Critical Environment Technologies™

Operation Manual

Rev. F | 2018.09

LPT Low Power Transmitter

www.critical-environment.com

TABLE OF CONTENTS

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 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 sections *10 Maintenance* and *8 Calibration* 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), 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. Warranty does not include third party trouble-shooting costs or freight to / from the manufacturer's facility. CETCI's liability is limited to replacement or repair of the equipment manufactured.

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 single sensor, analog LPT Low Power Transmitter.

The LPT is a rugged, easy-to-use analog gas detection transmitter for use as part of a fixed system with a Controller in non-hazardous (non-explosion rated) environments. Ideal applications include car parks, vehicle repair, aquatic centers, ice rinks and oxygen depletion environments.

It features a two-wire loop power, three-wire VDC or four-wire VAC power, 4 - 20 mA linear output signal, thermal resetting fuses, temperature compensation, and visual LED indication for power and fault conditions (refer to Section *3.1 Technical Specifications*), all in a RoHS compliant package.

It comes 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 wash down applications.

The LPT operates by diffusion. The sensors used 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 sensor
- 2-wire loop, 3-wire VDC or 4-wire VAC power
- Linear 4 - 20 mA output signal
- Standard water / dust tight, corrosion resistant enclosure (drip proof)
- Optional splash guard to protec sensor in wash down applications; IP54 rated when factory installed
- RoHS compliant circuit boards
- Easy maintenance, economical
- Includes sensor CEF (calibration extending firmware) for parking garage applications
- Auto resetting fuses

3 INSTRUMENT SPECIFICATIONS

3.1 Technical Specifications

MECHANICAL	
Enclosure	ABS / Polycarbonate, copper coated interior to reduce RF interferance, IP54 rated with splash guard installed
Weight	400 g (14 oz)
Size	127 mm x 127 mm x 48.5 mm (5.0" x 5.0" x 1.91")

ELECTRICAL	
Power Requirement	
2-wire mode	16 - 30 VDC, 1 W, Class 2
3-wire mode	16 - 30 VDC, 1 W, Class 2
4-wire mode	12 - 27 VAC, 50 - 60 Hz, 1 VA, Class 2 Use Class 2 transformer. See Section *6.7 Wiring Connections*.
Current Draw	Maximum 25 mA
Outputs	Linear 4 - 20 mA Maximum 216 Ω load (wiring plus termination resistor) at 16 VDC Maximum 316 Ω load (wiring plus termination resistor) at 12 VAC
Wiring	VDC two or three conductor shielded 18 awg (or larger) stranded within conduit VAC four conductor shielded 18 awg (or larger) stranded within conduit (refer to Section *6.7.2 Wire Gauge vs. Run Length*)

Fuse	Automatic resetting thermal
Indicator	Solid Green: Power ON Flashing Green (50% duty cycle): Warm up Flashing Green (short OFF, long ON): Fault mode LED OFF: No Power or 4-20 mA "Open Loop" (unit won't operate)

ENVIRONMENTAL *(sensor dependant)*

Operating Temperature	-20°C to 40°C (-4°F to 104°F)
Operating Humidity	15 - 90% RH non-condensing

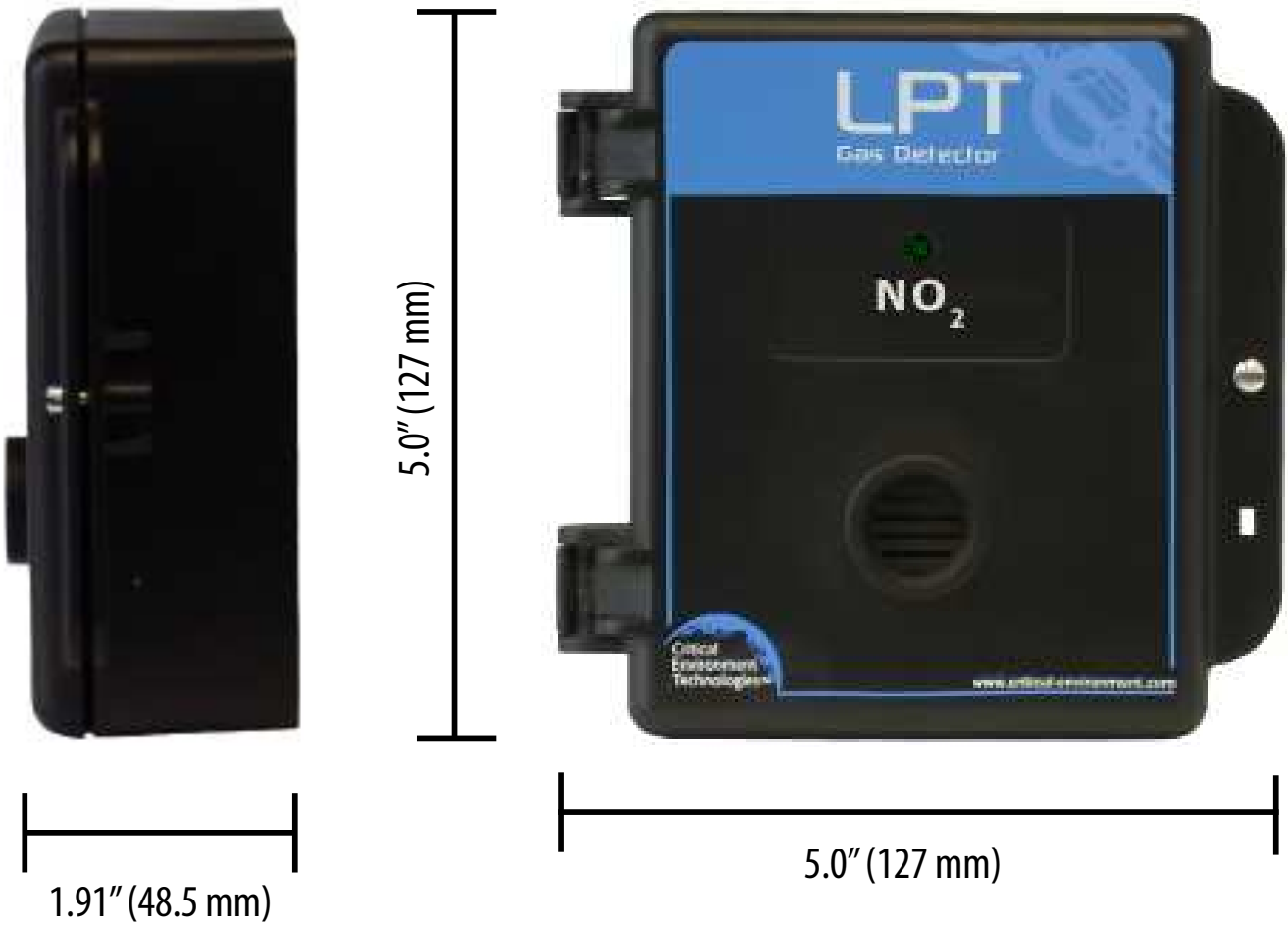
CERTIFICATION

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 that may cause undesired operation.

3.2 Enclosure Dimensions



2.24" (57 mm) with splash guard (not shown)

4 SENSOR SPECIFICATIONS

4.1 List of Available Internal Sensors

Internal Electrochemical Sensors	Part Number	Range	Lifespan
Ammonia (NH_3)	LPT-NH3	0 - 500 ppm	2 years
Carbon Monoxide (CO)	LPT-TCO	0 - 200 ppm	6 years
Chlorine (Cl_2)	LPT-CL2	0 - 5.0 ppm	3 years
Nitrogen Dioxide (NO_2)	LPT-END	0 - 10 ppm	3 years
Oxygen (O_2)	LPT-O2	0 - 25% vol	3 years
Ozone (O_3)	LPT-O3	0 - 2.0 ppm	2 years

4.2 Calibration Extending Firmware (CEF) and Sensor Aging for CO and NO_2 Sensors

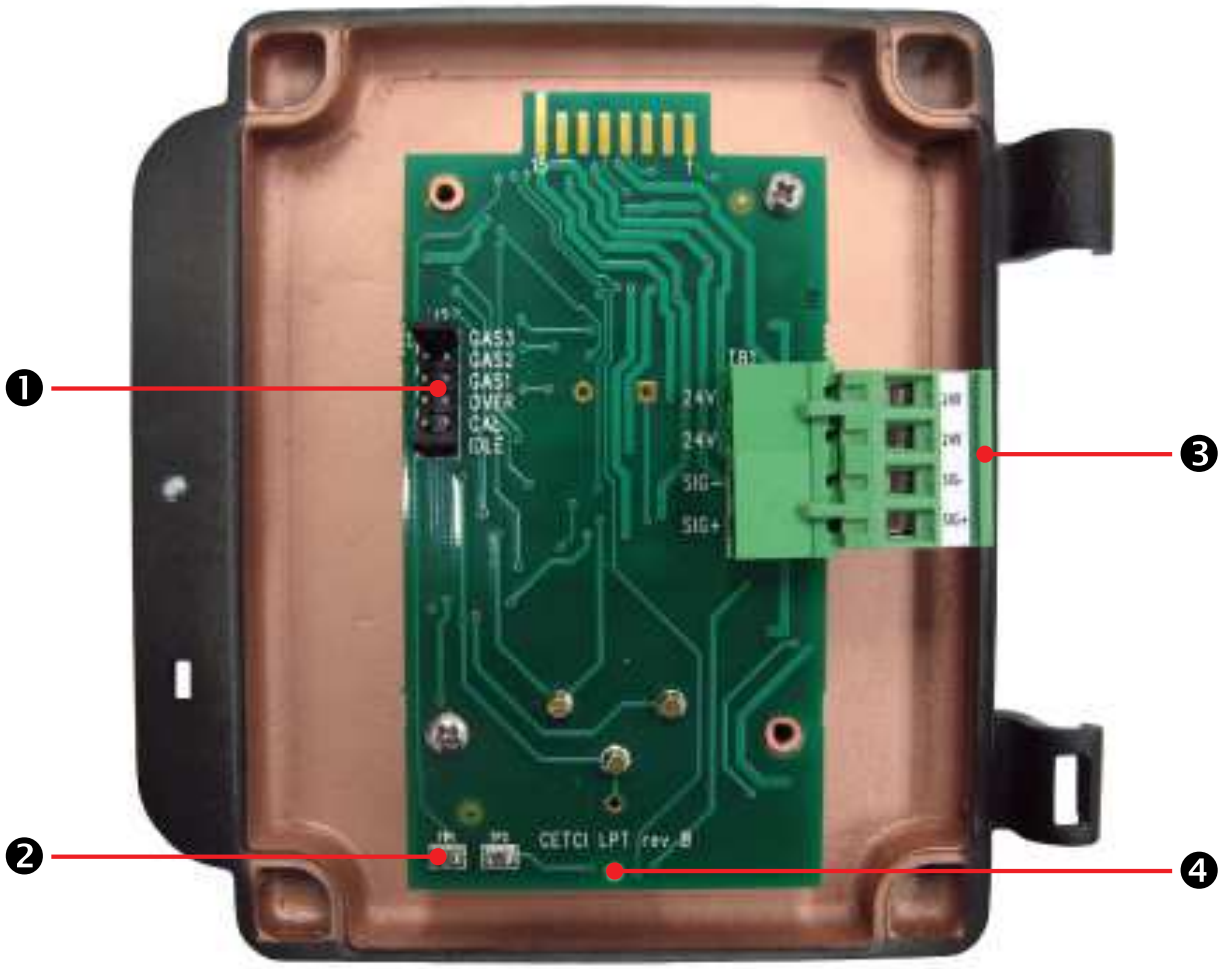
LPT systems with integral CO or NO_2 electrochemical sensors have been programmed with our CEF (Calibration Extending Firmware). This firmware takes into consideration the aging of the sensors so that less frequent calibrations are acceptable in less-critical applications such as parking garages. The 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
❶	Door Hinge	Secures door
❷	LED Indicator	Indicates Power & Fail
❸	Door Screw	Secures door
❹	Sensor Opening	To monitor diffused air and gas
❺	Padlock Opening	For padlock

5.2 Interior System Layout



NUMBER	FEATURE	FUNCTION
❶	Jumpers	For calibrations & test functions
❷	Test Points: TP-1 & TP-2	For measuring voltage output
❸	Wiring Terminal	Pluggable wiring terminal
❹	Internal LED	Calibration status indicator

6 INSTALLATION

The sensor in the LPT goes through a burn in period at our factory prior to shipiping so it is ready for operation upon arrival. If you install the LPT when it arrives, most sensors will not require a long warm up period (about 5 minutes for Ammonia and Nitrogen dioxide, 2 minutes for the other gases, except Oxygen which is a minimum of 2 hours). 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.

NOTE: CETCI suggests that upon power-up, all sensors be left to warm up for 24 hours prior to considering the gas readings to be accurate.

NOTE: All sensors are calibrated in the factory and do not require calibration at the time of a routine installation.

NOTE: 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.

6.1 Special Considerations for Different Types of Sensors

After installing an LPT-A with an *Oxygen sensor,* leave it to warm up for at least 2 hours before looking at the readings. If after at least 2 hours, the gas reading is not 20.9%, you should do a respan.

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.

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.

6.2 General Safety Warnings

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

The LPT 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.

6.3 Protection Against Electrical Risks

Disconnect all power before servicing. There may be multiple power sources. Power supply must 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 supply (disconnecting power to the LPT). Appropriate markings should be visible at the circuit breaker / switch that is supplying power to the LPT.

This device may interfer 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 a have a pacemaker, follow your healthcare provider's instructions about being around this type of equipment.

6.4 Protection Against Mechanical Risks

The door of the ABS / polycarbonate 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.**

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 ABS / Polycarbonate 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. See photo reference on preceding pages.

Be aware that the hinged door 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.

6.5 Mounting the Transmitter

The LPT should be mounted on a flat vertical surface using the four 4.4 mm (0.175") diameter mounting holes provided to maintain water tight status. Care should be taken to ensure that the face of the LPT 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 *5.7 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.

6.5.1 Wet Environment Considerations

If LPT is to be installed in a potential hose down application or any application whereby liquid could be directed towards the sensor opening, the LPT (depending on gas sensor type) should be ordered with a factory installed splash guard (Option -S) or a separate metal guard with a factory installed splash cover (p/n: SCS-8000-WSG). Standard gas sensors like CO, NO_2 and O_2 can be protected with the factory installed splash guard. Sticky gas sensors like Cl_2 and O_3 do not work with a splash guard, but can be protected by a metal guard with a splash cover.

If used in a wet or wash down application, the conduit hub entering the LPT enclosure must be a 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.

6.5.2 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.

6.5.3 Mounting Height (Sensor Dependent)

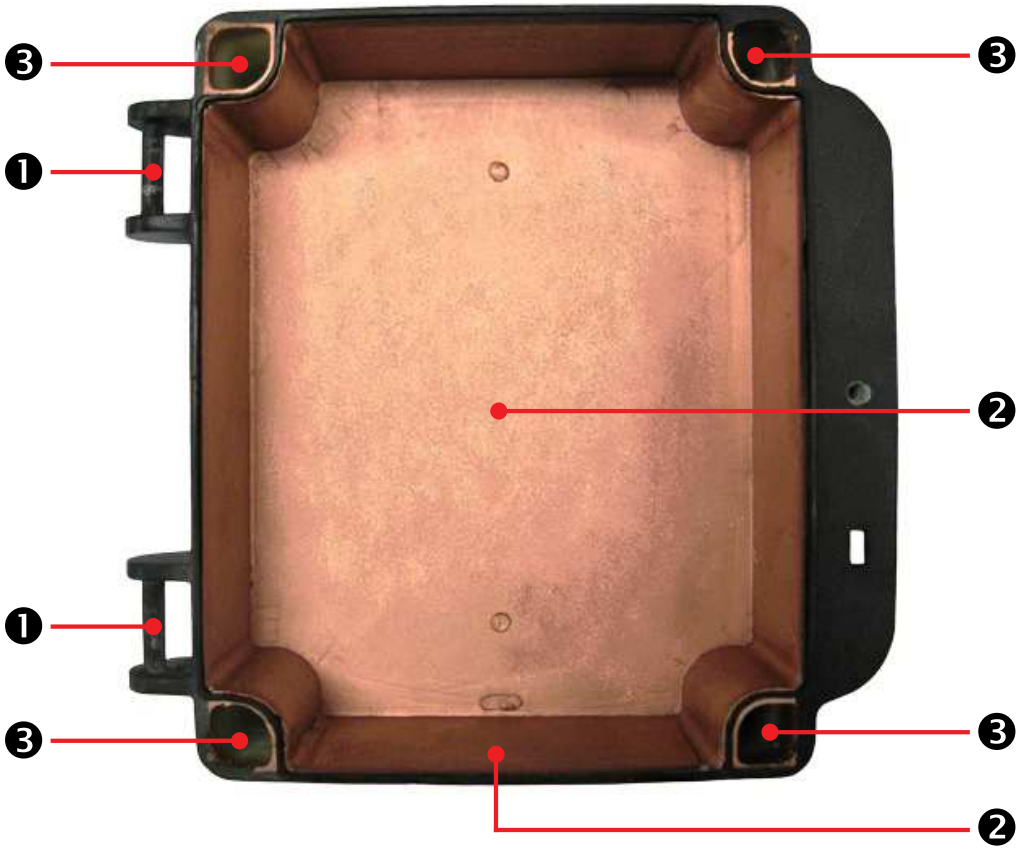
The sensor mounting height depends on the density of the gas relative to air. Heavier than air gases should be detected 6 in / 15 cm from the floor, lighter than air gas sensors should be placed on or near the ceiling, and gases which have a density close to that of air should have sensors installed in the "breathing zone" 4 - 6 ft / 1.2 - 1.8 m from the floor. The breathing zone refers to the area 4 - 6 ft / 1.2 - 1.8 m 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	4 - 6 ft above the floor 1.2 - 1.8 m above the floor
Nitrogen Dioxide (NO_2)	Diesel engine exhaust	
Ammonia (NH_3)	Commercial ice rinks Compressor rooms	Near or on the ceiling
Chlorine (Cl_2)	Commercial swimming pools	6 in above the floor 15 cm above the floor
Ozone (O_3)		
Oxygen (O_3)	Hospitals, Laboratories Chemical Storage Rooms	4 - 6 ft above the floor 1.2 - 1.8 m above the floor

NOTE: CETCI considers 4 - 6 ft from the floor as the "Breathing Zone" when it applies to sensors installed for vehicle exhaust applications.

6.6 Enclosure Mounting Components

6.6.1 Enclosure Base



NUMBER	FEATURE
❶	Door Hinge
❷	Conduit Entry
❸	Mounting Holes

6.6.2 Enclosure Bottom

NUMBER	FEATURE
1	Door Hinge
2	Conduit Entry

6.7 Wiring Connections

The LPT 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.

NOTE: Be careful when knocking out the conduit entry. Fully open the enclosure door so the circuit board is safely away from the conduit entry area so you do not risk damaging it.

6.7.1 Power Connection

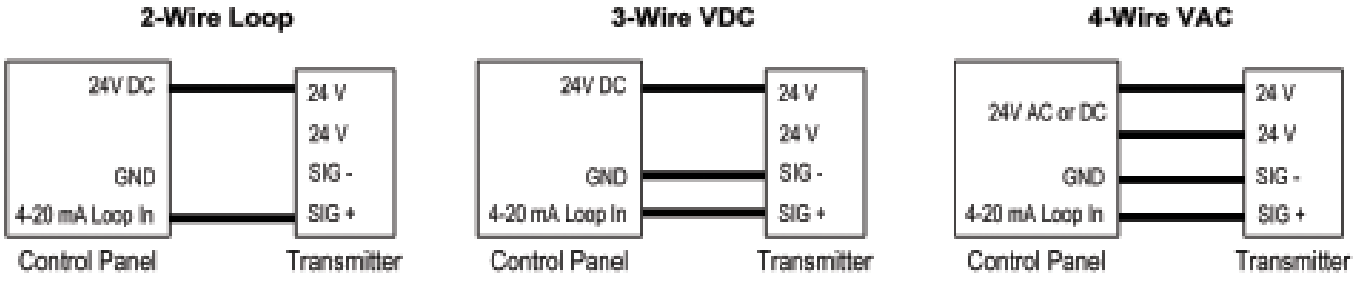
If the installer is powering the LPT with 24 VAC, both VAC wires should be connected to the terminal "one" and terminal "two", from the top down.

If the installer is powering the LPT with 24 VDC three wire, the "positive" wire should be connected to terminal "one" and the negative wire should be connected to terminal "three". The "signal" wire is **always** connected to terminal "four". With 24 VDC two wire the "Positive" wire should be connected to terminal "one' and the "signal" wire is **always** connected to terminal "four." Refer to *Wiring Examples*.

NOTE: DO NOT USE SOLID-CORE WIRE 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 "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.

Wiring Examples



Device must be used with rated equipment. External power to LPT must be supplied by a Class 2 or better transformer. For loop-powered applications, the controller must conform to CSA, UL & CE safety standards.

6.7.2 Wire Gauge vs Run Length

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	27,100
		18	43,200
		16	65,500
12 VAC	316 (assume a 200 Ω termination resistor)	20	5,600
		18	8,900
		16	13,583

NOTES: 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 green LED light indicator will illuminate and will be flashing and the current output is fixed at 4.0 mA for 5 minutes for a system warm up period. 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 alarms exist 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 green power LED illuminates continuously indicating normal operation.

6.7.3 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 will not run or function at all. At this point, the wiring should be inspected for potential problems.

7 OPERATION

7.1 System Operation

Normal operation is indicated by a solid light on the external LED. During normal operation, the gas level will be reported through the current loop, and a rough reading can be obtained from the voltage test points. The LED will remain solid when the device is in working order, and is not affected by gas concentration.

7.2 Fault Detection

The LPT has built in fault detection, and in the event of a problem with the measurement circuitry the transmitter will indicate a fault condition by flashing the external green LED (short OFF and long ON time). At this point, the transmitter will output approximately 3.5 mA on the current loop and the test points will alternate between 0 and 1 volt every second. Normal operation will resume once the fault condition has been rectified.

NOTE: While faults in the circuitry can be detected, a dead or damaged sensor will usually appear to the transmitter as a zero gas reading. To ensure safe operation, periodic bump tests are required.

7.3 Test Functions

During warm up and normal operation, the current loop and the voltage output can be tested by using Jumpers on J2 (refer to Section *7.4 Jumpers*).

Place the first Jumper to set the gas output level (GAS3, GAS2, GAS1), then place the second Jumper to the OVER pins. The current output will match the corresponding span gas level, and will remain at that level for 5 minutes.

After 5 minutes, the unit will return to normal operation. Please return the Jumper placed on the OVER location back to IDLE when testing is completed. (Refer to the table below for preset gas levels).

Voltage Output to Test Points "TP-1" and "TP-2":

NOTE: This output is intended as a rough indication of the gas level and has not been precisely calibrated.

Attach the meter 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. Eg. HVAC CO sensor has a standard measurement range of 0 - 200 ppm. Therefore 4.0 VDC = 200 ppm.

7.4 Jumpers

There are two jumpers on J2 located at the back of LPT PCA. These jumpers allow the user to perform a range of set up, test and calibration functions.

The following table details the jumper settings and explains the function enabled when these jumper positions are selected.

FUNCTION DESIRED (example)	J2 JUMPER-1	J2 JUMPER-2
Setting Span Gas Value ($CO = 200$ ppm, $NO_2 = 10$ ppm)	GAS3	IDLE
Setting Span Gas Value ($CO = 100$ ppm, $NO_2 = 5$ ppm)	GAS2	IDLE
Setting Span Gas Value ($CO = 50$ ppm, $NO_2 = 3$ ppm)	GAS1	IDLE
Perform Zero (Null) and Span Calibration	GAS1 or GAS2 or GAS3	CAL
To override the calibration if the zero and span value is over range high or low	OVER	CAL
During warm up and normal mode, check the voltage and current output	GAS1 or GAS2 or GAS3	OVER

GAS1, GAS2 and GAS3 allows setting the calibration gas level. The OVER setting allows overriding the value if out of range during calibration but still at a "reasonable" value.

Jumper-2 allows setting the calibration and checking the voltage and current output.

The three upper jumper's (GAS1-GAS3) allow setting the calibration gas value. The OVER jumper setting allows overriding the value if out of range during calibration but still at a "reasonable" value.

The default factory set location are as shown, (Jumper-1) is in the GAS3 position and the lower jumper (Jumper-2) is in the IDLE position.

Lower jumper set (CAL). This jumper allows setting the calibration and checking the voltage and current output.

Test Points: TP-1 & TP-2

8 CALIBRATION

8.1 Calibration Specifications

8.1.1 Gas

Calibration span gases should have 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 20.9% volume O_2 (scrubbed of hydrocarbons) before attempting to null adjust toxic gas sensors. In some cases N_2 can be substituted for zero air. Contact CETCI for clarification.

Every LPT 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 99.99% Nitrogen (N_2) for a true zero and span is done first, followed by zeroing. Refer to Section *8.3 Calibrating an Oxygen Sensor.*

8.1.2 Regulators & Flow

Calibration gases that are lighter than or the same weight as air (CO, O_2, etc.) should be flowed at 0.5 LPM. Gases heavier than air (NO_2, 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 calibration adapter plug for an LPT without a splash guard is part number **CET-7000-CAP**. For an LPT-A with a splash guard, you will need to use the Cal Clip, part number **CET-SGC**.

8.1.4 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

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.

8.1.5 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.

8.1.6 Sticky Gases

Sticky gases, such as Ozone (O_3) and Chlorine (Cl_2) adhere to surfaces such as tubing and splash guards. The LPT with an Ozone or Chlorine sensor will not be sold with the factory installed 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.

8.2 Calibrating the Internal Sensor

NOTE: If you are calibrating an Oxygen sensor, refer to Section *8.3 Calibrating an Oxygen Sensor.*

The calibration procedure within the LPT is jumper automated (there are no potentiometers to adjust). Monitoring the calibration with a volt meter is optional, but suggested. 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.

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 the manual instructions carefully.

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

Step 1:
Indicate what concentration of span gas used to flow over the sensor by putting Jumper-1 into gas position (GAS1, GAS2 or GAS3).

GAS SENSOR	SENSOR RANGE	JUMPER-1 SETTING	SPAN GAS CONCENTRATION LEVEL	VOLTAGE READING
CO	0 - 200 ppm	GAS3	200 ppm	4.00 VDC
		GAS2	100 ppm	2.00 VDC
		GAS1	50 ppm	1.00 VDC

NH_3	0 - 500 ppm	GAS3	500 ppm	4.00 VDC
		GAS2	300 ppm	2.40 VDC
		GAS1	50 ppm	0.40 VDC
NO_2	0 - 10 ppm	GAS3	10 ppm	4.00 VDC
		GAS2	5 ppm	2.00 VDC
		GAS1	3 ppm	1.20 VDC
O_2	0 - 25% vol	GAS3	23.0% vol	3.68 VDC
		GAS2	20.9% vol	3.34 VDC
		GAS1	19.0% vol	3.04 VDC
Cl_2	0 - 5 ppm	GAS3	5 ppm	4.00 VDC
		GAS2	3 ppm	2.40 VDC
		GAS1	1 ppm	0.80 VDC
O_3	0 - 2 ppm	GAS3	1 ppm	2.00 VDC
		GAS2	1 ppm	2.00 VDC
		GAS1	1 ppm	2.00 VDC

If the reference table is unavailable, the gas level for each jumper position can be determined by placing Jumper-1 into one of the GAS positions and Jumper-2 into the OVER position. This will cause the LPT to output the corresponding signal on both the current loop and the voltage test points.

Step 2:
Attach regulator to cylinder of zero air, insert calibration adapter into the sensor opening in the front of the enclosure door, and open regulator valve fully allowing zero air to flow over sensor for one minute.

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, slide the Cal Clip around the splash guard and attach the tubing to the nozzle on the Cal Clip.

Step 3:
Move the Jumper-2 on J2 to position "CAL".

Step 4:
If this level (possible residual gas) is too high, the internal LED will flash with a short OFF time and long ON time. This indicates that an override is needed. To override, move the Jumper-1 to the OVER position. If Jumper-1 is not moved to the OVER position in 30 seconds, the zeroing will be cancelled and will return to normal mode. After using the OVER position, Jumper-1 should be returned to the gas selection position (GAS1, GAS2 or GAS3).

Step 5:
Once zeroed, the internal LED will first flash 8 times, and then repeatedly flash 4 times and then pause with the LED off. This indicates that it is time to flow the gas.

If the digital multi-meter leads are attached to test points TP-1 and TP-2, the voltage should be 0.0 VDC.

Step 6:
Attach regulator to cylinder of span gas.

Step 7:
Insert the calibration adapter into the sensor opening in the front of the enclosure door.

Step 8:
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 performed from Step 2.

Step 9:
Once gas flow is detected, the internal LED pattern will change to flash four times and then pause with the LED on. During this time the current loop will follow the gas level based on the ideal span of the sensor.

The spanning can be cancelled by removing the Jumper-2 from the CAL position and move to IDLE position before the spanning is finished and the transmitter will return to normal operation (solid green light on the front).

Step 10:
After the span is completed and passed, the transmitter will return to normal operation.

If the span is out of range but within the override range, the LED will flash as it did for zero override range. To override, move the concentration jumper to the OVER position. If Jumper-1 is not moved to the OVER position in 30 seconds, the current loop will output 20 mA and will stay there until you move the Jumper. After using the OVER position, Jumper-1 should be returned to the gas selection position (GAS1, GAS2 or GAS3).

If the sensitivity of the sensor is calculated out of range more than the OVER can compensate for, the internal LED will turn on solid, the front LED will remain off and the current loop will output 20 mA 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 this does not correct the fault, please contact our service department at service@cetci.com.

To exit calibration mode, remove Jumper-2 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.

8.3 Calibrating an Oxygen Sensor

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

NOTE: Oxygen sensors have a 2 or 3 year life span. If the reading before starting the calibration has been dropping over the past couple of weeks a calibration may only last several days if the sensor is expiring. The calibration may complete but the reading will start to drop over the next couple of days .

The calibration procedure of the LPT is jumper automated (there are no potentiometers to adjust). Monitoring the calibration with a volt meter at TP1 and TP2 is optional but suggested. The range of 0 - 4.0 VDC is equal to the full measurement range of the sensor. O2 sensor has a standard measurement range of 0 - 25% vol. Therefore, 4.0 VDC = 25% VOL O2, 3.44 VDC = 20.9% VOL O2.

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

Step 1:
Indicate what concentration of span gas used to flow over the sensor by putting Jumper-1 into gas position (GAS1, GAS2 or GAS3).

GAS SENSOR	SENSOR RANGE	JUMPER-1 SETTING	SPAN GAS CONCENTRATION LEVEL	VOLTAGE READING
O_2	0 - 25% vol	GAS3	23.0% vol	3.68 VDC
		GAS2	20.9% vol	3.34 VDC
		GAS1	19.0% vol	3.04 VDC

The gas level for each jumper position can also be determined by placing Jumper-1 into one of the GAS positions and Jumper-2 into the OVER position. This will cause the LPT to output the corresponding signal on both the current loop and the voltage test points.

If the service person is confident of the air quality and is careful (do not exhale in the direction of the Oxygen sensor vent on the LPT being serviced while span adjusting), Oxygen (ambient air) in the breathing environment can be used as a fairly accurate source of span gas for jumper position GAS2. However, a cylinder of Oxygen 20.9% volume is suggested.

Step 2:
Attach the regulator to a cylinder of span gas. (If ambient conditions are being used, skip to Step 5.)

Step 3:
Insert the calibration adapter plug 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, slide the Cal Clip around the splash guard and attach the tubing to the nozzle on the Cal Clip.

Step 4:
Open regulator valve fully allowing Oxygen gas to flow over sensor for 3 minutes to 5 minutes. If the meter is attached, the voltage reading should be close to the span gas concentration being used.

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 5:
Once the reading on the voltage meter is stable you can start the calibration. Move Jumper-2 from IDLE to CAL. If the SPAN calibration is successful the LPT will blink the LED eight times indicating the SPAN has been completed.

If this is a daily or weekly calibration and no N_2 is available, move Jumper-2 back to IDLE and the SPAN calibration will be completed and the internal LED pattern will change to flash four times and then pause with the LED off.

Step 6:
Switch to NItrogen calibration gas (N_2 99.99 %). When the gas flow is detected, the internal LED pattern will change to flash four times and then pause with the LED on. During this time the current loop will follow the gas level based on the ideal span of the sensor.

The zeroing can be cancelled at any time by removing the Jumper-2 from the CAL position and move to IDLE position before the zeroing is finished and the transmitter will return to normal

operation (solid green light on the front).

If the zero is out of range but within the override range, the LED will flash. To override, move the concentration jumper to the OVER position. If Jumper-1 is not moved to the OVER position in 30 seconds, the current loop will output 20 mA and will stay there until you move the Jumper. After using the OVER position, Jumper-1 should be returned to the gas selection position (GAS1, GAS2 or GAS3).

If the sensitivity of the sensor is calculated out of range more than the OVER can compensate for, the internal LED will turn on solid, the front LED will remain off and the current loop will output 20 mA 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.

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 LPTs with "sticky gas" sensors, such as Chlorine, or Ozone. Sticky gases will adhere to the splash guard and cause inaccurate gas concentration readings.

9.2 Calibration Adapter Clip "Cal Clip" p/n: **CET-SGC**

Attach the Cal Clip around the splash guard to allow the use of both hands during calibration. The small barb hose fitting accommodates standard or Teflon tubing of 1/8" (3.175 mm) ID and 3/16" (4.762 mm) ID.

NOTE: The Cal Clip is designed to prevent entry or exit of air except via the hose barb fitting, therefore it must be removed from the splash guard during normal operation or else the gas readings will not be accurate.

9.3 Calibration Kit p/n: **CET-715A-CK1**

The Calibration Kit contains the items necessary for common field and shop calibration. It comes in a durable, hard plastic carrying case. **Gas cylinders are not included in the Kit.** They must be ordered separately from the CETCI factory. Many gases are carried in inventory but not all. 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.**

9.4 Metal Protective Guard

p/n: **SCS-8000-RSG**

p/n: **SCS-8000-WSG**

The metal protective guard is heavy duty metal protective guard to help protect against abrasive damage, theft and vandalism to the transmitters. This is an added preventative in addition to the product enclosure.

It is made from 16-gauge galvanized steel and has ½" (13 mm) 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.

10 MAINTENANCE

The LPT transmitter requires virtually no maintenance other than regular calibration of the sensor.

The transmitter should be monitored for possible damaging conditions.

4. The sensor port should be kept free of dirt or soot build up.
5. If in a damp location source of water should be shed from contacting the top of the transmitter.
6. If located in a working area the front of the transmitter should be kept clear.
7. If painting is to be conducted in the transmitters 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.

11 TROUBLE SHOOTING

LPT won't power up. (Outer LED is OFF)

Is the power properly connected? Refer to Wiring examples.
4 - 20 mA signal loop has not been connected properly. Check the connections.

Outer LED will flash with a short OFF time and long ON time and the current loop will output 20mA.

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

Outer LED will flash four times then pause.

The LPT is in Uninitialized mode. Return the LPT to factory.

During calibration, the internal LED will blink constantly.

Jumper-1 is missing. Install the jumper to desired gas concentration.

During calibration the internal LED will blink long ON and short OFF.
The sensor needs override. Move Jumper-1 to OVER position.

The internal LED turn solid green and the outside LED remains OFF.
It failed calibration. Try to recalibrate the sensor again.

LPT powered up (outer LED is ON) but the control panel will display "Fault".
4 - 20 mA signal loop has not been connected properly. Check the connections and refer to Section *6.7 Wiring Connections.*

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