PolyGard® AT-2000 V3

Infrared Refrigerant Gas Transmitter
Serial No. AT-2000

User Manual

March, 2009
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Infrared Transmitter for Refrigerant Gases

1 Intended Use

The PolyGard® refrigerant gas transmitter with digital processing of the measuring values and temperature compensation is used for the monitoring of leakages in refrigeration plants with Freon (HFC or HCFC) as cooling agent.

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® refrigerant transmitter must not be used in potentially explosive atmospheres. The 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 4-20 mA mode, the AT-2000 only works in the 3-wire technique.

2.2 Sensor

The integrated sensor is based on the principle of the infrared absorption of gases and accomplishes highest requirements concerning accuracy, reliability and economy. The sensor technology uses the individual absorption spectrum of the refrigerant gas and appoints its exact concentration through its accurate, quantitative analysis. The infrared principle nearly eliminates the cross-sensitivity to other gases.

An integrated evaluation electronic system reliably compensates all drift and temperature influences and therefore a genuine measurement result is guaranteed.

The sensor is factory-calibrated for a period of 10 years.

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.

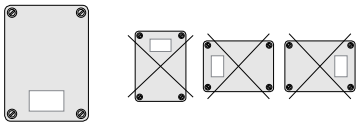
3.1 Mounting Instructions

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

- The 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 Overview Gases/ 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.
- **Transmitter must be mounted in the vertical position!**



Duct mounting

- Mount only in a straight section of duct with minimum air vortex. Keep a minimum distance of 1 meter (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.
- Fix the housing to the wall through the holes at the 4 corners using the enclosed screws/ wall anchors (sensor down).
- Replace the cover.

4 Electrical Connection

Consider static electricity! See 3.1 Mounting

- Installation of the electrical wiring should only be executed according to the connection diagram by a trained specialist, 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: 18 AWG shielded twisted cable.
- 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 X4 and X5. Pay attention to the cable to the sensor.
- Insert the cable and connect cable leads to terminal blocks. See fig. 1 and 2.
- Replug the PCB in the terminal blocks X4, X5 with care. Replace the cover.

5 Commissioning

Consider commissioning instructions at any exchange of the sensor element as well.

Only trained technicians should perform the following:

The filter at the gas inlet is part of the IP65 protection and must not be removed.

- Check mounting location.
- Select output signal form: Current or voltage, and starting point 0 or 20%. See fig.3 and 4.
- Check power voltage.
- Check PCB for correct mounting at X4 and X5.
- The transmitter is already factory-calibrated for 10 years. Therefore calibration is not required at commissioning.

Note:

The sensor is ready for use after a running-in period of 1 minute. During that period the zero-point signal is transmitted.

5.1 Check of the Analog Output Signal

The output signal can be checked at the test pins (see fig. 3) in dependence of the detected gas by using the following formula.

Signal start 2 V / 4 mA

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

Signal start 0 V / 0 mA

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

Example:

Measuring range	2000 ppm
Test gas concentration	800 ppm
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

$$\frac{160\ (\text{mV}) \times 800\ (\text{ppm})}{2000\ \text{ppm}} + 40\ (\text{mV}) = 104\ \text{mV}$$

Signal start: 0 V / 0 mA

$$\frac{200\ (\text{mV}) \times 800\ (\text{ppm})}{2000\ (\text{ppm})} = 80\ \text{mV}$$

5.2 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 the measuring range 2000 ppm.

Alarm threshold 1 = Relay 1: 500 ppm
Alarm threshold 2 = Relay 2: 1000 ppm
Switching hysteresis: 100 ppm

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 one of our authorized partners.

6.2 Exchange of Sensor Element

The sensor is always replaced together with the PCB.
Consider static electricity! See point 3.

- Unplug basic PCB carefully from the bottom part.
- Unscrew the sensor.
- Exchange the PCB sensor unit.
- Fix new sensor at the two screws, taking care not to over-tighten.
- Replug the PCB in the terminal blocks X4, X5 carefully.

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 voltage at X4: Two-wire: Pin 1 (+) and 4 (-) Three-wire: Pin 1 (+) and 2 (-)
	PCB AT03 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
No reaction of the output signal in spite of gas concentration	Power voltage not applied	Measure voltage at X4
	Signal (Pin 4) not wired correctly	Check the wiring

8 Technical Data

General sensor performances	
Gas type	Refrigerant gases - Freon
Sensor element	Two-beam infrared (NDIR)
Measuring range	0 – 2000 ppm
Temperature range	- 10 °C to + 40 °C (14°F to 104°F)
Pressure range	800 – 1100 hPa
Humidity	0 – 95 % RH non condensing
Storage temperature range	0 °C to 50 °C (32 °F to 122 °F)
Storage time	Max. 6 months
Mounting height	Depending on gas type
Accuracy group HCFC	< 3 % of measuring range
Accuracy group HFC	< 2 % of measuring range
Repeatability group HCFC	< 3 % of measuring range
Repeatability group HFC	< 2 % of measuring range
Resolution group HCFC	1 ppm
Resolution group HFC	10 ppm
Long-term zero-point drift group HCFC	< 2 % of reading/year
Long-term zero-point drift group HFC	< 3 % of reading/year
Long-term output signal drift l group HCFC	< 1 % of reading/year
Long-term output signal drift group HFC	< 1 % of reading/year
Electrical	
Power supply	18 – 28 VDC/AC, reverse polarity protected
Power consumption (without options)	45 mA, max. (1.1 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 (9600 ModBus)
Protocol, depending on version	DGC-05 or ModBus
Physical	
Enclosure[1]	Polycarbonate
Flammability	UL 94 V2
Enclosure colour	RAL 7032 (light gray)
Dimensions	(W x H x D) 94 x 130 x 57 mm
Weight	0.5 kg (1 lbs.)
Protection class	IP 65
Mounting	Wall mounting
Cable entry	Standard 1 x M 20
Wire connection	Screw-type terminal min. 0.25 to max. 2.5 mm^2 24 to 14 AWG
Wire distance	Current signal ca. 500 m (1500 ft.) Voltage signal ca. 200 m (600 ft.)
Guidelines	EMC Directive 2004 / 108 / EEC
	CE
Warranty	1 year on material (without sensor)

[1] Specifications only for standard housing; for further types see “AT-DT Enclosure” datasheet.

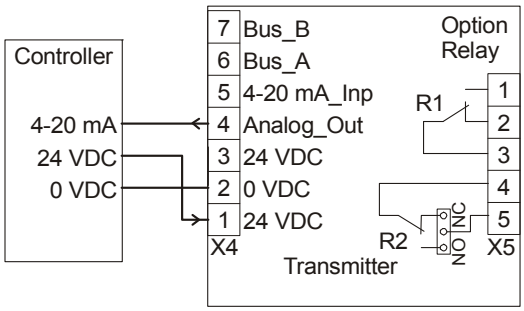
Options	
Relay output	
Alarm relay 1 (switching threshold 15000 ppm)	30 VAC/DC 0.5 A, potential-free, SPDT
Alarm relay 2 (switching threshold 30000 ppm)	30 VAC/DC 0.5 A, potential-free SPNO/SPNC
Power consumption	30 mA, (max. 0.8 VA)
Warning buzzer	
Acoustic pressure	85 dB (distance 300 mm) (1 ft.)
Frequency	3.5 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 consumption	0.3 A; 7.5 VA
Analog input	
Only for RS-485 mode	4 – 20 mA overload and short-circuit proof, input resistance 200 Ω
Power supply for external transmitter	24 VDC max. 50 mA

8.1 Table Overview of Gases/ Data

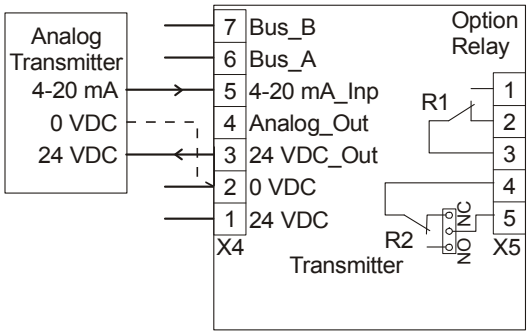
Gas type	ADT-D3-…	Group	Measuring range	Relative density (air =1)
R 22	2070	HCFC	2000 ppm	> air
R 401a	2071	HCFC	2000 ppm	> air
R 401b	2072	HCFC	2000 ppm	> air
R 401c	20XX	HCFC	2000 ppm	
R 402a	2073	HCFC	2000 ppm	> air
R 402b	2074	HCFC	2000 ppm	> air
R 403a	20XX	HCFC	2000 ppm	
R 403b	20XX	HCFC	2000 ppm	
R 405a	20XX	HCFC	2000 ppm	
R 406a	20XX	HCFC	2000 ppm	
R 408a	2075	HCFC	2000 ppm	> air
R 409a	2076	HCFC	2000 ppm	> air
R 409b	20XX	HCFC	2000 ppm	> air
R 411a	2067	HCFC	2000 ppm	> air
R 411b	20XX	HCFC	2000 ppm	> air
R 412a	20XX	HCFC	2000 ppm	> air
R 509a	20XX	HCFC	2000 ppm	
R 134a	2077..1	HFC	300 ppm	> 1
	2077..2	HFC	2000 ppm	
R 404a	2078..1	HFC	300 ppm	3,45
	2078..2	HFC	2000 ppm	
R407a	20XX..1	HFC	300 ppm	
	20XX..2	HFC	2000 ppm	
R407b	20XX..1	HFC	300 ppm	
	20XX..2	HFC	2000 ppm	
R407c	20XX..1	HFC	300 ppm	
	20XX..2	HFC	2000 ppm	
R413a	20XX..1	HFC	300 ppm	
	20XX..2	HFC	2000 ppm	
R 416a	2079..1	HFC	300 ppm	> air
	2079..2	HFC	2000 ppm	
R417a	20XX..1	HFC	300 ppm	
	20XX..2	HFC	2000 ppm	
R 507	2069..1	HFC	300 ppm	3,45
	2069..2	HFC	2000 ppm	
R 410a	2068..1	HFC	300 ppm	2,3
	2068..2	HFC	2000 ppm	
R11	20XX	CFC	2000 ppm	
R12	20XX	CFC	2000 ppm	
R133	20XX	CFC	2000 ppm	

9 Figures

Application: Analog mode
Fig. 1

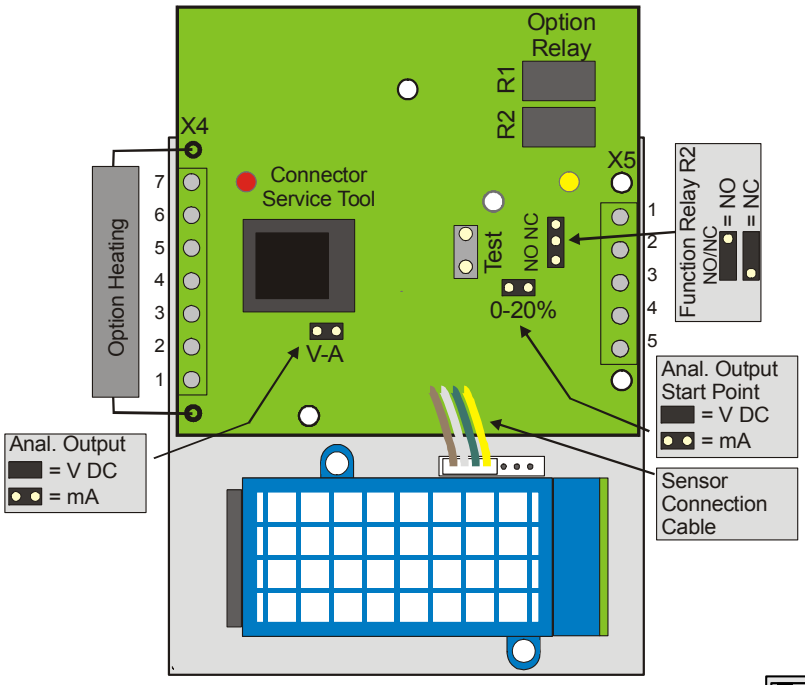


Application: DGC5_Bus mode
Fig. 2

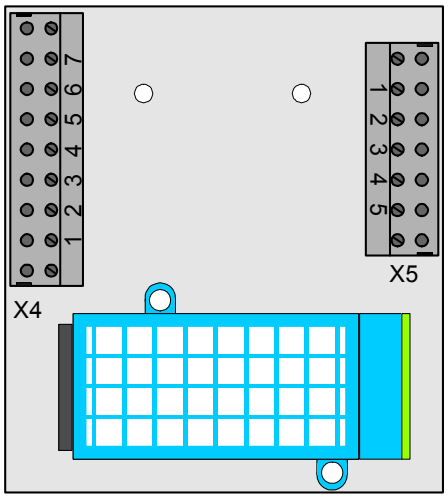


Connection analog transmitter
- Two- or three-wire connection, depending on transmitter type

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

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

Due to on-going product development, MSR reserves 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 this data.

10.1 Intended Product Application

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

10.2 Installers' Responsibilities

It is the installer's responsibility to ensure that all PolyGard® AT 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, the codes, standards and proper safety procedures for control installations, as well as the latest edition of the National Electrical Code (ANSI/NFPA70). It is also essential to strictly follow all instructions as provided in this user manual.

10.3 Maintenance

It is recommended to performance check the PolyGard® AT transmitter regularly. With regular maintenance, any performance deviations may easily be corrected. Re-calibration and part replacement in the field may be implemented by a qualified technician 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. MSR-Electronic-GmbH and/or IN*TEC* Controls 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.