



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 1 of 53

OPERATING MANUAL SSS-903 Toxic Gas Detection System

Model SSS-903 Transmitter and Controller
Model PGU-IR Infrared Optical Gas Sensor
Model PGU-P Photo Ionization Gas Sensor
Model PGU-E Electrochemical Gas Sensor
Model PGU-C Catalytic Bead Gas Sensor



Information and technical data disclosed in this document may be used and distributed only for the purposes and to the extent specifically authorized by ESP Safety Inc.

ESP Safety Inc. Reserves the right to change published specifications and designs without prior notice



Revision History

Date	Revision	Description	Approved
3/21/13	02	Addition; Appendix II Warranty & Return Policy	A. Burgos



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 2 of 53

General Information.....	3
Specifications of SSS-903 with PGU Sensors	4
SSS-903 Theory of Operation	11
Data Communication	17
IMPORTANT SAFETY INFORMATION.....	18
Physical Installation Procedure	19
Physical Installation Quick Guide.....	20
Wiring Requirements	24
Power up and Stand Alone Operation of the SSS-903	31
RS-485 Modbus Digital Communication and Operation.....	32
Calibration Procedures	33
Non-Invasive Calibration Magnet Procedure	33
Non-Invasive Calibration Procedure with HART Communicator.....	33
Bench Test Calibration Procedure with ESP Commander	438
Unpacking A New SSS-903	44
Appendix 1 Explosion Proof Design.....	45
Appendix 2 Warranty & Return Policy	46



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 3 of 53

General Information

This instruction guide details the specification, application and operation of the ESP Safety Inc. SSS-903 with an included sensor. The SSS-903 System consists of two components, a receiver and gas specific sensor that have been factory configured and calibrated to provide detection of toxic, flammable and combustible gases in open or closed environments. The product includes multiple features required to report alarms when the toxic gas concentrations in the environment reach three independently programmed levels. Each alarm also triggers a relay that is provided as a standard feature, which can be used to operate warning devices, sirens, valves or switches.

The SSS-903 receiver is a versatile product that can be used in a specific proximity or in a decoupled mode with the sensor and receiver head located up to 500 feet apart. Furthermore, any SSS-903 can be reconfigured in the field to detect toxic gases using optional sensor replacements.

Applications

The SSS-903 system is recommended for applications that require a gas detector with localized digital readout of detected gas levels. It comes factory standard for with Analog 4-20mA output with embedded HART, an independent HART connector that is conveniently located on the SSS-903 enclosure able, relay contacts, and Modbus RS485. The system is comprised of an SSS-903 Receiver and plug-in universal PGU sensors for electrochemical (PGU-E) , infrared (PGU-IR) ,photo-ionized (PGU-P) and catalytic bead (PGU-C)detection. Power is supplied from an external 24 VDC nominal power source (source can range 18-3VDC). In operation the

SSS-903 system has been designed for operation in temperature ranges from minus 40 to 75 °C (without internal heated option activation) and minus 60 to 75 °C (with activated internal heated option) and relative humidity of up to 100 % (non-condensing)

The SSS-903 receiver includes 5 LED annunciators plus an easily readable LCD display. On the display an operator can determine information of alarm status, gas detected, current level detected and view a Time Weighted Average (TWA) run time graphic showing each event and level detected during a user programmed time from 3 to 30 minutes. The design of the SSS-903 is an approved product for use in control monitoring of gas contamination levels with flammable and toxic gases present in the working area environment of oil, gas and chemical industries All electronics are enclosed in explosion-proof aluminum or stainless steel housings that have been certified by FM-Approvals for use in explosive areas pertinent to classes 1 and 2 with the potential hazard of forming explosive gas mixtures attributed to the subgroup IIC and to explosion hazard categories T1–T6, inclusive of the following zones, premises and facilities:

Drilling and production platforms	Petrochemical facilities
Refineries	Paint Manufacturing
Bulk terminals and tank farms	Fertilizer plants
Compressor stations	Fuel loading facilities
Pipelines	Residential areas
Transportation facilities	Boiler stations

Non-invasive calibrations can be performed in the field using an included magnetic wand or a HART communicator.

A device descriptor file is available from ESP Safety for use with a HART communicator. Calibration can also be performed with an included Windows PC application, ESP Commander. Both HART and ESP Commander applications can supply real time output of current operational data plus access a non-volatile memory in the SSS-903 for further diagnostic analysis.



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 4 of 53

Specifications of SSS-903 with PGU Sensors

Electrical Characteristics

Input Voltage	+24VDC Nominal (+18 to 32VDC)
Power Consumption	2 W-standby 5 W-during alarms
Output From SSS-903	+4-20mA industry standard analog with embedded HART Digital RS-485 Modbus RTU HART interface with easy access dedicated connector 4 "Dry Contact" relays (NO/Form-A) All Relays Contact Rating 1Amp@125VAC/30VDC
Alarm Relays	3 User Programmed Alarm Relays 1 Fault Condition Relay
GT Sensor Interface to SSS-903 Receiver	Digital RS-485 Modbus RTU *Note All ESP Safety gas detector products can be interfaced with the SSS-903
Sensor Types / Model	Electrochemical: PGU-E Infrared: PGU-IR Photo Ionized: PGU-P

Operational Characteristics

Humidity Range	Up to 100%, non-condensing (Withstands up to 100% RH for short periods)
Operating Temperature	Standard Operation: -40°F to +167°F (-40°C to +75°C) With Optic Heater Enabled: -76°F to +167°F (-60°C to +75°C)
Ingress Protection	IP66
RFI/EMI Protection	EN50081-1 / Class B E> 50270 *Operates with no interference from a 5 watt walkie talkie keyed (transmitting) at 1 meter
Annunciators (LED)	Tri-color status LED indicates operational mode, fault, and gas presence. Three LED indicators for Alarms activation A fourth LED indicates the unit is in calibration mode
Displayed Information (Illuminated LCD Display)	Continuous sensor data Gas Type Measuring Units Three Fixed Alarm Thresholds Graphic display of trending data for Peak Readings and Time-Weighted Average (TWA) of gas concentration 3-30 minutes
Explosion Proof Labels for SSS-903 & PGU Sensors	Ex d [ia Ga] IIC T6 Gb Ex d ia IIC T6
Dimensions of SSS-903 Receiver	270x150x120mm 10.63"x5.9"x4.73"
Dimensions of PGU Sensors	94x50mm 3.7"x1.97"

Mechanical Characteristics

SSS-903 and PGU	Stainless Steel Grade-316
Cable Entry	2 Cable Entries ¾" NPT
Weight	5.5kg / 11lbs



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 5 of 53

Dimensions Diagram of SSS-903 Receiver

All dimensions are in mm

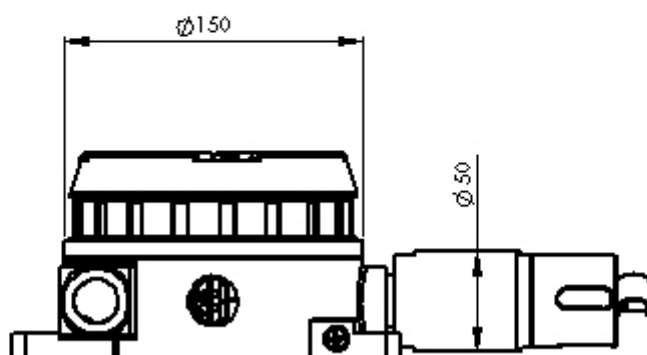
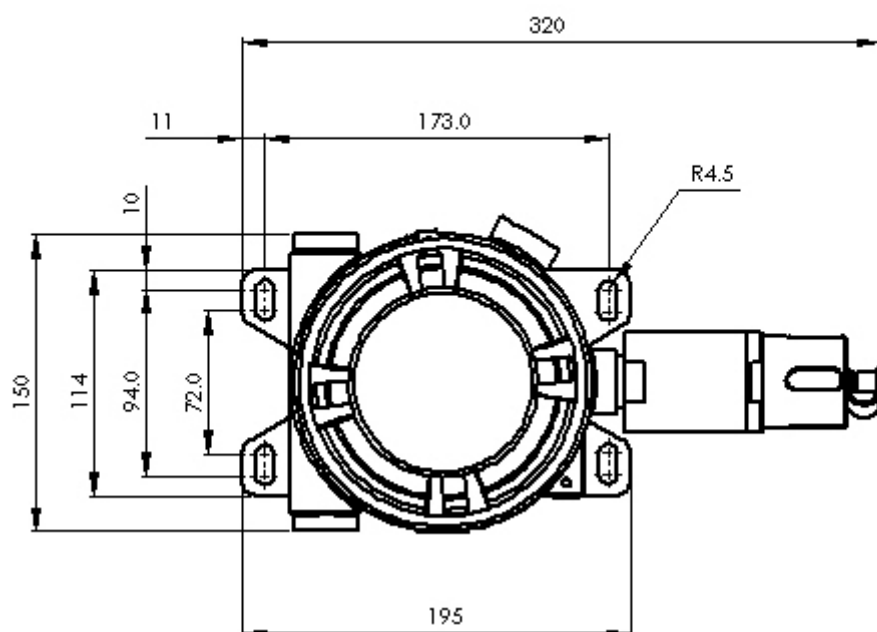




Table 1: SSS-903 with PGU-E Electrochemical Gas Sensor Range, Accuracy and Response Times

Using Gas Specific Electrochemical Detectors

*Response Time is the time to reach a percentage of final reading when gas concentration is equal to full scale of the sensor range of detection. (i.e. T50=50% Of Range)

**Some sensors have multiple ranges one of which is determined by the user during setup or calibration

Gas	Formula	Range of Detection**	Accuracy	Response Time*
Hydrogen	(H ₂)	0 to 4 % vol (100% LEL)	±2% full scale	T50 < 40 seconds T90 < 60 seconds
		0 - 1% vol (0 - 100) ppm		
Carbon Monoxide	(CO)	(0 - 100) ppm	±2% full scale	T20 < 10 seconds T90 < 25 seconds
		(0 - 500) ppm		
		(0 - 1000) ppm		
Ammonia	(NH ₃)	(0 - 1000) ppm	±2% full scale	T90 < 90 seconds
Hydrogen Fluoride	(HF)	(0 - 10) ppm	±2% full scale	T50 < 30 seconds T90 < 90 seconds
Methanol	(CH ₃ OH)	(0 - 100) ppm	± 2% full scale	T90 < 90 seconds
Oxygen	(O ₂)	(0 - 30) % vol	±2% full scale	T90 < 11 seconds
Hydrogen Sulfide	(H ₂ S)	(0 - 20) ppm	±2% full scale	T20 < 10 seconds T50 < 12 seconds T90 < 25 seconds
		(0 - 50) ppm		
		(0 - 100) ppm		
Chlorine	(Cl ₂)	(0 - 20) ppm	±2% full scale	T90 < 25 seconds
Formaldehyde	(CH ₂ O)	(0 - 10) ppm	± 2% full scale	T50 < 20 seconds
Nitrogen Dioxide	(NO ₂)	(0 - 20) ppm	±2% full scale	T50 < 12 seconds T90 < 25 seconds
Sulfur Dioxide	(SO ₂)	(0 - 20) ppm	±2% full scale	T50 < 12 seconds T90 < 25 seconds
		(0 - 100) ppm		
Hydrogen Chloride	(HCl)	(0 - 30) ppm	±2% full scale	T50 < 30 seconds T90 < 90 seconds
Vinyl Acetate	(C ₄ H ₆ O ₂)	(0 - 100) ppm	± 2% full scale	T90 < 90 seconds



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 7 of 53

**Table 2: SSS-903 with PGU-P Photo Ionization Gas Sensor:
Range, Accuracy and Response Times**

Using Gas Specific Photoionized Detectors

***Response Time** is the time to reach a percentage of final reading when gas concentration is equal to full scale of the sensor range of detection. (i.e. T50=50% Of Range)

**Some sensors have multiple ranges one of which is determined by the user during setup or calibration

Note: All gases with ionization potential <10.6 eV

Gas	Formula	Range of Detection**	Accuracy	Response Time*
Benzene	C ₆ H ₆	(0 - 100) ppm	± 2% full scale	T50 < 9 seconds T90 <25 seconds
		(0 - 1000) ppm		
		(0-10000) ppm		
Ethylene	C ₂ H ₄	(0 - 20) ppm		
		(0 - 2000) ppm		
Isobutylene	C ₄ H ₈	(0 - 20) ppm		
		(0 - 200) ppm		
		(0 - 2000) ppm		
Methyl Mercaptan	CH ₃ SH	(0 - 100) ppm Other ranges per request	± 2% full scale	T90 <25 seconds



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 8 of 53

**Table 3: SSS-903 with PGU-IR Infrared Optical Detection:
Range Accuracy and Response Times**

Using Gas Specific IR Detectors

*Response Time is the time to reach a percentage of final reading when gas concentration is equal to full scale of the sensor range of detection. (i.e. T50=50% Of Range)

Gas	Formula	Range of Detection**	Accuracy	Response Time*
Methane	CH ₄	(0 -100) % LEL	± 3% to 50% LEL ± 5% from 51% to 100% LEL	T20 < 5 seconds T90 < 25 seconds
Propane	C ₃ H ₈			
Ethylene	C ₂ H ₄			
Hexane	C ₆ H ₁₄			
Butane	C ₄ H ₁₀			
Isobutane	I-C ₄ H ₁₀			
Ethanol	C ₂ H ₅ OH			
Cyclopentane	C ₅ H ₁₀			
Propylene	C ₃ H ₆			
Methanol	CH ₃ OH			
Gasoline Vapor		(0 to 2) % Vol (0 to 5) % vol (1 – 3000) ppm	± 2% full scale	T90 <25 seconds
Diesel Vapor				
JP4 Fuel Vapor				
Carbon Dioxide	CO ₂			



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 9 of 53

**Table 4: SSS-903 with PGU-C Catalytic Bead Sensor:
Range Accuracy and Response Times**

Using Catalytic Bead (pellisor) sensor specifically for detection of hydrogen

*Response Time is the time to reach a percentage of final reading when gas concentration is equal to full scale of the sensor range of detection. (i.e. T50=50% Of Range)

** All data refers to catalytic bead sensor as tested with H2 gas from an approved source. The sensor data listed is based on ideal test environment with no interference from other gases

Gas	Formula	Range of Detection**	Accuracy	Response Time*
Hydrogen	H2	0-100 % LEL	< ± 10% of measured value	T 90 < 10 seconds









ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 10 of 53

Certifications

ATEX IEC   94/9/EC ATEX:	 CE 0539 II 2 G Ex d[ia] IIC T4 (Tamb 75°C) IP 66
  IECEx:	Ex d [ia] IIC T4 (Tamb 75°C) IP 66
 FOCT P:	1 Ex d [ia] IIC T4 X T= -60°C....75°C IP 66
EN Standards	EN 60079-0: 2006 EN 60079-1: 2007 EN 61779-1: 2000 EN 60529: 1991+A1: 2000 EN 50270: 2006.



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 11 of 53

SSS-903 Receiver Operation

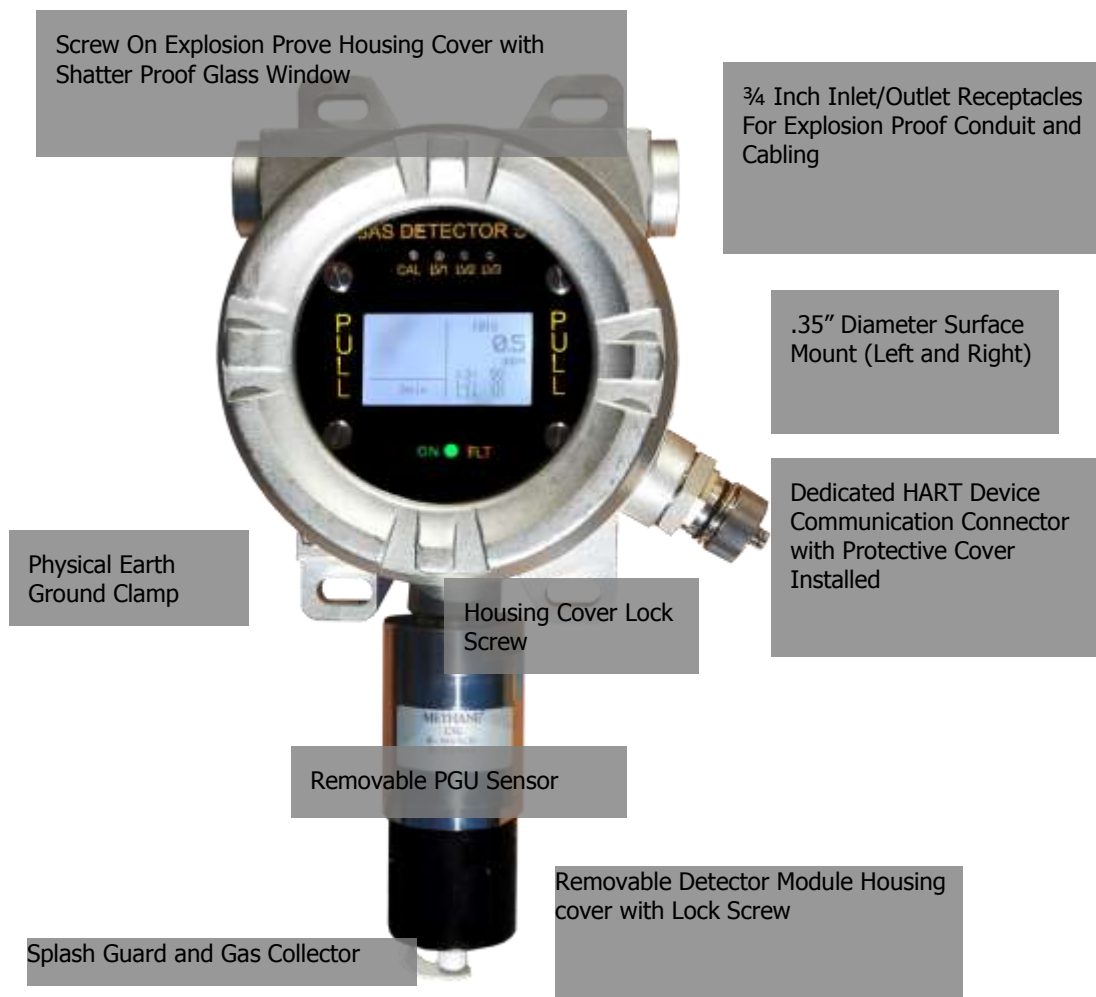
The SSS-903 is physically designed to perform in a wide range of hazardous environments and harsh weather conditions. Employing a durable enclosure that can withstand these conditions and even explosion is key to the operation and function of the device.

The SSS-903 is an elegant design that uses only two printed circuit board assemblies (PCBA) that have also been designed to resist the effects of environmental challenges. The PCBAs are installed in a layered fashion with a single interconnection for easy removal.

The Controller PCBA provides all information to the user via LED and LCD display. A micro controller with embedded software performs all functions used in communication and control. As noted the controller card also functions as the driver for the LCD display and performs all calculations used for the timed graphic HART. Event information displayed on the graphic cHART is also stored in a Non-Volatile memory within the PGU sensor that can be accessed using ModBus or a HART communicator. The second module is the Power PCBA. This PCBA accepts and regulates the externally supplied power source in addition to all signal connections. Four solid state-sealed relays are also located on the Power PCBA eliminating the potential of electronic discharge associated with mechanical relays.

All signals enter and exit the enclosure via $\frac{3}{4}$ " threaded female attachments for conduit as required by the user application and local regulations.

Figure 1 SSS-903 Receiver with PGU Sensor Installed





ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 12 of 53

Figure 2- SSS-903 LED Indicators

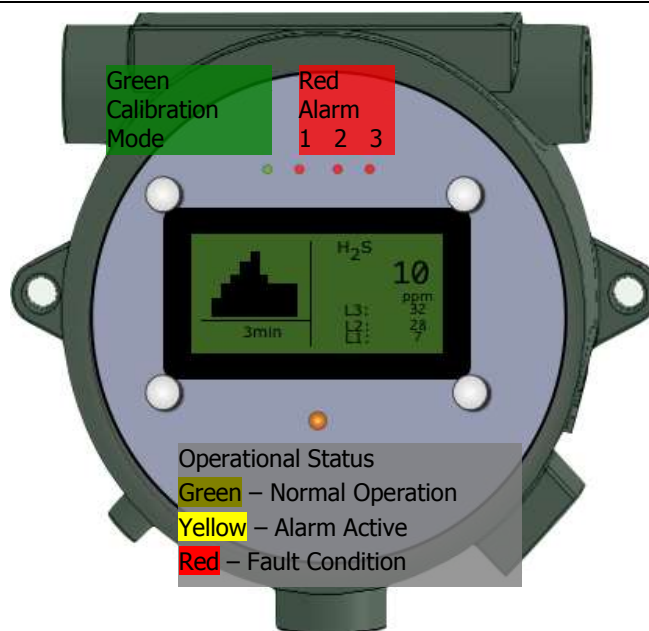
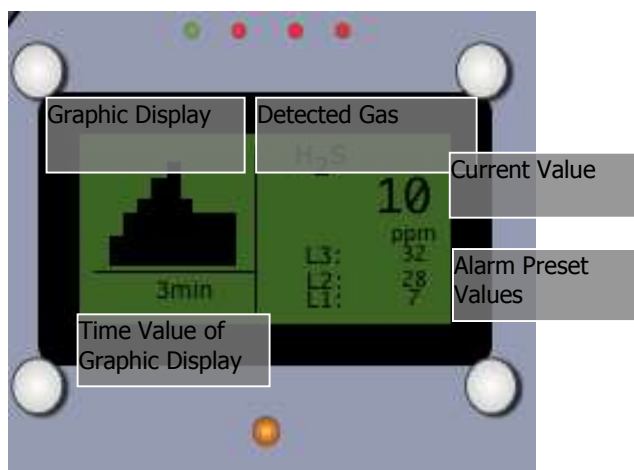


Figure 3 - SSS-903 LCD Display





PGU-P Photo Ionization Gas Sensor Theory of Operation

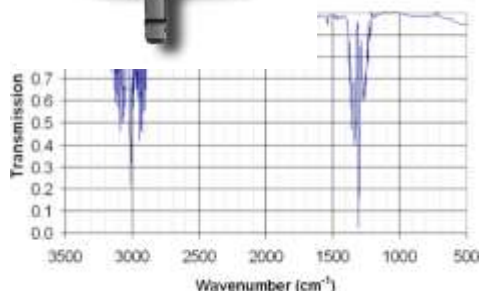


Figure-4 PGU-P Detector

The PGU-P performs selective detection of hydrocarbon molecules using infrared light and photo ionization detectors (PID). Air containing molecules of the selected combustible gas passes into a collection chamber that has an IR source and detector. The molecules containing the combustible gas absorb the IR photons and become ionized. Ionized molecules create an electric current that is measured by the detector. The electric current increases as the amount of gas molecules in the chamber increases. The current is measured and processed by the PGU-P sensor, generating the signals that are passed to the SSS-903 receiver via RS-485. Each detector is factor programmed for the gas requested by the customer at the time of purchase.

PGU-IR Infrared Optical Gas Sensor Theory of Operation

Figure -5 TG-IR Detector



The PGU-IR is based on selective signal disruption by hydrocarbon molecules when an IR source is projected to an optical detector. Measurement for a specific gas is made by passing the IR energy through a filter placed between the source and a chamber where the gas is collected. If no gas is present, the detector will receive all of the energy from the IR source and generate an electrical current. When gas molecules enter the chamber, each molecule of the gas blocks the IR energy, reducing the output of the detector. The signal is then processed by the PGU-IR sensor. Each detector is delivered preset for a specific gas. In the example shown, the gas is Methane (CH₄), which ionizes at two points on the spectrum, one for each Atomic Element, and are measured as wave numbers (cm⁻¹).





ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 14 of 53

PGU-E Electrochemical Gas Sensor Theory of Operation



Figure6 – TG-E Detector

The PGU-P sensor contains electrode in contact with an electrolyte. The target gas diffuses into the sensor through a membrane and comes into contact with electrodes where it is oxidized. The electrochemical reaction results in an electric current that passes to PGE-P microcontroller and from there to the SSS-903 receiver. The magnitude of the current is controlled by how much of the target gas is oxidized by the electrode. Output current from the sensor is also linearly proportional to the gas concentration. A linear output allows for more precise measurement of low concentrations and much simpler calibration.



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 15 of 53

PGU-C Catalytic Bead Gas Sensor Theory of Operation

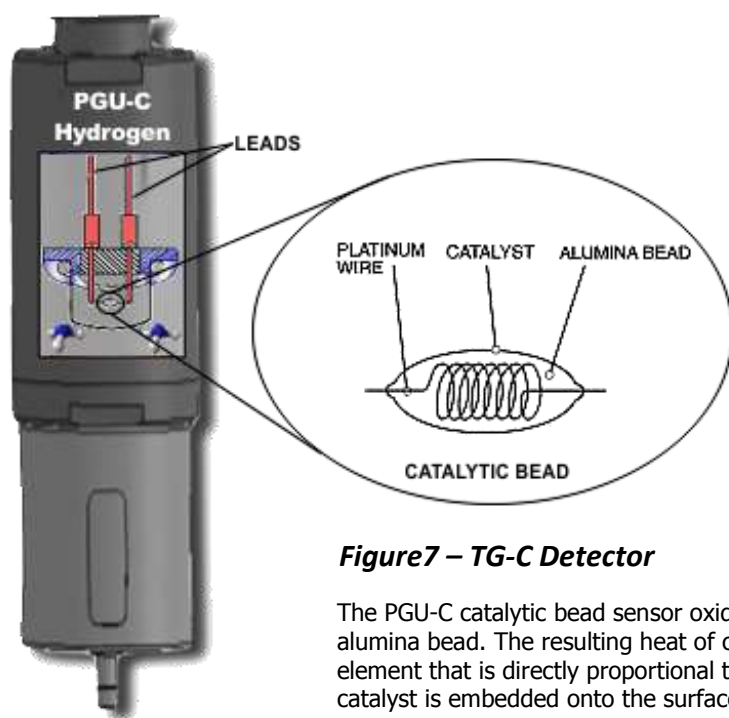


Figure7 – TG-C Detector

The PGU-C catalytic bead sensor oxidizes the target gas on the surface of a heated alumina bead. The resulting heat of combustion results in a change in resistivity of the element that is directly proportional to the concentration of the gas. A precious metal catalyst is embedded onto the surface of the alumina bead to lower the oxidation temperature. Two platinum wire leads are embedded in the alumina bead and connected electrically in a Wheatstone bridge circuit. Heat is generated by passing current through the leads.



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 16 of 53

Each PGU sensor consists of PGU module with imbedded processing and a single gas specific plug-in electrochemical, infrared (optical) or photo-ionized detector. There is a filter located between the collection chamber and the detector to minimize potential contamination from dust or moisture. The collection chamber is covered by a splashguard, which also serves as the gas collector. The splashguard also has an inlet nipple for calibration purposes.

Each PGU detector internally stores the data reported to the SSS-903, HART, or Modbus. All calibration information is also stored in the PGU module processor, thus any PGU module can be moved to another SSS-903 receiver and resume data collection from the time of removal. The detector module may be replaced in the field with a one that is intended for use to detect the same gas. If a different gas is required a replacement PGU module must be ordered from ESP Safety or their representative. Aside from detector or filter replacement there are no user serviceable parts in the PGU sensor.

Figure 7 – PGU Detector Module





ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 17 of 53

Digital Data Communication

The SSS-903 provides three digital communication methods:

HART (Highway Addressable Remote Transducer) accessible via a dedicated connector that
Digital RS-485 ModBus-RTU (Remote Terminal Unit)
HART over +4 to 20 mA output

Emerson 475 Shown

HART Dedicated Connector

HART is a bi-directional communication protocol that provides data access between Intelligent field instruments and host systems. In most applications for the SSS-903 the host is an ESP-Safety specific software application available from the HART Foundation for use on a technician's hand-held HART communicator device. A HART system is considered non-invasive in that the SSS-903 does not have to be opened or removed from a field installed location.

HART communicators and RS-485 devices can access:

Information detected gas type

The measuring range in PPM or LEL%

Value of current gas concentration

State and programming of fixed alarm thresholds

Calibration Zero Cal Address of the SSS-903 as used by RS-485

Download of Non-Volatile Memory of event occurrence from a 60 day history



Figure 8 - SSS-903 with HART Communicator

Digital RS-485 Modbus

Modbus is an interface structure that is used for communication to control devices (PLC) or computers. Modbus is a similar to HART but has been adapted as the industry standard for communication to multiple devices with a single cable run. (Series or "Daisy Chain" connection) Unlike HART, RS-485 must be considered and designed into the installation of the SSS-903. All of the same functions available with HART can also be accessed remotely with this system. Modbus is available for use as a dedicated communication system with High Speed data communication.

ESP-Safety provides a Windows compatible computer application, ESP Commander, that provides all access to the SSS-903 functions, and is often used for bench calibration of units removed from the field or prior to new installations. ESP-Commander may require a customer provided translation device. All ESP Safety gas detector models have the ability to interface with ESP Commander in RS-485 "daisy chain" networked installations. Modbus is also available in a single point to point interface (one SSS-903 to One port of a control system as a data signal that is imbedded in the +4 to 20mA analog output. In this application the data rate is significantly slower at 1200kb/s.

UPES Controller

ESP-Safety has an available rack mounted control system that can be used with all ESP devices along with those of other manufacturers.

Figure 9 - UPES Controller



Explosion Proof Integrity

Explosion proof integrity of SSS-903 units installed and in operation it must not be modified in any form. All labeling must be intact and visible. All surfaces that are subject to disassembly or removal during installation or maintenance must be installed as detailed in Appendix I (Explosion Proof Diagram)



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 18 of 53



Caution: The installation of SSS-903 must comply with relevant requirements of the latest edition of the national Electric Code (ANSI/NFPA 70)

Caution: Connection Conduit, Barrier Glands, and Epoxy Sealants are to meet EN-50018/IEC 60079-1 Standards

Caution: ESP Safety Inc. Recommends use of shielded cable with 14AWG conductors reaching a span no greater than 3,900 ft. (1200 meter)

IMPORTANT SAFETY INFORMATION

Be sure to read and understand the entire instruction manual before installing or operating the gas detection system. The products described in this document can be used with a variety of ESP-Safety gas detector models to provide early warning of the presence of a toxic or explosive gas mixture. Proper device installation, operation, and maintenance is required to ensure safe and effective operation. If this equipment is used in a manner not specified in this manual, safety protection may be impaired.



Cautions and Warnings

This user guide includes numerous cautions and warnings that are specifically included to prevent injury to personnel and prevent damage to equipment. Care is also taken to include notation of all applicable standards and best practices as appropriate information that may apply to any use or procedure associated with the product.



WARNING: TOXIC, COMBUSTIBLE, AND FLAMMABLE GASES OR VAPORS ARE VERY DANGEROUS. USE EXTREME CAUTION WHEN THESE HAZARDS ARE PRESENT.



Caution: The installation of SSS-903 must comply with relevant requirements of the latest edition of the national Electric Code (ANSI/NFPA 70)

Caution: Connection Conduit, Barrier Glands, and Epoxy Sealants are to meet EN-50018/IEC 60079-1 Standards

Caution: ESP Safety Inc. Recommends use of shielded cable with 14AWG conductors reaching a span no greater than 3,900 ft. (1200 meter)

WARNING: Take appropriate precautions, including wearing and use of protective clothing and devices when servicing the SSS-903 as they may have remnants of corrosive solutions.



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 19 of 53

Physical Installation Procedure

<i>Preparing For Installation</i>	The SSS-903 has unique installation procedures for either local or remote hardware configurations. Before installation, evaluate the gas leak locations and other conditions at the test site and configure the unit for that particular need.
<i>PGU sensor Location</i>	Selection of PGU sensor location is critical to the overall performance of the product. Five factors play an important role in the selection of PGU sensor locations: Density of the gas to be detected Most probable leak sources within the industrial process Ventilation and prevailing wind conditions Personnel exposure Maintenance access *Note the PGU Sensor must be pointed down.
<i>Density of detected gas</i>	If the target gas is heavier than air, the sensor should be located within 4 feet of grade. Heavier than air gases will tend to settle in low-lying areas. For gases lighter than air, PGU sensor placement should be 4-8 feet above grade in open areas or in pitched areas of enclosed spaces.
<i>Probable leak sources</i>	Leak sources include flanges, valves, and tubing. Connections of the sealed type where seals may either fail or wear. All potential leak sources and SSS-903 mounting locations are best determined by facility engineers with experience in similar processes.
<i>Ventilation and Prevailing Winds</i>	Normal ventilation or prevailing wind conditions can dictate efficient location of gas PGU sensors so that migration of potential gas clouds is quickly detected.
<i>Personnel exposure</i>	If an undetected migration of gas clouds should approach concentrated personnel areas such as control rooms, maintenance or warehouse buildings. Selection of PGU sensor location should include the potential leak source and perimeter of personnel. Use of ESP Safety PGUAES open field detectors should be considered for these areas.
<i>Maintenance Access</i>	Consideration should be given to providing easy access for maintenance personnel. PGU sensor location should also take into account the proximity to contaminants that may foul the PGU sensor prematurely.
<i>SSS-903 Receiver and PGU Sensor Location Guidelines</i>	There are no standard rules for placement since the optimum PGU sensor location is unique for each application. Before installing the SSS-903, check the conditions at the installation site to make a placement determination. The following guidelines can assist in determining the best possible placement of the SSS-903: Locate the SSS-903 near potential gas leak sources and away from excessive heat, light, wind, dust, water, vibration, shock, and radio frequency interference (RFI). Ensure the installation location has sufficient space to accommodate the SSS-903 housing, PGU sensor, and all necessary cabling. Mount the SSS-903 with the PGU sensor pointing down. Mount the SSS-903 housing in an easily accessible location for reading the digital display and calibration checks



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

**Part
Number:** 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 20 of 53

Physical Installation Quick Guide



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 21 of 53

Tools Required	18-Inch Adjustable Crescent (Spanner Wrench) with 2-inch or greater span for installation and removal of PGU sensor/Sensors 2-MM "Flat Head" screwdriver for protective cover lock screw and wire terminal block clamps #2 Phillips Head Screwdriver for Ground Connector
Physical Installation/ mounting	<p>The SSS-903 can be physically mounted in a number of ways. The surface mount "ears" can be used for a wall mount.</p> <div data-bbox="518 462 649 571"></div> <div data-bbox="698 476 1287 592"><p>Caution: The SSS-903 with TG Sensor installed must always be installed in a vertical orientation with the TG Sensor pointing down. This will minimize collection of contaminants in the TG sensor.</p></div> <p>Figure 10 – Mounting To Pole (Local Configuration)</p> <div data-bbox="493 703 1252 1037"></div>
Figure 11- Mounting with PGU Sensor in local configuration	<div data-bbox="493 1054 971 1417"></div> <p>Local configuration refers to the configuration where the SSS-903 housing and the pre-calibrated PGU sensor are attached and placed in the same location. This is also commonly referred to as a stand-alone configuration.</p> <p>Install explosion proof conduit or cable or conveying appropriate cabling using into a 3/4" Male NPT fitting using an explosion proof cable gland.</p> <p>Mount the SSS-903 vertically with the Smart PGU sensor pointing down to reduce the possibility of dirt and dust building up on the window.</p> <p>Ensure that the open slots of the gas passage are straight up and down to enable the gas to rise up and through the PGU sensor's cell.</p> <p>Using the two surface mounting holes, attach the SSS-903 to a pole bracket or a surface mount to a wall.</p>



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 22 of 53

Mounting in Remote configuration



Figure 13 – Sensor removal

In addition to the standard local configuration, the SSS-903 also supports remote placement of the PGU sensor up to 500 feet away from the housing.

Mount the SSS-903 housing vertically to reduce the possibility of dirt and dust building up on the window.

Using an optional bracket or the two surface mounting holes, attach the SSS-903 to a stable surface or wall.

Mount the PGU sensor to a stable surface or wall with user supplied clamps.

Connect the explosion proof conduit or cable to the SSS-903 housing.

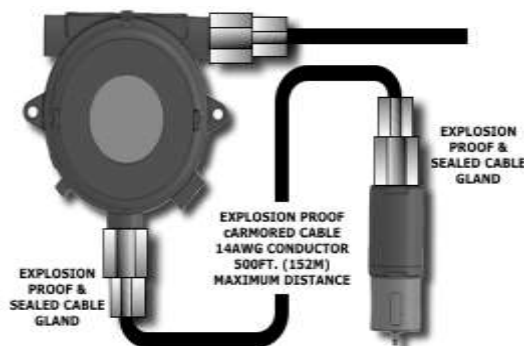
Connect the explosion proof conduit or cable to the PGU sensor.

Ensure that the PGU sensor is pointing down for maximum exposure.

All connections require explosion proof and sealed cable glands.

FIGURE 12 - REMOTE CONFIGURATION

Note: The SSS-903 remote configuration option can be utilized with any gas analyzer equipped with the standard RS-485 (Modbus RTU) output and a power consumption of 24 VDC. This includes all of ESP Safety's toxic gas PGU sensors and ESP's SGOES Combustible Gas Detector.



Earth Grounding

The enclosure of the SSS-903 Receiver must be earthed/grounded for for electrical safety and to limit the effects of radio frequency interference. An earth/ground point is provided on the outside of the SSS-903 Explosion Proof enclosure

Use 14 AWG copper, (Stranded or Solid), wire.


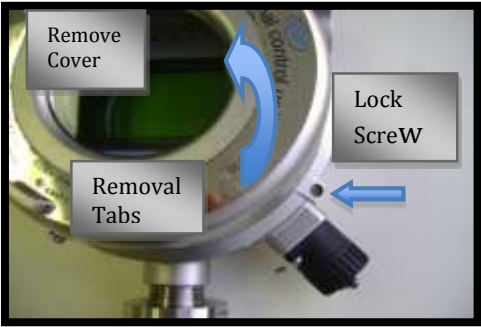


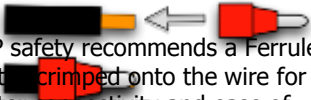



Loosen the screw sufficiently to enable wrapping the wire around the screw in a "U" shape. Raise the flat and lock washers and place the wire between the flat washer and ground base.

Tighten the screw to 10.4lb-in torque.



Figure 14 – Ground



<p>Step 1- Remove Protective Cover</p>	<p>Figure 15 - Cover Removal</p> <p>Loosen the Protective Cover Lock Screw approx. one turn.</p> <p>Remove the explosion proof protective cover by turning counter clockwise. The handle of a Crescent or Spanner Wrench can be used as a lever with the cover removal tabs.</p> 	
<p>Step 2- Remove Control PCBA Module</p>	<p>Figure 16 - Remove Module</p> <p>Un-plug the control circuit by grasping two of the thumbscrews surrounding the display and pulling outwards.</p>	
<p>Step 3- Wire Preparation</p> <p>Figure 17 - Wire Prep</p>	<p>Use a stripping tool for the selected wire gauge to remove ¼-inch (6mm) of the insulating jacket for each conductor to be inserted in the terminal blocks of the Connector PCBA.</p> <p>¼" (6mm)</p>  <p>Shielded 14 AWG Stranded wire (Recommended)</p>  <p>ESP safety recommends a Ferrule that is crimped onto the wire for better connectivity and ease of insertion into the terminal block.</p>	 <p>Paladin Model GripP – 1117 Multi-gauge wire stripper shown above</p>
<p>Step 4- Electrical Connections</p>	<p>Figure 18 - Spring Clamp Terminal Block</p> <p>Use a 2MM Flathead screwdriver or Spring Actuation Tool to engage spring connector slots when installing or removing wires.</p> <p>Insert wire</p>  <p>Use tool to lever the spring open</p>	
<p>Step 5- Re-assemble the SSS-903</p>	<p>After wiring is completed insert the control module with the 4 LED lights at the top then attach the Explosion Proof protective cover onto the SSS-903 and secure by tightening the housing cover lock screw.</p>	



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 24 of 53

General Wiring Requirements

Caution: All cable/conduit entries must be sealed with an appropriate and certified sealing plug and cable gland. The use of industrial grade, armored field cable is recommended. If installing the PGU sensor in a hazardous area using remote configuration, armored cabling is required for the Probe/Sensor connection to the SSS-903 receiver.

Cabling Guidelines

If installing connection cables in an explosion proof conduit, do not use the same conduit to carry wiring for any other purpose or equipment.

If installing the PGU sensor in a hazardous area using remote configuration armored cabling is required for the PGU Sensor connection to the SSS-903 Receiver

Minimum 14 AWG (2.08 mm²) shielded cable conductors are required for optimal performance. The gauge of the wire used determines the maximum distance between the controller and the PGU SENSOR.

When using Modbus power and signal must be separate shielded twisted pair conductors

CAUTION: ***System Power / Digital Ground***



System ground must be provided at the point of origination for 24VDC. Failure to do this may result in loss of range and/or signal integrity.

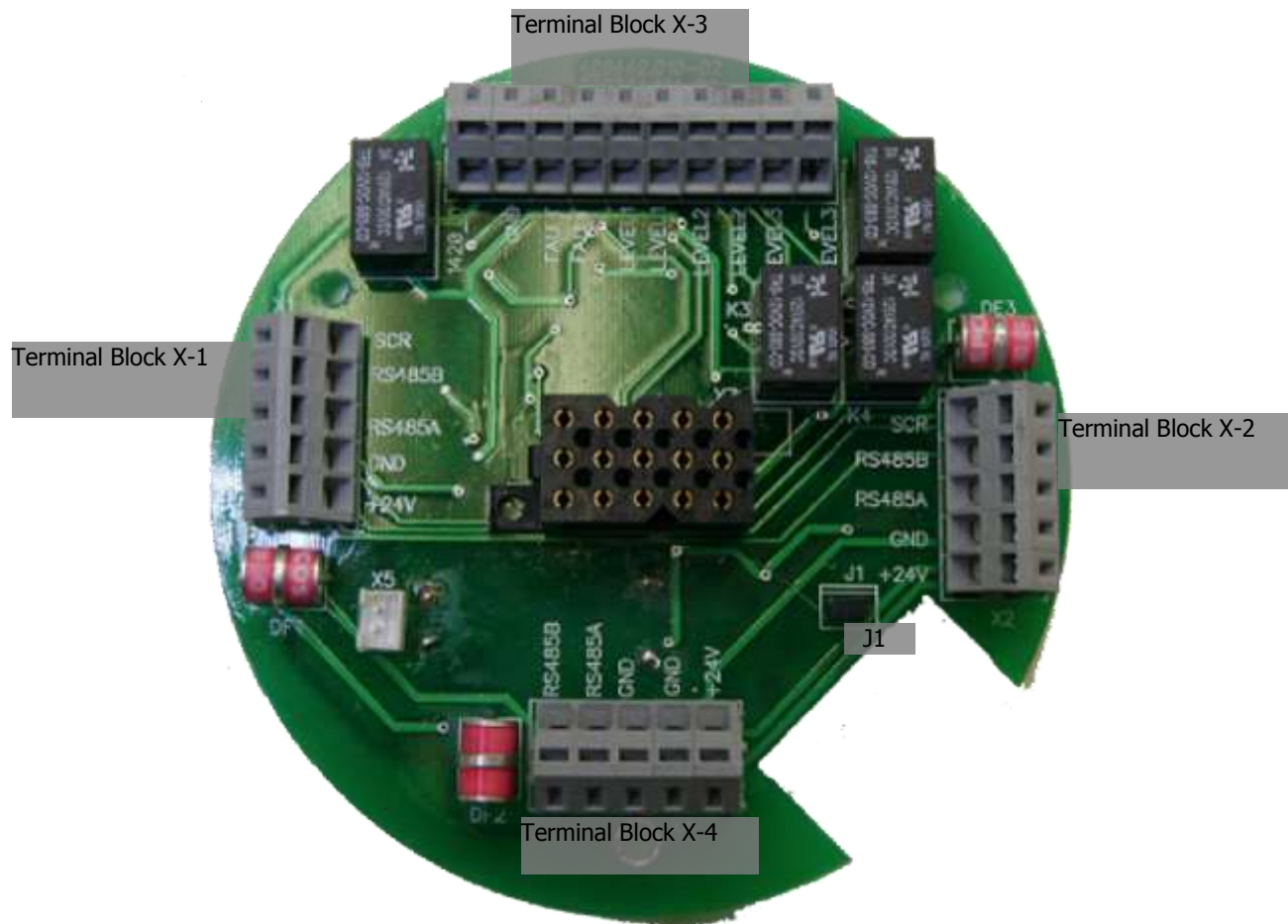


ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 25 of 53

Figure 19 - Power Board Connecting Terminal Block Locations





ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 26 of 53

Table 6 SSS-903 Connections

Connection	Label	Function
Terminal Block X1	SCR	Not Used
	RS485B	ModBus RTU Interface
	RS485A	ModBus RTU Interface
	GND	Digital Ground
	+24V	+24 VDC Power (From External Source)
Terminal Block X2	SCR	Bridge from X1 SCR for Daisy Chain configuration
	RS485B	Bridge from X1 RS-485B for Daisy Chain configuration
	RS485A	Bridge from X1 RS-485A for Daisy Chain configuration
	GND	Bridge from X1 GND
	+24V	Bridge from X1 +24 VDC
Terminal Block X3	+4 to 20 mA	Analog status system with embedded HART communication data
	GND	Digital Ground
	Fault Relay In	Normally Open Relay closes when the SS-903 detects a fault condition.
	Fault Relay Out	Closed condition output of Fault Relay
	Level 1 Relay In	Normally Open Relay closes when the SS-903 detects a pre-programmed level condition determined by +4 to 20 mA.
	Level 1 Relay Out	Closed condition output of Level 1 Relay
	Level 2 Relay In	Normally Open Relay closes when the SS-903 detects a pre-programmed level condition determined by +4 to 20 mA.
	Level 2 Relay Out	Closed condition output of Level 1 Relay
	Level 3 Relay In	Normally Open Relay closes when the SS-903 detects a pre-programmed level condition determined by +4 to 20 mA.
	Level 3 Relay Out	Closed condition output of Level 1 Relay
Terminal Block X4	SCR	
	RS-485B	Probe
	RS-485a	
	GND	
	+24V	
Jumper 1	J1	Termination Jumper For "Daisy Chain" RS-485 configuration of Multiple SSS-903 Units.



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

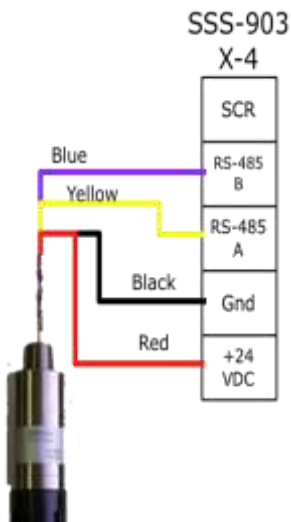
Rev: 03
Date: 08/15/2017
Page: 27 of 53

Remote PGU Sensor Wiring to SSS-903



Caution: All cable/conduit entries must be sealed with an appropriate and certified sealing plug and cable gland. The use of industrial grade, armored field cable is recommended. If installing the TG sensor in a hazardous area using remote configuration, armored cabling is required for the Sensor connection to the SSS-903 receiver.

Figure 20 –PGU Connection to Terminal Block X-4



Installation Wiring

There are several methods of wiring connections for the SSS-903 Receiver. To accommodate this variety and provide ease of installation, the SSS-903 includes all hardware and connections for any configuration determined by the user making it well suited for new and replacement applications.



Caution: The installation of SSS-903 must comply with relevant requirements of the latest edition of the national Electric Code (ANSI/NFPA 70)

Caution: Connection Conduit, Barrier Glands, and Epoxy Sealants are to meet EN-50018/IEC 60079-1 Standards

Caution: ESP Safety Inc. Recommends use of shielded cable with 14AWG conductors reaching a span no greater than 3,900 ft. (1200 meter)

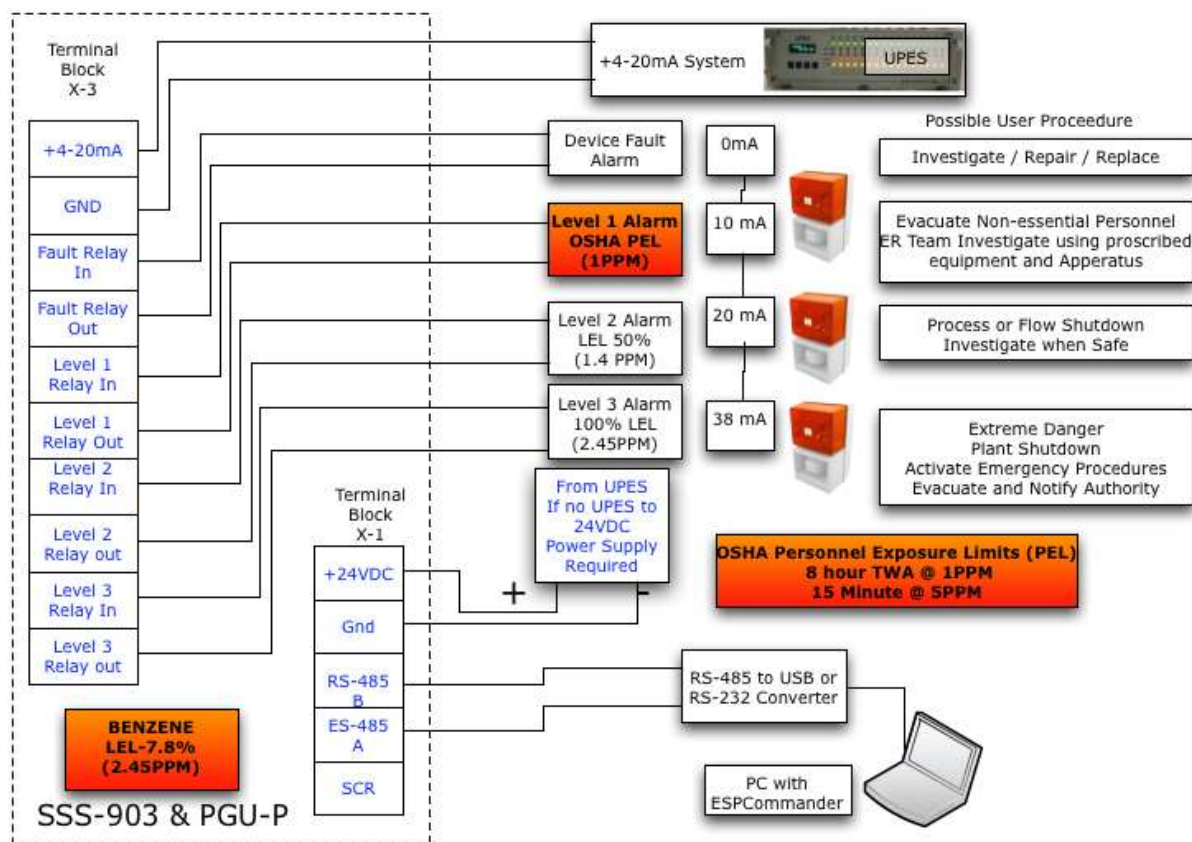


ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 28 of 53

Figure 21 - Comprehensive Wiring Diagram for Multiple use Configuration





ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 29 of 53

Figure 22 - Connecting the SSS-903 to ESP Safety UPES Multichannel Controller

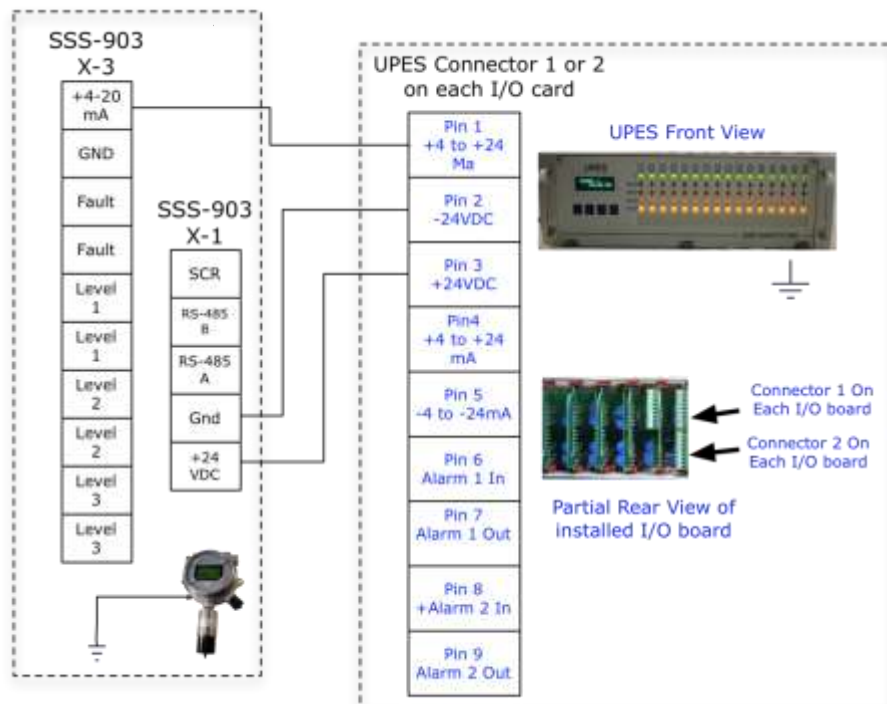
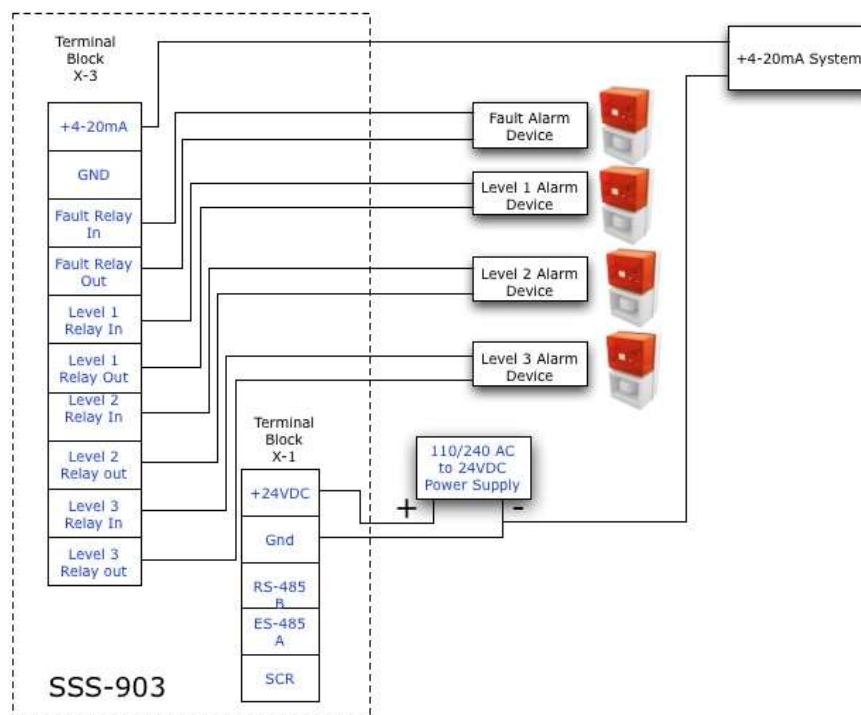


Figure 23 - Connecting the SSS-903 Using 3 Wire Analog Interface Method



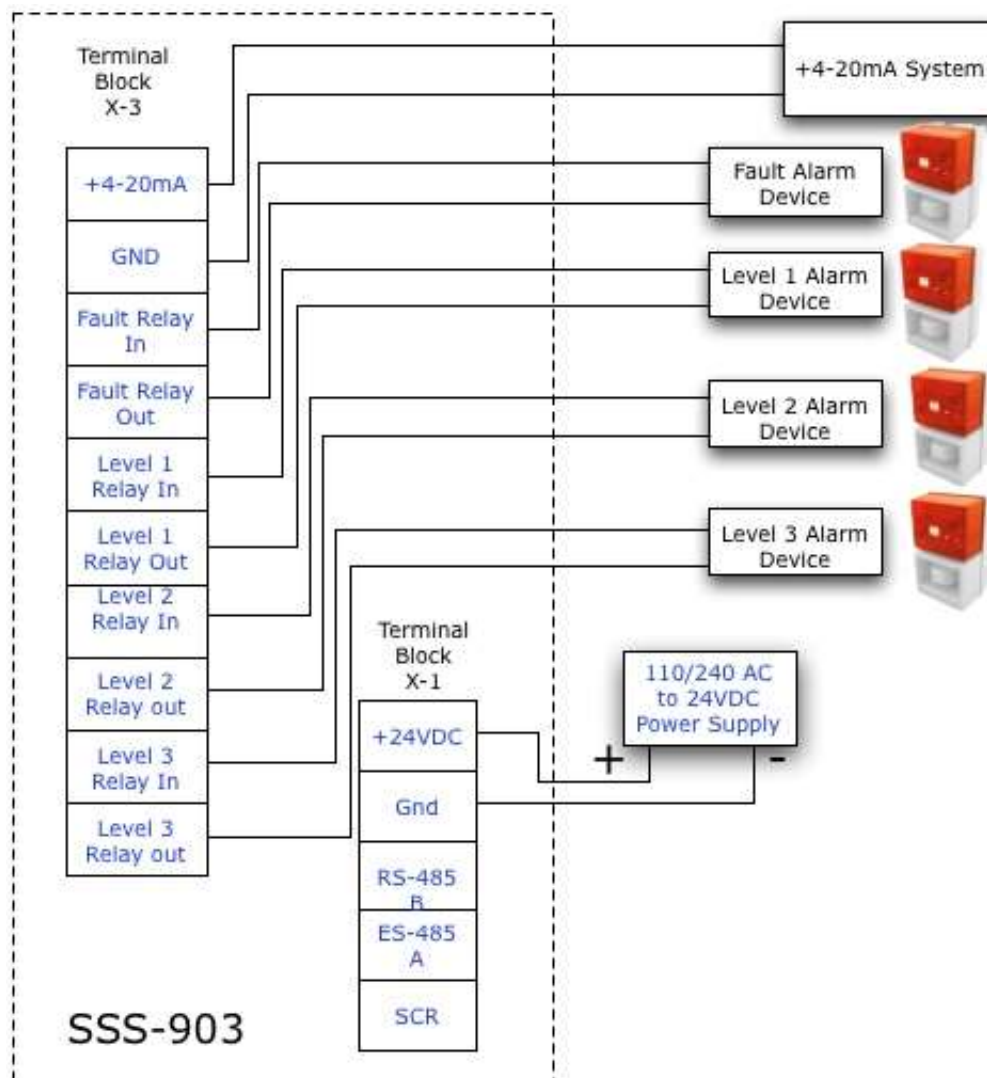


ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 30 of 53

Figure 24 - Connecting the SSS-903 Using 4 Wire Analog Interface Method





Power up and Stand Alone Operation of the SSS-903

Installation Review Prior to Startup

Once the mounting, cabling, and alarm relay installation has been completed, the SSS-903 is ready to begin the power-on sequence.

Before applying power to the system for the first time, review the steps below:

- Verify that the SSS-903 has been properly mounted. Ensure that all conduit / cable gland entries have been tightened and sealed if necessary.
- Verify that all of the signal wires have been installed correctly.
- Verify connection or earth/ground to the enclosure.
- Verify connections between the SSS-903 housing and the PGU sensor if in remote configuration.
- Verify the connections between the SSS-903 housing and any control room devices and alarm systems.
- Make sure that the SSS-903 cover is securely installed and locked with the housing cover lock screw.
- Make sure to turn off or disconnect any external devices, such as Trip Amplifiers, PLC devices or DCS systems, until after the startup sequence has been completed.

Once you are ready to begin startup, verify that the power supply is connected properly and verify input voltage with the SSS-903 disconnected at the source. The SSS-903 is powered by 24 VDC (12 to 36 VDC voltage range).

After completing the above, the SSS-903 is ready to be powered on.

Startup Procedure

Before the initial power up, remove power from or disconnect all output devices and alarms to prevent actuation.

Apply power to the system. Upon first power-up, the SSS-903 should be allowed to stabilize and allow the sensor to initialize

Figure 25 - Initialization Screen



After 15 seconds, the Operational Status indicator diode will glow green and all information will be available on the display.

Figure 26 - Operation Screen





ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 32 of 53

RS-485 Modbus Digital Communication and Operation

The Modbus interface is used for communication to all ESP Safety Detector models. Up to 480 devices can be connected in a Daisy Chain method. Modbus® RTU protocol uses ASCII/Hex data for communication and allows all SSS-903 functions to be transmitted using this method. Modbus protocol is a Master-Slaves protocol. ESP-Safety provides a communication program, ESP Commander that uses a PC as a Master Device controlling all connected Detectors as Slave devices.

The ESP Commander master initiates all communication to the devices. The slave detectors cannot transmit data without receiving a request from the master. The slave detectors cannot communicate with each other.

MODBUS® is a registered trademark of Schneider Automation Inc. ESP Commander can perform real time monitoring, control operations, adjustment of function, and download of the non-volatile flash memory on the SSS-903.

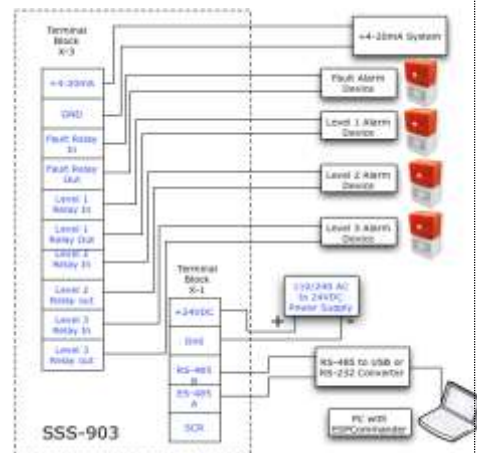
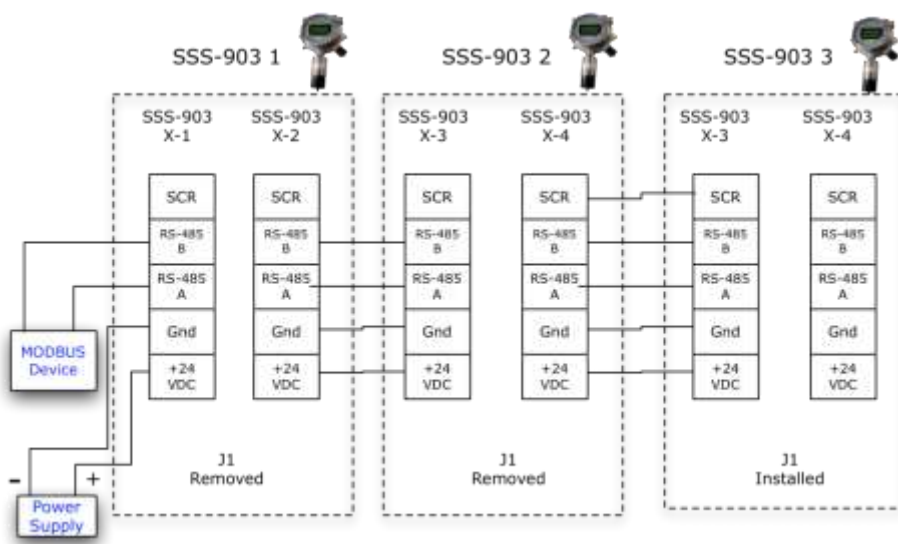


Figure 27 - Modbus Connection with Analog and Alarm

RS-485 Modbus Daisy Chain Digital Data Loop

ESP Safety manufactures a variety of detection devices for fire, explosive and toxic gas detection. Up to eight detectors, of any mix, can be connected in a string, or daisy chain. When using this configuration, Jumper J-1 must be used for the last unit in the chain, providing signal termination. All other units must have J1 removed.

Figure 28 - Modbus Daisy Chain





ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 33 of 53

Calibration Procedures



Warning: Trained staff must perform all calibration procedures.
The calibration procedure work area must be located a safe distance from any hazardous zone.
Follow all site safety operating procedures before removing any detector from service.



Warning: All alarms must be disconnected to eliminate the possibility of erroneous alarm activation when performing this procedure.

Methods of Performing Calibration

There are three methods available to perform calibration of the SSS-903 with Smart Probe:

Using RS-485 Modbus with the ESPCommander control Program (Bench Test Method A)

Using a HART Communicator (Non-invasive In Field or Bench Test Method B) HART Communicator required

Using a Magnetic "Wand" (Non-invasive In Field or Bench Test Method C) No Instrument or tools required

Non-Invasive Zero set up can be performed on SSS-903 detectors when installed in the permanent location by using a magnetic Wand that is included with every SSS-903 unit.

Required Equipment For Non-Invasive Calibration.

¼" PVC Tubing
ESP Safety Zero Gas and Span Gas disposable canister for the appropriate gas.
ESP Safety Magnetic Wands

Figure 29 - Equipment for Magnetic Wand Calibration

Magnetic Wand





ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part 10060-001
Number:
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 34 of 53

Non-Invasive Magnetic Wand Calibration Procedure



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 35 of 53

Purging

The working area must be free of any Gas or contaminants.

Connect the nipple of Sensor's collection chamber to the Zero Gas Cylinder with PVC tubing.

1. Apply magnetic wand to SSS-903 calibration point. CAL LED will turn solid green and 'CALIBRATION' message is displayed
2. Apply zero gas for at least 1 minute at 0.3 LPM flow rate. Ensure reading displayed on SSS-903 is a stable value (should be zero).

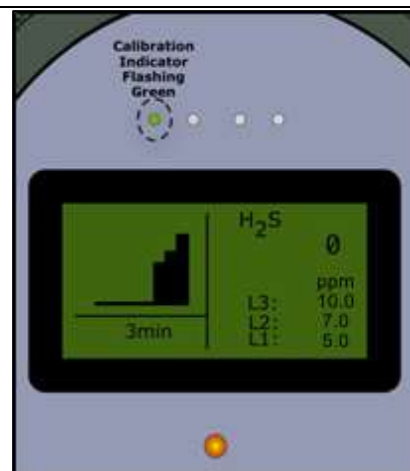


Figure 30 – Purge for Wand Calibration

Wand Zero Cal

Apply magnetic wand to SSS-903 calibration point. CAL LED will start to flash green. Displayed value should be zero (zero calibration is now complete).

Figure 31 - Zero Cal with Wand





ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

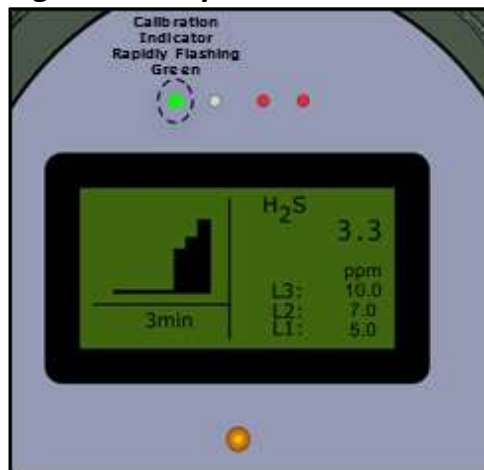
Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 36 of 53

Wand Span Cal

1. Apply calibration gas for 1 minute at 0.3 LPM flow rate. Reading displayed should increase to near calibration gas value. Ensure reading is stable value.
2. Apply magnetic wand to SSS-903 calibration point. The CAL LED will start rapidly flashing green. The magnetic calibration gas value is now set, displayed value should equal magnetic calibration gas value.
3. Remove the calibration cup, once calibration gas is clear of the sensor (readings approach zero) CAL LED will turn off and 'CALIBRATION' message turns off indicating calibration is complete.

Figure 32 – Span Cal with Wand



Caution: Factory calibration of the PGU sensor is performed using a gas flow rate of 0.3 LPM (Litres Per Minute). ESP Safety recommends that field calibration of PGU sensors is performed at the same flow rate. Using non-recommended flow rates may result in calibration errors.



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 37 of 53

Non-Invasive Calibration Procedure w HART Communicator



Non-Invasive field calibration can be performed on SSS-903 detectors with a HART communicator.

Establish communication between the HART Communicator and the SSS-903 by attaching the ESP Safety-supplied cable to the HART connection port of the SSS-903



Zero Calibration using a HART Communicator



Figure x-xx: Online Display

Step 1:

From the Online Display, select 1 Device Setup



Figure x-xx: Device Setup

Step 2:

Highlight and select the 2 Detailed Setup item.



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

**Part
Number:** 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 38 of 53



Figure x-xx: Detailed Setup

Step 3:

Highlight and select the 6 Sensor Trim item.



Figure x-xx: Sensor Trim Select

Step 4:

From the Sensor Trim Display, highlight and select 3 Zero Trim



Figure x-xx: Warning Message

Warning Message 1:

Note the warning message. As a safety precaution, any alarms or devices controlled by the gas sensor output should be disabled at this time.



Figure x-xx: Warning Message 2

Warning Message 2:

Note the warning message. The user may abort the calibration sequence at this point if calibration is not desired at this time.



Figure X-XX: Sensor Zero Calibration

Step 5:

Apply the zero gas to the sensor and wait for the reading to stabilize. Press "OK" to complete the sensor zero calibration. Press "ABORT" to cancel the calibration sequence. Remove the zero gas from the sensor.



Figure x-xx: Warning Message

Warning Message 3:



Span Calibration using a HART Communicator



Figure x-xx: Online Display

Step 1:

From the Online Display, select 1 Device Setup



Figure x-xx: Device Setup

Step 2:

Highlight and select the 2 Detailed Setup item.



Figure x-xx: Detailed Setup

Step 3:

Highlight and select the 6 Sensor Trim item.



Figure x-xx: Sensor Trim Select

Step 4:

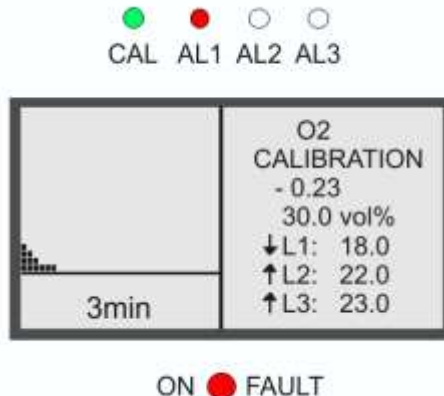
From the Sensor Trim Display, highlight and select 4 Device Variable Trim



Figure X-XX: Sensor Zero Calibration

Step 5:

Apply zero gas to sensor. When the displayed gas is stable, select OK



Step 5a:

The SSS-903 display will show 'Calibration' message and green CAL LED will flash.

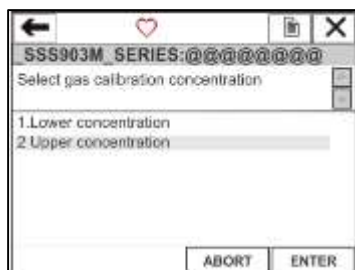


Figure x-xx: Warning Message

Step 6:

Select gas calibration.

1. Lower Concentration (choose for mid-span)
2. Upper Concentration (choose for full-scale)



Figure x-xx: Warning Message 2

Step 7:

Apply concentration gas. When the displayed gas value is stable, select 'OK'.

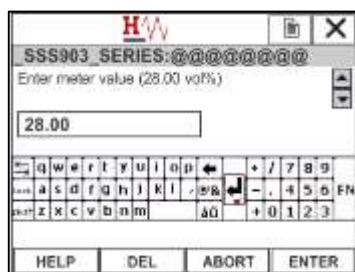
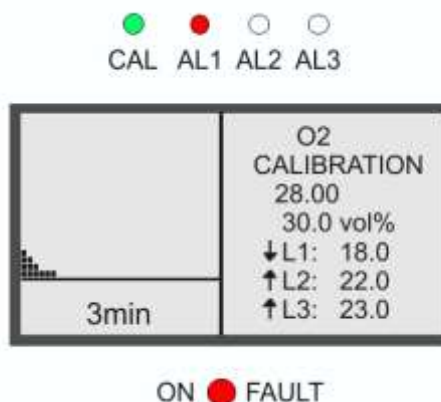


Figure X-XX: Sensor Zero Calibration

Step 8:

Enter the span gas concentration in the units specified. Press 'ENTER' to complete



Step 8a:

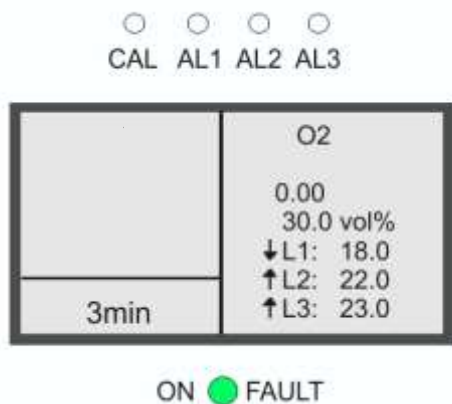
The value of the gas displayed on the SSS-903 should now equal the reference gas concentration.



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 42 of 53



Step 9:

Reapply zero gas. The green 'CAL' LED on the SSS-903 will flash for approximately three minutes as the readings stabilize. When calibration is complete, the green 'CAL' LED will turn off and the 'ON/FAULT' LED will display solid green, indicating normal function.



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 43 of 53

Bench Test Calibration Procedure with ESP Commander

The bench test procedure requires the SSS-903 and PGU sensor to be removed from a field installation for testing in an area designated by the user. Site safety procedures should designate the location, configuration, and safety requirements.

The user may also choose to perform a bench calibration as part of a commissioning procedure for a new (out of the box) unit prior to installation.



Warning: SSS-903 Receivers and PGU Sensors may be used in conditions where Toxic gasses may have been present. The customer must follow their defined and regulatory procedures, including protective clothing and or breathing apparatus for safe handling of these toxic substances, as residual of amounts of the toxic substance may be present in the Detector units being calibrated.



Caution: Before the calibration and verification procedure, inspect the SSS-903 for any mechanical damages to the enclosure and/or sensor elements. Please contact the ESP Safety Inc. service department for further information



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 44 of 53

The following equipment is required for ESP Commander calibration of the SSS-903:

ESP Safety Inc. SSS-903 Calibration Kit for Methane Gas (Part Number 24011-xxx)
Power supply: output voltage 0-30VDC with adjustable current limit (no less than .05mA)
Digital Multimeter (Optional)
Plastic or vinyl tube – 3 pieces of 59.06 inches (1.5M) in lenPGUh
Four control lamps (24VDC) for relay operation
PC With Windows operating System
Convertor RS232/485 (Or USB to RS-485 Ada
ESP Safety Inc. "ESP Commander Program"



Figure 39-
Safety Inc.
calibration
Methane



ESP
Kit
Gas

Calibration Gas Cylinders
Zero Gas (0% LEL)
Mid Span Gas (typically 50%LEL)
Span Gas (typically 90% LEL)
Cylinders are supplied with 1 cubic liter of
gas at 1600-1800 PSIG. Replace cylinders
when the internal pressure is lower than
200PSIG

Calibration Kit Components

ITEM	PART NUMBER	DESCRIPTION	QTY
1	50016-xxx	ZERO GAS CALIBRATION CYLINDER	1
2	50021-xxx	MID-SPAN CALIBRATION GAS CYLINDER (50% LEL)	1
3	50022-xxx	SPAN GAS CALIBRATION CYLINDER (50% LEL)	1
4	40072-xxx	REGULATOR, SINGLE STAGE, FIXED ORIFICE, 500 SCCM	3
5	40074-xxx	CUP, CALIBRATION, SSS-903	1
6	40076-xxx	CASE, TRAVEL, CALIBRATION KIT	1

***Note: User supplied tanks and
regulators may be employed.
Flow rates must be limited to
10 LPM as measured on a
rotameter.***

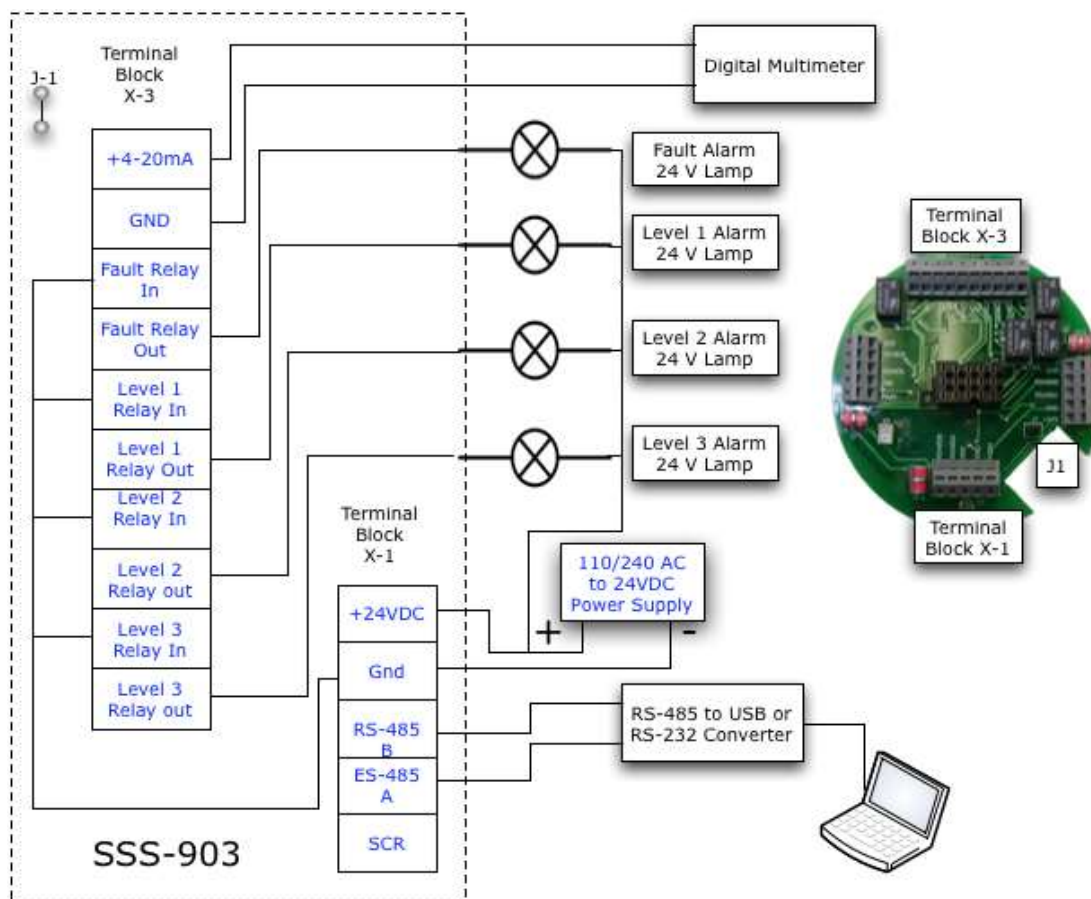


ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 45 of 53

Figure 40 - Wiring Diagram for Bench Calibration





ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 46 of 53

Figure 41 -Launch ESP Commander

Software Program on the user supplied PC interfaced to the user supplied RS-485 to USB converter.

Select The COM port for the link between the PC and converter

ESP Commander will scan for all devices connected (via MODBUS communication protocol)

Select the device to be calibrated by "double clicking"





ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 47 of 53

Figure 42 -ESP Commander Operating Screen Display and Function:

Device Model	Detection Gas
Device relay state	Calibration Values
Device Address	Alarm Values
Version	Graph of Alarm events
Serial Number	Recording of Real Time Data
Device Address Assignment	Polling Interval

SSS-903 Address: 3 - S/N: 1198

Fault Level 1 Level 2 Level 3

REAL TIME ALARM STATUS & DATA FROM SSS-903

Address	Baud Rate	Version	Serial #	Temp	Gas	Vol. Conc	% LEL
3	9600	7.9	2112	25c	H2S	1	.8

Calibrate Gas

H2S Zero

Pri. Conc - % Vol. Pri. Cal

Sec. Conc - % Vol. Sec. Cal

Alarms

ALARM THRESHOLDS AT SSS-903

	%LEL 1	%LEL 2	%LEL 3
Current	0.5	1.2	2.8
Edit			

ENTER & SET NEW THRESHOLD VALUES

Set

Set Default Record Graph

Comm

RxTx	Wrong Addr	Timeout	CRC	Exception	Version
58	0	0	0	0	0

Poll Intvl (ms) Address

250 3 Set

Stop Poll Baud Rate

9600 Set

After connecting the SSS gas analyzer to the PC, ensure that the digital interface is functional by comparing the SSS-903 settings with those display by ESP Commander.



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 48 of 53

Figure 43 –Cal Gas Selection

Use the pull down to select the gas to match the labeling on the sensor.

The gas pull down is pre-programmed with the required LEL/ppm for the selected gas.

Gas

O2

Set

Connect tubing between the gas cylinder and PGU sensor inlet nipple.

Using the Zero Gas Cylinder, purge the the cup and PGU sensor by inserting the tubing from the Zero Gas Cylinder and passing approximately one Liter of Gas into the sensor.

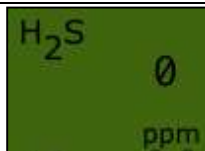
Figure 44- Zero Cal Purge using ESP Commander





Figure 45- Zero Cal

When measured gas level has stopped changing, Zero or close to it, Click on Zero.
Current loop out put will equal 4.0mA
The SSS-903-903 will show Zero



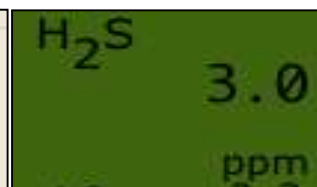
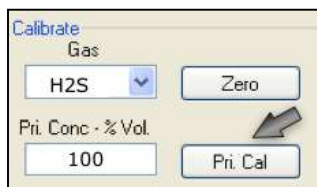
Attached the Span Gas Cylinder with the mixture value as required.

Start a flow into the Calibration cup. After about 60 seconds, the count will top out. Set this as Span or the user selected Max % of the LEL.

Current loop output will equal 20ma.

Hydrogen Sulfide is measured as ppm the setting for 100%LEL is equal to the screen value.

Figure 46 -Span Cal with ESP Commander



A second gas with a mixture equal to 50% LEL may be used for calibration of span or mid span.

Figure 47 – 50% Span



Level 1,2,3 Alarm levels can now be entered to the SSS-903 by entering the value and clicking set.

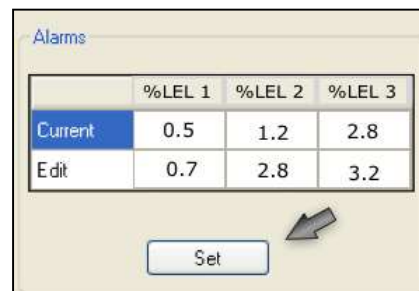
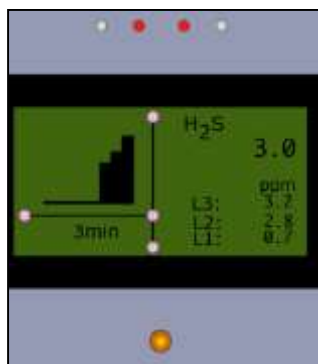
Stop the flow and remove the Span gas hose and Cal Cup at this point.

The SSS-903 can now be reassembled and returned to service.

Note that in the SSS-903 Screen (left) the Alarm 1, Alarm 2, are RED and the Tri Color LED Alarm Status is YELLOW.

When the Span gas is removed, the ppm value will drop to zero and alarms will turn off when thresholds are crossed.

Figure 48- Setting Alarm Thresholds



	%LEL 1	%LEL 2	%LEL 3
Current	0.5	1.2	2.8
Edit	0.7	2.8	3.2



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 50 of 53

Unpack A New SSS-903

The contents should be carefully removed and verified against the packing list. If any damage has occurred or there is any discrepancy in the order, please notify ESP Safety Inc. customer service department as soon as possible at (408) 886-9746 or via Email <mailto:info@espsafetyinc.com>

Warranty: ESP Safety Inc, 555 North First Street San Jose, CA 95112 USA, guarantees the SSS-903 will be free of manufacturing defects

for 5 years after date of commissioning, provided the customer follows all guidelines pertaining to installation, operation, and maintenance detailed in this Operating Manual. During this warranty period, the manufacturer will correct any failures detected in the SSS-903 or replace any damaged unit free of charge.

Field Repair

The SSS-903 detector has no user serviceable parts. If a problem should develop, refer to the Troubleshooting information. If it is determined that the problem is caused by a manufacturing defect, please return the device to the factory for repair or replacement.

Return Material Authorization (RMA)

Contact ESP Safety Inc at 408-886-9746 to obtain a Return Material Authorization (RMA) number. In the call, provide the following information:

- Company Name
- Serial Number
- Date of Commissioning
- A brief explanation of malfunction

Pack the unit properly to ensure that no shipping damage occurs and ship prepaid to:

ESP Safety Inc
555 North First Street
San Jose, CA 95112

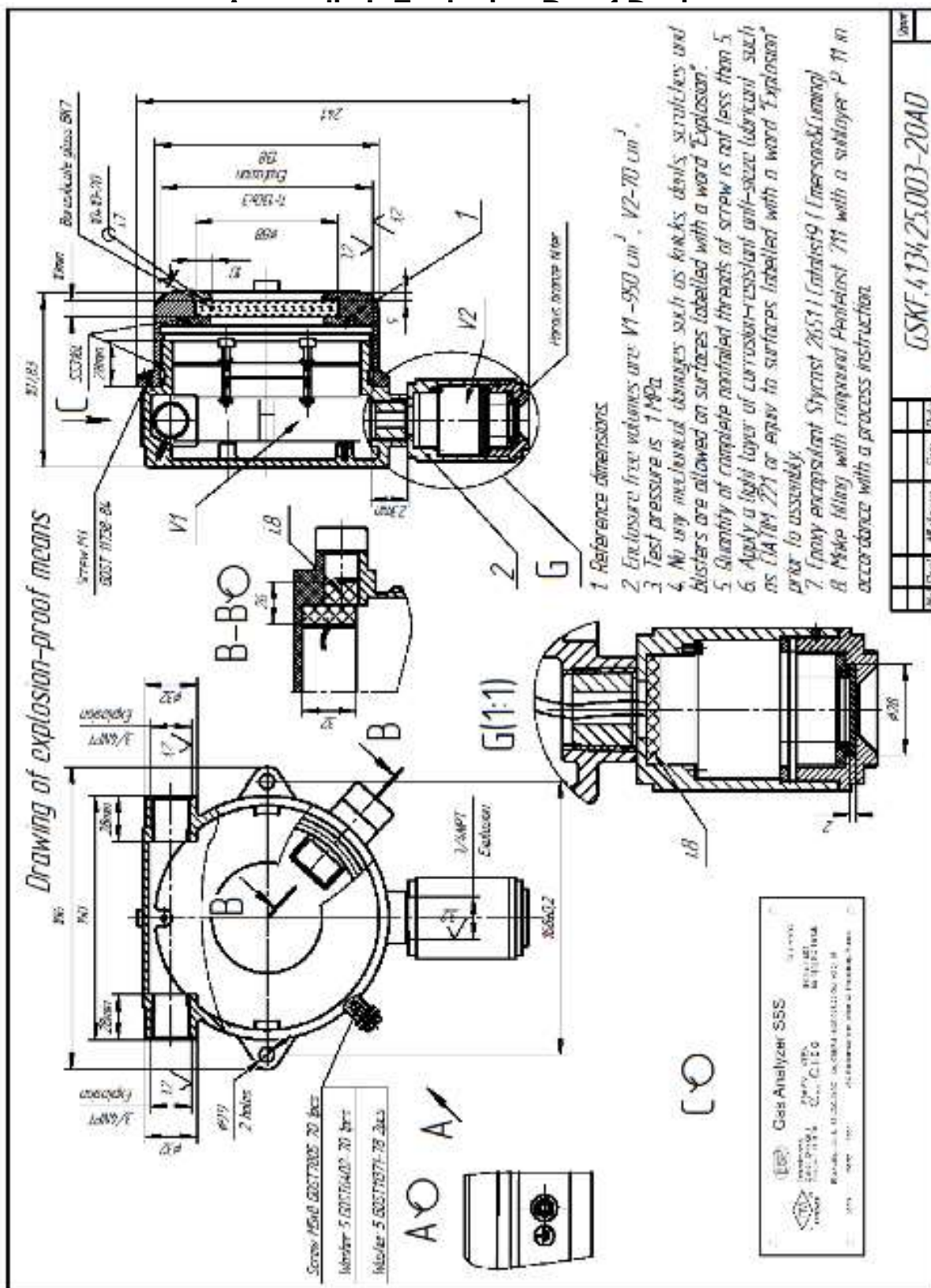
Write the RMA number on the front of the shipping carton.

Maintenance

The technical maintenance for the SSS-903 systems consists of periodical external examination and zero setup. The inspection interval is set by the based upon their operating procedures. Physical inspections of the detector installation should be performed at regular intervals as determined by customer procedure. Detectors used in corrosive environments should be replaced at regular intervals. Contact ESP Safety to order replacement PGU Sensors.

Troubleshooting

Malfunction / Problem	Possible Cause	Troubleshooting Method
Unit does not perform self test on power up	Low Power supplied.	Check input voltage to be 18 to 36 VDC range
Following power-up of and self testing mode completion some functions fail	Microprocessor error	Return to ESP Safety for repair





ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 52 of 53

Appendix II: Warranty & Return Policy

ESP Safety, Inc. ("ESP") warrants the SSS-903 Gas Detector to be free from defects in material and workmanship under normal use and service for a period of five (5) years, beginning on the date of shipment to the buyer. This warranty extends only to the sale of new and unused products to the original buyer. ESP's warranty obligation is limited, at ESP's option, to refund of the purchase price, repair, or replacement of a defective product or a component thereof, to the extent that the product is properly returned to ESP within the warranty period.

This warranty does not include:

- a) fuses, disposable batteries or the routine replacement of parts due to the normal wear and tear of the product arising from use;
- b) any product or component which in ESP's opinion, has been misused, altered, abused, tampered with, improperly maintained or used, neglected or otherwise damaged by accident or abnormal conditions of operation, handling or use, or to have deteriorated due to aging of any component made of rubber or any other elastomer; or
- c) any damage or defects attributable to repair of the product by any person other than an authorized dealer, or the installation of unapproved parts on the product.

The obligations set forth in this warranty are conditional on:

- a) proper storage, installation, calibration, use, maintenance and compliance with the product manual instructions and any other applicable recommendations of ESP;
- b) the buyer promptly notifying ESP of any defect and, if required, promptly making the product available for correction. No goods shall be returned to ESP until receipt by buyer of shipping instructions from ESP. A return authorization number must be obtained from ESP prior to shipment; and
- c) all warranty returns to be shipped pre-paid by buyer.
- d) the right of ESP to require that the buyer provide proof of purchase such as the original invoice, bill of sale or packing slip to establish that the product is within the warranty period.

THE BUYER AGREES THAT THIS WARRANTY IS THE BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ESP SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES. ESP WILL NOT BE LIABLE FOR LOSS OR DAMAGE OF ANY KIND CONNECTED TO THE USE OF ITS PRODUCTS OR FAILURE OF ITS PRODUCTS TO FUNCTION OR OPERATE PROPERLY. IN NO EVENT SHALL ESP'S LIABILITY HEREUNDER EXCEED THE PURCHASE PRICE ACTUALLY PAID BY THE BUYER FOR THE PRODUCT.

To the extent any provision of this warranty is held invalid or unenforceable by a court of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

Field Repair

The SSS-903 Gas Detector is not intended to be repaired in the field. If a problem should develop, refer to the troubleshooting section of this manual. If it is determined that the problem falls within this warranty, please return the product to ESP as instructed hereunder.



ESP SAFETY INC
555 N. First Street
San Jose, CA 95112

Part Number: 10060-001
Description: SSS-903 TG-E
Install Guide

Rev: 03
Date: 08/15/2017
Page: 53 of 53

Return Material Authorization (RMA) Number

Contact ESP Safety Inc. at +1-408-886-9746 to obtain a Return Material Authorization (RMA) number. Please provide the following information during your call:

- Company Name
- Product Type
- Serial Number
- Date of Shipment
- Brief explanation of malfunction

Pack the unit properly to ensure that no shipping damage occurs and ship pre-paid to:

ESP Safety Inc.
555 North First Street
San Jose, CA 95112 USA

Write the RMA number on the front of the shipping carton.