# PolyGard® AT-1125 V3

Electrochemical Ammonia Transmitter
**Serial No. AT03-005**

# User Manual

December 2013
September 15, 2014 – *Revision*



GAADT231125_E.pdf

Customer Services (858) 578-7887 & (888) GO IN*TEC* Fax (858) 578-4633 & (888) FX IN*TEC*
IN*TEC* Controls, 12700 Stowe Dr., Suite 100, Poway, CA 92064 www.inteccontrols.com

Specification subject to change without notice.
Printed in USA 140915

Customer Services (858) 578-7887 & (888) GO IN*TEC* Fax (858) 578-4633 & (888) FX IN*TEC*
IN*TEC* Controls, 12700 Stowe Dr., Suite 100, Poway, CA 92064 www.inteccontrols.com

### Electrochemical Ammonia Transmitter

# 1 Intended Use

The PolyGard® $NH_3$ analog transmitter AT-1125 with digital processing of the measured values and temperature compensation is used to detect leakages of ammonia in the ambient air.

The sites intended for use are all areas being directly connected to the public low voltage supply, e.g. domestic, commercial and industrial ranges as well as small enterprises (acc. to EN 50 082).

The PolyGard® $NH_3$ analog transmitter must not be used in potentially explosive atmospheres. The transmitter must only be employed in areas within the environmental conditions as specified in the Technical Data.

# 2 Functional Description

## 2.1 Control 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 4-20 mA mode and without any supplementary options, the AT-1125 also works in the 2-wire technique.

## 2.2 Sensor

The sensor portion of the transmitter is a sealed micro-fuel cell with three electrodes, sensing, counter and reference. The ambient air enters the cell through a diffusion barrier into the liquid electrolyte of the sensor. The chemical process of the measurement is one of reduction 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. 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 the zero-point and of the gain is necessary. See also section 6.

**Caution:**

There is a small quantity of corrosive liquid in the sensor element. If in case of damage persons or objects encounter 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.



Customer Services (858) 578-7887 & (888) GO IN*TEC* Fax (858) 578-4633 & (888) FX IN*TEC*
IN*TEC* Controls, 12700 Stowe Dr., Suite 100, Poway, CA 92064 www.inteccontrols.com

# 3 Installation

**Caution:** 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 conductive floor (acc. to DIN EN 100015).

## 3.1 Mounting Instructions

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

- The specific weight of Ammonia, $NH_3$, is lower than that of air (factor 0.59).

  **Installation at the highest point possible with a distance of ca. 300 mm to the ceiling.**
- Select the location of the sensor according to 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 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 airflow is in line with probe openings.

## 3.2 Installation

- Open cover of enclosure. Unplug PCB from terminal blocks.
- Fix bottom part by screws vertically to the wall (terminal blocks to the ground).
- Re-plug the PCB at X4 and X5. 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 and according to the corresponding regulations, without any power applied to conductors!
- Avoid any influence of external interference by using shielded cables.
- Recommended cable for analog mode: J-Y(St)Y 2x2x0.8 LG (20 AWG), max. loop resistance 73 Ω/km (20.8 Ω/1000 ft).
- When the PBC is mounted, it is important to ensure that the wire shields or any bare wires do not short the PCB.

## 4.1 Wiring Connection

- Open cover of enclosure. Unplug PCB from terminal blocks X4 and X5.
- Enter cable through hole; connect cable leads to the terminal blocks. See fig. 1 and 2.
- Re-plug the basic PCB at the terminal blocks X4, X5. Close cover.

**Note. The connection of the power supply at the output signal (X4 pin 4) can destroy the transmitter.**



Customer Services (858) 578-7887 & (888) GO IN*TEC* Fax (858) 578-4633 & (888) FX IN*TEC*
IN*TEC* Controls, 12700 Stowe Dr., Suite 100, Poway, CA 92064 www.inteccontrols.com

# 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 supply voltage.
- Check PCB for correct mounting at X4 and X5.
- Check sensor element for correct mounting at terminal X3 of the PCB.
- Calibration of the transmitter (if not factory-calibrated)

Required instruments to calibrate the transmitter:

- Test gas bottle with synthetic air (20 % $O_2$, 80 % N) or $NH_3$-free ambient air.
- Test gas bottle with $NH_3$ in the range of 20 to 70 % of the measurement range. Rest is synthetic air.
- Gas pressure regulator with flow meter to control the gas flow to 300 ml/min
- Sensor head calibration adapter with tube. Type calibration set AT1110SO1. See Fig. 5.
- Digital voltmeter with range 0 – 2 VDC, accuracy 1%.
- Screwdriver small.

**Note:** Prior to calibration the sensor element must be fully stabilized by applying power voltage for at least 18 hours without interruption.

Please observe proper handling procedures for test gas bottles according to TRGS 220!

**Attention:** $NH_3$ calibration gas is toxic, never inhale the gas!
Symptoms at high concentrations: Loss of motility and consciousness.
Procedure if exposed: Get the victim into fresh air at once, consult doctor.

## 5.1 Correction of the Zero-point at the Analog Output Signal

The analog output signal is factory set to the zero-point. If necessary, a manual adaptation of the analog signal is possible within 10 sec. after having applied the supply voltage.

- Jumper 0-20 % for signal start has to be set (= 4 mA or 2 V).
- Connect digital voltmeter (300 mV) at test pint “Test” (measuring signal ~ 40 mV = 4.0 mA).
- Switch on the operating voltage.
- Each pressing on the “Zero” push-button increases the signal by + 0.5 mV (0.05 mA). Press the button repeatedly until the measuring signal reaches 40 ± 0.2 mV. After 44mV the signal starts again at 36 mV. The correction is only possible within the 10 seconds after having switched on the power supply. An impulse pause of more than 10 sec. cancels the release of the correction function.

## 5.2 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).

Manual calibration is possible both in analog mode and in DGC-05_Bus mode.

In the DGC-05_Bus mode the jumper V-A has to be set before manual calibration. Only by doing so the control voltage is available at the test pins X6. Remove the jumper after calibration

### 5.2.1 Zero-point

- Connect digital voltmeter to pin “Test”.
- Connect the calibration adapter carefully to the sensor element.



Customer Services (858) 578-7887 & (888) GO IN*TEC* Fax (858) 578-4633 & (888) FX IN*TEC*
IN*TEC* Controls, 12700 Stowe Dr., Suite 100, Poway, CA 92064 www.inteccontrols.com

- Apply zero calibration gas, (300 ml/min; 1 Bar (14.5psi) ± 10%), or other clean air source to the sensor element.
- Wait 3 minutes until the signal is about 40 mV and stable, then press the button Zero for 5 seconds. Finished!

  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 digital voltmeter to pin “Test”.
- Connect calibration adapter carefully to the sensor element.
- Apply test gas $NH_3$ (20 to 70% of range) to the sensor (300 ml/min; 1 Bar ± 10%)
- Wait 3 minutes until the sensor is stable, adjust signal with gain potentiometer ”Gain” until the signal corresponds to the calculated value ± 3 mV, see calculation section 5.3.3 and is stable.
- 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.



Customer Services (858) 578-7887 & (888) GO IN*TEC* Fax (858) 578-4633 & (888) FX IN*TEC* Specification subject to change without notice.
IN*TEC* Controls, 12700 Stowe Dr., Suite 100, Poway, CA 92064 www.inteccontrols.com Printed in USA 140915

### 5.2.3 Calculation of Control Voltage

$$\text{Control voltage (mV)} = \frac{160\ (\text{mV}) \times \text{test gas concentration } NH_3\ (\text{ppm})}{\text{measuring range } NH_3\ (\text{ppm})} + 40\ (\text{mV})$$

Example

| | | |
|---|---|---|
| Measuring range $NH_3$ | 300 ppm | 1000 ppm |
| Test gas concentration $NH_3$ | 150 ppm | 300 ppm |
| Control voltage | 120 mV | 88 mV |

$$\frac{160\ (\text{mV}) \times 150\ (\text{ppm})}{300\ \text{ppm}} + 40\ (\text{mV}) = 120\ \text{mV}.$$

### 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 for measuring range 300 ppm:

Alarm threshold 1 = Relay 1: 80 ppm
Alarm threshold 2 = Relay 2: 250 ppm
Switching hysteresis: 15 ppm



Customer Services (858) 578-7887 & (888) GO IN*TEC* Fax (858) 578-4633 & (888) FX IN*TEC* Specification subject to change without notice.
IN*TEC* Controls, 12700 Stowe Dr., Suite 100, Poway, CA 92064 www.inteccontrols.com Printed in USA 140915

# 6 Service and Inspection

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.

According to EN 45544-4, inspection and service has to be executed at regular intervals. The maximum intervals have to be determined by the person responsible for the gas warning system according to the legal requirements. MSR-E recommends checking the PolyGard Transmitter every three months and maintaining it every 12 months. If different intervals are indicated, always consider the shortest interval.

Inspections and services must be documented. The date for the next maintenance has to be affixed to the transmitter.

## 6.1 Inspection

The PolyGard Transmitter should be controlled regularly by a competent person according to EN 45544-4. The following has to be checked in particular:

- Maintenance/ calibration interval not exceeded.
- Visual inspection of the transmitter including cable for damage etc.
- Remove dust deposits, especially at the gas inlet.
- The filter at the gas inlet has to be replaced if extremely dirty.

## 6.2 Service and Calibration

When performing the maintenance you have to do the calibration and the functional test in addition to the inspection.

- Calibration: See section 5.
- Functional test: Check the output signal at the test pins during calibration.

## 6.3 Exchange of Sensor Element

Consider static electricity! See point 3.

Sensor should always be installed without voltage applied.

- Unplug basic PCB carefully from the terminal blocks on base.
- Unplug old sensor element from the PCB.
- Take new sensor element out of original packing.
- Plug in sensor element into the PCB at X3.
- Plug in carefully the PCB into terminal block X4, X5.
- Calibrate according to section 5.




Customer Services (858) 578-7887 & (888) GO INTEC Fax (858) 578-4633 & (888) FX INTEC
INTEC Controls, 12700 Stowe Dr., Suite 100, Poway, CA 92064 www.inteccontrols.com

# 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:<br>Two-wire: Pin 1 (+) and 4 (-)<br>Three-wire: Pin 1 (+) and 2 (-) |
| | PCB 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 |



Customer Services (858) 578-7887 & (888) GO IN*TEC* Fax (858) 578-4633 & (888) FX IN*TEC*
IN*TEC* Controls, 12700 Stowe Dr., Suite 100, Poway, CA 92064 www.inteccontrols.com
Specification subject to change without notice.
Printed in USA 140915

# 8 Cross-sensitivity Data

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.

| Gas | Chemical formula | Gas concentration | Exposure time (min) | Influence on the reading (ppm $NH_3$) |
|---|---|---|---|---|
| Chlorine | $CL_2$ | 10 ppm | 5 | 0 |
| Ethanol | $C_2H_6O$ | 100 ppm | 5 | 0 |
| Ethylene | $C_2H_4$ | 1000 ppm | 5 | 0 |
| Carbon monoxide | CO | 200 ppm | 5 | 0 |
| Carbon dioxide | $CO_2$ | 5.000 ppm | 5 | 0 |
| Methane | $CH_4$ | 5.000 ppm | 5 | 0 |
| Hydrogen | $H_2$ | 1.000 ppm | 5 | < -10 (MB 100); <-150 (MB 300) |
| Sulphur dioxide | $SO_2$ | 10 ppm | 5 | < 15 (MB 100); < 12 (MB 300) |
| Hydrogen sulphide | $H_2S$ | 100 ppm | 5 | < 30 |
| Nitrogen monoxide | NO | 20 ppm | 5 | < 2 (MB 100); 0 (MB 300) |
| Nitrogen dioxide | $NO_2$ | 20 ppm | 5 | 0 |

## 9 Technical Data

| **General sensor performances** | |
|---|---|
| Gas type | Ammonia ($NH_3$) |
| Sensor element | Electrochemical, diffusion |
| Measuring range | 0 - 100 ppm / 0 - 300 ppm / 0 - 1000 ppm |
| Pressure range | Atmosphere ± 15 % |
| Humidity | 15 – 90 % RH non condensing |
| Storage temperature range | 5 °C to + 30 °C (41 °F to 86 °F) |
| Storage time | Max. 6 months |
| Accuracy | ± 30 ppm (range 300 / 1000 ppm) |
| | ± 5 ppm (range 100 ppm) |
| Repeatability | ± 10 % of reading |
| Zero point drift | < ± 50 ppm /year (range 300/ 1000 ppm) |
| | < ± 10 ppm /year (range 100 ppm) |
| Long term output drift | < 2 % measured value/month |
| Response time | $t_{90} \leq 120$ s (range 300 / 1000 ppm) |
| | $t_{90} \leq 90$ s (range 100 ppm) |
| Temperature range | -10 °C to + 50 °C (14 °F to 122 °F) w/o heating |
| Life expectancy | > 2 years/normal operating environment |
| **Electrical** | |
| Power supply | 18 - 28 VDC/AC, reverse polarity protected |
| Power consumption (without options)<br>- Analog mode | 22 mA, max. (0,6 VA) |
| **Output signal** | |
| Analog output signal<br>Selectable: Current / tension<br>Starting point 0 / 20 % | (0) 4 – 20 mA, load ≤ 500 Ω,<br>(0) 2 - 10 V; load ≥ 50 k Ω<br>proportional, overload and short-circuit proof |
| **Physical** | |
| Enclosure Plastic, Type "A" | Polycarbonate |
| Flammability | UL 94 V2 |
| Enclosure colour | Light gray RAL 7032 |
| Dimensions (W x H x D) | 94 x 130 x 57 mm (3.7 x 5.12 x 2.25 in.) |
| Weight | Approx. 0.3 kg (0.7 lb.) |
| Protection class | IP65 |
| Mounting | Wall mounting |
| Enclosure Galvanized Steel, Type "0" | Galvanized steel w/zinc coating |
| Enclosure colour | Light gray |
| Dimensions (W x H x D) | 113 x 135 x 45 mm (5.35 x 4.5 x 1.8 in.) |
| Protection class | NEMA 1 (IP42) |
| Mounting | Wall (surface) mounted,<br>or single gang electrical box |
| Cable entry | Standard 1 x M 20 |
| Wire connection | Screw-type terminal: 0.25 to 2.5 $mm^2$<br>24 to 14 AWG |
| Wire distance | Current signal ca. 500 m (1500 ft.)<br>Voltage signal ca. 200 m (500 ft.) |



Customer Services (858) 578-7887 & (888) GO IN*TEC* Fax (858) 578-4633 & (888) FX IN*TEC*
IN*TEC* Controls, 12700 Stowe Dr., Suite 100, Poway, CA 92064 www.inteccontrols.com
Specification subject to change without notice.
Printed in USA 140915

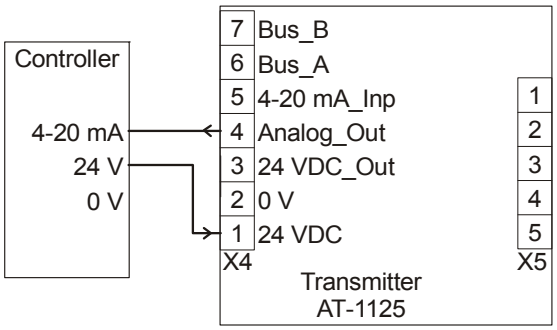
| | |
|---|---|
| **Guidelines** | EMC Directive 2004/108/EC<br>EN 61010-1; 2010<br>ANSI/UL 61010-1<br>CAN/CSA-C22.2 No. 61010-1<br>CE |
| **Warranty** | Two years material and workmanship,<br>12 months normal exposure for sensor element |
| **Options** | |
| **Relay output** | |
| Alarm relay 1 | 30 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) |
| **Heating** | |
| Temperature controlled | 3 °C ±2 °C (37 °F ± 4 °F) |
| Ambient temperature | - 40 °C (-40 °F) |
| Power consumption | 0.3 A; 7.5 VA |



Customer Services (858) 578-7887 & (888) GO IN*TEC* Fax (858) 578-4633 & (888) FX IN*TEC*
IN*TEC* Controls, 12700 Stowe Dr., Suite 100, Poway, CA 92064 www.inteccontrols.com
Specification subject to change without notice.
Printed in USA 140915

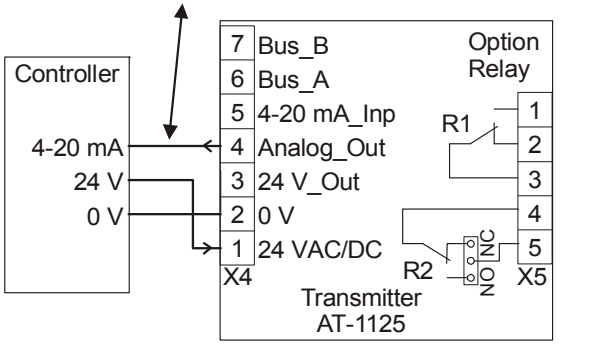
## 10 Figures

Application: Analog mode
Fig. 1



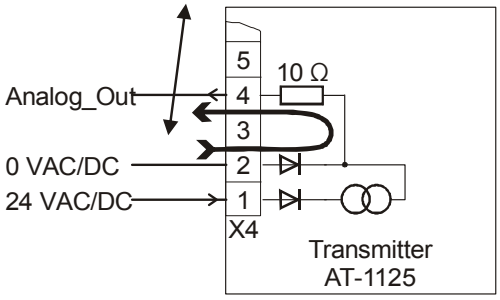

Two-wire connection
- 4 - 20 mA output signal without options

**Do not connect power supply at this pin.**
**(0 VDC, 24 VAC or 0VAC will destroy the transmitter.)**

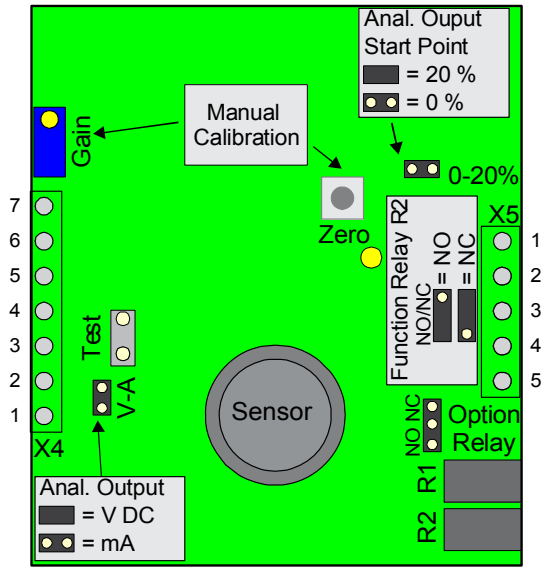



Three-wire connection
- VDC output signal
- 0 – 20 mA output signal
- Relay output
- LCD display
- Heating

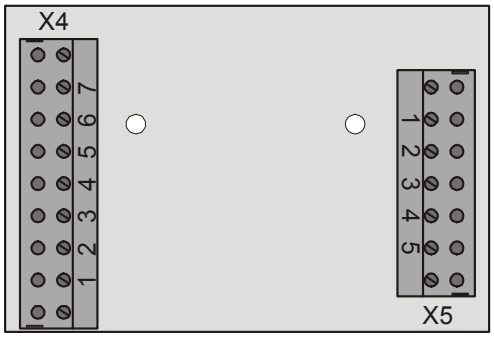
Do not connect 24 VAC at pin 2 and pin 4
or +24 VDC at pin 2 and 0 VDC at pin 4!!
**Short-circuit = R 10 Ohm burns up!!**



PCB
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-E/CH-LC

# 11 Part Disposal

Since August 2005 there are EC-wide directives defined in the EC Directive 2002/96/EC and in national codes concerning the waste electrical and electronic equipment and also regarding this device.

For private households there are special collecting and recycling possibilities. For this device isn't registered for the use in private households, it mustn't be disposed this way. You can send it back to your national sales organisation for disposal. If there are any questions concerning disposal please contact your national sales organisation.

Outside the EC, you have to consider the corresponding directives.

# 12 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® transmitters must be used within product specification capabilities. The appropriate operating and maintenance instructions and recommendations must be strictly followed.

Due to on-going product development, MSR-Electronic-GmbH and IN*TEC* Controls reserve the right to change specifications without notice. The information contained herein is based upon data considered to be accurate. However, no guarantee is expressed or implied regarding the accuracy of these data.

## 12.1 Intended Product Application

The PolyGard® $NH_3$ transmitters are designed and manufactured for control applications and air quality compliance in commercial buildings and manufacturing plants.

## 12.2 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 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.

## 12.3 Maintenance

It is recommended to check the PolyGard® transmitter regularly. Due to regular maintenance any deterioration of performance may easily be corrected. Re-calibration and part replacement may be implemented in the field 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.

## 12.4 Limited Warranty

MSR-Electronic-GmbH and IN*TEC* Controls warrant the PolyGard® transmitters for (2) years from the date of shipment against defects in material or workmanship and 12 months normal exposure for sensor element. Should any evidence of defects in material or workmanship occur during the warranty period, MSR-Electronic-GmbH 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 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® transmitters. MSR-Electronic-GmbH 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.

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



Customer Services (858) 578-7887 & (888) GO IN*TEC* Fax (858) 578-4633 & (888) FX IN*TEC* Specification subject to change without notice.
IN*TEC* Controls, 12700 Stowe Dr., Suite 100, Poway, CA 92064 www.inteccontrols.com Printed in USA 140915