PolyGard® AT-1110 V3

Electrochemical Carbon Monoxide Transmitter
Serial No. AT03-003

User's Manual

June 18, 2009
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Customer Services (858) 578-7887 & (888) GO IN*TEC* Fax (858) 578-4633 & (888) FX IN*TEC*
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Electrochemical Carbon Monoxide Transmitter

1 General Overview

The PolyGard® CO analog gas transmitter AT-1110 utilizes digital processing the measuring values and temperature compensation for the continuous monitoring of the ambient air to detect the presence of carbon monoxide gas. Main application ranges are underground car parks, tunnels, engine test stations, shelters, loading areas etc.

The intended sites are all areas being directly connected to the public low voltage supply, e.g. residential, commercial and industrial ranges as well as small enterprises.

The PolyGard® CO analog transmitter must not be used in potentially explosive atmospheres. The AT-1110 Transmitter may only be used within ambient conditions described in the technical data.

2 Functional Description

2.1 Control Mode

Analog mode:

The analog output can be selected as current signal with (0)4-20 mA or as voltage signal (0)2-10 V. In the (0)4-20 mA mode and without any supplementary options, the AT-1110 also works in the 2-wire technique.

2.2 Sensor

The sensor portion of the transmitter is a sealed electro-chemical cell with three electrodes, sensing, counter and reference or with two electrodes, sensing and reference. The ambient air to be monitored diffuses through a membrane filter into the liquid electrolyte of the sensor. 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 reference electrodes. This signal is linear to the volume concentration of the sensed gas. The signal is evaluated by the connected amplifier and transformed into a linear output signal.

Electrochemical processes always lead by-and-by to a loss of sensitivity. Therefore regular calibration of zero-point and gain is necessary

Caution:

There is a small quantity of corrosive liquid in the sensor element. If in case of damage persons or objects touch the liquid, you have to clean the affected areas as fast and carefully as possible with tap water. Out of use sensors must be disposed in the same way as batteries.

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3 Installation

Note:
Avoid any force (e.g. by thumb) on the sensor element during operation or installation. Electronics can be destroyed by static electricity. Therefore, do not touch the equipment without a wrist strap connected to ground or without standing on a conductive floor.

3.1 Mounting Instructions

When choosing the mounting site please pay attention to the following:

- The specific weight of carbon monoxide is a smaller than that of air (factor 0.97). Recommended mounting height is 1.5 m (5 feet) to 1.8 m (6 feet) above floor.
- Choose mounting location of the sensor according to the local regulations.
- Consider the ventilation conditions! Do not mount the transmitter in the center of the airflow (air passages, suction holes).
- Mount the transmitter at a location with minimum vibration and minimum variation in temperature (avoid direct sunlight).
- Avoid locations where water, oil etc. may influence proper operation and where mechanical damage might be possible.
- Provide adequate space around the sensor for maintenance and calibration work.

Duct mounting

- Mount only in a straight section of duct with minimum air vortex. Keep a minimum distance of 1 m (3,5 feet) from any curve or obstacle.
- Mount only in a duct system with a maximum air velocity of 10 m/s (2000 ft/min) or less.
- Mounting must be performed so that the probe openings are in line with the airflow.

3.2 Installation

- Open the cover. Unplug basic PCB carefully from the bottom part.
- Fix bottom part by screws vertically to the wall (terminal blocks to the ground).
- Plug in the basic PCB at X4 and X5 with care. Replace the cover.

4 Electrical Connection

Consider static electricity! See 3. Mounting

- Installation of the electrical wiring should only be performed by a trained specialist according to the connection diagram, without any power applied to conductors and according to the corresponding regulations!
- Avoid any influence of external interference by using shielded cables for the signal line, but do not connect the shield.
- Recommended cable for analog mode: Belden Twisted Shielded (20 AWG), max. res. 73 Ω/km (20.8 Ω/1000 ft).
- It is important to ensure that the wire shields or any bare wires do not short the mounted PCB.

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4.1 Wiring Connection

- Open the cover. Unplug basic PCB carefully from terminal blocks at X4 and X5.
- Insert the cable, connect cable leads to terminal blocks. See fig. 1 and 2.
- Replug the PCB in the terminal blocks X4, X5. Replace cover.

5 Commissioning

Consider commissioning instructions at when exchanging of sensor elements.

Only trained technicians should perform the following:

- Check mounting location.
- Select output signal form: Current or voltage, and starting point 0 or 20%. See fig. 4.
- Check power voltage.
- Check PCB AT-1110 for proper mounting at X4 and X5.
- Check the sensor for proper mounting at the connectors X3/X7 of the PCB AT-1110.
- Calibrate the transmitter (if not already factory-calibrated).

Required instruments for commissioning (calibration) of the transmitter:

- Test gas bottle with synthetic air of CO-free ambient air.
- Test gas bottle with CO (ppm) in the range of 30 – 80 % of the measuring range.
- Gas pressure regulator with flow meter to control the gas flow to 300 ml/min.
- Calibration adapter with tube, depending on the transmitter type.
- Digital voltmeter with range 0 – 300mV, accuracy 1% and a small screwdriver.

Note:

Prior to calibration the sensor element must be fully stabilized by applying power voltage for at least 1 hour without interruption.

Please observe proper handling procedures for test gas bottles!

Attention: CO calibration gas is toxic, never inhale the gas!
Symptoms: Dizziness, headache and nausea.
Procedure if exposed: Take the victim into fresh air at once, call a doctor.

5.1 Calibration

Depending on the version and the control mode there are three different possibilities to calibrate the transmitter:

Manual calibration

Manual calibration is only possible if the transmitter is equipped with the push-button “Zero” and the potentiometer “Gain” (= version for manual calibration).

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5.2 Manual Calibration

5.2.1 Zero-point

- Connect calibration adapter carefully to the sensor element.
- Apply synthetic air (300 ml/min; 1 Bar (14.5 psi) ± 10%), or CO-free ambient air.
- Wait 2 minutes until the signal is stable, push button “Zero” for 5 seconds.

  After successful calibration the measuring signal is corrected automatically. Depending on the selected signal starting point the measuring signal shows the following values:

  Signal start at 2 V or 4 mA 40 mV = 0 ppm
  Signal start at 0 V or 0 mA 0 mV = 0 ppm

  If the zero-point is out of the admissible range (> 20 mV at starting point 0% / > 60 mV at starting point (20%) before calibration, there is no correction of the measuring signal. The sensor has to be replaced.
- Remove calibration adapter carefully by turning lightly. Check the sensor for correct mounting!

5.2.2 Gain

- Connect calibration adapter carefully to the sensor element.
- Apply calibration test gas CO (300 ml/min; 1 Bar (14.5 psi) ± 10%).
- Wait two minutes until the signal is stable, adjust control voltage with potentiometer ”Gain” until the signal corresponds to the calculated value ± 3 mV, see calculation section 5.3.
- Remove calibration adapter with a careful light turn. Check the sensor for correct mounting!

  By limiting the gain factor, calibration will not be possible any more when the sensitivity of the sensor reaches a residual sensitivity of 30 %. Then the sensor has to be replaced.

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5.2.3 Calculation of Control Voltage

Signal start 2 V / 4 mA

$$\text{Control voltage (mV)} = \frac{160\ (\text{mV}) \times \text{test gas concentration CO (ppm)}}{\text{measuring range CO (ppm)}} + 40\ (\text{mV})$$

Signal start 0 V / 0 mA

$$\text{Control voltage (mV)} = \frac{200\ (\text{mV}) \times \text{test gas concentration CO (ppm)}}{\text{measuring range CO (ppm)}}$$

Example:

Measuring range	250 ppm
Test gas concentration	200 ppm CO
Control voltage: Signal start 2 V / 4 mA	168 mV
Control voltage: Signal start 0 V / 0 mA	160 mV

Signal start 2 V / 4 mA

$$\frac{160\ (\text{mV}) \times 200\ (\text{ppm})}{250\ (\text{ppm})} + 40\ (\text{mV}) = 168\ \text{mV}$$

Signal start 0 V / 0 mA

$$\frac{200\ (\text{mV}) \times 200\ (\text{ppm})}{250\ (\text{ppm})} = 160\ \text{mV}$$

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5.3 Option Relay Output

The two relays are activated in dependence of the gas concentration. If the gas concentration exceeds the adjusted alarm threshold, the corresponding relay switches on. If the gas concentration falls below the threshold minus hysteresis, the relay switches off again.

The contact function for relay 2, NC (normally closed) or NO (normally open), can be selected via the jumper NO/NC. See fig 1 and 3. Relay 1 is equipped with a change-over contact.

Via the ModBus interface the two alarm thresholds and the hysteresis are freely adjustable at the PC within the measuring range. The procedure can be read from the user manual “ModBus Software”.

The following parameters are factory-set.

Alarm threshold 1 = Relay 1: 50 ppm
Alarm threshold 2 = Relay 2: 100 ppm
Switching hysteresis: 15 ppm

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6 Inspection and Service

6.1 Inspections

Inspection, service and calibration of the transmitters should be done by trained technicians and executed at regular intervals. We therefore recommend concluding a service contract with Intec Wilson Mohr or one of their authorized partners.

6.2 Calibration

(See section 5.1 and 5.2)

- At commissioning and at periodic intervals determined by the person responsible for the gas detection system (recommendation every 6 months).
- After exchange of the sensor
- If in case of operational or climatic influences the sensitivity of the sensor falls below 70 % in operation, calibration will not be possible any more. Then the sensor has to be changed.

6.3 Exchange of Sensor Element

Consider static electricity! See point 3.

Sensor should always be installed without power applied:

- Unplug basic PCB AT-1110 carefully from the bottom part.
- Unplug old sensor from the PCB.
- Take the new sensor out of the original packing.
- Plug in the sensor element into the PCB at X3/X7.
- Replug the PCB AT-1110 into terminal blocks X4, X5 carefully.
- Calibrate according to section 5.

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7 Troubleshooting

7.1 Analog Mode

Trouble	Cause	Solution
Output signal < 3 mA / 1.5 V and/or control voltage < 30 mV only for starting signal 2V/4 mA	Jumper 0-20 % not set	Check jumper position
	Power voltage not applied	Measure tension at X4: Two-wire: Pin 1 (+) and 4 (-) Three-wire: Pin 1 (+) and 2 (-)
	PCB AT-1110 not plugged in correctly at X4 and X5	Replug PCB correctly
	Wire break	Check the wiring
Output signal > 22 mA /220 mV	Short-circuit	Check the wiring
Control voltage does not reach the calculated value	Sensor element not calibrated	Calibrate sensor element
	Sensor sensitivity < 30 %	Replace sensor element
No reaction of the output signal in spite of gas concentration	Power voltage not applied	Measure tension at X4
	Signal (Pin 4) not wired correctly	Check the wiring

8 Cross-sensitivity Data

The cross sensitivity depends on the used transmitter type and can be read from the table Technical Data (see 9.). Other gases can have an influence on the sensitivity, too. The table does not claim to be complete. The indicated sensitivity data are only standard values referring to new sensor elements.

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9 Technical Data

General sensor performances		
Gas type	Carbon monoxide (CO)	
Sensor element	Electrochemical, diffusion	
Measuring range (standard, other ranges according to the data sheet)	250 ppm factory set adjustable between 0-150 and 0-300 ppm	
Pressure range	Atmosphere ± 15 %	
Humidity	15 – 90 % RH non condensing	
Storage temperature range	-5 °C to 30 °C (23 °F to 86 °F)	
Storage time	Max. 6 months	
Mounting height	1.5 to 1.8 m (5 to 6 ft.)	
Sensor coverage	5,000 sq.ft. , max. 10,000 sq.ft. (465 m^2, max 930 m^2), under "ideal conditions"	
Accuracy	± .5 ppm of reading	
Repeatability	± 1% of reading	
Long-term sensitivity output drift	< .4% signal loss/month	
Response time	t_{90} < 30 sec.	
Life expectancy	5 years plus, normal conditions	
Temperature range	14°F to 104°F (-10°C to 40°C)	
Cross sensitivity*	Concentration (ppm)	Reaction (ppm)
Sulphur dioxide, SO_2	5	0
Hydrogen Sulphide, H_2S	15	1
Nitrogen dioxide, NO_2	5	0
Nitric oxide, NO	35	< 3.5
Hydrogen Cyanide HCN	10	0
Hydrogen Chlorine	5	0
Hydrogen, H_2	100	< 60
Chlorine CL2	1	0
Ethylene C2H4	100	<75
Electrical		
Power supply	18 - 28 VDC/AC, reverse polarity protected 2-wire mode: Only VDC	
Power consumption (without options)	22 mA, max. (0.6 VA)	

* The table doesn't claim to be complete. Other gases, too, can have an influence on the sensitivity. The mentioned cross sensitivity data are only reference values valid for new sensors.

Output signal	
Analog output signal Selectable: Current / tension Starting point 0 / 20 %	(0)4 – 20 mA, load ≤ 500 Ω, (0)2 – 10 V; load ≥ 50 k Ω proportional, overload and short-circuit proof
Physical	
Enclosure*	Galvanized steel
Enclosure color*	Light grey
Dimensions* (H x W x D)	142 x 142 x 63 mm / (5.59 x 5.59 x 2.48 in.)
Weight*	Approx. 0.7 lbs (0.3 kg)
Protection class*	NEMA 1
Mounting*	Wall mounting, pillar mounting
Cable entry	Standard 1 x M 20
Wire connection	Screw-type terminal min. 0.25, to 2.5 mm^2 24 to 14 AWG
Wire distance	Current signal ca. 500 m (1500 ft.) Voltage signal ca. 200 m (500 ft.)
Guidelines	EMC Directive 89/336/EEC
	CE
Warranty	Two years material and workmanship, 12 months normal exposure for sensor element
Options	
Relay output	
Alarm relay 1	30 VAC/DC 0.5 A, potential-free, SPDT
Alarm relay 2	30 VAC/DC 0.5 A, potential-free SPNO/SPNC
Power consumption	30 mA, (max. 0.8 VA)
LCD-Display	
LCD	Two lines, 16 characters each, not illuminated
Power consumption	10 mA (max. 0.3 VA)
Heating	
Temperature controlled	3 °C ± 2°C (37.5 °F ± 35.5 °F)
Ambient temperature	- 40 °C (-40 °F)
Power supply	18 – 28 VDC/AC
Power consumption	0.5 A; 12 VA

Options	
Enclosures	
Duct mounted "1"	NEMA 3 (IP45)
- w/probe	7/8 in. (22 mm) diameter and 7.16 in. (182 mm) length
- Cable entry	1 hole for 1/2 in. conduit
Wall mounted "4"	NEMA 4X (IP65), w/splash guard
- Material	ABS UL94 V0
- Color	Light gray
- Dimensions (H x W x D)	4.80 x 4.72 x 3.42 in. (122 x 120 x 87 mm)
Wall mounted "A"	NEMA 12 (IP55)
- Material	Polycarbonate, UL 94-HB, fire-retardant
- Color	Light gray
- Dimensions (H x W x D)	5.12 x 3.31 x 2.95 in. (130 x 84 x 75 mm)
- Conformity	UL 50 standards
- Cable entry	1 holes for 1/2 in. conduit for wall (surface) mounted and 1 hole on backside of base plate for single gang electrical box mounting connection Terminal blocks.

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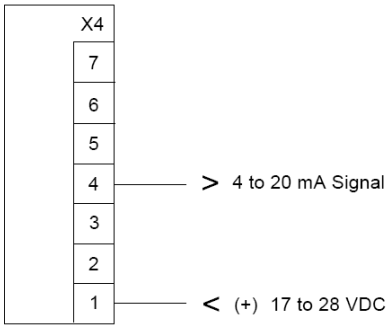
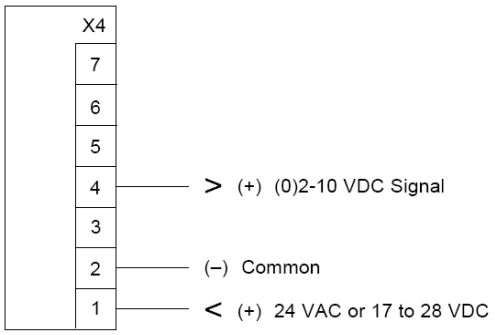
10 Figures

Application: Analog mode
Fig. 1

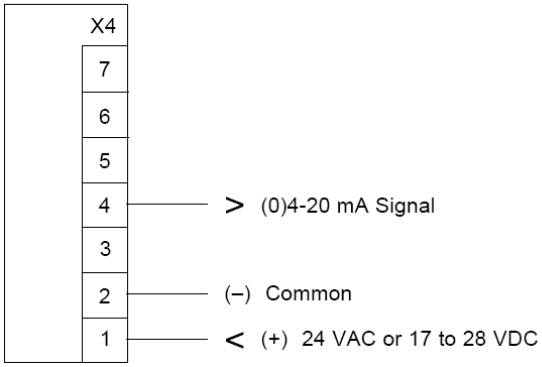
AT-1110
4-20 mA signal, 2-wire, loop-powered, 24 VDC*



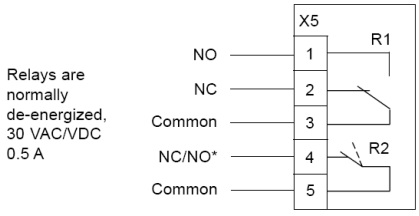
AT-1110
(0)2-10 VDC signal, 3-wire, 24 VAC or 24 VDC



AT-1110
(0)4-20 mA signal, 3-wire, 24 VAC or 24 VDC**



Optional relay package
(0)4-20 mA signal, 3-wire, 24 VAC or 24 VDC**



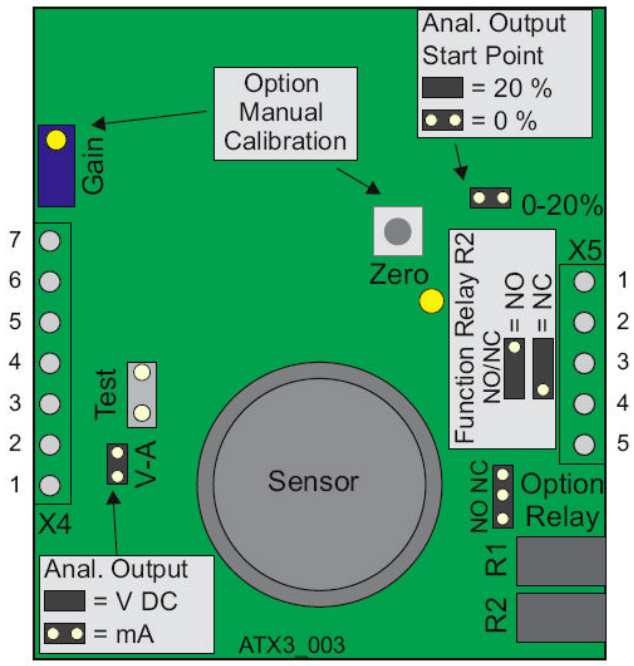
*Jumper SPST relay NC/NO selector:

Covers top two pins = SPST-NC
Covers buttom two pins = SPST-NO

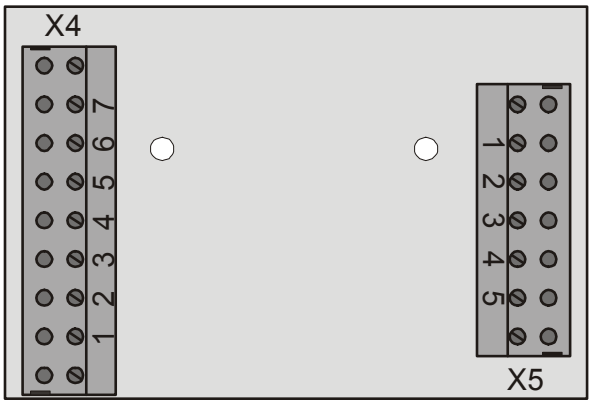
Note: When using AT-1110 transmitter w/relay package as a stand-alone unit (no connection to a controller), pins on jumpers "V-A" and "0-20%" must be covered.

Fig. 3

AT-1110 v3



Terminal block



Selection analog output signal
Fig. 4

Jumper 0- 20 %	Jumper V-A	Output signal
Not set	Not set	0 – 20 mA
Set	Not set	4 – 20 mA
Not set	Set	0 – 10 V
Set	Set	2 – 10 V

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Calibration adapter
Fig. 5
Type: CONKIT-E/CH-AT

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11 Notes and General Information

It is important to read this user manual thoroughly and clearly in order to understand the information and instructions. The PolyGard® transmitter must be used within product specification capabilities. The appropriate operating and maintenance instructions and recommendations must be followed. Due to on-going product development, IN*TEC* and MSR reserves the right to change specifications without notice.

The information contained herein is based upon data considered accurate. However, no guarantee is expressed or implied regarding the accuracy of this data.

11.1 Intended Product Application

The PolyGard® transmitter is designed and manufactured for control applications and 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® transmitter is installed in compliance with all national and local codes and OSHA requirements. Installation should be implemented only by technicians 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 follow strictly all instructions as provided in the user manual.

11.3 Maintenance

It is recommended to check the PolyGard® transmitter regularly. Due to regular maintenance, any performance deviations may easily be corrected. Re-calibration and part replacement in the field may be implemented by a qualified technician 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-Electronic-GmbH and IN*TEC* Controls warrants the PolyGard® transmitter for a period of two years, 12 months normal exposure for the sensor, 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, 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 attempted repair, or been subject 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 applies only to the PolyGard® transmitter. IN*TEC* Controls or MSR shall not be liable for any incidental or consequential damages arising out of or related to the use of the PolyGard® transmitter.

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

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