" EXPLORER 4"
MULTICHANNEL CONTROL UNIT

OPERATION and INSTALLATION MANUAL

December 2007/ rev.1.0

INTRODUCTION

Each detection system is supplied together with an instruction manual, as prescribed by the regulations on fixed equipment for the continuous monitoring of oxygen or flammable or toxic gases and vapours.

In this manual, the user will find all the information concerning the operation, assembly and the electrical connections of the instrument.

The information contained in this manual may be changed without notice by Recom Industriale srl.

The warranty provided by Recom Industriale srl at the time of purchase may be invalidated by the user's failure to carefully observe all the instructions contained in this manual.

Recom Industriale srl declines all responsibility in the event of failure to use the equipment in accordance with the procedures and conditions described in this manual, or those described in other authorised documents enclosed with the instrument, or in the event of the instrument being tampered with or repaired by unauthorised personnel.

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Overview

The *Explorer 4* is a fixed-mounted, continuous-monitoring instrument. This multiple channel gas monitor is capable of detecting gas at up to four locations. The display screens simultaneously display the gas readings of all active channels. The *Explorer 4* includes audible and visual alarms that warn you of hazardous gas conditions. The alarm circuit includes tree levels of gas alarms. The fail circuit alerts you to failures in the gas transmitter(s) or *Explorer 4*.

The *Explorer 4* can be connected to various types of sensor/transmitters providing an analog signal 4-20 mA.
The power supply to the sensors in the field is provided directly by the *Explorer 4 .*
The *Explorer 4* is equipped with an RS232 serial port, for transferring data to a PC.

TRANSMITTER SENSORS

The sensors used in the *Explorer* system are based on the following measuring principles:

- Catalytic combustion   : for monitoring flammable gas mixes
- Electrochemical   : for monitoring toxic gases and vapours
- Galvanic   : for measuring oxygen
- Infrared   : for HC or CO_2 monitoring
- PID   : for monitoring VOC (e.g. PCE – TCE – MEK – BTEX)
- TC   : for measuring binary gases (e.g. SF6 – H_2 – etc.)
      :

The electrical signals generated by the sensors are amplified and linearized to obtain a 4-20 mA signal. This signal is then transmitted via an electrical cable to the control unit housed in the rack.

TECHNICAL CHARACTERISTICS

Housing   : 4 – 8 – 16 channel rack and wall cabinet
Dimensions: : (4 pos. rack):width 105 mm (21U), height132.5 mm (3HE)
                                        : (power supply):width 35 mm (7U), height 132.5 mm (3HE)
Weight: : 1.7 kg approx.
Data display   : LCD display, 2x20 characters
Measuring range   : %, ppm, other programmable quantities
Power supply   : 24Vdc nominal / 100-250 Vac with power supply
Power consumption   : 5 W on no-load, 25 W with all the alarms active
Number of channels   : from 1 to 4, SW enabled
Alarms   : 3 thresholds, programmable from 0 to 100% f.s.
Analog signal inputs   : 1 per channel, 4-20 mA
Audible indicators   : 1 buzzer actived in the event of an alarm
Visible indicators   : 4 LEDs per channel /1 fault + 3 alarm thresholds + 1 status
                                           ON indicator led .
Relays   : 3 NO outputs per channel (1 for each threshold), 1 general
                                           alarm relay and 1 fault relay common to the 4 channels.
Buttons   : 3 multifunction buttons
Analog output for each channel   : 4-20 mA
Sensor power supply   : 24 V dc
Operating temperature range   : from – 20° to + 55° C
Moisture   : from 0% to 95% Rel. humidity without condensation
Programmable functions   : menu languages: I – F - GB – D – E – P (others on request)
                                           Adjustable average respons time
                                           Adjustable offset and F.S. for each channel
                                           3 adjustable alarm thresholds for each channel

GENERAL CHARACTERISTICS OF THE RECOM "*EXPLORER*" SYSTEM
GAS DETECTION

The system consists of a control unit for the acquisition of the data received from the sensors, with a display readout of the gas concentrations, and alarm and fault outputs; it can be:

- Multichannel monitoring unit (1-4)

Transmitter sensors for:

Substance		Sensor type	Max field and unit of measurement		Resolution
Combustible Gases and Vapours		Catalytic combust.	0-100% LEL	EExd IIC T6	1%
Hydrocyanic acid	**HCN**	Elect/Chem	0-100 ppm	EExd IIC T6	0.5 ppm
Hydrochloric acid	**HCl**	Elect/Chem	0-100 ppm	EExd IIC T6	0.5 ppm
Ammonia	**NH_3**	Elect/Chem	0-100 ppm	EExd IIC T6	0.5 ppm
Carbon dioxide	**CO_2**	I.R.	0-100% Vol		1% Vol
Sulphur dioxide	**SO_2**	Elect/Chem	0-20 ppm	EExd IIC T6	0.1 ppm
Nitrogen dioxide	**NO_2**	Elect/Chem	0-20 ppm	EExd IIC T6	0.1 ppm
Chlorine dioxide	**ClO_2**	Elect/Chem	0-20 ppm	EExd IIC T6	0.1 ppm
Chlorine	**Cl_2**	Elect/Chem	0-20 ppm	EExd IIC T6	0.1 ppm
Hydrogen	**H_2**	Elect/Chem	0-1000 ppm	EExd IIC T6	2 ppm
Hydrocarbons	**CH_4**	I.R.	0-100% Vol		1% Vol
Hydrocarbons	**HC**	I.R.	0-10.000 ppm		50 ppm
Hydrogen sulphide	**H_2S**	Elect/Chem	0-50 ppm	EExd IIC T6	0.1 ppm
Nitric oxide	**NO**	Elect/Chem	0-100 ppm	EExd IIC T6	0.5 ppm
Carbon monoxide	**CO**	Elect/Chem	0-1000 ppm	EExd IIC T6	0.5 ppm
Ethylene oxide	**C_2H_4O**	Elect/Chem	0-20 ppm	EExd IIC T6	0.1 ppm
Oxygen	**O_2**	Galvanic	0-30% Vol	EExd IIC T6	0.1 % Vol
Ozone	**O_3**	Elect/Chem	0-2 ppm	EExd IIC T6	20 ppb
Nitrous oxide	**N_2O**	I.R.	0-1000 ppm		
Binary gases	**e.g. SF_6**	TC	various scales		
VOC – volatile organic compounds		PID - Photo-ionisation	0-100 ppm 0-1000 ppm		0.1 ppm 1 ppm

over 250 substances with correction factor

Physical installation

The *Explorer 4* is housed in a ¼ 19" rack suitable for installation where general purpose equipment is in use (i.e. control room). On the back side it is possible to do all the external wiring connections. CAUTION: To avoid electrical interference, do not route transmitter and power wiring through the same conduit hub.

Electrical power supply

WARNING: Make all connections to the *Explorer 4* before you plug in or turn on the AC or DC power source. Before you make any wiring adjustments, always verify that all power sources are not live

The *Explorer 4* is powered directly on terminals 2 and 4 with a 24Vdc. The d.c. power can be provided externally or by the power supply card available on the left side of the rack.
The power supply card accept an universal AC voltage from 100 to 250 Vac 50/60Hz.

Connections for external analog inputs (sensors)

There are 4 terminal blocks for the electrical connections of the sensor/transmitters.
It is possible to connect transmitters in 3 wires loop current technology as well as 2 wires loop current technology.
Each terminal block provides: + 24 Vdc (0,2 A max)/ Input 4-20mA / Output 4-20 mA/ Groung (0Volt)

Connections for external digital outputs (alarms)

For each enabled sensor, there are 3 programmable analog alarm thresholds, each of which triggers an alarm associated with the corresponding relay.

Programmable functions + inputs

The analog inputs of the *Explorer 4* are programmable channel by channel : it is therefore possible to select the period over which the sensor reading is averaged (instantaneous, brief, long), the offset reading value and the measuring range (% - PPM).

Programmable functions + outputs

The *Explorer 4* essentially provides 4 types of outputs:

1) Data and messages displayed on a 20x2 line, 5x7 dot matrix LCD display.

2) Red alarm indication LEDs and yellow fault indication LEDs, positioned above the display area corresponding to the channel.

3) NO contacts output relays

4) Electronic buzzer on the circuit board, sounded for varying lengths of time or intermittently.

Local and remote Hardware reset

The local reset of the *Explorer 4* is carried out by simultaneously pressing the 3 buttons on the front panel.

If during the power-on self test the Vdc power supply internal to the *Explorer* is less than 16V or greater than 28V, the circuit board stops functioning. If after the start-up time the sensor output(s) is(are) out of range, i.e. one or more sensors are in the UF (underflow) or OF (overflow) condition, the message FLT appears in the display area corresponding to the implicated sensor.

The stabilization time for catalytic sensors is approximately 60 seconds. For electrochemical sensors the time varies depending on the sensor type (see the sensor technical data sheet).

Visible/audible indications

The first time an alarm of any type occurs, the buzzer (common to all channels on the circuit board) sounds a prolonged BEEP, and the LED corresponding to the type of alarm illuminates. After this time, the beep is periodically repeated until the alarm is reset. If the alarm is reset by a SW command, the beep is silenced and the associated LED blinks until the value of the input variable returns within the correct operating range. This also happens for variables averaged over a prolonged period. The steadily-illuminated LED also indicates that the corresponding relay has been activated.

DESCRIPTION OF THE "*EXPLORER 4*"

The instrument is normally mounted on a 28U-3H rack.

The rack contains the 2 parts of the *Explorer*, that is to say the main module on the right hand side (21U) and the power supply on the left (7U).

The main module is composed as follows:

one circuit board which incorporates the display, the control buttons and the power on, alarm and fault indication LEDs and, fixed to the side of this, the motherboard, which houses the heart of the instrument, (EPROM, microprocessor, etc.). These 2 circuit boards are physically positioned in the rack as follows: the part with the display on the front and the motherboard to the right hand side (viewing the instrument from the front).

Looking at the instrument from the front (display side), there is a GREEN LED (ON) on the top left-hand side: when this LED is illuminated it means that the instrument is powered up.

Again looking at the instrument from the front, on the same level as the green LED but on the right hand side, we find the BUZZER which can be sounded continuously or intermittently depending on the type of alarm.

In the middle are the RED ALARM LEDs, framed by a red box for quick identification. Each vertical column of LEDs is referred to the channel indicated underneath, above the display, with the numbers 1-2-3-4. Starting from the lowermost red LED, we find the sequence of 3 alarm levels; that is to say the 1st LED from the bottom illuminates when the concentration of the gas exceeds the first alarm threshold, the 2nd LED illuminates when the concentration of the gas exceeds the second alarm threshold and the 3rd LED on the top illuminates when the concentration of the gas exceeds the third alarm thresholds (the alarm levels are factory set to 20% of LEL for the first threshold, to 40% of LEL for the second threshold, to 60% of LEL for the third threshold). The thresholds can be programmed to the client's specification and can in any case be modified from the menu.

Also in the centre, between the alarm LEDs and the display, we find the yellow FAULT LEDs corresponding to each channel. The FAULT LED illuminates when the cable connection to its associated sensor is interrupted for any reason, or in the event of a sensor fault or improper operation of the offset. When the FAULT condition is active, a blinking FLT message also appears on the display, in the position corresponding to the implicated channel.

Again in the centre section, next to the CE symbol**,** is the instrument's alphanumeric display.

The display is divided into 2 horizontal lines of 16 characters each: the top line shows the sensor readout values for the channel corresponding to the number and the LEDs above, in the chosen unit of measurement. The bottom line indicates the unit of measurement during normal operation (LEL in the case of combustible gases monitoring, OXY in the case of oxygen measurements, PPM for toxic gas measurements.

During set-up, the 2-lines display shows the various MENU messages which assist the user in performing the various configuration settings using the three buttons immediately under the display, whose function is indicated on the bottom line of the display itself.

The *Explorer 4* is normally powered at 24 Vdc by the power supply.

The power supply is normally housed on the left hand side of the rack: the upper section incorporates a green power-on LED, which indicates that the instrument is being supplied from the electricity mains; if the green LED is off, it means that the mains power supply is absent, and the instrument will be supplied from the backup battery if one is installed.

The maximum permitted installation distance between the sensor-transmitter and the *Explorer 4* is approximately 1,000 metres.

The 4-20 mA transmitter is normally housed inside a class EEX d IIc T6 junction box and locally calibrated for its sensor. The sensor readings are transmitted continuously, and therefore the concentration measurement of the gas being monitored takes place in real time.

Programming via front panel buttons
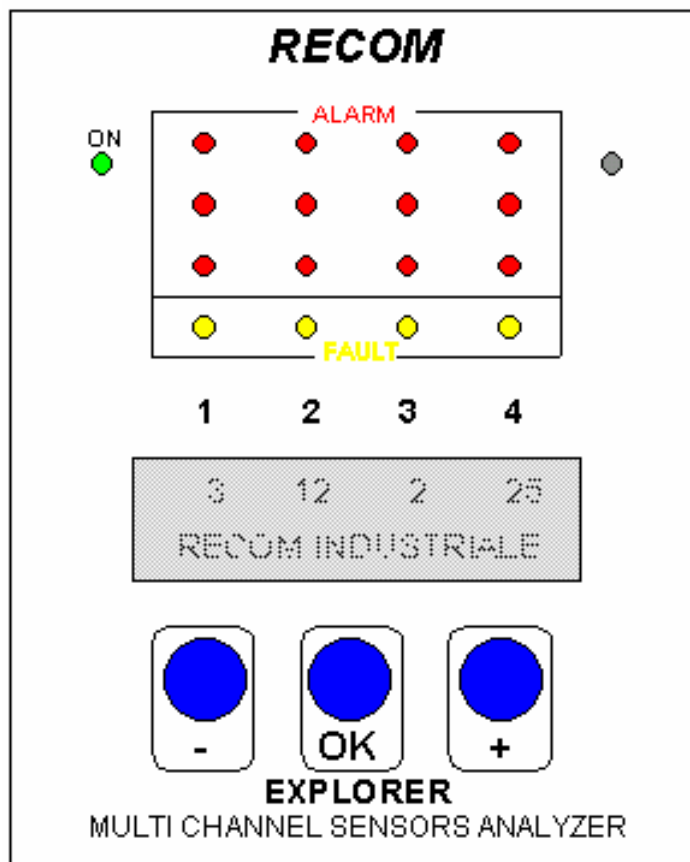
Using the buttons on the front panel, it is possible to configure many of the circuit board parameters. System messages on the LCD display guide the user through the tree-structured menus for configuring the circuit board.

To access the calibration menu, it is necessary to first make the number **"4"** appear on the upper left hand side of the display.

To do this, press the (+) button 4 times
Use the **(-)** button to clear if the value 4 is exceeded.
When the display shows the n° 4 on the left side, pressing the centre OK button accesses the MAIN MENU display.

MENU FUNCTION

Language Selection

	SET	
LANG	SETUP	EXIT
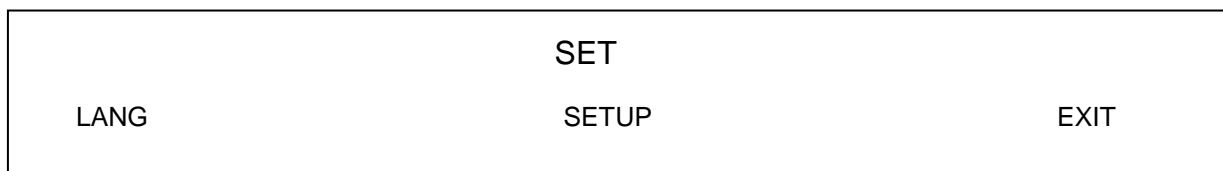
Pressing the **(-)** button on the display you can see:

	LANGUAGE SELECT	
-	ENGLISH	+
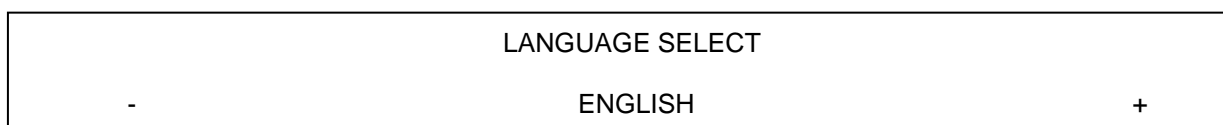
Pressing the **(-)** or **(+)** button scrolls through the available languages.

When a vertical bar appears on one of the two sides, it means that there are no more language options and the corresponding key loses its function. Pressing the centre button confirms the language option currently shown on the display.

The available languages are:
------ English ⇔ Italian ⇔ German ⇔ Spanish ⇔ French ⇔Portuguese ------
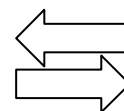
After choosing the desired language, press OK. The language selection will be stored in memory, and the instrument will advance directly to the next menu.

MENU 2

Enable or disable channels

	SET	
LANG	SETUP	EXIT
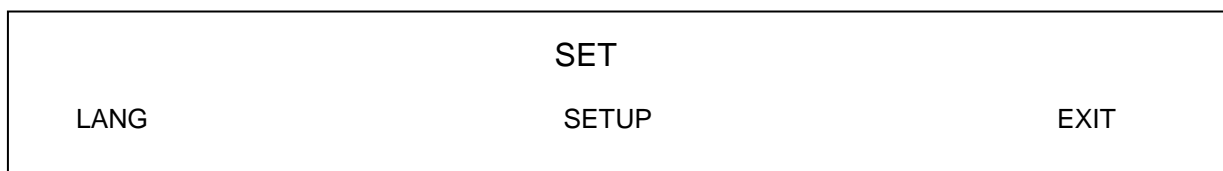
Press the OK button to proceed with setup

```
                              SETUP
  ALARM                       CHAN                          EXIT
```

Press the OK button to proceed with Channel Selection

```
     CHANNEL  1                      STATUS  OFF
  ---                   OK                        +
```

Pressing the **(-)** or **(+)** button changes the "ON" message to "OFF" and vice versa. When the "ON" message appears it means the channel is active, i.e. it will acquire the data transmitted from the sensor; the "OFF" message means that the channel is disabled.

To exit the menu, press the "OK" button for all 4 channels, until the next menu appears.

MENU 3
Enter or exit calibration menu

```
     CHANNELS  ON:      4
  NOT                  CAL(TAR)              YES
```

(-) exits the calibration menu,   **(+)** advances directly to the next menu.

MENU 4
Select the channel to be calibrated
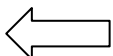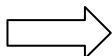
```
     CHANNELS  ON:  4
     SELECT  NUMBER:            1
```

The circuit board shows the total number of channels currently programmed as active, regardless of their position on the display. The **(-)** and **(+)** buttons increase or decrease the number of the selected channel, cycling sequentially through the currently active channels between 1 and 4.

The channels do not necessarily have to be selected in sequential order.

Press the centre OK button to select the channel currently shown on the display.

MENU 5
Set the range of measurement

```
┌──────────────────────────────────────────────────────────┐
│                                                          │
│          CHANNEL  01   VALUE=    0,0                      │
│  ⟵              % LEL                    ⟶               │
│                                                          │
└──────────────────────────────────────────────────────────┘
```

Repeatedly pressing the **(+)** or **(–)** buttons cycles through the possible ranges of measurement for that channel, for example: **% LEL, %OXY, PPM, etc..**   After selecting the desired range of measurement, press **OK** to confirm.
This operation must be repeated for each channel.

MENU 6

Offset calibration -Sensor reading "zero-setting"

```
┌──────────────────────────────────────────────────────────┐
│                                                          │
│         CHANNEL  1   VALUE =      0,2                     │
│  ---         OFFS  =              416        +           │
│                                                          │
└──────────────────────────────────────────────────────────┘
```

This function is used to zeroing display concentration reading (value= x,x) considering as zero the current close to 4 mA that the channel in receiving from sensor in that moment. Press **(-)** or **(+)** to adjust the offset until the reading (on the fist line of the display) for the channel is zero.
The value of the offset can never be negative.
The OK button confirms and saves the currently displayed offset value, and advances to the next calibration setting.
This operation must be repeated for each channel

MENU 7
Set sensor reading time average

```
┌─────────────────────────────────────────────────┐
│       AVER. (1 –> 128 )          001            │
│     ---              OK                    +    │
└─────────────────────────────────────────────────┘
```

To obtain more stable readouts, it may be necessary to increase the time period over which the sensor readings are averaged. This is useful, for example, in environments susceptible to transient "peaks" that can cause false alarms, triggering the outputs unnecessarily if the duration of the "peak" is brief.

The value 1 is the default selection. Higher values will delay the response time of the readings.
The OK button confirms and saves the average set value and advances to the next calibration setting.
This operation must be repeated for each channel

MENU 8

Set up alarm threshold levels

```
┌─────────────────────────────────────────────────┐
│        CHANNELS  ON:       4                    │
│   NOT              CAL(TAR)          YES        │
└─────────────────────────────────────────────────┘
```

(-) pushbutton advances directly to the next menu.

```
┌─────────────────────────────────────────────────┐
│                   SETUP                         │
│   ALARM           CHAN               EXIT       │
└─────────────────────────────────────────────────┘
```

(-) pushbutton advances directly to the ALARM menu.

```
┌─────────────────────────────────────────────────┐
│                 CHANNEL                         │
│     --             1                    +       │
└─────────────────────────────────────────────────┘
```

Pressing the (-) or (+) button changes the channel. OK to confirm and advances next step

```
┌─────────────────────────────────────────────────────────┐
│   CHANNEL   1  VAL=            0,0                        │
│  ---                 TRIG 1=                         +   │
└─────────────────────────────────────────────────────────┘
```

The first alarm threshold is shown, without any associated value (TRIG 1).
Pressing the OK button causes a value to appear, which can be modified as desired by pressing the
 (-) and (+) buttons. After setting the desired value, press the OK button to confirm the selection.
This operation must be repeated for each alarm threshold.

```
┌─────────────────────────────────────────────────────────┐
│   CHANNEL   1  VAL=            0,0                        │
│  ---                 TRIG 1=   20,0                  +   │
└─────────────────────────────────────────────────────────┘
```

MENU 10

Set up alarm threshold directions
Alarms triggered by increasing or decreasing measured value

```
┌─────────────────────────────────────────────────────────┐
│      SELECT DIR.                            ∧            │
│  ∧                    OK                           ∨     │
└─────────────────────────────────────────────────────────┘
```

This menu sets up whether the alarm is triggered when the value shown on the display is increasing or decreasing:
To trigger the alarm when the readout is increasing (example: alarm due to increase of the flammable gas mixture, approach to the LEL), press the (-) button: the indication ∧ will appear on the left side of the display.
To trigger the alarm when the value is decreasing (example: alarm due to insufficient oxygen, minimum concentration alarm 19.5% for O2), press the (+) button: the ∨ indication will appear on the left side of the display.
Confirm the selection by pressing the OK.
This operation must be repeated for each alarm threshold.

MENU 11

Configure channel alarm relays
Fixed or intermittent alarms

Fig. 1

SEL. CAR. RL		-- -- --
----	OK	-- -- --

Fig. 2

SEL. CAR. RL		------
----	OK	-- -- --

In certain cases, it may be necessary to configure the channel alarm for the 3 trigger thresholds (not the general alarm which is always fixed) so that the relays are always energized rather than intermittent.

This is useful, for example, in order to locally control the actuation of devices (fans, solenoid valves) by a single sensor, without involving the others which may be situated in different and possibly distant points. In such cases, the device needs to be actuated directly by the channel which triggered the alarm, rather than by the general alarm output. However an intermittent signal would cause the fans to switch on and off within a span of a few seconds. Therefore there is a choice between a fixed and intermittent alarm.

To choose an intermittent alarm (Fig.1) press the **(+)** key, and the indication **(-- --)** appears on the upper right side of the display.

To choose a fixed alarm (Fig.2) press the **(-)** key and the indication **(------)** appears on the upper right of the display.

Confirm the selection by pressing the OK button.

This operation must be repeated for each alarm threshold.

During this phase it is possible to advance to the other two thresholds (TRIG2) or (TRIG3), using the **(-)** and **(+)** buttons as usual, but it is also possible to exit the ALARM calibration by using the (-) button until in place of TRIG 1 the display shows EXIT.

Electrical connections

EXPLORER 4 – Back view

Alarm relays

GENERAL ALARM

FAULT ALARM

C	1
NO	3
C	5
NO	7

ALARM CHANNEL 1

C	9
A1	11
A2	13
A3	15

ALARM CHANNEL 2

C	17
A1	19
A2	21
A3	23

ALARM CHANNEL 3

C	25
A1	27
A2	29
A3	31

ALARM CHANNEL 4

C	33
A1	35
A2	37
A3	39

2 +
4 –
6 +
8
10 +
12 S
14 +
16 -
18 +
20 S
22 +
24 -
26 +
28 S
30 +
32 -
34 +
36 S
38 +
40 -

POWER 24Vcc from power supply

ACK PUSH BUTTON

CABLE 3 x 1,5 mm² Shielded

RECORDER 4-20mA

Sensor % LEL

CABLE 2 x 1,5 mm² Shielded

Sensor TOX/O2

TIPICAL WIRING FOR SENSOR/TRANSMITTERS 2 AND 3 WIRES