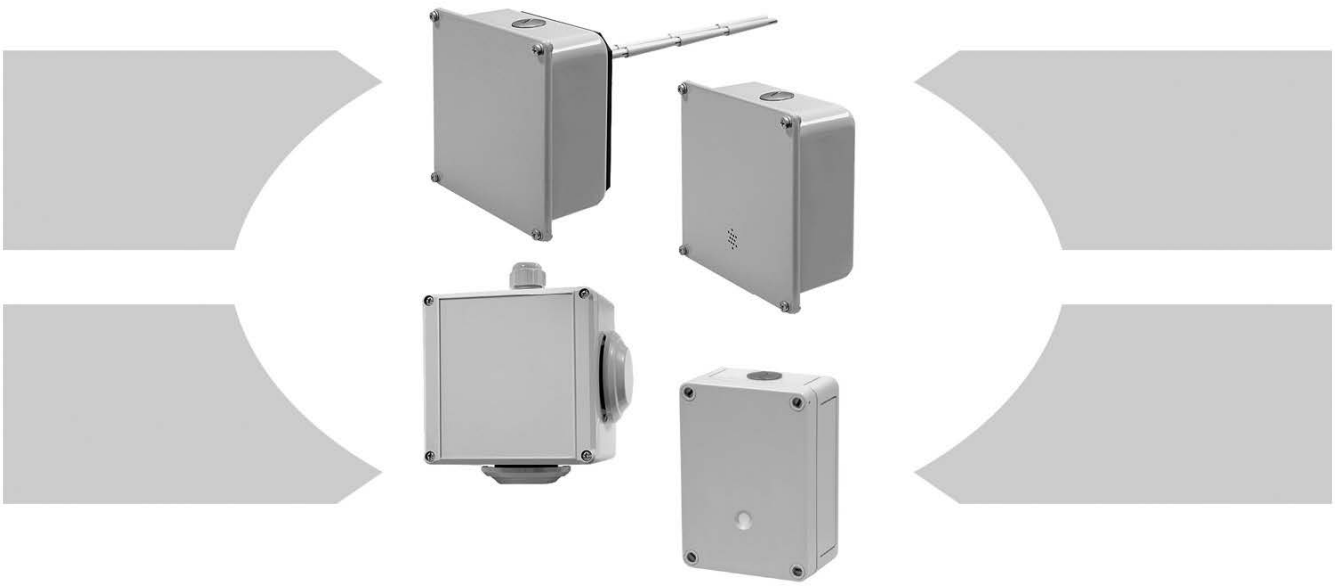

PolyGard® AT-3300 V3

Transmitter for Combustible Gases

Serial No. ET03-002

User Manual

April 2009

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Transmitter with cathalytic bead sensor for combustible gases and vapours

1 Intended Use

The PolyGard® gas transmitter with digital processing of the measuring values and temperature compensation is used for the continuous monitoring of the ambient air to detect the presence of combustible gases and vapours, such as natural gas, methane, propane, butane and ammonia etc. below the lower explosion limit (LEL). The transmitter is used for monitoring leakages in gas pipes, gas fan heaters, gas heating systems, gas engines (block heating stations), gas boilers, gas fittings, gas transfer stations, gas valves, natural-gas fuelling stations, domestic gas boiler installations, gas operated vehicles in underground car parks 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 (according to EN50 082).

The PolyGard® AT-33XX transmitter must not be used in potentially explosive atmospheres.

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.

2.2 Sensor

The integrated sensor works according to the catalytic bead principle. The ambient air being monitored diffuses through a sintered metal disk into the sensor. Here the combustible gases and vapours are burned by catalytic means at a heated detector element (pellistor). The resulting combustion heat also heats up the detector element. This heating changes the resistance of the detector element which is proportional to the partial pressure of the combustible gases.

In addition to the catalytic detector element, the sensor also has a similarly heated inactive compensator element. Both elements are part of a Wheatstone measuring bridge. Environmental influences such as temperature, ambient moisture or thermal conductivity of the monitored ambient air affect both elements to the same extent so that the influences on the measuring signal are almost completely compensated.

The integrated measuring amplifier converts this sensor current into a linear output signal. The zero point (Zero) and the amplification (Gain) are calibrated by potentiometers.

Certain substances and gases in the monitored ambient can affect the sensitivity of the sensor, or poison the sensor completely.

The following are currently known:

- polymerising substances, such as ethylene oxide, acrylonitrile, butadiene, styrene, silicone.
- corrosive substances, such as halogenated hydrocarbons.
- catalytic poisons, such as sulphur and phosphor compounds, silicon compounds, metal vapours.

Caution:

There is a small quantity of corrosive liquid in the sensor element. If in case of damage a person or an area comes in contact with the liquid, the affected person or area must wash the liquid off with water immediately. Out of use sensors must be disposed in the same way as batteries.

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 (acc. to DIN EN100015).

3.1 Mounting Instructions

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

- The mounting height depends on the gas type to be monitored.

  For gases and vapours with a density > air, the transmitter must be located near the ground.

  For gases and vapours with a density < air, the transmitter must be located at the highest point possible. Gas density and mounting height can be read from the table Cross-sensitivity data.
- Choose mounting location of the sensor according to the local regulations.
- Consider the ventilation conditions! Do not mount the transmitter in the centre 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 analog mode: (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.

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 any exchange 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-33XX V3 for proper mounting at X4 and X5.
- Check the sensor for proper mounting at the connectors X8 of the PCB AT-33XX V3 (only AT-34XX V3).
- Calibrate the transmitter (if not already factory-calibrated).

Required instruments for commissioning (calibration) of the transmitter:

- Test gas bottle with synthetic air (20 % O2, 80 % N).
- Test gas bottle with test gas (methane etc.) in the range of 30 – 60 % of the measuring range.
- Gas pressure regulator with flow meter to control the gas flow to 150 ml/min.
- Calibration adapter with tube, (silicon-free, e.g. Viton). Calibration set CALKIT-AT. See fig. 06.
- Digital voltmeter with range 0 – 10VDC, accuracy 1% and a small screwdriver.

Note: Prior to calibration the sensor element must be fully stabilized by applying power voltage for at least 4 hour without interruption.

Please observe proper handling procedures for test gas bottles (regulations TRGS 220)!

Attention: Combustible calibration gases are 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:

5.1 Manual Calibration

5.1.1 Zero-point

- Connect calibration adapter carefully to the sensor element.
- Apply synthetic air (150 ml/min; 1 Bar (14.5 psi) ± 10%).
- 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!

5.1.2 Gain

- Connect calibration adapter carefully to the sensor element.
- Apply calibration test gas (150 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 5.2.3.
- 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.

5.1.3 Calculation of Control Voltage

Signal start 2 V / 4 mA

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

Signal start 0 V / 0 mA

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

Example:

Measuring range	100 % LEL
Test gas concentration	40 % LEL (methane)
Control voltage: Signal start 2 V / 4 mA	104 mV
Control voltage: Signal start 0 V / 0 mA	80 mV

Signal start 2 V / 4 mA

$$\frac{160\ (mV) \times 40\ (\%\ LEL)}{100\ (\%\ LEL)} + 40\ (mV) = 104\ mV$$

Signal start 0 V / 0 mA

$$\frac{200\ (mV) \times 40\ (\%\ LEL)}{100\ (\%\ LEL)} = 80\ mV$$

5.2 Calculation calibration gas < >target gas (backup calibration)

$\ddot{U}W_{Gas} = KAL_{Gas} \times (K_{Gas} / \ddot{U}_{Gas})$

$\ddot{U}W_{Gas}$ = Target gas % LEL
KAL_{Gas} = Calibration gas % LEL
K_{Gas} = Factor relative sensitivity % LEL calibration gas
$\ddot{U}_{Gas}$ = Factor relative sensitivity % LEL target gas

Example:

Calibration gas	30% LEL/Methane
Target gas	Propane
30 % LEL/methane x (100/63)	47.6% LEL/Propane

The factor of the relative sensitivity can be read from the table cross sensitivity data.

Cross-sensitivity data AT-33XX V3

Type of gas/vapour	Chemical mark	Sensitivity[1] % % LEL/Methane	LEL/ % v/v	Gas Density Air = 1	Mounting high
Acetone	$(CH_3)_2CO$	50	2.60	2.00	Floor
Acetylene	C_2H_2	47	2.00	0.90	Ceiling
Benzene	C_6H_6	44	1.30	2.70	Floor
Cyclohexane	C_6H_{12}	44	1.30	2.91	Floor
Ethylene	CH_2	81	2.30	0.98	Ceiling
Ethane	C_2H_6	82	3.00	1.05	Floor
Ethyl Alcohol	C_2H_5OH	75	3.30	1.59	Floor
Ethyl Acetate	$CH_3COOC_2H_5$	46	2.20	3.04	Floor
Ethylene Oxide	C_2H_4O	52	2.60	1.52	Floor
Hydrogen	H_2	107	4.00	0.07	Ceiling
JP8		25	0.7		
JET_A		46	0.7		
Methane	**CH_4**	**100**	**4.40**	**0.55**	Ceiling
Methanol	CH_3OH	84	6.70	1.11	Floor
n-Butane	C_4H_{10}	51	1.80	2.11	Floor
n-Heptane	C_7H_{16}	44	1.05	3.46	Floor
n-Hexane	C_6H_{14}	46	1.02	2.98	Floor
n-Octane	C_8H_{18}	38	0.95	1.66	Floor
Propane	C_3H_8	63	1.70	1.55	Floor
n-Pentane	C_5H_{12}	50	1.40	2.49	Floor

[1] according to information of the sensor manufacturer.

The table does not claim to be complete. Other gases can have an influence on the sensitivity, too. The indicated sensitivity data are only standard values referring to new sensor elements.

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: 10 % LEL

Alarm threshold 2 = Relay 2: 20 % LEL

Switching hysteresis: 5 % LEL

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 MSR 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-33XX V3 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 ET03 at XB7/XB8.
- Replug the PCB AT-33XX V3 into terminal blocks X4, X5 carefully.
- Calibrate according to section 5.

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-33XX V3 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 Technical Data

General sensor performances	
Gas type	Combustible gases/ vapours See Ordering Information
Sensor element	Ex sensor, catalytic bead
Pressure range	Atmosphere ± 20 %
Storage temperature range	5 °C to 30 °C (41 °F to 86 °F)
Storage time	Max. 6 months
Mounting height	Depending on gas type
AT-33XX V3	
Measuring range	0 - 100 % LEL
Detection limit	0,5 % LEL
Accuracy	± 1 % of signal/methane
Repeatability	± 2 % of signal/methane
Long-term zero drift	< 5 % measuring range/year
Long-term sensitivity drift	< 2 % measuring range/month
Response time	t_{90} < 10 sec./methane
Life expectancy	> 3 years/normal operating environment
Temperature range	- 10 °C to + 40 °C (14 °F to 104 °F)
Humidity, continuous	15 – 90 % RH non condensing
Humidity, intermitted	0 – 99 % RH non condensing
Electrical	
Power supply	16 - 28 VDC/AC, reverse polarity protected
Power consumption (without options)	35 mA, max. (0,85 VA)
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
Serial interface	
Transceiver	RS 485 / 19200 Baud
Protocol, depending on version	MSR_DT05 or MOD_Bus
Physical	
Enclosure*	Stainless steel V2A
Enclosure colour*	Natural, brushed
Dimensions* (H x W x D)	113 x 135 x 45 mm /(5.35 x 4.5 x 1.8 in.)
Weight*	Approx. 0,5 kg (1.1 lbs.)
Protection class*	IP 55
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.)

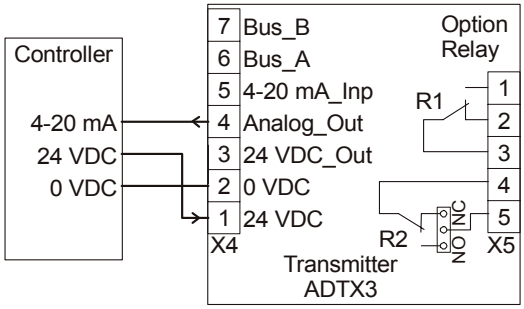
Guidelines	EMC Directive 2004 / 108 / EWG
	CE

Options	
Relay output	
Alarm relay 1 (switch threshold 10 % LEL)	30 VAC/DC 0,5 A, potential-free, SPDT
Alarm relay 2 (switch threshold 20 % LEL)	30 VAC/DC 0,5 A, potential-free, SPNO/SPNC
Power consumption	30 mA, (max. 0,8 VA)
Warning buzzer	
Acoustic pressure	83 dB (distance 200 mm) (0.7 ft.)
Frequency	2,3 kHz
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 ± 3,6 °F)
Ambient temperature	- 30 °C (- 22 °F)
Power supply	18 - 28 VDC/AC
Power consumption	0,3 A; 7,5 VA

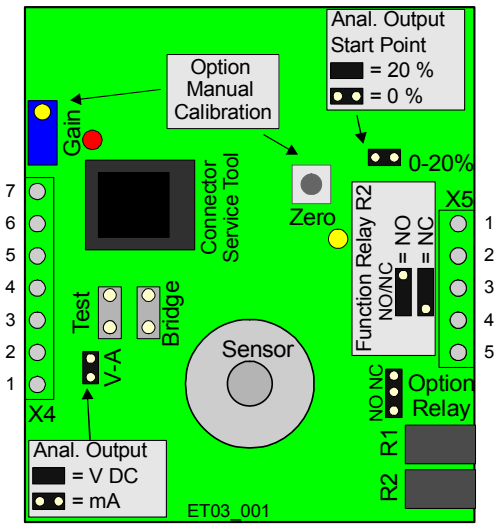
* Indications only for option "stainless steel", for further types see datasheet AT-DT Enclosure.

9 Figures

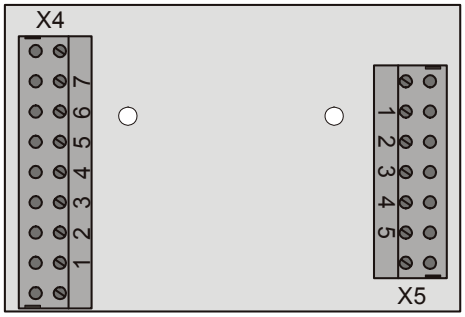
Application: Analog mode
Fig. 1



PCB ADT03
Fig. 3



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

Calibration adapter
Fig. 5
Type: CONKIT-COMB-AT

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10 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.

10.1 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.).

10.2 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.

10.3 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.

10.4 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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