# Guide to Installation and Operation

## Gas Detector
## TX-KFP

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# 1: Introduction

## 1.1 Instrument Overview

The TX-KFP series are highly reliable stand-alone systems capable of detecting a wide variety of toxic, corrosive and flammable gases both in low parts per million (ppm) concentrations as well as in the higher concentrations (vol. %).
The key element of the system is an electrochemical sensor which has been designed for a highly selective response to a specific gas or group of gases.

The gas detector models TX-KFP are diffusion type systems designed for use as environmental gas detection system or as in-line gas detection system for exhaust systems. The sensor is capable to operate under high humidity conditions and may be used as a stand-alone system or linked to an optional control system.

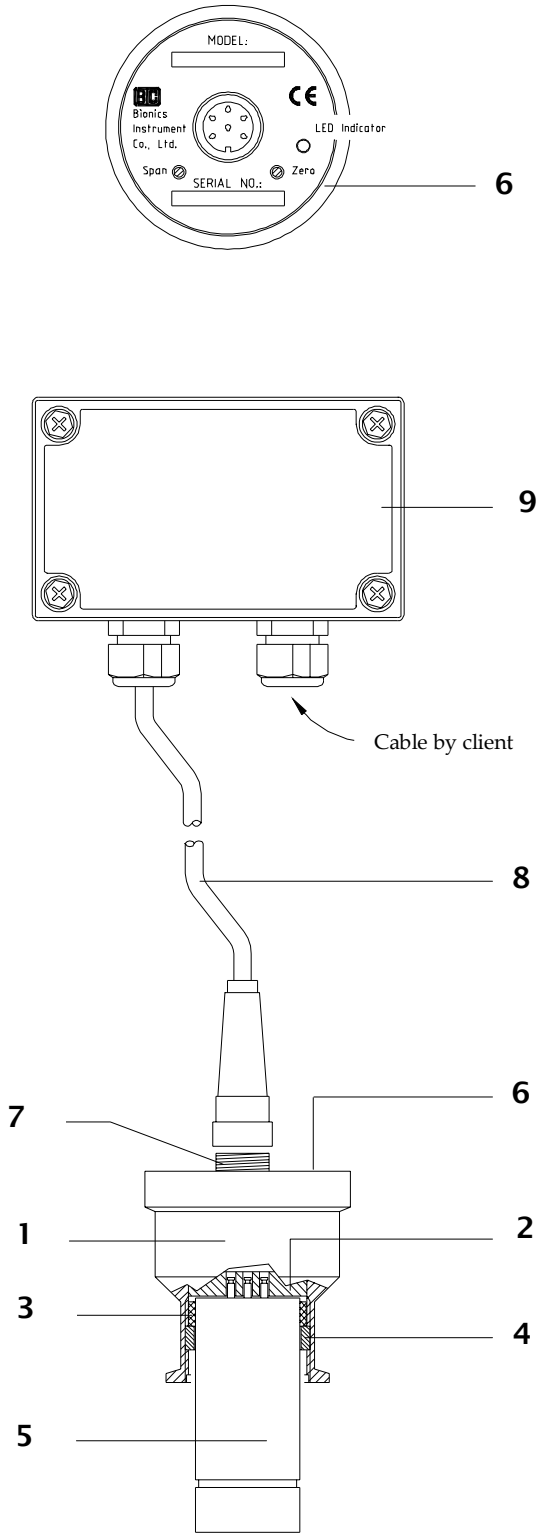
The industry standard KF40 vacuum type flange connection allows for quick and easy installation.

Features:

- An electrochemical gas sensor, maintainable for almost all types
- 24 V DC operated / 4 - 20 mA output
- Local display of gas concentration (analogue or digital indication)
- Test and calibration with 'live gas' in safe concentrations
- A good zero stability and high sensitivity.
- Calibration both on- and off-site
- Easy mounting by means of industry standard KF-connection

1: Introduction

## 1.2 Parts Identification TX-KFP




1 – KF-40 type Body, incl. PC-1280RL & PC-1280-KF PC-Boards

2 – Plug-in socket

3 – Silicon locking ring [1])

4 – Retaining ring

5 – Gas detection cell (Model: DP, ELP, MP or BP)

6 – Cover plate

7 – DIN Connector, type KGV-60 (female 6-pole)

8 – Power supply/signal cable (2.5 m), incl. DIN Connector, type SV-60 (male 6-pole)

9 – Junction box, incl. 2x PG-9 cable grommets

1) For DP and ELP sensor type only!

Fig. 1.2.1

# 1: Introduction

## 1.3 System Overview

The key element of the TX-KFP is an electrochemical gas sensor. Nearly all types operate according to the principle of membrane electrolysis. See appendix 2 for an explanation of the membrane electrolysis principle.

The TX-KFP operates on 24-Volt DC, usually supplied by an alarm/control unit.
The signal coming from the gas sensor is converted into a 4-20mA signal and transferred through the 2 wire shielded cable to the alarm/control unit.
Signal transmission can take place over distances up to 1000 meters.

The industry standard KF40 vacuum type flange connection allows for quick and easy installation.

Fig.1.3.1 gives an overview of some possible configurations.

## 1.4 Identification of Bionics systems and components

Bionics Instrument uses a Toxic Gas (TG) number to identify a gas or group of gases. This number is a '100' number. For example; Ammonia is TG-2400.
For a full list of the TG codes please refer to our documentation.

The Gas Sensor (GS) number has been derived from the TG number. This means the GS number for a specific gas or group of gases will start with the same '100' number. For example; the GS-2460DP is a sensor for the detection of ammonia. The GS number is followed by a code identifying the type of sensor.
Accordingly a TX-KFP for use with a GS-2460DP gas sensor is identified by:
TX-[2460]KFP

BP - exchangeable electrochemical sensor
DP - refillable electrochemical sensor
EP - exchangeable electrochemical sensor
ELP - exchangeable electrochemical sensor
MP - exchangeable electrochemical sensor

Other identification codes used in this manual:

PC- Printed Circuit board
RX- Alarm/Control Unit
A- Analogue Display
D- Digital Display
EL- Electrolyte
M- Membrane

# 1: Introduction

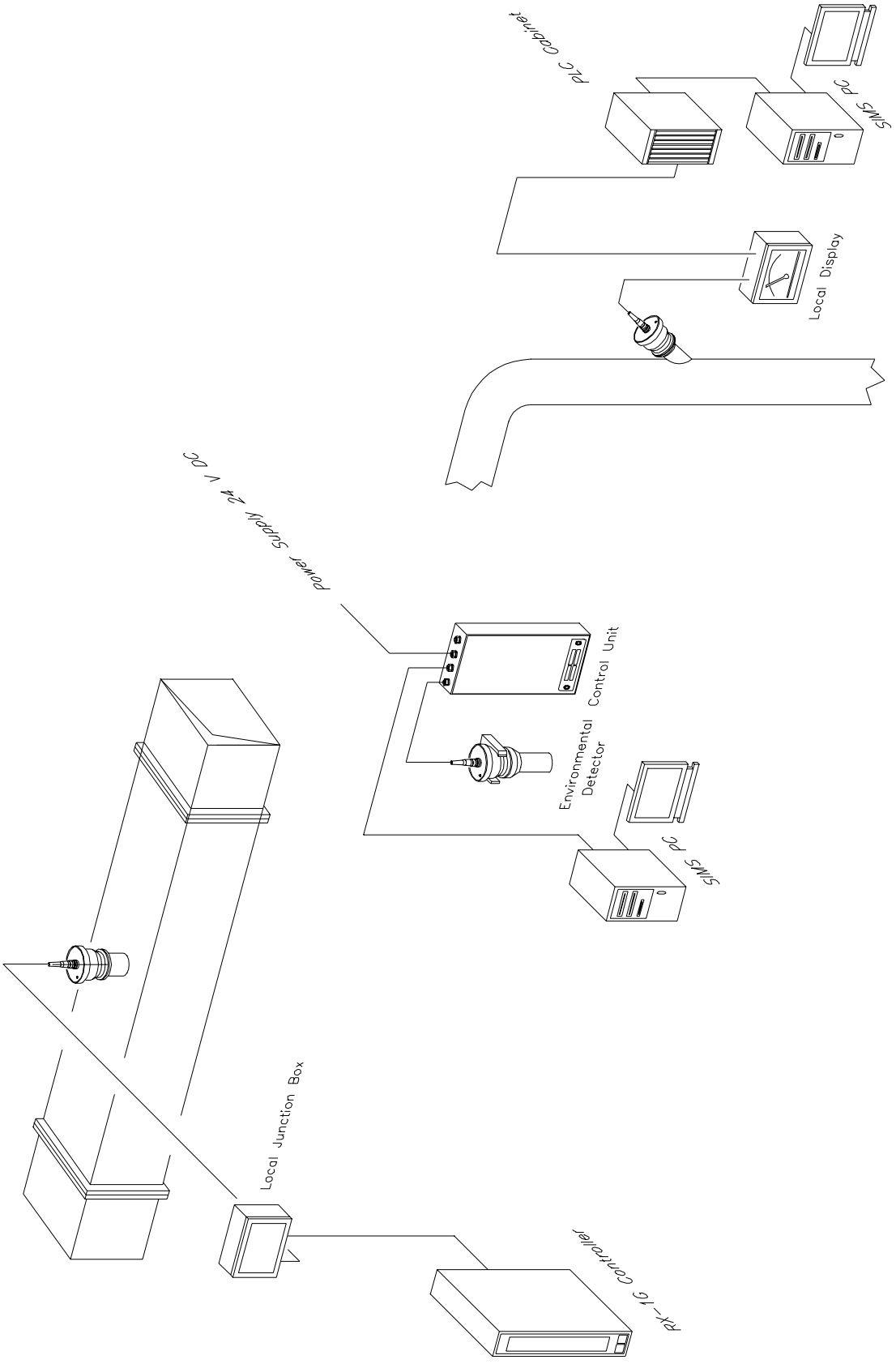



Fig. 1.3.1

# 1: Introduction

## 1.5 Product options

The standard supply of the TX-KFP unit includes a junction box with 2.5 meters of 2-wire shielded cable (2x 0.75 $mm^2$), connected at one end to the junction box and the other end provided with a SV-60 type DIN connector (see fig. 1.2.1), a gas sensor fastening tool and an installation and operation manual.
However, for easy installation and to suit your specific installation requirements, a number of optional items can be ordered from Bionics Instrument.

- Wiring options:

Cable – 2 wire (2x 0.75 $mm^2$) shielded, length= 6 m or any length up to 1000 m.

- Local Display options:

Local Analogue Indicator – scale, depending on application, in ppb, ppm or vol. %
Local Digital Indicator – scale, depending on application, in ppb, ppm or vol. %

- Mounting options:

1: "Clip-in" wall mount set SH-40 (see fig. 3.2.2)

| Model no. | Mounting Style | Gas Sensor Type | Colour |
|---|---|---|---|
| SH-40 | Wall | All types | Black |

2: (KFP Wall/Ceiling mount adapter):

Holder set for wall- or ceiling- mounting provided in white or black.
The unit comes complete with either wall mount bracket or ceiling mount bracket (see fig. 3.2.3/3.2.4/3.2.5)

| Model no. | Mounting Style | Gas Sensor Type | Colour |
|---|---|---|---|
| WM-40L/B | Wall | All types | Black |
| CM-40L/B | Ceiling | All types | Black |
| WM-40L/W | Wall | All types | White |
| CM-40L/W | Ceiling | All types | White |

- Gas sensor protection option:

A sensor protection jacket (black PVC), see fig. 2.2.3

# 1: Introduction

## 1.5 Product options (Cont'd)

- Duct mounting set:

To duct mount the TX-KFP the following set of materials is available (see fig. 3.3.2):

| Item | Description |
|---|---|
| 1 | KF-40 nozzle 90 mm |
| 2 | KF-40 clamp |
| 3 | Gasket (Centring ring + O-ring) |

- Calibration materials:

A complete calibration kit containing all necessary calibration aids can be ordered (see appendix – 2 for a detailed description of the calibration kit).

## 1.6 Safety

This gas detection system has been designed to provide long-term reliable performance. Nevertheless, we advise you to take the following basic precautions whilst installing operating and maintaining this device.

- Read this "Guide to Installation and Operation" carefully.
- Be sure to file this guide for future reference.
- Installation, maintenance, calibration and testing should be carried out by qualified personnel only.
- Check if the power supply matches the specifications given in this guide and ensure that the system has been connected properly.
- If you have any doubt with regard to the power supply, please contact one of the Bionics Instrument Offices [1]).
- If there are any signs of system damage or malfunctioning, please switch the alarm/control unit to 'Stand-by mode' and contact one of the Bionics Instrument Offices [1]).

1) For Bionics Instrument Offices see Appendix 4

# 2. Specifications

## 2.1 Technical specifications

### 2.1.1 General Specifications (gas sensor types: DP/ELP and MP)

| | |
|---|---|
| Device type | TX-[….]KFP *) |
| Power requirements | 24 V DC / 50 mA max |
| Operating temperature | 0 – 35 $^{O}$C |
| Indicator | LED for power on |
| Installation method | Wall-, ceiling-, or duct- mounted |
| Output signal | 4-20 mA, 2-wire closed loop |
| Output drive capacity | 0 – 600 Ω |
| Dimensions | 69 ø x ~ 130 mm lg. |
| Weight | Approx 1.5 kg |
| Power consumption | 1.25 W |
| Transmitter Board | 1280 KF/RL |

*) […] = TG number e.g TX-[1550]KFP

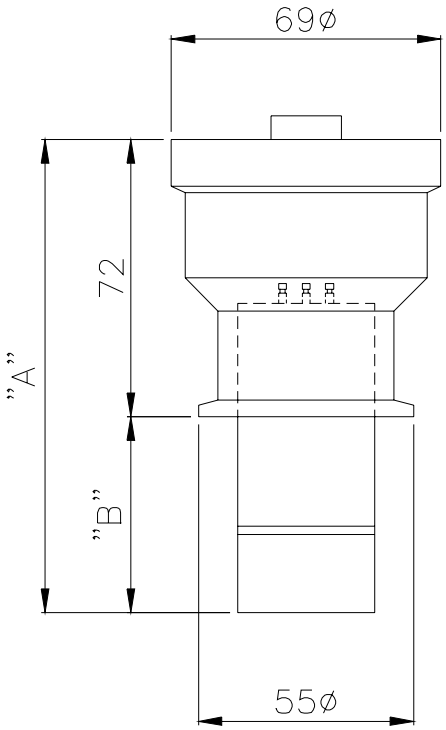
### 2.1.2 General Specifications (gas sensor type: BP)

| | |
|---|---|
| Device type | TX-[2300]KFP |
| Power requirements | 24 V DC / 300 mA max |
| Operating temperature | 0 – 35 $^{O}$C |
| Indicator | LED for power on |
| Installation method | Wall-, ceiling-, or duct- mounted |
| Output signal | 4-20 mA, 3-wire |
| Output drive capacity | 0 – 600 Ω |
| Dimensions | 69 ø x ~ 78 mm lg. |
| Weight | Approx 1.5 kg |
| Power consumption | 8 W max. |
| Pre-amplifier board | PC-5056 |
| Post-amplifier board | PC-5057 |

# Specifications

## 2.2 Dimensional drawings

- TX-KFP assembly




| Sensor Type Fitted | Dimension "A" | Dimension "B" |
|---|---|---|
| BP sensor*) | ~120 | ~48 |
| DP sensor*) | ~123 | ~51 |
| ELP sensor | ~125 | ~53 |
| MP sensor | ~125 | ~53 |
| | | |

*) Incl. EP-adapter (Extended plug-in adapter)

Fig. 2.2.1

- EP adapter (Extended Plug-in adapter)

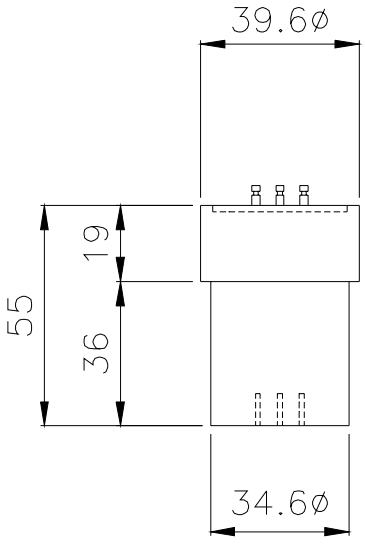



Fig. 2.2.2

- Sensor Protection Jacket

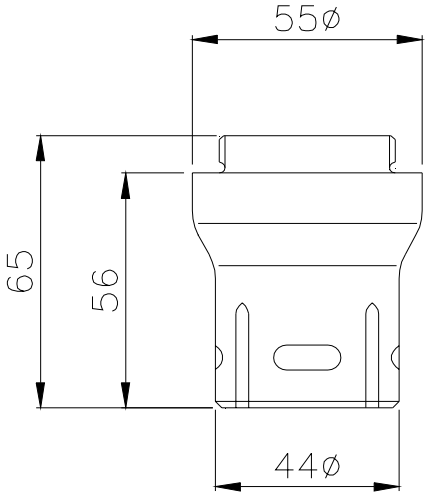



Fig. 2.2.3

# 3. Installation

## 3.1 Mounting

General mounting procedures:

Allow for sufficient space around the unit for cable connector insertion/withdrawal.
Mount the unit at such a location that the unit is easily accessible for wiring and maintenance activities.

The TX-KFP series is designed for indoor use only,
for outdoor use please refer to the TX-KXP series.

### 3.1.1 Gas sensor types for the TX-KFP

The TX-KFP can be fitted with the following plug-in type gas sensors:

- BP gas sensor, in combination with an EP-adapter *)
  - DP gas sensor
  - ELP gas sensor
  - MP gas sensor, in combination with an EP-adapter*)

*) For EP-adapter (Extended Plug-in adapter) see section 2.2, fig. 2.2.2

- BIAS voltage control

In order to optimise the sensor stabilisation time when a new sensor is being installed, a BIAS voltage control provision is applied.
The type of provision depends on the gas sensor's TG no's.

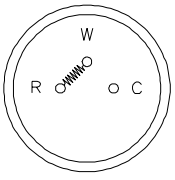



Fig. 3.1.1

For most of the TG no's the gas sensor working electrode "W" is short-circuited with the gas sensor reference electrode "R" by means of a spring, see fig. 3.1.1

Note:
Keep the spring, as it is recommended to re-fit the spring in case the sensor needs to be transported or stored for a longer period

# 3. Installation

### 3.1.1 Gas sensor types for the TX-KFP (Cont'd)

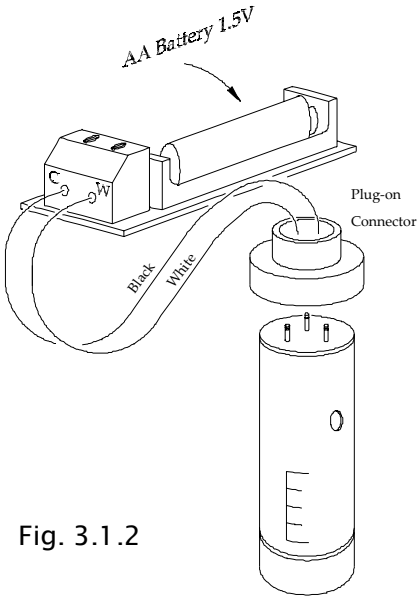



Fig. 3.1.2

For gas sensors with TG no.'s: 170/270/880/ 1560 and 1750 the "BIAS voltage control" is activated through a 1.5 Volts battery device, see fig. 3.1.2.
Make sure that in case you have to reconnect the device, the battery's voltage has not dropped under the required voltage level of 1.2 V.

### 3.1.2 Mounting of the gas sensor types BP and MP

The TX-KFP unit comes pre-assembled with items 1, 2 and 3.
To install the BP- or MP-type gas sensor into the TX-KFP body, proceed as follows.

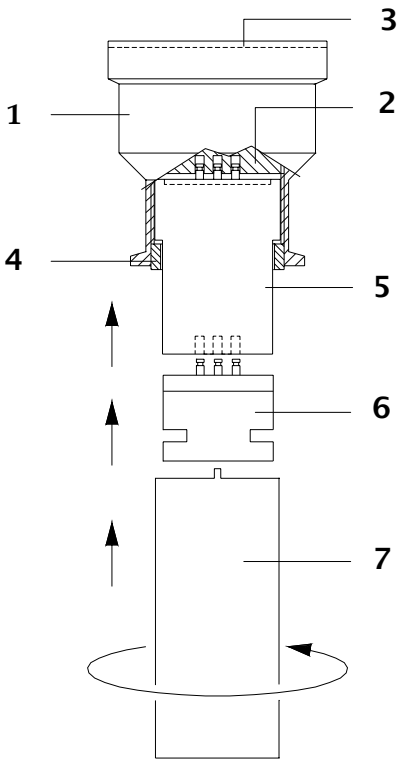



Fig. 3.1.3

- Remove the "BIAS voltage control" provision, see section 3.1.1.
- Push the EP-adapter (5) gently upwards into the KF body (1) through the retaining ring (4) until it snaps into the sensor socket (2).
- Plug the BP- or MP-type sensor (6) into the EP-adapter.
- Slide the fastening tool (7) over the sensor until the tool projections snap into the notches of the retaining ring (4). Turn anti-clockwise to secure the sensor with the retaining ring.

# 3. Installation

### 3.1.3 Mounting of the gas sensor types DP and ELP

The TX-KFP unit comes pre-assembled with items 1, 2, 3, 4 and 5
To install the DP- or ELP-type gas sensor into the TX-KFP body follow the following steps.

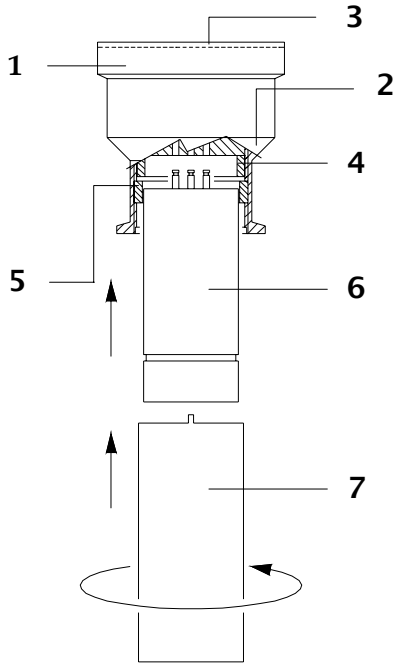



Fig. 3.1.4

- Remove the "BIAS voltage control" provision, see section 3.1.1.

- Push the DP- or ELP-type gas sensor (6) gently upwards into the KF body (1) through the retaining ring (5) and silicon locking ring (4) until it snaps into the sensor socket (2).
  If you feel a restraint when pushing the sensor upwards you must loosen the retaining ring and silicon ring.

- Slide the fastening tool (7) over the sensor until the tool projections snap into the notches of the retaining ring (5). Turn anti-clockwise until some pressure is felt, then apply further pressure to ensure that the silicon locking ring grips firmly around the sensor.

  Note:
  To remove the gas sensor proceed in reverse order

# 3. Installation

## 3.2 Mounting the gas detection unit

The TX-KFP unit can be installed as an environmental gas detector, whereby a choice can be made between wall- or ceiling– mounting the unit or the gas detector may be duct-mounted for monitoring applications in exhaust systems.

The TX-KFP unit should preferably be installed vertically.
In case the unit needs to be installed under an angle, please make sure that the unit is never placed under an angle greater than 45° relative to a vertical position (see figure 3.2.1).
This is to ensure that the main electrode is always in contact with a sufficient amount of electrolyte.
If the TX-KFP is placed under an angle the 'pressure stabilization screw ' should always face up wards.

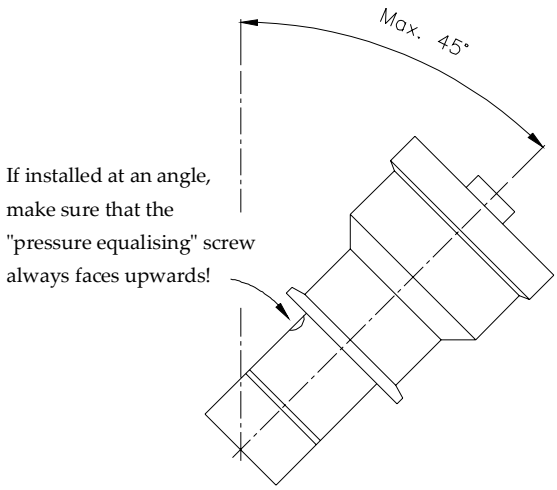



Fig. 3.2.1

# 3. Installation

### 3.2.1 Wall- or ceiling-mounting of the gas detection unit

- Wall mounting:

For wall-mount installation there are two options.

Option 1: Using the "Clip-in" wall mount set (optional item)
Option 2: Using the KFP-Wall/Ceiling mount adapter (optional item)

Option 1 ("Clip-in" wall mount set SH-40):

The set consists of two parts:
1 - Mounting plate, see fig. 3.2.2b
2 - Support ring, see fig. 3.2.2a

If not fitted already, fit the support ring with M4 bolts to the mounting plate.
Drill holes at the required distances (for details see fig. 3.2.2b) and fit the mounting plate with M6 bolts or equally sized screws to the wall. Place the unit into the support ring, see fig. 3.2.2c.

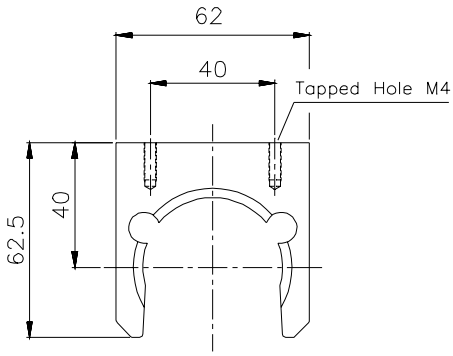



Fig. 3.2.2a

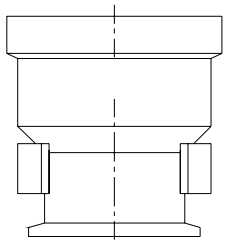


Fig. 3.2.2c

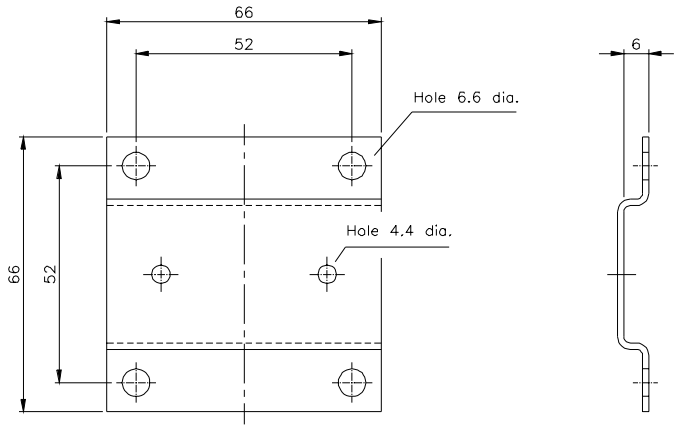



Fig. 3.2.2b

# 3. Installation

### 3.2.1 Wall- or ceiling-mounting of the gas detection unit (Cont'd)

Option 2 (KFP Wall/Ceiling mount adapter, WM-40/CM-40):

The WM-40/CM-40 holder assembly can be either wall or ceiling mounted and is suitable for all type gas sensors (BP/DP/ELP and MP).
The position of the cable entry can be adapted as such that it suits both mounting situations (see section 1.5 for possible options).

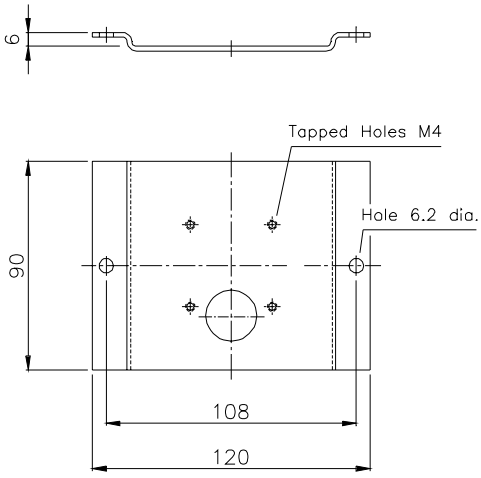



Fig. 3.2.3

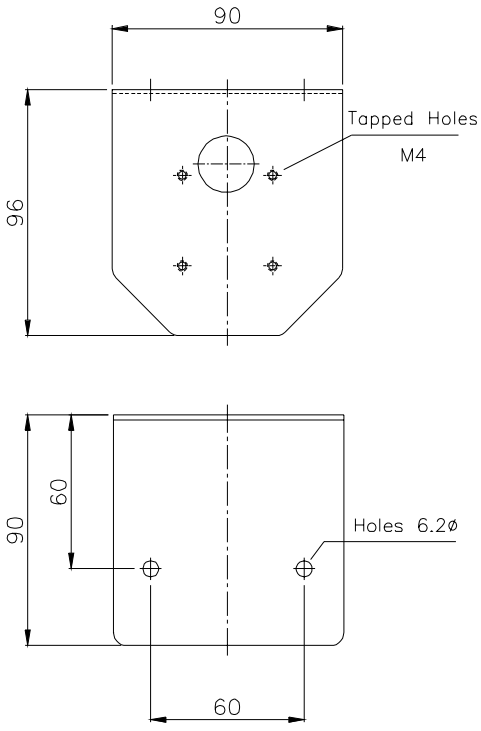


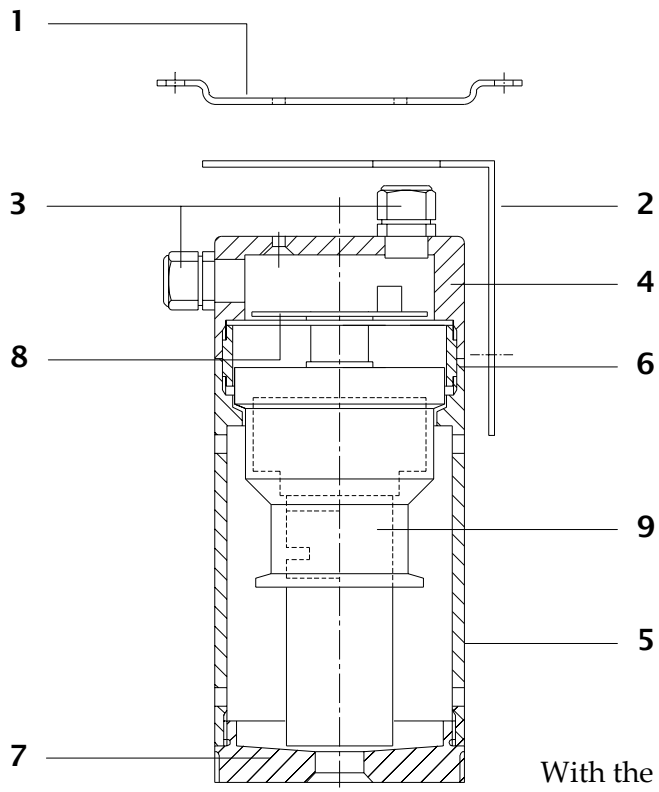

Fig. 3.2.4

To install the holder (see fig. 3.2.5), unscrew the bottom part (items 5 and 7) from the top part (item 4) and firstly install the mounting bracket incl. the top part of the holder either to the wall or ceiling.
For drilling dimensions ceiling mounting plate see fig. 3.2.3
For drilling dimensions wall mounting plate see fig. 3.2.4

Note:
Use M4 countersunk bolts to mount the holder top cover to the mounting plate.
Use M6 bolts or equally sized screws to install the mounting plate to the ceiling or wall.

3. Installation

### 3.2.1 Wall- or ceiling-mounting of the gas detection unit (Cont'd)




1 – Ceiling mounting plate
2 – Wall mounting plate
3 – Side/Top cable entry (PG-7)
4 – Holder top cover
5 – Holder bottom part
6 – Holder connecting ring
7 – Holder bottom cover
8 – PC-5028 connector board
(incl. St.St. mounting plate)
9 – TX-KFP unit

Fig. 3.2.5

With the top part in place unscrew the holder connecting ring (item 6) to release the PC-5028 board including the stainless steel mounting plate (item 8).

Feed the controller/signal cable through the cable entry grommet (item 3) and connect the cable to connector CN2 (see section 3.3 for wiring details).

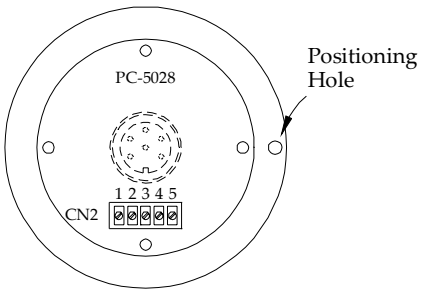



Fig. 3.2.6

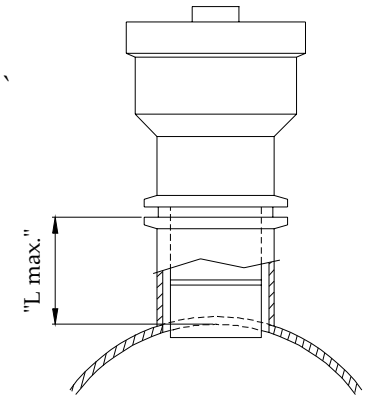
Remount the PC-5028 board.
Make sure that the locking pin fits into the positioning hole of the stainless steel mounting plate (see fig. 3.2.6).
Re-fit the holder connecting ring and plug the TX-KFP unit (item 9) into the SGR 60 DIN connector.
Screw-on the holder bottom part to secure the unit in the holder.

Note:
To accommodate the most practical cable routing the PG-7 cable entry grommet (3) in the top cover can be either top or side mounted.

# 3. Installation

## 3.3 Duct mounting of the TX-KFP in exhaust systems

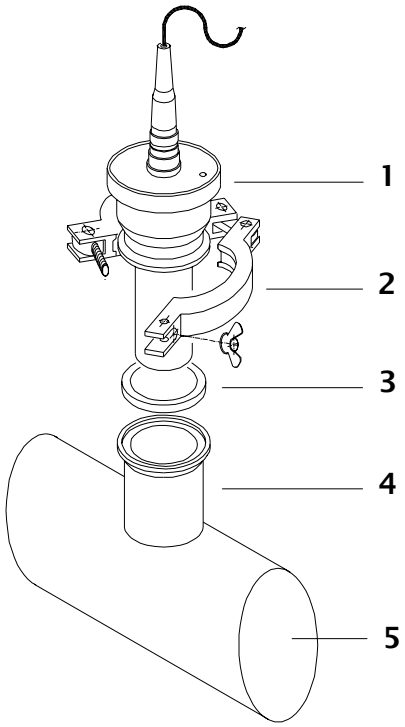
The installation of a TX-KFP in an exhaust system requires a 40 mm diameter stub provided with a KF-40 type flange installed on the pipe- or duct-work in order to match the KF-40 type body of the TX-KFP gas detector.




To ensure that the sensor is sufficiently in contact with the flow of air/gas, the flange should have maximum depth "L max " as illustrated (see fig. 3.3.1)

"L max" = Sensor length – 5 mm

Fig. 3.3.1




Duct mounting details:

Place the gasket (3) in the groove of the KF-40 type flange of the stub and then insert the TX-KFP unit. After insertion of the TX-KFP unit into the stub secure the two flange parts with the clamping ring (see fig. 3.3.2).

1 – TX-KFP
2 – Clamping ring
3 – Gasket (Centring ring with O- ring)
4 – KF-40 stub
5 – Exhaust duct

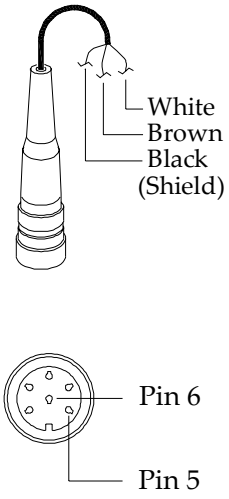
Fig. 3.3.2

# 3. Installation

## 3.4 Electrical Connections General

- Cabling:

The TX-KFP is supplied with a power/signal cable of approximately 2.5 mtr. long.
One end is fitted with a DIN connector, the other end is open.




Cable connection specification:

White - + 24 Volt
Brown - 4 – 20 mA
Black - Cable shield

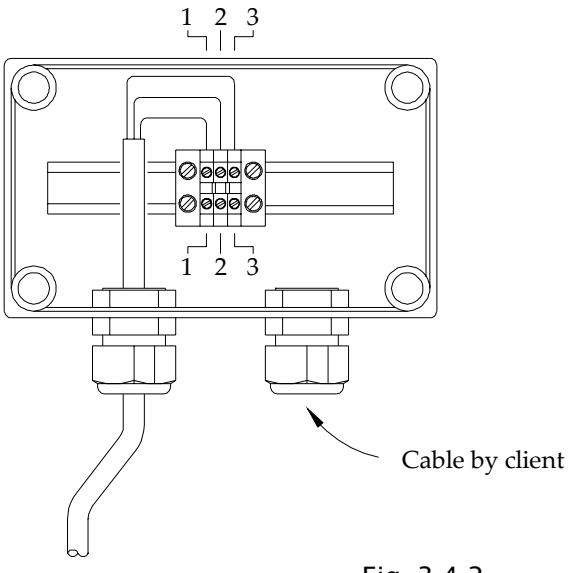
SV-60 DIN connector specifications:

Pin 1-4: spare
Pin 5: +24 Volt
Pin 6: 4 – 20 mA output

Fig. 3.4.1

- Junction Box:

The standard TX-KFP product is supplied with a junction box.
The 2.5 m 2-wire/ shielded (power/signal) cable must be connected to the junction box terminals as specified below.




Terminal Specification:

1 - 24 VDC in/out (White)
2 - 4-20 mA in/out (Brown)
3 – Shield (Black)

Fig. 3.4.2

# 3. Installation

### 3.4.1 Wiring details for PC-5028 board

The PC-5028 board is part of the wall/ceiling mount adapter (see fig. 3.4.3)

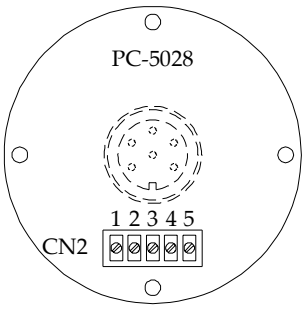



Fig. 3.4.3

Wiring details for connecting the controller/signal cable to connector CN2 .

Terminal specification:
1: not used
2: not used
3: 4 -20 mA
4: 24V DC
5: not used

### 3.4.2 Wiring details for analogue/digital local indicator

For local readings of the detected gas level or for calibration purposes an analogue or digital local indicator may be installed.
In- and out-going cables must be connected to the top and bottom terminals as specified below (see fig. 3.4.4)

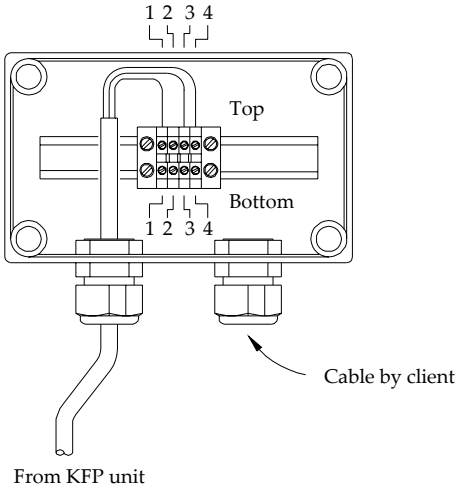



Fig. 3.4.4

Terminal specifications:

Top (TX-KFP cable):

1: 24V DC (White)
2: mA out )((Brown)
3: in use for indicator
4: shield (Black)

Bottom (Client's cable)

1: 24 V DC
2: in use for indicator
3: mA
4: shield

# 3. Installation

## 3.5 Start-up

After the electrical connections have been made, the system can be powered on. Be aware that there may be an increase in the output signal directly after powering on the system.
To avoid unwanted alarm outputs, ensure that in case an alarm/control unit is connected this unit is set to stand-by mode prior to start-up.
When the unit is properly connected, the green led in the cover plate (see fig. 3.5.1) should be on.
In case you encounter any problem during the start-up procedure please contact one of the Bionics Instrument offices [1])

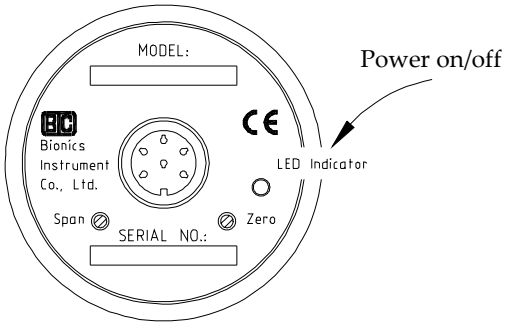



Fig. 3.5.1

1) For Bionics Instrument Offices see Appendix 4

# 4. Configuration

## 4.1 Configuring the digital display TX-KFP-D

If the settings of the digital indicator needs resetting or changing, please refer to one of the Bionics Instrument Offices [1]), as programming depends on the type of display installed in the local indicator.

1) For Bionics Instrument offices see Appendix 4

# 5. Operation

## 5.1 Maintenance

Regular preventive maintenance of the detection equipment ensures optimum safety.
Upon request, Bionics Instrument can present a maintenance advice tailored to suit your installed gas detection system.
All maintenance, calibration and testing should be carried out by qualified personnel.
Tailored training courses for your maintenance personnel are available upon request.
We advise to carry out maintenance/calibration at least every six months (unless particular circumstances request for a shorter period, please ask Bionics Instrument to advise).

Maintenance activities comprises mainly:

- Replacing the disposable gas sensor types BP, ELP or MP
- Replacing or topping up the electrolyte, replacing the O-ring and membrane of the DP-type gas sensor

Following these replacements the TX-KFP unit requires "zero" and "span" calibration, see section 5.2.2 / 5.2.3.

### 5.1.1 Maintenance procedure for the GS-[…]DP type sensor

The following steps describe the replacement of electrolyte, membrane and "O" ring.

When an alarm/control unit is attached to the TX-KFP, please ensure that the alarm/control unit is set to "stand-by" mode before performing any maintenance or calibration.

1. Remove the gas sensor from the unit (for reference see section 3.1.3)

2. Holding the gas sensor upside down, unscrew the membrane holder cap (fig. 5.1.1 / fig.5.1.2). Remove and dispose the O-ring and membrane. Allow the electrolyte to drain out. If the electrolyte does not drain readily, remove the adhesive membrane covering the vent plug's pressure equalising hole and unscrew the vent plug (fig. 5.1.3a & 3b)

In addition to the normal O-ring, several types of gas sensors carry a thin silicon mini seal. This silicon seal should remain with the gas sensor and should under normal circumstances not be replaced.

3. After the electrolyte has been drained out, hold the sensor with the measuring electrode pointing upwards and inspect the electrode.
   If necessary clean the electrode with a clean soft tissue (fig. 5.1.4).

# 5. Operation

### 5.1.1 Maintenance procedure for the GS-[….]DP type sensor (Cont'd)

4. To prevent contamination from the old electrolyte, rinse out the gas sensor interior twice with a small amount of fresh electrolyte (fig. 5.1.5)

5. Hold the gas sensor with the electrode pointing upwards. Ensure that the new O-ring has the appropriate colour and that, if applicable, the silicon seal is in place. (fig. 5.1.6)

6. Place a drop of fresh electrolyte carefully on the measuring electrode (fig. 5.1.7).

7. Place a new membrane onto the measuring electrode. Due to the hygroscopic behaviour of the electrolyte, the membrane will easily stay in place (fig. 5.1.8).
   Position the membrane holder and screw on the membrane holder cap, which should be firmly tightened (fig. 5.1.9).

8. Holding the sensor with the membrane pointing downwards, pour fresh electrolyte from the dispenser bottle into the electrolyte supply opening until the electrolyte in the sensor reaches the 'MAX' level (fig. 5.1.10).
   If necessary, wipe clean the electrolyte supply opening with dry paper tissue (fig. 5.1.11).

9. Remount the vent plug (fig. 5.1.12), cover the vent plug with a new adhesive membrane and gently shake the sensor to dislodge any air bubbles which may have formed around the electrode.

The type of electrolyte and membrane to be used is indicated on the label of the gas sensor. The code EL-[ ….] indicates the electrolyte type and the code M-[….] indicates the membrane type.
Depending on the type of sensor the O-ring's will either be white or black. When replacing the O-ring's please make sure to replace it with an O-ring of the same colour.

We recommend the following time schedule for changing the electrolyte:

| | | | | | | |
|---|---|---|---|---|---|---|
| Every 12 months * | EL-160-1<br>EL-1555 | EL-560-1<br>EL-2460 | EL-860-1 | EL-960-1 | EL-1460-1 | EL-1501 |
| Every 6 months | EL-270-2<br>EL-3415<br>EL-4850 | EL-370-2<br>EL-3460-1<br>EL-4960-1 | EL-415<br>EL-3760-1 | EL-660<br>EL-4070-7 | EL-760-1<br>EL-4155 | EL-3160<br>EL-4760-1 |
| Every 3 months | EL-1905K | | | | | |

# 5. Operation

### 5.1.1 Maintenance procedure for the GS-[….]DP type sensor (Cont'd)

Electrolyte is subject to evaporation.
The degree of evaporation depends highly on the initial evaporation factor of the electrolyte and the circumstantial conditions, such as humidity and environmental temperature.
The level of the electrolyte in the gas sensor can be read from the scale on the gas sensor body (see fig. 5.1.13).
Check this level at regular time intervals and top-up to max. in case the electrolyte level has dropped below one quarter of the scale.
Topping up must be followed by a "zero" and "span" calibration (see section 5.2.).

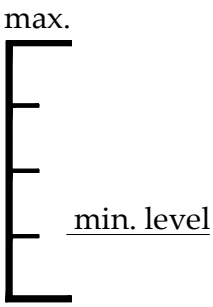



Fig. 5.1.13

The electrolyte is a non-toxic chemical substance.
However, avoid contact with your eyes, skin or clothing.
If such contact should occur, flush the affected area with water immediately.
Bionics Instrument can not be held responsible for accidents or injuries resulting from careless handling of the electrolyte.

# 5. Operation

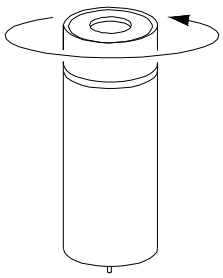


Fig. 5.1.1

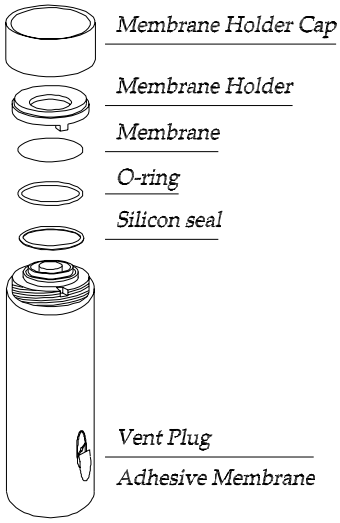



Fig. 5.1.2

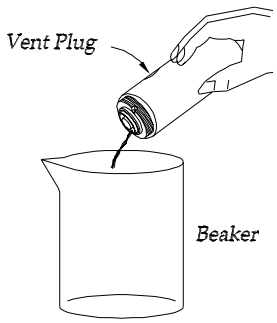



Fig. 5.1.3a

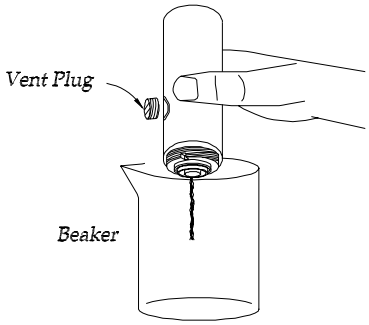



Fig. 5.1.3b

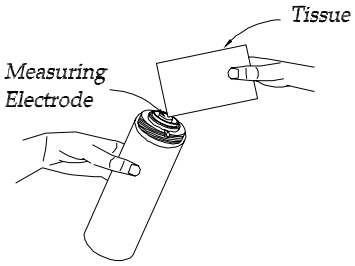



Fig. 5.1.4

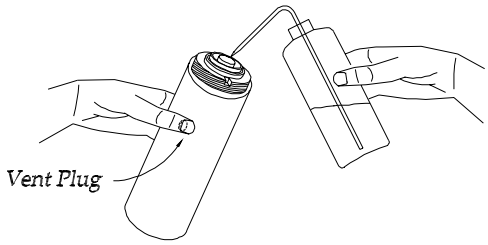



Fig. 5.1.5

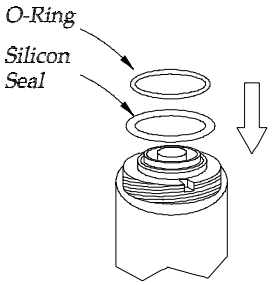



Fig. 5.1.6

# 5. Operation

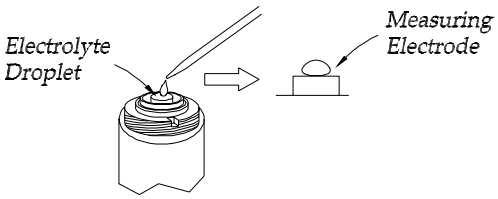



Fig. 5.1.7

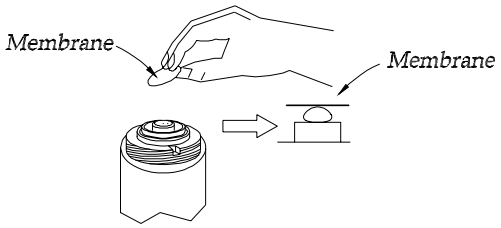



Fig. 5.1.8

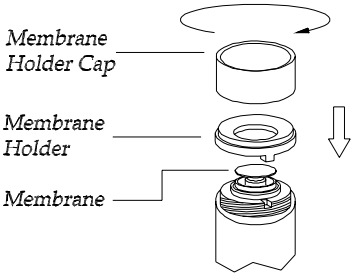



Fig. 5.1.9

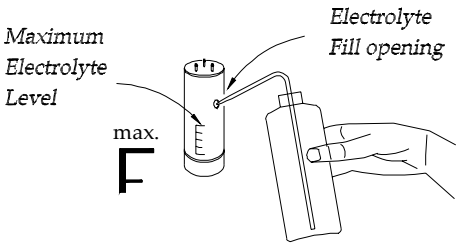



Fig. 5.1.10

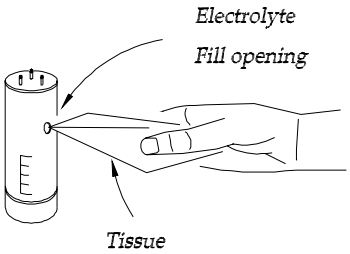



Fig. 5.1.11

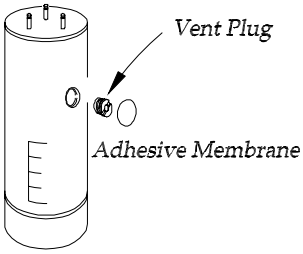



Fig. 5.1.12

# 5. Operation

## 5.2 Calibration

After the maintenance of the electrochemical gas sensor, a full calibration of the system is required.
To ensure an accurate calibration, each sensor needs stabilizing for a certain period of time.
Ideally calibration should be carried out with a standard gas or with one of the gases which can be generated by using a Bionics Instrument calibration kit (see appendix 2).
It is recommended to use a gas concentration which is equal or nearly equal to the specified full range of the gas sensor.

### 5.2.1 Setting-up the calibration procedure

- Fill the "Tedlar" bag with calibration gas of the required concentration level
  (Please refer to the instructions with the calibration kit for preparation of calibration gas).

- Assemble the "Tedlar" bag, flow-indicator, flow cap and calibration pump as shown in fig. 5.2.1 (use PTFE tubing to connect the items).

- Insert the gas sensor into the TX-KFP unit.

- If an alarm/control unit is connected to the system, ensure that this unit is set to "stand-by" mode.

- Disconnect the power/signal cable from the TX-KFP unit.

- Connect the calibration signal cable CC-1 to the unit and the disconnected power/signal cable.

- Connect the test leads either to the multi-meter or to the local indicator.

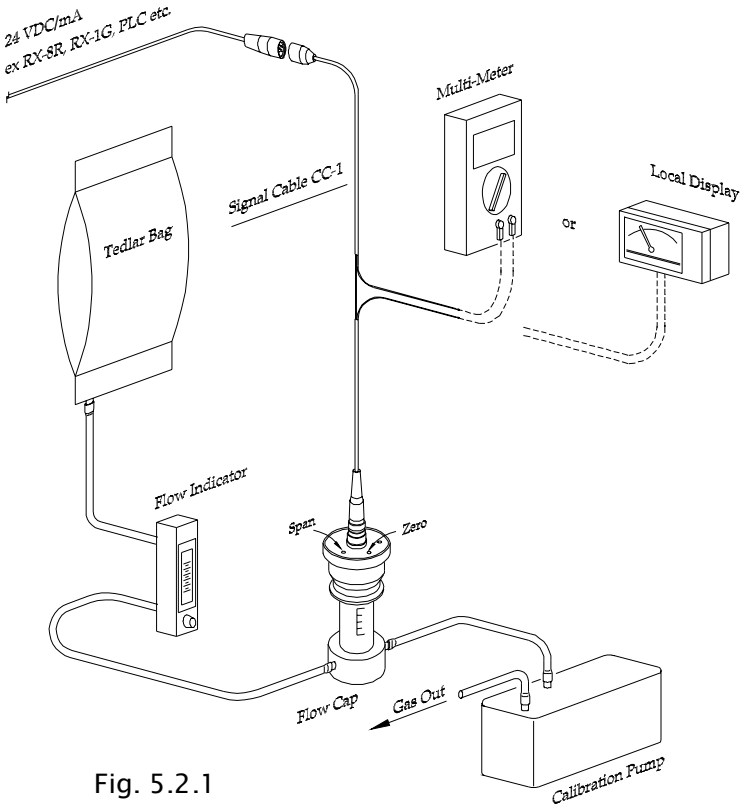



Fig. 5.2.1

# 5. Operation

### 5.2.2 Calibration procedure using a local indicator

1 - When the system is still exposed to the environmental air, use the "Zero" potentiometer on the TX-KFP unit to adjust the read-out of the local indicator to zero (see fig. 5.2.2).

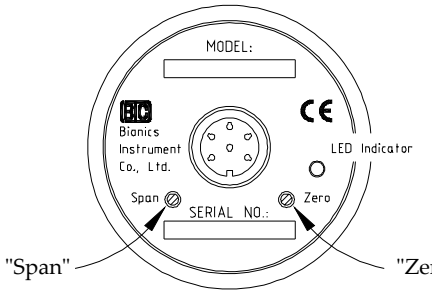



Fig. 5.2.2

2 - Place the TX-KFP unit into the flow cap and switch on the calibration pump (see fig. 5.2.1).
Use the "Span" potentiometer to set the local indicator reading to the gas concentration level of the applied calibration gas.

3 - Check if the analog indicator returns to zero after removing the calibration gas.

4 - If necessary repeat steps 2 until 4.

### 5.2.3 Calibration procedure using a multi-meter

1 - When the system is still exposed to the environmental air, use the "Zero" potentiometer on the TX-KFP unit to adjust the read-out on the multi-meter to 4 mA, (see fig. 5.2.2).

2 - Place the TX-KFP unit into the flow cap and switch on the calibration pump (see fig. 5.2.1).
Use the "Span" potentiometer to set the multi-meter reading to the gas concentration level of the applied calibration gas.

Use the following formula to calculate the current which should be measured when applying the calibration gas.

$$I = \left(\frac{\text{Conc.}}{\text{Full Scale}} \times 16\right) + 4$$

I = Current on multi-meter in mA
Conc. = Concentration of the calibration gas mixture
Full scale = Gas concentration indicated as full scale

For Example:
In case you have a "Tedlar" bag with a calibration gas of 9 ppm and the full scale reading of the TX-FP is 15 ppm, the multi-meter should read 13.6 mA.

# 5. Operation

### 5.2.3 Calibration procedure using a multi-meter (cont'd)

3 - Check if the indication of the multi-meter returns to zero concentration (4 mA) after removing the calibration gas.

4 - If necessary repeat steps 2 until 4.

## 5.3 Span response test

If desired, an extra span response test may be carried out between the normal maintenance intervals.
The test can be performed with a standard gas or with one of the gases, which can be generated by using a Bionics Instrument calibration kit (for information see: appendix 2)

Steps to follow:

- Put the connected alarm/control unit in "stand-by" mode.

- Expose the system to calibration gas (see sect. 5.2.2 / 5.2.3)

- Check the signal, depending on the configuration, using either the local indicator or a multi-meter.

If the application requires an adjustment of the signal please perform a full calibration as described in previous sections.

Calibration gases can be harmful.
Ensure that during calibration these gases are vented to

# Appendix 1- Principle of Membrane electrolysis

## Explanation of the principle of membrane electrolysis

When the gas being monitored passes through the membrane (1), an electrochemical reaction arises at the working electrode (2), which is in contact with the liquid electrolyte (3). An equivalent "redox" reaction then occurs at the counter electrode (4) producing a current 'i' that is in linear proportion to the partial pressure of the detected gas.
'i' is calculated according to the following formula:

$$I = \frac{nFaDC}{d}$$

Where:

n = number of electrons per mole of gas
F = Faraday's constant (approx. 96,500 coulombs)
a = area of working electrode
D = diffusion coefficient of the gas in cm/sec.
C = gas concentration in moles
d = thickness of the diffusion layer in cm

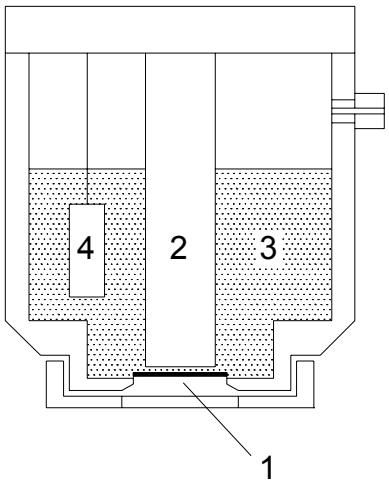



Figure A.1.1

# Appendix 2 - Calibration Kit and accessories


| | |
|---|---|
| 1 | Gas generation tube 10 pcs. |
| 2 | Gas generation liquid 10 ml |
| 3 | Soft paper towel 10 sheets |
| 4 | Reagent I, 1 bottle |
| 5 | Reagent II, 1 bottle |
| 6 | Plastic bottle (100 ml ) |
| 7 | Gas detection tube 20 pcs. |
| 8 | Gas detection tube 10 or 5 pcs. |
| 10 | Tedlar bag 2 Liters |
| 11 | Gas sampling pump |
| 12 | Double bellows |
| 13 | Teflon tube (6 Ø x 4 Ø ) |
| 14 | Silicon tube (8 Ø x 4 Ø ) |
| 16 | Carrying case |
| 17 | Mini pump |
| 18 | Sensor adapter/ Flow cap |
| 19 | Signal cable CC-1 for TX-KFP calibration (not shown) |

| Model | | K-I | K-II | K-Ill | K-IV | K-V | K-Vl | K-Vll | K-Vlll | K-Xl |
|---|---|---|---|---|---|---|---|---|---|---|
| Gas to Generate | | $PH_3$ | $Cl_2$ | HCN | $SO_2$ | $H_2S$ | $NH_3$ | HCl | HF | $NO_2$ |
| Gas generation tube 10 pcs. | | 1 box | - | 1 box | 1 box | 1 box | - | - | - | 1 box |
| Gas generation liquid 10 ml | | 2 btls. | - | 2 btls. | 2 btls. | 2 btls. | - | - | - | 2 btls. |
| Soft paper towel 10 sheets | | 1 pack | - | 1 pack | 1 pack | 1 pack | - | - | - | 1 pack |
| Reagent I, 1 bottle | | | (50ml) | | | | (30 g) | (50ml) | (50ml) | |
| Reagent II, 1 bottle | | | (50ml) | | | | (30 g) | (30 g) | (30 g) | |
| Plastic bottle (100 ml ) | | | 1 btl. | | | | 1 btl. | 1 btl. | 1 btl. | |
| Gas detection tube 20 pcs. | | 1 box | | | | | | | | |
| Gas detection tube 10 or 5 pcs. | | | 1 box (10) | 1 box (10) | 1 box (10) | 1 box (10) | 1 box (10) | 1 box ( 5) | 1 box (10) | 1 box (10) |
| Tedlar bag 10 litres | | 2 pcs. | 2 pcs. | 2 pcs. | 2 pcs. | 2 pcs. | 2 pcs. | 2 pcs. | 2 pcs. | 2 pcs. |
| Gas sampling pump | | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. |
| Double bellows | | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. |
| Teflon tube (6 Ø x 4 Ø ) | | 1 m | 1 m | 1 m | 1 m | 1 m | 1 m | 1 m | 1 m | 1 m |
| Silicon tube (8 Ø x 4 Ø ) | | 1 m | 1 m | 1 m | 1 m | 1 m | 1 m | 1 m | 1 m | 1 m |
| Instruction manual | | 1 copy | 1 copy | 1 copy | 1 copy | 1 copy | 1 copy | 1 copy | 1 copy | 1 copy |
| Carrying case | | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. |
| Not included in the Kit | Mini pump | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. |
| | Sensor adaptor | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. | 1 pc. |
| Applicable System Model Name: TX-[….]KFP | | 4000 | 100<br>800<br>900<br>1400<br>3100<br>4400 | 300 | 500<br>4500 | 200<br>600<br>1200<br>2100<br>2900<br>3000<br>3200<br>4200 | 2400 | 400<br>3400<br>4300 | 700-<br>3700<br>4700 | 1700<br>4100<br>4600 |

The procedure to generate a certain calibration gas is described in the manual 'Guide to Generating Calibration' which is supplied with the calibration kit.

# Appendix 3 - Transportation

If the TX-KFP unit has to be transported, please take the following precautions:

Remove the gas sensor from the TX-KFP unit.

Wrap the TX-KFP unit in proper padding.

Re-fit the following items onto the gas sensor:

- Blind plug (in the electrolyte supply opening, see fig. 5.1.12)
- Attach the BIAS voltage provision, type depends on TG no.
  (see fig. 3.1.1 / 3.1.2 for details)

All the above materials were supplied with the original delivery of the sampler unit.

Pack the gas sensor separately in a properly sealed plastic bag.

For additional advice, please contact one of our Bionics Instrument offices [1]).

1) For Bionics Instrument Offices see Appendix 4

# Appendix 4 - Bionics Instrument offices and service centers

For questions of any kind please contact one of the Bionics Instrument offices, preferably the center from which your system has been supplied.

**Bionics Instrument Co. Ltd.**
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E-mail: pureaire@dls.net

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http://www.bionics.net

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