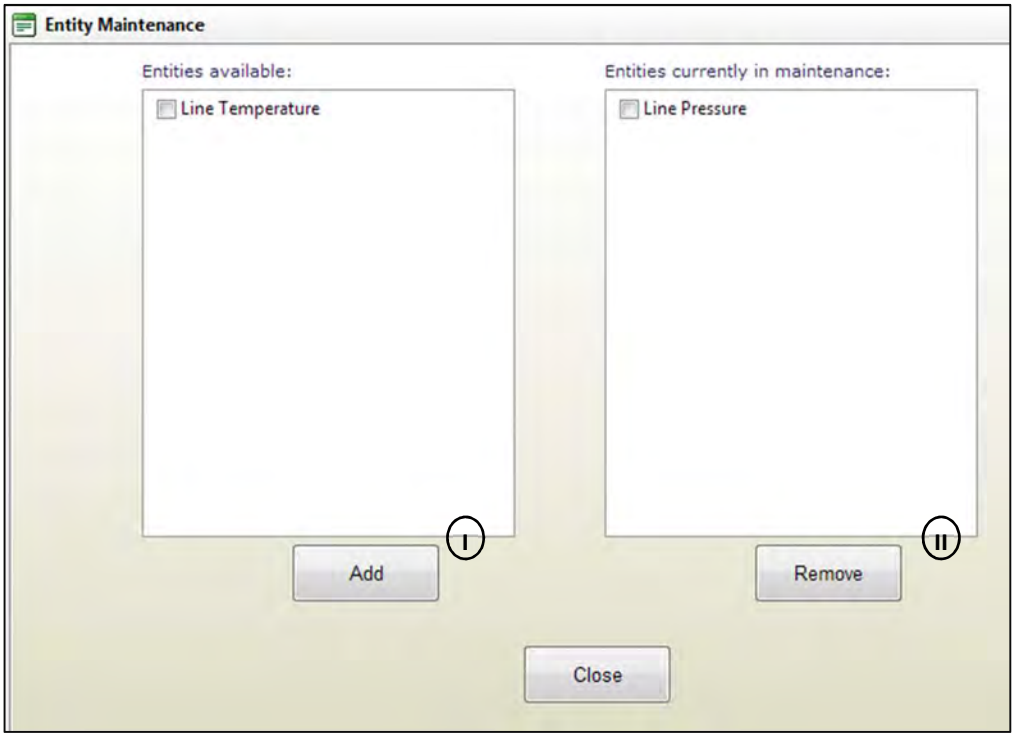
◆ You can see what devices are in maintenance by looking at the maintenance tab on the notification section.

1. Right click a specific entity under a well site on the navigation tree.
2. Use the drop box menu to scroll to **Maintenance**.
3. A box will appear like the one below.
4. On the left side, check any entity that you wish to put into maintenance.
5. Click **Add** to put it into maintenance. *(Image I. below)*

    - This message should appear "Items have been successfully put into maintenance mode!"

Measurements that are currently in maintenance mode will display the maintenance icon on the overall status page.

Maintenance Mode Configuration



9.7.2 How to take a measurement out of maintenance mode

1. Right click a specific entity under a well site on the navigation tree.
2. Use the drop box menu to scroll to **Maintenance**.
3. A box will appear like the one above.
   - In the box on the right are entities currently in maintenance.
4. Check the box by the name of the entity you wish to remove.
5. Click **Remove**. *(Image II. above)*

   - This message should appear "Items have been successfully removed from maintenance mode!"

9.8 SMS Configuration

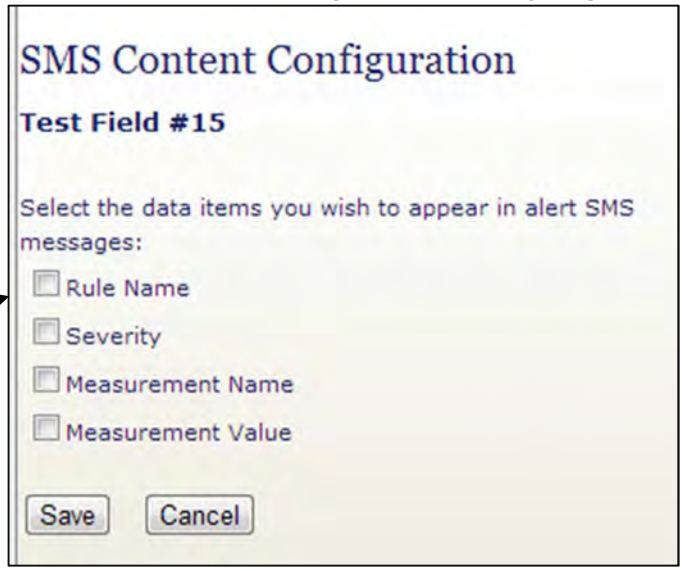
Removing a SMS field will also remove it from voice callout.

This application allows you to customize how much information each SMS message contains for when an alarm is triggered.

1. Right click a specific field on the navigation tree.
2. Use the drop box menu to scroll to **SMS Configuration**.
3. Check all that apply.
4. Click **Save**.

SMS Content Configuration Display Page

Check boxes to apply.



Content Options

- SMS content configuration is performed at the field level. All notifications under a field will be affected when changes are made.

Option	*Function*
Rule Name	Name of the rule that applies to the alarm
Severity	The priority level of the rule (minor, major, critical)
Measurement Name	The name of the measurement Ex: Tube Pressure
Measurement Value	The measurement value at the time of the alarm

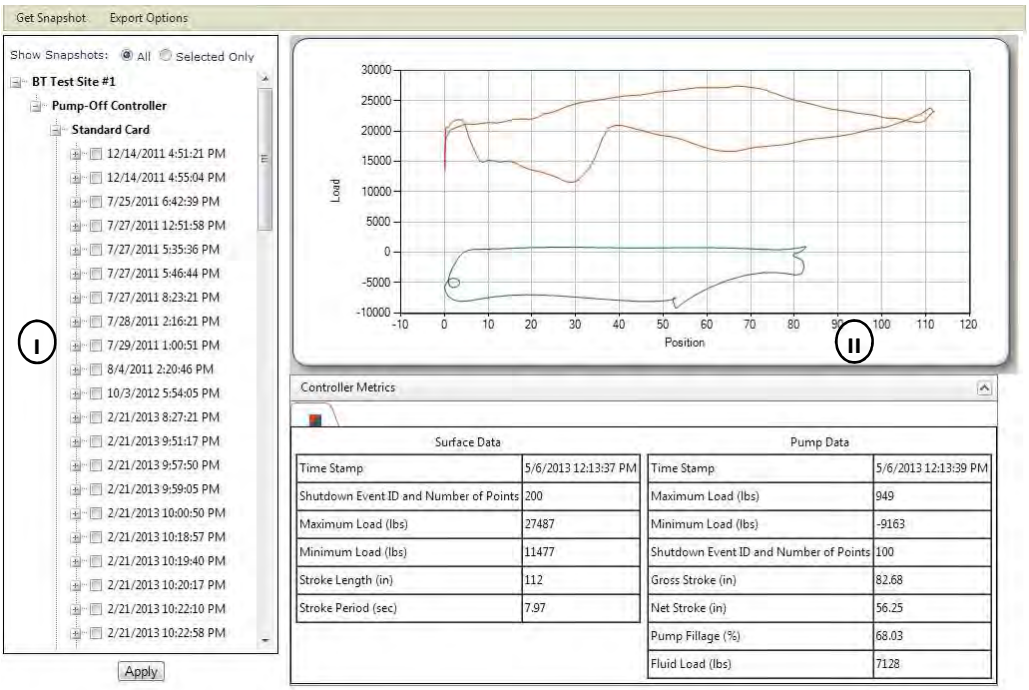
9.9 Pump-Off Card Data (if applicable)

This application allows a user to quickly view raw data reports and trending reports on the pump's activity for card data enabled devices.

1. Right click a card data enabled pumping unit entity on the navigation tree.
2. Use the drop box menu to scroll to **POC Card Data.**
3. A box will appear like the one bellow.

- Click *Get Snapshot* on the top left of to pull a data card.
- Click *Export Options* on the top left of the display page to export data to excel or a printer.
- Multiple cards can be overlaid for comparison by clicking the checkbox by those card and clicking the apply button.

POC Card Data



Corresponding Key Tabs:

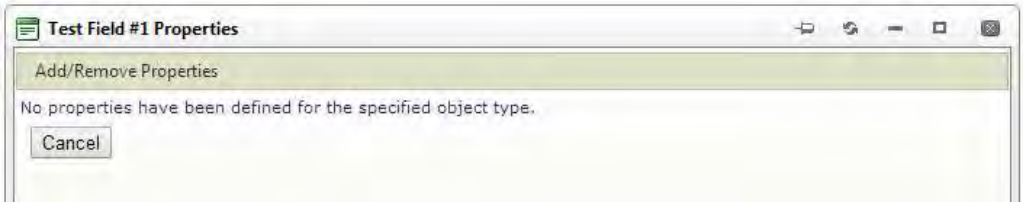
I. Previous snapshots of specific pump data reports.
   - Click to view.

II. Trending reports that show pump data reports over time.

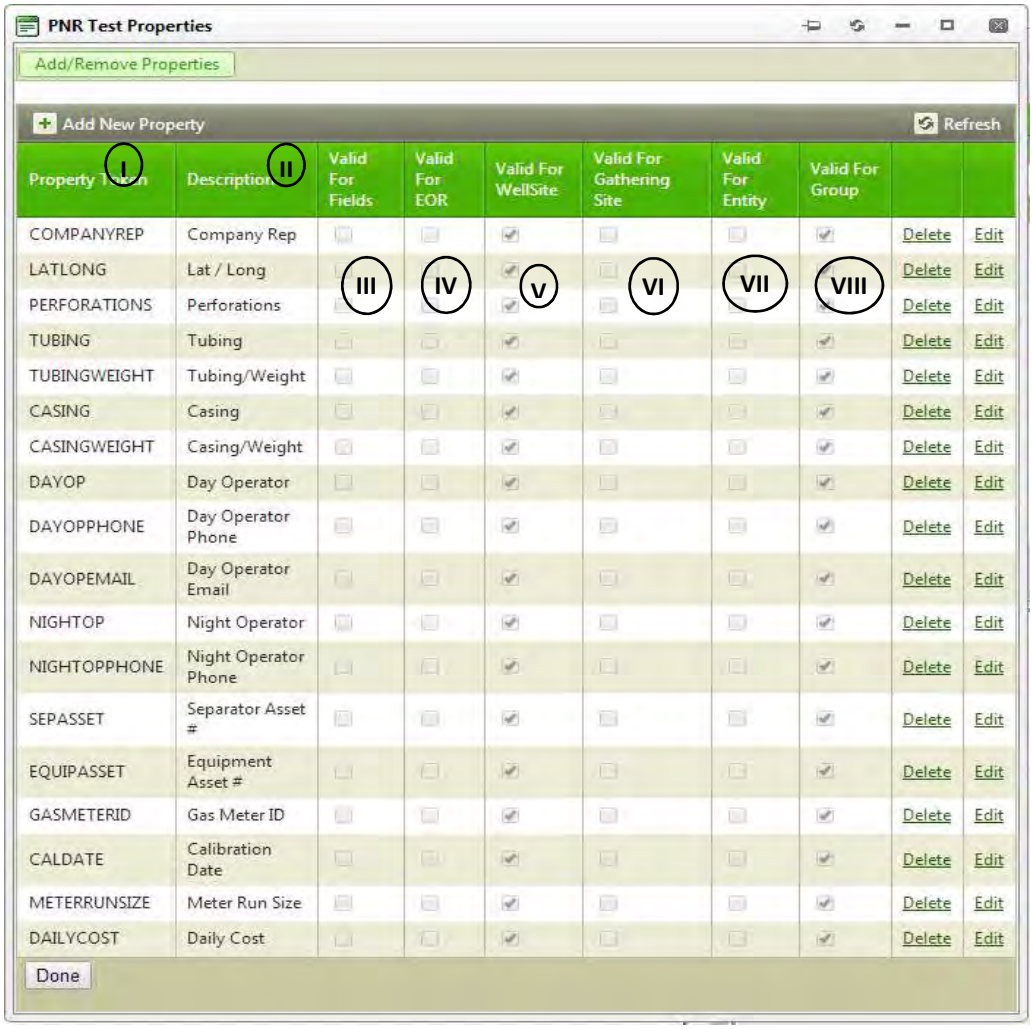
9.10 Site Properties

This feature allows the user to create well site properties that are displayed in the Properties section of the main graphical interface. The properties section is located on the bottom left section of the user screen.

1. Right click a *well site* on the navigation tree.
2. Select the Properties menu option. The following screen will appear.



3. The box with the default properties as shown below will be displayed. By default the properties will be available at the site and group level. The user can change the privileges be clicking the edit button.
4. Click on the Add/Remove Properties button



Corresponding Key Tabs:

I. *Property Token:* The token is used in the report template and the properties section of the web portal.

II. *Description:* Description of the Property Token.

III. *Valid for Fields:* If selected the property will be displayed in the properties section of the web portal at the field level.

IV. *Valid for EOR:* If selected the property will be displayed in the properties section of the web portal at the EOR level

V. *Valid for WellSite:* If selected the property will be displayed in the properties section of the web portal at the WellSite level.

VI. *Valid for Gathering Site:* If selected the property will be displayed in the properties section of the web portal at the Gathering Site level.

VII. *Valid for Entity:* If selected the property will be displayed in the properties section of the web portal at the Entity level.

VIII. *Valid for Group:* If selected the property will be displayed in the properties section of the myView interface at the Group level.

Chapter 10

10. RMC Mobile Application

The Bluetick RMC mobile application has been created to compliment the web portal by providing on the go data access. The mobile application runs natively under the iOS and Android operating systems. The mobile application also provides support for different types of devices including tablets and smartphones with different screen sizes.

The Bluetick RMC mobile application supports the following functions.

1. Overall Status Display
2. Quick Stats Display
3. Alarm Display and Suppression
4. Reports Display
5. Polling Function
6. Manual Control Function (MODBUS Write and Line Toggle)
7. Maintenance Mode Function
8. Measurement History Function
9. Site Notes Function
10. Online / Offline Field Data Capture
11. Multilingual Text (English/Spanish)

You can download the apple version of the mobile application from the apple store. Search for "Bluetick RMC"

You can download the Android version of the mobile application from google play store. Search for "Bluetick RMC"

While the Bluetick RMC mobile application runs on any platform with iOS 6.0 or Higher and Android 3.0 or Higher, Bluetick recommends the following hardware platforms to enhance the user experience.

For the Apple version of the Mobile Application

- iPad 2 or newer (7 inch or 10 inch)
- iPhone 4 or newer

For the Android version if the Mobile Application

- Quad Core processing unit or greater (any screen size)
- 8GB of storage

Regardless of the type of hardware selected, the user should be aware of the following

- Synchronization times vary depending on the speed of the connection and the number of measurements to be synchronized.
- The Mobile Application could use a significant amount of space on the device to locally store up to 7 days of measurements.
- The tablet version of the Mobile Application has been locked on landscape mode. Rotating the screen does not rotate the application.
- The smartphone version of the Mobile Application has been locked on portrait mode. Rotating the screen does not rotate the application.

10.1 Accessing the Mobile Application

The Mobile application can be accessed by clicking the Bluetick RMC icon on your Apple or Android device. Once the application opens the main login screen appears.

Username: Use the same username used to login to the web portal.

Password: Use the same password used to login to the web portal.

Remember Me: Click here to have the App remembers the Username. The password cannot be remembered.

Login: Click here to log into the app after the Username and Password have been entered.

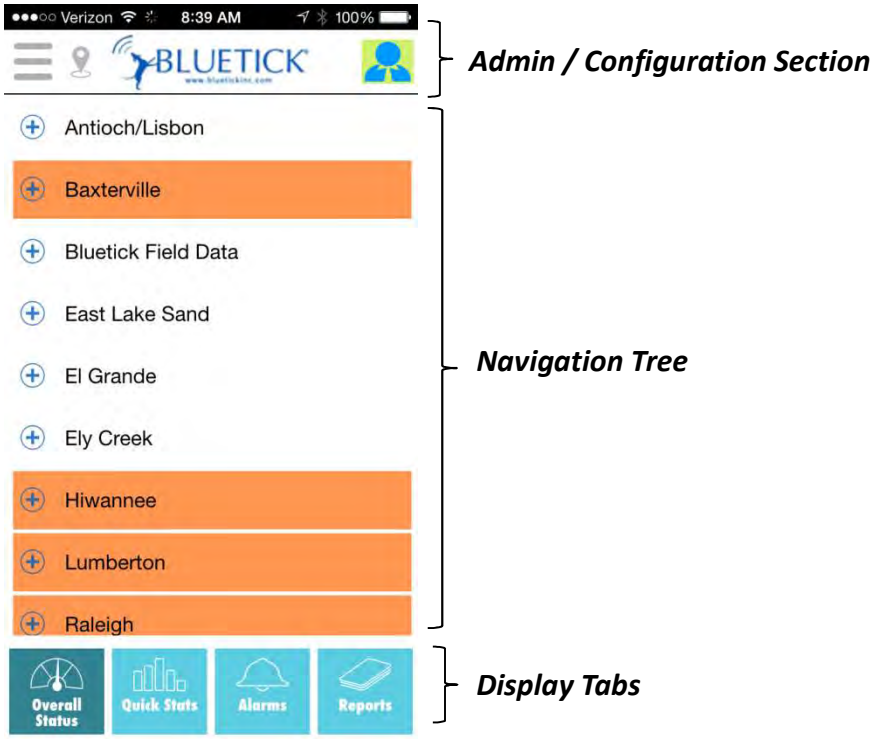
Forgot Password: Click here to recover your login credentials if you forgot them.

Once you entered the username and password, click the login button.

Note: During the initial Login the application requires additional time to process the values downloaded. Depending on the type of hardware and connection speed, this procedure can take minutes to complete. The user will see a spinning wheel while the device is downloading and processing data and the overall status screen once the processing is completed.

10.2 Navigating the Smartphone Mobile Application

Upon initial login, the Mobile application performs a full synchronization with the RMC servers. Depending on the connection speed and the hardware, this process can take several minutes. Once the synchronization is complete, the user is presented with a screen to the one shown below.



The Admin / Configuration section is comprised of 2 main components.

I. The Configuration Menu represented by  symbol. We will be covering the different configuration options on another chapter in this section.

II. The Network Connectivity indicator represented by the  symbol. A green background for the logo is an indication that connectivity to the RMC servers is available (system is online). A grey background for the logo is an indication that connectivity to the RMC servers is currently unavailable (system is offline).

III. The Map display indicator represented by the  symbol. Clicking the map indicator allow the user to see the location and state of the assets monitored based on their location.

The Main Navigation tree maintains the same hierarchy as the one on the web portal. It is also color coded to indicate the sites that are either in alarm or require attention. The color coding scheme is the same scheme that is used in the main web portal. After the initial synchronization is complete the mobile application presents to the user all the fields that are available. The user can they drill down to the sites and measurements by clicking the (+) sign. Conversely, the user can go up one level by clicking the (-) sign.

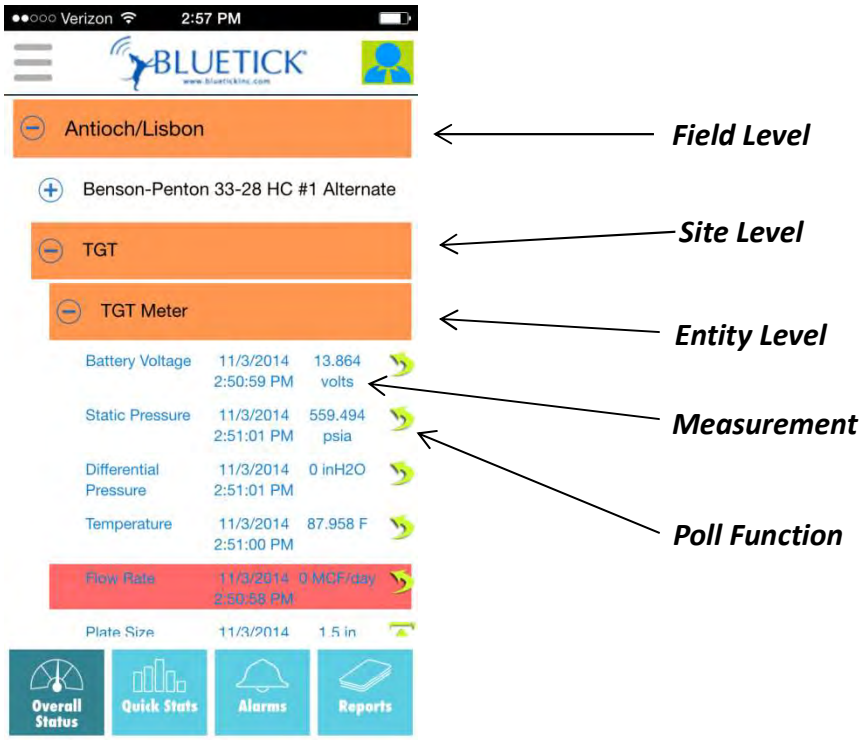
There are four Displays tabs available to the user.

I. ***Overall Status:*** Used to visualize the state of all the assets being monitored.
II. ***Quick Stats:*** Used to visualize the status of all the assets organized by field.
III. ***Alarms:*** Used to visualize all the current active alarms.
IV. ***Reports:*** Used to present the report data for reports that were created on the web portal.

10.3 Polling a Device from the Mobile Application

Use the polling feature to receive the latest data for a device.

1. Click the Overall Status Display tab.
2. Click the specific *field, site and entity* on the navigation tree.
3. Click the *green arrow icon*  next to a measurement to poll the device.



Polling allows the user to get a measurement value on demand without having to wait for the upload period. The poll function in the mobile application works the same way as the one in the main web portal.

10.4 Quick Stats in the Mobile Application

The quick stats can be accessed by clicking the "Quick Stats" display tab. The quick stats section is characterized by the following:

1. The navigation is the same as the one described in section 10.2. The (+) sign allows the user to drill down, while the (-) sign brings the user one level up.

2. Quick Stats can only be created, edited and deleted from the main web portal. The mobile application only acts as a display platform.

3. Quick Stats can be refreshed from the mobile application Administrator/Configuration menu. See Admin/Configuration section for more details.

4. Quick stats measurements are color coded based on alarm condition.

10.5 Alarms in the Mobile Application

The Alarms section can be accessed by clicking the "Alarms" display tab. The alarms section is characterized by the following:

1. All Active alarms for the assets monitored and available to that user are displayed. There is no filtering based on field/Site/Entity.

2. All Alarms are color coded based on their severity. A Yellow alarm is an indication of a minor severity, An Orange alarm is an indication of a major severity, and a Red alarm is an indication of a Critical severity.

3. All active alarm measurement values can be polled by clicking the green arrow  located next to the alarm measurement.

4. An alarm can be suppressed by clicking the blue box  located next to the measurement name.

5. Alarms can be refreshed from the mobile application Administrator/Configuration menu. See Admin/Configuration section for more details.

10.6 Reports in the Mobile Application

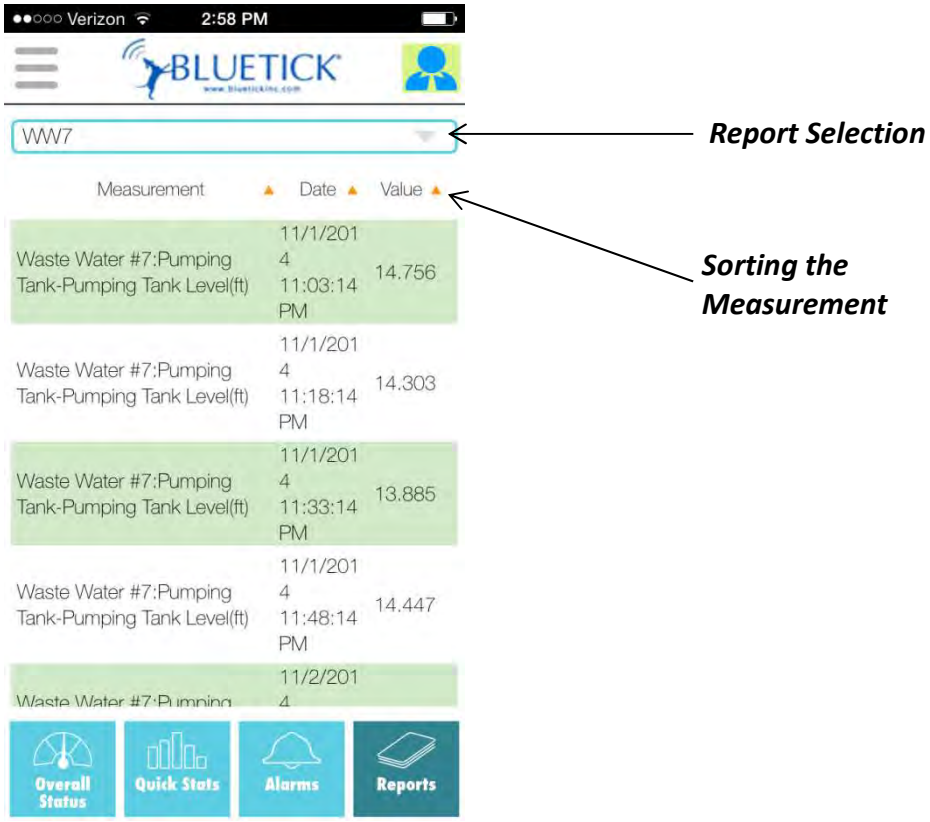
The Reports section can be accessed by clicking the "Reports" display tab. The reports section is characterized by the following:

1. Reports can only be created, edited and deleted from the main web portal. The mobile application only acts as a display platform.

2. The user can quickly change reports by clicking and selecting one of the available reports from the dropdown selection field.

3. The user can change the sorting of the data by clicking the orange arrows located next to the available report columns.

4. The user can define a default sorting method in the mobile application Administrator/Configuration menu. See Admin/Configuration section for more details.



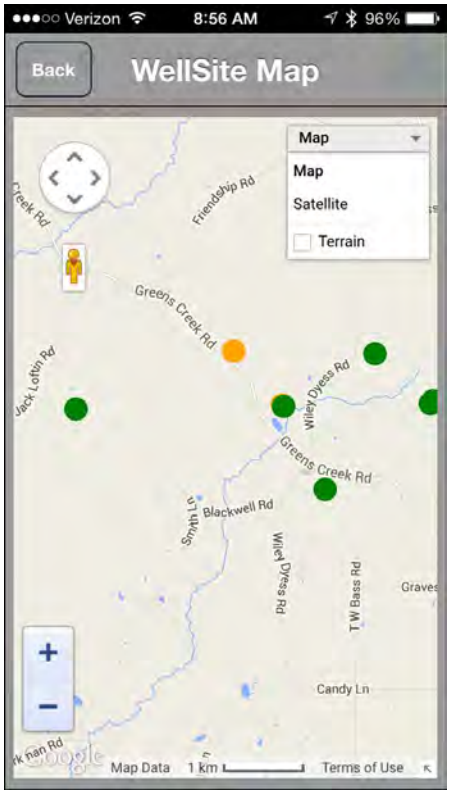
10.7 Using the Map Visualization

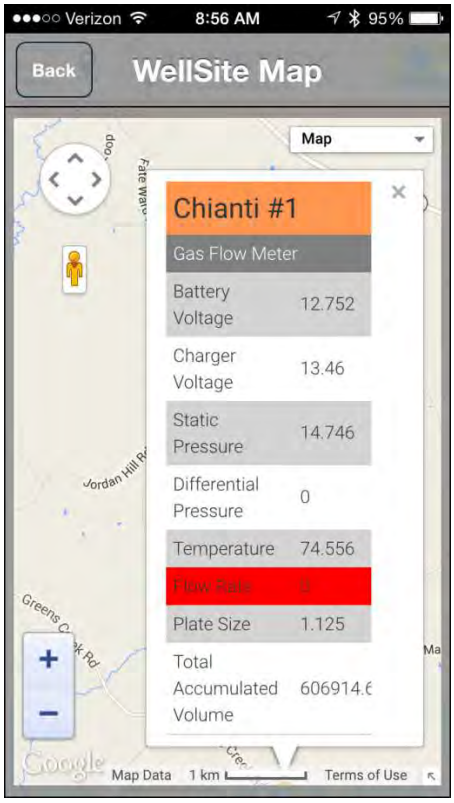
The mobile application gives the user the option to navigate and visualize all the well sites monitored via a map. The following functions are available under map visualization.

1. Pinch-Zoom and Pan-Drag Navigation
2. Well Sites are color coded based on alarm conditions
3. Well Site data can be accessed by clicking the color coded well site icon
4. Road or Satellite layer can be selected as the base map.

In order to access the Map function the user needs to click the  located on the top left of the screen. Please note that if the initial sync has not been completed, a warning message pops-up indicating that the map functions are not yet available.

Once the initial sync is completed, a map pop-up is presented. The user can then use the Pinch-Zoom and Pan-Drag functions to navigate to the appropriate location and then visualize the assets. Clicking on the colored icons displays the last measurements collected for that Well site. The images below show the way the data is presented using the Mapview.





The figures above show examples of the mapview. Clicking on the color icons provides the latest reading for the well site.

10.8 Site Notes and Set Site GPS in the Mobile Application

The mobile application gives the user the option to enter notes and set the GPS location for a site.

The notes works in a similar fashion to the notes function in the main web portal. The main difference is how the user accesses the notes. In order to enter notes to a site, the user needs to follow the steps listed below:

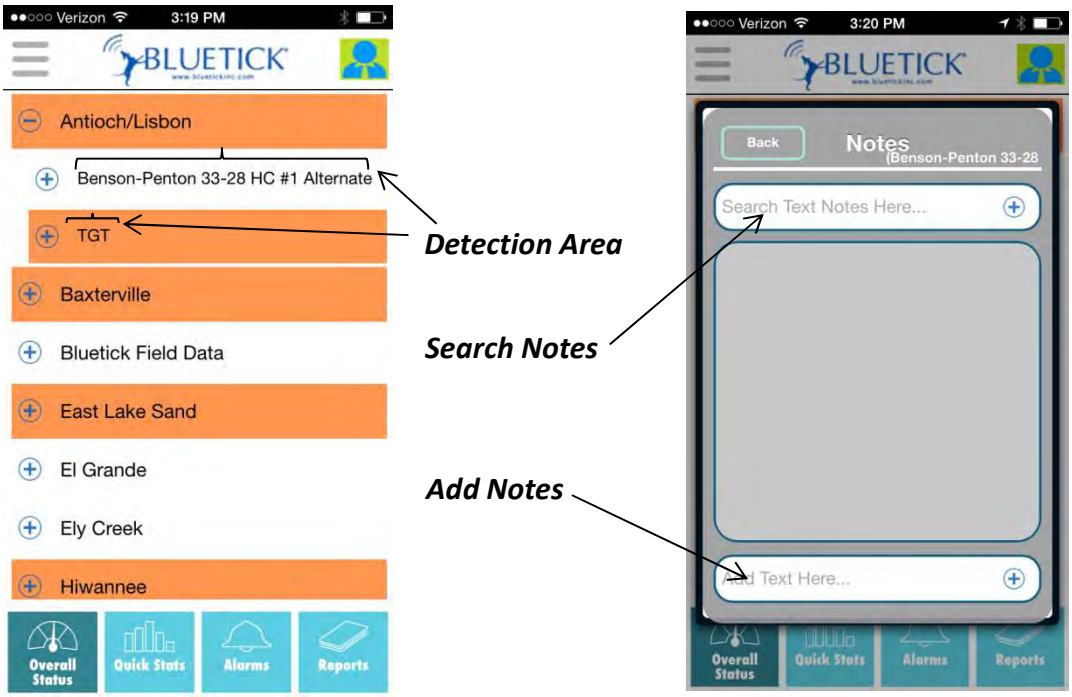
- The long press has to be performed on the site name. Depending on the length of the site name, the detection area is smaller or larger. See image for example of large and small detection areas.

1. From the overall status page, the user needs to perform a “long press” over the site name. A “long press” requires the user to press down and hold the press for up to 5 seconds or until the pop-up appears.

2. Select “Site Notes”. Once the site notes section pops-up the user has the option to search for notes, view the notes, or enter new notes.

3. To search for notes, type the text to search for in the top section and click the (+) sign.

4. To add notes, type the text in the bottom section and click the (+) sign.



The GPS location is used in the system to geo locate the assets on the map. Normally the location information will be entered by Bluetick during the deployment of the asset. There are instances when the user will have the need to record a new location for the asset due to the mobile nature of it. In this case the “Set GPS” option can be used to record the new location. In order to set the GPS location for the asset, the user need to follow the steps listed below.

1. From the overall status page, the user needs to perform a “long press” over the site name. A “long press” requires the user to press down and hold the press for up to 5 seconds or until the pop-up appears.

2. Select “Set Site GPS”. The coordinates will be recorded and updated on the Bluetick system.

10.9 Maintenance Mode in the Mobile Application

The mobile application gives the user the option to set a measurement into maintenance mode. This works in a similar fashion to the maintenance mode in the main web portal. The main difference is how the user accesses maintenance mode. In order put a measurement into maintenance mode, the user needs to follow the steps listed below:

1. From the overall status page, the user needs to perform a “long press” over the measurement to set be set into maintenance mode. A “long press” requires the user to press down and hold the press for up to 5 seconds or until the select option menu pops-up.

2. Click on the Set Maintenance button.

To take a measurement out of maintenance mode execute the procedure again. The maintenance mode procedure only works while in online mode.

10.10 Measurement History in the Mobile Application

The mobile application gives the user the option to view up to seven days’ worth of historic data for a measurement. In order to access the historic the user needs to follow the steps listed below:

1. From the overall status page, the user needs to perform a “long press” over the measurement that the historic data will be presented for. A “long press” requires the user to press down and hold the press for up to 5 seconds or until the select option menu pops-up. Once the select options menu section pops-up..

2. Click on the Measurement History button.

3. Once the user is done visualizing the data, click outside the Measurement history pop-up in order to close the measurement history window.

The user also has the option to graph the data that has been collected. In order to do this click the  symbol on the top right of the measurement history screen. Once the user is done visualizing the data, click outside the window to close the pop-up.

10.11 Manual Control in the Mobile Application`

The mobile application gives the user the option to execute manual control functions such as a MODBUS write or a line toggle. In order to perform a manual control action user needs to follow the steps listed below:

1. Go to overall status display.
2. Drill down by clicking the (+) sign until the measurement that needs to be controlled is located.
3. Click on the Manual Control  icon.
4. If the measurement is a MODBUS write measurement, enter the value to be written, click the plus sign to add it to the write table and click the write button at the bottom of the pop-up.
5. If the measurement is a line toggle, select the value from the dropdown box and click the write button at the bottom of the pop-up

Please note that the control function only works while in online mode only.

10.12 Field Data Capture in the Mobile Application

The mobile application gives the user the option to perform field data capture. With field data capture now Bluetick can replace traditional paper-based workflows and improves the way your operators record and track production information. Our mobile applications also serve as robust manual entry solutions, providing the user in the field the ability to manually enter data from their smartphone or tablet device.

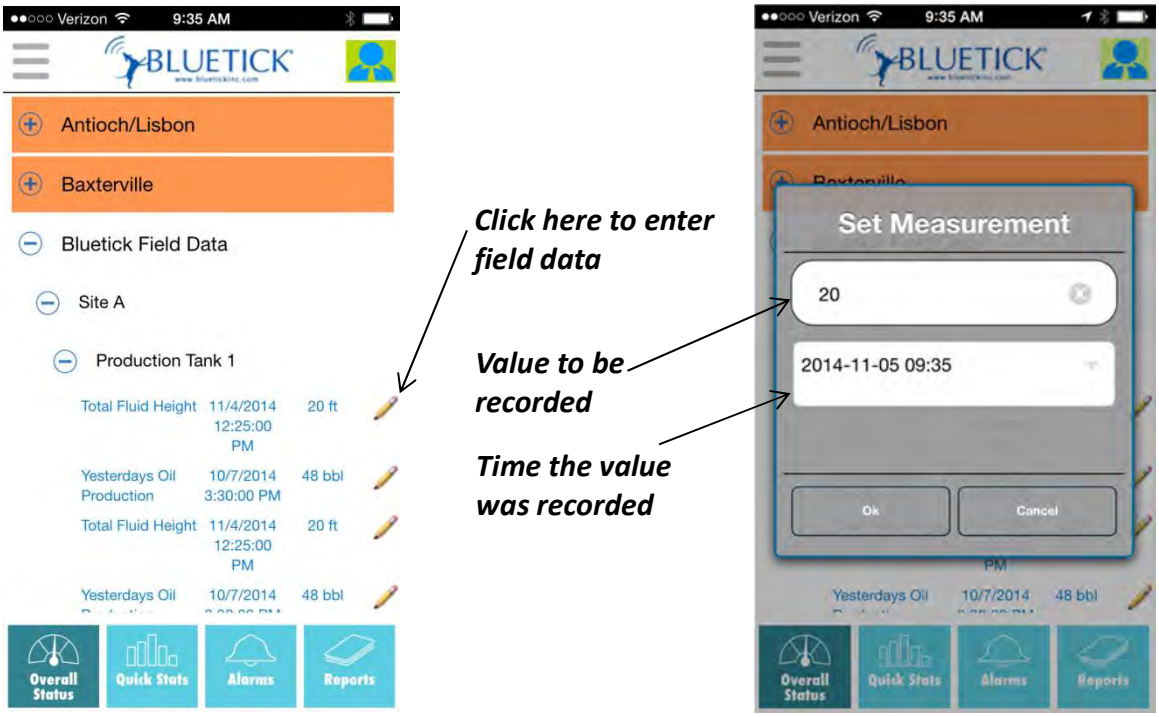
In order to order to perform field data capture follow this steps:

1. Go to overall status display.
2. Drill down by clicking the (+) sign until the measurement that needs to be capture is located.
3. Click on the Field Data Capture  icon.
4. The Set Measurement pop-screen comes up. Enter the value and date/time when the measurement was recorded.
5. Click OK.

The field data capture function works regardless if the user has network connectivity to the outside world (online via cellular or Wi-Fi) or not. If the user is operating offline (no network connectivity to the outside world) the Mobile Application stores the data locally in the

smartphone or tablet and synchronizes the data stored locally once it is able to connect to outside world.

The field data capture function also allows using manual entry measurements into fully automated sites. If the user sees the need to have manual entry values in a site that is currently automated by Bluetick, the field data capture system provides that functionality.



10.13 Admin/Config Options in the Mobile Application

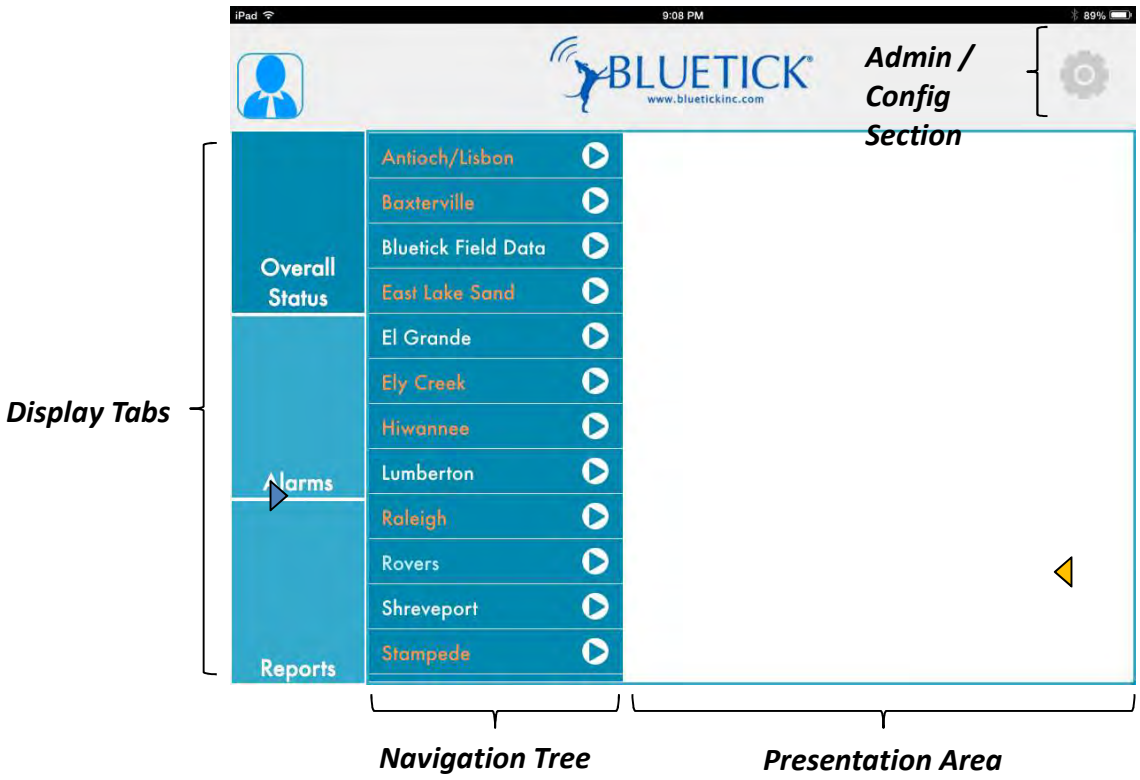
The mobile application Administrator / Configuration section allows the user to perform the following actions:

- ***Language:*** Allows the user to select the display language. Currently English and Spanish are supported.
- ***Sync on Wifi:*** Allows the system to sync the data only using a wi-fi network.
- ***Manual Sync:*** Allows the user to for a synchronization procedure with the customer database at Bluetick. It updates the tree structure, brings back all the new measurements, alarms and refreshes the quick statistics.

- ***Sync Time:*** Allows the user to configure the automated period for synching with the customer database at Bluetick. It also provides the user with the option to disable automated updates.
- ***Set Days For History:*** Specifies the amounts of historical data (in days) to be store in the mobile app.
- ***Reload Alarms:*** Allows the user to refresh active alarms without performing a full synchronization with the customer database at Bluetick.
- ***Reload Quick Stats:*** Allows the user to refresh quick stats without performing a full synchronization with the customer database at Bluetick.
- ***Report Sort:*** Allows the user to define the default sorting mechanism to be used when displaying reports.
- ***Set Measurement Setting:*** Allows the user to define the measurement settings.
- ***Enable History Support:*** Allows the user to enable/disable historic data in the Mobile App.
- ***Show WellSites in a Map:*** Displays the all Wellsites available on a map.
- ***Logout:*** Used when the user desires to log out of the Mobile application.

10.14 Navigating the Tablet Mobile Application

Upon initial login, the Mobile application performs a full synchronization with the RMC servers. Depending on the connection speed and the hardware, this process can take several minutes. Once the synchronization is complete, the user is presented with a screen to the one shown below.
It is important to know that all the functions that are described on the smartphone section of this manual are applicable to the tablet version of the Mobile Application.



The Admin / Configuration section is comprised of 2 main components.

I. The Configuration Menu represented by  symbol.

II. The Network Connectivity indicator represented by the  symbol. A green background for the logo is an indication that connectivity to the RMC servers is available (system is online). A grey background for the logo is an indication that connectivity to the RMC servers is currently unavailable (system is offline).

The Main Navigation tree maintains the same hierarchy as the one on the web portal. It is also color coded to indicate the sites that are either in alarm or require attention. The color coding scheme is the same scheme that is used in the main web portal. After the initial synchronization is complete the mobile application presents to the user all the fields that are available.

The user can they drill down to the sites and measurements by clicking the blue right arrow sign.

Conversely, the user can go up one level by clicking the orange left arrow sign.

There are three displays tabs available to the user.

I. ***Overall Status:*** Used to visualize the state of all the assets being monitored.
II. ***Alarms:*** Used to visualize all the current active alarms.
III. ***Reports:*** Used to present the report data for reports that were created on the web portal.

Quick Stats can be accessed if they have been configured on the main web portal by clicking at the field level. All other functions work in the same way as defined in Chapter 10.

Chapter 11

11. Mobile Web Site

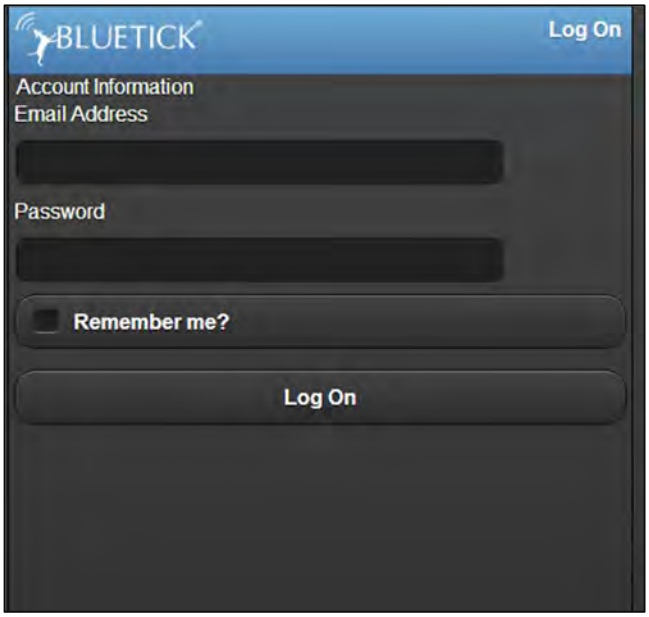
Another reason the web portal is useful and efficient is because it is user friendly. Another way Bluetick has provided you with easy way to access your data is the mobile website. Perfect for a quick view of your company assets while on the move.

The instructions in this chapter will describe navigation and basic functions of the online mobile system. The numbers on the graphic below correspond with the terms explained on the next page.

Online Access URL:
www.bluetickinc.mobi

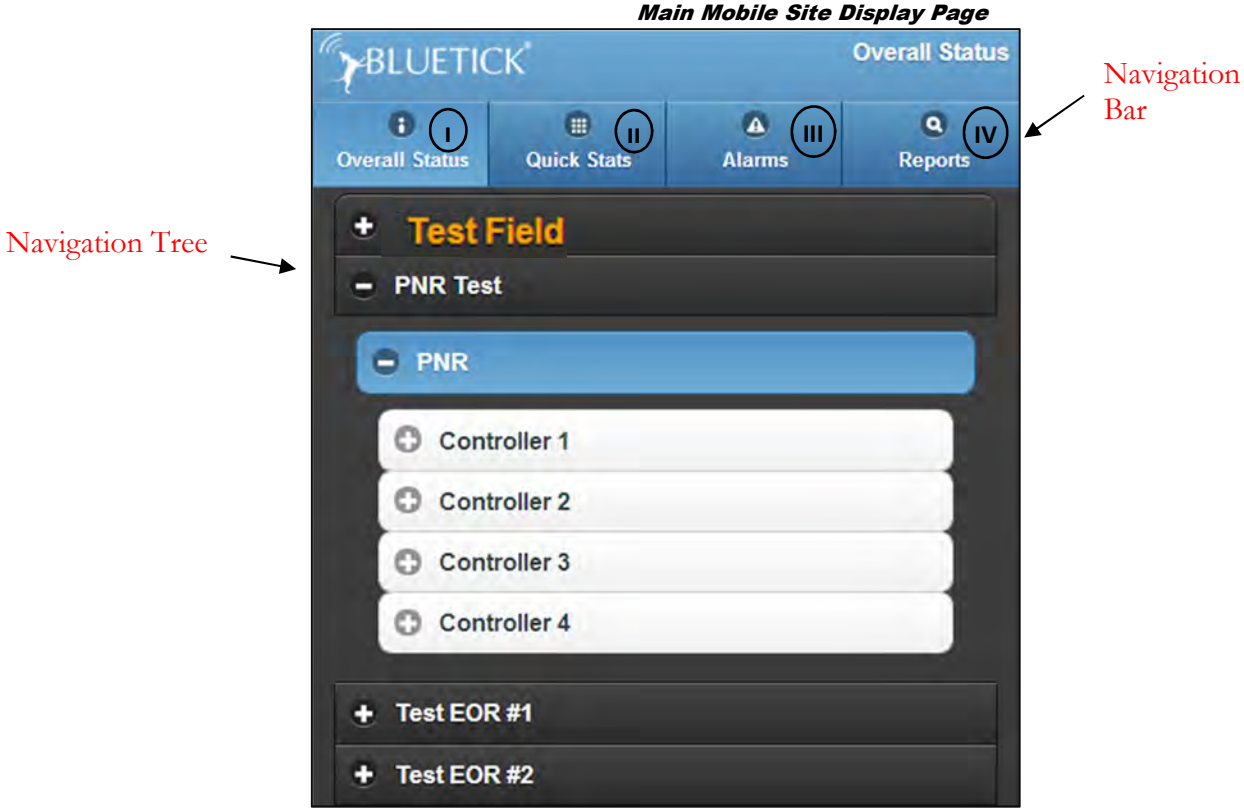
Same username and password as the main web portal.

Main Mobile Site Login Page



Check this box to avoid typing in your username and password every time you access the site.

Main Mobile Site Display Page



Corresponding Key Tabs:

I. *Overall Status*: View the status of each well site by specific entity.
II. *Quick Stats:* View Quick Stats that have been setup on the field on the web portal.
III. *Alarms:* View which are active on the company.
IV. *Reports:* View configured reports that were setup on the web portal.

11.1 Navigating on the Mobile Site

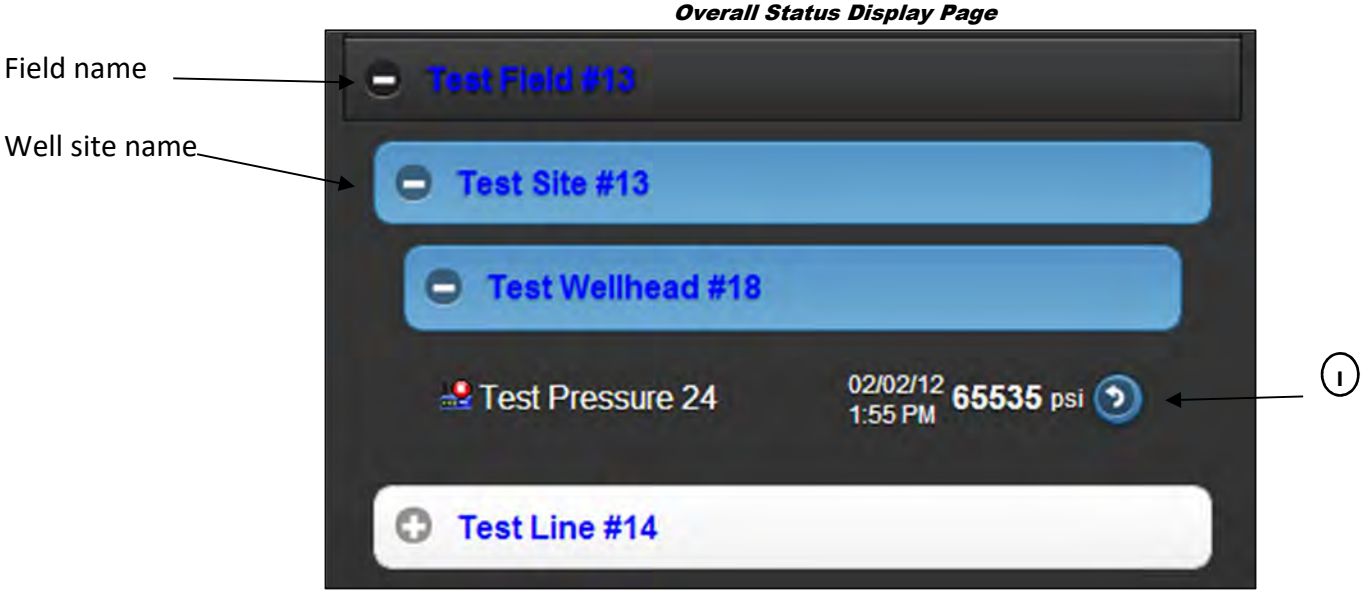
Use the navigation tree to click individual well sites or fields to view specific information provided under the navigation bar tabs.

All information is provided by the sensors on site and directly reflects the data on the web portal.

11.2 Mobile Site Overall Status

This tab shows the overall status of a site based on the configuration setup on the web portal.

Overall Status Display Page



Corresponding Key Tabs:

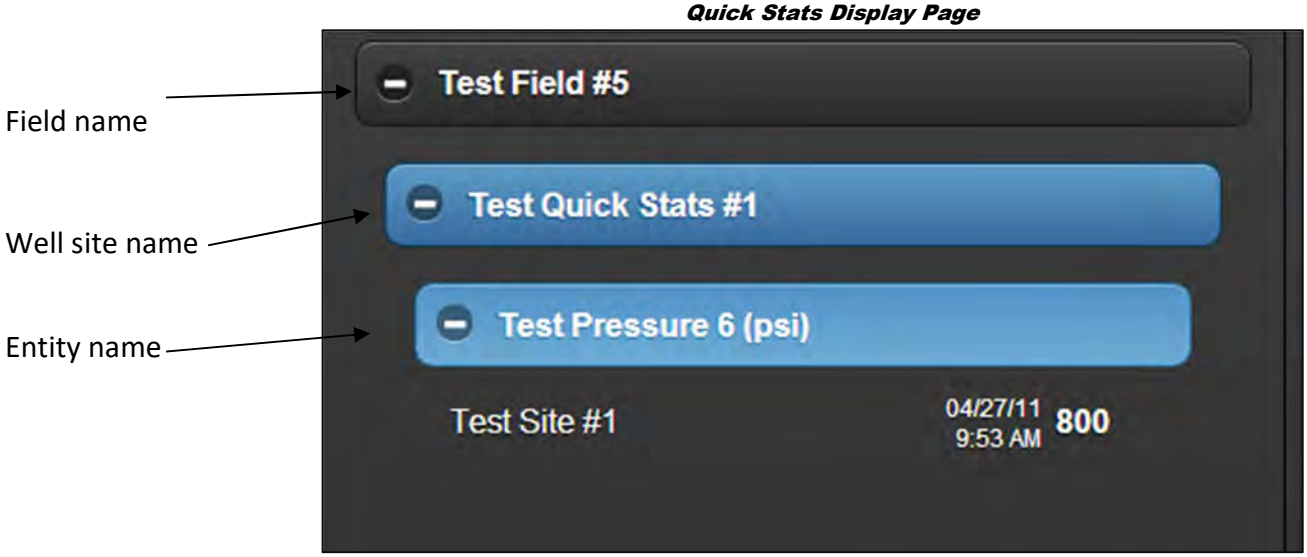
I. *Poll:* Click the *blue arrow* to generate a new poll for the device.

Note: To put a measurement into maintenance mode from the mobile site; click and hold on that measurement until a confirmation box pops up asking the operator if the measurement should be put into maintenance mode.

11.3 Mobile Site Quick Stats

This tab shows the quick stats of a field based on the configured quick stats that was setup on the web portal.

Quick Stats Display Page



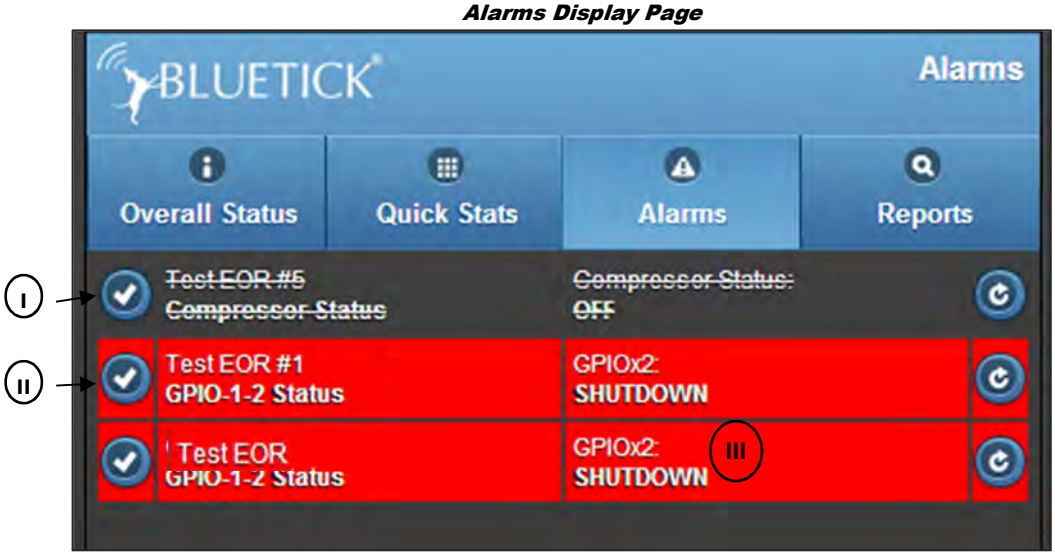
Notes

- What appears on Quick Stats mobile can be edited on the web portal by right clicking the field name and then selecting **Quick Stats**.
- Quick Stats cannot be edited on the mobile site.

11.4 Mobile Site Alarms

This tab shows an your company's active alarms based on the rules that were setup on the main web portal

Alarms Display Page



Corresponding Key Tabs:

I. An alarm with a line through it means the alarm has been suppressed.
II. Blue Check: Click the *blue check* button to suppress/un-suppress an alarm.
III. Blue Cycle: Click the *blue cycle* button to generate an alarms poll for that measurement.

Notes

- Alarms are organized by colors which correspond to their level of severity.

  Red: A critical alarm
  Orange: A major alarm
  Yellow: A minor alarm

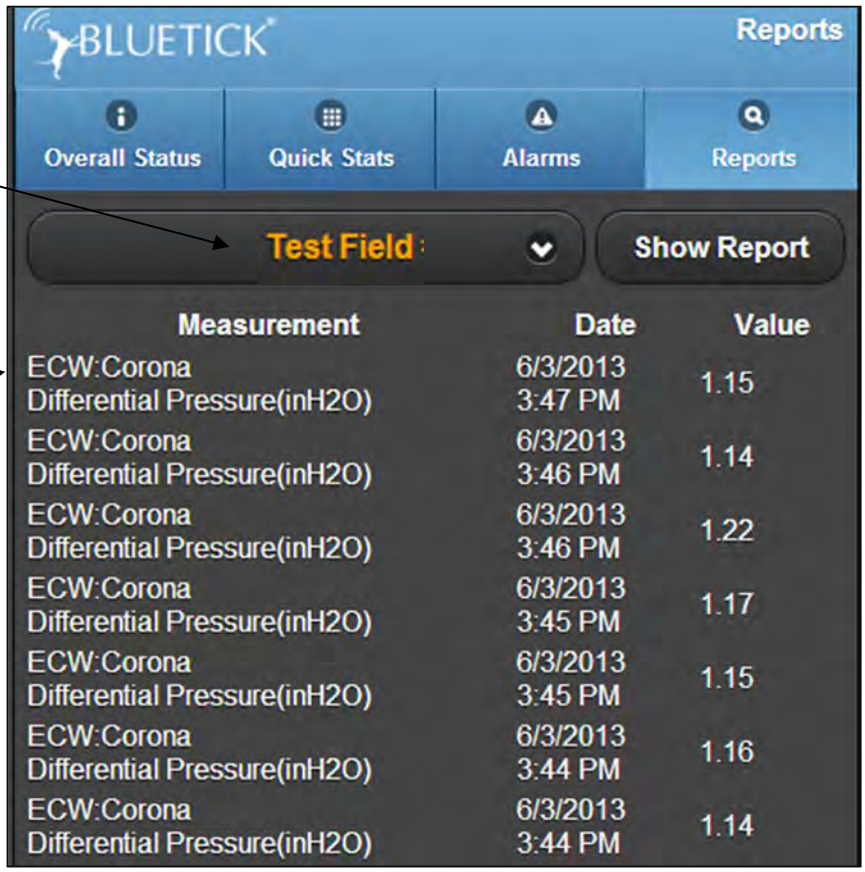
- All alarms reflect the rules configuration on the main web portal. They cannot be edited for content from the mobile site.

11.5 Mobile Site Reports

This tab shows reports based on the reports configurations previously created on the main web portal.

Clicking the drop box menu under the ***Reports*** tab will show reports to be selected from reports created on the main web portal.

Reports Display Page

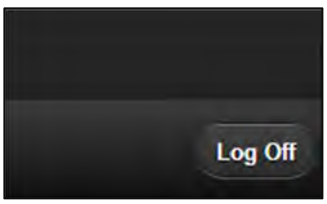


Report name as named on the main web portal.

Site and entity name

11.6 Mobile Site Log off

Exit the system by clicking the Log Off button on the bottom right corner of every tab's display page.

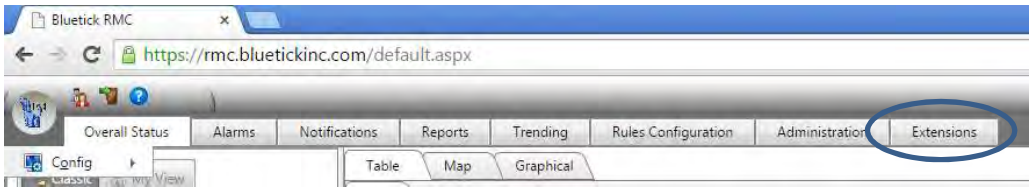


Click here to exit the mobile system.

Chapter 12

12. Extensions

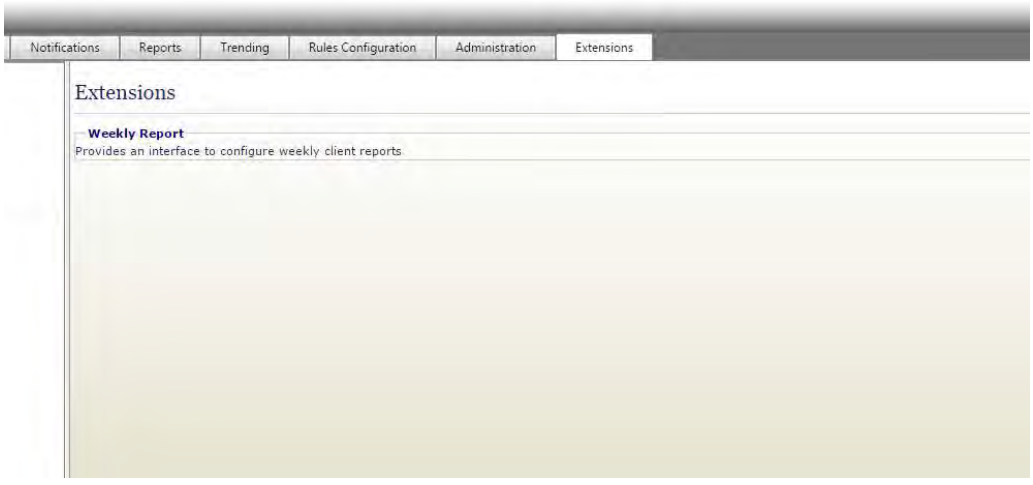
This section of the manual will be a quick and easy guide to some of the web extension functions. Extensions were created to support customer specific custom reports and may not be enabled for all Bluetick customers. If the extension module is enabled, a new tab labeled extensions is display (see image below). If the extension module is not enabled, contact Bluetick support to determine the necessary steps to enable the module.



12.1 Accessing Extensions

In order to use the extensions module follow these steps.

1. Click the **Extensions** tab. A list of the enabled extension will be listed. For this example we will use the weekly report extension.

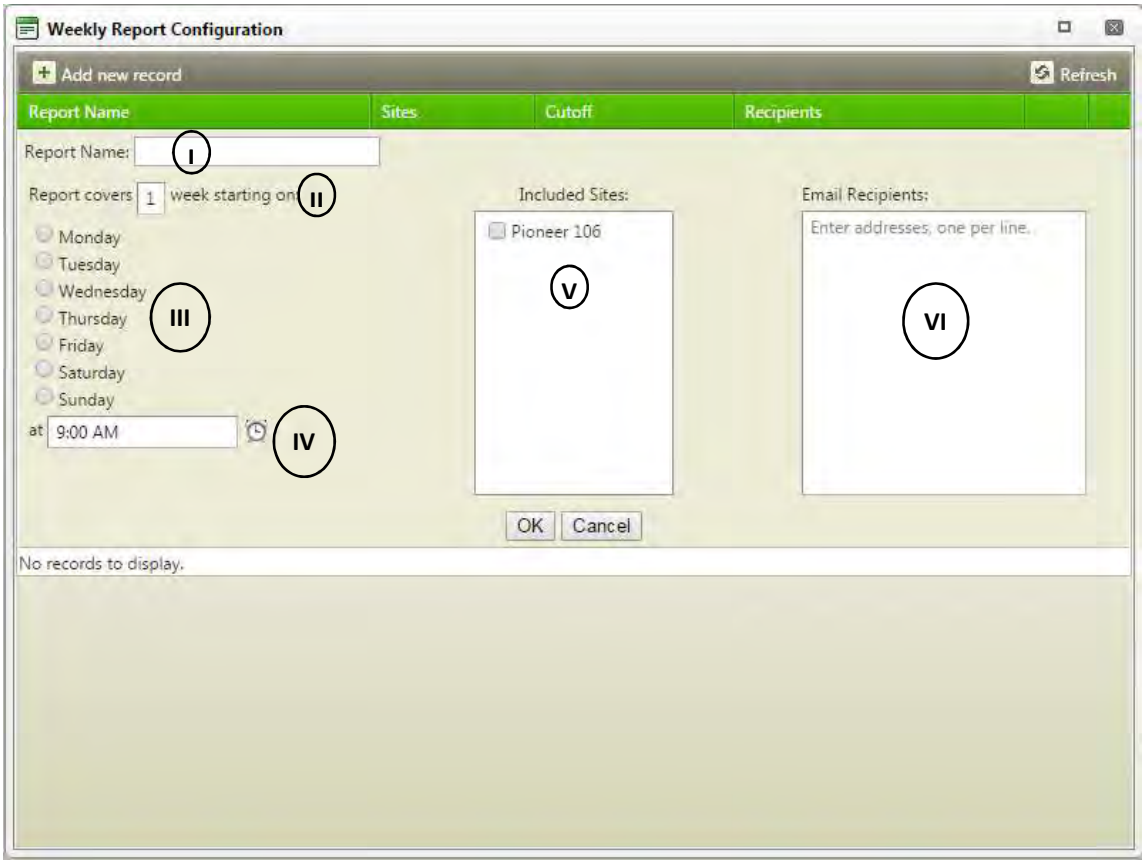


2. Click the **Weekly Report** extension in order to access the configuration screen.

12.2 Adding a New Record to an Extensions

In order to add a new record to an extensions follow these steps.

1. Click **Add a new record**. The following configuration screen comes up.

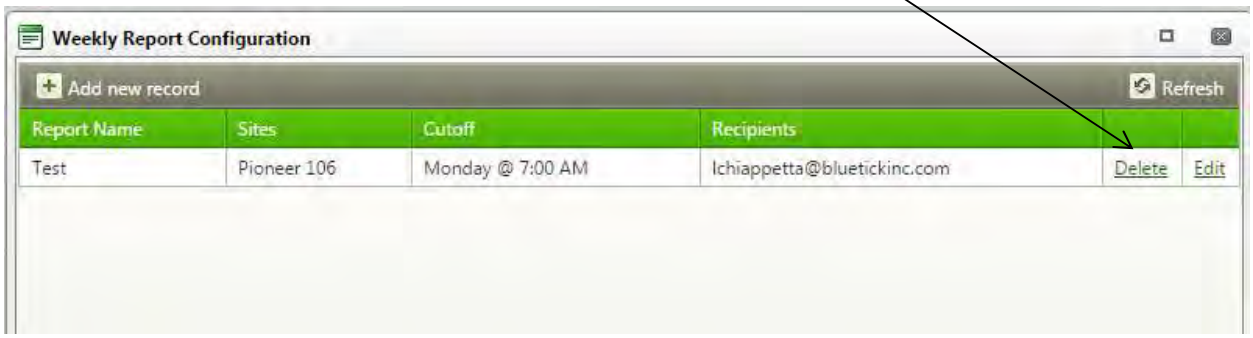


2. Enter the report name in the **Report Name** textbox (See I).
3. Select how often in number of weeks the report needs to be enabled. If the report needs to be sent every week, select 1 (See II).
4. Select the day of the week when the report needs to be generated (See III).
5. Select the cutoff time for the report. The cutoff time is not the time when the report will be emailed (See IV). The cutoff time is from / to range for the data. The report will be email 1hour after the cutoff time. For example if the user sets the cutoff time to be 7:00AM, the report will be emailed at 8:00AM.
6. Select the sites that need to be included in the report (See V).
7. Enter the list of recipients of the report (See VI).
8. Click OK.

12.3 Deleting an Extension Record

In order to delete an extension record, follow these steps.

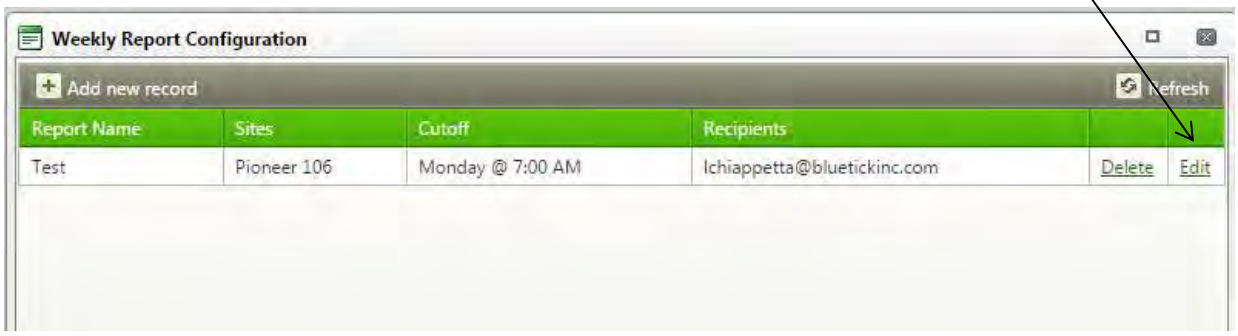
1. Access the extensions configuration menu. See section 12.1.
2. Click the **Delete** link next to the record.



12.4 Editing an Extension Record

In order to edit an extension record, follow these steps.

1. Access the extensions configuration menu. See section 12.1.
2. Click the **Edit** link next to the record.
3. Follow the steps defined in Section 12.2 to edit the record.



Chapter 13

13. Quick References

This section of the manual will be a quick and easy guide to some of the web portal basic functions.

13.1 How to Change your Password

1. Click the **Blue Dog** button on the top left hand corner of the display page.
2. When clicked, the **Blue Dog** button activates the configuration drop box.
3. Click **Change Password**.

13.2 How to Configure User Options

This can be done in two ways, first by User and also by Group.

User:

1. Go to the ***Administration*** tab, then the ***User*** tab.
2. Click the user that you would like to modify their viewing rights.
3. Click **Modify** next to the pencil icon on the bottom of the display page.
4. A box will appear, click the ***Rights*** tab in the box.
5. Modify as needed.

Group :

1. Go to the ***Administration*** tab, then the ***Group*** tab.
2. Click the group that you would like to modify their viewing rights.
3. Click **Modify** next to the pencil icon on the bottom of the display page.
4. A box will appear, click the ***Rights*** tab in the box.
5. Modify as needed.

13.3 How to Rename a Well Site

The updated well site name will only be presented on the main web portal. If the name needs to be propagated to the LCD screen on the field, please contact the Bluetick support team

1. Right Click on the well site that you wish to rename.
2. Select the Rename Option.
3. Enter the new name for the well site.

Chapter 14

14. Icon Glossary

The chapter will list icons found on the web portal and where to view more information on those icons in this manual.

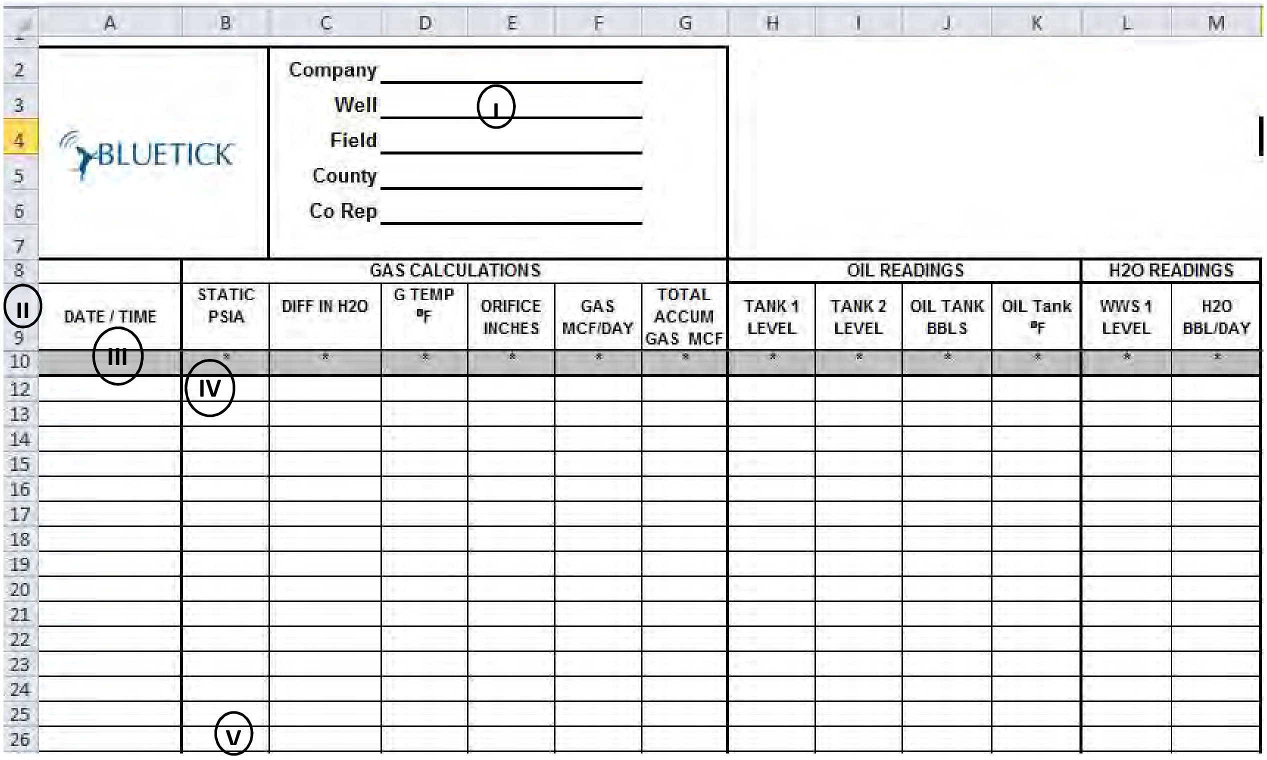
Icon	Name	Notes
	Enable Maintenance Mode	This icon will appear in a drop box when an entity on the navigation tree is right clicked.
	Active Maintenance Mode	This icon will appear next to the field, site or entity measurement that has been put into maintenance.
	Field Status Warning	This icon is shown on your navigation tree next to the name of your field site. It indicates that s site/entity under that field has an issue.
	Field Status Icon	This icon is shown on your navigation tree next to the name of your field.
	Site Status Warming	This is the icon that is shown on your navigation tree next to the name of your well site. It shows that the well site has an issue.
	Site Status Icon	This is an icon that is shown on your navigation tree next to the name of your well site.
	Device Down	This icon appears on the field/site/entity or measurement when the connection between NOC and the well site is interrupted.
	Poll	This icon is shown throughout the web portal and when clicked allows the user to view recent measurements from a device.
	Modbus Write	This icon is shown under the overall status tab. When clicked this application allows the operator to write values to a specific register of a device.
	Enter Measurement Data Edit distribution List Modify	This icon is shown throughout the web portal. The pencil next to an entity is for manual measurement data, it also appears next to distribution lists as a modify button.
	Calendar popup for scheduling	This icon appears throughout the web portal. When clicked, a calendar will appear and dates can be selected for distribution list, reports or trends.

 Suppressed Alarm	This icon appears next to alarms that have been silenced.
 Add Button	This icon appears throughout the web portal. When clicked, it acts as an add button for whatever tab it is under.
 Delete Button	This icon appears throughout the web portal. When clicked, it will delete or mark for delete whatever rule, report, etc... that was selected.
 Notes	This icon appears in a drop box when a field, site, or entity is right clicked on the navigation tree. It is also used as the address book and distribution list icons.
 SMS Configuration	This icon appears in a drop box when a field is right clicked on the navigation tree.
 Quick Stats	This icon appears in a drop box when a field is right clicked on the navigation tree or MyView tree.
 Pump Off Controller	This icon appears in a drop box when a card data enabled pumping unit entity is right clicked on the navigation tree.
 Down Configuration	This icon appears in a drop box when a field or site is right clicked on the navigation tree.
 The Blue Dog “Diesel”	This icon appears above your navigation tree. When clicked the icon opens the configuration drop box.
 My Profile	This icon appears next to Diesel. When clicked the icon opens a window, with options for the user account.
 Log Out	This icon appears next to the support button. When clicked it logs the user out of the web portal.
 Support	This icon appears next to the My Profile button. When clicked it takes the user to Bluetick’s support website.
 Rename	This icon appears when right clicking at the well site level and can be used to rename the well sites.

Chapter 15

15. Report Template Sample

This section of the manual will cover a sample custom report template



Corresponding Key Tabs:

I. *Properties Section:* These fields get populated from the properties by invoking the property token. For example ||COMPANYREP|| will add the defined company representative to the report.

II. *Date/Time Column:* This can be enabled/disabled from the report configuration screen. If enabled the measurements will display the date and time when it was collected.

III. *Marker Row (*):* An asterisk in the marker row allows RMC to identify which rows show be displayed for the mapping on measurements.

IV. *First Data Row: Indicates where the data will start.*

V. *Footer:* Footer First Row indicates where the footer begins. The data will be added in between the first data row and the footer first row.

DBS&A
Daniel B. Stephens & Associates, Inc.

Response to Comments

Revised Hydrogen Sulfide Prevention and Contingency Plan and Engineering Certification Report for Evaporation Pond Liners, Sundance Services West, Inc.

This document provides Daniel B. Stephens & Associates, Inc.'s (DBS&A's) responses to the New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division (OCD) comments on the revised hydrogen sulfide prevention and contingency plan and engineering certification report for evaporation pond liners, Sundance Services West, Inc. (dated June 8, 2021). OCD's comments were provided in a letter dated April 14, 2022.

Comments are reproduced in *italics*, with DBS&A's responses following in regular text.

Table of Contents

1. *List of Tables, Table II.3.8: In accordance with 19.15.11.16 NMAC, "the person shall notify the division upon a release of hydrogen sulfide requiring activation of the hydrogen sulfide contingency plan as soon as possible, but no more than four hours after plan activation, recognizing that a prompt response should supersede notification. The person shall submit a full report of the incident to the division on form C-141 no later than 15 days following the release." The notice requirements of 19.15.29 NMAC are not applicable during a H2S release. Update the plan notice requirements to recognize compliance to Part 11.*

Changed Table II.3.8 title and contents to the notification requirements from 19.15.11.16 NMAC (quoted above). Included form C-141 as Attachment II.3.E.

2. *List of Attachments, Request for Approval to Accept Solid Waste, OCD Form C-138: OCD was unable to locate a protocol in the H2S plan that required the use of the Form C-138 either during or after a hydrogen sulfide release. Either update the plan to include a protocol for the use of Form C-138 or omit the form from the plan.*

Deleted Form C-138 from Attachments list.

Attachment 1, Hydrogen Sulfide Prevention and Contingency Plan

3. *Section 1.3 Purpose: Update the fifth bullet in the second paragraph to recognize compliance to the notice and reporting requirements of 19.15.11.16 NMAC. Part 29 is not applicable for a H_2S release.*

Changed 19.15.29 NMAC to 19.15.11.16 NMAC.

4. *Table II.3.2, Emergency Response Agencies and Contacts: Update the OCD Santa Fe office number to (505) 476-3441.*

Updated phone number.

5. *Section 1.4 Hydrogen Sulfide Characteristics: In accordance with 19.15.11.9.B(2)(b) NMAC, "the hydrogen sulfide contingency plan shall include a discussion of the characteristics of hydrogen sulfide and sulfur dioxide." Update the plan accordingly and provide the required information for sulfur dioxide.*

Added characteristics of sulfur dioxide to section 1.4. Reorganized into sections 1.4.1 Hydrogen Sulfide Characteristics and 1.4.2 Sulfur Dioxide Characteristics.

6. *Section 1.5 Regulatory Requirements: 19.15.36 NMAC and 19.15.11 NMAC: Update this section to recognize compliance to 19.15.11.2 NMAC. In accordance with 19.15.11.2 NMAC, "19.15.11 NMAC does not exempt or otherwise excuse surface waste management facilities the division permits pursuant to 19.15.36 NMAC from more stringent conditions on the handling of hydrogen sulfide required of such facilities by 19.15.36 NMAC or more stringent conditions in permits issued pursuant to 19.15.36 NMAC, nor shall the facilities be exempt or otherwise excused from the requirements set forth in 19.15.11 NMAC by virtue of permitting under 19.15.36 NMAC." Recognize the scope of Part 11 as it applies to this Part 36 facility.*

Added 19.15.11.2 NMAC to recognize the scope of Part 11.

7. *OCD was unable to locate the radius of exposure (ROE) depicted on Figure II.3.2, as proposed in the last sentence of the second paragraph. Provide a reference to a different figure or update Figure II.3.2 accordingly and illustrate the ROE of 30 ppm. Also complete the assessment of public roads defined in 19.15.11.7.J NMAC, as required of 19.15.11.9.B(2)(a) NMAC.*

Added 250 ft ROE to Figure II.3.1 and changed figure reference in section 1.5. Added discussion regarding public roads. No public roads exist in the ROE.

8. *Table II.3.4, Immediate Action Plan: Minor Alarm: Based upon the proposed immediate action plan, SSWI will activate the H_2S Plan at the first detection of 10 ppm or greater. Update this section to recognize that a detection of 10 ppm or greater is the plan activation level required of 19.15.11.9.B(2)(f) NMAC.*

Added statement "As required of 19.15.11.9.B(2)(f) NMAC, 10 ppm or greater is the plan activation level."

9. *Table II.3.4: Update the Minor Alarm section to include the OCD notice and reporting protocols of 19.15.11.16 NMAC when SSWI activates the H_2S Plan at the first detection of 10 ppm or greater.*

Added bullets as follows

- Notify OCD upon activation of the hydrogen sulfide contingency plan as soon as possible, but no more than four hours after plan activation, recognizing that a prompt response should supersede notification.
- Submit a full report of the incident to the division on form C-141 no later than 15 days following the release.

10. *Table II.3.4: In the second bullet, identify the equipment and method SSWI will implement to monitor downwind concentrations.*

Changed bullet to "Remotely monitor downwind concentrations using existing GDS stationary sensors."

11. *Section 3.1, Incoming loads: Update Table II.3.10 in Section 5 to include the H_2S personal monitors on the Emergency Response Equipment List. Provide and reference the location of the specification sheet of the model of the H2S personal monitors proposed for use. The H_2S personal monitor should be capable of monitoring for hydrogen sulfide and sulfur dioxide.*

Added H2S personal monitors to Table II.3.10. Added spec sheet for the personal monitors as Attachment II.3.F.

12. *Section 3.2.1 Stationary Monitors: Update Table II.3.10 in Section 5 to include the continuous H_2S monitors installed along the outside perimeter of the pond area and windsocks on the Emergency Response Equipment List. Provide and reference the location of the specification sheet of the model of the continuous H_2S monitors proposed for use.*

Added H2S stationary monitors and windsocks to Table II.3.10. Added spec sheets and manuals for the monitors as Attachment II.3.G.

13. *Section 4.1 Implementation: Update the paragraph to clarify that SSWI will activate the H_2S Plan at the first detection of 10 ppm or greater to protect public safety, as required of 19.15.11.9 NMAC.*

Deleted last sentence of the paragraph. Added "As required of 19.15.11.9.B(2)(f) NMAC, 10 ppm or greater is the plan activation level."

14. *Section 4.2 Assessment: Pursuant to 19.15.11.9.F NMAC, "the person shall review the hydrogen sulfide contingency plan any time a subject addressed in the plan materially changes and make appropriate amendments. If the division determines that a hydrogen sulfide contingency plan is inadequate to protect public safety, the division may require the person to add provisions to the plan or amend the plan as necessary to protect public safety." Update the written response to clarify that SSWI will amend this Plan, as necessary, to protect public safety, as required of 19.15.11 NMAC.*

Deleted "During an emergency, the EC may amend this Plan, as necessary, to protect fresh water, public health, safety or the environment (19.15.11.9.F NMAC)." Replaced with "SSWI will amend this Plan, as necessary, to protect public safety, as required of 19.15.11 NMAC."

15. *Section 4.2 Assessment: In the second paragraph, omit the discussion regarding major and minor releases pursuant to Part 29. Part 29 is not applicable for a H_2S release. SSWI must comply with the notice and reporting requirements of 19.15.11.16 NMAC. Update accordingly.*

Deleted "Table II.3.8 provides OCD descriptions of "major" and "minor" releases which are applicable for assessment purposes (19.15.29.7 – 11 NMAC)." Added reference to notice and reporting requirements of 19.15.11.16 NMAC.

16. *Table II.3.8, Part 29: Release Notification Sundance West: Replace to regulatory language of Part 29 with the regulatory language of 19.15.11.16 NMAC and provide a copy of the most recent OCD Form C-141, so that it will be available for reporting.*

Replaced with 19.15.11.16 NMAC and attached Form C-141.

17. *Section 4.3, Notification of Authorities and General Public: Update the last sentence of the first paragraph to clarify that OCD will be notified within 4 hours after the Contingency Plan has been activated when H2S is detected at 10 ppm or greater.*

Add "…when H2S is detected at 10 ppm or greater."

18. *Section 4.3, Notification of Authorities and General Public: In the third paragraph, update the discussion to recognize the notice and reporting requirements of 19.15.11.16 NMAC and omit the discussion regarding Part 29 and "major" and "minor" releases.*

Deleted last sentence. Added reference to 19.15.11.16 NMAC.

19. *Section 5.2 External Communications: Update Table II.3.10 in Section 5 to recognize the emergency phone number laminated pocket cards on the Emergency Response Equipment List.*

Added emergency phone number laminated pocket cards to Table II.3.10.

20. *Section 5.3 Personnel Protection, First Aid, and Safety Equipment: Update Table II.3.10 in Section 5 to recognize the emergency shower discussed in the second paragraph on the Emergency Response Equipment List.*

Added emergency shower to Table II.3.10.

21. *Section 6.0 Recordkeeping: Update the second paragraph to recognize the notice and reporting requirements of 19.15.11.16 NMAC and omit the discussion regarding Part 29 and "major" and "minor" releases. OCD was unable to locate Attachment II.3.E, a copy of OCD Form C-141, in the revised H_2S plan. Provide a copy of the required form so SSWI may complete the reporting requirements of 19.15.11.16 NMAC.*

Replaced all references to 19.15.29 with the reporting requirements of 19.15.11.16 NMAC. Attached Form C-141.

22. *Section 9.0 Training: Update the written response to describe how SSWI will document the training, drills, and attendance, as required of 19.15.11.9.B(2)(d) NMAC. Also update the written response, to address the training of residents as appropriate on the proper protective measures to be taken in the event of a release and shall provide for briefing of public officials on issues such as evacuation or shelter-in-place plans.*

Added "As required of 19.15.11.9.B(2)(d) NMAC…" Added "Training will be provided to residents, as appropriate, on the proper protective measures to be taken in the event of a release. Briefings will be provided to public officials on issues such as evacuation or shelter-in-place plans."

23. *Attachment II.3.A, Material Safety Data Sheet: Update the plan accordingly and provide the information for sulfur dioxide required of 19.15.11.9.B(2)(b) NMAC.*

Attached SDS for sulfur dioxide within Attachment II.3.A. Added reference to attachment in Section 1.4.2.

24. *Attachment II.3.B, OCD FORM C-138: Either update the plan to include a protocol for the use of Form C-138 or omit the form from the plan.*

Removed Form C-138.

25. *Based upon Table II.3.1, SSWI will have a tank battery of 45 produced water tanks. Review the requirements of 19.15.11.12 NMAC to determine if the plan needs to be updated to address any concerns regarding the tank battery.*

Table II.3.1 has been updated to reduce the number of produced water tanks. DBS&A does not consider the requirements of 19.15.11.12 NMAC to apply to these tanks. Quantities of the other items in the table have been updated and the crude oil receiving tanks were removed.

26. *Please update the Hydrogen Sulfide (H_2S) Prevention and Contingency Plan based upon the review comments above to recognize compliance to the requirements of 19.15.11 NMAC and resubmit.*

Referenced compliance with 19.15.11 NMAC throughout. Removed reporting requirements of 19.15.29 NMAC.

Attachment 2, Engineering Certification Report for the Evaporation Pond Liners

27. *OCD has completed the review of Attachment 2, the Engineering Certification Report for the Evaporation Pond Liners. The certification report will be placed in the administrative record of permit NM1-62.*

No response required.

State of New Mexico
Energy, Minerals and Natural Resources Department

August 23, 2022

Mr. Arif Mussani
Sundance Services West, Inc.
1006 6th Street
Eunice, New Mexico 88231
MussaniUK@hotmail.com

RE: Revised Hydrogen Sulfide Prevention and Contingency Plan
Sundance Services West, Inc. – OGRID 371811
Permit NM1-62
South 1 /2 of Section 30, Township 21 South, Range 38 East NMPM,
Lea County, New Mexico

Mr. Mussani:

The Oil Conservation Division (OCD) has completed its review of Sundance Services West, Inc.'s (SSWI) revised Hydrogen Sulfide (H_2S) Prevention and Contingency Plan, emailed to OCD on August 11, 2022 from Gundar Peterson of Daniel B. Stephens & Associates, Inc., for the Sundance West surface waste management facility under permit NM1-62. OCD has determined that the changes to the revised Hydrogen Sulfide (H_2S) Prevention and Contingency Plan are adequate. OCD hereby approves the August 2022 Hydrogen Sulfide (H_2S) Prevention and Contingency Plan with the following conditions:

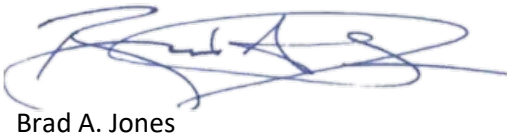
- In accordance with 19.15.11.9.H NMAC, Annual inventory of contingency plans. On an annual basis, each person required to prepare one or more hydrogen sulfide contingency plans pursuant to 19.15.11 NMAC shall file with the appropriate local emergency planning committee and the state emergency response commission an inventory of the wells, facilities and operations for which plans are on file with the division and the name, address, and telephone number of a point of contact. SSWI shall provide the information required of 19.15.11.9.H NMAC to Lea County Emergency Management and the New Mexico Department of Homeland Security and Emergency Management;

- In compliance with Section 1.3 of the August 2022 Hydrogen Sulfide (H_2S) Prevention and Contingency Plan, SSWI will invite the local emergency response authorities identified in Table II.3.2 to the site for a briefing on the approved plan. During this briefing, SSWI will discuss notification, emergency response procedures, and evacuation plans; and

- In compliance with Section 7.0, Coordination Agreements, of the August 2022 Hydrogen Sulfide (H_2S) Prevention and Contingency Plan, SSWI will provide copy of the plan to the emergency response organizations identified in Table II.3.2 to familiarize each emergency response organization with the operations of the facility and the types of emergencies and responses that may be required, and to allow the emergency response organizations to provide input regarding emergency response procedures.

If there are any questions regarding this matter, please do not hesitate to contact me at (505) 469-7486 or brad.a.jones@state.nm.us.

Respectfully,



Brad A. Jones
Environmental Specialist

Cc: Gundar Peterson, Daniel B. Stephens & Associates, Inc., gpeterson@dbstephens.com

Jones, Brad A., EMNRD

From: Jones, Brad A., EMNRD
Sent: Tuesday, August 23, 2022 10:33 AM
To: 'MussaniUK@hotmail.com'
Cc: 'Peterson, Gundar'; 'gpeterson@dbstephens.com'
Subject: RE: [EXTERNAL] RE: Revised Hydrogen Sulfide Prevention and Contingency Plan and Engineering Certification Report for the Evaporation Pond Liners OCD Review
Attachments: 2022 0823 NM1-62 Sundance West Inc Revised H2S Plan approval letter signed.pdf

Mr. Mussani,

Please see the attached OCD approval of the Revised Hydrogen Sulfide Prevention and Contingency Plan. If you have any questions regarding this matter, please do not hesitate to contact me.

Sincerely,

Brad Jones

Brad A. Jones ● Environmental Scientist Specialist - Advanced
Environmental Bureau
EMNRD - Oil Conservation Division
1220 S. Saint Francis Drive | Santa Fe, New Mexico 87505
(505) 469-7486 | brad.a.jones@state.nm.us
www.emnrd.nm.gov

From: Peterson, Gundar <gpeterson@geo-logic.com>
Sent: Thursday, August 11, 2022 2:05 PM
To: Jones, Brad A., EMNRD <brad.a.jones@state.nm.us>
Subject: [EXTERNAL] RE: Revised Hydrogen Sulfide Prevention and Contingency Plan and Engineering Certification Report for the Evaporation Pond Liners OCD Review

Brad-
Attached are a response to OCD's comments and an updated coy of the H2S plan. Please let me know if you need anything else at this time.

Gundar Peterson, P.E.

Daniel B. Stephens & Associates, Inc.
a Geo-Logic Company
Office: (505) 822-9400|Direct: (505) 353-9134|Mobile: (505) 730-9146
Licensed in AZ, ID, IL, NM, NV, OH, OK, TX, WA
gpeterson@geo-logic.com

From: Jones, Brad A., EMNRD <brad.a.jones@state.nm.us>
Sent: Thursday, April 14, 2022 2:25 PM
To: andy@wambsganss.com
Cc: Peterson, Gundar <gpeterson@dbstephens.com>
Subject: Revised Hydrogen Sulfide Prevention and Contingency Plan and Engineering Certification Report for the Evaporation Pond Liners OCD Review

Mr. Mussani,

Please see the attached OCD's review of the Revised Hydrogen Sulfide Prevention and Contingency Plan and Engineering Certification Report for the Evaporation Pond Liners. If you have any questions regarding this matter, please do not hesitate to contact me.

Sincerely,

Brad Jones

Brad A. Jones ● Environmental Scientist Specialist - Advanced
Environmental Bureau
EMNRD - Oil Conservation Division
1220 S. Saint Francis Drive | Santa Fe, New Mexico 87505
(505) 469-7486 | brad.a.jones@state.nm.us
www.emnrd.nm.gov

District I
1625 N. French Dr., Hobbs, NM 88240
Phone:(575) 393-6161 Fax:(575) 393-0720
District II
811 S. First St., Artesia, NM 88210
Phone:(575) 748-1283 Fax:(575) 748-9720
District III
1000 Rio Brazos Rd., Aztec, NM 87410
Phone:(505) 334-6178 Fax:(505) 334-6170
District IV
1220 S. St Francis Dr., Santa Fe, NM 87505
Phone:(505) 476-3470 Fax:(505) 476-3462

State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
Santa Fe, NM 87505

CONDITIONS

Action 136887

CONDITIONS

Operator:	OGRID:
Sundance Services West, Inc. 1006 6th Street Eunice, NM 88231	371811
	Action Number: 136887
	Action Type: [C-137] Non-Fee SWMF Submittal (SWMF NON-FEE SUBMITTAL)

CONDITIONS

Created By	Condition	Condition Date
bjones	OCD emailed the approval letter to Arif Mussani (SSWI) and Gundar Peterson (DBSI) on August 23, 2022. The approval letter with conditions is attached to the request.	8/23/2022