Critical Environment Technologies™

"PET" Series

BACnet digital transmitters

Single sensor

Dual sensor

REV: B April 20 - 2011

INSTALLATION / OPERATION MANUAL

Unit 145, 7391 Vantage Way
Delta, BC V4G 1M 3 Canada
Phone: 604-940-8741 Fax: 604-940-8745 Toll: 1-877-940-8741
www.critical-environment.com

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1.0 INTRODUCTION

The PET series transmitters are reliable, user-friendly, digital transmitter gas detectors for use in non-hazardous (non-explosion rated) environments for commercial HVAC and light industrial use. They can be configured for either electrochemical toxic gas sensors, electrochemical Oxygen sensors or semi-conductor (solid-state) sensors for combustibles, refrigerants or TVOCs. PET transmitters provide a digital **BACnet** signal output and will communicate with other true **BACnet** devices. The PET is BTL lab tested and certified.

A standard transmitter provides a tri-colour LED indicating light for power, fault condition, gas alarm condition and calibration status. An LED digital display is the only currently available option. Water tight enclosures are being developed for future applications.

A selection of electrochemical toxic gas sensors, Oxygen sensor, combustible gas, refrigerant gas or TVOC gas sensors are available for use with this gas detector. The sensors utilized in this device are accurate enough to measure to Occupational Health & Safety hazardous levels for toxic gases and Oxygen levels.

The PET is available in several configurations. The PET digital transmitters operate by diffusion mode only.

2.0 BACnet TRANSMITTER SPECIFICATIONS

Physical:	Standard ABS plastic enclosure:	
	a) Dimensions: 6.5” (165 mm) wide X 4.43” (113 mm) high X 2.54” (65 mm) deep	
	b) Weight: 20 ounces	
	Optional water / dust tight enclosure: Not yet available	
Power:	16VDC to 30VDC	
Current draw:	80 to 120 mA (depending upon options selected)	
Indicators:	a) One tri-colour LED: Green = power, Red = alarm, Flashing Red = Fail (external)	
Options:	LED digital display (3.5 digits)	
Communication:	ANSI/ASHRAE standard 135 BACnet communication protocol: 135-2007	
MAC Addressing:	On-board DIP switch is used to set the MAC address. The valid address is from 1 to 127	
LED:	Indication	Description
	ON	Powered without communication activity
	Quick Flashing (less than 50ms interval)	Active receive/transmit data over MS/TP
	OFF 1/2 second then ON:	Jumper changing
	Slow Flashing (1-second interval)	Configuration mode (J1 & J2 set to PC) or failed communication to main board
Baud Rate:	9600, 19200, 38400, 76800 bps on-board jumper selectable	

2.1 PET CONFIGURATIONS

1) Single integral electrochemical sensor outputting real-time gas and temperature readings.

2) Dual integral electrochemical sensors outputting real-time gas and temperature readings.

3) Single integral solid-state sensor outputting real-time gas and temperature readings.

4) Single with remote solid-state sensor outputting real-time gas and temperature readings.

5) Single channel PET as a controller accepting 4-20 mA analog “input” from a remote device. This PET version accepts 4-20 mA input and converts it to BACnet. This is useful for sensors not available in a BACnet configuration package such as infrared CO2.

2.1.1 MODEL NUMBER EXAMPLES

PET-TCO: Single with integral, electrochemical CO sensor

PET-TCO-END: Dual with integral, electrochemical CO and NO2 sensor

PET-SR2: Single with integral, solid-state sensor for refrigerants (specify refrigerant when ordering)

PET-SR2-R: Single with remote, solid-state refrigerant gas sensor (specify target gas when ordering)

PET-SCB: Single with integral, solid-state combustible gas sensor (specify target gas when ordering)

PET-SCB-R: Single with remote, solid-state combustible gas sensor (specify target gas when ordering)

PET-SCB-A Dual with integral solid-state combustible sensor plus 4-20 mA input activated for remote analog transmitter (specify gas type for remote analog transmitter when ordering).

PET-SR2-A Dual with integral solid-state refrigerant sensor plus 4-20 mA input activated for remote analog transmitter (specify gas type for remote analog transmitter when ordering).

2.2 SENSORS - SPECIFICATIONS

SENSOR GAS TYPE	STD. RANGE	LIFE SPAN ESTIM.	RESO-LUTION	OPER. TEMP.	OPER. RH	RE-SPONSE TIME	WARM UP TIME
Ammonia (NH3)	0-500 ppm	2 years	1-2 ppm	-40 to +50 deg. C (temp drift occurs)	15-90% Non-condensing	T_{90} <90 seconds	2-6 hours
Combustible (solid-state sensor)	0 - 50% LEL	5 to 8 years	1% LEL	-20 to +40 deg. C.	15-90% Non-condensing	T_{90} <60 seconds	2-3 hours after power up
Carbon Monoxide (CO)	0-200 ppm	5-8 years	1 ppm, 3 ppm without regular cal.	-20 to +50 Deg. C.	10-95% Non-condensing	T_{90} <2 minutes	1 hour minimum
Ethylene (C2H4)	0-200 ppm	2 years	0.5 ppm	-20 to +50 deg. C.	15-90% Non-condensing	T_{80} <60 seconds	2 hours
Formalde-hyde (HCHO)	0-10 ppm	2 years	0.02 ppm	-20 to +50 deg. C.	15-90% Non-condensing	N.D.	20-minutes
Hydrogen (H2)	0-2000 ppm	2-3 years	1 ppm	-20 to +50 deg. C.	15-90% Non-condensing	T_{90} <30 seconds	2 hours
Nitric Oxide (NO)	0-100 ppm	3 years	1 ppm	-30 to +50 deg. C.	15-90% Non-condensing	T_{90} <20 seconds from 0 to 50 ppm	1-2 hours
Nitrogen Dioxide (NO2)	0-5.0 ppm	3 years	0.1 ppm	-30 to +50 deg. C.	15-90% Non-condensing	T_{90} <60 seconds from 0 to 10 ppm	1-2 hours
Sulphur Dioxide (SO2)	0-20 ppm	2 years	1 ppm	-30 to +50 deg. C.	15-90% Non-condensing	T_{90} <30 seconds from 0 to 20 ppm	2 hours
Oxygen (O2)	0-25.0% Volume	2 years	0.1% Vol.	-30 to +50 deg. C.	5-95% Non-condensing	T_{90} <15 seconds from 20.9%to 0%	1 hour minimum
Refrigerants (solid-state sensor)	0 - 2000 ppm	3 to 5 years	1 ppm	-20 to +40 deg. C.	15-90% Non-condensing	T_{90} <120 seconds	2-3 hours after power up
TVOCs	0-500 ppm	5 + years	1 ppm	-20 to +40 deg. C.	15-90% Non-condensing	T_{90} <60 seconds	2-3 hours after power up

NOTE: Sensors for other gases may be available in the future. Contact factory for more information.

2.3 SENSOR CROSS SENSITIVITIES

GAS	CROSS SENSITIVITY
Ammonia (NH3)	300 ppm CO=8, 15 ppm H2S=30, 5 ppm SO2=-0.5, 35 ppm NO=6, 5 ppm NO2=-1, 10% volume CO2=-15, 1 ppm CL2=-1, 200 ppm H2=4, 5 ppm HCl=-3
Combustible (solid-state sensor)	All vapourizing flammable gases & vapours. Many toxic gases in high concentrations
Carbon Monoxide (CO)	15 ppm H2=50, 5 ppm SO2=4, 35 ppm NO=27, 1 ppm Cl2= -1, 100 ppm H2=60, 5 ppm N02= -2
Ethylene	CO = <60% (performance conditions: 20C, 50% RH, 1013 mbar)
Formaldehyde (HCHO)	1% to 3% H2, 10% to 18% alcohol, reducing gases such as alcohol
Hydrogen	300 ppm CO=<3, 15 ppm H2S=<3, 35 ppm NO=10, 10 ppm HCN=3, 100 ppmEthylene=80
Nitric Oxide	10 ppm NO2=<5, 20 ppm SO2=<4, 10 ppm Cl2=<5, 400 ppm H2=<0.1, 20 ppm H2S=<60, 400 ppm CO=<0.1, 20 ppm NH3=<0.1,
Nitrogen Dioxide	50 ppm NO=<0.5, 20 ppm SO2=<-2, 10 PPM Cl2=100, 400 ppm H2=<0.1, 20 ppm H2S=-100, 400 ppm CO=<0.1, 400 ppm C2H4=<0.1, 20 ppm NH3=<0.1
Sulphur Dioxide	50 ppm NO=<-3, 10 ppm NO2=<-100, 10 ppm Cl2=<-70, 400 ppm H2=<0.1, 400 ppm CO=<1, 400 ppm C2H4=<40, 20 ppm NH3=<0.1
Oxygen	5% volume CO2=0.1, 0% to 95% rh @ 40 deg.C =<0.7
Refrigerants (solid-state sensor)	Any vapourizing toxic and flammable gases & vapours in mid to high concentrations
TVOCs	Any vapourizing toxic and flammable gases & vapours in mid to high concentrations

3.0 BACnet PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT

Last modified March, 2011

Vendor Name: Critical Environment Technologies Canada Inc.

Product Name: PET (Parkade Emissions Transmitter)

Application Software Version: CET-PET 1.0

Product Model Number: PET-XXX, PET-XXX-N, PET-XXX-XXX, PET-XXX-XXX-N

Firmware Revision: 1.3

BACnet Protocol Version: 1

BACnet Protocol Revision: 5

3.0 BACnet PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT

Product Description:
The Parkade Emissions Transmitter (PET) is a gas detector/transmitter. It will contain one channel of gas data, another channel for temperature, and optionally a third channel containing a second gas reading. In terms of the BACnet protocol it is an end device.

BACnet Standardized Device Profile (Annex L):
_ BACnet Operator Workstation (B-OWS)
_ BACnet Building Controller (B-BC)
_ BACnet Advanced Application Controller (B-AAC)
_ BACnet Application Specific Controller (B-ASC)
X BACnet Smart Sensor (B-SS)
_ BACnet Smart Actuator (B-SA)

BACnet Interoperability Building Blocks Supported (Annex K):
BIBB-Data Sharing-Read Property-B (DS-RP-B)
BIBB-Data Sharing-Write Property-B (DS-WP-B)
BIBB-Device Management-Dynamic Device Binding-B (DM-DDB-B)
BIBB- Device Management-Dynamic Object Binding-B (DM-DOB-B)

Segmentation Capability:
_ Segmented requests supported Window Size
_ Segmented responses supported Window Size

Standard Object Types Supported:
Device Object
Analog Input Object

Data Link Layer Options:
_ BACnet IP, (Annex J)
_ BACnet IP, (Annex J), Foreign Device
_ ISO 8802-3, Ethernet (Clause 7)
_ ANSI/ATA 878.1, 2.5 Mb. ARCNET (Clause 8)
_ ANSI/ATA 878.1, RS-485 ARCNET (Clause 8), baud rate(s)
X MS/TP master (Clause 9), baud rate(s): 9,600, 19,200, 38,400, 76,800.
_ MS/TP slave (Clause 9), baud rate(s):
_ Point-To-Point, EIA 232 (Clause 10), baud rate(s):
_ Point-To-Point, modem, (Clause 10), baud rate(s):
_ LonTalk, (Clause 11), medium: _____
_ Other:

3.0 BACnet PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT

Device Address Binding:
Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.) _Yes **X** No

Networking Options:
_ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.
_ Annex H, BACnet Tunneling Router over IP
_ BACnet/IP Broadcast Management Device (BBMD)
Does the BBMD support registrations by Foreign Devices? _ Yes _ No

Character Sets Supported

X ANSI X3.4	_ IBM/Microsoft DBCS	_ ISO 8859-1
_ ISO 10646 (UCS-2)	_ ISO 10646 (UCS-4)	_ JIS C 6226

Objects Supported

Object	Description	Creatable	Deletable
Device	Analog Transmitter	False	False
Analog Input	Analog input for gas concentration and site temperature	False	False

Service Supported

Service	Description	Initiate	Execute
Read Property	Contain readable properties	False	True
Write Property	Contain Writable properties	False	True
Who-Is	Response to Who-Is request	False	True
I-Am	Broadcast unconfirmed I-Am request	True	False
Who-Has	Response to Who-Has request	False	True
I-Have	Broadcast unconfirmed I-Have request	True	False

3.0 BACnet PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT

Property List of Objects

Device:

Property	Access	Default Value	Confor-mance Code
Object Identifier	Read	changeable by SW, eg. 270007	Required
Object Name	Read	Eg. PET1009B00001	Required
Object Type	Read	Device	Required
System Status	Read	Normal	Required
Vendor Name	Read	CET	Required
Vendor Identifier	Read	270	Required
Model Name	Read, Write	PET-ECO-END	Required
Firmware Revision	Read	1.0	Required
Application Software Ver-sion	Read	CET-PET-1.0	Required
Protocol Version	Read	1	Required
Protocol Revision	Read	5	Required
Protocol Service Supported	Read	Refer to Supported Services	Required
Protocol Object Types Sup-ported	Read	Refer to Supported Objects	Required
Object List	Read	Refer to Supported Objects	Required
Maximum APDU Length Accepted	Read	206	Required
Segmentation Supported	Read	No	Required
APDU Timeout	Read, Write	6000, [100, 60000]	Required
Number of APDU Retries	Read	0	Required
Maximum Master	Read, Write	127, [1, 127]	Required
Maximum Information Frames	Read	1	Required
Device Address Binding	Read	NULL	Required
Database Revision	Read	1	Required
Description	Read, Write	ANALOG TRSMTR	Optional
Location	Read, Write	CANADA	Optional

3.0 BACnet PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT

Analog Input 1:

Property	Access	Default Value	Confor-mance Code
Object Identifier	Read	1	Required
Object Name	Read	[gas type], e.g. CO	Required
Object Type	Read	Analog-Input	Required
Present Value	Read	NA	Required
Status Flag	Read	NA	Required
Event State	Read	Normal	Required
Out of Service	Read	False	Required
Unit	Read	Based on gas type, (e.g. ppm)	Required
Description	Read	Analog Input	Optional
Minimum Present Value	Read	Based on gas type (e.g. 0)	Optional
Maximum Present Value	Read	Based on gas type (e.g. 200)	Optional

Analog Input 2 (only available if a second sensor is used)

Property	Access	Default Value	Conformance Code
Object Identifier	Read	2	Required
Object Name	Read	[gas type], e.g. NO2-A1	Required
Object Type	Read	Analog-Input	Required
Present Value	Read	NA	Required
Status Flag	Read	NA	Required
Event State	Read	Normal	Required
Out of Service	Read	False	Required
Unit	Read	Based on gas type (e.g. ppm)	Required
Description	Read	Analog Input	Optional
Minimum Present Value	Read	Based on gas type (e.g. 0.0)	Optional
Maximum Present Value	Read	Based on gas type (e.g. 10.0)	Optional

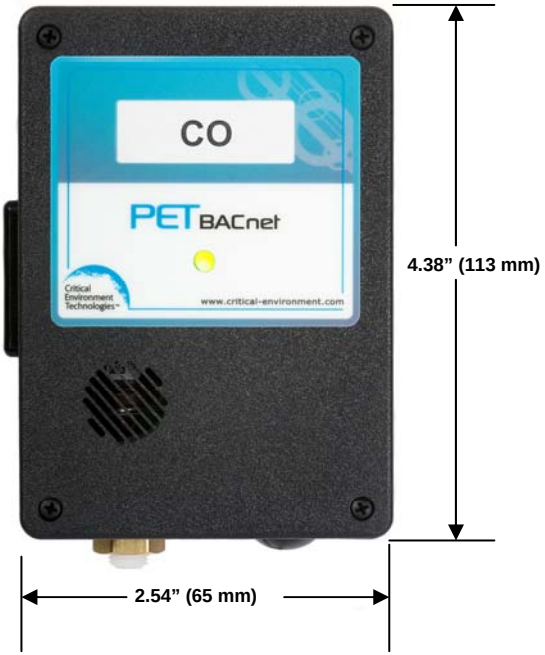
3.0 BACnet PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT

Analog Input 3:

Property	Access	Default Value	Conformance Code
Object Identifier	Read	3	Required
Object Name	Read	Temperature	Required
Object Type	Read	Analog-Input	Required
Present Value	Read	NA	Required
Status Flag	Read	NA	Required
Event State	Read	NA	Required
Out of Service	Read	False	Required
Unit	Read	Celsius	Required
Description	Read	Temperature	Optional
Minimum Present Value	Read	(e.g. - 55)	Optional
Maximum Present Value	Read	(e.g. - 125)	Optional

Note: Reference BTL lab device listing web page:
http://www.bacnetinternational.net/catalog/index.php?m=81&p=481

4.0 SINGLE-SENSOR ABS GENERAL PURPOSE ENCLOSURE



SINGLE-SENSOR UNIT WITHOUT DIGITAL DISPLAY

PHOTO-1

4.0 SINGLE-SENSOR ABS GENERAL PURPOSE ENCLOSURE

SINGLE-SENSOR UNIT WITH DIGITAL DISPLAY

PHOTO-2

SINGLE-SENSOR UNIT BOTTOM VIEW

PHOTO-3

4.38” (113 mm)

4.1 DUAL-SENSOR ABS GENERAL PURPOSE ENCLOSURE

PHOTO-4

DUAL-SENSOR UNIT
WITHOUT DIGITAL DISPLAY

DUAL-SENSOR UNIT
BOTTOM VIEW

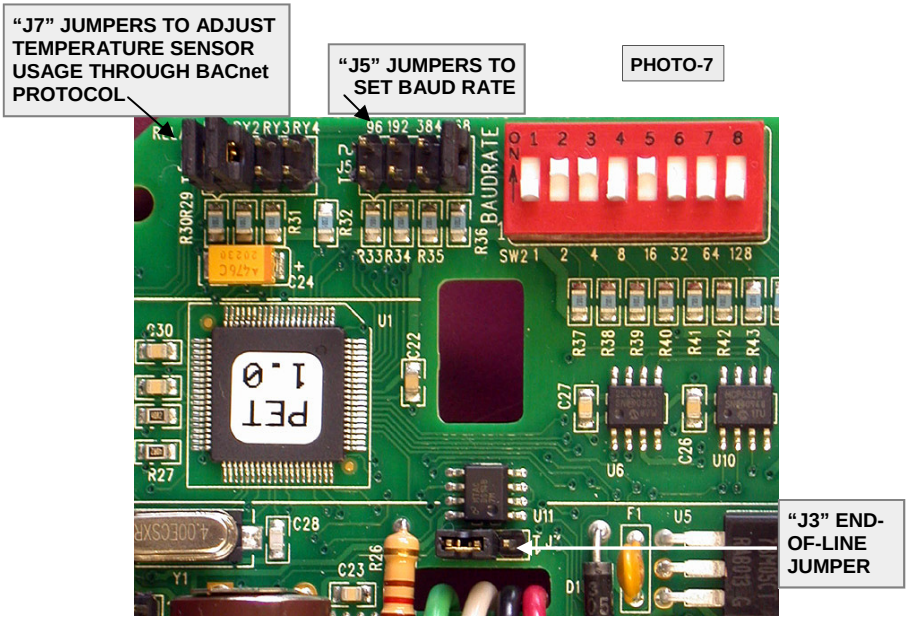
PHOTO-5

4.38” (113 mm)

PHOTO-6

DUAL-SENSOR UNIT
WITH DIGITAL DISPLAY

5.0 JUMPER SETTINGS



5.1 JUMPER CONFIGURATION FOR PET

J3
RS485 end-of-line jumper
Positions 1 & 2: Resting position
Positions 2 & 3: End-of-line activated

J5
Baud Rate configuration, use JUMPER at
1 – 9600
2 – 19200
3 – 38400
4 – 76800

J7
J7-1 (RY1) is used to indicate whether temperature is shown on BACnet controller interface.
Jumper installed – temperature value not sent to BACnet controller
Jumper removed – sends temperature value to BACnet controller

J7 – 2 (RY2) is used to indicate whether temperature is shown on local 7-segment LED display
Jumper installed – No temperature value is indicated on 7-segment LED display
Jumper removed – Temperature value indicated on 7-segment LED display

Note: J7-3 & J7-4 are not used

5.2 DIP SWITCHS FOR MAC ADDRESS

SW2 for MAC address configuration

PIN 1 to PIN 7 on SW2 is used to configure MAC address of a PET device. The MAC address is from 0 to 127. PIN 1 represents the least significant bit (LSb), and PIN 7 represents the most significant bit (MSb) in the MAC address. If switch is at OFF (bottom) side, it means 0 in the corresponding bit of a MAC address. If the switch is at ON (Up) side, the corresponding bit in MAC address is 1. For example, the following configuration represents MAC address is 5

PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
ON	OFF	ON	OFF	OFF	OFF	OFF

6.0 INSTALLATION

The PET should be installed on a flat vertical surface with the sensor pointing outwards in a clean, dry, ambient environment. If the PET is to be installed in a potentially wet environment, the optional water tight enclosure should have been selected (NOT YET AVAILABLE. CONSULT FACTORY). This reference refers to the standard, general purpose ABS enclosure. Four 3/16" (4.8mm) diameter mounting holes are provided in the enclosure base for securing the PET to the wall. Do not block the front of the enclosure as this is where the sensor is situated and where it monitors the air for the target gas. It monitors by diffusion.

The PET is designed to be installed on any standard electrical junction box. Reference photos on following pages. No conduit entry points are provided for the standard enclosure. The reason is the conduit entry knock outs are typically in all standard electrical junction boxes.

The cover of the general purpose ABS enclosure can be easily removed to facilitate installation of the base. First remove the four securing screws being careful not to lose them. The circuit board has two small rectangular slots at the centre top and centre bottom areas allowing access to insert two installation screws and tighten them to secure the PET to the electrical junction box. All wiring connections protrude outside of the rear of the PET enclosure. Installers wiring can be easily connected using wire nuts. Reference photo-7 on the following page.

6.1 MOUNTING HEIGHTS

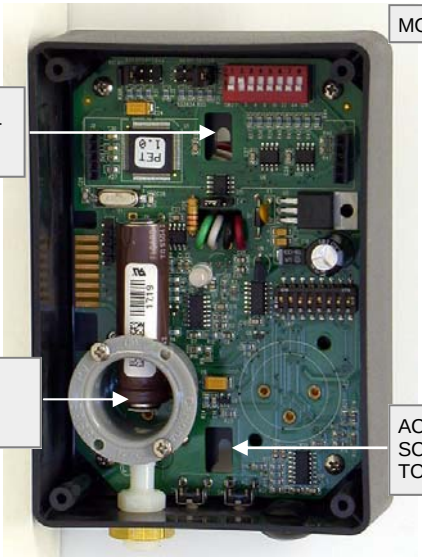
Sensors for vehicle exhaust applications should be installed in the "Breathing Zone", 4' to 6' from the floor. This includes CO, NO2, O2 and NO sensors.

Sensors for lighter-than-air gases such as Methane (Natural Gas CH4), Hydrogen (H2) & Ammonia should be installed on or near the ceiling.

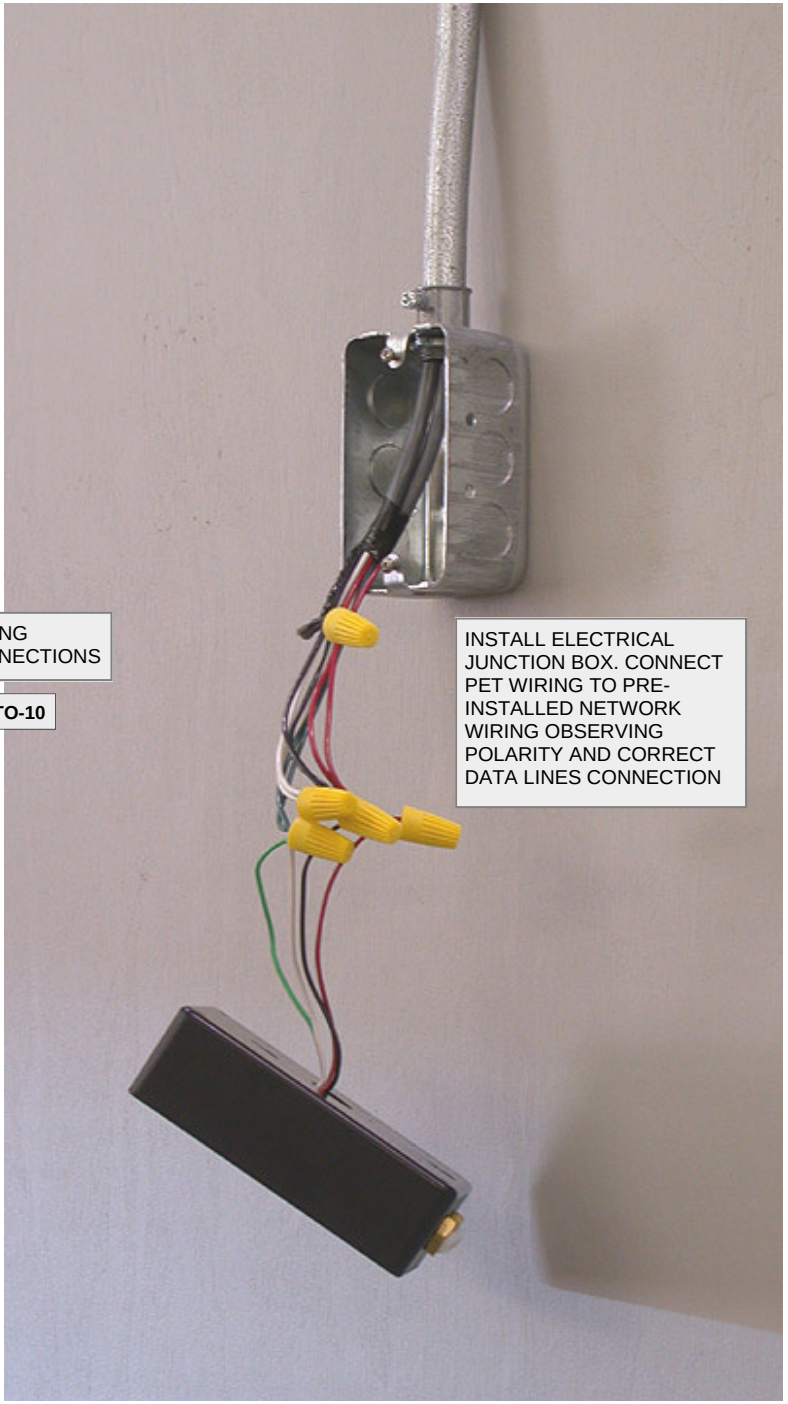
Sensors for heavier-than-air gases such as Propane (C3H8), Sulphur Dioxide (SO2), Refrigerants & TVOCs should be installed at 6" (Propane, TVOCs) to 12" (Refrigerants, SO2) from the floor.

NOTE: If the area to be monitored is a wet environment, water tight enclosures should be used. NOT YET AVAILABLE. CONSULT FACTORY.

6.2 MOUNTING REFERENCE PHOTO



6.3 INSTALLATION EXAMPLE-1



WIRING CONNECTIONS

PHOTO-10

INSTALL ELECTRICAL JUNCTION BOX. CONNECT PET WIRING TO PRE-INSTALLED NETWORK WIRING OBSERVING POLARITY AND CORRECT DATA LINES CONNECTION

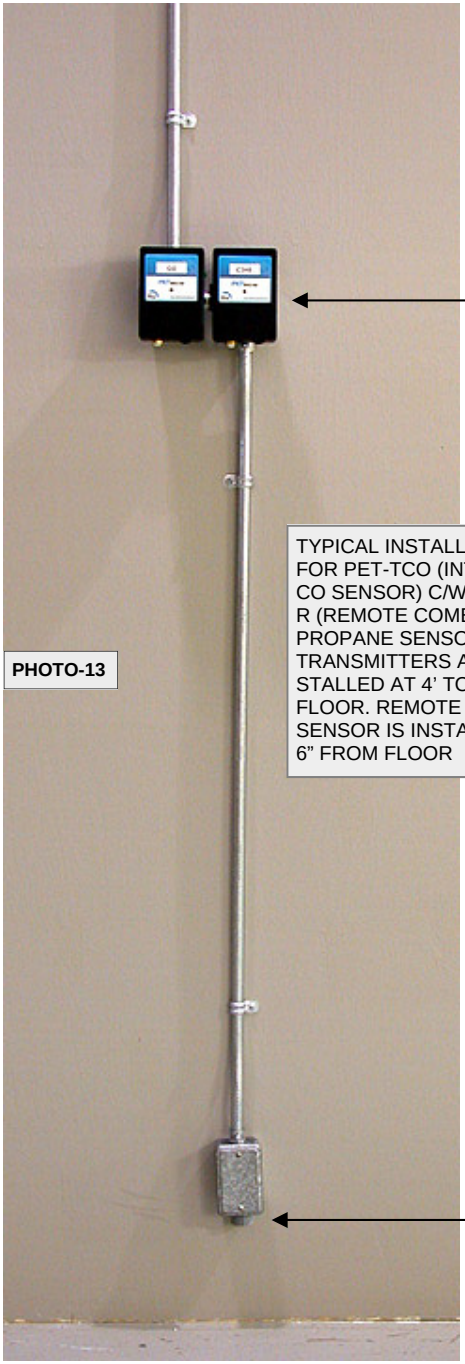
6.3 INSTALLATION EXAMPLE-2

PHOTO-11

ATTACH PET TO ELECTRICAL JUNCTION BOX. REFERENCE PHOTO ON PAGE-21 FOR ACCESS HOLES. MODEL SHOWN HERE IS PET-TCO-END DUAL MONITORING FOR GAS ENGINE AND DIESEL ENGINE EXHAUST

PHOTO-12

6.3 INSTALLATION EXAMPLE-3

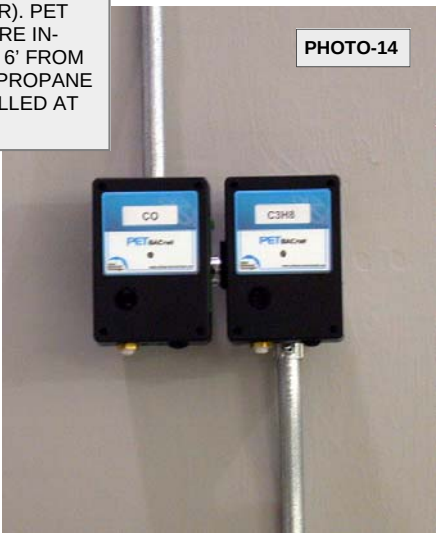


INSTALLATION HEIGHT: 4’ TO 6’ FROM FLOOR

TYPICAL INSTALLATION FOR PET-TCO (INTEGRAL CO SENSOR) C/W PET-SCB-R (REMOTE COMBUSTIBLE PROPANE SENSOR). PET TRANSMITTERS ARE IN-STALLED AT 4’ TO 6’ FROM FLOOR. REMOTE PROPANE SENSOR IS INSTALLED AT 6” FROM FLOOR

PHOTO-13

PHOTO-14



INSTALLATION HEIGHT: 6” FROM FLOOR

6.3 INSTALLATION EXAMPLE-4

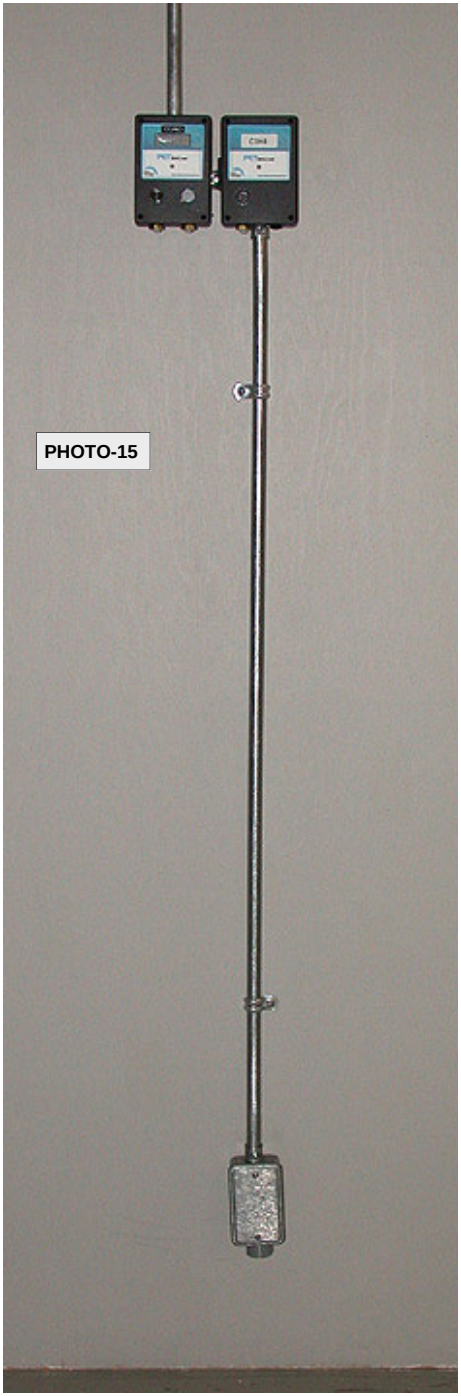


PHOTO-15

TYPICAL INSTALLATION FOR PET-TCO-END-N (INTEGRAL CO & NO2 SENSOR WITH OPTIONAL DIGITAL DISPLAY) C/W PET-SCB-R (REMOTE COMBUSTIBLE PROPANE SENSOR). PET TRANSMITTERS ARE INSTALLED AT 4' TO 6' FROM FLOOR. REMOTE PROPANE SENSOR IS INSTALLED AT 6" FROM FLOOR.

THIS INSTALLATION PROVIDES MONITORING FOR GAS ENGINE AND DIESEL ENGINE EXHAUST AS WELL AS PROPANE OR GASOLINE FUEL LEAKING FROM VEHICLE FUEL TANKS.

PHOTO-16

PHOTO-17

7.0 WIRING THE TRANSMITTER

The installer should provide 4-conductor, shielded wire or cable suitable for use in a RS-485 network wiring system. Wiring must be “daisy-chain” network style wiring with four wires in and four wires out to the next device.

The PET series BACnet transmitter is a low voltage powered device. Any application of operating voltages higher than indicated in the specification may result in damage. Double check wiring connections prior to powering the transmitter. Damage from incorrect wiring connections or from too much voltage applied are not covered under warranty.

The PET solid-state version is capable of working with a remote solid-state sensor as an alternative to an integral sensor. This is useful for applications such as heavier-than-air gases such as Propane. The PET can be installed at 4’ to 6’ from the floor then the installer drops a short length of conduit and wire to a second junction box mounted at 6” from the floor with the remote sensor installed in the bottom.

The last configuration is the PET solid-state version which accepts a 4-20 mA analog signal from a remote device and converts it to BACnet. The remote device can be any analog transmitter for any gas with a 4-20 mA output. It can be installed beside the PET or a considerable distance from the PET. Wiring consists of 3-conductor, shielded wire or cable between the remote analog transmitter and the PET. The wiring from the analog device enters the same junction box that the PET is mounted on through an unused knockout. Wiring connection is at the rear of the PET as it is with the BACnet wiring.

Installation

PET needs to be powered by a 24VDC (500mA) power supply. There are four wires behind the external case. Red wire is 24VDC, and black wire is ground. White wire and green wires are for the BACnet/MSTP communication, where white wire is SIG+ and green wire is SIG- in RS-485.

Remote sensor

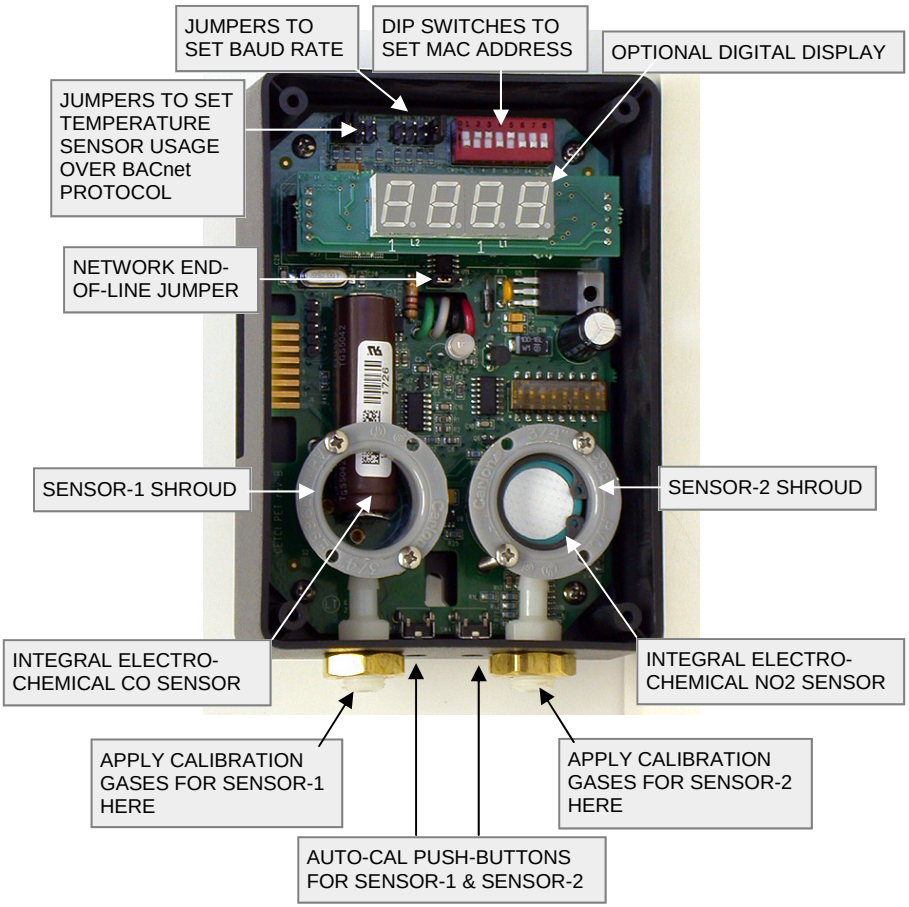
On PET solid state version with remote sensor there will be an additional three wires behind the external case. White with red strip is 5 Vdc to sensor and White with black strip is ground and White with yellow strip is Signal.

Remote 4-20 mA transmitter

On PET 4-20 mA version with remote transmitter there will be an additional three wires behind the external case. White with orange strip is 24 Vdc to transmitter and White with brown strip is ground and White with blue strip is Signal.

8.0 GENERAL PURPOSE SINGLE-SENSOR ENCLOSURE INTERIOR

8.1 GENERAL PURPOSE DUAL-SENSOR ENCLOSURE INTERIOR



DUAL-SENSOR UNIT WITH DIGITAL DISPLAY

PHOTO-18

9.0 TRANSMITTER OPERATION

LED Module

PET uses a tri-color LED to indicate the status of the unit. The status of PET unit is classified into measurement status and calibration status. In measurement status, a constant GREEN LED indicates the PET unit is in measurement status, and the measurement reading values are within the normal range. The RED LED represents the measurement of one or both channels and is either less than its low alarm or higher than its high alarm.

When the unit is powered up, it will take a few minutes to warm up the sensors. In the warming-up process, the LED FLASHES green. If an LED digital display is present, the decimal point for the display will flash along with the LED. The warm up time period varies according to sensor. The list below provides warm up times for each sensor.

The sequence of displayed information is: Start -> Temperature unit -> Temperature value -> unit of first sensor -> reading of first sensor -> unit of the second sensor -> reading of the second sensor -> Start

The display of unit lasts 1 second, and the display of gas value reading lasts 2 seconds.

Sensors

Electrochemical: These sensors are quite gas specific but will respond to some other gases. Refer to the sensor table for more details on cross sensitive gases. The PET main circuit board provides temperature compensation to reduce some of the drift in environments where the temperature changes regularly.

Oxygen: These sensors are gas specific and typically will not respond to anything but Oxygen and Nitrogen (zeroing gas).

All sensors require a warm up and stabilization time after installation. Do not perform any calibration functions until the sensors have been operating for at least 24 hours. When any transmitter has been shipped from our factory, a standard initial warm up time has been programmed into each one. The initial warm up is signified to the user by the flashing green LED or in the case of a device supplied with a local display, the scrolling decimal point. The standard ***warm up times*** are as follows:

Ammonia (NH3): 5-minutes , Combustibles: 3-minutes, Carbon Monoxide (CO): 2-minutes, Ethylene: 3-minutes, Formaldehyde (HCHO): 5-minutes, Hydrogen (H2): 3-minutes, Nitric Oxide (NO): 3-minutes, Nitrogen Dioxide (NO2): 5-minutes, Sulphur Dioxide (SO2): 3-minutes, Oxygen (O2): 5-minutes, Refrigerants: 5-minutes, TVOCs: 5-minutes.

10.0 CALIBRATION SPECIFICATIONS

Equipment required to perform calibration:

Calibration kit consisting of:

1) Fixed flow regulator
2) Length of gas tubing with attached calibration adapter
3) Nulling gas: Cylinder of zero air or nitrogen N2
4) Span Gas: factory specified concentration of target gas rated +/- 5% accuracy with air Balance for all Combustibles and Refrigerant or Nitrogen balance for Electrochemical.

10.0 CALIBRATION SPECIFICATIONS

Regulators & Flow: Calibration gases should be flowed at 0.5 to 0.7 LPM. Fixed flow regulators provide more accuracy. Zero air and span gases should be flowed over the sensor for a specific amount of time. Refer to list on page-27 for span gas flow times. The system warm up time delays are the same time periods for flowing span gas. All cylinder regulators supplied by CETCI use a fixed flow orifice rated 0.5 LPM. The proper calibration adapter should be utilized to allow the gas to properly diffuse around the sensor. They are available from CETCI.

Gas: Calibration span gases should be at least +/- 5% accuracy and have a current date stamp. Gas generators should have a current dated cell installed. Service personnel should flow zero emissions air or Oxygen (20.9% volume) before attempting to null adjust toxic gas sensors. Nitrogen (N2) can be substituted for zero air for most electrochemical sensors and is required to null (zero) an Oxygen sensor. Do not use Nitrogen (N2) to null adjust a solid-state combustible, refrigerant or TVOC sensor. Zero air just be used for all solid-state sensors.

Span gas values are specified by CETCI and are generally about 50% of sensor range. Example: CO sensor have a standard range of 0-200 ppm and CETCI has set the Span gas concentration to 100 ppm. Reference the table on the page-30 for default factory span gas values. If you must change the span gas value to conform to cylinders of gas that you already have, then you will require our interface cable and software utility program. A notebook computer will be required to perform this function.

Calibration frequency: For best performance and to ensure the sensor meets the published specifications, all electrochemical sensors should be calibrated every six months. All solid-state sensors should be calibrated every twelve months. The sensors may not perform to the published specifications if they are not maintained regularly.

Bump testing sensors every one to three months is a good safety procedure to ensure sensors are still responding properly. When bump testing Ammonia sensors use 50 ppm or slightly less so as not to damage the sensor.

10.1 CALIBRATION PROCEDURE

Ensure the PET has been powered up for at least 24 hours so that the sensor(s) are warmed up and acclimatized to their environment.

Flow zero air over the sensor for approximately 2 minutes. Some sensors, such as Carbon Monoxide stabilize more quickly than other gas sensors. For example, Ammonia, Nitrogen Dioxide, Ozone and Chlorine sensors will require that the zero air is applied for longer than 2 minutes.

Press the correct push-button for zeroing the sensor. The left push-button is used to calibrate sensor 1 and the right push-button is used to calibrate sensor 2. If the PET sees clean air the LED flashes green indicating the zero is successful and span gas can be applied.

If instead the front LED turns red this indicates the PET is seeing trace amounts of gas or the sensor has drifted over time. The zero calibration can be forced by pressing and holding the push-button for 5 seconds. THIS SHOULD ONLY BE DONE IF YOU ARE CONFIDENT THAT THE UNIT IS IN CLEAN AIR AND THAT THE SENSOR IS NOT EXPOSED TO ANY OF THE TARGET (SPAN) GAS.

10.1 CALIBRATION PROCEDURE

If you are not confident that the zero failure should be overridden then the calibration will automatically abort after 30 seconds.

When the PET recognizes that span gas is being applied, the LED will begin to flash with an amber color. After the span time-out has occurred, the LED changes back to green and the span value is saved. Note that if the span gas concentration is high enough, the PET may quickly change the LED color to a steady red, to indicate alarm. This is normal and removing the span gas will cause the LED to return to green again.

Note: Because each type of sensor has a different response time to gas exposure, each type of sensor has a specific span gas flow time programmed at the factory. These times are indicated in the table below. These different times are necessary to accomplish a proper span calibration.

If during the span calibration of the PET a problem occurs (the span gas is removed, or the sensor output does not change as expected) the PET will start to flash the red LED for 10 seconds, and will then automatically abort the span calibration.

The calibration procedure can be repeated as many times as is required to get a successful result. However, you should wait at least 20 minutes in between attempts to calibrate the PET transmitter.

7-segment LED display: After a PET device is powered on there is a warm up time before readings are displayed. The warm-up time is sensor dependent. Some sensors will exit the warm up more quickly than others. During the warm up time a series of dots will scroll along the bottom of the display. Once the warm up is complete, the display will show information about the sensors and their readings. During calibrations the display will show which channel is being calibrated and the gas type (e.g. CAL 1 CO), but will not display any concentration values.

SENSORS	CHEMICAL SYMBOLS	SPAN GAS FLOW TIMES
Ammonia	NH3	5 - minutes
Combustibles	Eg. CH4, C3H8, etc.	3 - minutes
Carbon Monoxide	CO	2 - minutes
Ethylene	C2H4	3 - minutes
Formaldehyde	HCHO	5 - minutes
Hydrogen	H2	3 - minutes
Nitric Oxide	NO	3 - minutes
Nitrogen Dioxide	NO2	5 - minutes
Sulphur Dioxide	SO2	3 - minutes
Oxygen	O2	5 - minutes
Refrigerants	R134A, R405, etc.	5 - minutes
TVOCs	Hundreds of compounds	5 - minutes

10.2 FACTORY DEFAULT SPAN GAS VALUES FOR CALIBRATION

SENSOR	SPAN GAS VALUE	SENSOR RANGE
Ammonia	300 ppm N2 balance	0-500 ppm
Combustibles	20% LEL air balance	0-50% LEL
Carbon Monoxide	100 ppm N2balance	0-200 ppm
Ethylene	100 ppm air balance	0-200 ppm
Formaldehyde	50 ppm CO N2 balance correlates to 7 ppm	0-10 ppm
Hydrogen	1000 ppm air balance	0-2000 ppm
Nitric Oxide	50 ppm N2 balance	0-100 ppm
Nitrogen Dioxide	5 ppm N2 balance	0-10.0 ppm
Sulphur Dioxide	10 ppm N2 balance	0-20 ppm
Oxygen	20.9% volume N2 balance	0-25.0% volume
Refrigerants	1000 ppm air balance	0-2000 ppm
TVOCs	100 ppm Isobutylene air balance	0-500 ppm

10.3 ALTERNATIVE FOR CHANGING SPAN GAS VALUES FOR CALIBRATION

Purchase a special interface cable and utility program from CETCI which allows you to use your pc to change the span gas value and perform basic calibration functions such as null and span.

11.0 ACCESSORIES

METAL PROTECTIVE GUARDS

PET transmitters are all supplied in rugged, non-metallic enclosures. However, in some applications more protection may be desired. CETCI can provide protective guards made from 16 gauge galvanized metal with a pattern of square perforations to permit air and gas to diffuse easily to the sensor. The slotted mounting holes allow for easy removal for service access.

PHOTO-19