PolyGard® DGC DT-1110-interoperable

Electrochemical carbon monoxide transmitter LON interoperable

serial no. DT-S 005

User Manual – Preliminary Edition

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Electrochemical carbon monoxide transmitter LON interoperable

Electrochemical carbon monoxide transmitter with LON interoperable Interface

1 General Overview

The PolyGard®CO digital gas transmitter is used for detection of carbon monoxide in the ambient air to monitor the presence of carbon monoxide gas.

2 Function description

The sensor portion of the PolyGard® DT-1110 digital gas transmitter is a micro-fuel cell, which is completely sealed. The measurement is a gas-in-liquid chemical reaction rather than a surface area measurement. With no surface area to coat, this sensor retains its sensitivity to carbon monoxide even after prolonged exposure to clean air.

The cell consists of a diffusion barrier, O-ring seal, electrolyte reservoir and two electrodes, sensing and counter. The target gas, carbon monoxide, enters the cell through a diffusion barrier. The chemical process of the measurement is one of oxidation where one molecule of the target gas is exchanged for one molecule of oxygen. The reaction drives the oxygen molecule to the counter electrode, generating a DC microampere signal between the sensing and counter electrodes. The amount of electrons produced by the reaction is directly proportional to the amount of gas present and measuring the current flowing through the external circuit is a basic gas monitor.

The integrated amplifier circuit and ADC converts this DC microampere signal to a digital signal with a ppm range. For the interoperable communication this value is written in the Standard Network Variable SNVT *nvo01_TOX*.

Most sensors produce a small amount of baseline current in clean air. This is adjusted out with the zero potentiometer on the transmitter.

This oxidation at the electrodes causes wear of the sensor. Typical life for this sensor is approximately five years in normal operation. This will vary somewhat from sensor to sensor, with some working lifetimes less than five years and some greater than five years. This wear also changes the characteristics of the sensor, requiring periodic recalibration. It is recommended that the sensor accuracy be verified every six months and recalibrated with the gain 1 potentiometer as necessary.

The DGC- DT 1110 has (1) 4 to 20 mA Input for connection of (1) analog gas Transmitter with 4 to 20 mA Output. The signal is available in the SNVT *nvo02_COMB*. (4 mA = 0 %, 20 mA = 100%)

3 Installation

Note:

- Avoid any force (e.g. by thumb) during operation or installation on the sensor element. This could destroy the element.
- Electronics can be destroyed through static electricity. Therefore, do not work on the equipment without a wrist strap connected to earth ground or standing on conductive floor.

3.1 Assembly information

- The specific weight of carbon monoxide is almost the same as that of air (factor 0.967).
- Location of the sensor must conform to the layout of the area being monitored.
- Disregard the ventilation ratio! Do not mount sensor in the center of the airflow. In larger rooms, it might be necessary to install two or more transmitters where there is not adequate air movement. Do not mount in corners or directly in front of air inlets (e.g. doors, windows, open ramps, dampers, etc.). In areas with un-defined air movement, it might be necessary to distribute several transmitters in a vertical and horizontal direction over the whole area to be monitored.
- Avoid locations where water, oil etc. may influence proper operation and where mechanical damage can be possible.
- Mounting height is five feet above floor (max. 6 feet), (1.5 - 1.8 m).
- Provide adequate space around sensor for maintenance and calibration work.
- Duct model mounting:
  Mount only in a straight section of duct with minimum air vortex. Keep a minimum distance of 3.5 feet (1m) from any curve or obstacle.
  Mount only in a duct system with a maximum air velocity of 2000 ft/min or less.
  Mounting must be made so that the airflow is in line with probe openings. (see Fig. 5 page 14)

3.2 Enclosure

- Un-screw cover of enclosure.
- Carefully unplug the basic PCB mounted on fixed terminal blocks.
- Screw the base vertically on wall or on a single gang electrical box. (see Fig. 4, page 14).
- For duct model mounting:
  Cut a hole in the duct and install the probe in the hole. (see Fig. 6, page 14)
  Screw the housing to the duct using the mounting holes inside enclosure.
- Plug in the basic PCB and replace the cover after wiring connection is completed (see Fig. 1 page 13).

4 Electrical Connection

4.1 Instructions

Note:

Electrostatic discharge (ESD) may damage electronic components. During wiring, open the cover only when completely grounded via grounding strap or standing on conductive floor.

- Connections should be made without any power applied to conductors.
- Installation of the electrical wiring should be according to the connection diagram and only performed by a trained specialist.
- Cable Type LON: see "Wiring Guidelines for Twisted Pair LonWorks Networks" from Echelon.
- Cable Type Power: No recommendation (Generally use one cable for LON and Power)
- Cable insulation:

  Since the PCB mounts on top of the wiring terminations, it is important to ensure that the wire shields or any bare wires do not short to the PCB!

Terminal strip X4

Connector 1	Power supply Input (+) 24 VDC, 10 – 28 VDC
Connector 2	0 VDC Input
Connector 3	Power supply Output (+) for analog Tansmitter (= Power supply Input – 0.7 V)
Connector 4	0 VDC Output
Connector 5, 6, 7	Shield

Terminal strip X5:

Connector 1	LON Bus (A)
Connector 2	LON Bus (B)
Connector 3, 4	NC
Connector 5	4 to 20 mA Input from analog Transmitter

4.2 Wiring connection

- Unscrew cover of enclosure.
- Unplug basic PCB from terminal blocks.

For single gang electrical box mounting:

- Pull through cable via hole in base; connect cable leads on terminal block X4 and X5. (see Fig. 1 page 13)

For surface mounting (cable entry always from the top) and also for duct mounting:

- Remove cover to access cable.
- Connect cable leads on terminal block X4 and X5.
- Plug the PCB on fixed terminal blocks on base.
- Screw cover on base.

5 Start-up operation

Only trained technicians should perform the following:

- Check mounting location.
- Check airflow direction for duct mounting.
- Check power voltage.
- Check PCB DT-S05 for proper mounting at X4 and X5.
- Check for correct sensor element (Eco Sure) at terminal PCB DT-S05.
- Commissioning and Binding of the DGC- DT with LONMaker or other Binding Tool.
- Verify transmitter operation (sensor/transmitter was factory calibrated).

5.1 Calibration

Note:
Please observe proper handling procedures for test gas bottles!

Note:
If calibration is necessary, the sensor element must be powered and be fully stabilized for at least **1** hour.

Required instruments to calibrate the transmitter:

- Test gas bottle with synthetic air.
- Test gas bottle with 150 - 250 ppm CO.
- Gas pressure regulator with flow meter to control the gas flow to 150 ml/min.
- Sensor head calibration adapter with tubing.
- Digital voltmeter with range 0 – 10 VDC, accuracy 1% and a small screwdriver.

Zero adjustment
Zero-point calibration (4 mA):
(After sensor warm-up)

- Connect digital voltmeter to test pins X13 – and + (with a range selected that will display 10 VDC max.).
- Connect the calibration adapter to sensor element.
- Apply sensor element zero calibration gas, (150 ml/min; 14.5 psi ± 10%), or other clean air source.
- Wait two minutes until the signal is stable, adjust signal with zero potentiometer ”Zero” until the signal is 2450 mV ± 3 mV and stable.
- Remove calibration adapter carefully by turning lightly.

Span adjustment
Note:
CO calibration gas is toxic, never inhale the gas!
Symptoms: Dizziness, headache and nausea.
Procedure if exposed: Bring into fresh air at once, consult doctor.

- Connect calibration adapter to the sensor element.
- Apply sensor element span calibration gas (150 – 250 ppm CO), (150 ml/min; 14.5 psi ± 10%).
- Wait two minutes until the signal is stable, adjust signal with span potentiometer ”Gain1” until the signal reads the appropriate mVDC (± 3mV, see calculation for control span voltage 5.2) and is stable.
- Remove calibration adapter with a careful light turn. Inspect the seating of the sensor element!

5.2 Control span voltage calculation

2450 (mV) – [8 (mV) x test gas concentration (ppm)]

Example

Test gas concentration	220 ppm CO
Control voltage	690 mV

2450 (mV) – [8 (mV) x 220 (ppm)] = 690 mV

6 Inspection and Service

6.1 Inspection

Inspection and service of the transmitters should be done by a trained technician and executed on a periodic interval. It is recommended that the sensor operation be verified at least every six months.

6.2 Calibration

(See part 5.1 and 5.2)

- Service at periodic intervals is to be decided by the person responsible for the gas detection system.
- If span calibration voltage < 40% of the calculated Control span voltage, when applying Carbon Monoxide calibrate gas in air, then the sensor element has to be replaced. After the sensor element has been replaced a calibration is required.

6.3 Replacing of the sensor element

Static electricity (see section 4.1).

Sensor should always be installed without power applied:

- Unplug basic PCB DT-S05 carefully from the terminal blocks on the base.
- Unplug old sensor element out from the PCB DT-S05.
- Take new sensor element out of original packing.
- Plug sensor element in the PCB DT-S05.
- Plug the PCB DT-S05 in terminal block X4, X5 carefully.
- After sensor warm-up, Calibrate see section 5.1)

7 Troubleshooting

7.1 Diagnostics of the transmitter

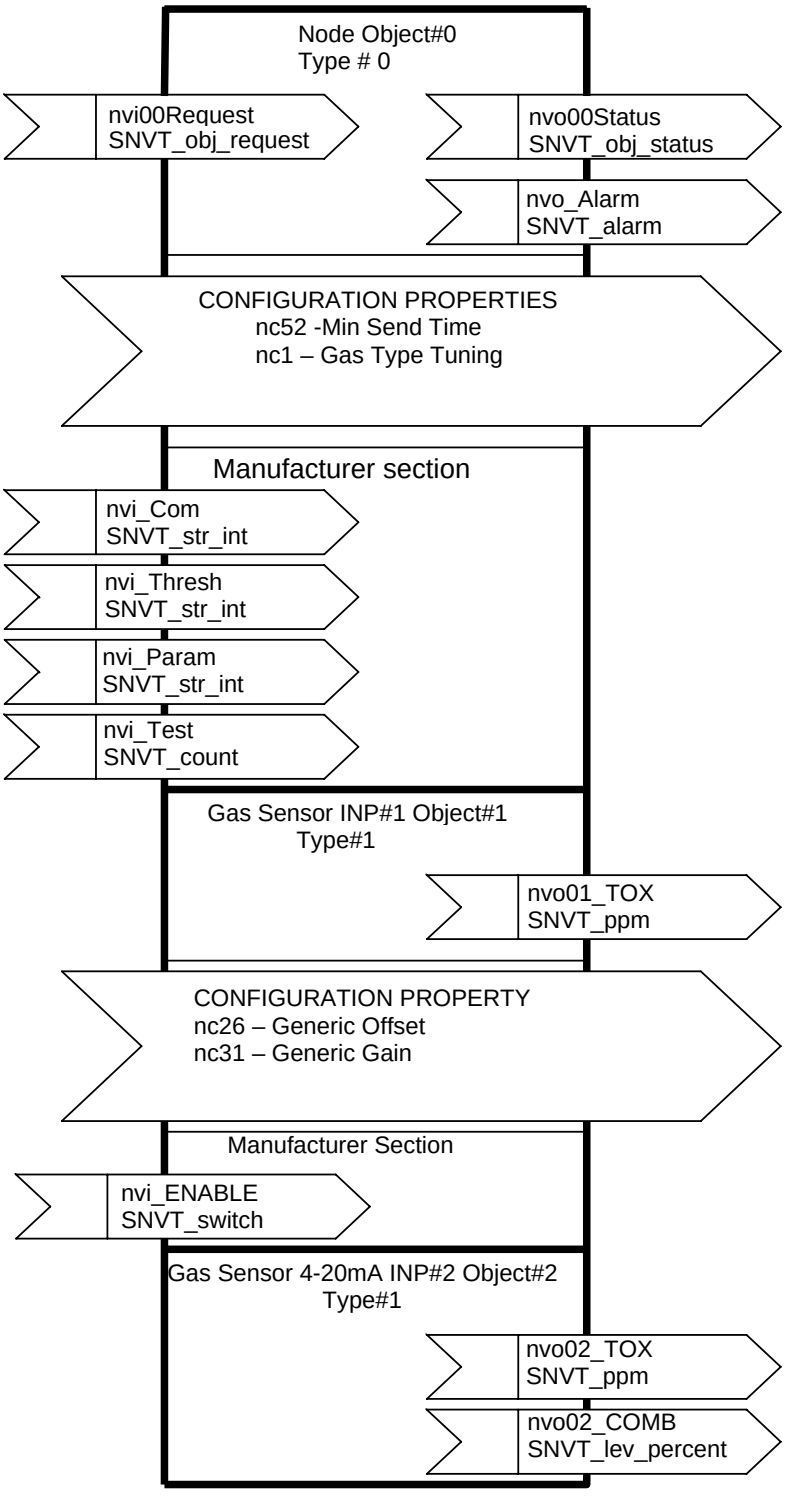
Trouble	Reason	Solution
Power LED not light up	Power not applied	Measure power voltage terminal block X4 terminal 1 (+) and 2 for 10 – 28 VDC
	Basic PCB DT-S05 X4 and X5 not plugged in correctly	Plug in the basic PCB DT-S05 into X4 and X5 correctly
Service LED flash	No Application load	Load Application File

8 Cross-sensitivity Data

This table shows the typical response to be expected from the sensor when exposed to the following gases.

Gas	Chemical mark	Gas concentration	Exposure Time (mins)	Tolerance ppm CO
Acetone	$(CH_3)CO(CH_3)$	1000 ppm	5	0 ppm
Acetylene	C_2H_2	40 ppm	5	80 ppm
Ammonia	NH_3	100 ppm	5	0 ppm
Carbon Dioxide	CO_2	5000 ppm	5	0 ppm
Chlorine	CL_2	2 ppm	5	0 ppm
Ethanol	C_2H_5OH	2000 ppm	30	5 ppm
Hydrogen	H_2	100 ppm	5	20 ppm
Hydrogen sulphide	H_2S	25 ppm	5	0 ppm
Iso Propanol	C_3H_7OH	200 ppm	120	0 ppm
Nitric oxide	NO	50 ppm	5	8 ppm
Nitrogen dioxide	NO_2	50 ppm	900	1 ppm
Sulphur dioxide	SO_2	50 ppm	600	< 0.5 ppm

9 LonMark Object and Network Variables



9.1 Description of Network Variables

Index	Network	Typ	Description
Object #0 Type #0			
0	nviRequest	SNVT_obj_request	To request modes for objects within this node.
1	nvoStatus	SNVT_obj_status	To report the status of objects on this node
2	nvo_Alarm	SNVT_alarm	Only for DGC-system function, no interoperable function
3	nc52 (nci-minSEND)	SNVT-time_sec	Min Send Time **(Min Value =1) Must set on each Node!!**
4	nc1		Only for DGC-system function, no interoperable function
5	nvi_Com	SNVT_str_int	
6	nvi_Thresh	SNVT_str_int	
7	nvi_Param	SNVT_str_int	
8	nvi_Test	SNVT_count	
Object #1 Type #1 (Value ppm)			
9	nvo01_TOX	SNVT_ppm	Value CO gas Concentration (ppm)
10	nc26 (nci_OFFSET)	SNVT_ppm	Only for DGC-system function, No interoperable function
11	nc31 (nci_GAIN)	SNVT_muldiv	
12	nvi_ENABLE	SNVT_switch	
Object #2 Type #2 (Value external Input) (%)			
13	nvo02_TOX	SNVT_ppm	Only for DGC-system function, no interoperable function
14	nvo02_COMB	SNVT_lev_percent	Value (%) Input 4- 20 mA (4 mA = 0%, 20 mA = 100%)

9.2 LonMark product details

Product data sheet (PDF)	PolyGard Digital Transmitter DT
Device category	Gas concentration
Communication	TP/FT-10
LonMark version	3.2
LonMark object	0000 – Node object 0001 – Open loop sensor object 0002 – Open loop sensor object
Download files	8000230A50060402.zip XIF (External interface file)
Standard programm ID	8 00023 0A50 06 04 02
Certificates	TÜV, VDI 2053

10 Specifications

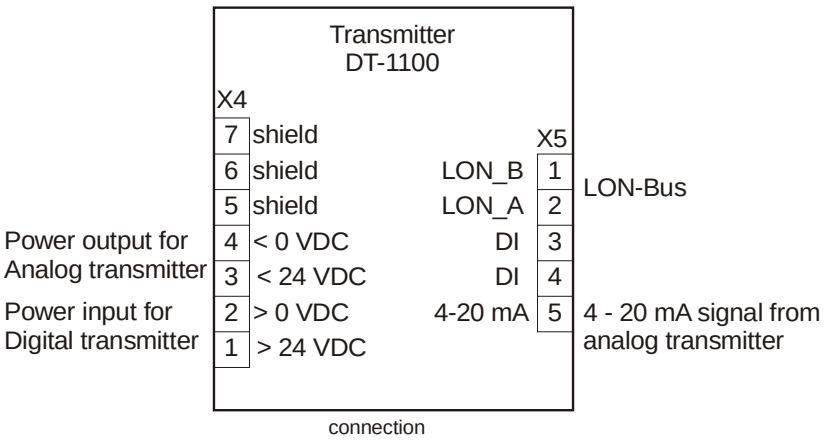
Electrical	
Power supply:	10-28 VDC (polarity protected)
Power consumption:	28 mA, (0.7 VA), max.
Power consumption ext. Transmitter	100 mA, (3.0 VA), max.
RFI/EMI protection	5.0 W @1 ft. (0.31 m) radiated
Sensor Performance	
Gas detected	Carbon monoxide (CO)
Sensor element	Electrochemical, diffusion
Range	0 – 300 ppm factory set
Stability & resolution	± 3 % of reading
Repeatability	< ± 3 % of reading
Long term output drift	< ± 5% /year
Response time	$t_{90} \leq 50$ sec.
Sensor life expectancy	5 year, normal operating environment
Sensor coverage	5,000 sq.ft., (465 m^2), to10,000 sq.ft. (930 m^2) under “ideal conditions”
Mounting height	5 to 6 ft. (1.5 to 1.8 m) above floor
Type of Control	
SNVT *nvo01_TOX*	Proportional, 0 – 300 ppm CO
SNVT *nvo02_COMB*.	Proportional, 0 – 100 % (4 – 20 mA)
Communication	
Processor	Neuron 3150
Clock speed	10 MHz
Transceiver	FTT 10A
Network speed	78 kBits/sec
Network compatibility	TP/FT-10
Operating Environment	
Working temperature	14 °F to 122 °F (-10 °C to + 50 °C)
Storage temperature	41 °F to 86 °F (5 °C to + 30 °C)
Humidity - Continuous	15 to 90% RH non-condensing
- Intermittend	0 to 99% RH non-condensing
Pressure range	Atmospheric ±10%
Physical characteristics	
Enclosure material	Galvanized Steel w/zinc coating, corrosion resistant
Enclosure color	Light gray
Wall mounting	NEMA1 (IP 42)
Installation	Wall (surface) mounted or single gang electrical box
Dimensions (HxWxD)	5.59 x 5.59 x 2.48 in. (142 x 142 x 63 mm)
Cable entry	2 hole for ½ in. conduit for wall (surface) mounting, and 1 hole
	on back side of base plate for single gang electrical box mounting
Wire connection	Terminal blocks, screw type for lead wire
Wire size	Min. 24 AWG (0.25 mm^2), max. 14 AWG (2.5 mm^2)
Weight	0.7 lbs. (0.3 kg)

Approvals/Listings	
	CE
	VDI 2053 *
	EMV-compliance 89/336/EWG
Warranty	Two years material and workmanship
Opions	
Enclosures	
Duct mounted	NEMA 3 (IP 44)
- w/probe	7/8 in. (22 mm) diameter and 7.16 in. (182 mm) length
- cable entry	1 hole for ½ in. conduit
Wall mounted	NEMA 4X w/splash guard (IP 65)
- material	ABS UL94V0
- color	Light gray
Dimensions (HxWxD)	4.8 x 4.72 x 3.42 in. (122 x 120 x 87 mm)
Heater, built-in	
Power supply	24 VAC ± 5%, 50/60 Hz
Power consumption	1.0 A (24 VAC), max.
For ambient temperature	- 40 °F (-40 °C)
Thermostatic control	32 °F (0 °C) ± 5 °F (3 °C)

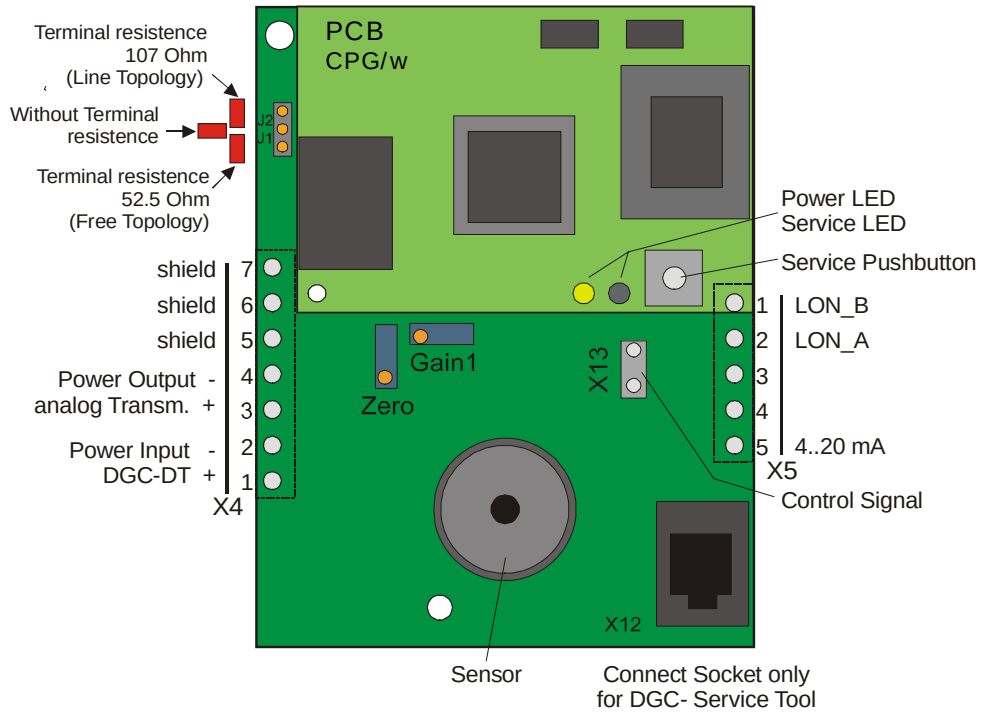
* Pending

11 Wiring Configuration and Enclosure Dimensions

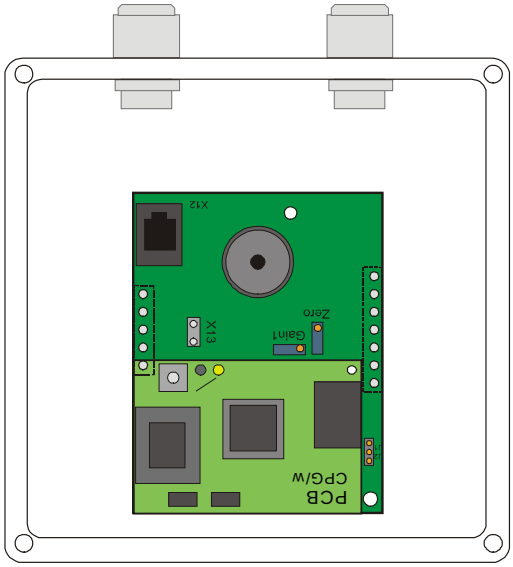
Wiring Configuration
Fig. 1



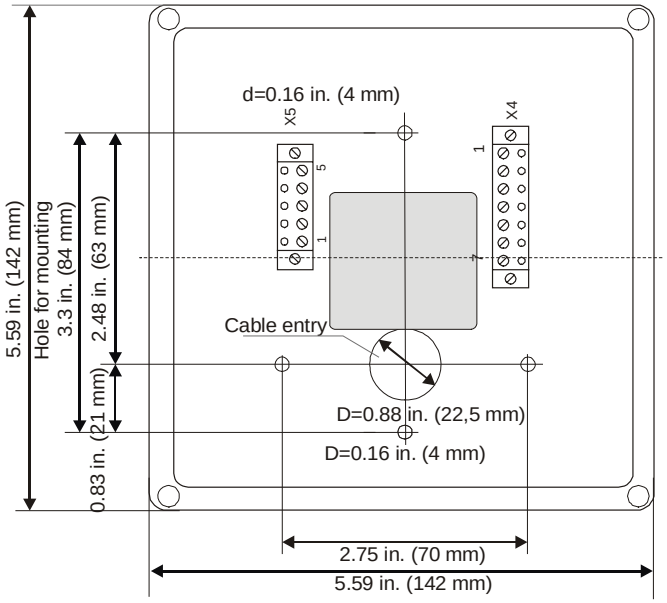
Printed circuit board DGC DT-S05
Fig. 2



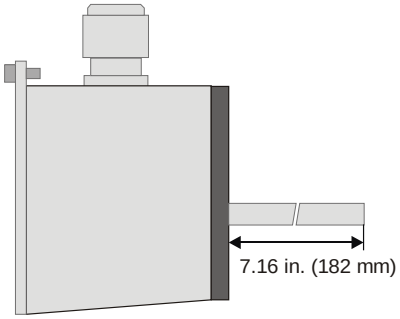
Assembly
Fig. 3

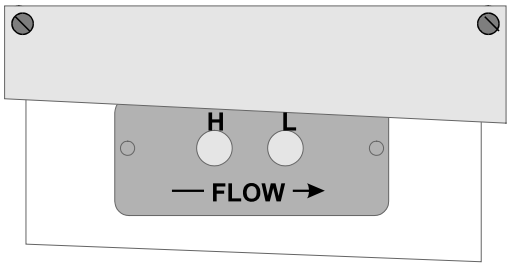


Dimensions
Fig. 4

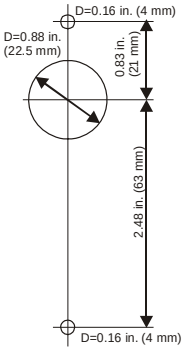


Duct mounting enclosure
Fig. 5





Cutout for duct model
Fig. 6



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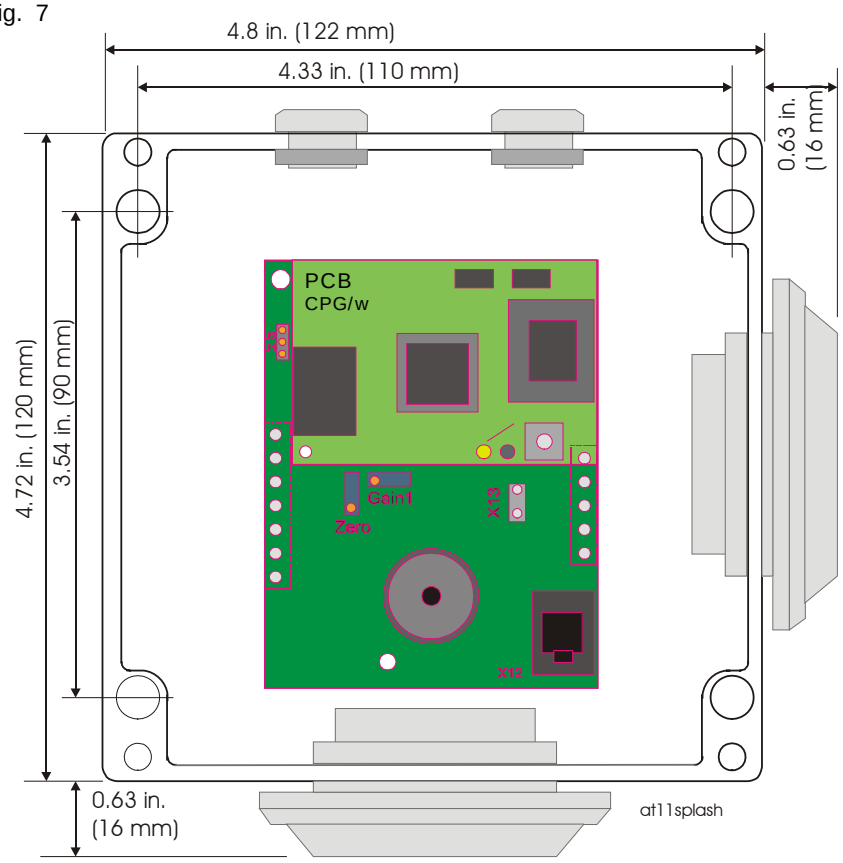
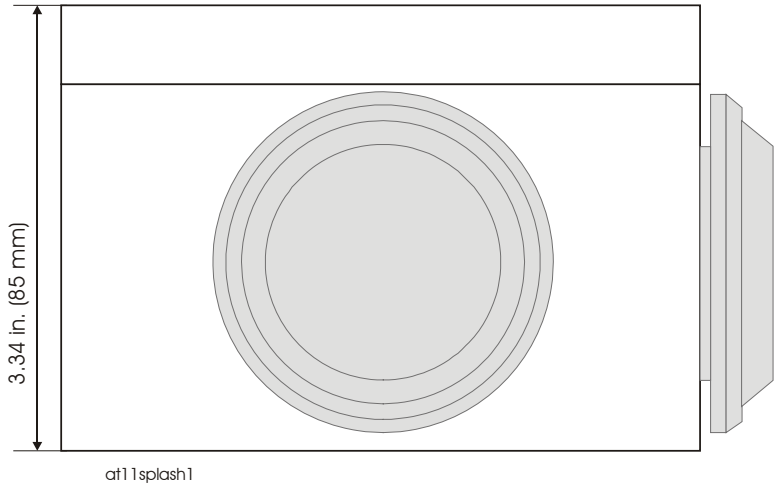
Splash guard enclosure
Fig. 7



Splash guard enclosure
Fig. 8



12 Notes and General Information

It is important to read this user manual thoroughly and clearly understand the information and instructions. The PolyGard® transmitters must be used within product specification capabilities. The appropriate operating and maintenance instructions and recommendations must be followed.

Due to ongoing product development, MSR and IN*TEC* reserves the right to change specifications without notice. The information contained herein is based upon data considered to be accurate. However, no guarantee is is expressed or implied regarding the accuracy of this data.

11.1 Intended product application

The PolyGard® DT-1110 combustible gas transmitters are designed and manufactured for control applications for energy savings and OSHA air quality compliance in commercial buildings and manufacturing plants (i.e., detection and automatic exhaust fan control for automotive maintenance facilities, enclosed parking garages, engine repair shops, warehouses with forklifts, fire stations, tunnels, etc.).

11.2 Installers' responsibilities

It is the installer's responsibility to ensure that all PolyGard® transmitters are installed in compliance with all national and local codes and OSHA requirements. Installation should be implemented only by individuals familiar with proper installation techniques and with codes, standards and proper safety procedures for control installations and the latest edition of the National Electrical Code (ANSI/NFPA70). It is also essential to strictly follow all instructions as provided in the user manual.

11.3 Maintenance

It is recommended that the PolyGard® transmitter performance check is done on a routine schedule. Any performance deviations may be serviced based on needed requirements. Re-calibration and part replacement may be implemented in the field by a qualified individual and with the appropriate tools. Alternatively, the easily removable plug-in transmitter card with the sensor may be returned for service to IN*TEC* Controls.

11.4 Limited warranty

MSR and IN*TEC* Controls warrant the PolyGard® transmitters for a period of two (2) years from the date of shipment against defects in material or workmanship. Should any evidence of defects in material or workmanship occur during the warranty period, MSR or IN*TEC* Controls will repair or replace the product at their own discretion, without charge.

This warranty does not apply to units that have been altered, had repair attempted, or been subjected to abuse, accidental or otherwise. The warranty also does not apply to units in which the sensor element has been overexposed or gas poisoned. The above warranty is in lieu of all other express warranties, obligations or liabilities.

This warranty extends only to the PolyGard® transmitter. MSR and IN*TEC* Controls shall not be liable for any incidental or consequential damages arising out of or related to the use of the PolyGard® transmitters.

11.5 Return instructions

If the PolyGard® transmitter needs to be returned to IN*TEC* Controls for service, an RMA number must be obtained prior to sending.