Critical Environment Technologies Canada Inc.

INSTALLATION & INSTRUCTION MANUAL

REV: A SEPTEMBER 10, 2010

AST "X" (Blind) SERIES
COMBUSTIBLE SENSOR - TRANSMITTERS
Explosion-proof

#45, 7391 Vantage Way
Delta, B.C., V4G 1M3
Phone: 604-940-8741 Fax: 604-940-8745
www.critical-environment.com

IMPORTANT NOTICE

READ AND UNDERSTAND THIS OPERATION MANUAL PRIOR TO USING THIS INSTRUMENT.

THIS INSTRUMENT SHOULD BE INSPECTED AND CALIBRATED AT REGULAR INTERVALS BY QUALIFIED AND TRAINED PERSONNEL. FOR MORE INFORMATION REFER TO THE "CALIBRATION" SECTION OF THIS MANUAL.

THIS INSTRUMENT HAS BEEN DESIGNED TO BE INSTALLED IN AREAS CLASSIFIED HAZARDOUS (EXPLOSION RATED). CHECK THE HAZRADOUS AREA RATINGS LISTED FOR THE ENCLOSURE AND SENSOR BEFORE INSTALLING IN A HAZARDOUS AREA.

INSTRUMENT SERIAL NUMBER: _____

PURCHASE DATE: _____

PURCHASED FROM: _____

WARRANTY

CRITICAL ENVIRONMENT TECHNOLOGIES CANADA INC. WARRANTS THIS INSTRUMENT TO BE FREE FROM DEFECTS IN MATERIALS AND WORKMANSHIP FOR A PERIOD OF TWO YEARS (ENCLOSURE AND ELECTRONICS), ONE YEAR (CATALYTIC SENSOR HEAD), FROM THE DATE OF PURCHASE. THE WARRANTY STATUS MAY BE AFFECTED IF THE INSTRUMENT HAS NOT BEEN INSTALLED AND MAINTAINED AS PER THE INSTRUCTIONS INDICATED IN THIS MANUAL OR HAS BEEN ABUSED OR DAMAGED IN ANY WAY. THIS INSTRUMENT IS ONLY TO BE USED FOR PURPOSES STATED HEREIN.

APPLICATION

THE MODEL AST "X" SERIES HAVE BEEN DESIGNED AS REMOTE MOUNT ANALOG SENSOR / TRANSMITTERS FOR THE DETECTION OF COMBUSTIBLE GASES AND VAPOURS, TOXIC GASES OR OXYGEN. THESE INSTRUMENTS ARE DIFFUSION DEVICES. THEY OPERATE ON POWER SUPPLIED BY A REMOTE SOURCE AND PROVIDE A ANALOG SIGNAL REPRESENTING THE QUANTITATIVE CONCENTRATION OF TARGET GAS MEASURED. THEY WILL OPERATE WITH ANY GENERIC CONTROL DEVICE THAT ACCEPTS 4 - 20 MA OR 0-10 VDC ANALOG SIGNAL.

SELECTING AN INSTALLATION LOCATION SHOULD BE IN ACCORDANCE WITH LOCAL REGULATIONS, PROJECT ENGINEERING SPECIFICATIONS AND MANUFACTURERS SPECIFICATIONS.

ENVIRONMENT

THE CAST ALUMINUM, EXPLOSION-PROOF JUNCTION BOX UTILIZED FOR THE AST "X" SERIES OF INSTRUMENTS IS WATER AND DUST TIGHT, WHEN INSTALLED CORRECTLY. ENSURE THAT A LIQUID TIGHT CONDUIT FITTING IS UTILIZED TO MAINTAIN THE SAME LEVEL OF PROTECTION. THE SENSOR HEAD HOUSING THE CATALYTIC COMBUSTIBLE SENSOR IS MADE OF 316 STAINLESS STEEL. THE SENSOR HEAD HOUSING THE TOXIC OR OXYGEN SENSOR IS MADE OF MACHINED ALUMINUM. THIS SERIES OF TRANSMITTERS HAVE BEEN DESIGNED TO BE INSTALLED IN CLASSIFIED HAZRADOUS (EXPLOSION RATED) AREAS. CHECK THE HAZRADOUS AREA RATINGS LISTED FOR THE ENCLOSURE AND SENSOR BEFORE INSTALLING IN A HAZARDOUS AREA.

TABLE OF CONTENTS

1.0 GENERAL DESCRIPTION

The model AST X" series are analog transmitters designed to be remote mounted for the detection of combustible gases and vapours, toxic gases or Oxygen in classified hazardous areas (explosion rated environments). They are housed in a cast aluminum, explosion-proof, water / dust tight junction box with attached sensor housing.

AST X" series transmitters provide continuous monitoring with continuous analog signal output, representing the quantitative measurement of the presence of a "target" gas. The industry standard 4 - 20 mA signal is linear and can be "fed" into a building management system or any generic controller that will accept one of the analog signals. The controlling device can then be utilized to provide a measure of control and alarm.

Glossary:

a) LEL: "Lower Explosive Limit" Lowest concentration of a combustible gas in air that will support combustion when exposed to an ignition source.

b) UEL: "Upper Explosive Limit" A point at which the concentration of combustible gas in air exceeds the maximum concentration that will support combustion.

c) Inhibitors: Substances that produce a temporary loss of pellistor sensitivity.

d) Poisons: Substances that produce a permanent reduction in pellistor sensitivity.

e) PPM: "Parts Per Million" The accepted unit of measure for toxic gases

1.1 SENSORS

All AST "X" series transmitters utilize poison-resistant, catalytic pellistor sensor elements to detect combustible gases and vapours. Catalytic pellistor sensors are designed to provide good accuracy and selectivity to "target" combustible gases and vapours. They are very stable over long periods and require minimal maintenance (two to four times per year calibration).The affect of moderate swings in temperature and humidity are only minimal on these sensors. Avoid contact with or installation in areas containing potential inhibitors or poisons as described in the glossary above.

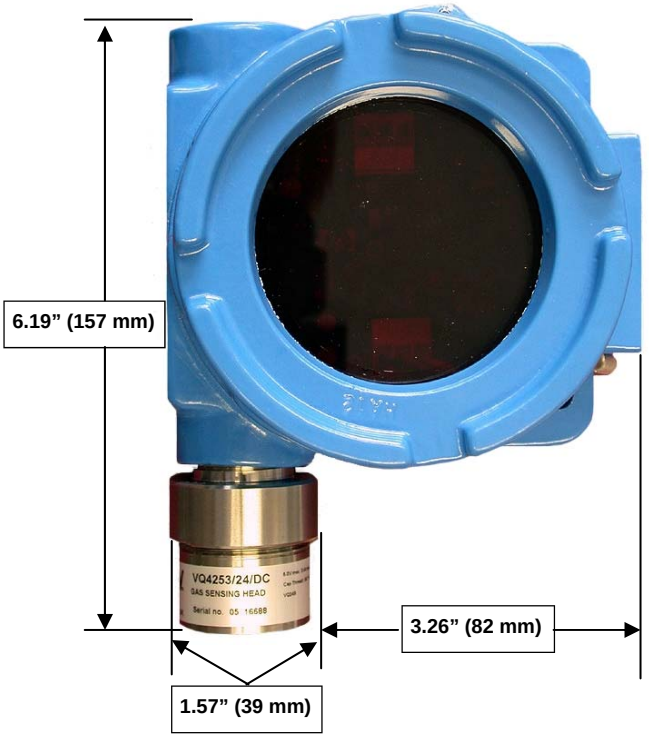
2.0 TRANSMITTER SPECIFICATIONS

Size:	Combustible version 4.92" X 6.75" X 4.56" (junction box) 125 mm X 171 mm X 116 mm	
Weight:	1.72 pounds (780 grams)	
Construction:	Junction box: Cast aluminum, explosion-proof Combustible sensor housing: 316 Stainless steel	
Power:	20 to 30 VDC approximate current draw: 250 mA	
Output Signal:	Linear, analog 4 - 20 mA	
Loop Resistance:	Maximum 1000 Ohms	
Bridge Voltage:	Standard 3.5 VDC for poison resistant catalytic pellistor sensor	
Adjustments:	Bridge:	Setting sensor heater voltage at time of installation of a new sensor
	Zero:	Setting circuit board output to "0" VDC
	4 mA:	Setting 4 mA output signal in clean air
	20 mA:	Calibrating span output value for accuracy

2.1 SENSOR SPECIFICATIONS

Type:	Poison resistant, catalytic combustible pellistor
Range:	0 - 100% LEL of target combustible gas
Life span:	3+ years
Operating Temperature:	-40C to +50C (-40F to 122F)
Operating RH:	0 - 80% RH non-condensing
Response Time:	T_{50} <10-seconds
Drift:	Long term zero & signal drift: <5% LEL per month
Note:	Response time and drift measured with Methane. The response to flammable vapours, especially heavy aromatic compounds, may be different.
Gas Exposure:	Exposure to gas concentrations greater than the LEL could permanently damage the sensor. If sensor has been exposed to high concentrations of combustible gas, it should be calibrated to confirm operation and accuracy.

3.0 TRANSMITTER DIMENSIONS



4.0 TRANSMITTER INSTALLATION

The explosion-proof junction box supplied is a conduit mount style. The transmitter enclosure should be installed with stainless steel sensor diffusion head pointing downward (vertical position). Utilize liquid tight conduit hubs to ensure liquid does not enter the enclosure through the conduit / wiring entrance. Install a conduit clamp close top where the transmitter attaches to the incoming conduit to ensure it is tight against the wall.

Sensor Mounting Heights and Locations (Examples)

Methane (CH4) and Hydrogen (H2) are much lighter than air and so the transmitter should be installed on or near the ceiling.

Propane (C3H8) is much heavier than air and so the transmitter should be installed with sensor approximately 6" from the floor.

Always ensure that the sensor / transmitter unit is installed at the right mounting height to easily detect the target combustible gas or vapour.

Attach appropriate conduit to transmitter enclosure, utilizing liquid tight fitting to maintain water tight rating and hook-up wiring conductors to terminal block (see drawing on previous page for direction).

Note: Never install sensors in the direct path of moving air, such as exhaust fans, ducts, etc. Moving air can move any target gas away from the sensor. It can also cool the sensor, making it less accurate.

4.1 TRANSMITTER WIRING CONNECTIONS

4.1 TRANSMITTER WIRING CONNECTIONS, CONT'D…..

Transmitter Wiring Hook-Up

Utilize 18 - 20 gauge, 3-conductor shielded cable (stranded wire) for VDC connection. Connect 24VDC positive to terminal top terminal, 24VDC negative to middle terminal and signal to bottom terminal. ***Double check connections for correct polarity, prior to powering up transmitter.*** Power can be supplied from one of several different control panels manufactured by CETCI, a generic controller manufactured by another company, or a regulated VDC power supply or other such source.

NOTE: Observe local regulations with regards to hazardous area installations with regards to conduit type and installation instructions.

5.0 TRANSMITTER OPERATION

Once power has been connected to the AST-CCB-X (combustible) transmitter, the green "power" LED (inside) will illuminate. The signal output may indicate a fail condition, at the controlling device, for a brief moment while the circuit powers up the catalytic sensor element. The sensor output to the circuit then may rise through the transmitter full measurement range, indicating gas alarm conditions on the controlling device. This condition may last for several minutes or more, depending on how long the transmitter has been without power. Once the sensor has reached peak operating temperature and stabilized, the output signal will automatically settle down to normal operating condition (approximately 4.00 mA signal output in clean air).

A powered up sensor / transmitter in normal operating condition will have a linear analog signal output of approximately "4.00 mA". Once a combustible gas or vapour has been detected, the signal will rise through the detection range of 4 to 20 mA. Eg. a concentration of 50% LEL will output 12.0 mA.

NOTE: Do not attempt to adjust a transmitter until it has been powered up for at least 2-hours.

6.0 TRANSMITTER MAINTENANCE

All sensor / transmitters should be inspected on site after installation to ensure that they have been installed and connected properly. All sensor / transmitters are factory calibrated, twice, prior to shipping, but an on-site gas test serves to confirm accuracy of zero and span settings, in case they have been tampered with. Regular maintenance is minimal and consists of two to four times per year on-site gas calibration (application dependent).Regular bump testing may be required by local authorities in your area.

6.1 TEST & CALIBRATION PROCEDURE

IMPORTANT: Ensure sensor / transmitter has been powered up for at least 2 to 6 hours prior to performing any calibration procedure.

Equipment Required:
* Calibration adapter for explosion-proof head
* Precision digital multi-meter with "pointer" leads
* Small blade screwdriver (to adjust potentiometers)
* Calibration kit with appropriate cylinders of zero emissions air and calibration span gas

Procedure: *4-20 mA current signal from transmitter connected to a controller*

Note: *Reference circuit board identifier photo on page - 12 for location of test points and potentiometers.*

Zero Adjust:

Attach negative lead from digital multi-meter to test point "C" (zero test point). Attach positive lead from digital multi-meter to test point "D" (span signal). Set meter to voltage measurement scale of "0.000".

Attach calibration adapter and flow zero emissions air at a rate of 0.5 to 0.7 LPM over sensor for approximately one to two minutes. Adjust the "ZERO" potentiometer "VR2" to achieve a reading of "0.000" VDC on meter across test points C & D.

4.0 mA Adjust:

Next, install the meter in series between the signal output of the transmitter and the controller signal input and set it to measure mA current. With zero emissions air still flowing, adjust potentiometer "VR4" to achieve a reading of "4.00" mA.

Span Adjust:

Based on the span calibration gas you are using, calculate the desired signal reading to be expected from the transmitter, using the following formula.

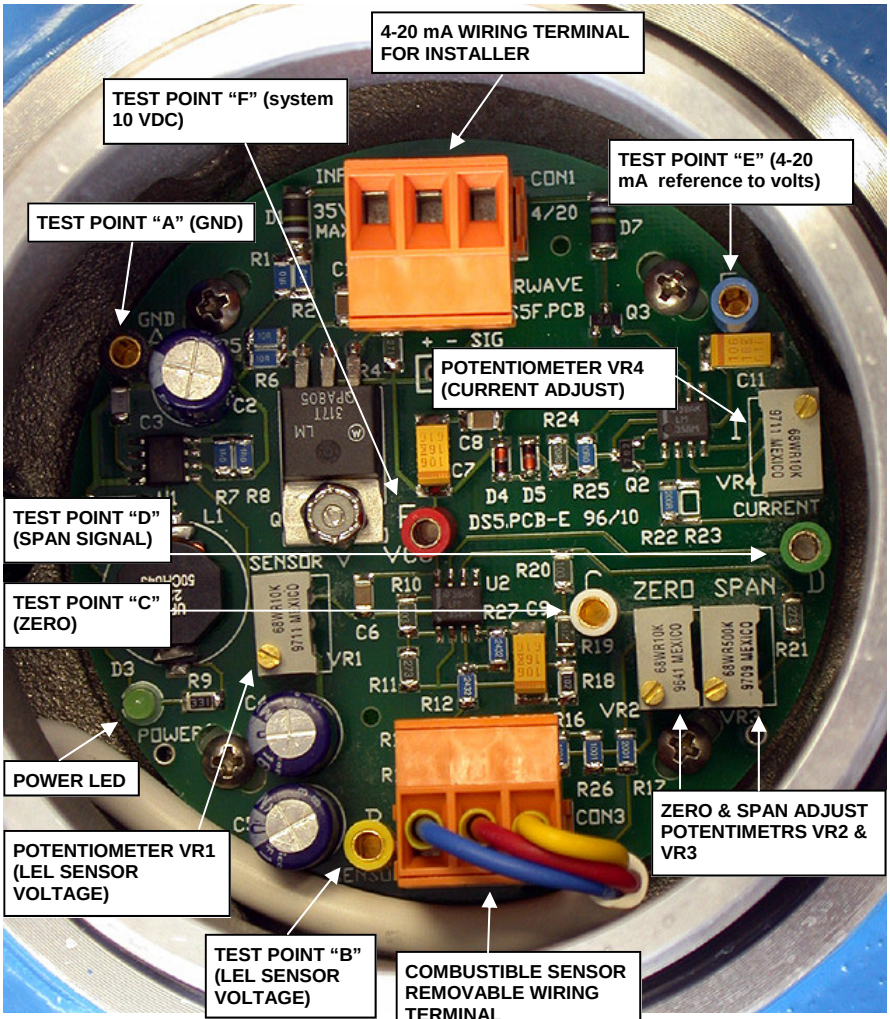
$$\frac{\textbf{Span Gas Concentration}}{\textbf{Sensor Range (100\%)}} \textbf{ X 16 + 4 = Desired mA Signal}$$

Eg. Span calibration gas concentration = 50% LEL CH4 (Methane)
50 / 100 X 16 + 4 = 12.0 mA

Apply calibration span gas for approximately two to three minutes. Adjust "SPAN" potentiometer "VR3" to obtain a reading equal to the target as calculated above. Remove span gas and allow sensor to recover for at least ten minutes.

Calibration procedure is complete. Remove regulator from gas cylinder for storage.

6.2 CIRCUIT BOARD ADJUSTMENTS IDENTIFIER



Calibration Adapter

6.3 SENSOR REPLACEMENT

Before beginning, ensure that the area has been de-classified or you have a hot work permit. To replace a sensor head, first disconnect the power to the transmitter and remove the threaded cap to the explosion-proof transmitter. Unplug the orange three-pole wiring terminal strip located at the bottom of the circuit board.

Remove the three existing sensor head wires, carefully noting the colour code sequence (reference photo on page-16). Carefully unthread the stainless steel sensor head and remove it.

Install the new sensor head, applying thread sealant compound to the threads to ensure a good seal. Tighten the sensor head in place.

Re-attach the three sensor wires to the removable orange wiring terminal noting the colour code sequence. Power up the transmitter and allow it to stabilize for approximately 2 to 6 hours before attempting to perform a calibration procedure.

NOTE-1: The "Bridge" voltage is factory set and should not have to be adjusted in the field unless someone has tampered with it. If tampering is suspected, do not power up the transmitter until bridge voltage has been checked. *Carefully follow the procedure below.*

NOTE-2: All new sensors must be calibrated prior to usage. See section "6.1" of this manual preceding pages, for details.

NOTE-3: ***"IMPORTANT"*** Ensure hands are clean prior to handling sensor head diffusion end to avoid contamination of pellistor sensor elements. Avoid contacting the flame arrestor with any compounds or dirty hands.

Bridge Voltage Adjustment Procedure:

a) Connect only "-" and "sig" wires from the new sensor.

b) Attach meter leads to "TP-1" and "TP-2" on the lower circuit board. Power up the transmitter. The voltage reading should be 2.00 VDC on the meter. If not, adjust the bridge voltage potentiometer "VR1", located just to the left of the test points, to achieve a reading of "2.00" VDC.

NOTE-4: Some substances that can cause temporary loss of sensitivity or permanent poisoning to pellistor sensors are: H2S, Silicone compounds, Chlorine, Chlorinated Hydrocarbons, Phosphate esters, Tetra-ethyl lead and most Halogenated compounds.

NOTE-5: Some common sources of contamination include silicone oils and greases on joints and cases, residues of cutting fluids or mould-release compounds on metal or plastic components, furniture polish, degreasing compounds and some paints.

7.0 REPLACEMENT PARTS & ACCESSORIES

DESCRIPTION	PART NUMBER
Calibration adapter (plastic)	FLOWCAPPVC
Transmitter circuit board	AST-XA
Replacement stainless sensor head	SEE-1000-SE2