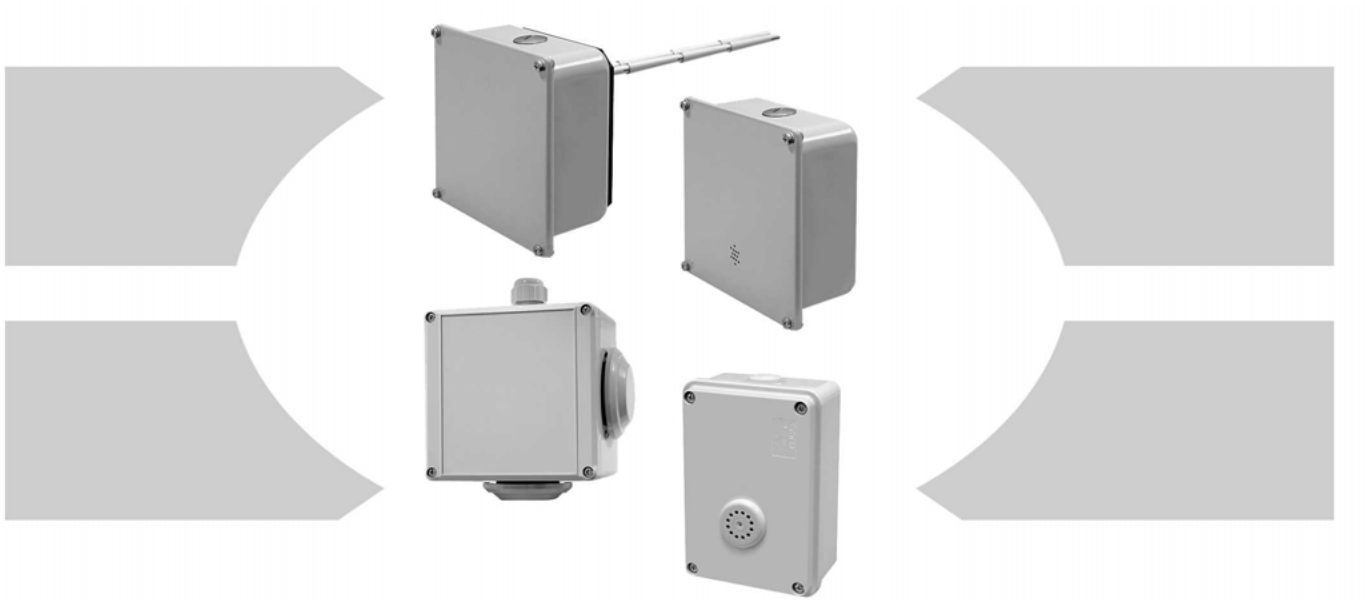

PolyGard® DT5-1110

Carbon Monoxide (CO) RS-485 Digital Gas Transmitters

Serial Number _

User's Manual

December 05, 2008

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Specification subject to change without notice.
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Electrochemical Carbon Monoxide Transmitter

1.1 Description

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 carbon monoxide gas. Main application ranges are parking garages, tunnels, engine test stations, shelters, loading areas etc.
The sensor portion of the transmitter is a sealed electro-chemical cell with three electrodes: sensing, counter 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.

1.2 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 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.

1.2.1 Intended product application

The PolyGard® 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.).

1.2.2 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.

1.2.3 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.

1.2.4 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.

1.2.5 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.

2. Mounting Instructions

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 work on the equipment without a wrist strap connected to earth or standing on a conductive floor.

2.1 Mounting location

- **The mounting height is five feet above floor (max. 6 feet).**
- Provide adequate space around sensor for maintenance and calibration work.
- 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, vehicle exhaust 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 might be possible.
- **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

2.2 Enclosure

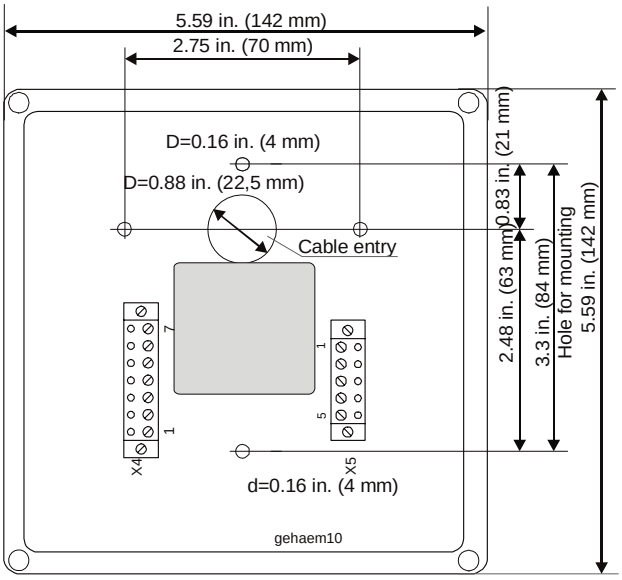
- Un-screw cover of enclosure.
- Unplug basic PCB carefully from the bottom part.
- Fix bottom part by screws vertically to the wall (terminal blocks to the ground).
- Replug the basic PCB at X4 and X5 with care. Replace the cover.

Caution:

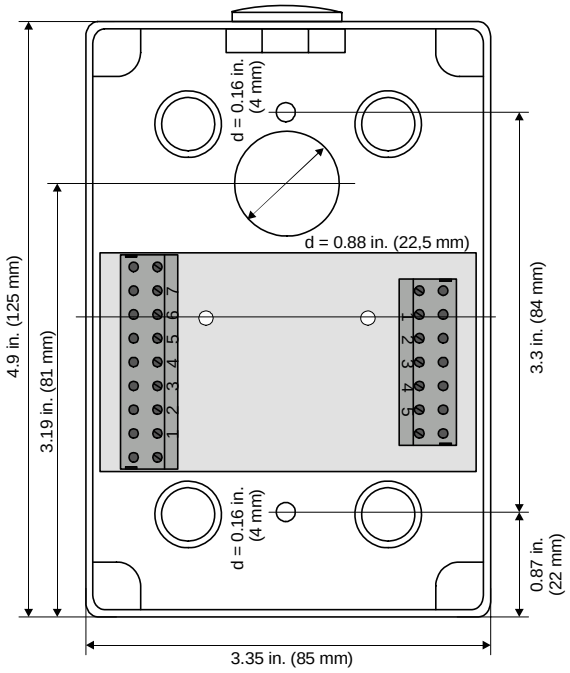
There is a small quantity of corrosive liquid in the sensor element. If the sensor is damaged and a person or an area comes in contact with the liquid, the affected person or area must wash the liquid off with water immediately. Out of use sensors must be disposed in the same way as batteries.

2.3 Figures

Housing/dimensions,
standard enclosure NEMA 1



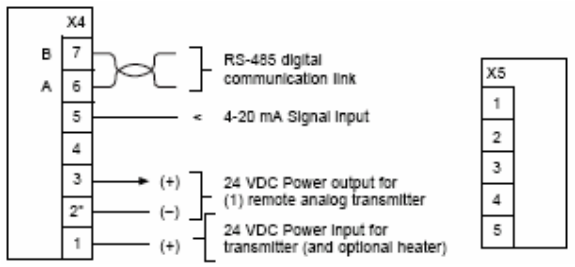
Housing/dimensions,
Optional enclosure NEMA 12,
high impact



3. Wiring Connection

3.1 Connection Diagram

Fig. 1
Wiring configuration



*Terminal X4 No. 2, common (-), for both power input and output

Notes:
No wiring connection to terminal block X5

Fig. 2
RS-485 digital communication and 24 VDC power supply, trunk/bus configuration

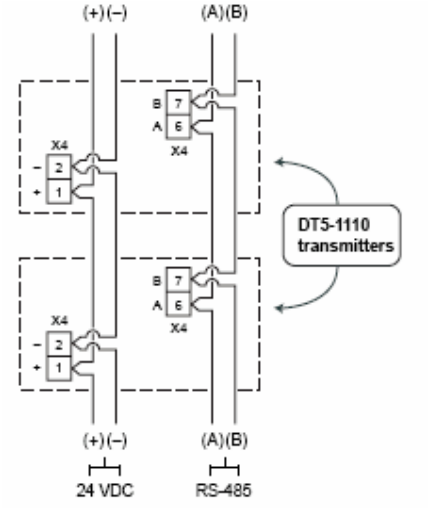
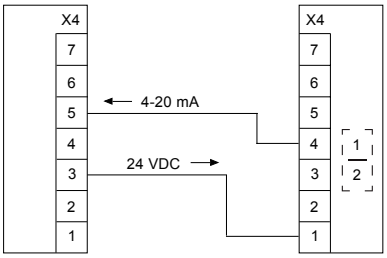


Fig. 3
4-20 mA analog transmitter piggybacked via RS-485 digital transmitter

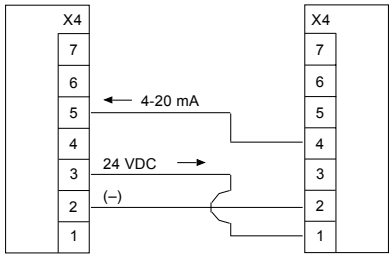
DT5-1110
RS-485

AT-11.. Version 3
4-20 mA, loop powered



DT5-1110
RS-485

AT-33.. Version 3
4-20 mA, 3-wire



3.2 General

The intended sites for the PolyGard® gas transmitter 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® transmitter must not be used in potentially explosive atmospheres.

3.3 Wiring

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

- 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: 18 AWG (0,75 mm^2), max. resistance 40 Ω/km (10 Ω/1000 ft).
- Required cable for RS-485 mode: 18 AWG (0,75 mm^2), max. resistance 40 Ω/km (10 Ω/1000 ft)
- It is important to ensure that the wire shields or any bare wires do not short the mounted PCB.
- Maximum daisy-chain trunk length is 2,900 ft.
- Implement daisy-chain (multi-drop) communication and power supply between transmitter(s) and controller.
- Do not connect power to A and B, this may damage the transmitters and possibly the trunk protector CON linked on the same daisy-chain trunk.
- Daisy-chain between transmitters and controller A to A, B to B. Do not cross A to B, this creates malfunction of communication.
- No ground connections required for shielded cable, transmitters, and controller enclosure.
- Do not use high voltage lines in the same RS-485 communication cable conduit.

With optional heater:

The wiring and DC power supply must be sized appropriately for a power of 0.6 A, 24 VDC!

3.4 Control Mode

The analog output transmitter is equipped with a serial interface RS-485 connection to communicate with the PolyGard® DGC-05 system.

Analog mode:

The analog output can be selected as current signal with 4-20 mA or as voltage signal 2-10 V. In the 4-20 mA mode and without any supplementary options, the transmitter also works in the 2-wire loop powered configuration.

DGC-05 Bus mode:

The transmitter can be connected to the PolyGard® DGC-05 system via the RS-485 interface. In this mode there is an analog input for the connection of an additional 4-20 mA transmitter. The two measuring values are transmitted via the RS-485 interface to the gas controller. The cable topology for the RS-485 bus can be taken from the “Guidelines for wiring and commissioning of the DGC-05 hardware”.

The two control modes are both available.

3.5 Connection Work

- 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.
- Plug the PCB in the terminal blocks X4, X5. Replace cover.

Caution:

There is a small quantity of corrosive liquid in the sensor element. If the sensor is damaged and 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.

4. Commissioning

4.1 Addressing – only for DGC-05_Bus mode

In the DGC-05_Bus mode each transmitter has to be addressed a unique number.

In the standard version with the RJ 45 input, addressing is done by the **digital programming tool.**

In the manual addressing version the transmitter addressing is done by the switch and jumper position. There is a maximum of 60 addresses to be selected. The jumper is responsible to define the address group and the switch to define the address according to the following table.

Switch position	Jumper pos. 01 = address	Jumper pos. 02 = address	Jumper pos. 03 = address	Jumper pos. 04 = address
0	inactive	inactive	inactive	inactive
1	01	16	31	46
2	02	17	32	47
3	03	18	33	48
4	04	19	34	49
5	05	20	35	50
6	06	21	36	51
7	07	22	37	52
8	08	23	38	53
9	09	24	39	54
A	10	25	40	55
B	11	26	41	56
C	12	27	42	57
D	13	28	43	58
E	14	29	44	59
F	15	30	45	60

4.2 Commissioning

Only trained technicians should perform the following:

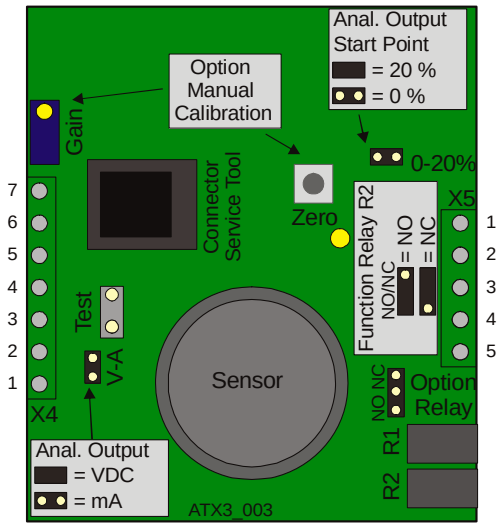
- Check mounting location. Check airflow direction for duct mounting.
- Select output signal form: Current or voltage, and starting point 0 or 20%. See fig. 1.
- Check power voltage.
- Check PCB for proper mounting at X4 and X5.
- Check the sensor for proper mounting at the connectors X3/X7 of the PCB.
- Addressing of the transmitter in the DGC-05_Bus mode.
- Calibrate the transmitter (if not already factory-calibrated).
- Verify transmitter operation (sensor/transmitter was factory calibrated).

4.3 Figures

Selection analog output signal
Fig. 1

Jumper 0- 20 %	Jumper V-A	Output signal	Wire mode
Not set	Not set	0 – 20 mA	3-wire
Set	Not set	4 – 20 mA	2-/3-wire
Not set	Set	0 – 10 V	3-wire
Set	Set	2 – 10 V	3-wire

Fig. 2
PCB
Type DT5-1110



4.4 Technical Data

Electrical	
Power supply	17 - 28 VDC/AC, reverse polarity protected 2-wire mode: Only VDC
Power consumption (without options)	10 mA (0,25 VA), max.
RFI/EMI protection	5.0 W @ 1 ft. (o.31 m) radiated
Sensor performances	
Gas type	Carbon monoxide (CO)
Sensor element	Electrochemical, diffusion
Range	Span field adjustable from 0-150 to 0-300 ppm 0 - 250 ppm (ex works)
Stability and resolution	± 0,5 % of reading
Repeatability	± 1 % of reading
Long-term output drift	< 0.4%signal loss/month
Response time	t_{90} < 30 sec.
Sensor life expectancy	> 5 years/normal operating environment
Sensor coverage	5,000 sq.ft., max. 10,000 sq.ft. (465 m^2, max. 930 m^2) under ideal conditions
Installation location	
Mounting height	5 to 6 ft. (1.5 to 1.8 m) above floor
Type of control	
General	Continuous proportional sensor 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
Output signal for serial communication	Digital, RS-485, proprietary protocol, 19200 baud
AT series remote gas transmitter input capability - analog input - power output	 (1) 4-20 mA, overload / short circuit protected 24 VDC, max. load 50 mA

Environmental/ permissible ambient		
Working temperature	14°F to 104°F (-10°C to 40°C)	
Storage temperature	23°F to 86°F (-5°C to 30°C)	
Storage time	Max. 6 months	
Humidity, continuous	15 to 95% RH non condensing	
Humidity, intermitted	0 to 99% RH, non-condensing	
Working pressure	Atmospheric ± 10%	
Physical/ standard enclosure		
Material	Galvanized steel w/zinc coating, corrosion resistant	
Color	Light gray	
Protection	NEMA 1, general purpose	
Installation	Wall (surface) mounted or single gang electrical box	
Dimensions (H x W x D)	5.59 x 5.59 x 2.48 in. (142 x 142 x 63 mm)	
Cable entry	1 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 to 14 AWG (0,25 to. 2,5 mm^2)	
Weight	Approx. 0.7 lbs. (0.3 kg)	
Cross sensitivity*	Concentration	Reaction
Sulphur dioxide, SO_2	50	0
Hydrogen Sulphide, H_2S	25	0
Nitrogen dioxide, NO_2	50	0
Nitric oxide, NO	50	0
Hydrogen, H_2	100	< 60
Approvals /listings	UL Recognized CO sensor CE City of Los Angeles (pending) TÜV – NRTL USA/Canada (pending) VDI 2053, air treatment systems for garages and tunnels EMC Compliance 89/336/EEC Low voltage directives 73/23/EEC	
Warranty	2 years on material and workmanship	
Options		
Heater, built-in		
Ambient temperature	- 40°F (-40°C)	
Power consumption	0,5 A; 12 VA	
Thermostatic control	32 °F (0°C) ± 5 °F (3°C)	
Optional enclosures		
Duct mounted	NEMA 3	
W/probe	7/8 in. (22 mm) diameter and 7.16 in. (182 mm) length	
Cable entry	1 hole for ½ in. conduit	

Optional Enclosure	
Wall mounted	NEMA 12 (IP55)
Material	High impact, GW-Plast, IEC 60695-2-12, GWFI-650 °C, fire-retardant
Color	Light gray
Installation	Wall (surface) mounted or single gang electrical box
Dimensions (HxWxD)	5.0 x 3.4 x 2.2 in. (127 x 87 x 56 mm)
Wall mounted	NEMA 4X, w/splash guard
Material	ABS UL94 VO
Color	Light gray
Dimensions	4.80 x 4.72 x 3.42 in. (122 x 120 x 87 mm)

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

5. Calibration

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 (regulations TRGS 220)!

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.

Required instruments to calibrate 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 150 ml/min.
- Calibration adapter with tube, depending on the transmitter type.
  Calibration set CONKIT-E-CH/AT. See fig. 2.
- Digital voltmeter with range 0 – 300mV, accuracy 1% and a small screwdriver.
- Calibration tool DGC-05 STL (only for calibration with service tool DGC-05).
- DGC-05 configuration and calibration software DGC-05-EasyConf incl. USB/RS-485 communication set (only for software calibration mode).

Calibration Modes

Depending on the version and the control mode there are three different possibilities to calibrate the transmitter: Manual calibration, calibration with service tool, software calibration via PC.

5.1 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.

5.1.1 Zero-point

- Connect calibration adapter carefully to the sensor element.
- Apply synthetic air (150 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!

5.1.2 Gain

- Connect calibration adapter carefully to the sensor element.
- Apply calibration test gas CO (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 5.1.3.
- 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

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

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	160mV

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

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

5.2 Calibration with DGC-05 Service Tool

In the standard version (with the RJ 45 input) the transmitter is delivered for tool and/or software calibration.

In the analog mode the service tool calibration is only possible with the 3-wire technique of the transmitter!

In the DGC-05_Bus mode calibration is always possible.

- Connect the DGC-05 Service Tool to the transmitter, open menu “Calibration”.
- Enter measuring range and test gas concentration.
- Connect calibration adapter carefully to the sensor element
- Apply synthetic air (150 ml/min; 1 Bar (14.5 psi) ± 10%), or CO -free ambient air.
- Wait until the measuring value is stable, and then perform automatic zero calibration.
- Apply calibration test gas CO (150 ml/min; 1 Bar (14.5 psi) ± 10%).
- Wait until the measuring value is stable, and then perform automatic gain calibration.
- Remove calibration adapter carefully by turning lightly. 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 %. In this case the sensor has to be replaced.

Further information can be taken from the user manual of the DGC-05 Service Tool.

5.3 Calibration with DGC-05 Configuration and Calibration Software DGC05-EasyConf

In the standard version (with the RJ 45 input) calibration can also be done by means of the configuration and calibration software.

Software calibration is possible for both control modes.

- Connect the PC via USB/RS-485 communication set to the transmitter, open menu “Calibration”.
- Enter measuring range and test gas concentration.
- Connect calibration adapter carefully to the sensor element
- Apply synthetic air (150 ml/min; 1 Bar (14.5 psi) ± 10%), or CO -free ambient air.
- Wait until the measuring value is stable, and then perform automatic zero calibration.
- Apply calibration test gas CO (150 ml/min; 1 Bar (14.5 psi) ± 10%).
- Wait until the measuring value is stable, and then perform automatic gain calibration.
- Remove calibration adapter carefully by turning lightly. 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 %. In this case the sensor has to be replaced.

Further information can be taken from the user manual of the DGC-05 Configuration and Calibration Software DGC-05 EasyConf.

5.4 Figures

Fig. 1
PCB
Type DT5-1110

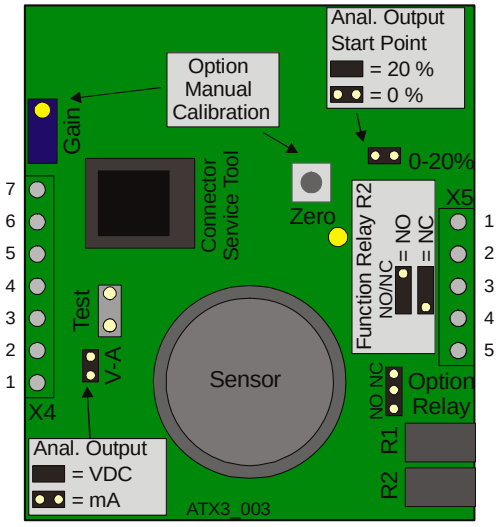


Fig. 2
Calibration adapter
Type: Calibr-set CONKIT-E-CH/AT

5.5 Inspection and Service

5.5.1 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.

5.5.2 Calibration

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

5.5.3 Exchange of Sensor Element

Consider static electricity! Sensor should always be installed without power applied:

- Unplug basic PCB AT03 carefully from the bottom part.
- Unplug old sensor from the PCB.
- Take the new sensor out of the original packing.
- Plug the sensor element into the PCB at X3/X7.
- Replug the PCB AT03 into terminal blocks X4, X5 carefully.
- Make calibration.

5.5.4 Troubleshooting

5.4.4.1 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 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
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

5.4.4.2 DGC-05_Bus Mode

Trouble	Cause	Solution
Yellow LED not shining	Power voltage not applied	Measure tension at X4: Pin 1 (+) and 2 (-)
	PCB not plugged in correctly at X4/X5	Replug PCB correctly
	Wire break	Check wiring
Yellow LED not flashing	No communication at the transmitter	Transmitter not addressed, check bus wiring incl. topology and termination Voltage < 16 V
No control voltage at calibration	Jumper V-A not set	Set the jumper. Remove it after calibration!