Interscan Corporation

Instruction Manual

ACCUSAFE Sensor Module

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Section 1 - Introduction

1.1   IMPORTANT SAFEGUARDS

To reduce the risk of fire, electrical shock, injury to persons or permanent damage to this device, these safety precautions should always be followed:

- Use the included 12VDC power supply or specified power connector to operate this device. Inappropriate voltage supply or power connector could cause irreparable damage to this device.

- Make sure power plug and Modbus cable are plugged in and secured before powering up the device. The power connector will not make connection to GND if not fully plugged into the socket. Also make sure the locking ring is securely tightened.

- If sampling via tubing, make sure that the tubes are securely attached to the device before operating. Use the provided particulate filter to prevent dust and particulates from entering the device. See section 2.1.2, pg. 7.

- Do not operate the device with an obstructed flow path. Obstruction during air sampling will damage the internal micropump. See section 5.2, pg. 26.

- Do not expose this device to any liquids.

- Sensors must not be exposed to temperature, humidity and pressure that are outside the operating range. See section 1.2, pg. 4.

1.2   ACCUSAFE SENSOR SPECIFICATIONS

Measurements	Target Gas, RH, Temperature, Barometric Pressure
Air Sampling Rate	125-280 mL/min (Pump speed 50% - 100%)
Measuring Rate	Continuous or variable (trigger mode)
Communication	Modbus via RTU/RS485 & TCP/IP
Sampling Port	Inlet/outlet with Luer lock fittings
Operating environment	0°C - 50°C, 15-90% relative humidity non-condensing
Power Input	12VDC regulated
Avg. Power Consumption	2.5W
Dimensions	8 in x 4.7 in x 2.2 in (includes mounting flanges)
Weight	0.98kg
Enclosure	Powder-coated aluminum

Gas Sensor

Type	3 electrode electrochemical
Nominal Range	See section 1.2.1 below
Accuracy	± 2% of reading ± least significant digit
Response Time (T90)	< 2 minutes (varies widely by gas type)
Temperature Range	-20 °C to 50 °C (varies by gas type)
Pressure Range	atmospheric ± 10 %
Relative Humidity Range	15 % to 90 % R.H. non-condensing
Long Term Output Drift	< 2 - 5 % per month in continuous exposure (varies by gas type).
Lifetime	2 – 3 years (varies by gas type)

NOTE: The model number "F901" as depicted numerous times in this manual in device and software screenshots is the original model number for the Accusafe devices. While no longer in use and not referred to in the manual text, this model number remains in current versions of the firmware and app software. Future versions will eliminate this model number.
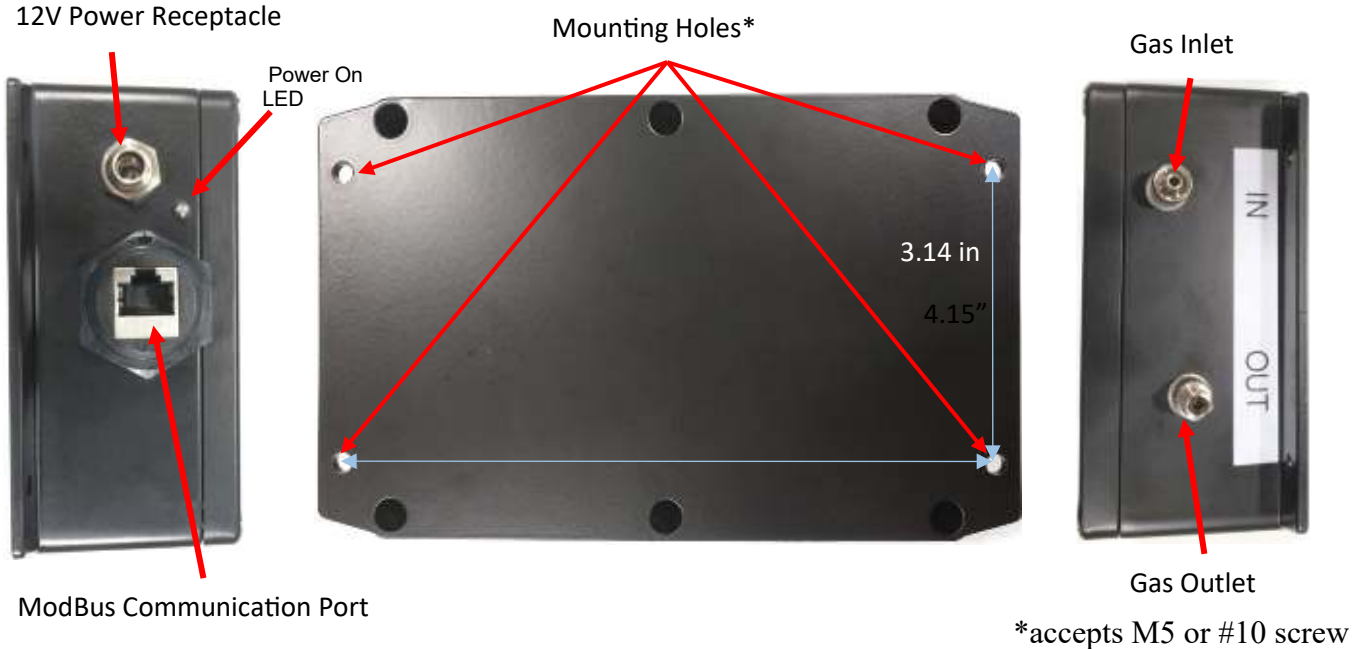
1.2.1   SENSOR MODULE CONFIGURATION

This section details the specific parameters related to gas, range and recommended calibration settings for your ACCUSAFE instrument. If your system contains multiple sensor modules, each module's setup is detailed in a list below. Highlighted sections indicate user settings to be input in maintenance modes. All other sections indicate factory settings.

SENSOR #1 – ASSE26455

GAS **–** _____	SENSOR RANGE **–** _____
ZERO CAL DURATION –	SPAN CAL DURATION – _____
CALIBRATION MODE – _____ (see section 4.2.1. Page 20)	
FLOW RATE (PUMP SPEED) – ____ (see section 3.15 on Page 13)	
TRIGGER MODE SAMPLE DURATION - _____ (Modbus Holding Register 21)	
TOTAL TRIGGER MODE DURATION – _____ (Modbus Holding Register 20)	

Section 2 - Installation

2.1   ENCLOSURE WALL MOUNTING

12V Power Receptacle

Power On LED

Mounting Holes*

Gas Inlet

3.14 in

4.15"

IN

OUT

ModBus Communication Port

Gas Outlet

*accepts M5 or #10 screw

The sensor module is wall mountable using M5 or #10 screws. Install the module in the immediate area from which you want to draw sample. Although consideration should be given to the whether the target gas is heavier or lighter than air, generally the sensor module should be mounted with the inlet at nose level for the average person. **Allow for 18" total horizontal space to accommodate pneumatic and cabling connections to the sides of the enclosure.**

2.2   WIRING AND PNEUMATIC CONNECTIONS

2.1.1   POWER AND MODBUS CONNECTIONS

Connect the 12V power adapter to the sensor module by inserting the plug into the 12V power receptacle and tightening the lock ring snugly.

For TCP/IP communications applications, connect a standard CAT5 communications cable to the MODBUS communications port. This cable will connect to the "ETHERNET" port on the ACCUSAFE controller module for non-web browser single sensor applications or to an Ethernet switch or hub for single or multi-sensor applications that utilize the web browser application.

For RTU (RS485) communications applications, connect a standard CAT5 communications cable to the MODBUS communications port. This cable will connect to the "RS485" port on the ACCUSAFE controller module for single sensor applications or to the next sensor in the daisy chain for multi-sensor applications**.

NOTE: Multi-sensor applications using RS485 connections will require a splitter device be used at each node in the chain using a multi-drop (daisy chain) topology.

NOTE: Waterproof cap for CAT5 cabling shown below (not provided with sensor) can be acquired as needed at this link: https://www.installerparts.com/16279-patch-cable-waterproof-cap.html
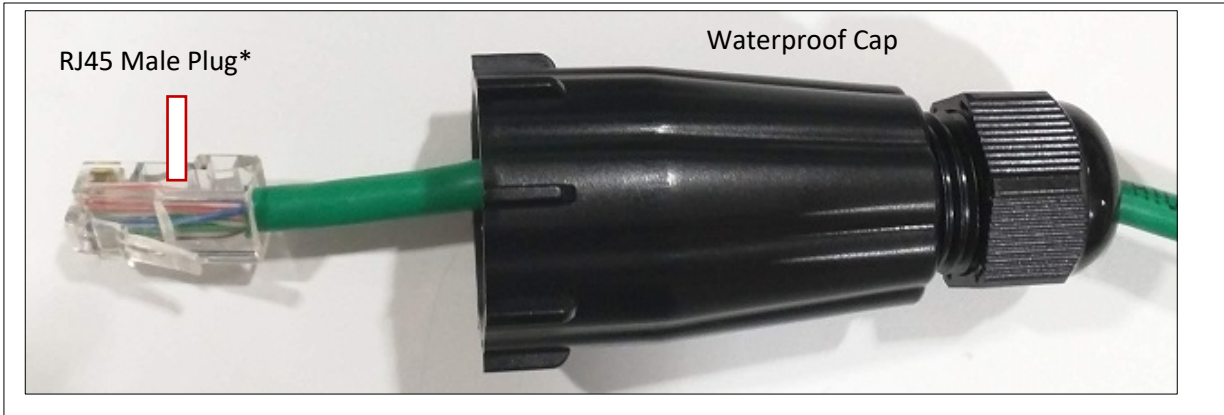

2.1.2 PNEUMATIC CONNECTIONS

A particulate filter (pictured on the right) is provided for connection to the inlet of the sensor module. This filter protects the sensor and internal components from dust and particulates that may be present in the sample.

To connect this filter, slip the end of the filter fitting into the opening of the inlet fitting and rotate the filter in a clockwise direction. Tighten snugly but do not over tighten.

Connect exhaust tubing (1/8" I.D.) as needed by inserting the provided barbed adapter fitting connected to tubing into the OUTLET fitting as shown on the right. Turn the fitting in a clockwise direction until snugly tightened. Do not over tighten.
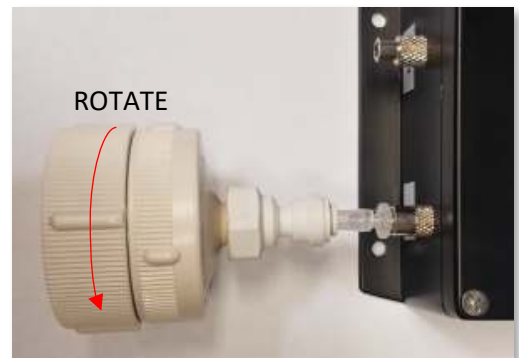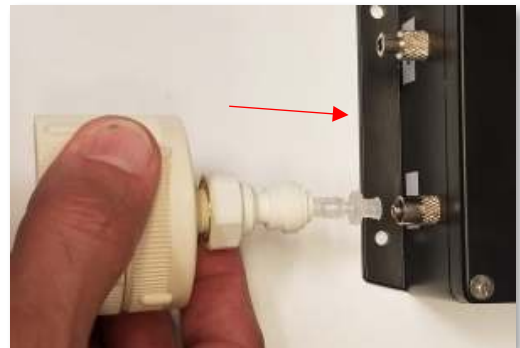
IMPORTANT:

- MAKE SURE POWER CABLE AND MODBUS CABLE ARE **SECURED** BEFORE POWERING UP DEVICE.

- MAKE SURE THERE IS NO FLOW OBSTRUCTION AT INLET/OUTLET BEFORE POWERING UP DEVICE.

- PARTICULATE FILTER SHOULD BE CHECKED PERIODICALLY AND REPLACED AS NEEDED ACCORDING TO SECTION 5 OF THIS MANUAL.

NOTE: Power is applied to the sensor module by plugging the 12V power adapter into an AC outlet. There is no power switch on the module. If power cannot be applied to ALL modules in the system at once (including the Controller module), it is recommended that the controller module be powered up LAST.

Section 3 - Operation

3.1 PNEUMATIC OPERATION MODES

The ACCUSAFE Sensor Module houses all the pneumatic components and Modbus microprocessors that interface with the Controller module (see dedicated controller manual for operation of the controller).

When the Sensor module is connected to the Controller module via Modbus and the firmware is fully booted following power up, the sample pneumatics will begin to operate according to one of two pre-selected operation modes – *Continuous Sampling mode* or *Trigger mode.* The choice of mode is based on the target gas and associated sensor type. Section 3.1.1 below details specifics on sensor types and associated sampling modes. Sections 3.1.2 and 3.1.3 below detail the operation of the sampling modes

The gas sensor's output signal is communicated via Modbus to the controller which then displays this signal in graphical and numeric forms.

3.1.1 GAS/SENSOR CATEGORIES

The lifetime of the Accusafe gas sensor for certain target gases can be significantly reduced by continuous exposure to the target gas. These cases dictate the choice of operation mode. The sections below detail the sensor/gas categories as they pertain to sensor life and operation mode.

GAS CATEGORY 1 -

CO / ETO / H_2 / NO / O_2.

These sensors are not affected by continuous exposure to the target gas. CONTINUOUS Sampling will be the factory set mode of operation for these gases.

GAS CATEGORY 2 –

CH_2O / Cl_2 / ClO_2 / CS_2 / NO_2 / O_3 / SO_2

These sensors are rapidly depleted by continuous **HIGH concentration** exposure to the target gas. In these applications, TRIGGER Mode is the recommended factory set mode of operation for these gases. In applications where continuous **LOW concentration** exposure or occasional spot measurements of target gas over the full measuring range is expected, CONTINUOUS Sampling mode is the recommended factory set mode of operation for category 2 gases.

GAS CATEGORY 3 –

**C_2H_4 / C_2S / H_2S / H_2O_2 / HCl / HCN / NH_3 / PH_3 / SiH_4**

These sensors are rapidly depleted by continuous exposure to the target gas at ANY level. TRIGGER mode will be the factory set mode of operation for these gases in all cases.

NOTE: If your application is altered after installation, consult with the Interscan Service Dept. regarding how to change your operation mode should that become indicated.

3.1.2   CONTINUOUS SAMPLING MODE

In Continuous Sampling mode, the sample pump continuously draws sample into the Inlet and pushes it through the gas sensor as shown in the figure below. Gas concentration values are displayed continuously in real time. This is the mode of choice in applications where continuous sampling won't affect the sensor's expected life span.

Continuous Sampling Mode is enabled by setting Modbus Holding Register 20 to a value of "0". See section 3.2.4 for details on Modbus holding registers.

CONTINUOUS MODE
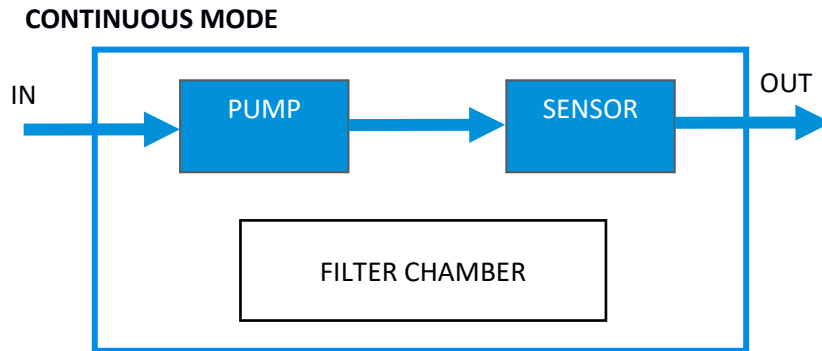
3.1.3   TRIGGER MODE

In Trigger mode the sample is cycled between normal sampling as described above and a "cleaning" cycle that effectively scrubs the sample path of any target gas or common interference gas. This serves to extend the sensor's life span and reduce zero drift in applications where frequent exposure to moderate or high levels of target gas is expected.

Trigger Mode operates in 3 distinct cycles as follows:

- o   Sample Interval - ambient sample is drawn into the sensor for a specified period of time in the manner shown in the Continuous Mode figure above. Sample time will be anywhere from 30 – 120 seconds depending on the target gas and the response specs for the associated gas sensor.

- o   Cleaning Interval - flow is diverted through a filter chamber as shown in the CLEANING MODE figure below effectively cleaning the sample and refreshing the sensor. This purge period lasts for 30 seconds.

- o   Idle Interval – With the Cleaning Mode pneumatic path below still in effect, the pump will now cycle on and off (2 seconds on / 8 seconds off) for the remainder of the total Trigger Interval time period. This offers additional time for the sensor to stabilize to the "no sample" condition while minimizing depletion of the scrubber filter.

CLEANING MODE
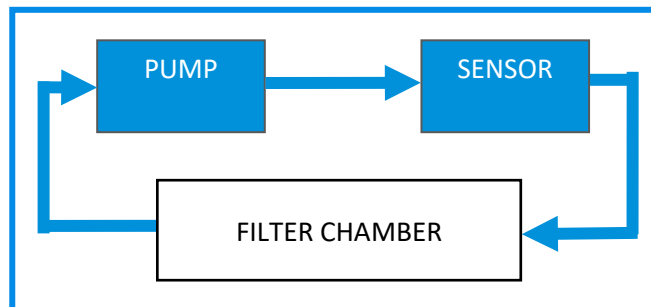
The figure below shows the entire Trigger Interval cycle.
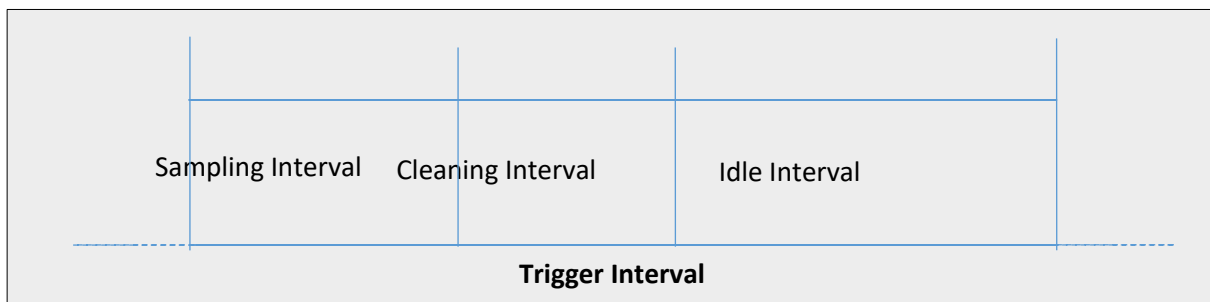
Gas concentration is displayed at the end of each sampling interval and this value is held on the display throughout the Cleaning and Idle intervals until the end of the next sampling interval.

Continuous Sampling Mode is enabled by setting Modbus Holding Register 20 to a value other than "0". The actual value will depend on the target gas type and sensor specifications. Section 3.1.4 below details the trigger mode timing values. See section 3.2.4 for details on Modbus holding registers.

3.1.4   TRIGGER MODE TIMING VALUES

The time values associated with the segments of the trigger cycle are accessible to the user via Modbus registers as shown in the address tables of section 3.2.4 and are detailed below.

Sample Interval time – Set in Modbus Holding register 21. Value based on the characteristics of the gas sensor being used and derived from the sensor's Txx* specification. Sample Interval time for your sensor modules is indicated in section 1.2.1 on page 4.

Purge Interval time – Fixed at 30 seconds.

Total Cycle interval time – Set in Modbus Holding register 20. Typically set to some multiple of the Sample Cycle time according to the gas and application. The Total Cycle Interval time for your sensor modules is indicated in section 1.2.1 on page 4.

Idle Interval time – The difference of Total Cycle Interval (HREG 20), Sample Interval (HREG 21) and Purge Interval (30 seconds).

*Txx refers to the sensor response specification which can range from T60 to T90 and indicates the time it takes the sensor to reach the numeric percentage of a full response.

EX: T90 < 35 sec indicates the time to reach 90% of a full response is under 35 seconds.

NOTE: Because trigger mode does not provide continuous sampling, the active concentration display value is also not continuous. The displayed value will update once every trigger duration period (see section 1.2.1, page 4 for the value of this duration for your system). Be aware of this when challenging the sensor with test or calibration sample as it may take up to the full trigger duration to see a change in the displayed value depending on when you introduce the sample relative to the start of the sample cycle.

3.1.5   FLOW RATE (PUMP SPEED)

Sample flow rate is regulated by the pump speed which is set in Modbus Holding register 0 as a percentage of pump power. The default setting for pump power is 50% which translates to a flow rate of approximately **100 CCM.** This is the flow rate at which all factory calibrations are conducted and is the recommended setting for all sampling operation.

The pump's speed can be controlled at the controller as detailed in section 3.1.2 in the Controller User Manual. **NOTE:** It is NOT recommended that the pump speed be altered from its factory setting. Consult with the Interscan service dept. for any concerns about pump speed/flow rate.

3.2   MODBUS OPERATION

The Sensor Module supports the standard Modbus protocol in both RTU and TCP/IP modes. The 3 available operation modes are detailed below. (see MODBUS MODE in table 3-4, pg. 15 for Modbus mode register addressing information). AUTO MODE is the recommended mode and is factory set prior to shipment:

- **AUTO Mode (factory preset mode) -** In this mode, if the sensor detects a connection to an active Ethernet device, it will initialize Modbus TCP/IP protocol via the default static IP address 192.168.1.XX port 502 (The suffix of this address will be indicated on a label next to the Ethernet port. Address is configurable via Modbus commands where necessary. See SLAVE ADDR in Table 3-4, pg. 15). If not connected to an Ethernet connection, it will initialize in RTU mode.

- **Fixed TCP/IP mode -** Upon powering up, the Sensor Module always initializes the Modbus TCP/IP protocol via the default static IP address 192.168.1.XX port 502 (The suffix of this address will be indicated on a label next to the Ethernet port. Address is configurable via Modbus commands where necessary. See SLAVE ADDR in Table 3-4, pg. 15).

- **Fixed RTU mode -** Upon powering up, the Sensor Module always initializes the Modbus RTU protocol via the default static IP address 192.168.1.XX port 502 (The suffix of this address will be indicated on a label next to the Ethernet port. Address is configurable via Modbus commands where necessary. See SLAVE ADDR in Table 3-4, pg. 15).

NOTE: The Sensor Module's internal communications cabling is factory configured to operate in TCP/IP mode. If operating in RTU mode is desired, the internal communications cabling will need to be swapped. Contact the INTERSCAN SERVICE DEPT. for more information on making this change.

3.2.1 RTU RS485 CONFIGURATION

RS485 cabling configuration is shown in the diagrams and table 3-1 below.
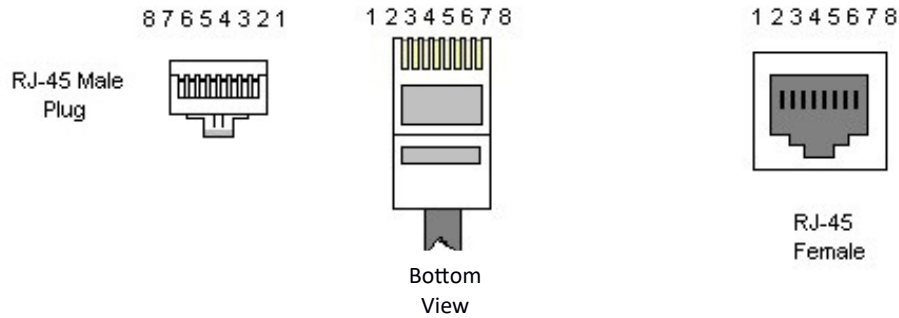
Pin	Name	Type	Description
1	3.3V	Reference potential	3.3V Reference Voltage
2	GND	Reference potential	Local device ground
3	UART_TX	Digital Output	Firmware update interface
4	B (D-)	Bus In/Out	Driver output and receiver input
5	A (D+)	Bus In/Out	Driver output and receiver input
6	UART_RX	Digital Input	Firmware update interface
7	BOOT	Digital Input	Firmware update interface
8	RESET	Digital Input	Microcontroller reset input (Active-Low) Firmware update interface

TABLE 3-1

IMPORTANT: use pin 4,5 (B/A) and GND for Modbus RS485 communication. Pin 3,6,7,8 are reserved for firmware updating and are **3.3V** tolerant.

Absolute Maximum Rating

Voltage range at A or B …………………………………………… -8V to 12V

Voltage range at pin 3,6,7,8 ………………………………………….. -0.3V to 4V

Electrostatic discharge at A and B ……………………………… ±8kV

RS485 Modbus Parameters

Parameter	Value
Default address	50
Baud Rate	19200
Data bits	8
Parity	Even
Stop bits	1

TABLE 3-2

3.2.2 MODBUS SPECIFICATIONS

- Operates as a slave, half-duplex mode

- Modbus functions supported:
    - o 0x01 - Read Coils
    - o 0x03 - Read Holding Registers
    - o 0x04 - Read Input Registers
    - o 0x05 - Write Single Coil
    - o 0x06 - Write Single Register
    - o 0x0F - Write Multiple Coils
    - o 0x10 - Write Multiple Registers
- Exception messages supported
- Default address:
    - o RTU: 50
    - o TCP/IP: 192.168.1.50

3.2.3 INPUT REGISTERS

Mode: Read-only, size: 16 bits

Name	Address	Description
SENSOR OUTPUT	0	Gas measurement x 10, ppm
TEMPERATURE	3	Temperature measurement x 10, C (Note: 16bit signed number)
RELATIVE HUMIDITY	4	Relative Humidity measurement x 10, %
BAROMETER	5	Barometric pressure measurement x 10, mbar
VAPOR PRESSURE	6	Vapor pressure of water measurement x 10, mbar
ERROR STATUS	9	0 = OK. 1 = C2H4 offset error, Sensor over-exposed or KMnO4 filter needs to be replaced.
SENSOR_RAW_VALUE	10	Sensor raw measurement, counts
DEV_TYPE	100	Default device type ID: 9011
FIRMWARE	101	Firmware version

TABLE 3-3

NOTE:

- Above addresses are offsets. The function address for input register is [30001 + offset]
- Temperature and Humidity are measured at the sensor's inlet and may not represent room condition or remote/localized spots.

3.2.4 HOLDING REGISTERS

Mode: Read/Write, size: 16 bits (unsigned)

Name	Address	Default	Description
PUMP_POWER	0	50	Internal pump power 0-100%
SENSOR_SPAN	1	NONE	Sensor span calibration parameter. Calibration formula: $SENS\_SPAN=SENS\_CUR*SENS\_SPAN\_CUR/SENS\_CAL$ Note: SENS_CAL: expected calibration concentration SENS_SPAN_CUR: Current span value SENS_CUR: Current SENSOR measurement
SENSOR_ZERO	2	NONE	SENSOR zero calibration parameter
TRIGGER INTERVAL	20	NONE	Trigger Mode Total Interval - duration in seconds. Value setting of "0" disables trigger mode.
SAMPLE INTERVAL	21	NONE	Trigger Mode Sample Interval – Duration in seconds. Based on sensor's response specifications.
SLAVE_ADDR	30	50	Device Modbus RTU slave address. Update this register to change the slave address. Valid slave addresses: 0-99
MODBUS_MODE	31	2	0: TCP/IP (LED blinks 2 times at boot) 1: RTU (LED blinks 3 times at boot) 2: Auto Config Mode. (Factory Default) During boot up, if the internal TCP/IP cable is plugged in and the device is connected to active ethernet hub/router or the Accusafe Controller, the device will select TCP/IP mode. Otherwise, RTU mode is selected.
IP_ADDR0	32	192	Device local IP address
IP_ADDR1	33	168	Device local IP address
IP_ADDR2	34	1	Device local IP address
IP_ADDR3	35	50	Device local IP address

TABLE 3-4

NOTE:

- Above register addresses are offsets. The function address for holding register is [40001 + offset]
- Values written to the above holding registers remain after Power-off/Reset

IMPORTANT:

- Changing the pump power to different value than the factory default may affect measurement accuracy. In such case, a complete sensor re-calibration is recommended.
- Backup calibration parameters before overwriting their values (performing a calibration) or update device firmware (all parameters will be erased). All F-901B comes with factory calibration using standard certified gases.

3.2.5 COILS

Mode: Read/Write, size: 1 bit

Name	Address	Default	Description
CONF	7	False	Confirmation of zero action
RESET	9	False	True: (software) reset False: no action

Note:

- Above addresses are offsets. The function address for coil is [00001 + offset]

IMPORTANT: backup calibration parameters before performing a calibration. A calibration will overwrite the factory calibration parameter in the Holding register.

Section 4 - Calibration

All units are shipped factory-calibrated. Over time all sensors require recalibration to compensate for natural sensor sensitivity loss. The performance of a sensor or the whole instrument should be checked occasionally with calibration gas. When there is significant accuracy error in response, calibration may be indicated.

NOTE: Because environmental conditions may differ between factory calibration and installation, it is a good idea to challenge the sensor with a known concentration of gas upon installation to confirm the calibration integrity following shipping. Re-calibration may be indicated if reading error is significant.

Calibration frequency depends on a number of factors including application, environmental conditions, local regulations and accuracy requirements. Calibrating every quarter is a good starting point. If significant scaling adjustment is required during calibration using this interval, more frequent calibration is indicated.

There are several options for calibration:

- You can ship your F-901B sensor module back to Interscan Corp. for calibration.

- You can order pre-calibrated sensors from Interscan for replacement of the existing sensor and perform *Digital Calibration* after installation (See section 4.2.2, pg.23)

- You can calibrate the sensors yourself (*Gas Calibration* – See section 4.2.1, pg. 20).

NOTE 1: If performing calibration yourself, **replace the sensor when its sensitivity (span) is below 50 % of its initial value.** Initial SPAN value can be determined from the "*Sens Span*" value on the *SENS DATA* Panel in the Control Panels Menu of the Controller. See section 3.1.2, Figure 3-3 of the Controller Module User Manual for details on accessing this parameter.

NOTE 3: Calibration procedures will entail making numeric entries on the pop-up screen shown to the right. The current value is shown at the top of the window. Always clear this value first by touching the **C** button (red arrow shown on right) before entering a new value. Use the **BACKSPACE** button (green arrow shown on right) to erase individual digits and use the **ENTER** button (yellow arrow shown on right) to save the entered value.
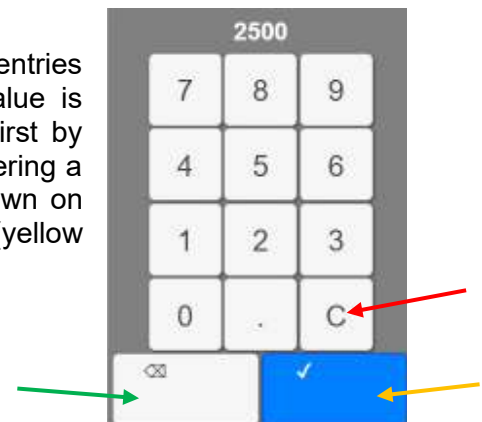
4.1   ZERO CALIBRATION

Zero calibration should be performed periodically to compensate for natural temperature drift in the gas sensor. Zeroing should also be performed upon initial start-up and prior to every SPAN calibration. In applications where temperature swings are significant, daily zeroing may be indicated.

In most cases clean ambient air can be used for zeroing as long as it is known to be free of any target or interference gases. Some interferences can be eliminated with the use of the provided charcoal scrubber filter shown to the right. This filter attaches to the inlet filter as shown.
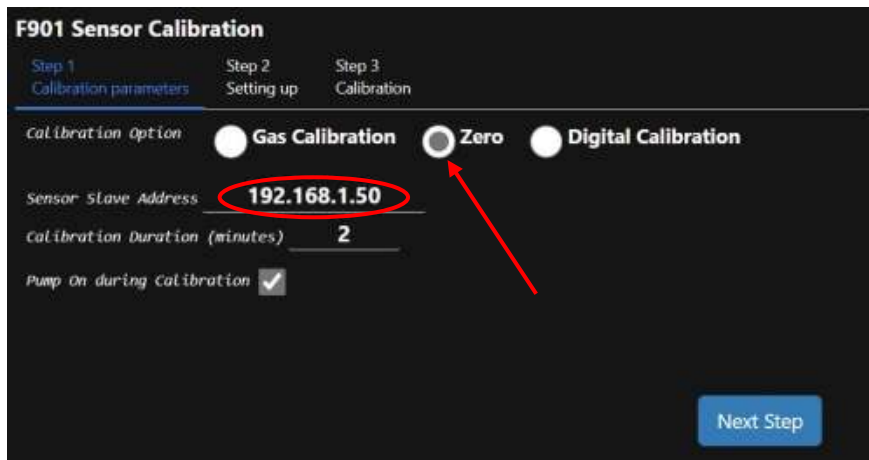
DO NOT USE NITROGEN AS A ZERO GAS FOR THE ACCUSAFE SYSTEM.


4.1.1 ZERO CALIBRATION PROCEDURE

1) Open the CALIBRATION screen on the Controller Module by touching the CALIBRATION icon on the main toolbar as shown below.

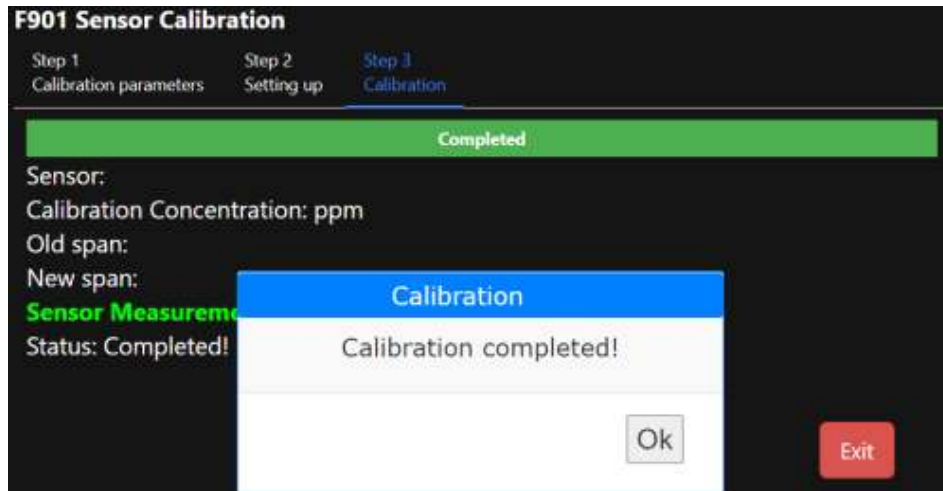2) Select the **ZERO** radio button as shown by the arrow below.

3) Enter the correct **Sensor Slave Address** by touching the entry field (circled in the image above) and entering the address number on the pop-up entry screen.

   - For TCP/IP applications, the slave address will be 192.168.1.XX (substitute the Sensor module's modbus address for "XX").

   - For RTU applications, the slave address will only be the 2 digit modbus address. Be sure to check that the address is correct before continuing.

4) Enter the **Calibration Duration** time in minutes by touching the entry field circled below and entering the number on the pop-up entry screen. The correct duration value for your application is noted earlier in this manual in section 1.2.1 on page 4.
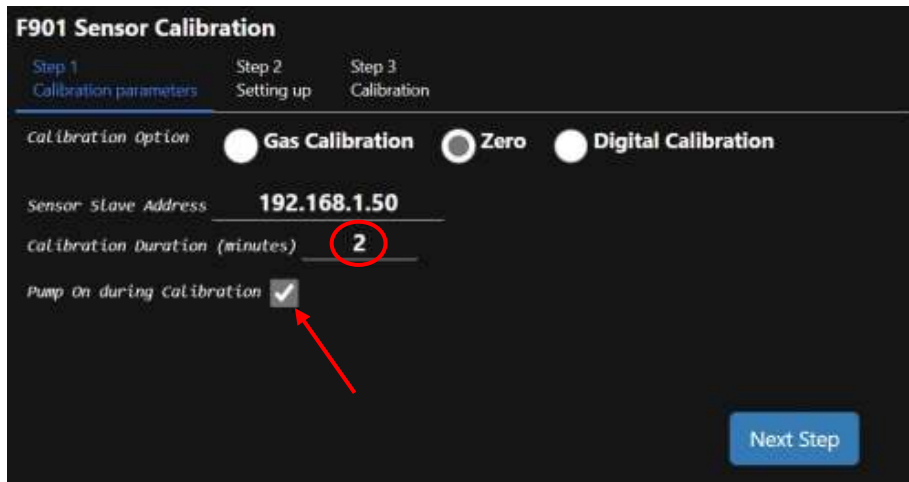
5) Tick or untick the **Pump On During Calibration** checkbox (red arrow above) for your application. PUMP ON will be the correct selection in most applications. Consult with the *INTERSCAN Service Dept*. for guidance if unsure.

6) Connect the zero air sample source to the inlet of the sensor module as shown on the previous page.

7) Touch the "**NEXT STEP**" button to advance.

8) Wait while the Zero calibration timer elapses as indicated by the green timeline bar. Press "**ABORT**" to cancel the calibration if desired.
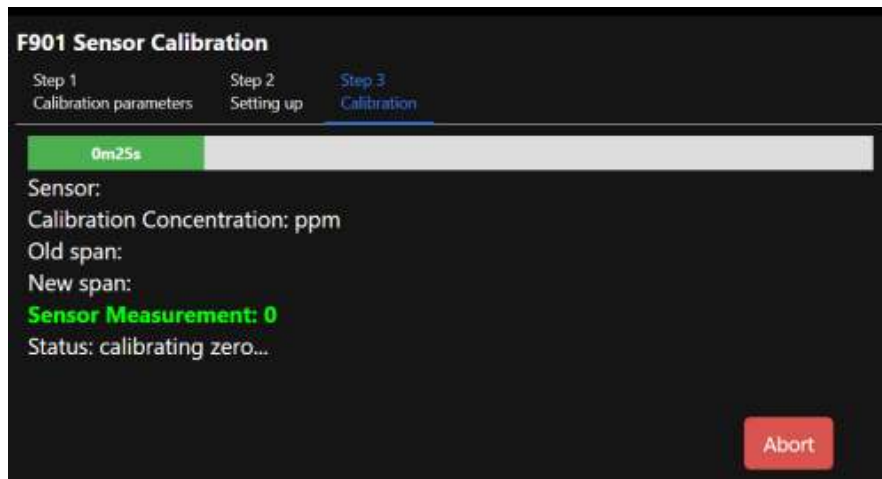
9) When the calibration timer has elapsed, a "Calibration Completed" window will be displayed as shown below. Press "**OK**" to accept then press "**EXIT**" to return to the main SENSOR CALIBRATION screen.

F901 Sensor Calibration

Step 1 — Calibration parameters
Step 2 — Setting up
Step 3 — Calibration

Completed

Sensor:
Calibration Concentration: ppm
Old span:
New span:
Sensor Measureme
Status: Completed!

Calibration

Calibration completed!

Ok   Exit

10) If finished with calibration, select the desired screen from the main toolbar.

4.2   SPAN CALIBRATION

SPAN Calibration compensates for sensitivity loss in the gas sensor. The instrument can be calibrated in one of two ways:

Gas Calibration - A known concentration of gas is introduced and the sensor is allowed to respond over the calibration sampling period. The calibration scaling is automatically updated at the end of this sampling period.

The sources of gas standards include commercially available gas mixtures **diluted with air** in cylinders or permeation devices. **NOTE: Gas blends in a balance of nitrogen should not be used with the Accusafe sensors.**

Delivery of cal gas is most effectively accomplished using a suitable sample bag (5L volume) or properly regulated gas cylinder. Step 8 in the procedure below details safeguards for using pressurized sources for calibration.

Digital Calibration – A pre-calibrated sensor is provided by Interscan to replace the old sensor. The new sensor is accompanied by calibration instructions that include a sensitivity value to be entered during the Digital calibration procedure.

4.2.1   GAS CALIBRATION PROCEDURE

1) Open the CALIBRATION screen on the Controller Module by touching the CALIBRATION icon on the main toolbar as shown below.

2) Select the **Gas Calibration** radio button as shown by the arrow below.

3) Enter the correct **Sensor Slave Address** by touching the entry field (circled in the image below) and entering the address number on the pop-up entry screen.

   - For TCP/IP applications, the factory set slave address will be 192.168.1.XX (substitute the Sensor module's modbus address for "XX").

   - For RTU applications, the slave address will only be the 2 digit modbus address. Be sure to check that the address is correct before continuing.
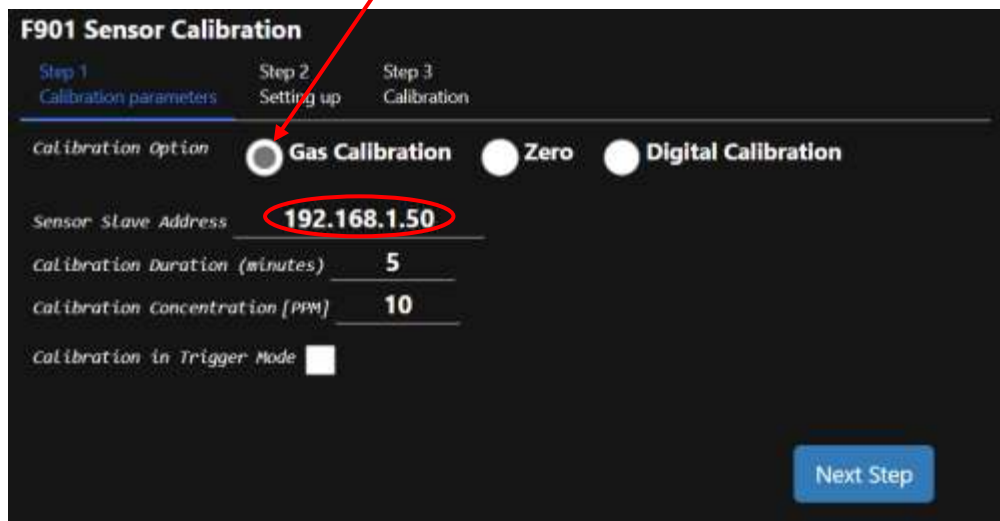
4) Enter the **Calibration Duration** time in minutes by touching the entry field circled below in red and entering the number on the pop-up entry screen. The correct duration value for your application is noted earlier in this manual in section 1.2.1 on page 4.
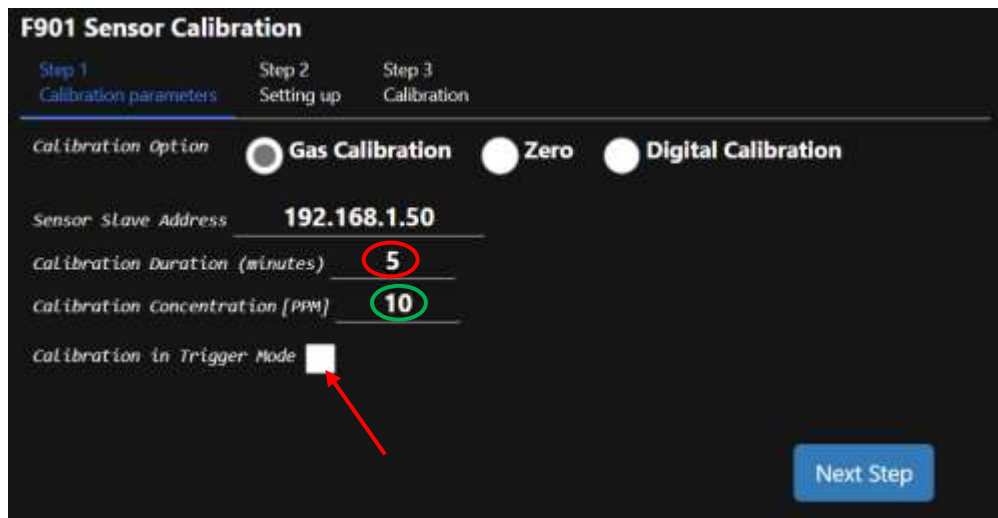
5) Enter the **Calibration Concentration [PPM]** value by touching the entry field circled above in green and entering the number on the pop-up entry screen. This is the value of the CAL GAS concentration being used for calibration.

   IMPORTANT NOTE: For sensors measuring PPB levels, disregard the PPM designation and enter the cal gas concentration as a PPB value. EX: enter 5 ppm cal gas as "5000".

IMPORTANT NOTE 2: For sensors measuring PPM levels and displaying one or more decimal places, enter the cal gas concentration value including all the decimal places that would be displayed. EX: for 5 ppm cal gas and a 2 decimal display range enter "500" as the cal gas concentration. For the same concentration and a 3 decimal display range enter "5000".

6) The *Calibration in Trigger Mode* box should be ticked if Trigger Mode is the active monitoring mode. Leave this box unticked of sampling in continuous mode. See section 1.2.1 on page 4 for the proper setting of this parameter for your system. **NOTE: CALIBRATING WITH THIS SELECTION MISMATCHING THE SAMPLING MODE WILL RESULT IN CALIBRATION ERRORS.**

IMPORTANT: When ticking this box the CAL DURATION setting may update to a default value. **ALWAYS check the CAL DURATION value after ticking the *Calibration in Trigger Mode* box and re-enter as needed.**
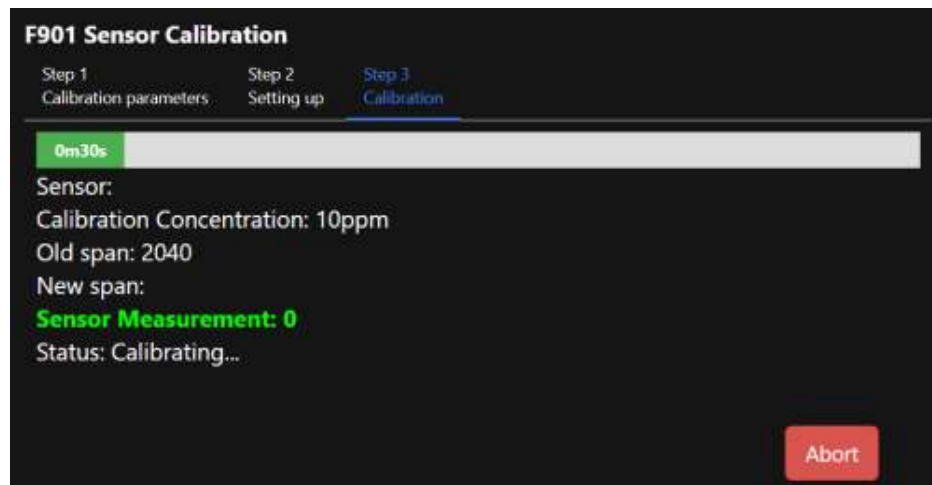
7) Touch the "**Next Step**" button to advance the cal routine.

8) Connect the CAL GAS supply to the inlet of the sensor module as indicated on the screen shown below. Touch the "**NEXT STEP**" button when ready. Touching the "**RESET**" button will cancel the calibration.
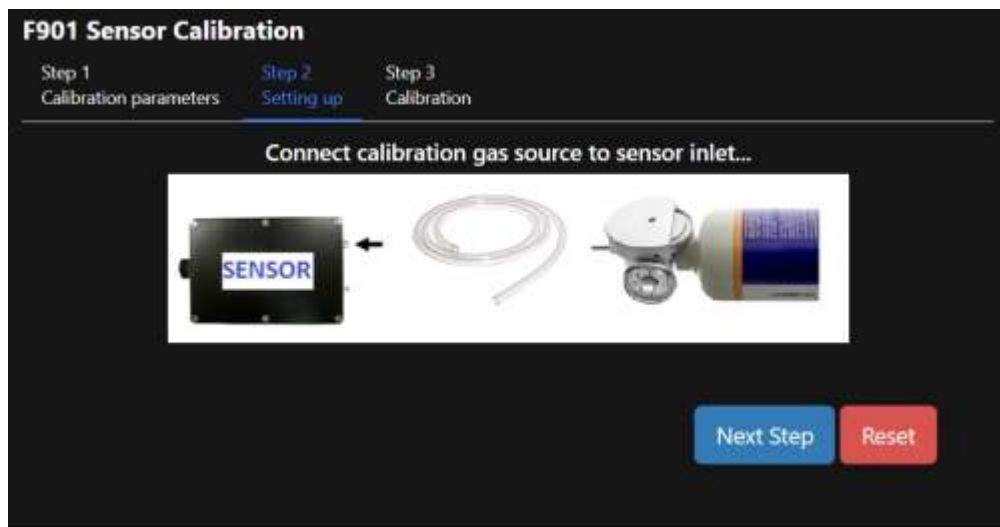
NOTE: When using CAL GAS from a pressurized source, be sure to include an "on demand" regulator at the source OR a tee fitting between the source and inlet as shown below. (**limit pressure to 4 PSI or lower**).

INLET   T JUNCTION   PRESSURE REGULATOR

Excess Gas
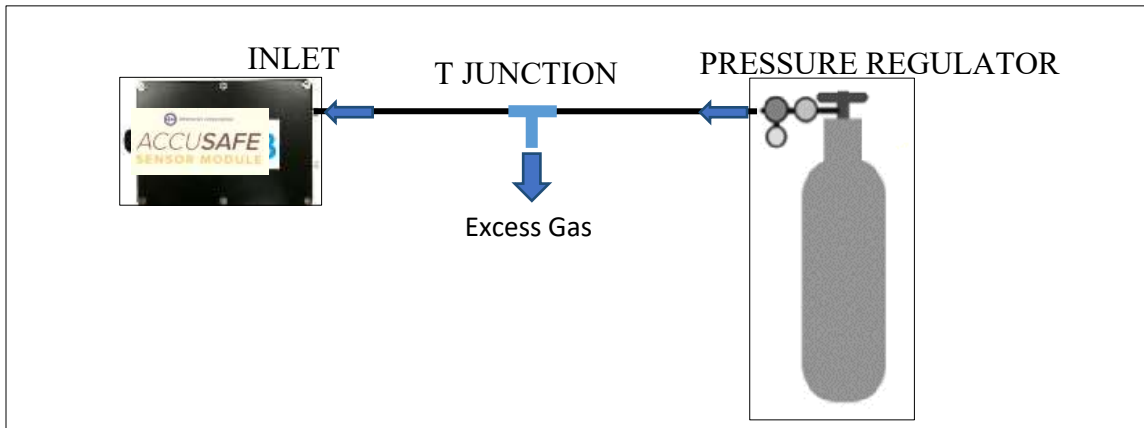
9) Wait while the Span calibration timer elapses as indicated by the green timeline bar. During this time, the gas sensor will respond to the Cal Gas as indicated by the green "**Sensor Measurement**" value. The screen also displays the Calibration Concentration, the previous span value, and the new updated span value (shown after cal is completed). Press "**ABORT**" to cancel the calibration if desired.

F901 Sensor Calibration

Step 1   Step 2   Step 3
Calibration parameters   Setting up   Calibration

0m30s

Sensor:
Calibration Concentration: 10ppm
Old span: 2040
New span:
**Sensor Measurement: 0**
Status: Calibrating...

Abort

10) Once the calibration timer elapses a verification process will begin. **This verification can take several minutes especially when calibrating in Trigger Mode.** When verification is complete a new window will display "**Calibration Completed**". Click **OK** to accept the calibration and **EXIT** to return to the main sensor calibration screen. The calibration scaling will then update automatically and the new span value written to memory.

4.2.2 DIGITAL CALIBRATION PROCEDURE

1) Replace the existing sensor with the pre-calibrated sensor provided by Interscan Corp. (See section 5-1, pg. 25 for directions on replacing the sensor). With power applied to the sensor module, allow 24 hours for the new sensor to stabilize before calibrating.

2) Perform a ZERO calibration according to section 4.1.1, pg. 18.

3) Open the CALIBRATION screen on the Controller Module by touching the CALIBRATION icon on the main toolbar as shown below.

4) Select the **Digital Calibration** radio button as shown below (red arrow)
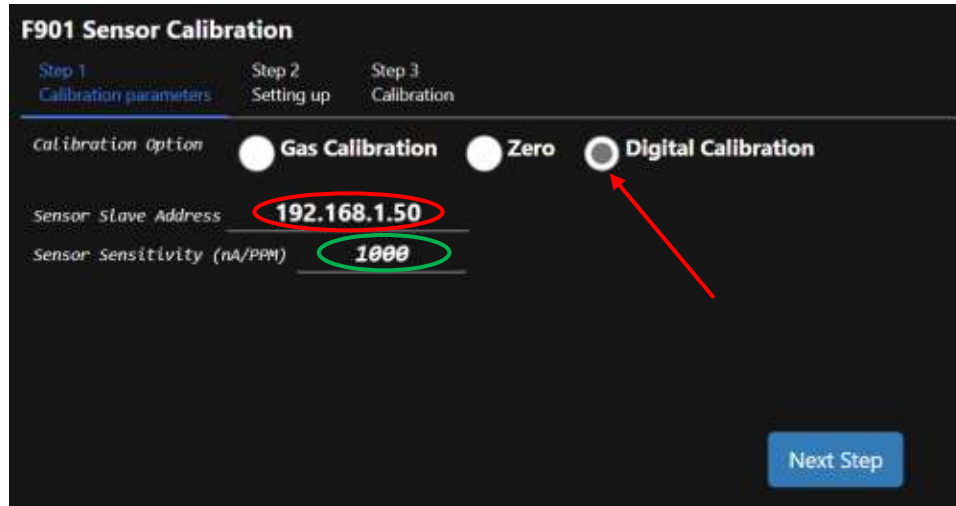
5) Enter the correct **Sensor Slave Address** by touching the entry field (circled in red in the image above) and entering the address number on the pop-up entry screen.

   - For TCP/IP applications, the slave address will be 192.168.1.XX (substitute the Sensor module's modbus address for "XX").

   - For RTU applications, the slave address will only be the 2 digit modbus address. Be sure to check that the address is correct before continuing.

6) Enter the **Sensor Sensitivity (nA/PPM)** value as indicated on the calibration certificate that accompanied the sensor. Touch the field shown above circled in green and enter this value on the pop-up entry screen. Be sure this value is correct before proceeding. Touch the **NEXT STEP** button when satisfied with your entry.

7) The confirmation screen shown below will now be displayed indicating that the sensitivity value was set. Touch the **OK** button to confirm then touch the **EXIT** button to complete the calibration.

5.1   REPLACING THE GAS SENSOR

IMPORTANT:

- Make sure you have sufficient ESD (electrostatic discharge) protection before accessing internal components.
- Follow the steps below carefully to ensure proper sensor installation.
- NOTE: Sensor images shown may be different from your instrument but the procedure is the same.

1) Remove the shorting spring from the new sensor (see image to the right). If you are sending your old sensor back to the factory for *Sensor Express* service, retain this spring to use on your old sensor (install to sensor pins as shown on the right). Otherwise, dispose of this spring.

2) Remove power from the sensor module by unplugging the power supply from the power source.

3) Remove the 6 screws holding the cover to the top of the sensor enclosure and remove cover.

4) With sensor connector still attached, remove sensor body from the manifold socket. Use a gentle rocking motion to free the sensor from the socket.
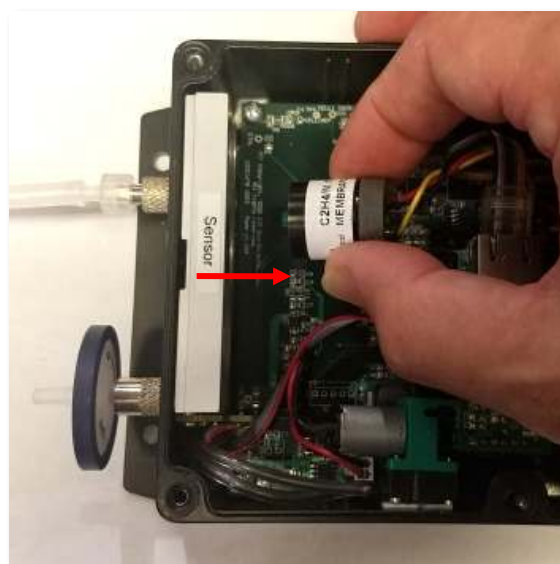
5) Remove old sensor from the connector and re-connect to the new sensor.

6) Push the new sensor into the manifold socket making sure it is fully seated and straight.

7) Replace the enclosure cover and securely tighten all 6 screws.

8) Restore power to sensor module.

## 5.2   PARTICULATE FILTER MAINTENANCE

The particulate filter should be checked regularly to determine if excess buildup of particulate is present. Interscan recommends quarterly inspections as a starting place. If the filter element shows visible discoloration or dirt collection, it should be replaced. If quarterly maintenance checks consistently reveal heavily packed or clogged filters, more frequent inspection is indicated.

To check and/or change the particulate filter element, first remove the filter assembly from the inlet fitting by rotating the filter in a counter-clockwise direction to free it from the fitting.

ROTATE   GRASP

Next, grasp the fitting end of the housing and unscrew the front section revealing the filter element disc. If the disc is noticeably dirty or clogged, replace it with a new one. It is also a good idea to inspect the inside of the inlet port and clean as necessary.

Insert the new filter element with the shiny side facing in toward the inner part of the housing as shown on the right. Carefully screw the outer housing back on to the inner housing making sure the element stays flush against the inner housing surface.

Re-install the filter assembly onto the INLET fitting by inserting the filter fitting into the INLET fitting and twisting the filter assembly in a clockwise direction until snug. Do not over tighten.
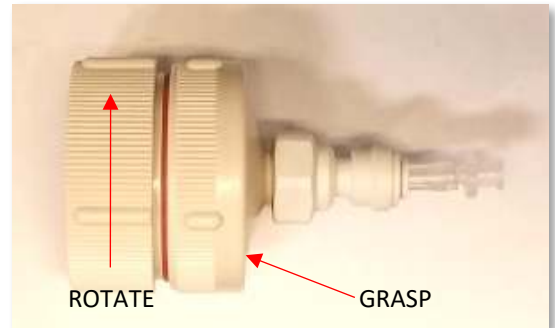
5.2   TRIGGER MODE FILTER MAINTENANCE

In applications where trigger mode is used, the trigger mode sample cleaning filter will gradually be depleted and will require maintenance or replacement. This filter should be checked every 6 months and maintained as needed as detailed below.

The trigger mode filter is located inside the sensor module near the communications and power connectors. Open the sensor module by loosening the 6 cover screws and removing the cover.

Before working inside the sensor module, **ensure that you have adequate ESD (Electrostatic Discharge) protection in place**

The filter is a plastic tube filled with potassium permanganate pellets as shown below (yellow arrow). These pellets are normally a reddish purple color when new as shown and will gradually turn to a dark brown as they are depleted. When most of the pellets have changed color, it is time to refill the filter. **Contact the INTERSCAN SERVICE DEPT. for assistance in acquiring replacement filter pellets. (See section 8 at the end of this manual).**
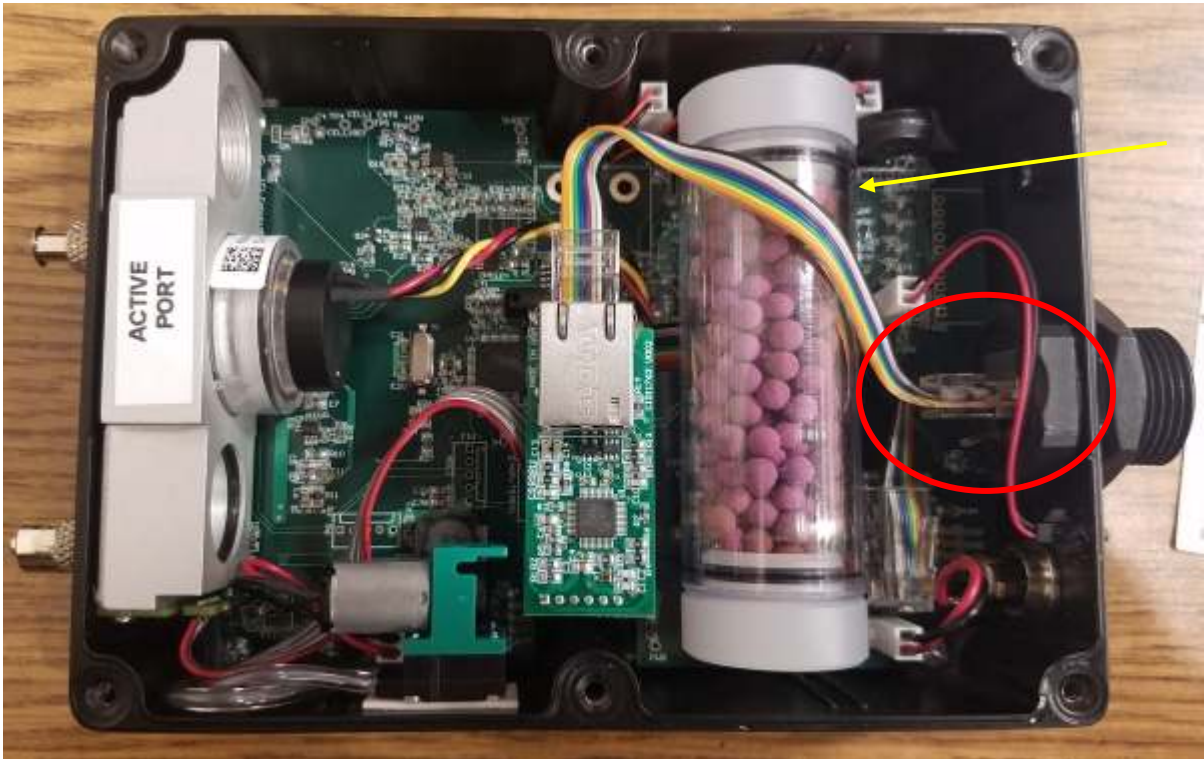

To remove the filter tube, first disconnect the Ethernet cable from the connector jack on the side of the enclosure (circled in red above). Next, grasp the tube at both ends and lift upward with equal pressure on both ends being careful not to disturb any of the internal wires or harnesses.

To refresh the pellets, grasp one end of the tube and twist the end cap while pulling it away from the tube. Empty the contents and refill with fresh pellets. Fill the tube as completely as possible leaving room for the end cap.

Replace the end cap by twisting it while pushing it against the tube. Make sure to align the connector ports on both ends of the tube for easy connection to the port connectors.

> Align ports before reinstalling.

Twist cap while pulling cap away from tube to remove.
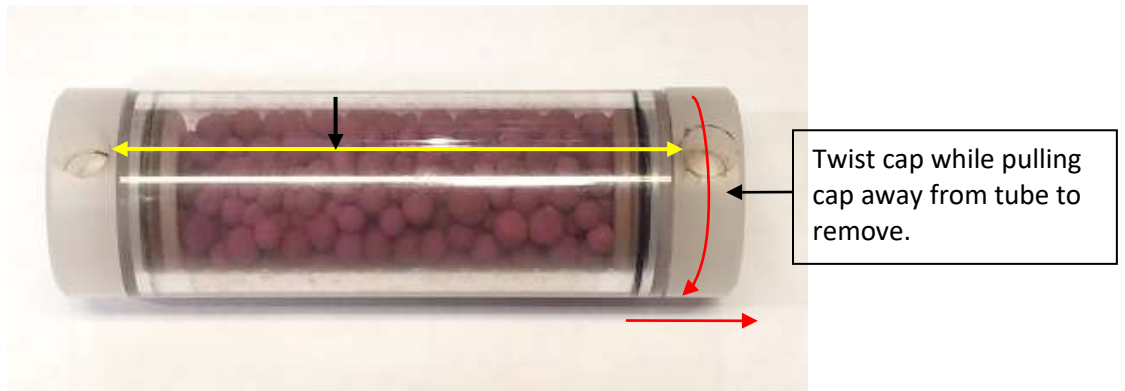
To reinstall the tube in the sensor module, first make sure the Modbus ribbon cables indicated by the arrows in the image below are routed away from the filter connector and are routed as indicated.

Route above filter tube.

Route underneath filter tube.
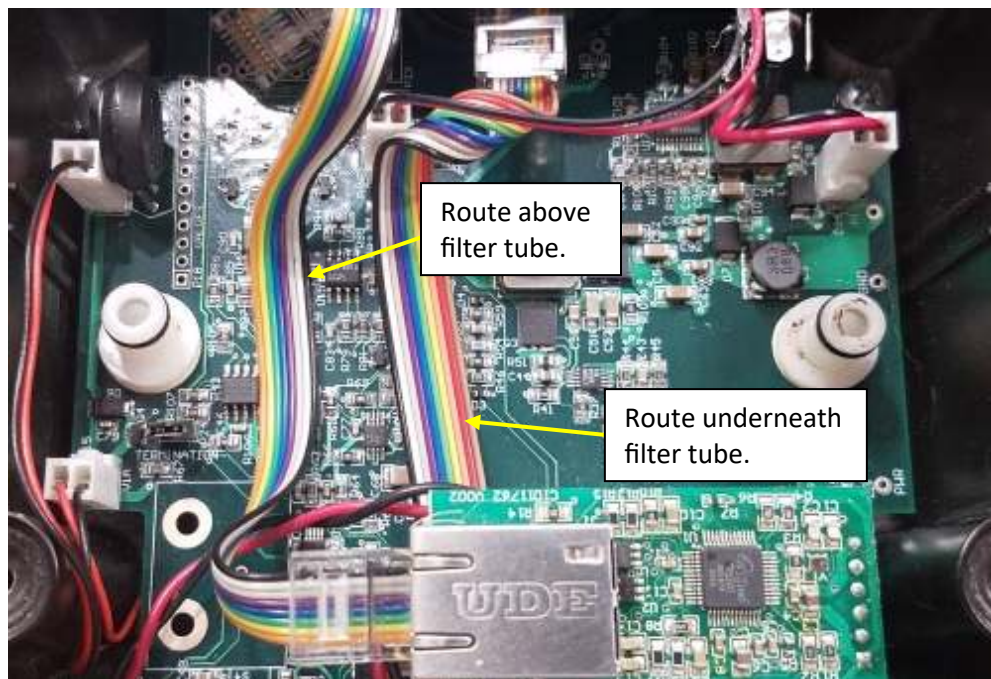
Next, align the connector ports on the tube with the connectors and gently but firmly press the tube down onto the connectors. It may help to get one side started then move the tube side to side until the second connector finds its port then press down until the tube is flush with the board. DO NOT FORCE THE TUBE ONTO THE CONNECTORS. It should not require a high degree of pressure to seat the connectors.

Section 6 – Sensor Module Tester App

The sensor tester app provides the user with computer access to the sensor module's Modbus registers with both read and write capability. This is most handy for changing the Modbus address of the sensor module if necessary in a multi- sensor network. NOTE: This app is for

accessing the Senor module(s) only and will not provide access to the Accusafe Controller module.

The Sensor Tester app is provided on a flash drive labeled "ACCUSAFE APPS". Plug this flash drive into a USB port on a computer *that is connected to the Accusafe network* and access the drive in Windows Explorer. You will see the 2 files pictured below. Double click on the file titled "**F901_Tester V1.1.exe**" (version number may vary).
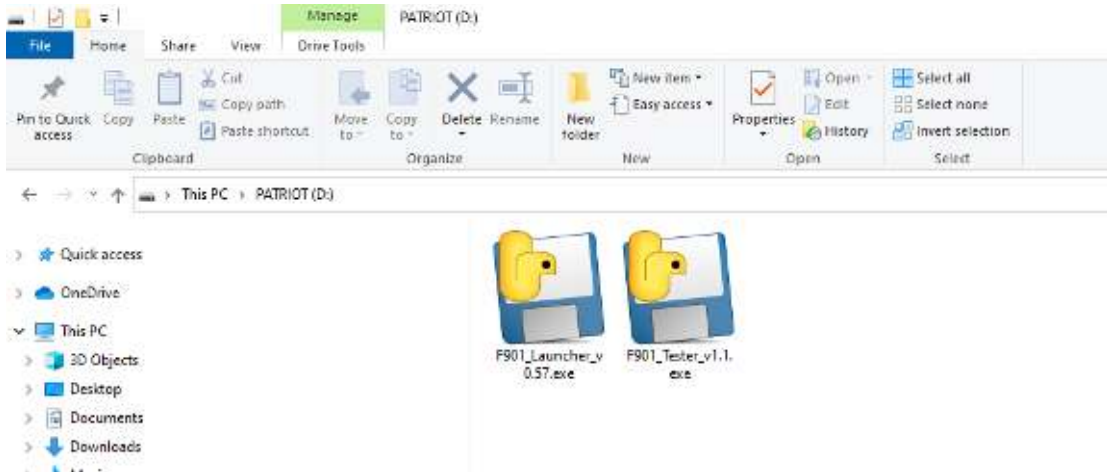

A security warning window will open. Click RUN to open the app. The window shown below will open.
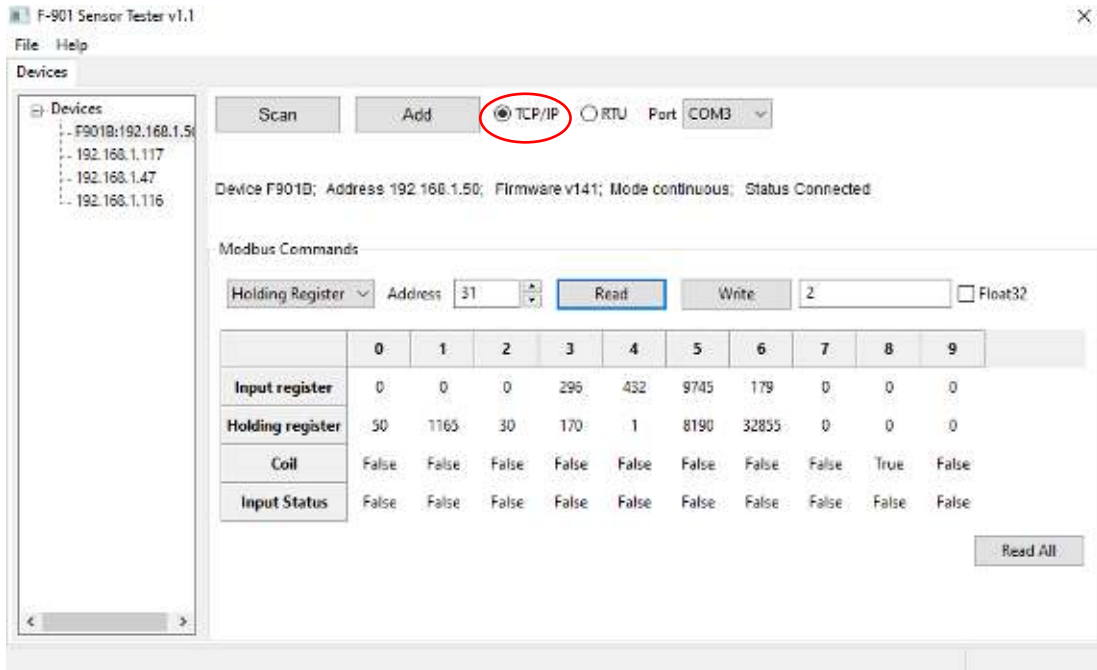

The Devices list along the left edge of the window should show all the connected devices in the network. If the device you wish to access is not displayed, do the following to connect to the desired module:

- Make sure the TCP/IP radio button is ticked** as shown above (circled in red).

- Click the "ADD" button. This will open the "Add a device" window as shown below.

- From the dropdown menu at the top, select "F901B".

- In the "Enter current Device IP Address or RTU Slave address", enter **192.168.1.XX** (XX = the slave address of the module).

- Click OK.
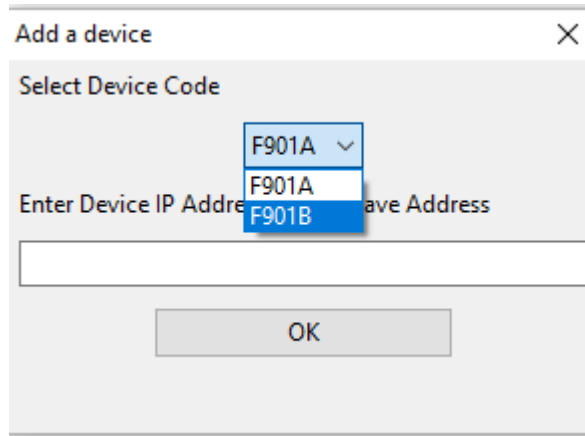
The Devices list should now show the module added as shown below (module highlighted in blue). The device address should also be listed below the top row of buttons and show "Status Connected". This process can be repeated for all sensors in the network as desired.
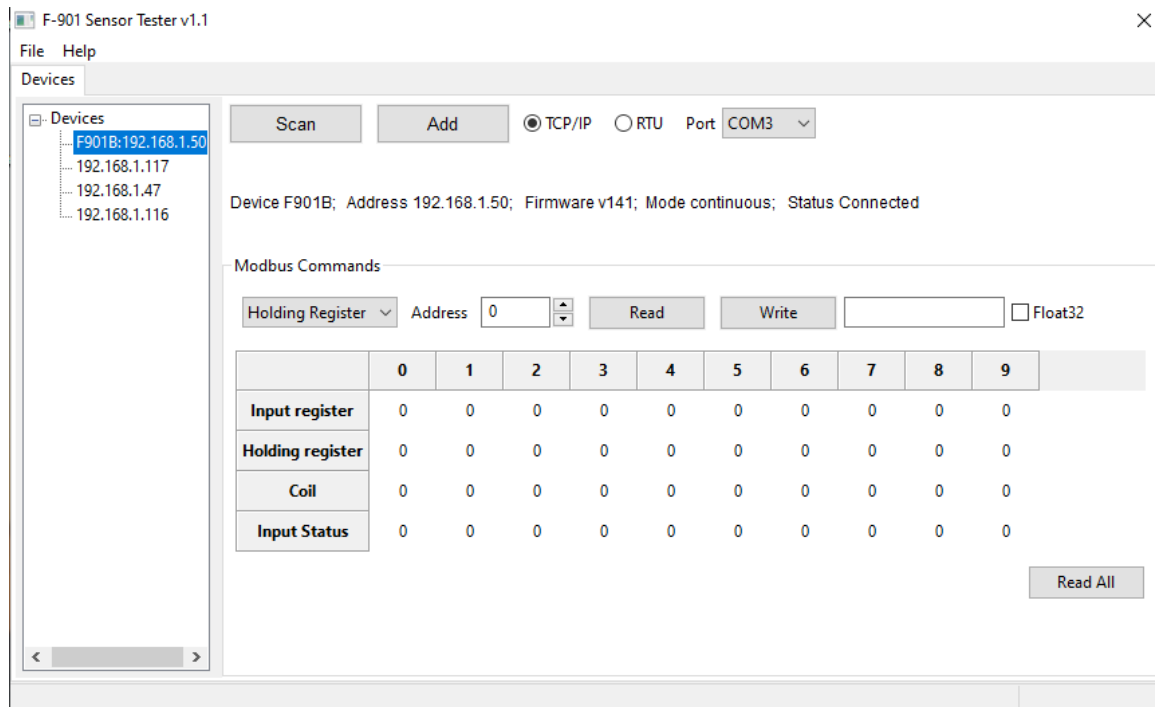
NOTE: If operating in RTU mode, tick the RTU radio button before clicking the "Add" button and enter the RTU Slave address (the 2 digit suffix of the TCP/IP address).

Clicking the "Read All" button will then populate the register table with all the current values in the registers as shown below. To access a value in a register not shown on the table:

- Select the register type from the dropdown menu at the left of the circled row.

- Enter the desired address number in the "Address" window.
- Click the "Read" button.

The current value will be displayed in the window on the far right of the circled row. The example below shows the Modbus mode register (31) holding a value of 2.

Writing to an address is the same process but instead, enter the desired register value in the right side window and click the "Write" button to enter that value into the selected register.
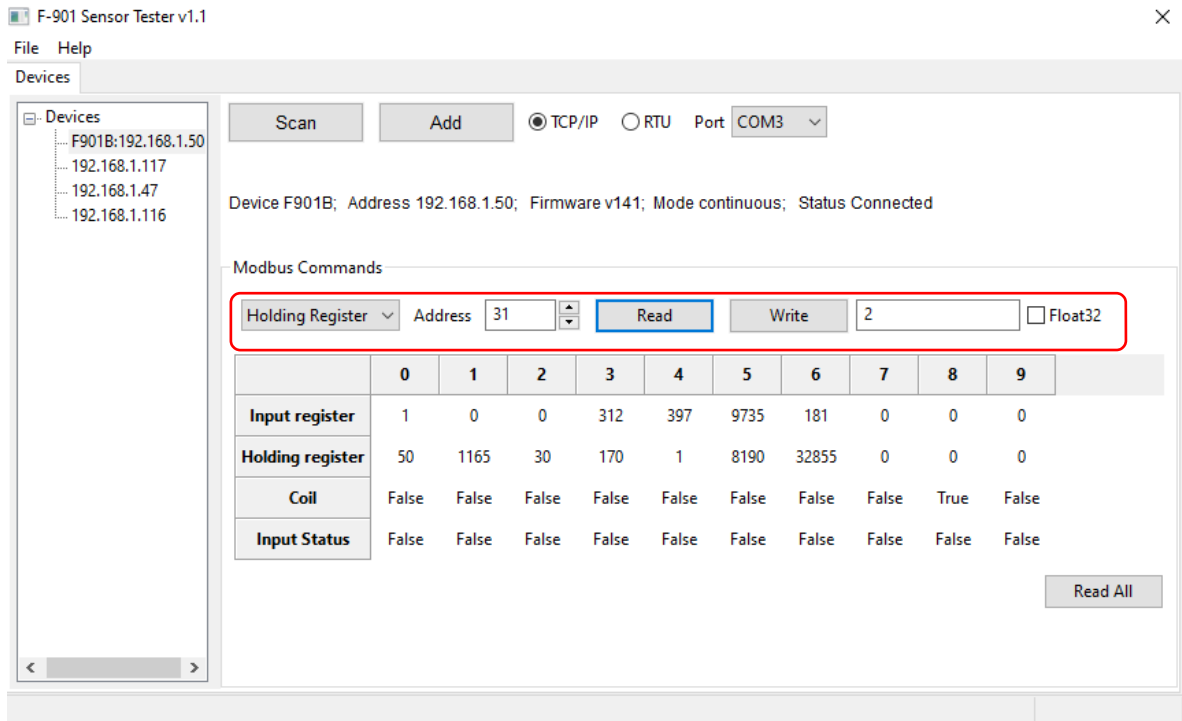
Section 7 - Warranty

INTERSCAN CORPORATION warrants any ACCUSAFE series instrument and gas sensor to be free from defects in material and workmanship for a period of one year from date of shipment.

INTERSCAN CORPORATION's sole obligation under this warranty is limited to repairing or replacing, at its option, any item covered under this warranty, when such item is returned intact, prepaid to the Factory (or designated service center).

This warranty does not apply to any of our products which have been repaired or altered by unauthorized persons, or which have been subject to misuse, negligence, or accident, incorrect wiring by others, installation or use not in accordance with instructions furnished by the manufacturer, or which have had the serial numbers altered, effaced, or removed. The sensors are factory-sealed and must not be opened or modified in the field for the warranty to remain in effect. This warranty is in lieu of all other warranties whether expressed or implied.

This warranty does not apply to any of our products, that have had any program and/or software changes incurred, without written authorization from *INTERSCAN CORPORATION*.

Additionally, warranty on any component shall not exceed the manufacturer's warranty given to *INTERSCAN CORPORATION*.

Section 8 - Customer Service

The INTERSCAN Customer Service Department can be reached at the numbers listed below:

Toll-Free **800-458-6153 x121**

So. Cal.   **818-882-2331 x121**

FAX   **818-341-0642**

e-mail: service@gasdetection.com

8.1   RETURN AUTHORIZATION

All units being returned for repair or service require a RETURN AUTHORIZATION NUMBER issued by the INTERSCAN Customer Service Department upon request. This is required to ensure the problem truly needs factory service.

In many cases, problems can be resolved in the field by the user. As such, before contacting Interscan with service questions, consult the TROUBLESHOOTING section of this manual (section 7, page 23) as this may help you to resolve any problems without returning the unit.

Should consulting the TROUBLESHOOTING section of the manual not address your problem, contact the INTERSCAN Customer Service Department as noted below to acquire a RETURN AUTHORIZATION NUMBER. The RMA will expedite prompt return of the repaired unit.

The RMA request form can be found at the following link on line…

http://www.gasdetection.com/contact-interscan/rma-request/

8.2   SPARE PARTS

Contact the Interscan Customer Service Department for inquiries regarding consumable spare parts for your instrument. Have your instrument's serial number at hand when calling. A list of such parts for your instrument is listed below:

-   Gas Sensor – model varies with target gas.
-   Inlet Filter Element – P/N 417-00002'
-   Potassium Permanganate Filter media (1 Liter) – 030-00043