Vulcain

Division of BW Technologies

Gas Transmitter

VA 301 D_2

User Manual

ISO 9001:2000

CERTIFICATION

Intertek

Protecting your health and your environment.

WARRANTY AND LIMITS OF LIABILITY

Vulcain Inc. warrants to the original purchaser that its product, and the component parts thereof, will be free from defects in workmanship and materials for a period of one year from the date of purchase. Vulcain will, without any charge and at its option, repair or replace defective products or components upon their delivery to its Repair and Service Department. This warranty does not apply in the event of misuse or abuse of the product, or as a result of unauthorized alterations or repairs. Vulcain shall not be liable for any consequential damages, including, without limitation, damages resulting from loss of use.

Every precaution for accuracy has been taken in the preparation of this manual. However, Vulcain neither assumes responsibility for any omissions or errors that may appear, nor liability for any damages that may result from the use of the products in accordance with the information contained in this manual.

To obtain warranty service, return the product, along with a complete description of the defect, transportation prepaid. Vulcain assumes no risk for damage in transit. Following warranty repair, the product will be returned to the buyer, transportation prepaid.

Vulcain
Division de BW Technologies

Technical Support Line:
1-800-563-2967
Before returning a product for warranty service, please contact Vulcain's Technical Support Department.

Warranty Registration

To validate the warranty, this registration form must be completed in full and sent to Vulcain within 90 days of the date of purchase. Fax it to Vulcain at 1 888 967-9938.

Customer's name: _____

Address: _____

City: _____ State/Province: _____

Location of the installation: _____

Serial No.: _____

BEFORE RETURNING ANY INSTRUMENTS, PLEASE CONTACT US TO OBTAIN A RETURN OF MATERIAL AUTHORIZATION NUMBER.

TABLE OF CONTENTS

UNPACKING

After opening the package and removed the equipment and components. Make sure that you have all the items described on the order form or packing slip.

DESCRIPTION

Characterized by their reliability, long life and superior performance in the most adverse environmental conditions, Vulcain's industrial line of products has earned an extensive and excellent reputation in a broad range of applications. The VA301D$_2$ Series can monitor a large variety of toxic and hundreds of different flammable gases.

WARNING

Some materials such as, but not limited to, tetraethyl lead, silicones, some sulfur, phosphorus, and chlorinated compounds may have a poisoning effect resulting in a loss of sensibility.

IMPORTANT NOTICE

Make sure to locate the monitor and sensing assemblies in an area easily accessible to a technician.

Avoid any location where the monitor could be subject to vibrations.

Avoid any location close to noisy equipment.

Avoid any location where temperature changes occur rapidly.

Verify all the requirements and existing regulations which may affect the choice of location.

Select a location at the perimeter of the chiller, boiler, cooler or any other equipment that may leak. Airflow patterns must also be considered.

Always mount the sensor pointing downwards.

Conduit installation must conform to local fire, building and electrical codes.

SURFACE-MOUNT INSTALLATION

Installation of the monitor (stand-alone) or transmitter (network) simply requires the physical mounting of the enclosure and connection of the power and output lines.

TABLE 1
Recommended height

Detected gas		Relative Density (air = 1)	Recommended Height
CO	Carbon Monoxide	0.968	3-5 feet (1 - 1.5 m) from floor
* NO_2	Nitrogen Dioxide	1.58 (cold)	1-3 foot (30 cm-1 m) from ceiling
H_2	Hydrogen	0.07	1 foot (30 cm) from ceiling
CL_2	Chlorine	2.50	1 foot (30 cm) from floor
NH_3	Ammonia	0.59	1 foot (30 cm) from ceiling
H_2S	Hydrogen Sulfide	1.19	1 foot (30 cm) from floor
HCL	Hydrogen Chloride	1.30	1 foot (30 cm) from floor
HCN	Hydrogen Cyanide	0.932	1 foot (30 cm) from floor
ETO	Ethylene Oxide	1.50	1 foot (30 cm) from floor
O_2	Oxygen	1.43	3 -5 feet (1 - 1.5 m) from floor
SO_2	Sulfur Dioxide	2.25	1 foot (30 cm) from from floor
COMB	Most combustibles are heavier than air, with the exception of methane, hydrogen, ethylene and acetylene. For gases that are heavier than air, sensors should de installed approximately 1 foot (30 cm) from the floor. For combustibles that are lighter than air, sensors should be installed 1 foot (30 cm) from the ceiling, close to the potential leak source.		

* Can be different for specific use. Hot NO_2 from exhaust systems is lighter than 1.58.

DETERMINATION OF THE NUMBER OF TRANSMITTERS

The number of transmitters is determined by a unit's radius of surveillance. Using Table 2 below, the number of units can be easily evaluated.

TABLE 2
Radius of surveillance

Gas Detected	Radius of Surveillance	Area Covered
CO Carbon Monoxide NO_2 Nitrogen Dioxide	50 feet (15 metres)	7,854 square feet (707 m^2)
Others	23 feet (7 metres)	1,662 square feet (154 m^2)

TABLE 3

Interfering gases sensor

Gas	Factor	Gas	Factor
Acetic Acid	3.413	Methyl Alcohol	1.460
Acetone	2.208	Methyl Ethyl ketone	2.631
Acetylene	1.665	N-Butane	2.040
Ethane	1.392	N-Decane	3.413
Ethyl Alcohol	1.691	N-Pentane	2.210
Ethylene	1.537	N-Propyl Alcohol	1.967
Hydrogen	1.233	O-Xylene	2.998
Iso-Butane	1.832	Propane	1.883
Iso-Pentane	2.300	Propene	1.837
Methane	1.000	Toluene	2.470

DUCT-MOUNT INSTALLATION

This system is used to sample air flowing through ventilation ducts. The unit is suitable where the air velocity is between 500 and 4000 ft/minute (2.5 to 20.3 m/sec.), and it is generally installed in the main return ventilation duct before the recirculation fans. Make sure to verify all the requirements and existing regulations which may affect the choice of its location. We recommend installation on a straight duct at 3 feet (1 m) away from any curve.

1. Post the drilling guide to the ventilation duct.

2. Drill the openings for the sampling tubes.

3. Insert the sampling tube with lateral air holes in the appropriate connector orienting air holes facing airflow. Tighten with the (8-32 5/16) screw on the connector.

4. Insert the exhaust tube into the appropriate connector orienting the slant away from airflow. Tighten with the (8-32 5/16") screw on the connector.

5. For a ventilation duct longer than 20 inches, extra tubing is necessary. It is preferable to drill a hole at the opposite side facing the detection unit to support the far end of the tube. Seal the end of the tube with the cork supplied. If necessary, seal the openings on the duct around the tubings.

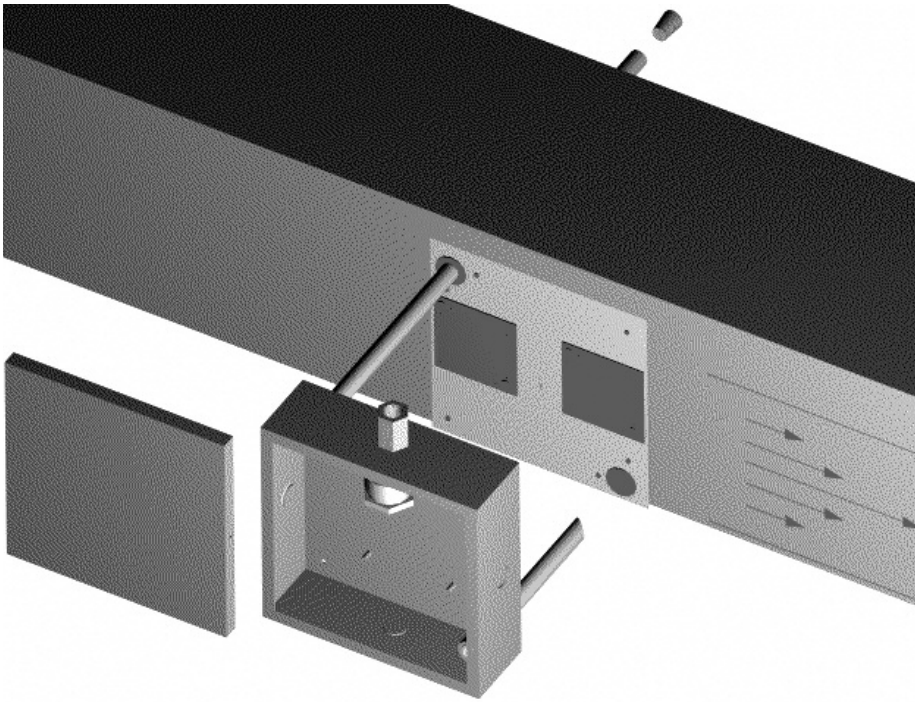
6. Connect the power and the outputs as shown in the *electrical wiring* section.

7. Before mounting the cover of the sampling unit box, start the ventilation feeding fan and check if there is any leakage. If necessary, seal with air plugs.

8. The cover should be mounted using metallic screws (6/32 1/2").

To convert from CFM to velocity (ft./minutes), divide the flow by the area. Example: In a 2ft X 4ft duct, where the area is $8ft^2$ and a CFM of 40,000, the air velocity will be $40{,}000ft^3$ /minutes /($8ft^2$) = 5,000 ft/minutes

DUCT MOUNT INSTALLATION DETAILS



ELECTRICAL WIRING

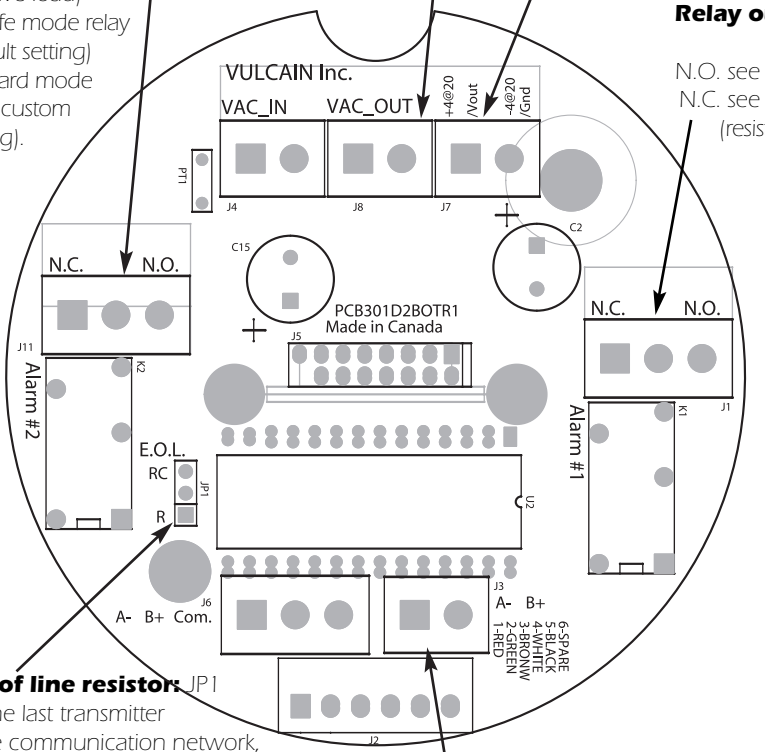
BACK

Power: Input J4 and Output J8
15 to 27 Vac, 18 to 38 Vdc, 380 mA @ 24 Vdc.
Frequence 60Hz
See details in table 4.

4-20 mA loop: Output at J7
See details in table 4.

Relay outputs: J11
N.O.: 2A 250 Vac, 5A 120 Vac, 3A 30 Vdc
N.C.: 1A 250 Vac, 2A 125 Vac, 1A 30 Vdc
(resistive load)
Fail-safe mode relay
(default setting)
Standard mode
relay (custom
setting).

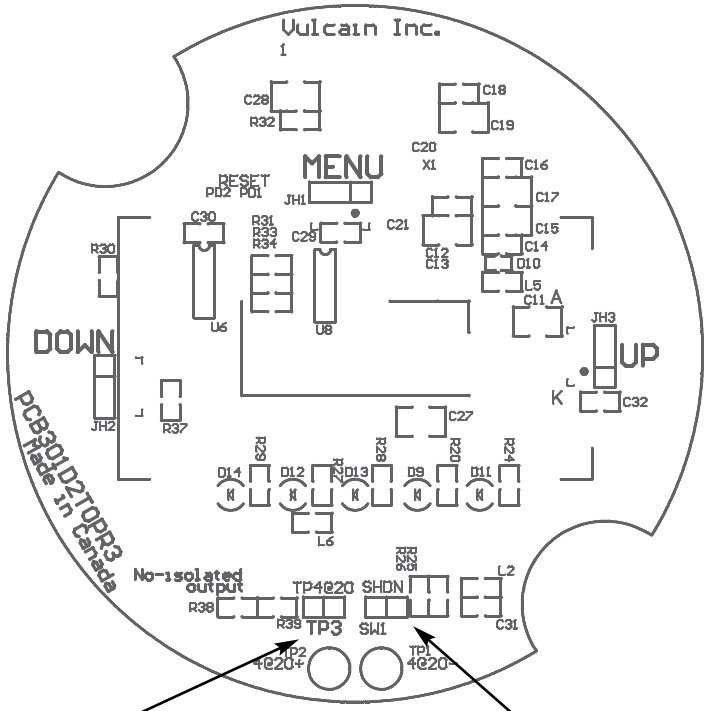
Relay outputs:
J1
N.O. see relay J11
N.C. see relay J11
(resistive load)



End of line resistor: JP1
On the last transmitter
of the communication network,
a jumper must be installed.

Communication: Input J6 and Output J3
Up to 3280 feet (1,000 m) per channel
T-tap: 65 feet (20 m) maximum per t-tap
130 feet (40 m) total

FRONT



4@20 loop jumper: TP3

Remove the jumper to obtain a measure of current on TP2 and TP1.

Power jumper: SW1
Place the jumper correctly in order to power the transmitter.

Remove the jumper before unplugging the top PCB.

INITIAL START-UP

Once powered up, the unit will begin displaying gas concentrations. The initial stabilization period for the combustible detectors is within 5 minutes. For the other configurations, the period is less than 24 hours.

WIRING REQUIREMENTS

TABLE 4
Power wire gauge

Cable length	Number of transmitters						
	4	8	12	16	32	64	128
500 feet (150 m)	18 AWG	18 AWG	16 AWG	14 AWG	14 AWG	12 AWG	12 AWG
1000 feet (300 m)	18 AWG	16 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG
1500 feet (450 m)	16 AWG	16 AWG	14 AWG	12 AWG	12 AWG	***	***
2000 feet (600 m)	14 AWG	14 AWG	12 AWG	12 AWG	***	***	***
4000 feet (1200 m)	12 AWG	12 AWG	12 AWG	***	***	***	***

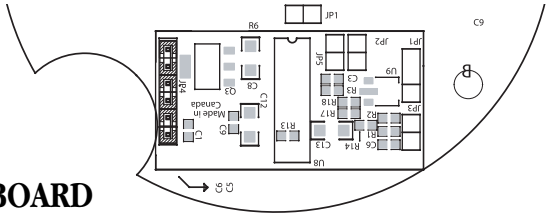
The communication cable must be one pair twisted (6 twist per foot) and shielded 24 AWG Belden 9841 or equivalent up to 4,000 feet (1,200 m).

4-20 mA LOOP CONFIGURATION

CURRENT SOURCING OUTPUT CONFIGURATION

The transmitter supplies the loop current. The maximum impedance supported by the loop is 400 ohms. Set jumpers on S1 at 1-2, 3-4 and 5-6.

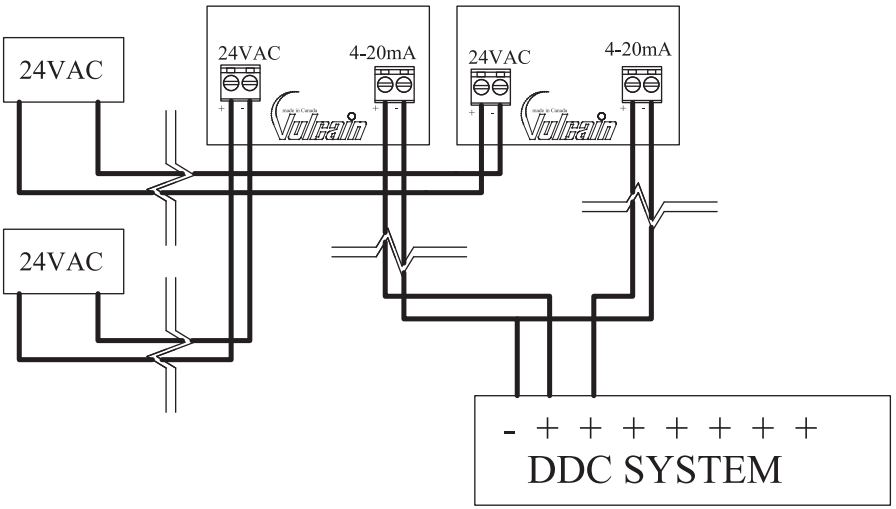
BOTTOM OF FRONT BOARD



WARNING

A dedicated power supply must be used with each unit. Considerable damage may occur if this condition is not strictly followed.

Current sourcing output



LOOP POWERED CONFIGURATION *(factory setting)*

The 4-20 mA output is **factory set for loop powered configuration** and requires a power source of 12 Vdc to 30 Vdc. The overall impedance depends on the voltage supplied to the 4-20 mA loop.

UNDERNEATH FRONT BOARD

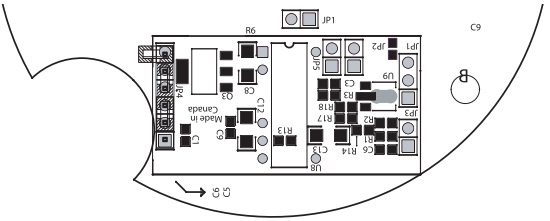
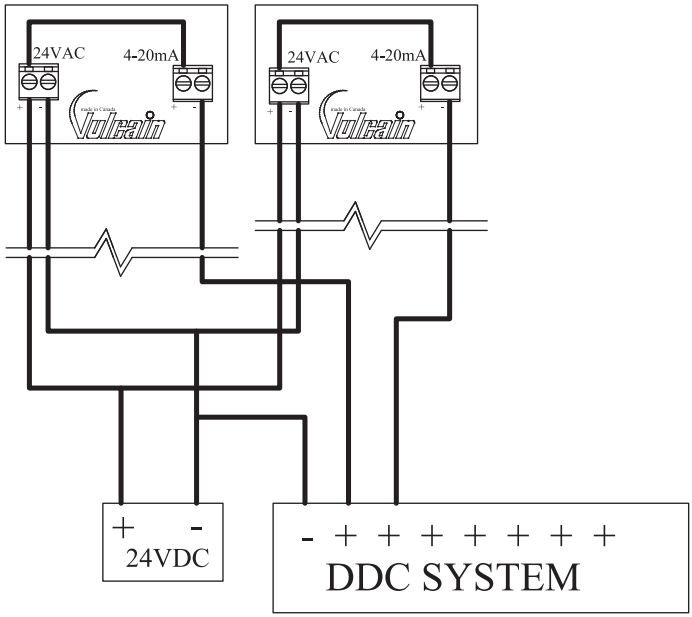


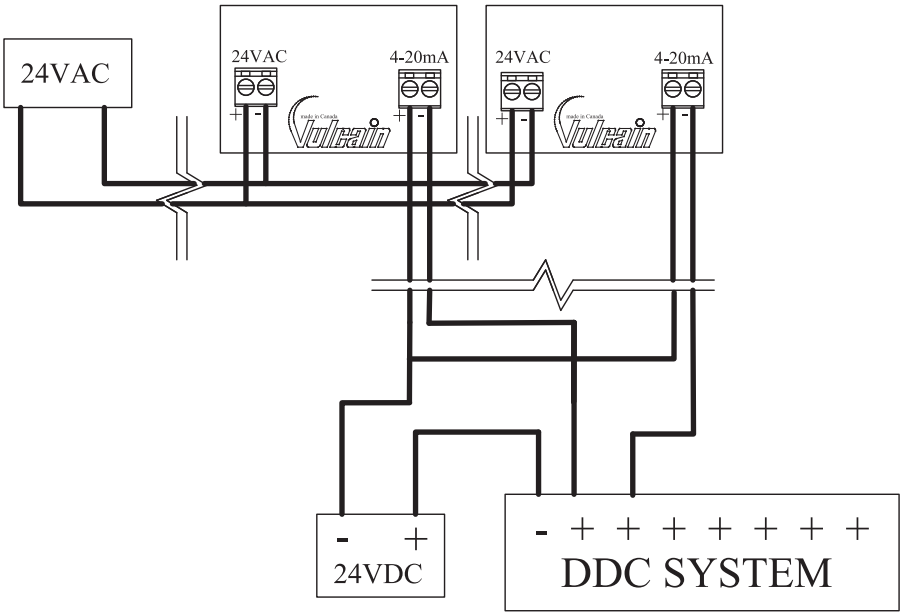
TABLE 5
Permitted impedance in the 4-20 mA loop

Voltage Source applied	Total Impedance
12 Vdc	400 Ohms
16 Vdc	600 Ohms
20 Vdc	800 Ohms
24 Vdc	1000 Ohms
30 Vdc	1300 Ohms

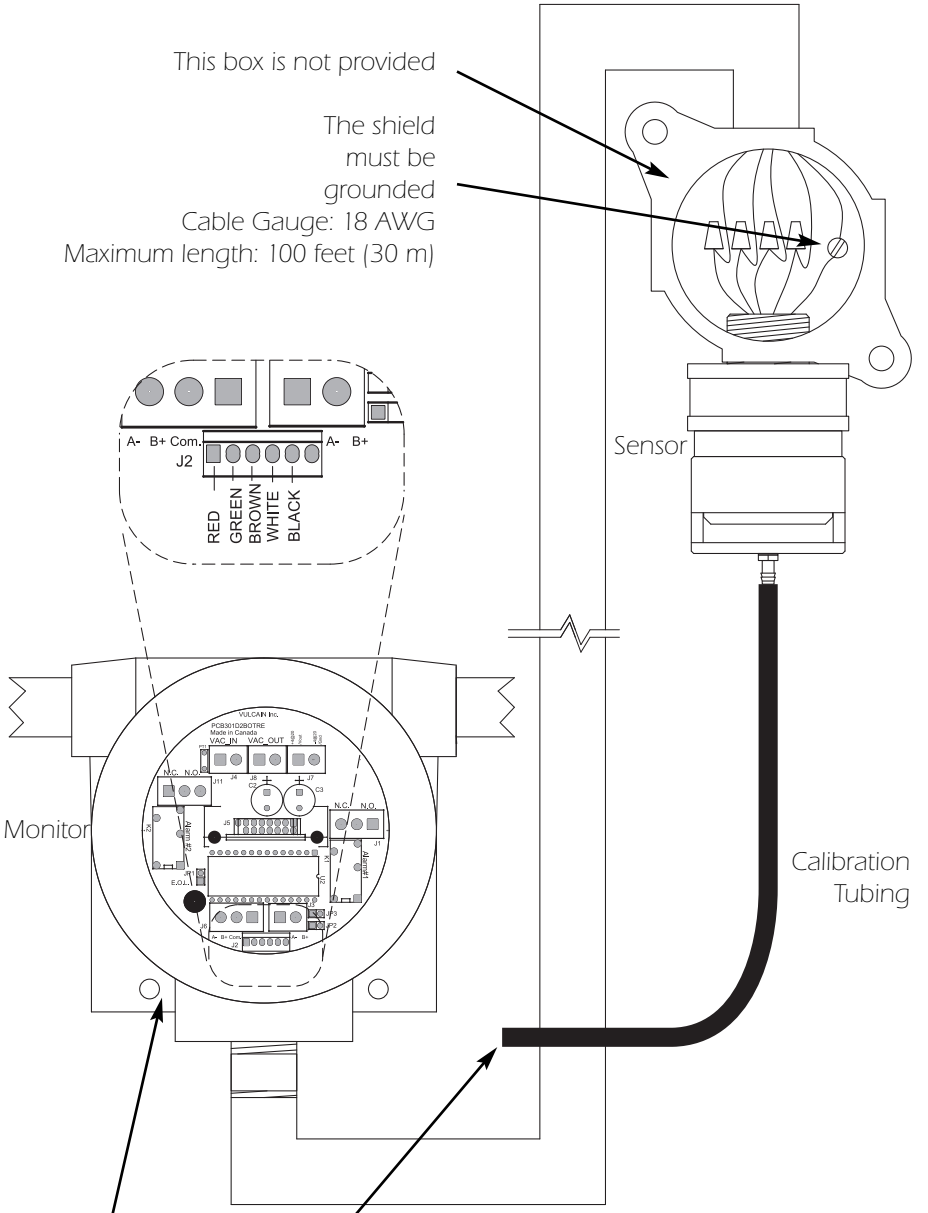
3-wire Configuration



4-wire Configuration

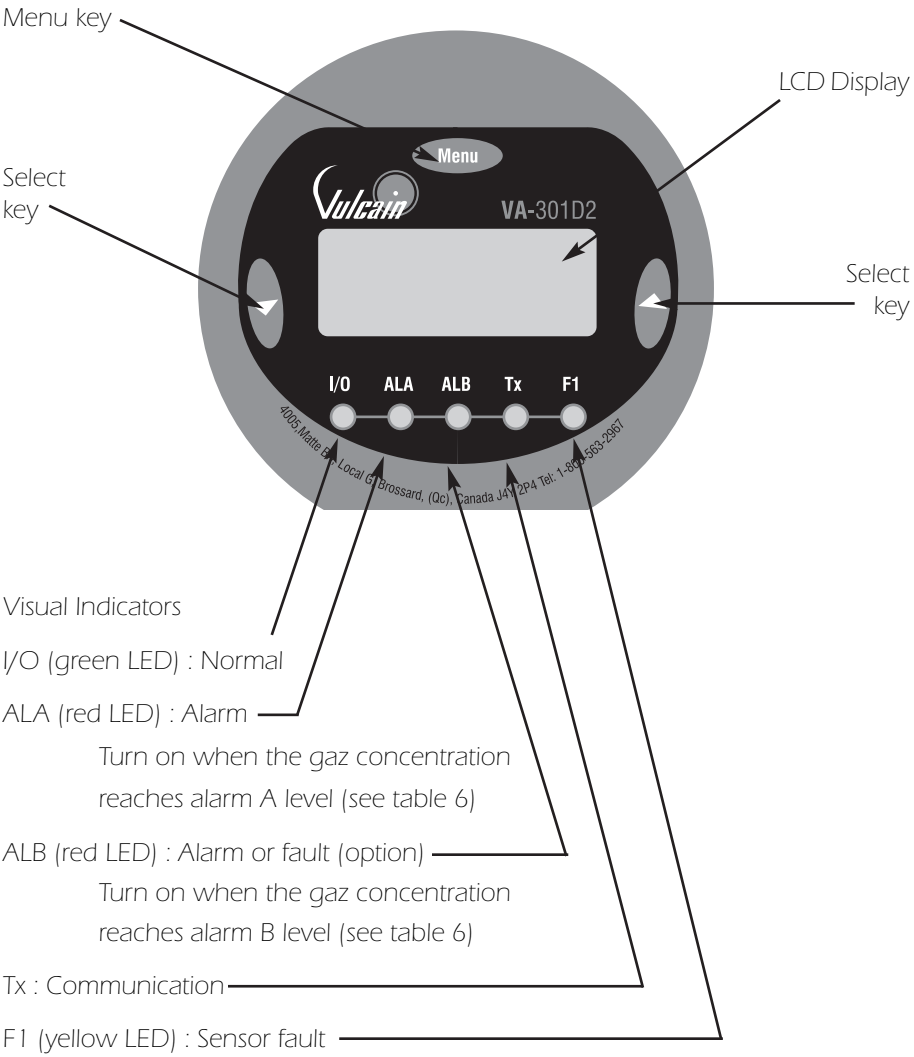


OPTIONAL REMOTE SENSOR CONFIGURATION



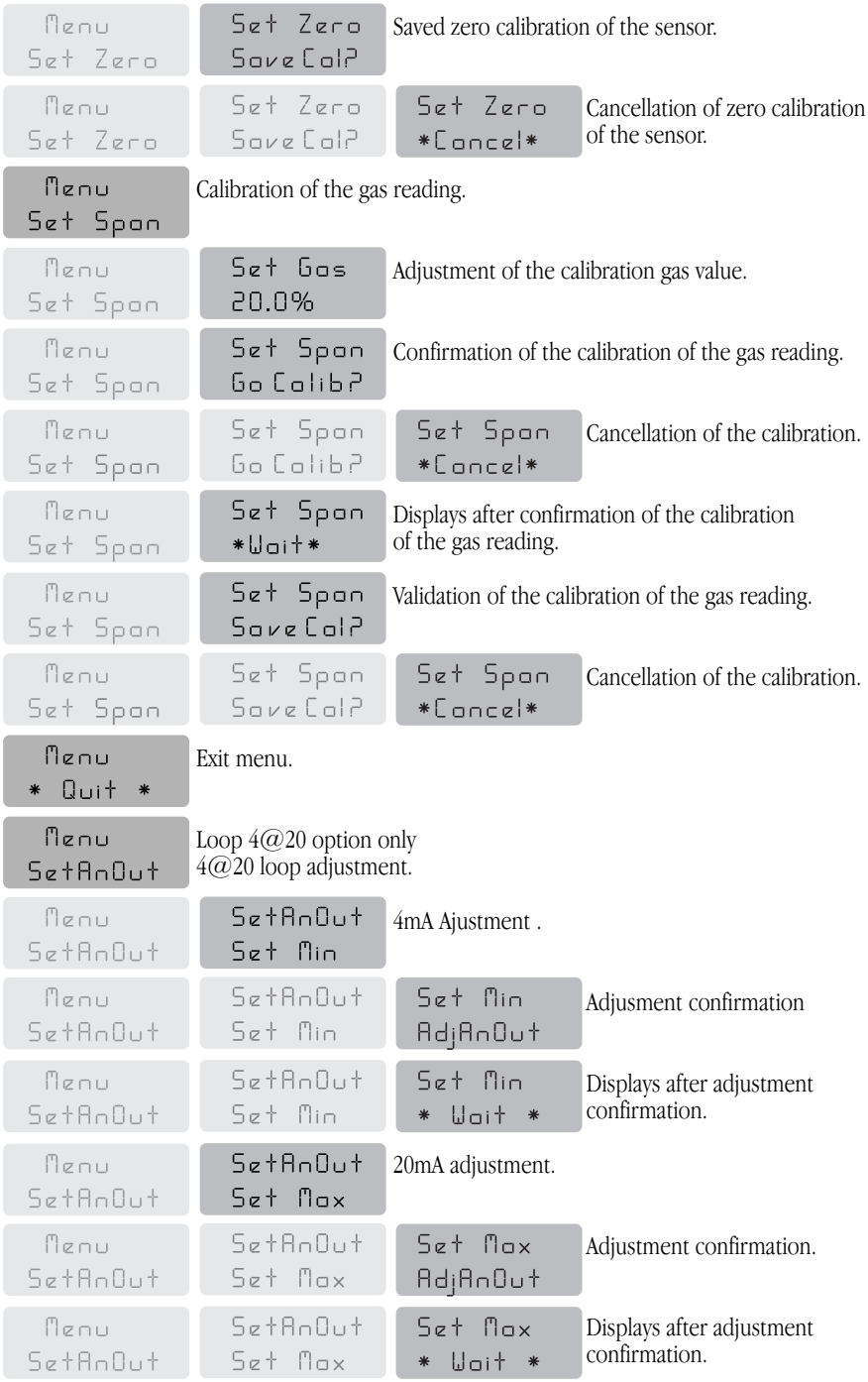
See table 1 in the ***surface mount installation*** section for sensor installation height requirements

USER INTERFACE



USER'S MENU

VA-30102			Name of the unit, displayed upon initialization.
Password * AA *			Password for user's programming menu.
Menu Set ADR.			Address configuration menu
Menu Set ADR.	Set ADR. M002 V02		Transmitter address configuration.
Menu Set Alr			Alarm level adjustment menu.
Menu Set Alr	Set Alr Min AlrA		Alarm A minimum level configuration.
Menu Set Alr	Set Alr Min AlrA	Min AlrA 22.0%	Alarm A minimum level adjustment.
Menu Set Alr	Set Alr Max AlrA		Alarm A maximum level configuration.
Menu Set Alr	Set Alr Max AlrA	Max AlrA 25.0%	Alarm A maximum level adjustment.
Menu Set Alr	Set Alr Min AlrB		Alarm B minimum level configuration.
Menu Set Alr	Set Alr Min AlrB	Min AlrB 47.0%	Alarm B minimum level adjustment.
Menu Set Alr	Set Alr Max AlrB		Alarm B maximum level configuration.
Menu Set Alr	Set Alr Max AlrB	Max AlrB 50.0%	Alarm B maximum level adjustment.
Menu Set Zero			Zero calibration of the sensor.
Menu Set Zero	Set Zero GoCalib?		Configuration of zero calibration of the sensor.
Menu Set Zero	Set Zero GoCalib?	Set Zero *Cancel*	Cancellation of zero calibra tion of the sensor.
Menu Set Zero	Set Zero * Wait *		Displays after confirmation of zero calibration of the sensor.



*WRONG**	Entry of an invalid password.
NoSensor Connect	Indicates no sensor is connected.
* Wait * Re-init	Automatic re-initialization before returning to detection mode.
VA-30102 Rev 0.07	Product name and program version.
CH4 9.7%	Sensor type and percent (%) concentration.
Mod: 002 9.6%	Indicates thet the unit is in Modbus communication mode. Indicates the assigned address. Indicates the concentration read.

SPECIFICATIONS

Power Requirements:	15 - 27 Vac, 18 - 38 Vdc, 380 mA @ 24 Vdc
Operating Temperature Range:	-40°F to 100°F (-40°C to 40°C) Toxic gases
	-40°F to 112°F (-40°C to 50°C) Combustible gases
Operating Humidity Range:	0% to 95% RH Non-condensed
	NH_3: 15% to 90% RH, Non-Condensed
Sensing Technologies:	Q1: electrochemical (toxic)
	catalytic combustion (combustibles)
	diffusion fuel cell (oxygen)
Display:	Alpha numeric LCD display with back light
Visual Indicators:	Green LED: Normal operation
	Red LED: Alarms A
	Red LED: Alarms B
	Green LED: Communication
	Yellow LED: Fault
Outputs:	4-20 mA, 2 optional SPDT fail safe relays
Communication (lenght of lines):	Up to 2000 feet (600 m) per channel
	T-tap: 65 feet (20 m) maximum per t-tap
	130 feet (40 m) total
Minimum size Conductors:	See *wiring requirements* section
Relay Output Rating:	Normally open: 2A 250 Vac, 5A 125 Vac, 3A 30 Vdc
(Unlatching)	Normally close: 1A 250 Vac, 2A 125 Vac, 1A 30 Vdc
Relay Mode:	Fail-safe mode relay (default setting)
	Standard mode relay (custom setting)
Storage Temperature:	-40°F to 112°F (-40°C to 50°C)
Pressure Limits:	800 to 1200 millibars
Communication:	RS-485 two wires
Communication Protocol:	Autodetect Vulbus or Modbus
Transmission Speed:	9.6 kBauds (also available: 0.3, 2.4, 19,2)
Eight-bit Frame:	1 start bit, 7 bits of data, 2 stop bits, no parity
	8 status bits available
Enclosure:	Class 1, Division 1, Groups B, C, D
Dimensions:	7.5 in. (H) X 6.25 in. (W) X 4.5 in. (D) (19 cm x 16 cm x 11.5 cm)
Weight:	4.6 lbs. (2.1 Kg)
Frequence:	60 Hz

RANGE AND ALARM LEVELS

Table 6
Range and Alarm Levels

	Gas Detected	Range	Alarm A	Alarm B
CO	Carbon Monoxide	0 - 250 PPM	35 PPM	200 PPM
NO_2	Nitrogen Dioxide	0 - 10 PPM	0.72 PPM	2 PPM
CL_2	Chlorine	0 - 15 PPM	0.5 PPM	1 PPM
NH_3	Ammonia	0 - 100 PPM	25 PPM	35 PPM
H_2S	Hydrogen Sulfide	0 - 50 PPM	10 PPM	15 PPM
HCL	Hydrogen Chloride	0 - 25 PPM	3 PPM	4 PPM
HCN	Hydrogen Cyanide	0 -50 PPM	10 PPM	20 PPM
ETO	Ethylene Oxide	0 - 20 PPM	1 PPM	5 PPM
O_2	Oxygen	0 - 25% Vol.	19.5% Vol.	22% Vol.
SO_2	Sulfur Dioxide	0 - 10 PPM	2 PPM	5 PPM
O_3	Ozone	0 - 2.5 PPM	1 PPM	2 PPM
HF	Hydrogen fluoride	0 - 10 PPM	2 PPM	3 PPM
F_2	Fluor	0 - 1 PPM	0.1 PPM	0.3 PPM
AsH_3	Arsine	0 - 2.5 PPM	0.05 PPM	0.1 PPM
COMB	Combustibles	0 - 100% LEL	25% LEL	50% LEL

Specific setting of the alarm levels may have already been performed to meet the specific customer application.

PERIODIC INSPECTIONS AND CALIBRATION

This unit requires calibration. The calibration frequency will be a function of the operating conditions, including operating under extreme temperatures, exposure to contaminants or gas. If the exposure to the gaz is greater than the unit's full scale, the unit must be recalibrated. A calibration inspection must be included as part of a routine maintenance to ensure proper operation of the gas detection unit.

If the units span or zero cannot be adjusted, the sensor may be approaching its end-of-life and have been contaminated with high concentration of gas, and it must be replaced.

CALIBRATION PROCEDURE

1- Warm-up period

Turn the unit on for a minimum of (15) minutes

2- Connecting the hardware

Plug the calibration adaptor onto the gas sensor inlet
Screw the regulator to the calibration span gas cylinder or air cylinder for the zero adjustment
Connect the regulator outlet to the calibration adaptor with the 1/8" I.D. polymer tubing

3- Adjusting the zero (if required)

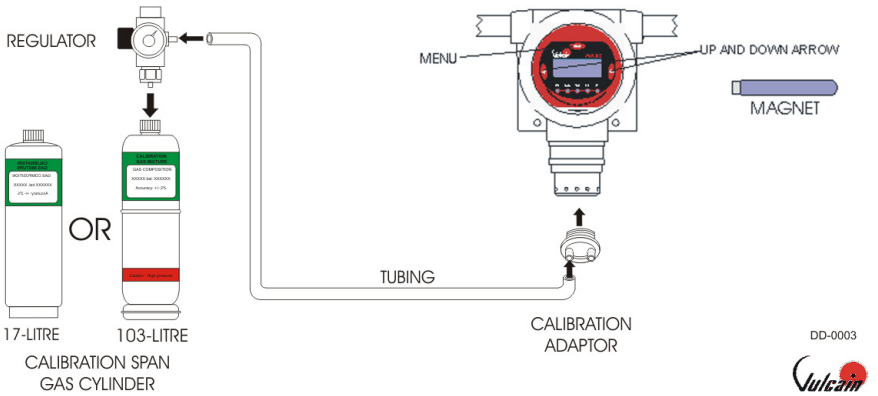
When the unit indicates 0% COMB in an area with no presence of combustible gas, proceed to step 4, adjusting the span.
To adjust the zero, inject air at a flow rate of 500ml/min.
Place the magnet on top of Menu. Then place it above Up or Down Arrow until the password VA is reached.
Place the magnet on top of Menu to acknowledge.
Place the magnet on top of Up or Down Arrow until the Set Zero field is reached.
Place the magnet on top of Menu to acknowledge.
Place the magnet on top of Menu to activate GoCalib.
Wait message appears, the transmitter will go into zero calibration.
When the Menu Set Zero message appears, the zero calibration is complete.
Place the magnet on top of Up or Down Arrow until the Quit field is reached.
Place the magnet on top of Menu to confirm.

4- Adjusting the span

Turn on the regulator. The calibration span gas is now flowing into the unit. Let the gas flow for a minimum of 1 minute. After one minute, the reading should be stabilized.
Place the magnet on top of Menu. Then place it above Up or Down Arrow until the password VA is reached.
Place the magnet on top of Menu to acknowledge.
Place the magnet on top of Up or Down Arrow until the Set Span field is reached.
Place the magnet on top of Menu to acknowledge.
Place the magnet on top of Up or Down Arrow to select the proper gas value.

The proper span gas value equals the 20% LEL CH4 multiplied by the sensitivity factor related to the target gas. See appendix for related factor. (verify calibration gas concentration label).
Example: Propane's sensitivity factor is 1.883. The span gas value is 20% * 1.883 = 37.7%

Once the span gas value is selected, place the magnet on top of Menu to acknowledge.
Place the magnet on top of Menu to activate GoCalib.
Once this field is selected, place the magnet on top of Menu to acknowledge.
Wait message appears, the transmitter will go into auto calibration mode and will indicate a gas concentration.
When the Menu Set Span message appears, the calibration is complete.
Place the magnet on top of Up or Down Arrow until the Quit field is reached.
Place the magnet on top of Menu to confirm.



TROUBLESHOOTING

Fault Displayed	Possible Cause	Solution
NO SENSOR CONNECT	-The sensor connector (J2) has been disconnected	-Insert the connector (J2) on the unit's bottom card
	-The remote sensor hasn't been connected	-Make the junction inside the junction box
	-Any other cause	-Reset the unit or replace the sensor housing
SENSOR??	-The sensor board has been removed	-Replace the sensor board and reset the unit
	-Any other cause	-Reset the unit or replace the sensor board
FAILSENS	-The sensor board has been removed	-Replace the sensor board and reset the unit
	-Calibration has been performed without gas or with a wrong span gas value	-Reset the unit, then it takes the previous setting before calibration
	-Any other cause	-Reset the unit or replace the sensor board
NOTCALIB	-Unit hasn't been calibrated	-Calibrate the zero then the span

