PolyGard®2 DT6

(ref. optional remote sensor DR6)

Digital Gas Transmitters

Serial No. SB-03

User Manual

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Intended Use

The PolyGard®2 DT6 are designed for the detection of toxic, combustible or dangerous atmosphere in many commercial and industrial applications in connection with the Gas Controller System DGC6.

The intended sites are all areas being directly connected to the public low voltage supply, e.g. residential, commercial and industrial environments as well as small enterprises (according to EN 50 082).

The PolyGard®2 Series must not be used in potentially explosive atmospheres. The sensor must only be employed in areas within the environmental conditions specified in the Technical Data.

1 Functional Description

1.1 General

The Sensor consists of the two components DT6 Basic Sensor Board (BSB) and SC2 Sensor Cartridge (SC).

The Sensor Cartridge contains a µController for signal processing besides the sensor element and the measuring amplifier. All data and measured values of the sensor element are stored fail-safe in the µController and transferred digitally via the local bus to the DT6 Basic Sensor Board. The calibration management is also integrated in the µController of the SC2 Sensor Cartridge.

The DT6 Basic Sensor Board has got three local bus interfaces for connection of up to three Sensor Cartridges and a field bus interface (RS-485) for communication with the DGC6 Gas Controller. The DT6 Basic Sensor Board is integrated in the system as a slave with its basic address. The addressing on the field bus level as well as the registration and assignment of the Sensor Cartridge on the local bus level is done via the STL6 Service Tool or with the DPT6 EasyConfig Software, which is directly connected to the BSB.

The cable topology for the RS-485 field bus can be taken from the "Guidelines for wiring and commissioning of the DGC6 hardware".

1.2 Measuring Mode

The sensor element continuously monitors the ambient air to detect an existing gas concentration and transmits a measurement signal which is proportional to the gas concentration via the amplifier directly to the AD converter of the µController. The µController checks the measurement signal for plausibility (within defined measuring, temperature and voltage ranges, etc.), calculates the average and sends both values with the attributes gas type and unit via the local bus to the µController of the DT6 Basic Sensor Board. The BSB (slave) sends the data of the registered Sensor Cartridge upon polling request to the DGC6 Controller (master).

1.3 Special Mode

If a fault occurs (measurement signal, temperature or operating voltage outside the defined range, communication error on local bus) or when the DT6 Basic Sensor Board is in the maintenance/calibration mode, the measurement operation is interrupted and the status of "special mode" is sent to the DGC6 Controller.

The integrated measuring amplifier converts this change in resistance into a linear output signal. The continuous combustion leads by-and-by to a loss of sensitivity that can be compensated by performing regular calibration of zero and gain. See section 4.4.

2 Installation

Electronics can be destroyed by electrostatic discharge (ESD). Therefore, the installation work should be done only by persons connected to ground, e. g. with a wrist strap connected to ground or by standing on a conductive floor (acc. to DIN EN 100015).

2.1 Mounting Instructions

The housing with the Basic or Remote Sensor Board comes in closed state. Therefore, before mounting, break out the pre-embossed knockouts to insert the cable entries and the Sensor Cartridge(s). The housing offers different mounting options by a variety of knockout openings depending on the number and types of Sensor Cartridge(s).

Prior to breaking out the knockouts it is essential to determine the exact position and size of the Sensor Cartridge(s) and cable entries with reference to the drawings "mounting options and knockouts in the enclosure", fig. 3 and 4.

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

- The mounting height depends on the relative density of the gas type to be monitored.
- Choose mounting location of the sensor according to the local regulations.
- Consider ventilation conditions! Do not mount the sensor near the airflow (air passages, suction holes etc.).
- Mount the sensor 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.

2.2 Installation Work

- Open housing cover.
- On the housing bottom part break out the required pre-embossed knockouts for cable glands and Sensor Cartridge.
- Fix the housing bottom part to the wall through the four mounting points according to the drawing "Housing dimensions" Fig. 5 so that the Sensor Cartridge is always directed vertically to the ground.
- Close the cover.

3 Electrical Connection

Consider static electricity instructions (ESD)! See point 2.

- The technical requirements and regulations for wiring, electrical security, as well as project specific and environmental and local conditions etc. must be observed when mounting.
- Avoid any influence of external interferences by using shielded cables for the bus line, but do not connect the shield.
- When selecting and installing the cables you have to comply with the regulations concerning the RS-485 bus installation. The installations have to be executed in line topology. Cable length and type have to be considered as well.
- Strip the cables as short as possible. It is important to ensure that bare wires, e.g. wire shields do not come into contact with the mounted PCB (risk of short-circuit).
- Recommended cable for field bus: J-Y(St)Y 2x2x0.8 LG (20 AWG) min 300V, loop resistance 73 Ω/km (20.8 Ω/1000 ft).
- Recommended cable for local bus (remote mounting): J-Y(St)Y 2x2x0.8 LG (20 AWG), min 300 V.
- Use Copper conductors only if the terminal is only for connection to copper wire.

3.1 Wire Connection

- Open the cover.
- Insert the field bus cable from above and connect it.
- Remove terminal block X4 from BSB, connect cable according to connection diagram fig. 1.
- Replug terminal carefully on the BSB at X4.
- For remote sensor:
  - Insert and connect local bus cable at the basic and remote sensor board.
  - Remove terminal block X7 at sensor board, connect cable acc. to connection diagram fig. 1.
  - Replug terminals carefully on both sensor boards.
- Close cover.

Connecting the 24 V field bus voltage to the local bus terminal X7 can destroy the DT6 Basic Sensor Board completely!

4 Commissioning

Only trained technicians should perform the following when commissioning:

- Check for correct mounting location.
- Check that the DT6 board is firmly seated in the housing.
- Check if connection is correct according to connection diagram.
- Check power voltage.
- Install the SC2 Sensor Cartridge(s) if not already installed ex works.
- Check SC2 Sensor Cartridge connector for correct engagement.
- Address the DT6 Basic Sensor Board (BSB).
- Register the SC2 Sensor Cartridge(s) at the DT6 BSB.
- Calibrate (if not already factory-calibrated).

Required instruments for commissioning (calibration):

- Service Tool STL6 or
- DPT6 incl. EasyConfig Software and USB/RS-485 communication set:
- Calibration: See SC2 user manual.

4.1 Installation of Sensor Cartridge

The Sensor Cartridge is supplied in a separate package and should be installed on the housing only during commissioning to protect it against dirt and damage.

- Check gas type, range and calibration date of Sensor Cartridge.
- Define installation place on the housing of the basic or remote sensor and break out knockouts. See Fig. 3
- Insert Sensor Cartridge, O-ring seal must rest on the housing exterior.
- Tighten the Sensor Cartridge with M32 hexagon lock nut.
- Plug in the Sensor Cartridge at X2 or X3 of the sensor board. Observe plug polarity, the plug must engage.

4.2 Addressing

A basic communication address is assigned to the DT6 board with the help of the STL6 Service Tool or the DPT6 EasyConfig Software. Using this basic address, the data of the Sensor Cartridge assigned to input 1 are sent via the field bus to the gas controller. Any further SC connected / registered on the printed circuit board automatically gets the next address.

4.3 Registration / Assignment of the Sensor Cartridge(s) (SC)

The DT6 recognizes automatically the SC(s) physically connected to it (unimportant whether directly on the DT6 or on the remote DR6) via the gas type and the measuring range which are factory-integrated in the SC address bit. By selecting the signal type, analog or bus, the input is activated. In the second step by assigning the gas type and defining the measurement range, the SC is connected to the input.

Up to two different SC can be connected at the DT6, with a third to an attached remote DR6. The physical position of the SC does not have to agree with the input in the menu.

Example:

DT6 with three SCs for CO, NO_2 and C_3H_4 with basic address 09

Input	Mode	Field Bus Address	Gas Type	Measuring Range	Result
1	SC	DP 09	CO	300 ppm	CO SC assigned to input 1 und thus field bus address DP09
2	SC	DP 10	NO_2	30 ppm	NO_2 SC assigned to input 2 und thus field bus address DP10
3	SC	DP 11	C_3H_4	100 % UEG	C_3H_4 SC assigned to input 3 und thus field bus address DP11

Only the parameters with blue background have to be worked on for the BSB addressing and the SC registration.

Mode: Not active: = SC assignment to input not possible
SC: = SC assignment possible
Analog: = Input with 4-20 mA signal, assignment possible

Gas type and meas. range: Selection of gas type and measuring range of the SC connected to the input or of the analog sensor

The registration is only accepted if the assigned gas type/measuring range are identic in the BSB and in the SC. Gas type and measuring range of the BSB are checked for identity by the GC Controller, too.

Only one SC per gas type must be connected to the same DT6 Basic Sensor Board.
Two SC2 sensor heads of the same gas group (Freons) must not be connected.

4.4 Calibration

The STL6 service tool or DPT6 EasyConfig Software are available for convenient on-site calibration.

There is also the possibility to exchange the SC against a calibrated SC on site. The used SC can then be calibrated directly in the office or at INTEC Controls and then reused.

Prior to calibration the Sensor Cartridge must be supplied with power voltage without interruption for warm-up and stabilisation. The warm-up time depends on the sensor element and is shown in the following table for Example: See also User Manual for Sensor Cartridge.

Sensor Cartridge	Warm-up for calibration (h)	Stabilization time to specification (min)	Flow rate (ml/min)
CO	24	60	500
NO_2	24	60	500
LPG (C_3H_4)	24	60	150

Table Calibration

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

Test gas can be toxic, so never inhale it!
Symptoms: Dizziness, headache and nausea.
Procedure if exposed: Remove victim to fresh air, seek medical attention.

4.5 Calibration with DPT6 EasyConfig Software

- Connect DPT6 EasyConfig Software Interface to the DT6 Basic Sensor Board.
  Prior to calibration you have to activate the mode "Special Mode" at the BSB, only then the calibration menu is enabled. During the special mode the BSB doesn't issue alerts.
- Select the Sensor Cartridge to be calibrated by selecting the gas type.

Zero calibration

- The current zero offset and the offset value of the first calibration is read with "Read".
- Slide calibration adapter carefully onto the Sensor Cartridge.
- Apply synthetic air (flow rate according to the table "calibration", 1 bar ± 10%) to the Sensor Cartridge.
- When the value is stable, the new zero offset factor is calculated with "Calibration".

The new offset factor is checked for plausibility and stored in the buffer memory. The current measured value is output with the new offset factor and the offset display is updated.

- With "Save" the new offset factor is written in the SC memory, only then the Zero calibration has been successfully completed. If you exit the menu without pressing "Save", the original offset data for the measured value calculation will continue to be used.

  With a zero reading> 10% of measuring range during the zero calibration, zero calibration is not possible.

Gain calibration

- Enter test gas concentration (value between 30 and 70 % of the measuring range)
- The current sensor element sensitivity is read with "Read".
- Slide calibration adapter carefully onto the Sensor Cartridge.
- Apply test gas (flow rate according to the table "calibration", 1 bar ± 10%) to the Sensor Cartridge.
- When the value is stable, the new gain factor is calculated with "Calibration".

The new gain factor is checked for plausibility and stored in the buffer memory. The current measured value is output with the new gain factor and the sensor element sensibility is updated.

- With "Save" the new gain factor is written in the SC memory, only then the gain calibration has been successfully completed. If you exit the menu without pressing "Save", the original gain data for the measured value calculation will continue to be used.

By limiting the gain factor, calibration will not be possible anymore when the sensitivity of the sensor reaches a residual sensitivity of 40 %. Then the Sensor Cartridge has to be replaced

For more information, see the user manual of the DPT6 EasyConfig Software.

4.6 Exchange of Sensor Cartridge

Instead of the on-site calibration, the used SC can be easily and conveniently replaced by a calibrated one.

The communication of the local bus (Sensor Cartridge <> BSB) is continuously monitored during operation and results in an immediate error message on the gas controller in case of fault or interruption. When replacing the sensor unit, the communication of the local bus is also interrupted when unplugging the SC connector which leads to an immediate triggering of the error message.

- Disconnect the SC connector from the BSB or the RSB (error message will be activated).
- Loosen the locknut.
- Remove used SC.
- Take calibrated SC out of the original packaging, check for gas type, measuring range and valid calibration date.
- Insert the SC and retighten with lock nut.
- Insert the SC plug into the socket at the BSB or RSB. Check plug for proper engagement.

The local bus communication is automatically established and tested. At the same time the gas type and the measuring range of the "new" SC are compared with the data stored in the BSB. If they match and the communication is correct, the error message will be automatically acknowledged at the Gas Controller.

The yellow LED of the BSB flashes with a pulse duration of 1 sec., while the SC connector is disconnected (communication error). After the local bus communication has been re-established and the conformity test has been successful, the LED will go into flashing mode with 3 sec. pulse duration.

- Perform functional test of the exchanged SC with gas generator. On successful completion of the test, the flashing LED goes off after approximately 10 sec.

The sensor element is treated with a defined gas concentration with the help of the gas generator. As a result the measurement signal acknowledges the LED when an internal switching threshold is reached. With this test, the complete function chain "Sensor Element > Sensor Cartridge> Local Bus> BSB> Field Bus> GC Controller" is tested.

5 Inspection and Service

Regular maintenance and calibration of the sensors by trained technicians is recommend. See SC2 datasheet for requirements.

According to EN 45544-4, inspection and service has to be executed at regular intervals. The maximum intervals have to be determined and observed by the person responsible for the gas warning system according to the legal requirements. Inspection and maintenance intervals as prescribed in the general regulations of the gas measuring technique like VDI-2053, EN 60079-29-1 etc. The inspection interval normally is three months. The recommended service intervals are depended from the connected Sensor Cartridges. If different intervals are valid, always consider the shortest one.

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

5.1 Inspection

Gas sensors 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 sensor including cable for damage, vandalism etc.
- Remove dust deposits, especially at the gas inlet.
- The filter at the gas inlet has to be replaced if extremely dirty.
- Check the Unit including measuring head for dust, dirt and moisture deposits and clean it with a dry cloth if necessary.

5.2 Service and Calibration

When performing the maintenance, you have to do the calibration and the functional test in addition to the inspection. See section 4.

6 Troubleshooting

6.1 DT6 Basic Sensor Board

Trouble	Cause	Solution
Green LED isn't on.	Power voltage not applied	Measure tension at X4: (16-28 V DC) Pin 1 (+) and 2 (-)
	Polarity not correct at X4	Connect correctly.
	Connector X4 not plugged in	Check the plug.
	Wire breakage	Check the wiring.
Green LED doesn't flash.	BSB hasn't got any address.	Check BSB address, address correctly.
	BSB: no field bus communication	Check field bus wiring, topology and termination.
No measured value at the Tool or Controller	SC not or wrongly plugged in	Check SC plug.
	SC not registered	Register SC.
	SC gas type/measuring range doesn't match with registered ones.	Check SC data<> registration data for conformity.
Message at the Tool / Controller: - 24 V DC voltage <range> - 5 V DC voltage <range> - Temp. <range> - WatchDog triggered	Internal error	Replace BSB.

6.2 Sensor Cartridge (Messages at the Tool/Controller)

Measuring signal <range>	Internal error	Replace SC.
5 V DC voltage < range >		
Temp. < range >		
WatchDog triggered.		
SC Input 1 ≠ stored type	Wrong SC type at input 1	Check SC at input 1, replace it.
SC Input 2 ≠ stored type	Wrong SC type at input 2	Check SC at input 2, replace it.
SC Input 3 ≠ stored type	Wrong SC type at input 3	Check SC at input 3, replace it.

7 Technical Data

Electrical	
Power supply	16-29 VDC, polarity protected
Power consumption	24 VDC
- base	6 mA
- sensors	*See SC2 datasheet*
- horn & status LED	5 mA, max.
Output for local bus	5 VDC, 250 mA max. Overload, short-circuit and polarity protected
Output signal for serial communication	Digital, RS-485, proprietary DGC6 protocol, 19200 baud
Sensors	SC2 Series
- performance	*See SC2 datasheet for specific gases*
- coverage	See SC2 datasheet for specific *gases*
- storage time	6 months (for sensor elements)
Environmental	
Permissible ambient	*See SC2 datasheet for specific gases*
Serial interface	
- local bus	plug connector / 19200 Baud
- field bus	RS-485 / 19200 Baud
- tool bus	2-wire / 19200 Baud
Physical	
Enclosure “A”, standard	
- material	Polycarbonate, UL 94-HB, fire retardant
- conforms to	UL 50
- color	Light gray
- protection	NEMA 4X (IP65)
- installation	Wall (surface) mounted, or single gang electrical box; mounted vertically for single gas sensor and horizontally for dual gas sensor
Dimensions (H x W x D)	
- base unit	5.12 x 3.70 x 2.25 in. (130 x 94 x 57 mm)
Cable entry, knock out	1 hole (long side) for 1/2 in. conduit, closed w/screwed “plug”
Wire connection	
- field bus	Screw-type removable terminal; 24 AWG (0.25 mm^2), min. 14 AWG (2.5 mm^2), max.
- local bus (SC2)	3-pin removable connector
Cable lengths local bus for Remote Sensor Board	16.4 ft (5 m), max.
Weight	0.7 lb (0.3 kg)
Certified to	UL 2075 Listed, NRTL performance tested for models DT6-E1110-E-02, DT6-E1110-E-E1130-B-02, DT6-E1110-E-E1130-B-32
Conforms to	EMC Directive 2014/30/EU CE EN 50271, EN 61010-1:2010 ANSI/UL 61010-1 CAN/CSA-C22.2 No. 61010-1 City of Los Angeles
Warranty	Two years material and workmanship, 12 months normal exposure for sensor element

OPTIONS & ACCESSORIES

Horn & Status LED	Configurable to local thresholds set at this unit
- acoustic pressure	> 85 dB (A) (dist. 0.1 m / 0.3 ft)
- frequency	2300 Hz
- protection class	NEMA 4X (IP65)
Status LED	
- color / mode	Red = Alarm
- protection class	NEMA 4X (IP65)
Duct Mounting Kit	**PG2-DUCTKIT**
- flow rate	Min. 3.1 mph (5000 m/h), max. 12.4 mph (20,000 m/h)
- air duct diameter	Min. 3.94 in. (0.1 m), max. 39.37 in. (1.0 m)
- length of sampling tube	9.84 in. (250 mm), adaptable
- hose length	2 x 39.37 in. (1000 mm)
Calibration Kits	
- carbon monoxide	**CALKIT-PG2-CO** Sensor calibration adapter w/ tube and cup, 500 mL/min. regulator, 17L 200 ppm carbon monoxide, 17L 99.99% nitrogen, carrying case
- combustible gases	**CALKIT-PG2-COMB** Sensor calibration adapter w/ tube and cup, 150 mL/min. regulator, 17L 2.5% methane, 17L 99.99% nitrogen, carrying case
- nitrogen dioxide	**CALKIT-PG2-NO2** Sensor calibration adapter w/ tube and cup, 500 mL/min. regulator (stainless steel), 70L 10 ppm nitrogen dioxide, 70L 99.99% nitrogen, carrying case
- carbon monoxide & nitrogen dioxide	**CALKIT-PG2-CO-NO2** Sensor calibration adapter w/ tube and cup, 500 mL/min. regulator (for CO), 500 mL/ min. regulator (stainless steel, for NO2), 17L 200 ppm carbon monoxide, 70L 99.99% nitrogen, 70L 10 ppm nitrogen dioxide, and (2) carrying cases

Note: SC2 infrared sensors are incompatible with the DR6 module

8 Figures

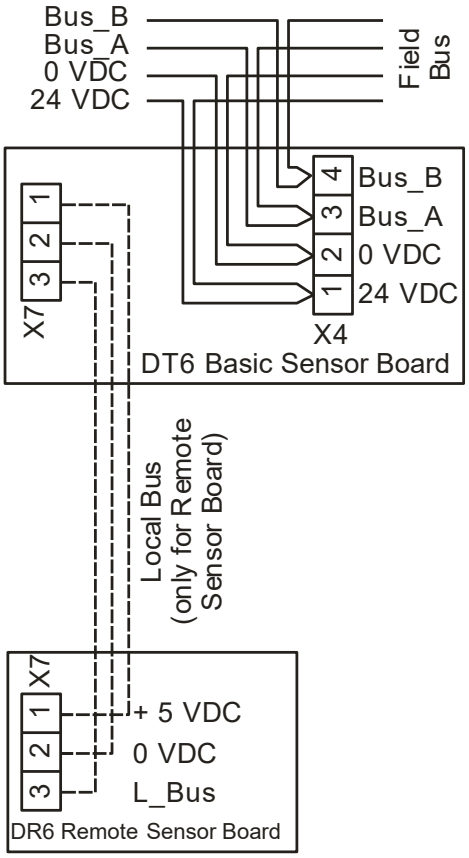

Fig 1: Electrical connection of field bus and optional local bus

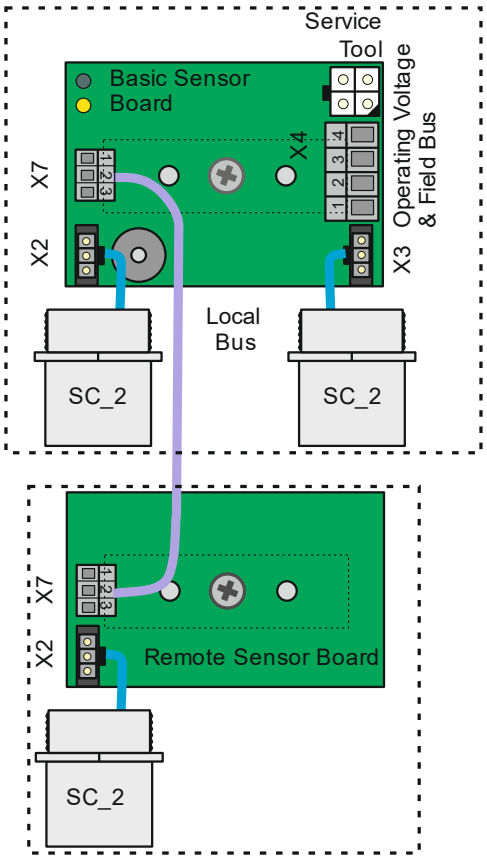

Fig 2 Basic Sensor Board with Sensor Cartridge and with option Remote Sensor Board

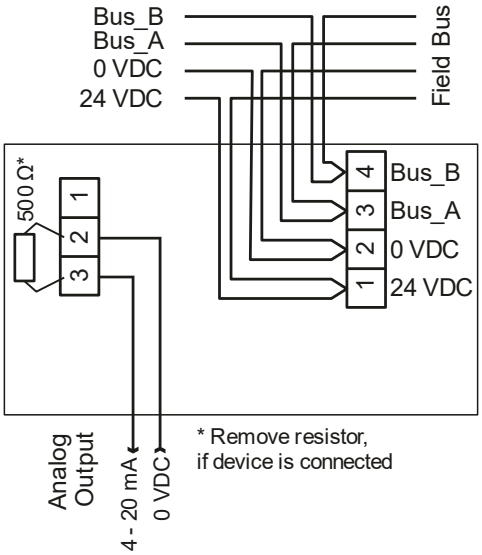

Fig 3: Electrical connection with option analog output

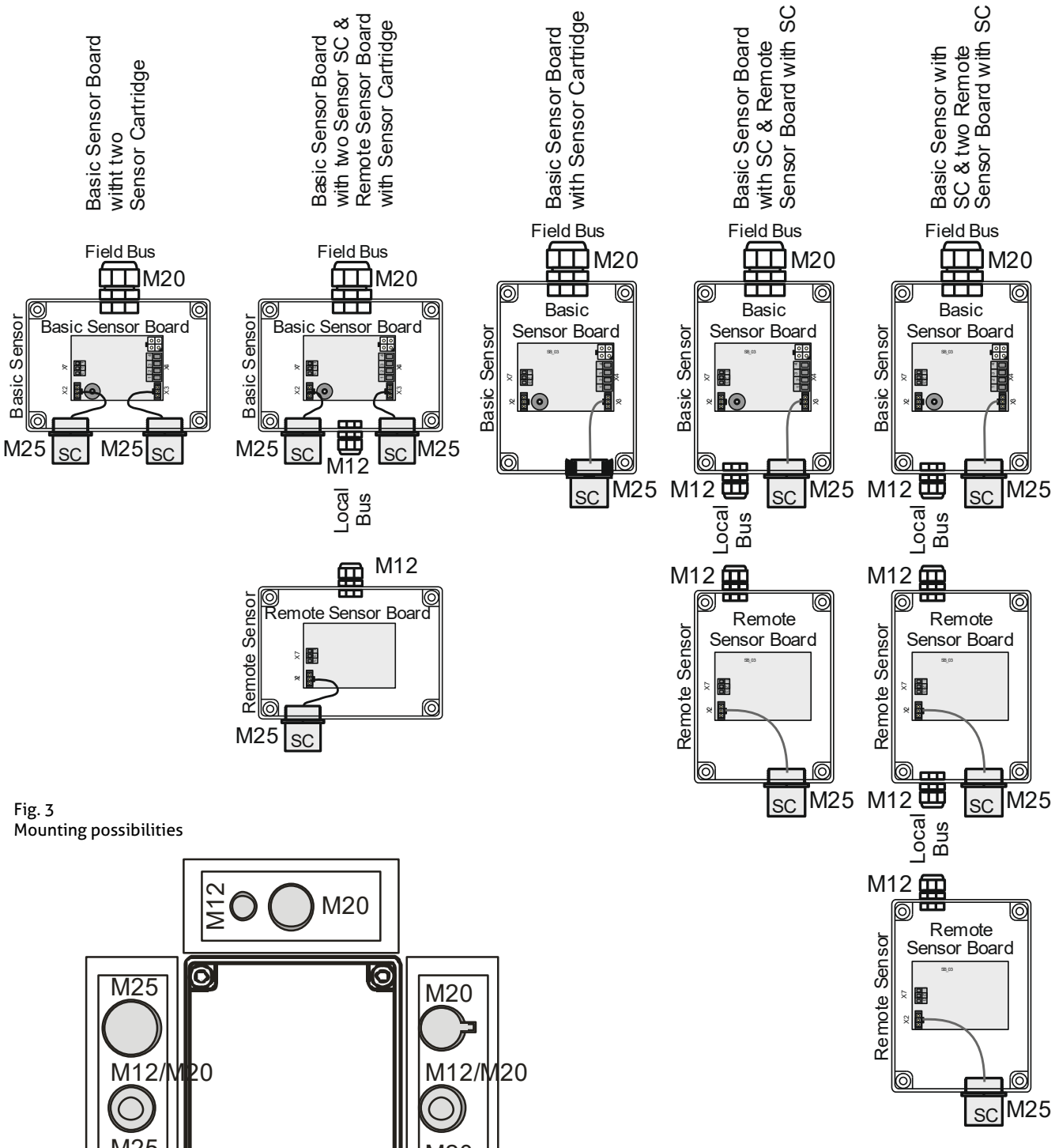

Fig. 3
Mounting possibilities

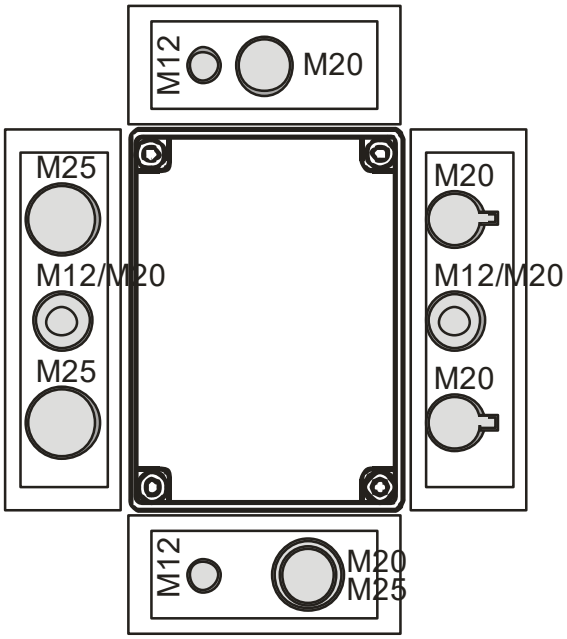

Fig. 4
Housing knockouts

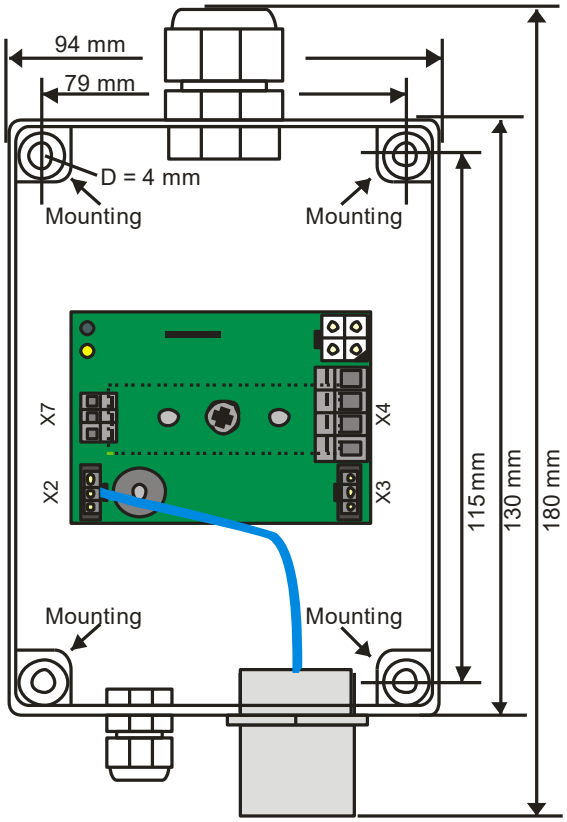

Fig. 5
Housing dimensions

Fig. 6
Calibration adapter

9 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 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.

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

Due to on-going product development, INTEC Controls and MSR-Electronic GmbH 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 these data.

10.1 Intended Product Application

The PolyGard®2 devices 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®2I devices 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).
The equipotential bonding required (also e.g. secondary potential to earth) or grounding measures must be carried out in accordance with the respective project requirements. It is important to ensure that no ground loops are formed to avoid unwanted interference in the electronic measuring equipment.
It is also essential to follow strictly all instructions as provided in the user manual.

10.3 Maintenance

It is recommended checking the PolyGard®2 device 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 Sensor Cartridge with the sensor element may be returned for service to INTEC Controls.

10.4 Limited Warranty

INTEC Controls and MSR-Electronic GmbH warrants the PolyGard®2 devices for a period of two (2) year from the date of shipment against defects in material or workmanship; 12 months for sensor elements operating within normal exposures. Should any evidence of defects in material or workmanship occur during the warranty period, INTEC Controls will repair or replace the product at their own discretion, without charge. A preauthorized RMA number is required for returns.

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®2 devices. INTEC Controls and MSR-Electronic GmbH shall not be liable for any incidental or consequential damages arising out of or related to the use of the PolyGard®2 devices.