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LPT-A

Analog Transmitter

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1 POLICIES

1.1 Important Note

Read and understand this manual prior to using this instrument. Carefully read the warranty policy, service policy, notices, disclaimers and revisions on the following pages.

This product must be installed by a qualified electrician or factory trained technician and according to instructions indicated in this manual. This instrument should be inspected and calibrated regularly by a qualified and trained technician. For more information, refer to Section 8 *Calibration* and Section 10 *Maintenance* of this manual.

This instrument has not been designed to be intrinsically safe. For your safety, **do not** use it in classified hazardous areas (explosion-rated environments).

INSTRUMENT SERIAL NUMBER:

PURCHASE DATE:

PURCHASED FROM:

1.2 Warranty Policy

Critical Environment Technologies Canada Inc. (CETCI), also referred to as the manufacturer, warrants this instrument, (excluding sensors, battery packs, batteries, pumps and filters) to be free from defects in materials and workmanship for a period of **two years from the date of purchase from our facility**. The sensors have a warranty period of **one year on a pro-rated basis from the date of purchase from our facility**. If the product should become defective within this warranty period, we will repair or replace it at our discretion.

The warranty status may be affected if the instrument has not been used and maintained per the instructions in this manual or has been abused, damaged, or modified in any way. This instrument is only to be used for purposes stated herein. The manufacturer is not liable for auxiliary interfaced equipment or consequential damage.

Due to ongoing research, development, and product testing, the manufacturer reserves the right to change specifications without notice. The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of this data.

All goods must be shipped to the manufacturer by prepaid freight. All returned goods must be pre-authorized by obtaining a Returned Merchandise Authorization (RMA) number. Contact the manufacturer for a number and procedures required for product transport.

1.3 Service Policy

CETCI maintains an instrument service facility at the factory. Some CETCI distributors / agents may also have repair facilities; however, CETCI assumes no liability for service performed by anyone other than CETCI personnel.

Repairs are warranted for 90 days after date of shipment (sensors have individual warranties). Should your instrument require non-warranty repair, you may contact the distributor from whom it

was purchased or you may contact CETCI directly.

Prior to shipping equipment to CETCI, contact our office for an RMA #. All returned goods must be accompanied with an RMA number.

If CETCI is to do the repair work, you may send the instrument, prepaid, to:

Attention: Service Department
Critical Environment Technologies Canada Inc.
Unit 145, 7391 Vantage Way
Delta, BC, V4G 1M3

Always include your Returned Merchandise Authorization (RMA) number, address, telephone number, contact name, shipping / billing information, and a description of the defect as you perceive it. You will be contacted with a cost estimate for expected repairs, prior to the performance of any service work.

For liability reasons, CETCI has a policy of performing all needed repairs to restore the instrument to full operating condition.

Pack the equipment well (in its original packing if possible), as we cannot be held responsible for any damage incurred during shipping to our facility.

1.4 Copyrights

This manual is subject to copyright protection; all rights are reserved. Under international and domestic copyright laws, this manual may not be copied or translated, in whole or in part, in any manner or format, without the written permission of CETCI.

1.5 Disclaimer

Under no circumstances will CETCI be liable for any claims, losses or damages resulting from or arising out of the repair or modification of this equipment by a party other than CETCI service technicians, or by operation or use of the equipment other than in accordance with the printed instructions contained within this manual or if the equipment has been improperly maintained or subjected to neglect or accident. Any of the forgoing will void the warranty.

Under most local electrical codes, low voltage wires cannot be run within the same conduit as line voltage wires. It is CETCI policy that all wiring of our products meet this requirement.

It is CETCI policy that all wiring be within properly grounded (earth or safety) conduit.

1.6 Revisions

This manual was written and published by CETCI. The manufacturer makes no warranty or representation, expressed or implied including any warranty of merchantability or fitness for purpose, with respect to this manual.

All information contained in this manual is believed to be true and accurate at the time of printing. However, as part of its continuing efforts to improve its products and their documentation, the manufacturer reserves the right to make changes at any time without notice. Revised copies of this manual can be obtained by contacting CETCI or visiting www.critical-environment.com.

Should you detect any error or omission in this manual, please contact CETCI at the following address:

Critical Environment Technologies Canada Inc.
Unit 145, 7391 Vantage Way, Delta, BC, V4G 1M3, Canada
Toll Free: +1.877.940.8741

Telephone: +1.604.940.8741
Fax: +1.604.940.8745
Email: marketing@cetci.com
Website: www.critical-environment.com

In no event will CETCI, its officers or employees be liable for any direct, special, incidental or consequential damages resulting from any defect in any manual, even if advised of the possibility of such damages.

2 INTRODUCTION

2.1 General Description

Thank you for purchasing our LPT-A Analog Transmitter.

The LPT-A transmitter is a single sensor, analog transmitter available with a wide range of sensors and sensor types of continuous monitoring of gases or oxygen in non-hazardous (non-explosion rated) environments such as commercial HVAC and light industrial applications.

Operating as an analog transmitter or a stand-alone fixed system, the LPT-A offers a back lit LCD display, an internal audible alarm, one dry relay contact, a jumper selectable 4-20 mA or 0 - 10 VDC analog output signal, 3-wire VDC or 4-wire VAC power, a thermal resetting fuse and temperature compensation all in a RoHS compliant package. It comes in a standard with a water / dust tight, corrosion resistant ABS / polycarbonate enclosure with a hinged, secured door. With the optional splash guard installed, the enclosure is IP54 rated and ideal for use in water spray or washdown applications.

LPT-A transmitter is available with internal or remote sensor options. All LPT-A transmitters operate by diffusion. The sensors utilized in this device are accurate enough to measure to Occupational

Health & Safety (OHS) hazardous levels for toxic gases.

If after reading through the manual, you have any questions, please do not hesitate to contact our service department for technical support.

2.2 Key Features

- Single channel
- Wide range of internal sensor types including electrochemical, solid state and TVOC
- Remote combustible and PID sensor options
- Graphic LCD display (user selectable function)
- Audible alarm
- 3-wire VDC or 4-wire VAC power
- 24 volt DC or AC power (nominal)
- Linear 4 - 20 mA or 0 - 10 volt output signal
- 1 dry contact relay, 30 volt 2 amps maximum
- Standard water / dust tight, corrosion resistant enclosure (drip proof). With optional splash guard installed, the enclosure is IP54 rated.
- Copper coated interior to reduce RF interference
- RoHS compliant circuit boards
- Includes sensor Calibration Extending Firmware (CEF) for some electrochemical sensors
- Auto resetting fuse

3 INSTRUMENT SPECIFICATIONS

3.1 Technical Specifications

MECHANICAL

Enclosure	ABS / Polycarbonate, IP54 rating with splash guard installed. Copper coated interior to reduce RF interference.
Weight	400 g (14 oz)
Size	127 mm x 127 mm x 53.34 mm (5.0 in x 5.0 in x 2.1 in)

ELECTRICAL

Power Requirement	3-wire mode 16 - 30 VDC, 3 W, Class 2 4-wire mode 12 - 27 VAC, 50-60 Hz, 3 VA, Class 2 Use Class 2 transformer. See Section 6.7 <i>Wiring Connections</i> .
Current Draw	125 mA @ 24 VDC
Wiring	VDC (or ground referenced AC) three conductor shielded 18 awg (or larger) stranded within conduit VAC four conductor shielded 18 awg stranded within conduit (refer to Section 6.7.5 <i>Wire Gauge vs. Run Length</i>)
Fuses	Automatic resetting thermal

USER INTERFACE

Display	Graphic LCD, grey border. Text prompting for calibration operation and fault indications. Installer configurable to suppress all other displays.
Magnetic Sensors	Using the magnetic wand to initiate calibration without opening enclosure.

INPUTS / OUTPUTS

Outputs	Linear 4 - 20 mA Maximum 216 Ω load (wiring plus termination resistor) @ 12 VDC Maximum 316 Ω load (wiring plus termination resistor) @ 12 VAC
Relay	Voltage 0 - 10 volt Minimum 1k ohm load One SPDT dry contact relay, rated 2A @ 30V maximum

ENVIRONMENTAL

Operating Temperature	-20°C to 40°C (-4°F to 104°F) NOTE: Low temperature option available to -40°C (-40°F) (<i>Sensor dependent, some extremely cold applications may require a small internal silicone heater to maintain temperature stability for sensor. Contact CETCI for details and pricing.</i>)
Operating Humidity	15 - 90% RH non-condensing

CERTIFICATIONS

Model: LPT-A-XXX

S/N: LPTAE1601H00374

Rating: 16-30 VDC, 3W, Class 2

12-27 VAC, 50-60 Hz 3VA, Class 2



CERTIFIED FOR ELECTRIC SHOCK & ELECTRICAL FIRE HAZARD ONLY. LA CERTIFICATION ACNOR COUVRE UNIQUEMENT LES RISQUES DE CHOC ELECTRIQUE ET D'INCENDIE D'ORIGINE ELECTRIQUE.

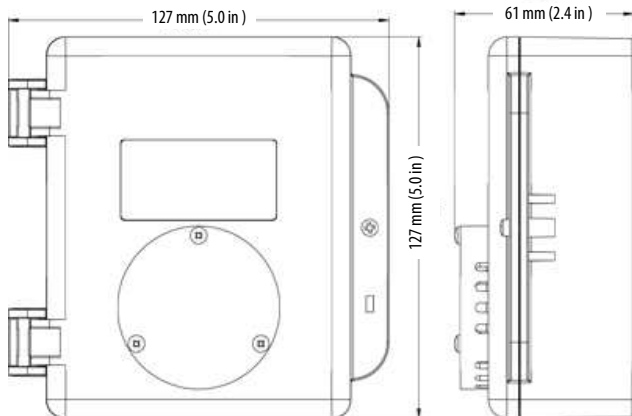
Conforms to: CSA-C22.2 No. 205-M1983 (R2009), UL508 (Edition 17):2007

Conforms to: EMC Directive 2004/108/EC, EN 50270:2006, Type 1, EN61010

Conforms to: FCC. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.



3.2 Standard Enclosure Dimensions



Above dimensions are shown with optional splash guard. Without splash guard, thickness is 53.34 mm (2.1 in). The area required for enclosure door to be open 90 degrees is 178 mm (7 in) or 254 mm (10 in) for fully open. With the splash guard, the enclosure has an IP54 rating.

NOTE: During calibration, the sensor response time will be slower with a splash guard installed.

NOTE: Splash guard is not available for transmitters with internal electrochemical Ozone (O_3), Hydrogen Chloride (HCL) or Chlorine (Cl_2) sensors.

4 SENSOR SPECIFICATIONS

4.1 List of Available Internal Sensors

Internal Electrochemical Sensors	Part Number	Range	Lifespan
Ammonia (NH ₃)	LPT-A-NH3	0 - 500 ppm	2 years
Carbon Monoxide (CO)	LPT-A-COA	0 - 200 ppm	3 years
Carbon Monoxide (CO)	LPT-A-COB	0 - 200 ppm	6 years
Chlorine (Cl ₂)	LPT-A-CL2	0 - 5 ppm	3 years
Chlorine Dioxide (ClO ₂)	LPT-A-CL02	0 - 1.0 ppm	2 years
Ethylene (C ₂ H ₄)	LPT-A-C2H4	0 - 200 ppm	2 years
Ethylene Oxide (C ₂ H ₄ O)	LPT-A-EETO	0 - 20 ppm	2 years
Fluorine (F ₂)	LPT-A-F2	0 - 2 ppm	1 - 2 years
Formaldehyde (CH ₂ O)	LPT-A-CH2O	0 - 5 ppm	2 years
Hydrogen (H ₂)	LPT-A-EH2	0 - 2,000 ppm	2 years
Hydrogen Chloride (HCl)	LPT-A-HCL	0 - 20 ppm	2 years
Hydrogen Cyanide (HCN)	LPT-A-HCN	0 - 100 ppm	2 years
Hydrogen Fluoride (HF)	LPT-A-HF	0 - 10.0 ppm	1 - 2 years
Hydrogen Sulphide (H ₂ S)	LPT-A-H2S	0 - 50 ppm	2+ years
Hydrogen Sulphide (H ₂ S)	LPT-A-H2SB	0 - 50 ppm	5+ years
Nitric Oxide (NO)	LPT-A-NO	0 - 100 ppm	2 years

Internal Electrochemical Sensors continued...	Part Number	Range	Lifespan
Nitrogen Dioxide (NO ₂)	LPT-A-NO2A	0 - 10 ppm	3 years
Nitrogen Dioxide (NO ₂)	LPT-A-NO2B	0 - 10 ppm	6 years
Oxygen (O ₂)	LPT-A-O2	0 - 25% Vol	3 years
Ozone (O ₃)	LPT-A-O3	0 - 2 ppm	2 years
Phosphine (PH ₃)	LPT-A-PH3	0 - 5 ppm	2 years
Silane (SiH ₄)	LPT-A-SIH4	0 - 20 ppm	2 years
Sulphur Dioxide (SO ₂)	LPT-A-SO2	0 - 20 ppm	2+ years
Internal Solid State Sensors	Part Number	Range	Lifespan
Refrigerant (R22)	LPT-A-SR22	0 - 2,000 ppm	5 years
Refrigerant (R134A)	LPT-A-SR134A	0 - 2,000 ppm	5 years
Refrigerant (R402A)	LPT-A-SR402A	0 - 2,000 ppm	5 years
Refrigerant (R404A)	LPT-A-SR404A	0 - 2,000 ppm	5 years
Refrigerant (R407C)	LPT-A-SR407C	0 - 2,000 ppm	5 years
Refrigerant (R410A)	LPT-A-SR410A	0 - 2,000 ppm	5 years
Refrigerant (R422D)	LPT-A-SR422D	0 - 2,000 ppm	5 years
Refrigerant (R438A)	LPT-A-SR438A	0 - 2,000 ppm	5 years
Refrigerant (R438A)	LPT-A-SR438A	0 - 2,000 ppm	5 years
Refrigerant (R507)	LPT-A-SR507	0 - 2,000 ppm	5 years
TVOC (Isobutylene)	LPT-A-STVOC	0 - 500 ppm	5 years

Internal Catalytic (Combustible) Sensors	Part Number	Range	Lifespan
Hydrogen (H ₂)	LPT-A-CH2-100	0 - 100% LEL	5 years
Methane (CH ₄)	LPT-A-CCH4-100	0 - 100% LEL	5 years
Propane (C ₃ H ₈)	LPT-A-CC3H8-100	0 - 100% LEL	5 years

4.2 List of Available ESH-A Remote Sensors

ESH-A Remote Sensors - Catalytic (Combustible)			
Hydrogen (H ₂)	ESH-A-CH2-100	0 - 100% LEL	5 years
Methane (CH ₄)	ESH-A-CCH4-100	0 - 100% LEL	5 years
Propane (C ₃ H ₈)	ESH-A-CC3H8-100	0 - 100% LEL	5 years
ESH-A Remote Sensors - TVOC PID			
TVOC PID	ESH-A-SPL	0 - 30 ppm	usage / application dependent
TVOC PID	ESH-A-SPH	0 - 300 ppm	

4.3 Special Considerations for Sensors

If you install the LPT-A when it arrives, the sensor will not require a long warm up period (about 5 minutes for Ammonia and Nitrogen dioxide and 2 minutes for all the others). The sensors go through a burn in period at our factory so they are ready for operation upon arrival. If the device is not installed within two weeks of delivery, the sensor may require a longer warm up time to stabilize (approximately 48 hours) and provide accurate readings.

After installing an LPT-A with an Oxygen sensor, leave it to warm up for 2 hours before looking at the readings.

After a substantial warm up period, an Ethylene Oxide sensor should be zeroed on site if the ambient temperature is above 22°C (71.6°F). This particular sensor has a drift factor that can be as much as 1 ppm if the temperature rises to 25°C (77°F). With the low set point you could experience false alarms.

For an R11 refrigerant sensor, allow 30 minutes after power up before considering the LPT-A's readings valid. The sensor's response to R11 refrigerant and to humidity levels can affect the readings of the LPT-A and can take up to 30 minutes after power up to recover and stabilize.

During calibration, when flowing span gas on an Ammonia sensor, if the reading climbs higher than the calibration point after applying gas for 3 minutes, use that reading as the calibration point. It should be around 300 ppm.

Ozone sensors are reactive to temperature changes and will drift.

Silicone, lead and chlorinated hydrocarbon vapours can poison catalytic sensors.

A bump test will help you determine if a sensor requires calibration. If the sensor still does not respond as it should after a successful calibration, it probably requires replacing.

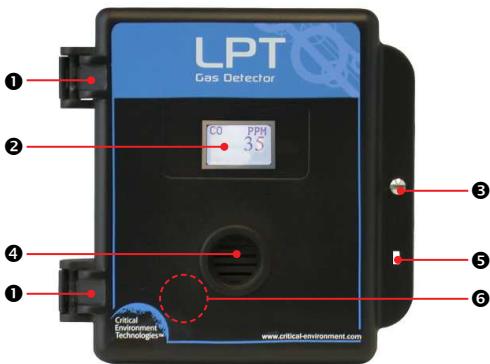
Temperature affects calibration. It is important to ensure the gas is at the appropriate temperature during calibration. If the sensor is being used in an extreme temperature range, calibration should be done in that same temperature range.

4.4 Calibration Extending Firmware (CEF) and Sensor Aging

Some LPT-A systems with certain electrochemical sensors have been programmed with our Calibration Extending Firmware (CEF). This firmware takes into consideration the aging of the sensors so that less frequent calibrations are acceptable in less-critical applications such as parking garages. The system tracks the age of the sensor and automatically compensates for the reduced output of the sensor as it ages.

5 FEATURES & FUNCTIONS

5.1 Exterior Enclosure

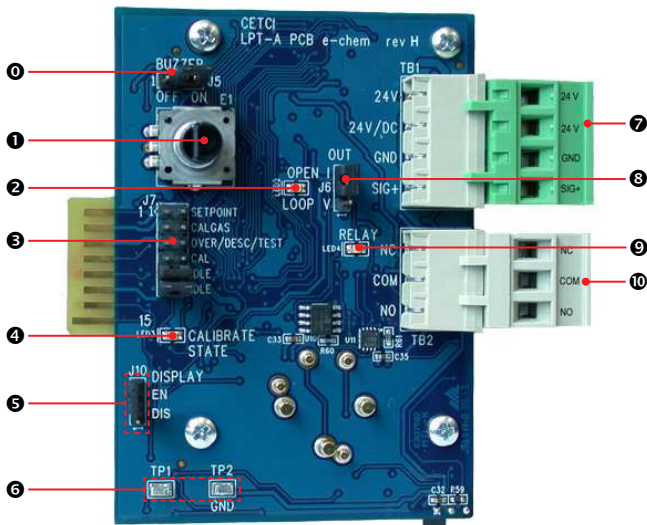


NUMBER	FEATURE	FUNCTION
1	Door Hinge	Secures door
2	Display with gray border	Indicates transmitter operation
3	Door Screw	Secures door
4	Sensor Opening	Allows gas diffusion into sensor
5	Padlock Opening	For security padlock
6	Magnetic Calibration Trigger Point	To enter calibration

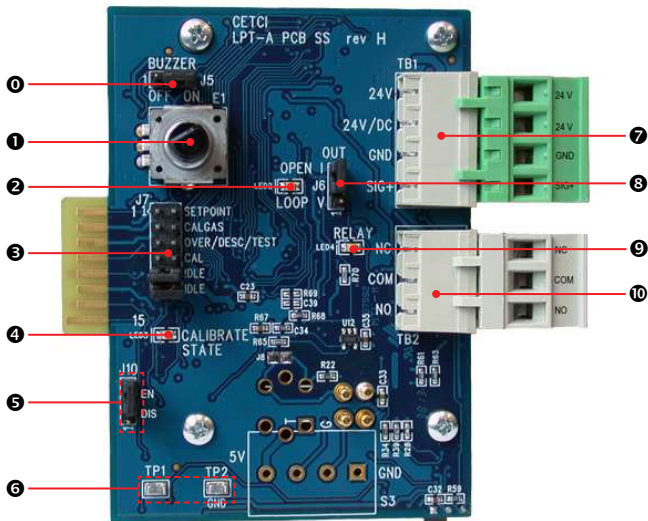
5.2 Interior System Layout

Depending on the type of sensor the LPT-A is configured with, one of three circuit boards will be installed inside.

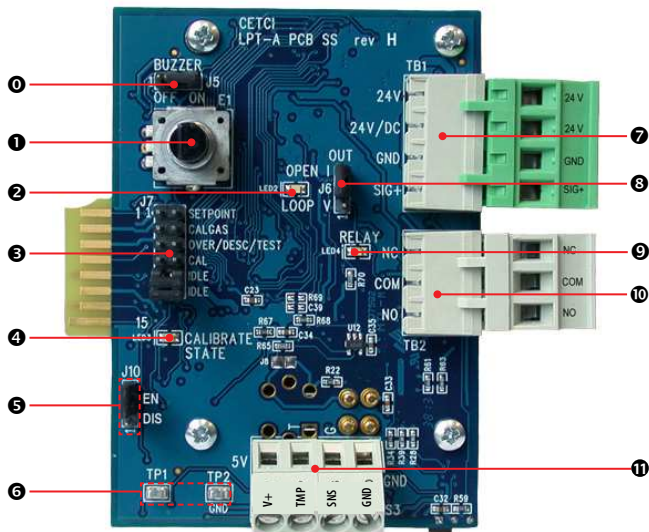
5.2.1 Electrochemical Sensor Board



5.2.2 Solid State (Internal) Sensor Board



5.2.3 Solid State (Remote) Sensor Board



NUMBER	FEATURE	FUNCTION
0	J5 Buzzer Enable	Enables / disables the buzzer.
1	Rotary Encoder	Sets calibration values, etc. with the jumpers.

②	Open Loop LED	Lights if there is no connection for current output (always lit in voltage output mode).
③	J7 Jumper Bank	For calibration & test functions.
④	Calibrate State LED	Further prompting for calibration operation.
⑤	J10 Display Enable	Enables / disables the display of the measured gas level.
⑥	Test Points: TP1 & TP2	For measuring voltage output.
⑦	TB1 Wiring Terminal	Pluggable terminal for Power & signal output.
⑧	Output Select	Select either current or voltage output.
⑨	Relay LED	Indicates (when on) that the gas level is above the trip point (the relay will indicate alarm level).
⑩	TB2 Relay Terminal	Pluggable terminal for relay connections.
⑪	Remote Sensor Terminal	Terminal for remote sensor connections.

6 INSTALLATION

6.1 General Safety Warnings

The LPT-A is intended for indoor use, permanently mounted at a height that is appropriate for the type of gas being monitored. Refer to Section 6.5 *Sensor Mounting Heights*. The LPT-A should be protected from extreme weather conditions.

The LPT-A requires no assembly and virtually no maintenance other than regular calibration of the integral and/or remote sensors and ensuring that excess water or dust is not somehow entering

the enclosure and physically damaging the circuit board or internal components. There are no serviceable elements other than the calibration instructions outlined in this manual. There are no replaceable components except the sensors.

6.2 Protection Against Electrical Risks

Disconnect all power before servicing. There may be multiple power sources. Power supply may have a building installed circuit breaker / switch that is suitably located and easy to access when servicing is required and should be labelled as LPT-A supply (disconnecting power to the LPT-A). Appropriate markings should be visible at the circuit breaker / switch that is supplying power to the LPT-A.

This device may interfere with pacemakers. Modern pacemakers have built-in features to protect them from most types of interference produced by other electrical devices you might encounter in your daily routine. If you have a pacemaker, follow your healthcare provider's instructions about being around this type of equipment.

6.3 Protection Against Mechanical Risks

The door of the enclosure can be removed if absolutely necessary to facilitate installation of the base but it is not recommended on this version. Extreme care and caution must be exercised when removing the door to avoid damaging the hinges. The door should only be removed when absolutely required. Any damage occurring from door removal procedure will not be covered under warranty.

Simply grasp the door with one hand, being careful not to make contact with any of the internal components (circuit board), grasp the base with your other hand. Tug on the base and pull straight apart. **DO NOT TWIST**. The section of the hinges located on the base should "snap" apart from the part of the hinges located on the door.

After installation, simply locate the lid hinges over the installed base hinges and pull toward you. The hinges should easily “snap” back into place.

The enclosure has one screw securing the door to the base for electrical safety and provides an opening to allow the user to apply a padlock or tie wrap if they desire the transmitter to be locked. Refer to Section 5.1 *Exterior Enclosure*.

Be aware that the hinged door that could potentially pinch fingers and the sharp edges and/or jumper pins on the board could potentially prick or cut fingers if not handled carefully.

6.4 System Installation

The LPT-A should be installed on a flat vertical surface using the four 0.175” (4.4 mm) diameter mounting holes provided to maintain water tight status. Care should be taken to ensure that the face of the LPT-A is not obstructed in order to maximize the sensor’s exposure to the environment being monitored.

Two 12.7 mm (½ in) conduit entry points are provided in the enclosure. Both are located in the enclosure base. One in the rear of the base and one on the bottom edge of the base. See Section 6.6 *Enclosure Mounting Components*.

The clearance from the PCA to the base enclosure is 12.7 mm (½ in). **Do not use a conduit connector that has more than 12.7 mm (½ in) of thread length.**

NOTE: When mounting the enclosure, allow enough room to allow the end user to open the door fully to access the internal adjustments.

6.4.1 Wet Environment Considerations

If the LPT-A is to be installed in a potential hose-down application or any application whereby liquid could be directed towards the sensor opening, the LPT-A should be ordered with an optional

attached splash guard (factory installed).

If used in a wet or wash down application, the conduit hub entering the LPT-A enclosure must be liquid tight type.

Any water or physical damage to the transmitter that occurs from the installer drilling their own installation holes will not be covered under warranty.

6.4.2 EMI and RF Interference Considerations

All electronic devices are susceptible to EMI (Electromagnetic Interference) and RFI (Radio Frequency Interference). Our detectors have been designed to reduce the effects of these interferences and we meet CSA FCC and CE requirements for these type of devices. However there are still circumstances and levels of interference that may cause our equipment to respond to these interferences and cause them to react as if there has been gas detected.

There are some installation procedures that will reduce the likelihood of getting faulty readings:

1. Locate the detectors and controllers out of the way from normal foot traffic and high energy equipment.
2. Confirm the devices are properly grounded using conduit and shielded cabling.
3. Inform operators and technical staff working in the surrounding area to be aware of these possible conditions and that two way radios, Bluetooth enabled devices, cell phones and other electrical equipment may interfere with the response of the gas detectors.

6.5 Sensor Mounting Heights

The sensor mounting height depends on the density of the gas relative to air. Heavier than air gases should be detected 15.24 cm (6 inches) from the floor, lighter than air gas sensors should be placed on or near the ceiling, and gases which have a density close to that of air should have sensors

installed in the “breathing zone” which is the area approximately 1.22 m - 1.8 m (4 ft - 6 ft) from the floor, where most human breathing takes place. This is a good default location for sensors, as many gases are often well dispersed in air.

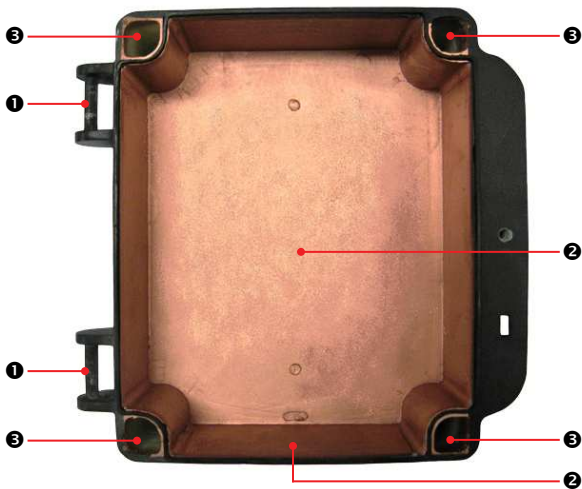
GAS	APPLICATIONS / TYPES	SUGGESTED MOUNTING HEIGHT
Carbon Monoxide (CO)	Gas engine exhaust	1.22 m - 1.8 m (4 ft - 6 ft)
Nitrogen Dioxide (NO ₂)	Diesel engine exhaust	above the floor
Ammonia (NH ₃)	Commercial ice rinks Compressor rooms	Near the ceiling
Refrigerants	Chiller rooms Cold storage rooms	15.24 cm (6 in) above the floor
Chlorine (Cl ₂) Ozone (O ₃)	Commercial swimming pools	15.24 cm (6 in) above the floor

For more examples, visit:

www.critical-environment.com/technicallibrary/sensor-mounting.html

6.6 Enclosure Mounting Components

6.2.1 Enclosure Base

**NUMBER****FEATURE****1**

Door Hinge

2

1/2" Conduit Entry Knockout

3

Mounting Holes

6.2.2 Enclosure Bottom



NUMBER	FEATURE
①	Door Hinge
②	1/2" Conduit Entry Knockout

6.7 Wiring Connections

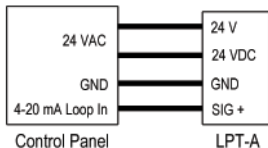
The LPT-A analog transmitter is a low voltage powered device. Any application of operating voltages higher than indicated in the specification may result in damage. Double check wiring connections prior to powering the transmitter. Damage from incorrect wiring connections or from too much voltage applied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

All wiring should be run in EMT (or better) conduit properly earth grounded. Signal output and supply should be in shielded cable. The cable shield should be connected to earth ground at the controller/power supply that is providing power for the LPT-A.

6.7.1 Power Connection

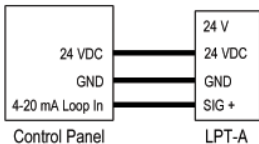
If the installer is powering the LPT-A with four wire 24 VAC, the VAC wires should be connected to the terminal “one” (AC) and terminal “two” (AC / DC), from the top down. The signal return should be connected to terminal “three” (GND). The “signal” (4 - 20 mA or 0 - 10 volt) wire is always connected to terminal “four”.

Wiring Example: 4-Wire



If the installer is powering the LPT-A with three wire 24 VDC or ground referenced AC, the “positive” wire should be connected to terminal “two” (AC / DC) and the negative wire should be connected to terminal “three” (GND). The “signal” (4 - 20 mA or 0 - 10 volt) wire is always connected to terminal “four”.

Wiring Example: 3-Wire



NOTE: WARRANTY VOID IF SOLID-CORE WIRE IS USED AT THE WIRING TERMINAL STRIP.

When using solid core wiring for distribution (in the conduit), use stranded wire pigtails 18 AWG within the enclosure to connect to the circuit board. The rigidity of solid-core wire can pull a soldered terminal strip completely off a circuit board and this will not be covered under warranty.

System power: The main wiring terminal strip on the LPT circuit board can be unplugged for easier wiring installation. Grasp the two sides of the terminal strip and pull sideways.

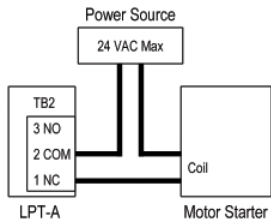
Device must be used with rated equipment. External power to LPT-A must be supplied by a Class 2 or better transformer.

6.7.2 Relay Connection

The relay operates in “failsafe” mode, i.e. the relay coil is energized under normal non-alarm conditions. The relay is de-energized when the detected gas level is greater than or equal to the trip point, or if power fails.

In most applications the relay function should use the common “COM” and normally closed “NC” terminals. With this wiring the connection will be open under normal, low gas concentration conditions. When the gas concentration rises (or if there is a power failure) the connection relay will close and signal the control panel or fan control.

Wiring Example: Relay

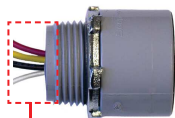


6.7.3 Wiring from LPT-A to Remote ESH (dongle style) Sensor for Hotel Room Air Conditioning Applications

Four-conductor, 16-18 awg stranded shielded cable is required for the remote dongle style sensor wiring. This wiring should be run in a conduit, separate from the signal output, and should not exceed 50 feet. The voltage at the remote sensor (Red V+ to Black GND) should be 5 VDC \pm 2%. If this voltage is not met after installation, the wrong gauge wire may have been used or the wiring run is too long.



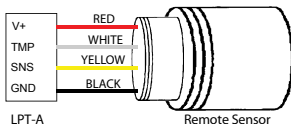
The solid state sensor breathes through these openings.



Wiring:

- Red (V+)
- Yellow (Signal)
- Black (Ground)
- White (Temperature)

Wiring Example: Remote ESH (dongle style) Sensor



The maximum length of wire between the ESH Remote Sensor (dongle style) and the transmitter should not exceed 50 ft (15 m).

6.7.4 Wiring from LPT-A to an ESH-A Remote Sensor

Four-conductor, 16-18 awg stranded shielded cable is required for the ESH-A Remote Sensor wiring. This wiring should be run in a conduit, separate from the LPT-A's wiring, and should not exceed 200 feet.

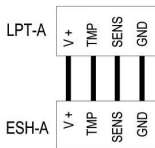
NOTE: WARRANTY VOID IF SOLID-CORE WIRE IS USED AT THE WIRING TERMINAL STRIP.

When using solid core wiring for distribution (in the conduit), use stranded wire pigtails 18 AWG within the enclosure to connect to the circuit board. The rigidity of solid-core wire can pull a soldered terminal strip completely off a circuit board and this will not be covered under warranty.

The wiring terminal strips on the ESH-A Remote Sensor circuit board are mounted on a 30 degree angle, making the wiring connections easier to install.

Device must be used with rated equipment. External power to the ESH-A is supplied by the controller or transmitter it is connected to.

Wiring Example: ESH-A Remote Sensor



The maximum length of wire between the ESH-A Remote Sensor and the transmitter should not exceed 200 ft (61 m).

6.7.5 Wire Gauge vs Run Length

The table below shows the maximum cable length between the LPT-A and the controller for normal installations (a separate cable from the controller for each LPT-A).

SUPPLY VOLTAGE	MAXIMUM LOAD (Wire + Termination Resistor) (ohms)	WIRE GAUGE (awg)	MAXIMUM CABLE LENGTH (feet)
24 VDC	592	20	4,400
		18	7,100
		16	10,700
16 VDC	216 (assume a 200 Ω termination resistor)	20	700
		18	1,200
		16	1,800
24 VAC	1,060	20	27,000
		18	43,200
		16	65,500
12 VAC	316 (assume a 200 Ω termination resistor)	20	5,600
		18	8,900
		16	13,583

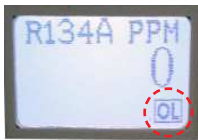
NOTE: The termination resistor could be as high as 500 Ω (10 volt measurement at 20 mA). A poor quality 24 VAC transformer might supply as little as 14 volts at low line conditions.

Upon application of power, the display will show the gas formula (e.g. NO₂), the units of measurement (e.g. PPM), and a “WARM UP” message. During this warm-up period (typically five minutes, but varies with sensor type) the output signal is fixed at 4.0 mA (current) or 0 volt (voltage). After the warm up period, the system may exhibit gas alarm condition if the sensor has not completely stabilized during the warm up period. This is normal and the length of time the gas alarm exists is dependent upon the length of time since the unit was last powered up and the state of the environment it is installed in.

After warm up the display will show the current gas reading, if the display jumper is in the ENable position. If the display jumper is in the DISable position the display will continue to show the gas type, but will not display the units or gas reading.

6.7.6 Open Loop

If the 4 - 20 mA signal loop has not been connected properly or has been damaged in some manner between the analog transmitter and the device to which it is sending its signal output, the LPT-A will show an open loop icon OL at the bottom right of the display, as well as turning on the internal open loop LED. Check for broken wire(s) / inspect the wiring for problems.



NOTE: If the voltage output is chosen, the open loop indicator on the circuit board will always be on. Refer to Section 5.2 *Interior System Layout* to find where the Open Loop LED is located.

7 SYSTEM OPERATION & CONFIGURATION

NOTE: The LPT-A can operate as part of a network or as a standalone gas detection device.

When part of a network, the LPT-A will continuously monitor gas concentrations on the configured channels and will send an analog signal back to the BAS / DDC / controller. The BAS / DDC will interpret the signal as gas readings and it will trigger the safety responses (alarms, relays) as it has been configured.

If the LPT-A is being used as a standalone device, the LPT-A will operate according to the gas readings, alarm setpoints, buzzer and relay configurations as outlined in this manual. In the event of a gas build up in excess of the alarm setpoints, the internal alarm will sound and the relay will be triggered to activate a remote horn and/or strobe device, ventilation fans and/or some other safety procedure. When the gas level drops below the configured alarm point, the device will return normal operation.

Normal operation is indicated by the display showing the gas reading or the gas formula. During normal operation, the gas level will be reported through the current loop (or voltage) output, and a rough reading can be obtained from the voltage test points.

7.1 Power Up and Warm-up

The current gas level reading can be monitored at any time during normal operation using the display. The display will be backlit when the menu is in active use.

Upon application of power, the device will enter the warm-up period and display a countdown of the time remaining before it is done warming up.



The warm up period is approximately 3 minutes (some gases, like Chlorine, may take a little longer). After the warm up period the device may exhibit gas alarm conditions if the sensor has not completely stabilized during the warm up period. This is normal and the length of time the gas alarm exists is dependent upon the length of time since the unit was last powered up and the state of the environment it is installed in.

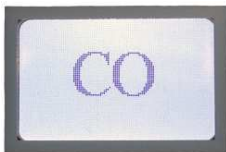
7.2 Display Select

The normal display can be selected by moving the jumper at J10 from one position to the other. J10 in ENable position (pins 2 - 3 connection):



The display will be backlit and show the gas formula, the units and the current gas level. This is the factory default position.

J10 in DISable position (pins 1 - 2 connected):



The display will be backlit but will only show the name of the gas (it will not show the gas readings) and any abnormal conditions, e.g. fault, etc.

The display will always show messages during service functions, e.g. test, calibrate, etc.

7.3 Enable / Disable the Buzzer

The LPT-A has an internal buzzer (alarm) that can be enabled or disabled. The buzzer is linked to the backlight of the display, so that in an alarm condition, the backlight of the display will flash on and off. The alarm, flashing display and relay will return to normal state when the gas level reading drops below the setpoint.

The factory default setting for the buzzer is ENabled. The buzzer can be DISabled by moving the jumper at J5 from the ON (pins 2 - 3 connected) to the OFF position (pins 1 - 2 connected).

7.4 Selecting the Output Signal

The default signal output mode is 4 - 20 mA current loop. Zero concentration gas will output 4 mA and full scale (e.g. 200 ppm CO) will output 20 mA.

The output can be changed to voltage (0 - 10 volt) by moving the jumper at J6 from the I position (pins 2 - 3 connected) to the V position (pins 1 - 2 connected). The voltage signal will swing from zero (0) volts to indicate no gas detected, to 10 volts to indicate full scale gas detected.

7.5 Fault Detection

The LPT-A has built in fault detection, and in the event of a problem with the measurement circuitry the transmitter will indicate a fault condition on the display. At this point, the transmitter will output 0 mA on the current loop (or 0 volts on the voltage output). Normal operation will resume once the fault condition has been rectified.

NOTE: While faults in the circuitry can be detected, a dead or damaged electrochemical sensor will usually appear to the transmitter as a zero gas reading. To ensure safe operation, periodic bump tests are required. A damaged solid-state or catalytic sensor will go open circuit and create a fail indication on the LPT-A.



7.6 Test Functions

During warm up and normal operation, the signal output (current or voltage), the relay and the buzzer (if enabled) can be tested using the jumpers at J7.

Placing a jumper on the OVER / DESC / TEST position (while there are no jumpers on the SETPOINT, or CALGAS positions) will initiate the test function. The current (or voltage) output will match the span gas level, and will remain at that level until the jumper is removed from the OVER / DESC / TEST position or for 5 minutes.

Note that the relay and buzzer (if enabled) will be tested, even if the SETPOINT is higher than the span gas level. During the test the display will show the span gas value, and an icon indicating that the LPT-A is in the test mode. The displayed concentration is the real world current readings even

though the outputs are the span gas level while the display continues to show ambient levels.



After 5 minutes (or when the jumper is removed from the OVER / DESC / TEST position), the unit will return to normal operation.

Return the jumper placed on the OVER / DESC / TEST location to an IDLE position when testing is completed.

Voltage Output to Test Points “TP-1” and “TP-2”:

Attach a volt meter's leads to the two test points (TP-1 & TP-2) located on the lower left corner on the back of the circuit board. Set the meter to volts DC with one decimal point. The range of 0 - 4.0 VDC is equal to the full measurement range of the sensor. e.g. a CO sensor has a standard measurement range of 0 - 200 ppm, therefore 2.0 VDC = 100 ppm, 4.0 VDC = 200 ppm.

7.7 Relay Operation / Setting the “Alarm” Level

The Alarm level is the gas concentration at (and above which) the device will acknowledge a high gas level which will trip the relay, the buzzer will sound (if enabled) and the display will indicate an alarm condition (if enabled).

The set point can be changed by:

- Moving a jumper from one of the IDLE positions to the SETPOINT position
- Rotate the shaft of the encoder, E1, clockwise to increase the set point or counter-clockwise to decrease the set point,

- The set point will be displayed, along with a “SETPOINT” icon indicating that the set point is being changed



- The set point can also be monitored with a volt meter connected between TP1 and TP2. The value will be a zero to four volt signal proportional to the set point level. For example; the maximum range for CO is 200 ppm, so 50 ppm ($\frac{1}{4}$ of the range) will be indicated by a voltage between TP1 and TP2 of 1 volt.
- After the set point is changed as desired, move the jumper from the SETPOINT position back to the IDLE position.

If the LPT-A has an oxygen sensor (p/n LPT-A-02), it supports both an ascending and a descending alarm point. The factory default ascending set point is 23.0 %volume and the descending is 19.5% volume (normal atmospheric oxygen content is 20.9% vol). The descending point can be set by placing jumpers at both the SETPOINT and the OVER / DESC / TEST position.

If there is no activity (turning the encoder shaft) for 5 minutes, the LPT-A will return to normal mode. After returning to normal mode the jumper will have to be moved from the SETPOINT position to the IDLE position and then re-installed at the SETPOINT position if further adjustment is needed.

SENSOR GAS TYPE	TRIP POINT (ALARM LEVEL)	TP1 - TP2 VOLTAGE
Carbon Monoxide (CO)	25 ppm	0.5 volts
Nitrogen Dioxide (NO ₂)	0.7 ppm	0.28 volts
Solid State Refrigerants	250 ppm	0.5 volts
Combustible	10% LEL	0.8 volts

8 CALIBRATION

8.1 Calibration Specifications

8.1.1 Gas

Calibration span gases should have at least $\pm 5\%$ accuracy and have a current date stamp.

Gas generators should have a current dated cell installed. Service personnel should flow zero emissions air or 20.9% volume O₂ (scrubbed of hydrocarbons) before attempting to null adjust toxic gas sensors. In some cases nitrogen (N₂) can be substituted for zero air when null adjusting electrochemical sensors. Contact CETCI for clarification.

Every LPT-A transmitter is calibrated in a chamber by true diffusion method prior to leaving our facility. This method more closely emulates actual “real world” conditions. Field calibration using gas cylinder, regulator and hose directing span gas into the sensor may result in slightly higher readings. It is important to note that the type of gas mixture, how old the gas is and what temperature it has been stored at will also affect repeatability during field calibration.

NOTE:

- Oxygen sensors require 100% N₂ for a true zero and span is done first, followed by zero.
- Solid-state and catalytic sensors require oxygen to work and thus the user **MUST** flow clean air or oxygen to obtain a true zero and the span gas must have “air” balance, not N₂ balance.

8.1.2 Regulators & Flow

Calibration gases that are lighter than or the same weight as air (CO, O₂, etc.) should be flowed at 0.5 LPM. Gases heavier than air (NO₂, etc.) should be flowed between 0.5 and 1.0 LPM. Fixed flow regulators provide more accuracy.

8.1.3 Adapters

The proper calibration adapter should be utilized to allow the gas to properly diffuse around the sensor. The adapter cup for an LPT-A with an internal sensor without a splash guard is part number **CET-7000-CAP**. For an LPT-A with a splash guard, use part number **CET-4700-SCC**. For an LPT-A with an ESH Remote Sensor (dongle style), use part number **CET-8000-ESH**.

8.1.4 Humidifier

For refrigerant sensors (solid state), an inline humidifier is required for all operations with bottled gas (bump test, zero and span).

8.1.5 Calibration Frequency

- Parking garage detectors: Once every 12 months
- OHS applications: Once every 6 months (OHS: Occupational Health & Safety)
- For best performance and to meet published specifications: once every six months

NOTE: A calibration label should be applied after every calibration to confirm work performed and the date it was confirmed. If a controller is involved, the alarm set points should be indicated on a label on the front door of the enclosure so anyone working in the environment can be aware.

Equipment: Calibration Kit, calibration gases, digital multi-meter, magnetic wand

Users can order the Calibration Kit, calibration accessories and / or gases from any CETCI authorized distributor or you can supply your own gas and equipment as long as the gas meets the minimum specifications. **NOTE:** CETCI does not ship gas cylinders outside of Canada.

8.1.6 Gas Testing Frequency (Bump Testing)

For the purpose of safety in OHS applications, sensors should be gas tested (bump tested) once every month to confirm response and alarm activation.

8.1.7 Sticky Gases

Sticky gases, such as Ozone (O_3), Chlorine (Cl_2) and Hydrogen Chloride (HCl) adhere to surfaces such as tubing and splash guards. The LPT-A Analog Transmitter with an Ozone or Chlorine or Hydrogen Chloride sensor will not be sold with the factory stock splash guard. When calibrating with sticky gases we recommend using Teflon lined tubing so the gas doesn't adhere to the tubing, reducing the concentration of the flow of gas. Also keep the length of the tubing as short as possible, no more than 0.91 m - 1.22 m (3 ft - 4 ft) so the gas flow concentration doesn't lessen over the distance from the gas cylinder to the sensor.

It is also recommended that when calibrating a Chlorine sensor, you use a chlorine gas generator due to the instability of Chlorine gas in a cylinder and the fact that it is difficult to get accurate readings from that source.

8.1.8 Non-Intrusive Calibration

Calibration can normally be performed without opening the transmitter. A magnetic calibration wand (CETCI part number **CET-MW**) is available from CETCI and is used to touch the enclosure at the lower left edge of the vent opening (refer to page 16 of this manual for location photo). A second touch with the calibration wand can be used to cancel the current calibration step.

The LPT-A will need to be opened for calibration when any of the following conditions occur:

- The transmitter has not been calibrated for an extended period, which has allowed the sensor aging to reach a level that there appears to be an ambient gas level higher than the transmitter is allowed to correct for.
- The calibration gas concentration to be used is different from that previously set.

- The ambient gas level is higher than considered reasonable. CETCI strongly recommends using zero air (N_2 must be used to zero Oxygen sensors).

8.2 Setting the Calibration Gas Level

The calibration gas concentration can be changed in the same fashion as the set point:

- Move a jumper from an IDLE position to the CALGAS position
- Rotate the shaft of the encoder, E1, to increase or decrease the calibration gas value.
- The display will show the calibration gas value and a “CALGAS” icon.



- While adjusting the calibration gas value a corresponding voltage will be signaled on the test points TP-1 and TP-2. For example: a common calibration gas for CO is 100 ppm, which is half the range, so 2 volts at the test points indicates 100 ppm.
- After changing the calibration gas level move the jumper from the CALGAS position back to the IDLE position.
- If the encoder is not rotated for 5 minutes the transmitter will automatically return to normal operation. The jumper will have to be removed and re-installed at the CALGAS position if further adjustment is required.

8.3 Calibrating the Internal Sensor

NOTE: If you are calibrating an Oxygen sensor, refer to Section 8.5 *Calibrating an Oxygen Sensor*.

The calibration procedure of the LPT-A is jumper automated (there are no potentiometers to

adjust). Monitoring the calibration with a volt meter at TP1 and TP2 is optional. The range of 0 - 4.0 VDC is equal to the full measurement range of the sensor, e.g. CO sensor has a standard measurement range of 0 - 200 ppm. Therefore, 4.0 VDC = 200 ppm.

To achieve calibration, the user must go through the following steps:

Step 1: Set Calibration Gas Level

If you are using a different calibration gas concentration than from previous calibrations, you will need to set the Calibration Gas Level. Refer to Section 8.2 *Setting the Calibration Gas Level*.

The factory default calibration gas concentrations are:

SENSOR GAS TYPE	CALIBRATION GAS LEVEL	TP1 - TP2 VOLTAGE
Carbon Monoxide (CO)	100 ppm	2 volt
Nitrogen Dioxide (NO ₂)	5 ppm	2 volt
Solid State Refrigerants	1,000 ppm	2 volt
Combustibles	20% LEL	1.6 volt

Step 2: Expose to Clean Air:

- Attach regulator to cylinder of zero air (Nitrogen is used to zero Oxygen sensors).
- Insert the calibration adapter into the sensor opening in the front of the enclosure door.
 - Use a slight twisting motion as you gently push the calibration adapter into the sensor opening.
 - If the calibration adapter is hard to insert, moisten the O-ring seal slightly then try re-inserting it.
 - If the optional splash guard is installed, use the large cup adapter (part number **CET-4700-SCC**) and place it over the splash guard.

- Open regulator valve fully allowing zero air (Nitrogen) to flow over sensor for one minute. As the amount of oxygen decreases, it will trigger the descending alarm point and the alarm will go off.
- In some situations using ambient air instead of zero air is possible, but refer to the limitations in Step 4.

Step 3: Trigger the Calibration by:

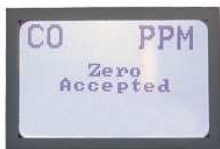
- Touching the enclosure of the LPT-A with a magnet wand (below and just left of the gas vent opening) or moving an internal jumper from a J7 IDLE position to the CAL position.



The LPT-A will use the last four seconds of gas data to determine the zero calibration level.

Depending on the reading the LPT-A will show one of the following messages:

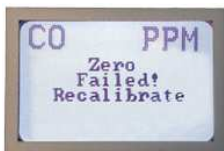
- ZERO ACCEPTED - proceed to Step 5



- ZERO OUT OF RANGE, OVERRIDE? - proceed to Step 4

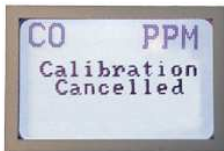


- ZERO FAILED! RECALIBRATE - see Section 7.5 *Fault Detection*



Step 4: Possible Override

- If the zero level appears too high (the ambient air might have a slight background of the target gas present, or it might have been so long since the last calibration that the sensor has drifted), the display will show “ZERO OUT OF RANGE, OVERRIDE?” and the internal Calibrate State LED will flash with a short OFF time and long ON time.
- To cancel calibration, move the jumper from the CAL position back to the IDLE position. The display will show:



- To override, move the second IDLE jumper from its rest position to the OVER / DESC / TEST position.
- If the jumper is not moved to the OVER position within 30 seconds, the calibration will be cancelled and the LPT-A will return to normal mode.
- After using the OVER / DESC / TEST position, the second IDLE jumper should be returned to its rest position.

Step 5: Zero Accepted

- Once zeroed, the display will show 'FLOW GAS' and the internal calibrate state LED will flash four times and then paused with the LED off.



- Disconnect the zero air (N_2) from the calibration adapter.

Step 6: Attach hose from the bottle of calibration gas to the calibration adapter.

- Ensure that the adapter has not fallen out of the transmitter's sensor opening.

Step 7: Open regulator valve fully and allow span gas to flow over sensor.

- If no gas is detected after one minute, the transmitter returns to normal operation and the procedure will need to be repeated from Step 2.

NOTE: If an inappropriate concentration of span gas is applied during calibration, calibration may succeed but it does not mean the equipment has been calibrated properly. CETCI is not responsible

for improperly calibrated transmitters. Follow manual instructions carefully.

Step 8: Wait for stable reading

- Once gas flow is detected, the display will show 'WAITING FOR STABLE READING'.



- The calibrate state LED pattern will flash four times and then pause with the LED on. During this time the TP1 voltage will follow the gas level based on the ideal span of the sensor.
- Spanning can be cancelled by removing the jumper from the CAL position; return it to the IDLE position. Note that the zero value set in Step 5 is not cancelled.
- If spanning times out without an acceptable value the display will show 'SPAN FAILED! RECALIBRATE'.
- The 4-20 mA output will signal the failure with 0 mA (0 -10 volt will be 0 volt). This condition can only be resolved by a successful calibration.



Step 9: Span Complete

- After the span is completed successfully, the transmitter will display 'CALIBRATION COMPLETE' for several seconds, then return to normal operation. Please return the jumpers to the IDLE

positions.



- If the calculated sensitivity of the sensor is out of range the display will show 'SPAN FAILED! RECALIBRATE' indicating the sensor cannot be calibrated. You can try to recalibrate, starting from Step 2, to confirm the procedure was followed correctly and this may correct the fault.
- If span fails repeatedly the sensor has either aged beyond its useful life or has otherwise failed, please contact our service department at service@cetci.com.

NOTE: The LPT-A will automatically return to normal operation after a successful calibration. If the calibration gas is still applied the level will be reflected on the output signal, and relay, which could cause a control panel to enter an alarm state. If the span calibration was not successful the LPT-A will display 'CALIBRATION FAILED! RECALIBRATE' and output 0 mA (0 volts) until a successful calibration is performed.

NOTE: Some sensors and gas (e.g. refrigerants) will continue to climb as long as gas is applied. CETCI uses a 2 minute mark for calibration in these cases.

To exit calibration at any time, either:

- Touch the enclosure with the calibration wand a second time or
- Remove the jumper from the CAL position and return it to the IDLE position

If the digital multi-meter leads are attached to test points TP-1 and TP-2, the measured voltage will start moving towards the voltage calculated for the span gas value.

8.4 Calibrating an ESH-A Remote Sensor Connected to an LPT-A

There are two different processes for calibrating an ESH-A Remote Sensor. One process is for a new or replacement sensor and the other is for a properly functioning sensor. For either process, first ensure that the sensor has been continually powered for at least 24 hours.

8.4.1 Zero and Span Calibration of a Responsive ESH-A Remote Sensor (done at the LPT-A)

If the sensor does not need to be replaced and is responding correctly, the Zero and Span calibrations will need to be done at LPT-A transmitter that the ESH-A is connected to.

Follow the instructions in Section 8.3 *Calibrating the Internal Sensor* **with the exception of applying the gas to the ESH-A sensor opening instead of the LPT-A sensor opening.**

8.4.2 Zero Calibration of a New or Replacement ESH-A Remote Sensor

If a new replacement sensor has been installed, the ESH-A will require a zero calibration of its sensor. This process will normally be required if the sensor has been replaced or there is concern that the sensor is not responding correctly.

Make sure the ESH-A Remote Sensor is powered up and has been warmed up for a 48 hour period prior to calibration.

Step 1

Open the ESH-A Remote Sensor enclosure. Move the jumpers from their resting position to JP1-1 and JP1-2 (bottom two jumper positions).

Step 2

Apply the correct Null gas for the type of sensor installed, for a minimum of 2 minutes.

Step 3

Attach a volt meter to TP1 and TP2. Using the POT RN1 potentiometer (located on the left underside of the ESH-A board), adjust the voltage to read 0.40 VDC. Verify that the voltage output from digital multi-meter leads attached to test points TP1 and TP2 on the LPT-A is reading 0.0 VDC (a Zero and Span Calibration of the LPT-A will be required if this is not the case).

Step 4

Return the jumpers to their original positions and close the ESH-A.

Step 5

Follow the instructions in Section 8.3 *Calibrating the Internal Sensor* **with the exception of applying the gas to the ESH-A sensor opening instead of the LPT-A sensor opening.**

8.5 Calibrating an Oxygen Sensor

When calibrating an Oxygen sensor, the process is reversed. You need to do the span first and then the zero.

Flow Nitrogen (N_2) over Oxygen (O_2) sensors before attempting to null adjust them. If the service person is confident of air quality and is careful (do not exhale in the direction of the Oxygen sensor being serviced while span adjusting), oxygen in the breathing environment can be used as a fairly accurate source of span gas (20.9% volume) "in a pinch". It is not recommended to use this procedure for all span adjustments of Oxygen sensors.

The calibration procedure of the LPT-A is jumper automated (there are no potentiometers to adjust). Monitoring the calibration with a volt meter at TP1 and TP2 is optional. The range of 0 - 4.0 VDC is equal to the full measurement range of the sensor. The Oxygen sensor has a standard measurement range of 0 - 25% vol. Therefore, 4.0 VDC = 25% VOL O_2 , 3.44 VDC = 20.9% VOL O_2

To achieve calibration, the user must go through the following steps:

Step 1: If you are using a different calibration gas concentration than from previous calibrations, you will need to set the Calibration Gas Level. The calibration gas concentration can be changed in the same fashion as the set point:

- Move a jumper from an IDLE position to the CALGAS position
- Rotate the shaft of the encoder, E1, to increase or decrease the calibration gas value.
- The display will show the calibration gas value and a “CALGAS” icon.
- While adjusting the calibration gas value a corresponding voltage will be signaled on the test points TP-1 and TP-2.
- After changing the calibration gas level move the jumper from the CALGAS position back to the IDLE position.
- If the encoder is not rotated for 5 minutes the transmitter will automatically return to normal operation. The jumper will have to be removed and re-installed at the CALGAS position if further adjustment is required.

The factory default calibration gas concentration for Oxygen is:

SENSOR GAS TYPE	CALIBRATION GAS LEVEL	TP1 - TP2 VOLTAGE
Oxygen (O ₂)	20.9%	3.44 volt

Step 2: Span the Sensor with Oxygen:

- Attach regulator to cylinder of calibration gas. (If ambient conditions are being used, skip to Step 3.)
- Insert the calibration adapter into the sensor opening in the front of the enclosure door.
- Use a slight twisting motion as you gently push the calibration adapter into the sensor opening. If the calibration adapter is hard to insert, moisten the O-ring seal slightly then try re-inserting it.

- Open regulator valve fully allowing calibration gas to flow over sensor for 3 minutes. If no gas is detected after one minute, the transmitter returns to normal operation and the procedure will need to be repeated from Step 2.

NOTE: If an inappropriate concentration of span gas is applied during calibration, calibration may succeed but it does not mean the equipment has been calibrated properly. CETCI is not responsible for improperly calibrated transmitters. Follow manual instructions carefully.

Step 3: Trigger the Calibration by:

Touching the enclosure of the LPT-A with a magnet wand (below and just left of the gas vent opening), or moving the internal jumper from a J7 IDLE position to the CAL position.

The LPT-A will use the last four seconds of gas data to determine the Oxygen span gas level.

If the Span is successful, the LPT-A will show the following message: SPAN ACCEPTED.
Proceed to Step 4.

If the Span was not successful:

- If spanning times out without an acceptable value the display will show 'SPAN FAILED! RECALIBRATE'.
- The 4-20 mA output will signal the failure with 0 mA (0 -10 volt will be 0 volt). This condition can only be resolved by a successful calibration.
- If the calculated sensitivity of the sensor is out of range the display will show 'SPAN FAILED! RECALIBRATE' indicating the sensor cannot be calibrated. You can try to recalibrate, starting from Step 2, to confirm the procedure was followed correctly and this may correct the fault.
- If span fails repeatedly the sensor has either aged beyond its useful life or has otherwise failed, please contact our service department at service@cetci.com.

Step 4: Span Accepted

- Once spanned, the display will show 'FLOW NITROGEN'.
- Disconnect the calibration gas (if used) from the calibration adapter.

Step 5: Attach hose from the bottle of Nitrogen (N_2) 100% vol to the calibration adapter. Ensure that the adapter has not fallen out of the transmitter's sensor opening.

Step 6:

Open regulator valve fully and allow Nitrogen (N_2) gas to flow over sensor. If no Nitrogen (N_2) gas is detected after one minute, the transmitter returns to normal operation and the procedure will need to be repeated from Step 2.

Step 7: Wait for Stable Reading

- Once gas flow is detected, the display will show 'WAITING FOR STABLE READING'.
- During this time the TP1 voltage will follow the gas level based on the ideal span of the sensor.
- Zeroing can be cancelled by removing the jumper from the CAL position; return it to the IDLE position. Note that the span value set in Step 4 is not cancelled.
- If zeroing times out without an acceptable value the display will show 'ZERO FAILED! RECALIBRATE'.

Step 8: Possible Override

- If the zero level appears too high (it might have been so long since the last calibration that the sensor has drifted), the display will show "ZERO OUT OF RANGE, OVERRIDE?"
- To cancel calibration, move the jumper from the CAL position back to the IDLE position. The display will show "CALIBRATION CANCELLED" for several seconds then return to normal operation.

- To override, move the second IDLE jumper from its rest position to the OVER / DESC / TEST position.
- If the jumper is not moved to the OVER position within 30 seconds, the calibration will be cancelled and the LPT-A will return to normal mode.
- After using the OVER / DESC / TEST position, the second IDLE jumper should be returned to its rest position.

Step 9: Zeroing Complete

- After the zeroing is completed successfully, the transmitter will display 'CALIBRATION COMPLETE' for several seconds, then return to normal operation. Return the jumpers to the IDLE positions.
- If the calculated sensitivity of the sensor is out of range the display will show 'ZERO FAILED! RECALIBRATE' indicating the sensor cannot be calibrated. You can try to recalibrate, starting from Step 2, to confirm the procedure was followed correctly and this may correct the fault.
- If calibration fails repeatedly the sensor has either aged beyond its useful life or has otherwise failed, please contact our service department at service@cetci.com.

NOTE: The LPT-A will automatically return to normal operation after calibration completes (whether passed or failed). If the Nitrogen (N_2) gas is still applied the level will be reflected on the output signal, and relay, which could cause a control panel to enter an alarm state.

To exit calibration at any time, either:

- Touch the enclosure with the calibration wand a second time or
- Remove the jumper from the CAL position and return it to the IDLE position

If the digital multi-meter leads are attached to test points TP-1 and TP-2, the measured voltage will start moving towards the voltage calculated for the applied gas value.

9 ACCESSORIES

9.1 Splash Guard p/n: S



The splash guard attaches to the front of the enclosure and when installed, the enclosure meets IP54 standards. Factory installed only.

NOTE: The splash guard will slow down the response time of the sensor.

NOTE: The splash guard option is not available for LPT-A's with "sticky gas" sensors, such as Chlorine, Ozone or Hydrogen Chloride. Sticky gases will adhere to the splash guard and cause inaccurate gas concentration readings.

9.2 Magnetic Wand p/n: CET-MW

The magnetic wand is used for non-intrusive calibration (without opening the enclosure).



Lifts	226.7 g (½ lb) solid steel
Size	66.6 mm x 6.35 mm (2 5/8" X 1/4") Hexagon

9.3 Metal Protective Guard p/n: SCS-8000-RSG



The metal protective guard is made of heavy gauge, galvanized metal and helps protect against abrasive damage, theft and vandalism to the transmitters. The 16-gauge galvanized steel has 13 mm (½ in) square openings in the front to allow gas and air to flow through to the sensor. With only four slotted mounting holes, installation and removal for gas detector servicing is easy.

Enclosure	16 gauge galvanized steel
Weight	800 g (28 oz)
Size	178 mm W x 160 mm H x 91 mm D (7.0 in W x 6.3 in H x 3.6 in D)

9.4 Calibration Kit p/n: CET-715A-CK1

The Calibration Kit contains the items necessary for common field and shop calibrations. It comes in a durable, hard plastic carrying case and includes a regulator, adapters, humidification chamber, brass fitting, hand tools and tubing. It does not include cylinders of gas. These must be ordered separately.



Calibration Kits and gases are available from the CETCI factory. Many gases, but not all are carried in inventory. Check with any CETCI authorized distributor for availability of specific gas types. **Gas cylinders cannot be shipped from Canada to other countries, including the USA.** For more information check out our website:

<http://www.critical-environment.com/products/calibration-kit.html>

10 MAINTENANCE

The LPT-A transmitter requires virtually no maintenance other than regular calibration of the sensor. There are no replaceable components except the sensors.

The transmitter should be regularly inspected and monitored for possible damaging conditions.

- The sensor vent should be kept free of dirt or soot build up.
- If in a damp location, source of water should be shielded from contacting the top of the transmitter.
- If located in a working area, the front of the transmitter should be kept clear.
- If painting is to be conducted in the transmitter's location the transmitter needs to be protected from over spray and the sensor port should not receive paint fumes – these fumes may damage or reduce the life of the sensor.

It is important to ensure that excess water and/or dust is not somehow entering the enclosure and physically damaging the circuit board or internal components.

11 TROUBLE SHOOTING

LPT-A won't power up. (blank display)

Is the power properly connected? Check the connections. Refer to Section 6.7 *Wiring Connections*.

Display shows a fault message and the current loop outputs 0 mA.

The LPT-A is in fault mode. If re-calibrating the sensor fails, replace the transmitter.

During calibration the display shows "override" message.

The sensor needs an override. Move the second IDLE jumper to the OVER / DESC / TEST position.

Display shows "Span Failed. Recalibrate".

The span calibration failed. Try to recalibrate the sensor again.

LPT-A powered up (display appears normal) but the control panel displays "Fault".

4 - 20 mA signal loop has not been connected properly. Check the connections and refer to the Wiring Examples in Section 6.7 *Wiring Connections*.

Display shows OL in the lower right hand corner.

The 4 - 20 mA signal loop has not been connected properly or has been damaged in some manner between the analog transmitter and the device to which it is sending its signal output. Check for broken wires and other wiring problems.

List of Possible LPT-A Error Codes:

(appears on the display with a triangle that has an ! in the center of it)

Code		Description
001	Negative Sensor	The sensor signal is too far negative. May be caused by a sensor that is temperature or humidity sensitive. Zeroing the sensor will normally resolve this.
002	High Sensor	The sensor signal is too high (above the defined range for the LPT-A). May be caused by using a calibration gas with a concentration that doesn't match the setting in the LPT-A.
003	AFE chip has failed	Internal chip AFE has failed. If a power cycle does not resolve this, then the LPT-A must be replaced.
004	POT chip has failed	The internal chip POT has failed. If a power cycle does not resolve this, then the LPT-A must be replaced.
005	DAC chip has failed	The internal chip DAC has failed. If a power cycle does not resolve this, then the LPT-A must be replaced.



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