NRC FORM 567
(1-1999)

U.S. NUCLEAR REGULATORY COMMISSION

REQUEST FOR A SEALED SOURCE OR DEVICE EVALUATION

INSTRUCTIONS: Send this rerquest AND a copy of all related letters/applications and drawings to the Chief, Sealed Source Safety Section, OWFN Mail Stop O-6 H3. Change the License Tracking System milestone to 19 and assign to reviewer code 1-5.
NOTE: Retain a copy of this request with the application and background files.

REQUESTER: Environics	REGION/LOCATION: ☐ I ☐ II ☐ III ☐ IV ☐ HQ ☐ LFARB
TELEPHONE NUMBER: 386-304-5252 / DATE:	TYPE OF ACTION REQUESTED *(Check as appropriate)*
NAME OF APPLICANT: Rolf Meinholtz & Michael Phillips	☐ SOURCE REVIEW ☑ AMENDMENT OF REGISTRATION SHEET NUMBER(S)
MAIL CONTROL NUMBER(S):	☑ DEVICE REVIEW
LETTER/APPLICATION DATE: 08/10/2004 / LICENSE NUMBER(S):	☐ CUSTOM REVIEW NR-174-D-101-E

COMMENTS:
4401 Eastport Parkway
Port Orange, FL 32127

FOR SSSS USE ONLY

REVIEWER	MODEL NUMBERS	NUMBER ASSIGNED
Tomas Herrera	M-90 Chemical Agent Detector	04-54
DATE RECEIVED	**DATE ASSIGNED**	**DATE TO FEES**
08/18/2004	08/18/2004	08/18/2004

TYPE OF ACTION *(Indicate the number of each type)*

☑ COMMERCIAL DISTRIBUTION (FORMAL) ☐ USE BY A SINGLE APPLICANT (CUSTOM)

SOURCE (9C)	DEVICE (9A)	SOURCE (9D)	DEVICE (9B)
☐ NEW	☐ NEW	☐ NEW	☐ NEW
☐ AMENDMENT	☑ AMENDMENT	☐ AMENDMENT	☐ AMENDMENT

☑ NO SAFETY EVALUATION REQUIRED
NO FEES REQUIRED

☑ LICENSING ACTION REQUIRED (IF KNOWN) ☑ YES ☐ NO

☐ OTHER *(Specify)*

	TOTAL NUMBER OF REVIEW HOURS	NOTES: Amdt request to possess, manufacture, & distribute the Environics M-90 Chemical Warfare Agent Detector and Environics Model MGD-1 Multiple Gas Detector on registration certificate NR-174-D-101-E.
	NUMBER OF DEFICIENCY LETTERS	
	NUMBER OF DEFICIENCY CALLS	

FOR FEE USE ONLY

TYPE OF FEE	FEE CATEGORY
Amendment	☑ 9A ☐ 9B ☐ 9C ☐ 9D

AMOUNT RECEIVED	CHECK NUMBER	DATE OF CHECK	LOG
N/A	N/A	N/A	AUG 04 55 D

APPROVED BY: Rosalyn Jones — DATE OF RETURN: 8/23/04

COMMENTS

Environics

August 10, 2004

Thomas Herrera
Materials Safety and Inspection Branch
Division of Industrial and Medical Safety
Office of Nuclear Material Safety and Safeguards
Washington, DC 20555-0001

Dear Sir:

This is the response to your request for more information letter dated July 12, 2004 in regards to the MGD Multiple Gas Detector. Enclosed you will find six attachments that are linked to the original questions that you sent in the information request letter. The attachments and links to the letter are listed below.

Attachments and References:

Attachment 1A: Description and Construction - This letter is from Osmo Anttalainen who is the VP of Technology at the Finland Office. It points out and discusses the differences between the M-90 and the MGD-1.

Attachment 1B: This contains the drawings from attachment 1A that have been extracted from the letter onto separate pages to allow easy copies for inclusion into the registration certificate.

Attachment 2: Conditions of Use
This is the formal letter requested confirming that Environics USA is the successor to the listed companies and will adhere to their prior commitments.

Attachment 3: Labeling –The extracted pictures from the letter in regards to the Radiation labels for the MGD-1. Note that the labels and placement are the same to that used for the M-90.

Attachment 4: Prototype Testing- As noted in attachment 1A since the MGD-1 uses the same sensor module and body as the M-90 the test data for the M-90 has been submitted

Attachment 5: User Manual for the MGD-1 Multiple Gas Detector.

Attachment 6: Radiation Profiles: since the M-90 and the MGD-1 use the same sensor module the Radiation profiles are similar, therefore the data for the M-90 has been included along with

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Environics

If there are any questions, errors or omissions please call me at the Fl office (Attn; Rolf Meinholtz at 386-304-5252) at your convenience.

Sincerely

Rolf Meinholtz
Chemist/RSO

Michael Phillips
President Environics USA

4401 Eastport Parkway
Port Orange, FL 32127- USA
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Response letter to NRC about differences between MGD-1 and M90 gas detectors

1. General

This is response to NRC request of differences between M90 and MGD-1 gas detectors.

2. Differences of MGD-1 and M90

The MGD-1, Multi Gas Detector is based on the design of M90 CWA detector. The MGD-1 utilizes the same sensor module as M90, is constructed into the same mechanical body as M90 and uses the same electronics as M90. The main difference between M90 and MGD-1 is in the software and user interface, which in case of MGD-1 is optimized to show the gas names using a LCD display whereas M90 is optimized to warn of Chemical Warfare Agents with specific LED displays.

Visual difference between M90 and MGD-1 are as follows, the color of the unit faceplate (see number 1 below): M90 faceplate is green with specific LEDs; MGD-1 faceplate is blue in color with a Multi line LED display module. The M-90 has a large special 'rain cap' type of cover for the inlet and exhaust, while the MGD-1 uses the small cap type (see number 2 below.) The M-90 has a pair of terminal posts for a remote alarm cable while the MDG-1 does not (see number 3 below) Figures 1 and 2 show the visual differences between two detector models below.

The differences are shown with numbered circles and pinpointed in Table 1.

Number	M90	MGD-1
1	LED-display for CWA warning	LCD-display for identification
2	Special rain cap design	Small cap design
3	Screw terminals for pair-cable	No screw terminals
PWR-board		Resistor values changed to provide suitable power for LCD-display

Table 1: Visual Differences between M90 and MGD-1

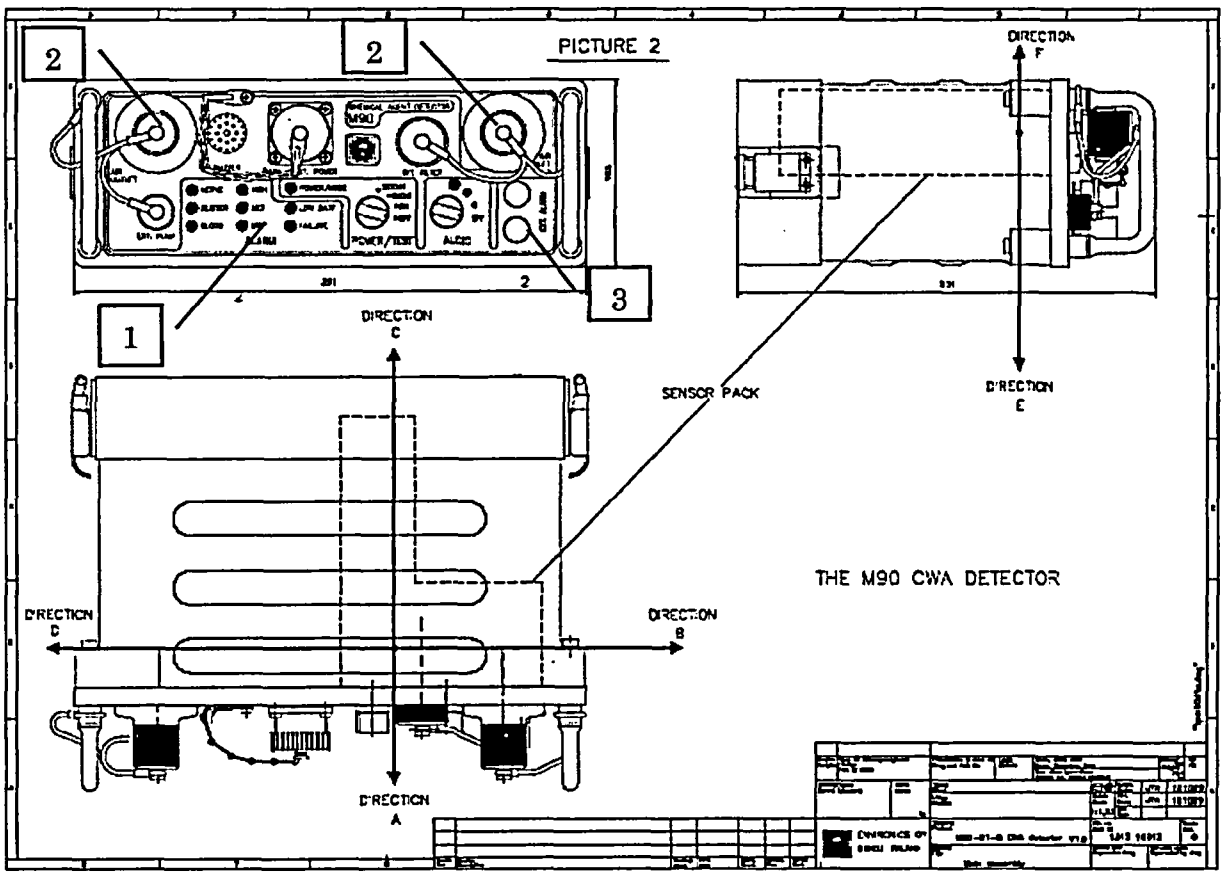


Figure 1: M90, interface view, external dimensions and sensor location

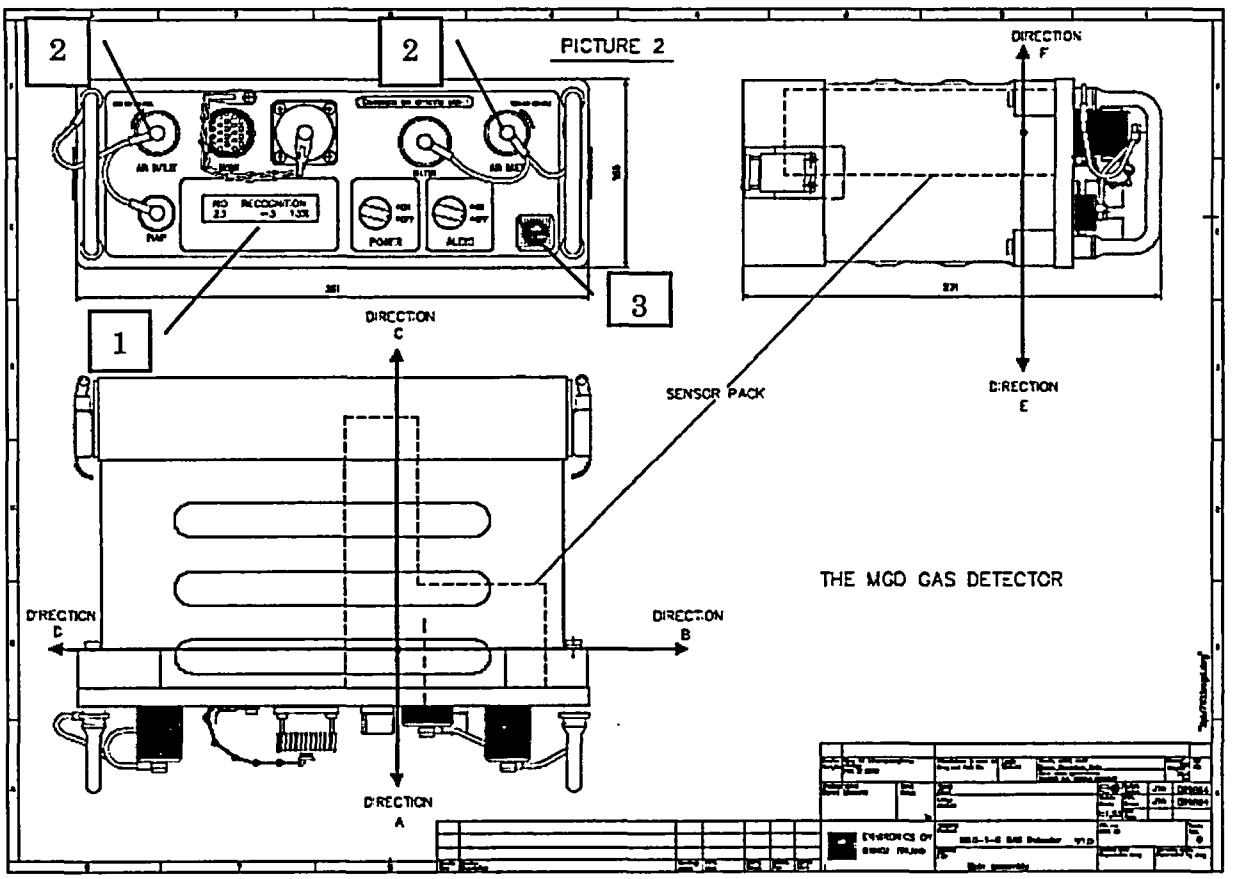


Figure 2: MGD-1, interface, external dimensions and sensor location

3. Radiation

Because of same design with only minimal differences between mechanical constructions MGD-1 is considered to have same radiation characteristics as M90. Please see attachment 1, the Protocol of inspection from the Finnish Centre for Radiation and Nuclear Safety.

4. Labelling

The following pictures show the labels used in M90 and MGD-1 to indicate presence of the warning radioactive element inside the M90 sensor.

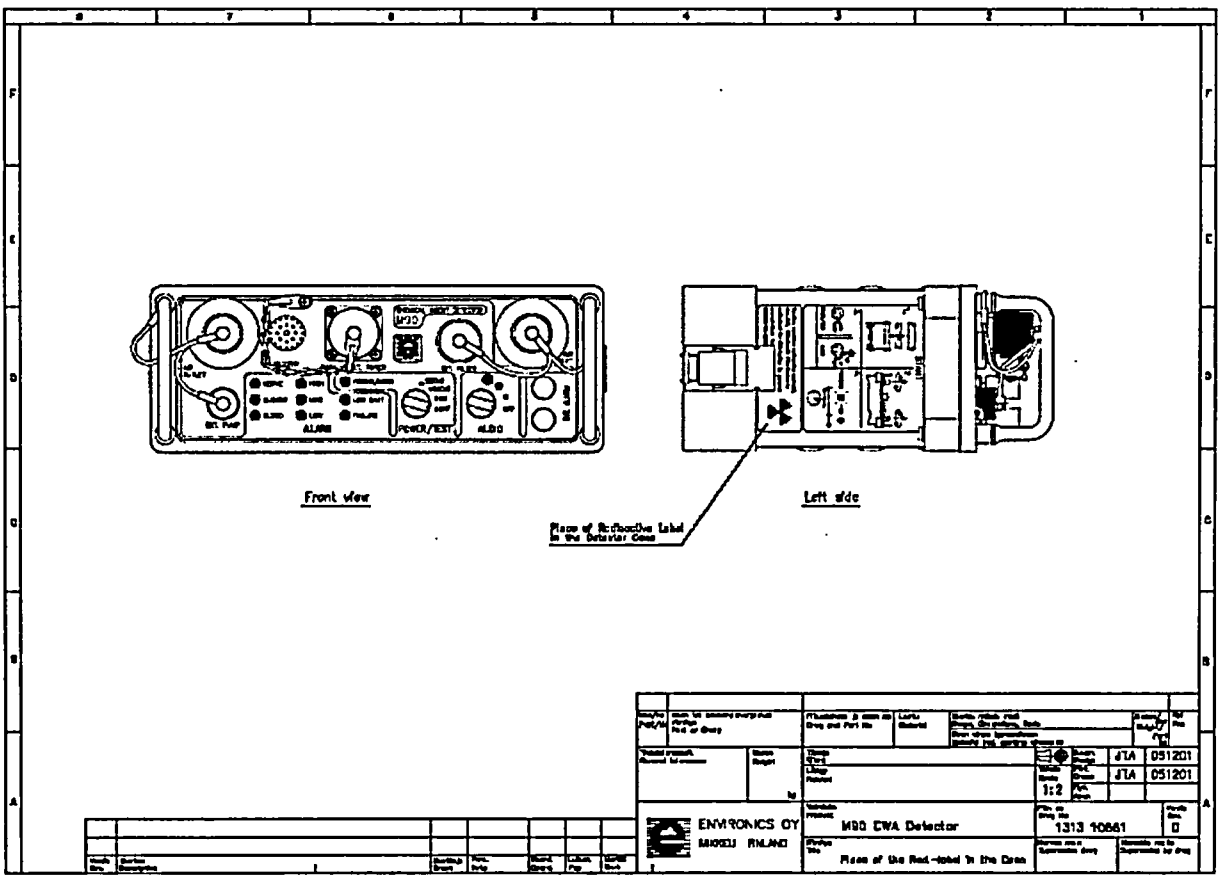


Figure 3: Label position in M90. Label position is same for MGD-1.

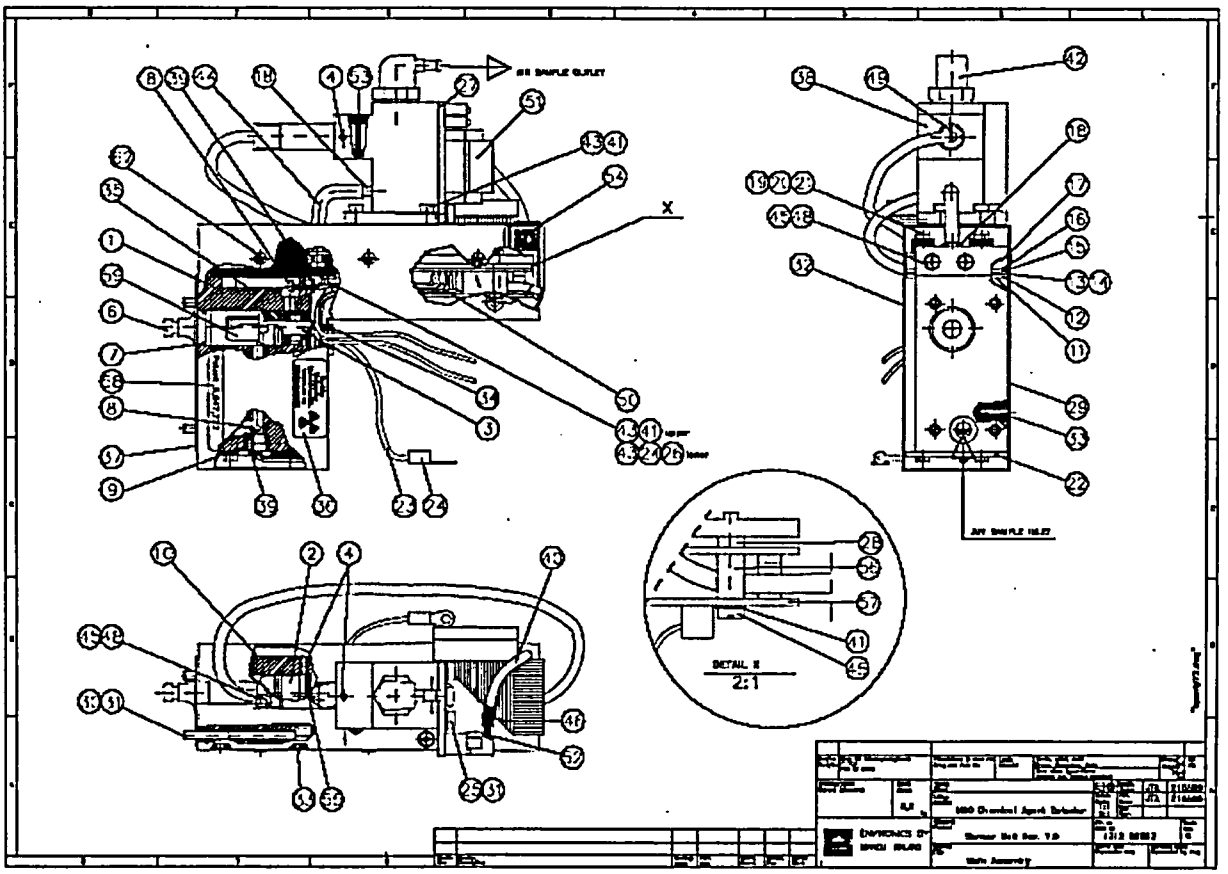


Figure 4: Label position (36) on sensor module. Note: MGD-1 and M90 have the same sensor module.

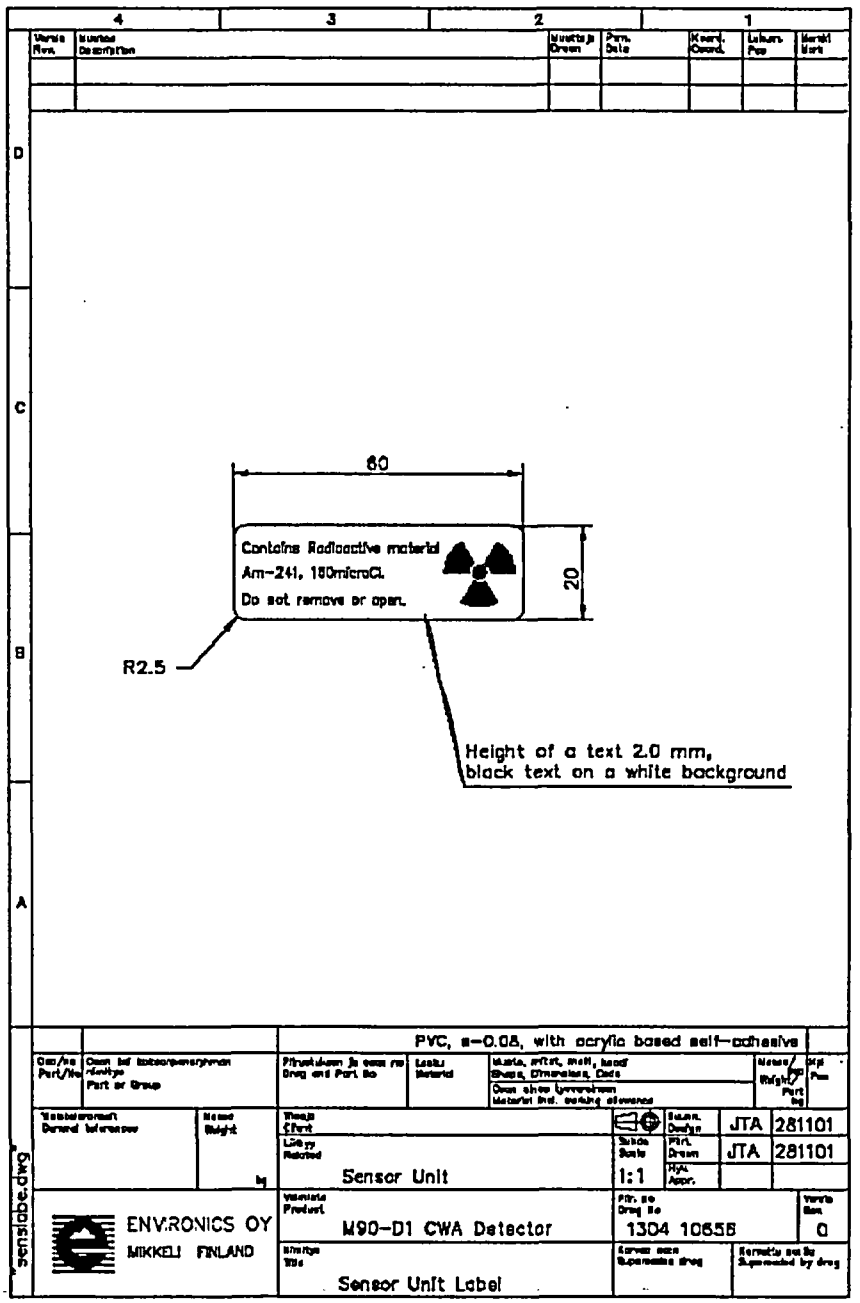


Figure 5: Sensor warning label. Similar label is used for MGD-1 sensor.

Environics	Prepared	Checked	Accepted	Changed
P.O. Box 349	Osmo Anttalainen			
50101 Mikkeli	10.8.2004			
Finland	Rolfs copy of Osmo's NRC responce letter 8-10-04			

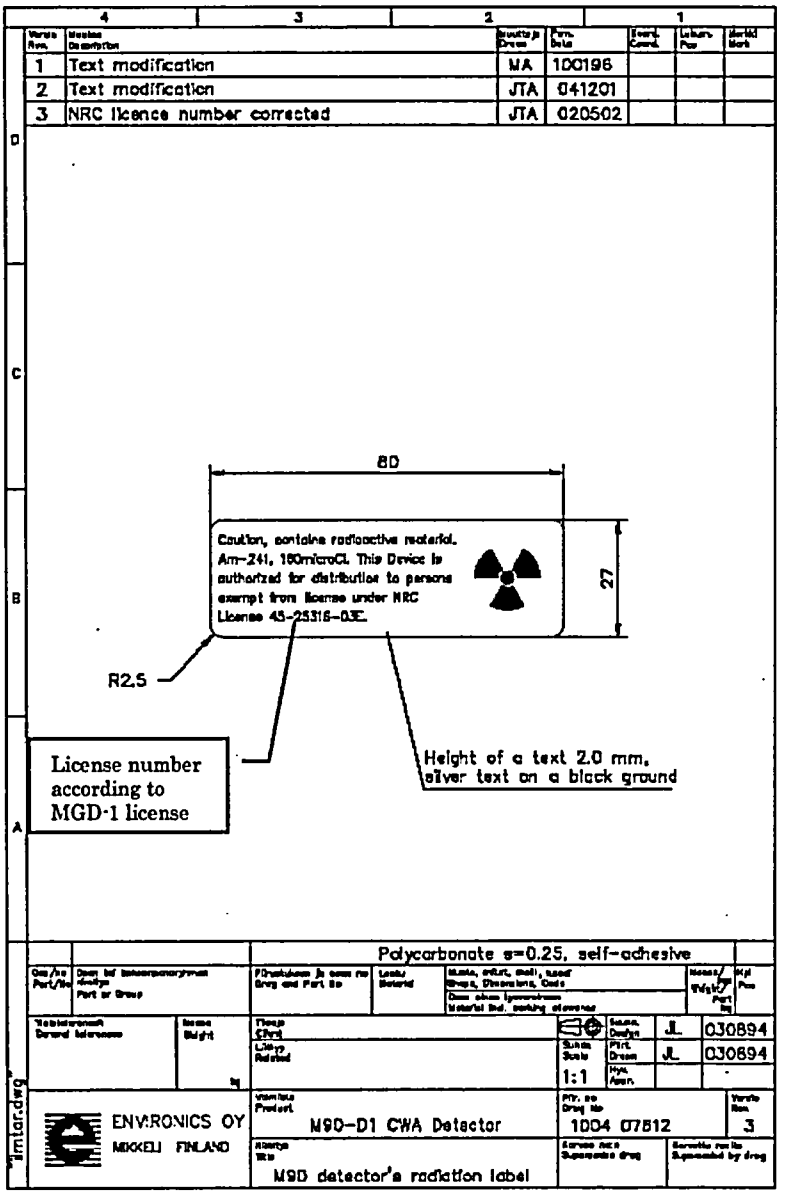


Figure 6: Warning label used in for M90. Similar label with MGD-1-related NRC-license number (when available) is used for MGD-1.

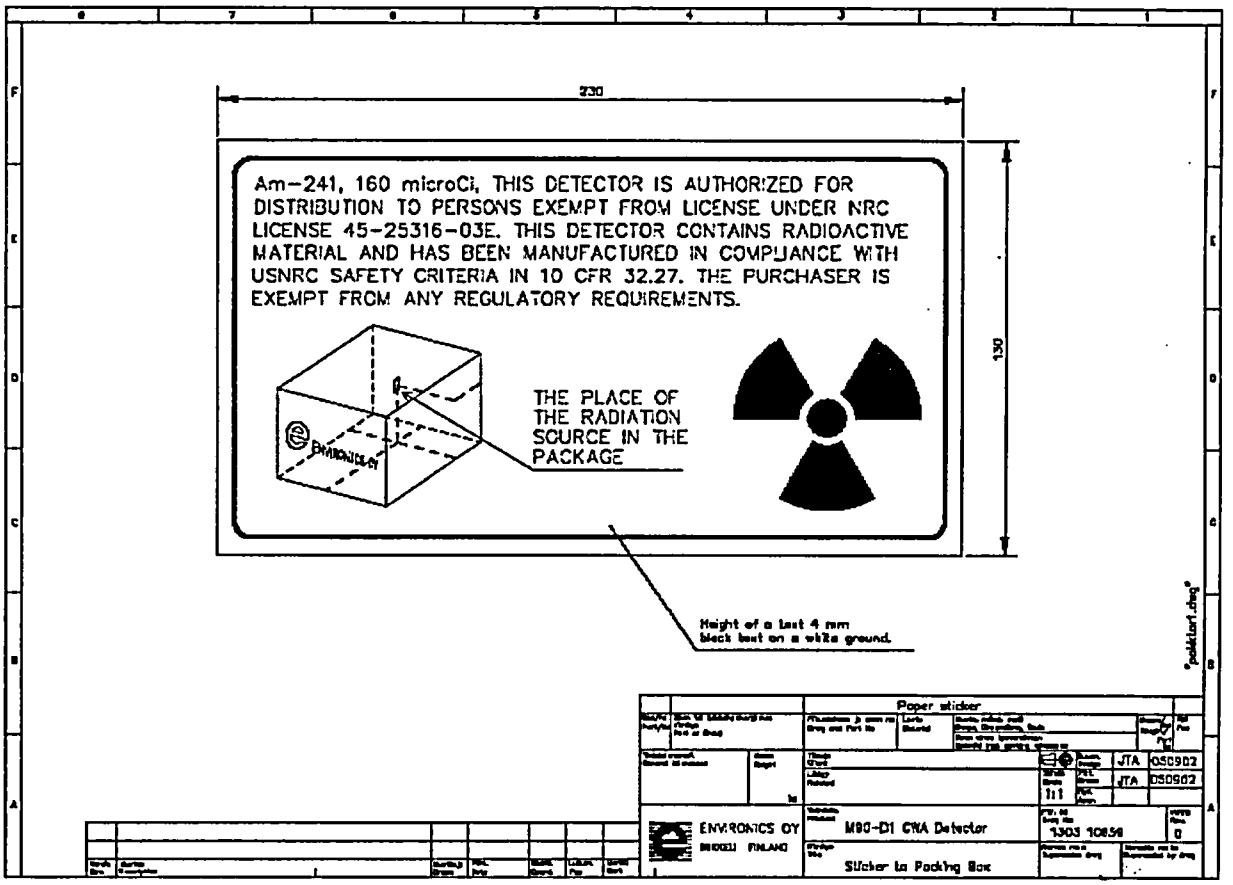


Figure 7: Position of warning label on package used for M90. Similar package is used for MGD-1. License number will be according to MGD-1-related NRC-license when available.

Mikkeli 10.08.2004

Osmo Anttalainen
V.P. Technology

Environics	Prepared	Checked	Accepted	Changed
P.O. Box 349	Osmo Anttalainen			
50101 Mikkeli	10.8.2004			
Finland	Rolfs copy of Osmo's NRC responce letter 8-10-04			

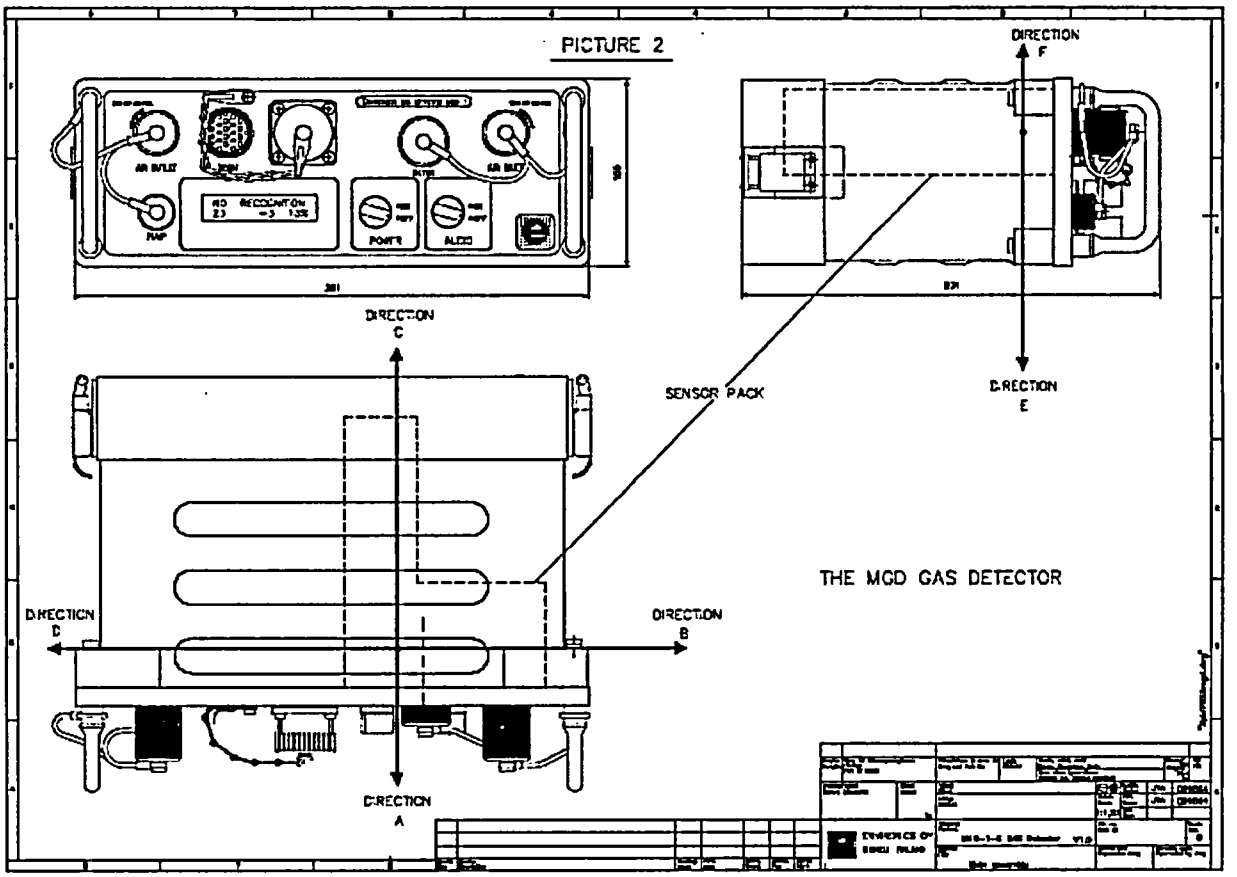
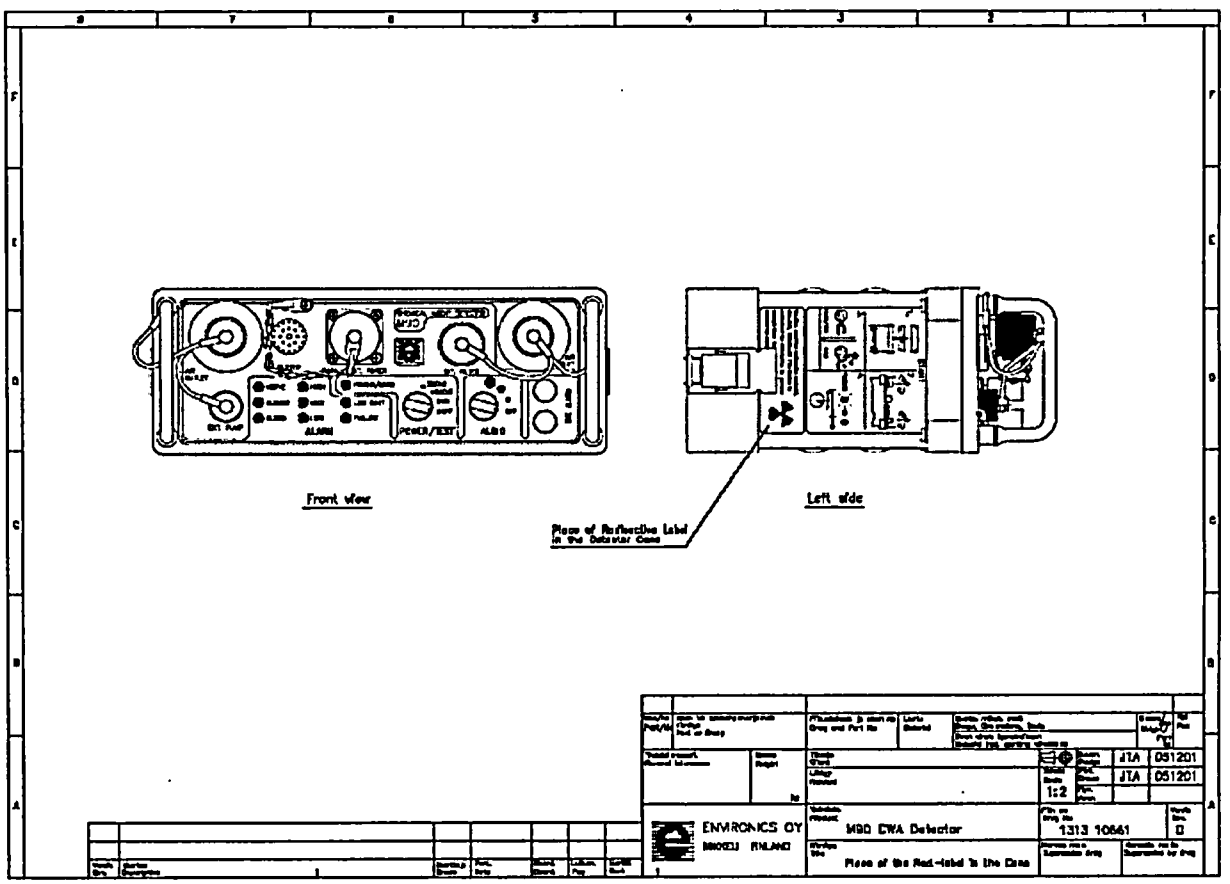


Figure 2: MGD-1, interface, external dimensions and sensor location



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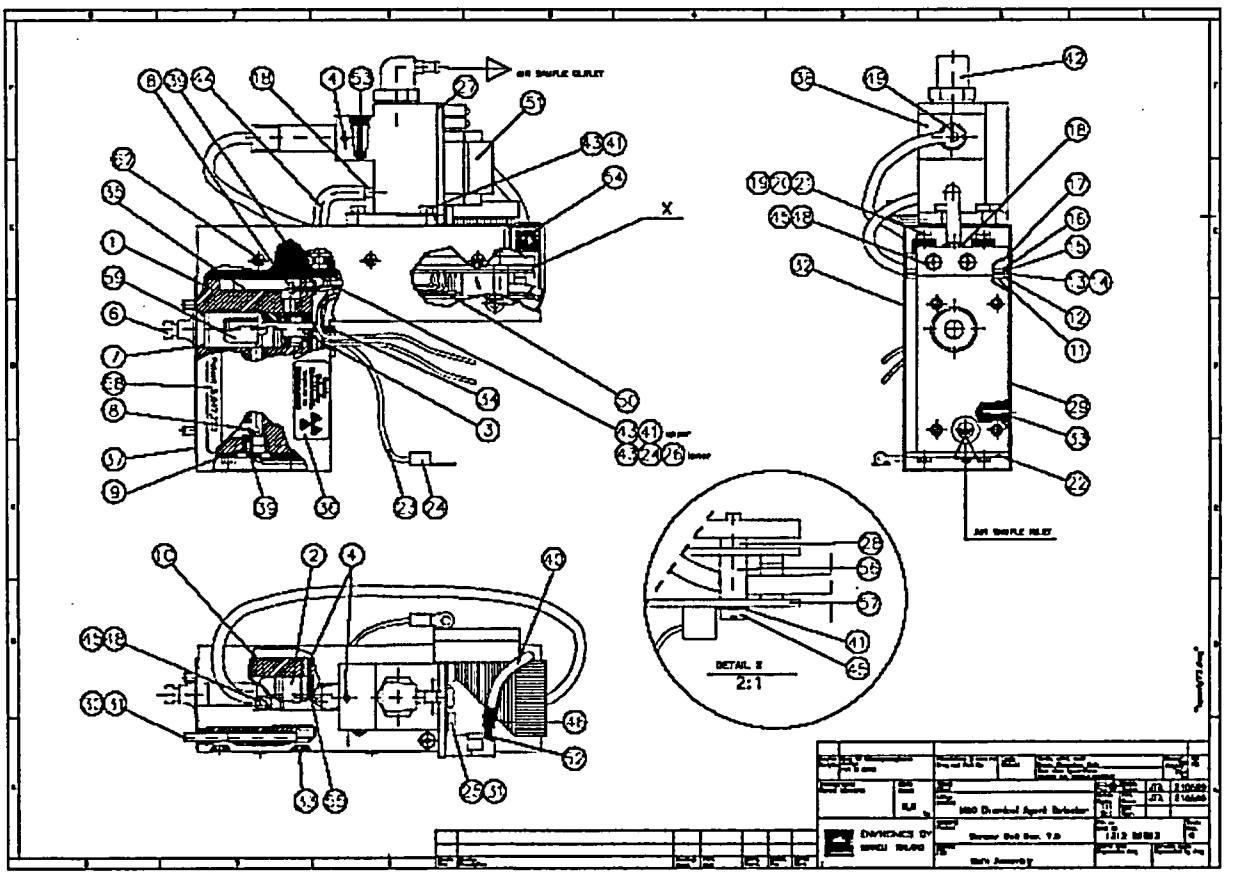
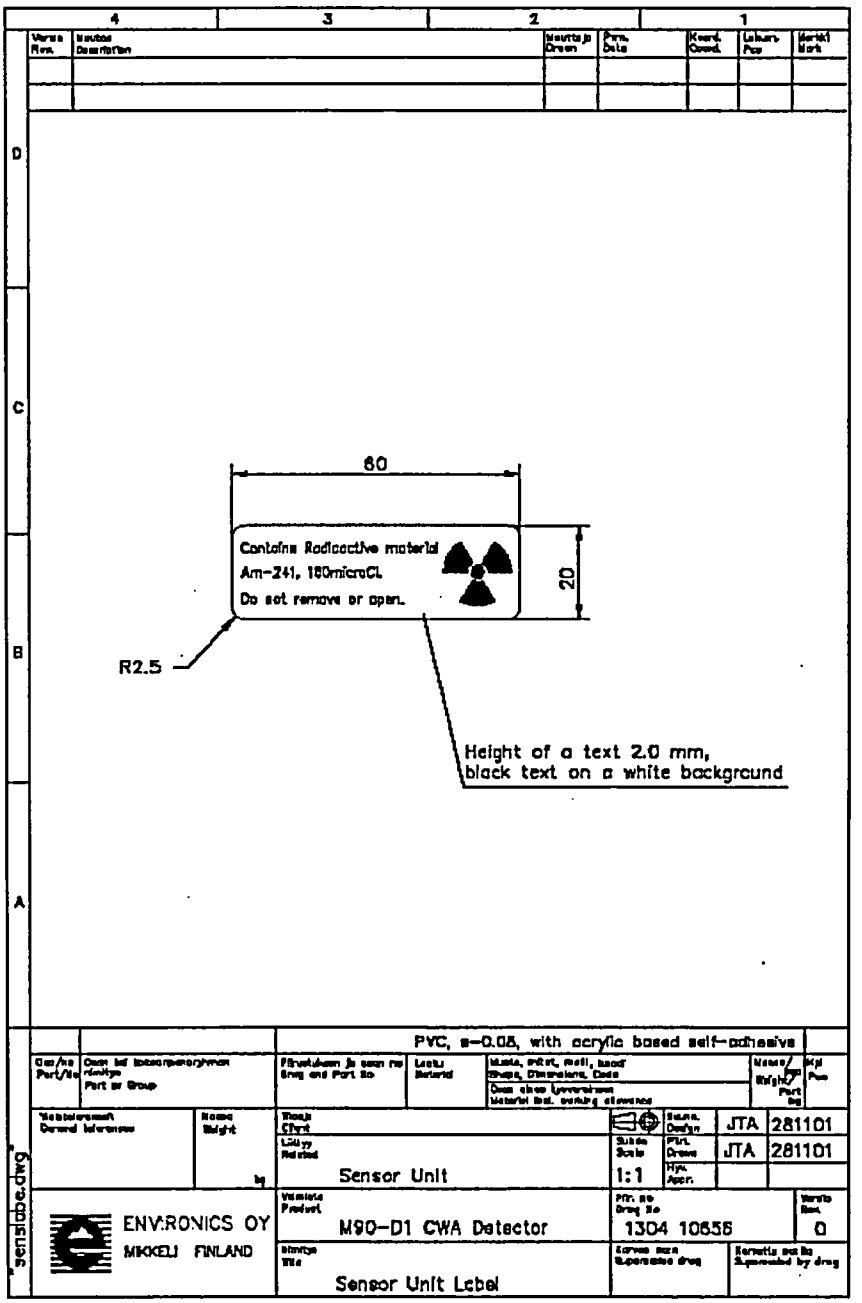


Figure 4: Label position (36) on sensor module. Note: MGD-1 and M90 have the same sensor module.



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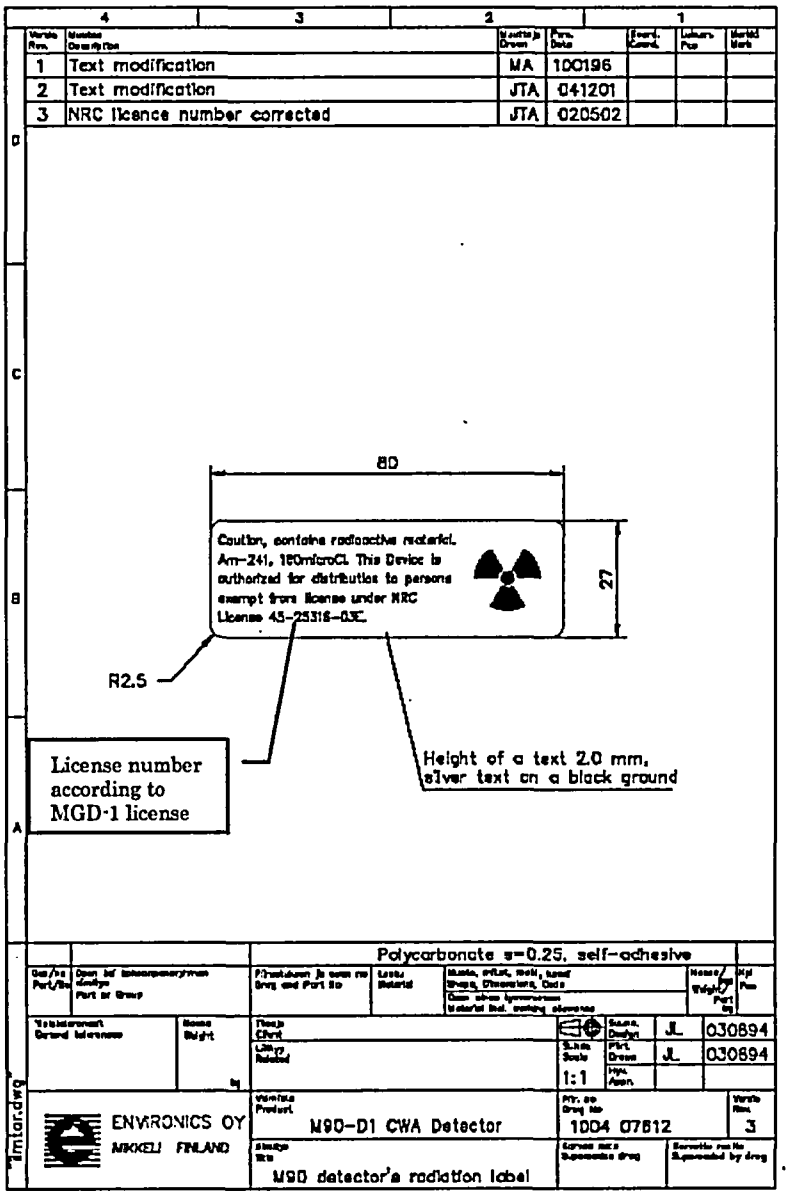

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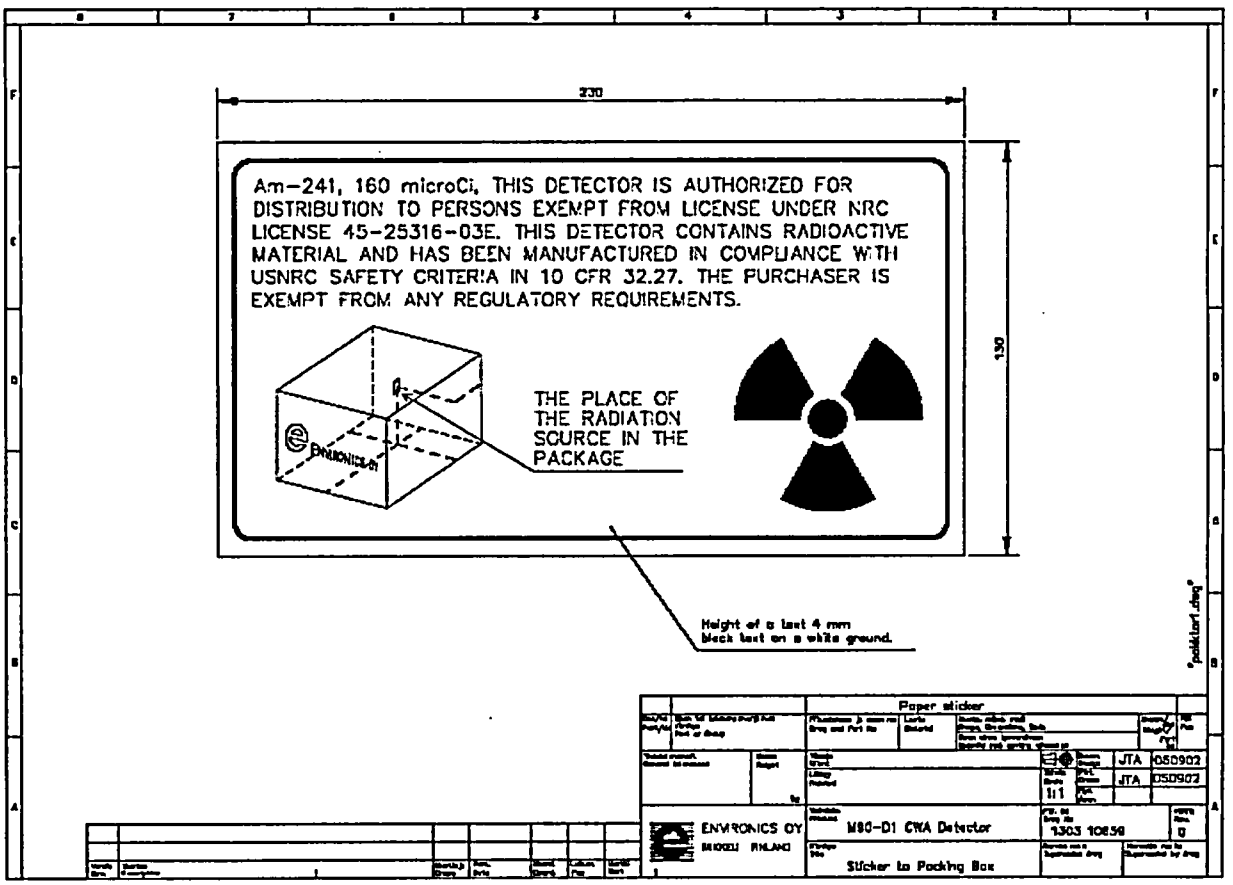

Figure 7: Position of warning label on package used for M90. Similar package is used for MGD-1. License number will be according to MGD-1-related NRC-license when available.

Environics

August 12, 2004

Subject: Conditions of Use

Gentlemen

This letter is to confirm the following issues in regards to conditions of usage for the Environics M-90, MGD-1 and Chempro. That Environics USA, Inc. will adhere to the prior commitments made by the following entities, Temet USA Inc., Palomar Sensor Applications Inc. and Sensor Applications Inc.

Also in the existing documentations let it be understood that Environics USA Inc. is the successor to the following companies; Temet USA Inc., Palomar Sensor Applications Inc., And Sensor Applications Inc. and references or mentions of these companies will now mean Environics USA Inc.

Thank you,

Michael Phillips

President, Environics USA Inc.

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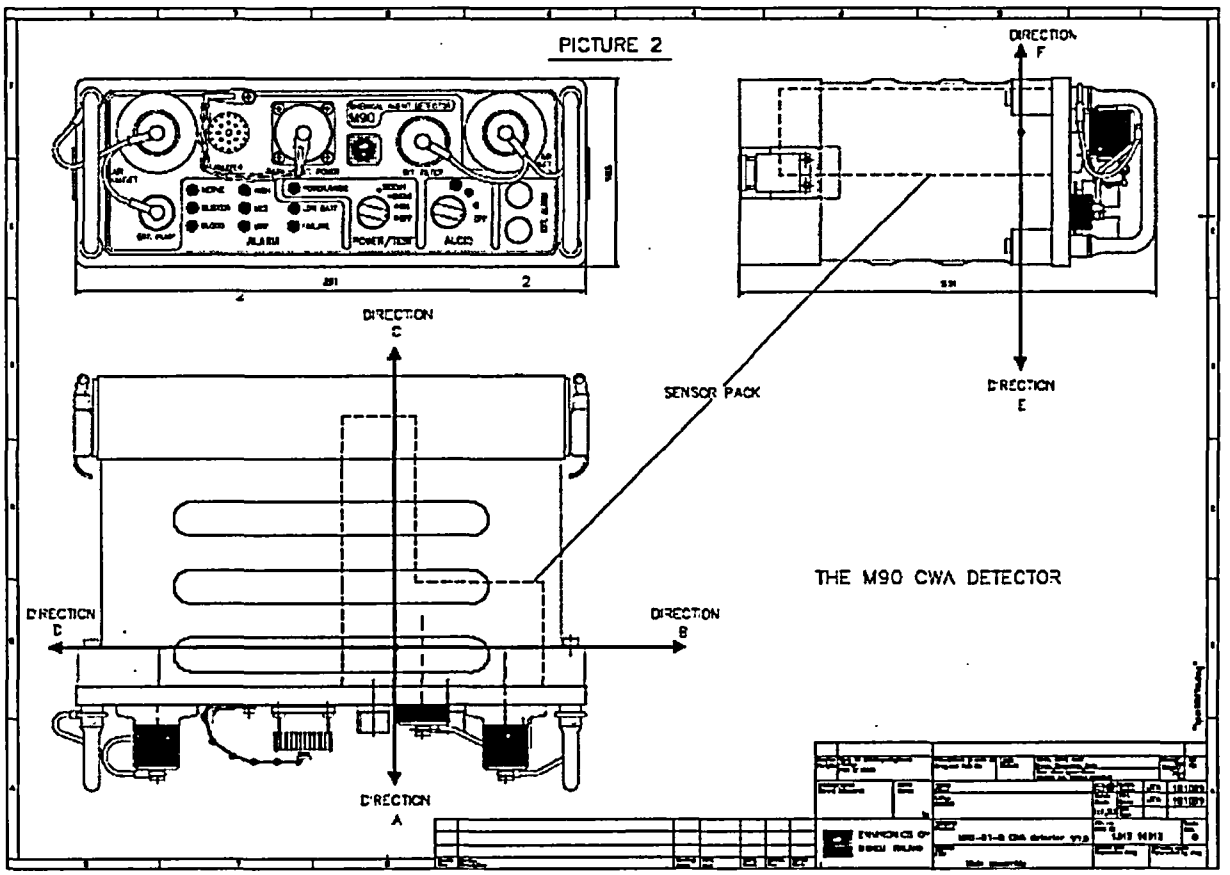
Port Orange, FL 32127- USA
Telephone: (386) 304-5252 Telefax: (386) 304-5251



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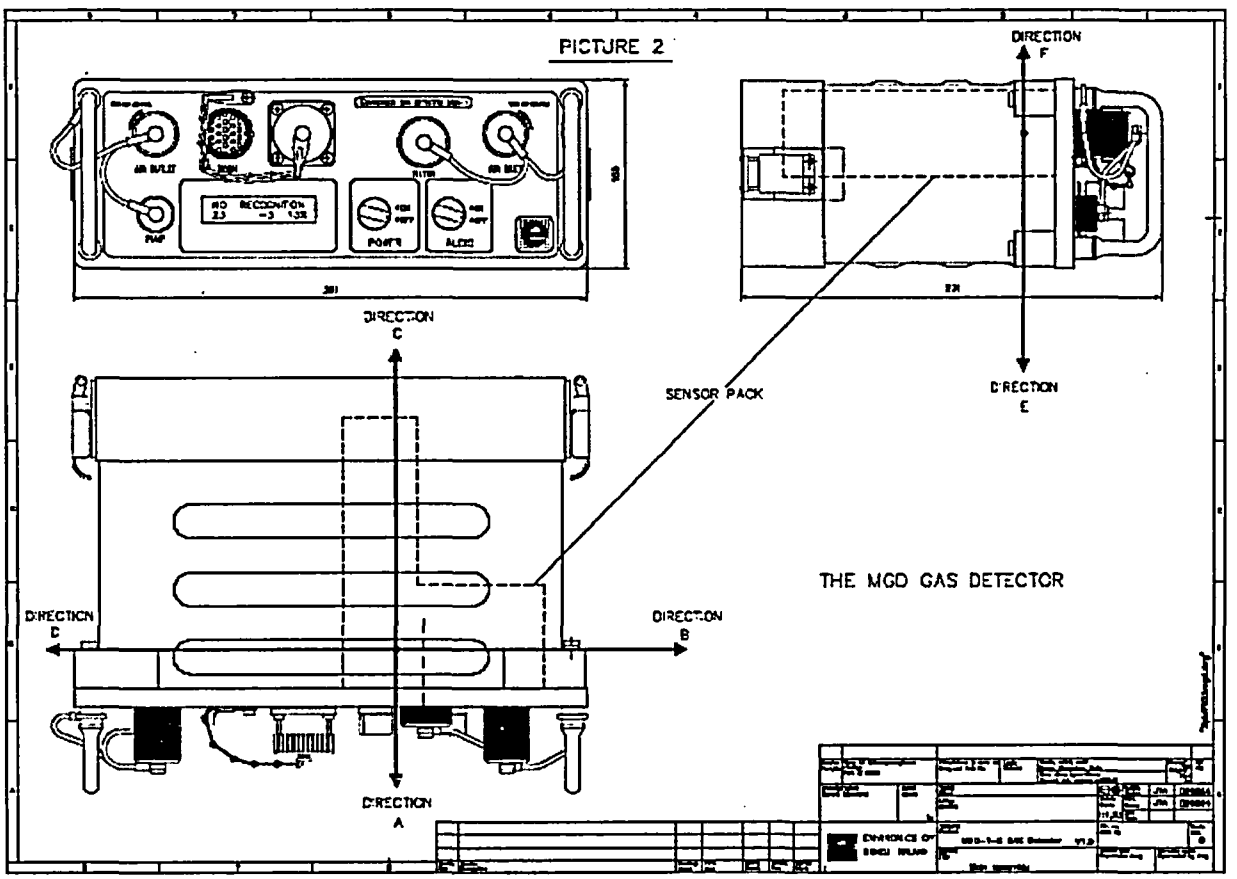
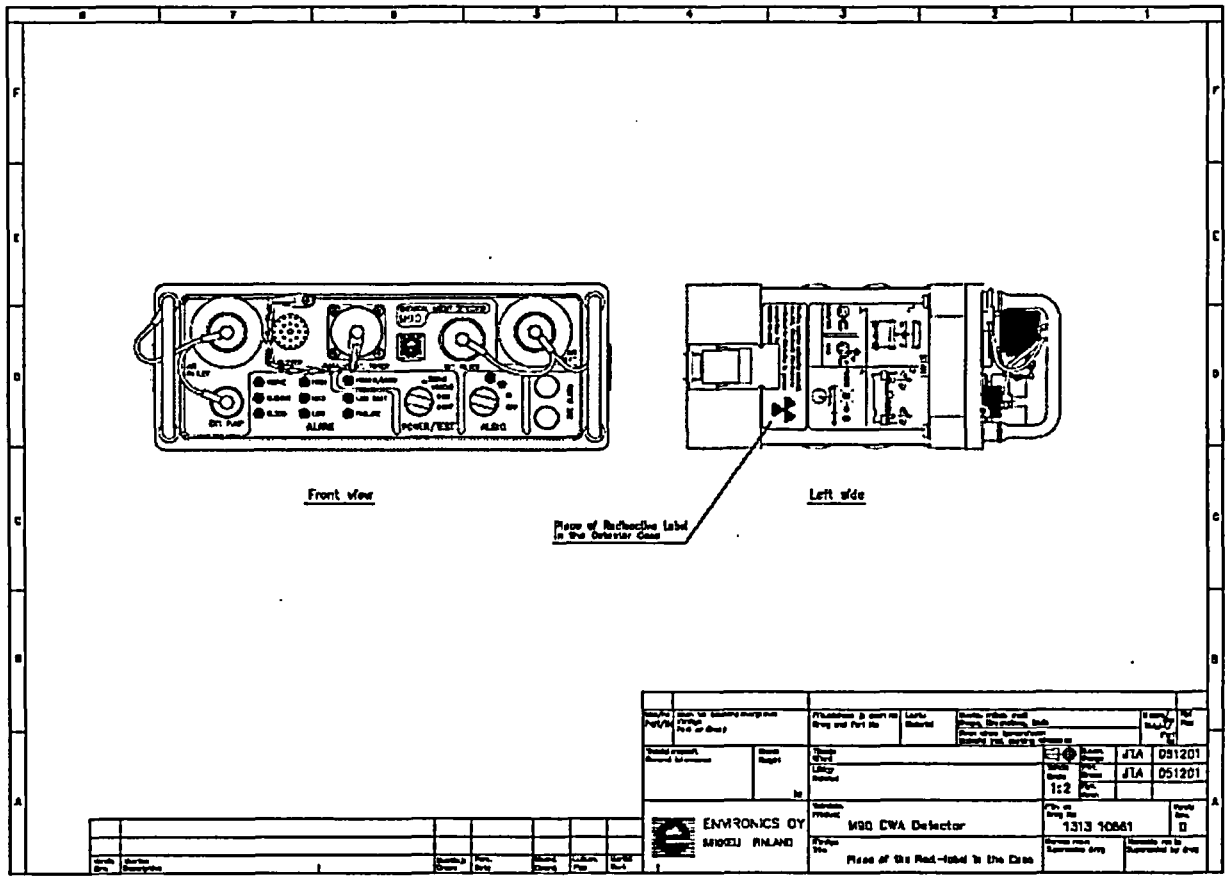


Figure 2: MGD-1, interface, external dimensions and sensor location



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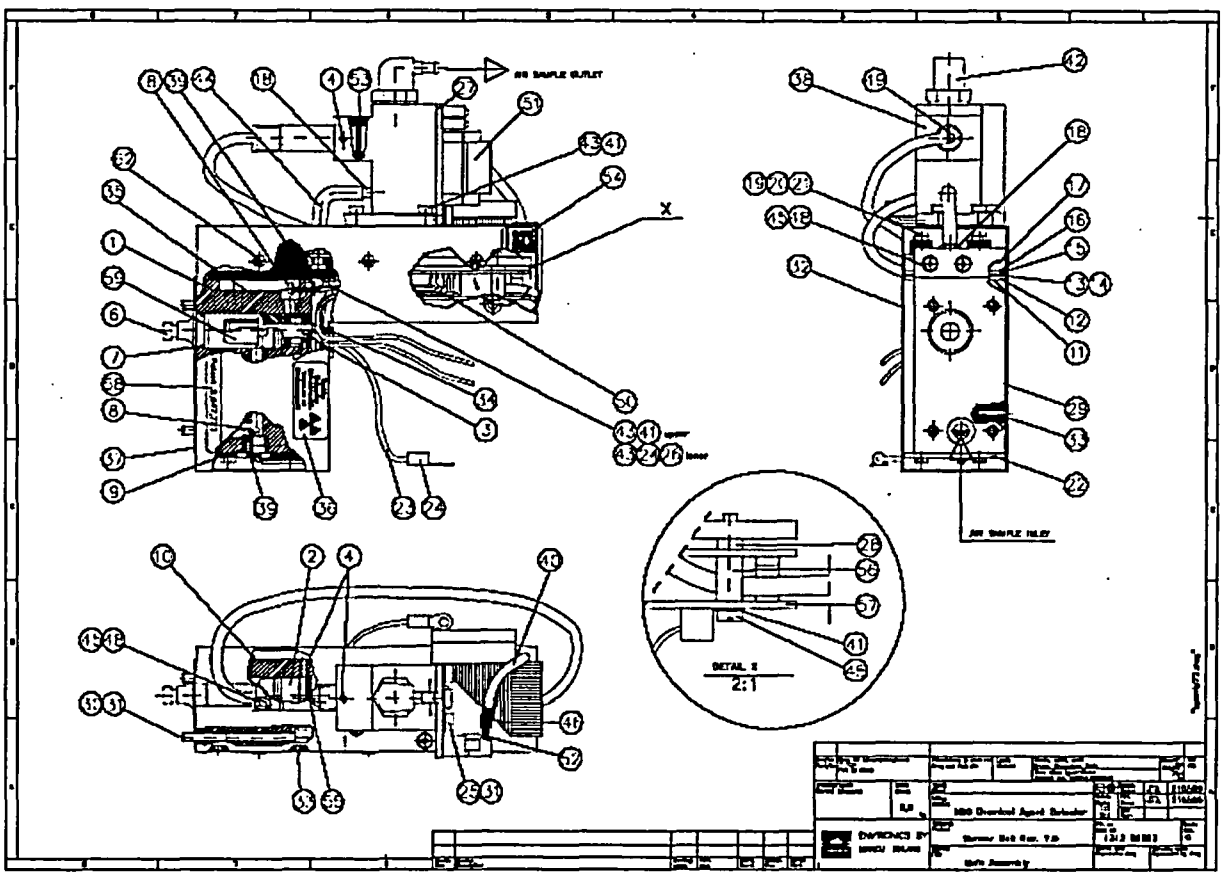

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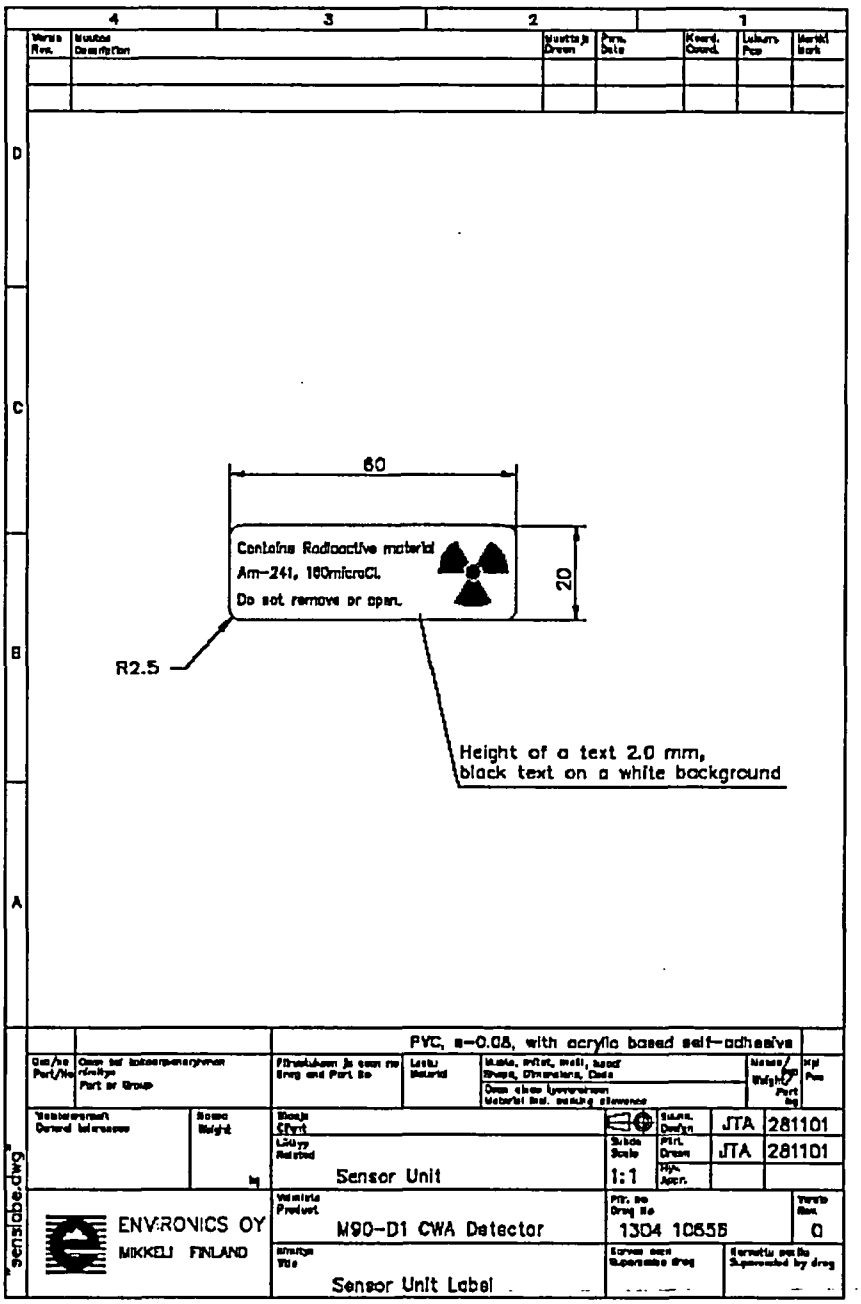

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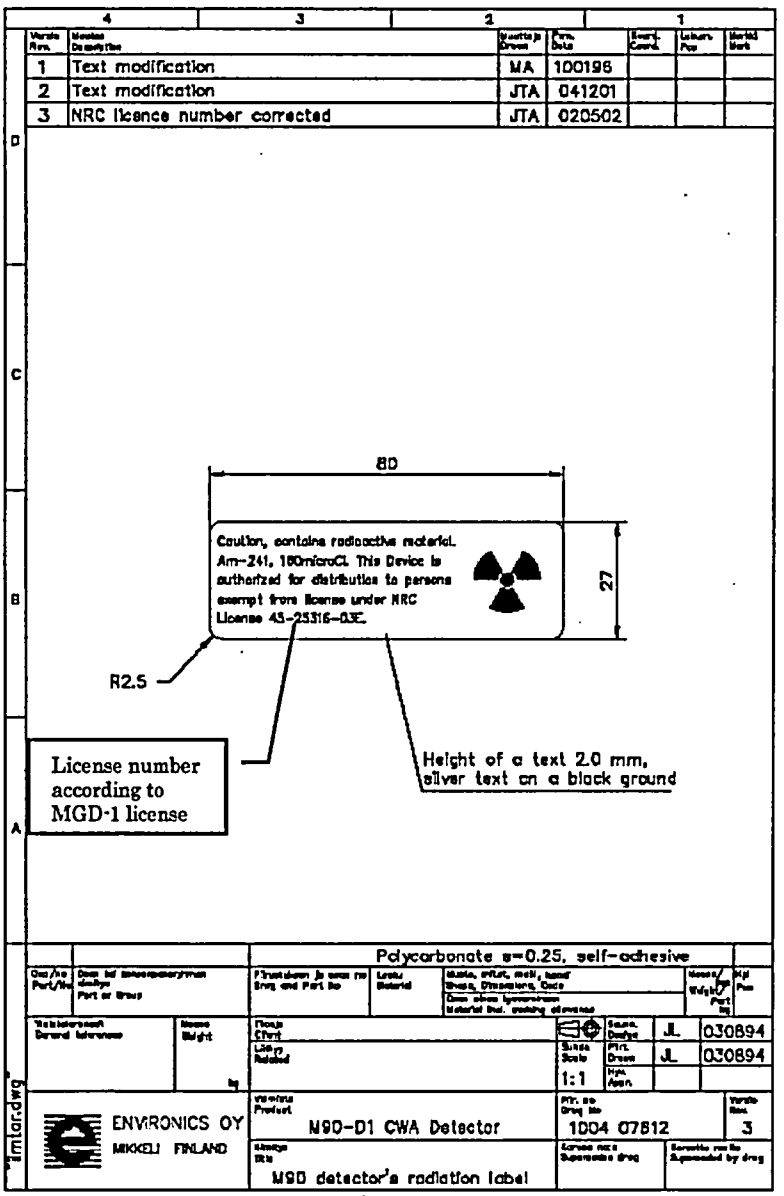
Environics	Prepared	Checked	Accepted	Changed
P.O. Box 349	Osmo Anttalainen			
50101 Mikkeli	11.8.2004			
Finland	MGD Drawing pictures extracted 8-11-04.doc			



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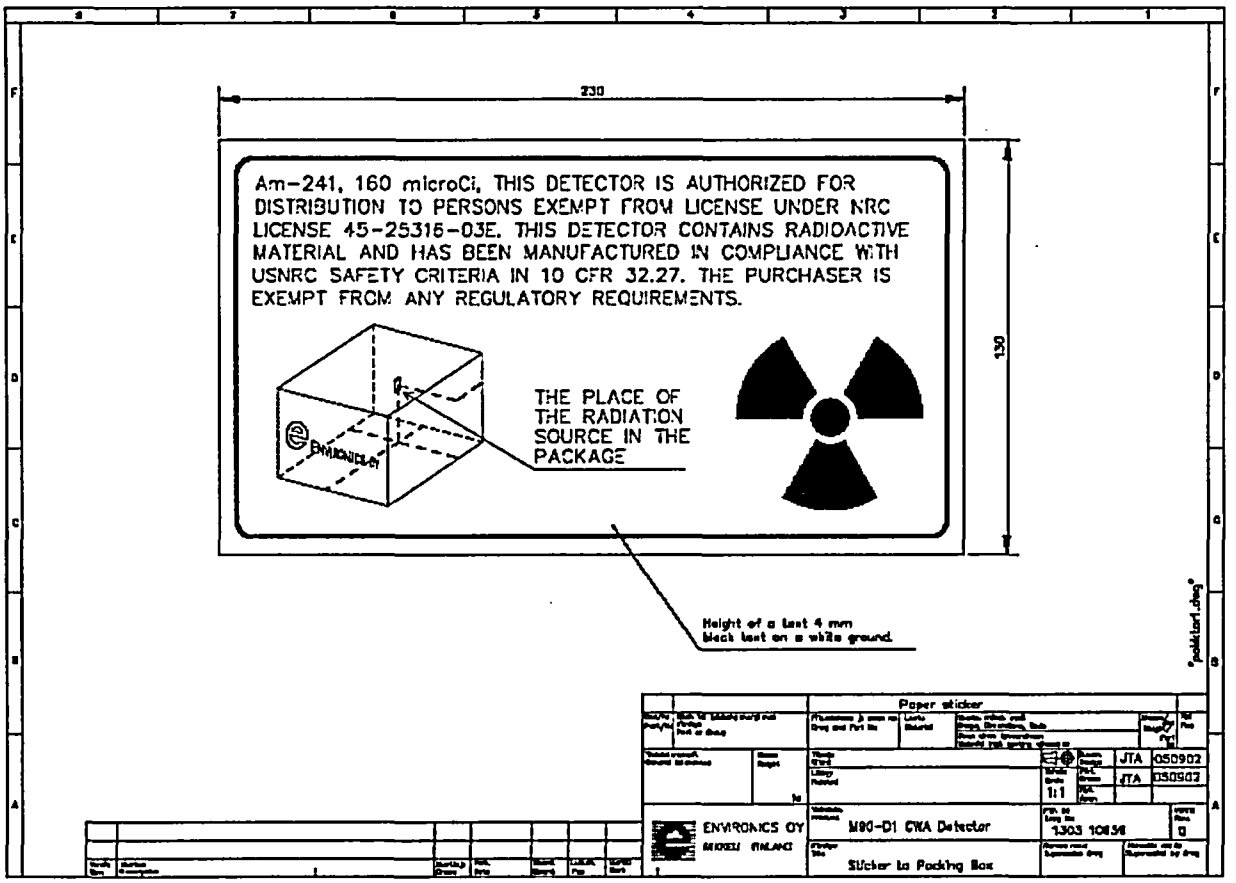


Figure 7: Position of warning label on package used for M90. Similar package is used for MGD-1. License number will be according to MGD-1-related NRC-license when available.

VTT

TELECOMMUNICATIONS LABORATORY RESEARCH REPORT NO. TEL2126/92

Requested by	Environics Oy Työmiehenkatu 2 50101 MIKKELI, Finland
Order	No. 420037, 09.04.92, Jorma Lampinen
Object	Mechanical durability test for the portable gas detector (Assignment no. TEL2163)
Test specimens	M90 Gas detector, Serial no. 005, preproduction series
Test program	According to MIL-STD-810D, 19 July 1983 "Environmental test methods and engineering guidelines"

1. Initial inspections
   - visual examination
   - functional check

2. Vibration test
   Method 514.3, Procedure I for category I, Basic transportation
   - Wide band random vibration test on the level depicted in fig 514.3-1, on three perpendicular axis
   - test duration 60 minutes/axis (total 3 hours)
   - test item is not operational during the test conditioning
   - after the test the visual and functional inspections are carried out

3. Shock test
   Method 516.3, Procedure IV - Transit drop
   - height of drop is 122 cm
   - one drop for each face, edge and corner, totalling 26 drops
   - the floor receiving the impact is two-inch playwood backed by concrete
   - after the test, possible injuries, and their inpact on the functionality of the test item is checked

Inspections:

1. Visual inspection
   Examination of the mechanical injuries

2. Limited functionality check
   - switch the test item on
   - check the alarms while plugging the inlet and the outlet of the test item

3. Functionality check
   - connect the test item to the personal computer
   - switch the test item on
   - check the alarms while plugging the inlet and outlet of the test item
   - verify that the test item reacts to the DIMP gas and the acetone gas

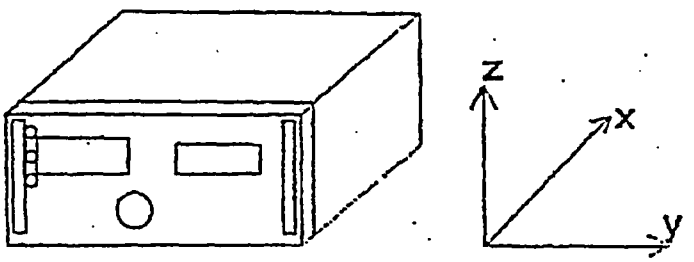
TEST RESULTS

1. Initial inspection

   - no remarks in visual examination
   - operationally in normal condition in functionality check

2. Vibration test

   Test directions are shown in the picture below.



Test item fastening to the shaker is shown in the snapshot attached.

During the test the batteries were in the test item but the item was inoperative.

After each direction the client made limited functionality check. No defects were noticed.

After the test the client made the functionality check. The item was functionally in normal condition.

Visual inspection showed no injuries.

3.1 Shock test - transit drop

Drop on six faces
- the air pump came loose of the motor
- when switched on the motor was running
The loose air pump was removed from the test item.

Drop on the four side edges
- the motor came loose
- data communication operated
The loose motor was removed from the test item.

Drop on the eight end edges
- permanent deformation on both handles, bending about 20 degrees

Drop on the eight corners
- additional permanent deformation on both handles, about 10 degrees
- data communication operated

After the test, the client improved the construction and the shock test was renewed.

3.2 Shock test - transit drop (renewed)

Drop on six faces
- test item passed the limited functionality check
- no mechanical injuries were found

Drop on twelve edges
- test item passed the limited functionality check
- premanent deformation on both handles, bending about 20 degrees

Drop on eight corners
- test item passed the limited functionality check
- additional permanent deformation on both handles, about 10 degrees

VTT

TELECOMMUNICATIONS LABORATORY RESEARCH REPORT NO. TEL2126/92

After the test the client made the functionality check. Test item passed.

Espoo 18.5.1992

TECHNICAL RESEARCH CENTRE OF FINLAND
Telecommunications laboratory

Senior Research Scientist
Risto Hienonen

Technician
Olavi Nevalainen

APPENDIX 1 page

M90-D1 CHEMICAL AGENT DETECTOR - HUMIDITY TEST

1 Equipment needed

The M90-D1 CWA Detector is tested in relative humidity range of 10 to 95 % RH in TNO Prins Maurits Laboratory (in The Netherlands) simultaneously with the real chemical warfare agent -testing. Testing is carried out at room temperature and with air that is contaminated with agent. Because of the M90-D1 teaching capability only a few detectors have to be tested in TNO.

Equipment needed during the testing:

-M90-D1 CWA-detector and the power supply M90-MP1,
-vapor generation system (in TNO)
-Meloy flame photometric analyzer, model PA 260-4 and model 460-1,
-Novasina MIK 3000-C capacitive RH-meter,
-PC and M90UIP-program,
-M90's device card (production card, 1094 04680 v1).

2 Preliminary actions

M90-D1 is started via a PC and M90UIP-software and let to stabilize for at least 15 minutes. At the same time the vapor generation system and all meters are switched on and let them to stabilize.

3 Test performance

The M90-D1 is tested in TNO in a wide concentration and humidity range in order to find out, how the concentration and humidity affect on the detector signals and responses, profiles, reaction times and detection limits.

Air contaminated with agent is generated by evaporating of the pure compounds and then diluting them with clean, pressurized air in the vapour generation system. Air streams are controlled with Hi-Tec F 201-EA mass flow controllers or by hand using rotameters. Experiments are carried out at room temperature and at different relative humidities. Humid air is generated by bubbling clean, dry air through a water column and mixing it with the contaminated air stream to obtain the required relative humidity. The contaminated air is supplied through the air inlet of the M90-D1.

The concentration of the agents is monitored with a Meloy flame photometric analyzer, or calculated from the loss of the weight of the source during the generation period and the dilution factors applied. The relative humidity is measured with the Novasina MIK 3000-C capacitive RH-meter.

The purpose of this testing is to teach every gas or agent to the M90-D1. The teaching is easily performed by exposing the M90-D1 to constant concentration of the gas in constant humidity and storing the signal pattern measured from the sensor into the internal memory of the M90-D1 as a part of the gas data library. These procedures can be performed with PC and the user interface program, UIP. To complete the teaching process the user then designates the agent (gas) a new

name, a gas class and its parameters, which are also stored in M90's memory.

As a result of the teaching there is a gas data library for every agent containing several classes having different concentrations and humidities. When measuring the M90-D1 compares the measured data to that of the gas library and alarms if certain criteria are fulfilled. This gas data library can be loaded into the internal memory of any other M90-D1, when the similarity of cells in every M90-D1 is guaranteed.

The similarity testing of the cells is done in Mikkeli, Finland using nerve-simulants (simulate the real agents) and other convenient chemicals, e.g. acetone. The testresults are compared to the corresponding data received by the detectors that were in TNO-teachings. Major differences cause always inspections, repairs and retestings of the cells. For example if the moisture has caused some deterioration the differences can be seen immediately in the profiles of the detector and they cannot be renovated without repairs.

The testing equipment in Mikkeli consists of custom-made syringe injector, reaction chamber, heating unit, mixing chamber, the needed air stream controllers and magnet vent. Humid air is produced like in TNO by bubbling clean, dry air through a water colums and mixing it with the contaminated air stream to obtaine the required relative humidity. The humidity is measured by Humidity & Temperature Indicator HMI31 made by Vaisala Oy. The concentration is checked by collecting vapor into the adsorbent and analysing it with a gas chromatograph.

The profile test agent, DIMP is generated by the DIMP-calibrator to ensure always identical exposures. The primary DIMP-profiles prior to the TNO (humidity) tests are compared with DIMP-profiles produced after the tests to verify the similarity. The profiles are considered identical, if the projection between the profiles are bigger than 0.97. The intensity of the radioactive source is followed indirectly by observing the total ions gathered: the sum of the 6 channels must be the same before and after the humudity test.

4 Test reports

TNO provides a test report after the testing period. It presents e.g. the response times and the residual contamination times for every agent concentration and relative humidity. Additionally all test data is stored in logfiles by computer and can be used afterwards.

Similarity test data are stored in files and every test is documented on the device card (1094 04660 V1) with the date and sign, when the detector has passed the test (on the back sheet of the device card).

Requested by	ENVIRONICS Oy PL 349 SF-50101 MIKKELI
Order number	430026, 24.3.93, Tarmo Karhapää
Object	Low air pressure test for the gas indicator. (Assignment no. TEL3138)
Test specimen	Gas indicator M90 A5 manufactured by Environics Oy
Test equipment	Low air pressure chamber - volume 0,1 m³ - minimum air pressure about 20 kPa

1 TEST PROGRAM

1.1 Initial inspection
- visual inspection
- functional inspection

1.2 Low air pressure test, IEC 68-2-13, Test M
- air pressure 70 kPa (700 mbar), approximate altitude above sea is 3000 m (from ISO Standard 2533)
- test duration at least 30 min
- functional inspections during pressure changes and at test pressure

1.3 Final inspections
- visual inspection
- functional inspection

2 TEST RESULTS

2.1 Initial inspections

Visual inspection

The outer parts of the specimen were inspected visually by naked eye. There were no remarks on the construction of the specimens.

Functional inspection

The specimen was connected to the clients PC-computer during the testing and by the specimen measured values of atmospheric condition was saved in files.
DIMP-alarm was checked with the test gas and the air flow was monitored with the flow meter connected to the outlet connection.

The function of the specimen was normal and the air flow was 2,25 l/min.

2.2 Low pressure test

The pump down to the test pressure takes about one minute and the pressure was maintained at 70 kPa about 30 minutes. After that the chamber was pressurised to the normal ambient condition.

The specimen functioned normally during the pump down and the air flow was at the low pressure 2,3 l/min. At the test pressure the specimen was witched off and then again on and there was no remarks in function, DIMP-alarm works and the flow control works normally.
The function was normal also during the pressurised.

2.3 Final inspection

Visual inspection
The outer parts of the specimen were inspected visually by naked eye. There were no remarks on the construction of the specimens.

Functional inspection
The function of the specimen was normal and the air flow was 2,25 l/min.

Espoo April 15, 1993

TECHNICAL RESEARCH CENTRE OF FINLAND
Telecommunications laboratory

Senior Research Scientist — Risto Hienonen

Technician — Olavi Nevalainen

M90-D1 CHEMICAL AGENT DETECTOR - TEMPERATURE TEST

1 Equipment needed

- software: YMPTST2 of M90, DIGICOM.EXE
- PC with serial, parallel port and DIGIBOARD (serial-bus card),
- PC-M90 Datacable,
- M90-MP1 Mains Power Supply,
- M90's Production card (1094 04680).

2 General

The temperature test of the M90-D1 CWA Detector consists of three parts: cooling to -30 °C, cold start and test in + 55 °C. The purpose of the test is to determine the starting time of the detector in cold and the operation of the detector in cold and hot atmosphere. Additionally it serves to ensure the function and efficiency of products at an early stage i.e. for testing the mechanical and electrical quality of a product. When comparing the responses of the detector to the previous normal ones it is possible to find out any failures in construction (defective radiation source, deteriorated cell surfaces, defective vacuum pump or other component,...), electronics or other parts of the M90-D1.

It is recommended to make the cold test first. Then it is easy to remove the condensed water away from the detector during the hot test.

3 Preliminary actions

Prior to testing YMPTST2 -program must be loaded into the memory of the M90-D1 and the DigiBoard installed in the logging PC. It is possible to test 8 detectors simultaneously. Then the detector casing is closed, the power supply is connected and the unit, which is not operating, is placed in the test chamber.

4 Cold test

The M90-D1 is allowed to stay in -30 °C temperature for 16 to 20 hours prior to the actual start. First the PC-program, DIGICOM.EXE is started, the file-logging is turned on and after that the M90 can be switched on. The name of the logfile can be anything, but the extension is always .CLD. It is recommended to use the detector name (serial number) as a logfile name.

The program stores cell temperatures and the measurement values of the six cell signals into the logfile every ten seconds. The maximum duration of the logging is 25 minutes. If the detector cell temperature has stabilized before that, the power led is on continuously and the cell signals are normal, the test can be stopped earlier. The unit has passed this test and the test data (starting time and the logfile) must be written down.

5 Hot test

The performance of the hot test is analogous to the cold test. The warming time prior to the start of the M90 and the actual hot test is 3 to 5 hours.
The logfile name is the detector name and extension is .HOT. The start of the M90 is made normally and after about 30 seconds there should be printed basic level calculation and channel signals on the screen. After that the M90 is changed to measurement stage and the cell signals are followed until they are stabilized.

6 Test reports

Each successful part of the temperature test is documented on the production card of the detector with the date and signed. Every test is compared to the previous well-proved values before the approval.

In cold and hot tests the logfiles are named according to the detector name and with extensions .cld and hot.

In any malfunctions the unit must be inspected, repaired and retested successfully. Only after that the detector has passed the temperature test.

STUK
Finnish Centre for Radiation and Nuclear Safety
P.O.BOX 14,
FIN-00881 HELSINKI
Tel. Int. + 358 0 759881
Telefax Int. + 358 0 7598 8248

(Supplement to type inspection protocol 1008/311/93, March 25, 1993)

July 21, 1994 1008/311/93

Instrument:	Chemical Warfare Agent Detector
Type:	M90 CWA Detector
Manufacturer:	Environics Oy P.O.BOX 349 FIN-50101 Mikkeli, Finland
Radiation Source:	5.9 MBq, Americium 241
Date of measurement:	July 12, 1994
Place of measurement:	Finnish Centre for Radiation and Nuclear Safety

Following measurements were made:

1. External dose rate on various sides of the instrument
2. External dose rate on various sides of the detector unit (sensor pack) detached from the instrument
3. External dose rate on various sides of the source box detached from the detector unit

The radiation meter used was: Smart ION, (Mini Instruments Ltd, Morgan Nuclear Safety Products, Great Britain), serial number 2144, (calibration data attached).

Results of measurements:

Local background (0.1 μSv/h) is subtracted.
For the symbols of directions of measurements, see attached drawings, picture 1 and 2.

1. Dose rates (in μSv/h) outside the instrument:

measuring direction:	A	B	C	D	E	F
dose rate:						
(at the surface)	0.2	<0.1	<0.1	<0.1	<0.1	<0.1

(10 cm from the surface): <0.1 μSv/h in all directions

2. Dose rates (in μSv/h) outside the sensor pack (measuring distance from the outer surface = 10 cm):

measuring direction:	A	B	C	D	E	F
dose rate:	0.3	<0.1	<0.1	<0.1	0.2	0.2

3. Dose rates (in μSv/h) outside the source box:

measuring direction:	A	B	C	D	E	F
dose rate:						
(10 cm from the surface)	0.4	<0.1	0.1	2.0	0.2	0.2
(5 cm from the surface)	0.6	<0.1	0.2	3.2	0.3	0.3

The maximum dose rate outside the source box is 10 μSv/h (obtained on the surface of the box in direction D).

Jaakko Tikkinen,
Physicist, Radioisotope Applications

Attachments: 1, 2: Drawings of the instrument (picture 1, 2)
3: Calibration data of the radiation meter

Environics

MGD - 1- S
Gas Detector

User's Manual

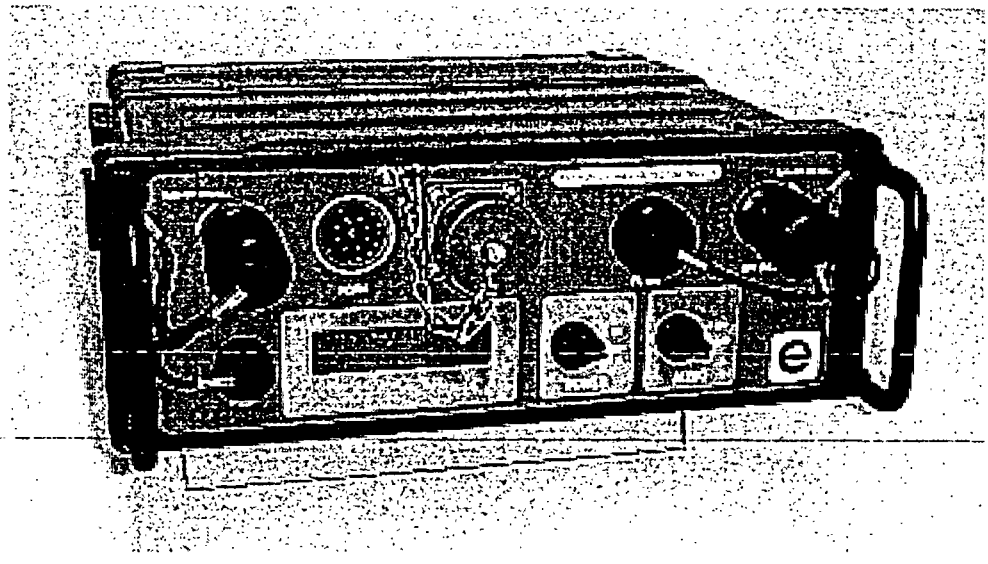


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Table of Contents

General Information

This manual includes instructions for using the MGD-1-S gas detector and the main features of the MGD-WinUIP program. Instructions are to be used as a guidance during normal operation but also as training material.

MGD-1-S is a fast and versatile gas detector which is manufactured in Finland. It detects and recognizes real time from ambient air gases and odors which have been saved in its memory. The detector can be programmed either to monitor changes in gas profiles or to identify gases and their concentrations.

The detection is based on the ionization of gas molecules in a measurement cell, IMCell™, which is internationally patented by Environics Oy. During operation, ambient air is continuously pumped through the device (~2 l/min). In the ionization chamber of the IMCell™ incoming sample gas molecules are ionized by ^{241}Am source. The ion clusters formed through ion molecule reactions are brought into different electrical fields perpendicular to the sample flow. This technique is based on ion mobility which is proportional to the molecular weight and charge. The ion clusters are collected to the six separate measuring electrodes forming a specific identifiable signal pattern for each type of gas. The detection is executed by comparing the measured profiles with the learned gas profiles in the memory of the MGD-1-S. From the measured signal level the concentration of the sample gas can be calculated.

MGD-1-S gas detector with IMCell™ method measures profile changes/concentrations continuously. The measurement cell requires minimum maintenance since the sensor does not use any catalysts or other consumables. The MGD-1-S can temporarily tolerate high concentration levels and it recovers quickly after the exposure.

The MGD-1-S detector can either be portable or permanently installed without the need for constant supervision. The LCD display shows the detected signal changes or the name and concentration of the calibrated chemical. In addition, failure messages are displayed if a malfunction occurs. The MGD-1-S provides both audio and visual alarms. After the alarm given, the concentration of the detected chemical is shown in a flashing display for 30 seconds.

The user can modify and optimize the characteristics of the MGD-1-S detector with PC. The MGD-WinUIP user interface program enables the user to adjust and set the working parameters, change the internal data libraries, save the measured data and teach new gases to the detector.

1 Important to know before Operation

It is possible to calibrate the MGD-1-S detector according to the customer's needs. If the detector is exposed to some gas for which it has not been calibrated, the detector might start recognizing. In the display the name of some gas from the current gas library as well as concentration values will be seen. These measurements are not reliable and the measured values must not be used. The detector measures correctly only those chemicals which it has been calibrated. If there is need to detect extra gases, please contact the supplier.

MGD-1-S detectors are also internally compatible which means that in most cases the gas libraries can be transferred from one detector to another. However, the other operating parameters vary between detectors and unauthorized changing of gas libraries and other parameters might lead to serious operating problems. Instructions and special training for adjusting and specialized operation are available from the supplier.

1.1 Radioactive Source

MGD-1-S contains a radioactive source 160μC of ^{241}Americium. Detectors have passed a wide range of tests and they do not pose any danger or risk to the user. However, unauthorized repair or disassembly of the MGD-1-S detector is not allowed.

Unauthorized repair or disassembly of the detector may result in exposure to α-radiation. If a malfunction occurs and this cannot be resolved with normal user operations, please, contact the nearest authorized service agency.

A detector that has been taken out of use has to be returned to Environics Oy for radiation source removal.

1.2 Safety Instructions

MGD-1-S is safe and riskless to use. However, the circumstances where a detector is used can be harmful or dangerous. It is not allowed to use a detector in EX classified rooms. When working with hazardous chemicals, remember to follow the safety instructions of chemical supplier.

2 Operation

All the switches, connectors and the LCD display as well as the air inlet and outlet are located on the front panel of the MGD-1-S. The battery or alternative power supply unit is clipped on to the bottom of the detector. When the detector is installed in a permanent position (fixed systems), power is supplied through the multipurpose data/power connector.

The air sample for analysis is drawn through the air inlet to the sensor unit. This unit consists of an internal dust filter, heater, air flow controller and the two separate sensors, IMCell™ and SCCell. After the sensor unit, the air flows through the Venturi tube and air pump before being expelled. The Venturi tube is used along with the pressure sensor to measure the air flow rate. The internal software keeps the air flow through the sensor constant by controlling the voltage supplied to the air pump.

The signals of the sensors are processed, converted into digital form and continuously analyzed by the internal processor. As a result of this real time analysis, the possible recognition of the gas/chemical will be done by indicating the name of the gas/chemical on the LCD display, and by the alarm sound if the audio alarm is switched on. The processor controls the total operation of the MGD-1-S including the start-up of the device, built-in testing and operational log recording.

The signal analysis software uses Advanced Signal Pattern Recognition Method, called ASPRM. The user can communicate with the MGD-1-S by the User Interface Program (MGD-WinUIP). This software is described more detailed later in this manual. (see chapter 6)

2.1 Main Parts and Connections

Figure 1 shows the main parts and connections of the MGD-1-S detector as follows:

1. LCD Display
When there are none of the detected chemicals in the air, the text "NO RECOGNITION" and some numerical values are displayed (IMCell and SCCell responses, relative humidity). A set information will be shown in display, when recognizing a chemical. A failure message is displayed if a malfunction occurs.

2. Filter Protection Gap and the Internal Dust Filter
In the normal case, the internal filter is not needed. Only when the sample air is dusty or sandy the internal filter should be used. When using the detector the protection gap must be carefully closed.

3. Buzzer
If the AUDIO switch is ON, the buzzer will sound during alarm (intermittent) or for a malfunction (continuous sound).

4. Air Inlet Protection Cap
The air sample is taken through this inlet. The cap should be removed before starting the operations. If necessary, the air inlet tube should be fitted to the inlet before starting the detector. The detector can be used when it's raining, if the protection cap is loosely placed (smoothly click the cap on). Keep the protection cap closed when not in use.

5. Data/Power Connector
This connector features a wide range of connections to various external systems such as PC, RS-232 and RS-485-communication, plotter etc. Using the MGD-1-S with PC requires the User Interface Program (MGD-WinUIP). Keep the connector protection cap fitted when not in use.

6. Power Switch

7. Audio Switch
If the AUDIO-switch is in the ON-position, the buzzer will sound during alarm and malfunction.

8. External Pump Connector
In a fixed installation, the tube from an external air pump can be connected to this connector. An appropriate air pump is specified by the manufacturer. Keep the protection cap tightly closed when not in use.

9. Air Outlet Protection Cap
The air sample flowing through the detector will exit via this connector. During operation it must be kept open. During transportation and storage this cap should be kept closed. When using the detector in rain, this cap should also be loosely placed as an air inlet protection cap.

10. Carrying Handles

11. Battery Box

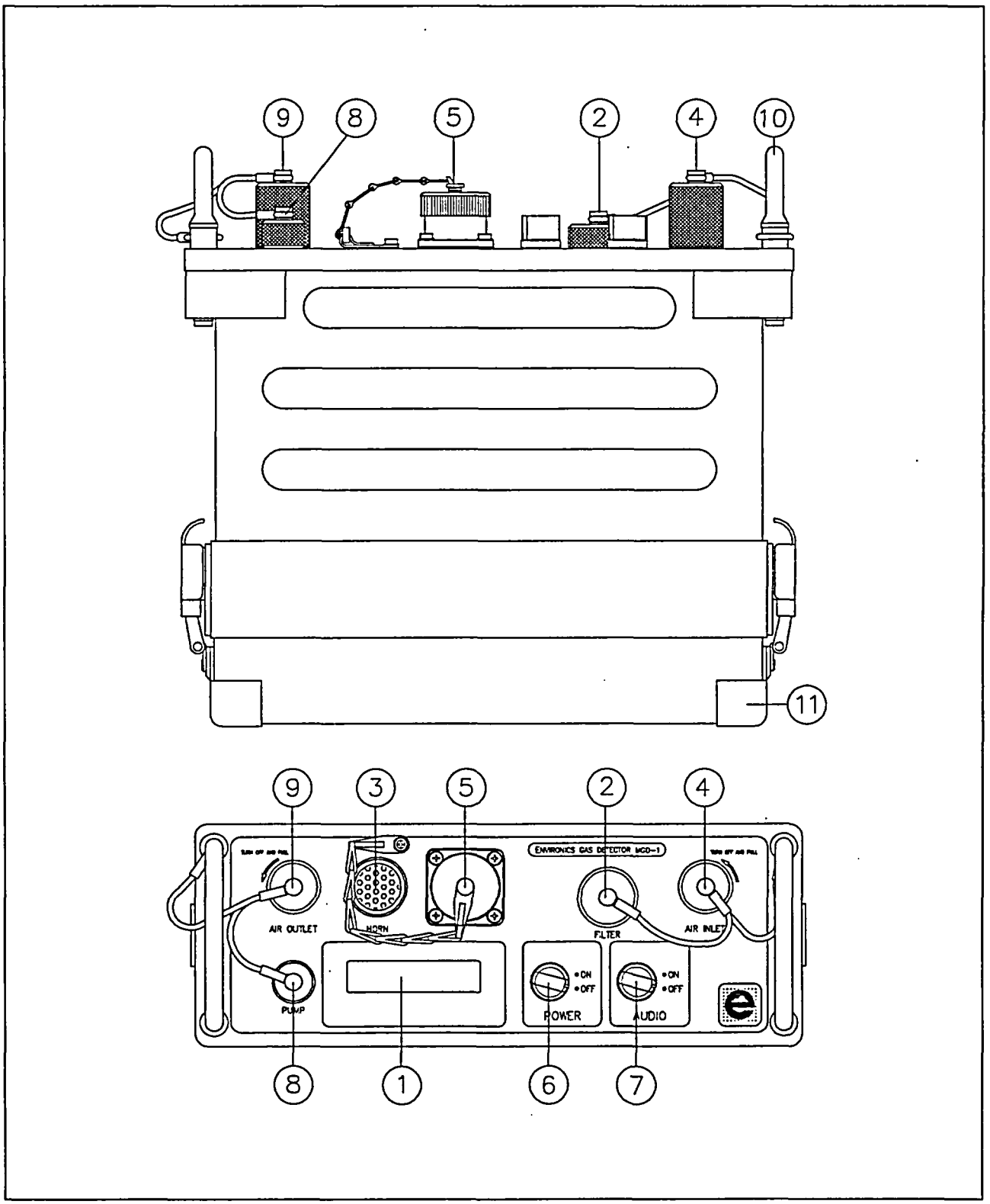


Figure 1. The main parts and connections of MGD-1-S Gas Detector

2.2 Preparations for Operation

MGD-1-S Gas Detector has a self diagnostic program that is activated upon start up and during the operations. This self diagnostic program continuously controls and monitors the operation of the detector. The items which are diagnosed are:

- Air flow through the unit (FLOW FAILURE)
- Power to the unit (VBATT FAILURE or VOLTAGE TOO LOW, TURN MGD OFF!)
- IMCELL™ operation (IMCELL FAILURE)
- SCCell operation (SCCELL FAILURE)
- Temperature (TEMP FAILURE)

If the self diagnostic program detects one of the above failures, the type of failure will be displayed on the LCD-display. If the alarm audio switch is in the on position, the detector will sound a continuous alarm. The self diagnostic program controls that all set-up parameters are correct, so that operation with "false set-up" is not possible. If the required set-up parameters cannot be adjusted, the detector will not start. The operator must perform the following checks to ensure the proper operation of the detector and to avoid giving failure alarms:

- Inspect to see if both the air inlet and outlet are open and free from blockage
- Check that the internal air filter and the external pump connector caps are tightly closed
- Visually inspect that serviceable battery or power supply is properly connected

2.3 Actions before Start Up

1. Check that the external pump connector cap, internal filter cap, and the Data/Power connector cap are tightly closed and install battery or other power source:
   a) Place the detector on a flat surface and turn it upside down.
   b) Open and remove the battery box cover and install a battery. Note that the battery box can be fitted in only one correct position.
   c) Ensure that the electrical connectors fit well together. Do not use excessive force.
   d) Close the cover and return the detector to the upright, normal operating position.

2. Open the air inlet by twisting the cap counterclockwise until it can be removed. Pull the cap completely off and let it hang by the nylon cord. By pushing the cap only halfway on, it will act as a rain shield.

3. Open the air outlet cap in the same way as the air inlet cap.

4. Set audio switch to the ON or OFF position.

5. Determine whether conditions are such to require an external micro filter (e.g. are there dust or other particles in the air).

2.4 Start Up

The portable detector must be started in the same configuration and under the same conditions that it will be required to operate. The start up has to be done under conditions where there are no extra chemicals in the air, because the detector will calculate the basic levels as zero. Ensure that the chemical sampling tube is connected prior to starting the detector (when used). In the laboratory, MGD-1-S can be started in normal ambient air or it can use so called reference air. To start up, proceed as follows:

1. Turn the power switch to the ON position.
2. After a few seconds the following text will appear on the LCD display:

```
SW V.N.N.N.N
READING EEPROM

INITIALIZING
HEATING SCCELL

INITIALIZING
HEATING IMCELL
```

At "HEATING IMCELL" state the sound of the pump can be heard. In the same time the self diagnostic program starts. At room temperature, the detector needs about 5 minutes to warm up. In colder temperatures the warm-up will take a longer time. The warm-up time also depends on the charge and age of the power source.

After warm-up the following text will quickly appear on the LCD display:

```
IMCELL CHECK
BLC CALCULATION
```

When the text "NO RECOGNITION" appears to the display, the MGD-1-S detector is ready for operation

3. If a malfunction is discovered during the diagnostic program a failure is displayed on the LCD and continuous alarm is given if the audio switch is in the ON position
4. During the startup procedure, if a failure is discovered, turn the detector off and refer to the troubleshooting section of this manual (see chapter 2.9)

2.5 Carrying Out the Measurements

The operation can be started when the text "NO RECOGNITION" is shown on the LCD display. When the detector has not been used for several days, it is recommended to wait about 10 minutes before starting measurements.

For example when making leakage measurements the detector can be placed in the carrying bag and with the inlet tube the air samples from pipe lines and tanks can be taken. It is not allowed to block up the air flow during the measurement. If a malfunction occurs (failure text in display), the detector has to be taken to a place where the concentration of chemicals is minimum since after recovering from the failure the detector will automatically calculate a new basic (zero) level. Measurements that have a basic level calculated in an environment which contains a significant concentration of some chemical are not reliable. The settings which control the automatic basic level calculation after malfunction and other failure settings can be adjusted with the MGD-WinUIP program.

2.5.1 LCD Display

At the normal situation the text "NO RECOGNITION" and three numerical values are displayed on the LCD display. First value is the sum signal response from IMCell™, second value is the SCCell response (semiconductor) and third value is a instantaneous value of the relative humidity.

When MGD-1-S recognizes a chemical, the name (or abbreviation) of the chemical is shown on the LCD display. If the concentration calibration is set, the concentration is shown on the LCD display in real-time. The names and concentration units that are shown on the LCD display can be set by the user's requirements. The graphic bar tells the user whether the concentration is within the reliable measuring range (see figure 2). When the concentration calibration is not set, the IMCell™ signal level is used.

If the detector is exposed to some gas/chemical which is not retrained to its' memory, the detector might start recognizing. In the display, the name of some calibrated gas as well as its concentration values may be shown. However, these measurements are not reliable and the measured values must not be used.

In addition, a failure message is displayed if a malfunction occurs. When connected to PC, the text "SERVICE MODE" is displayed.

On the LCD display the recommended measuring range of the concentration values is shown by a graphic bar. When the reliable range is exceeded, the graphic bar is at maximum.

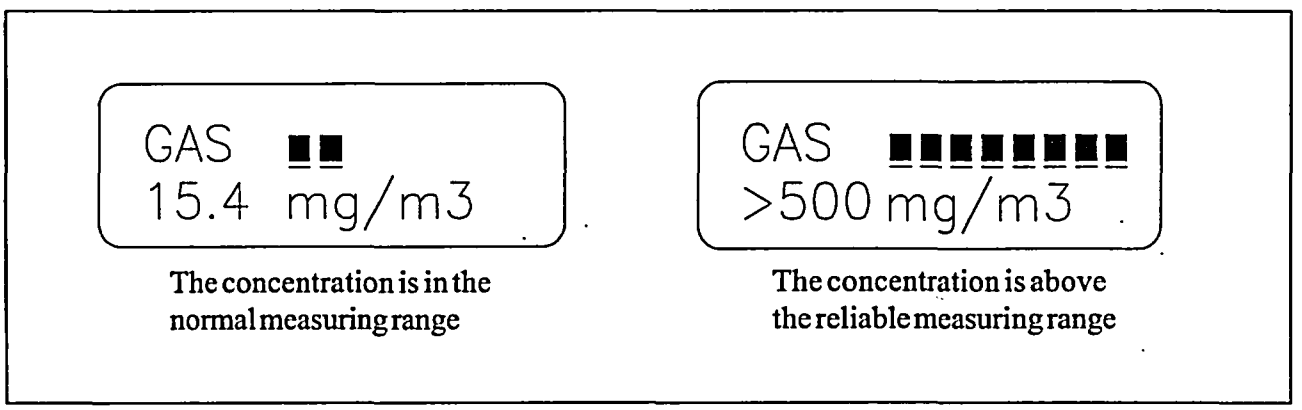


Figure 2. Reading the LCD display

2.5.2 Data Logging (extra function)

It is possible to save measured data by connecting the MGD-1-S gas detector to PC. Data logging requires a MGD-WinUIP user interface program and a communication cable for PC connection.

2.6 Operation under Unusual Conditions

The MGD-1-S gas detector can be used also under unusual conditions such as rain, dust and temperatures below 0°C (32°F), if the necessary precautions are taken. While operating under unusual conditions, it is important that dust particles or water do not penetrate inside the detector. If that happens, contact the nearest authorized service agency and ask for additional instructions or return the device to supplier for maintenance.

2.6.1 Rain

MGD-1-S Gas Detector is capable of operating also in rainy conditions. Ensure that the protection caps on the air inlet and outlet are placed on the rain position (pushed halfway on).

2.6.2 Dust

When operating under dusty conditions, the external micro filter should always be used. The filter is placed at the end of the inlet tube by twisting it clockwise until it fits tightly. Operation under very dusty or smoky conditions is not recommended.

2.7 Shut Down

1. Turn the power which to OFF
2. Remove the inlet tube and replace the air inlet and outlet protective caps.
3. Remove the battery or power source prior to extended storage (1 week or longer).

2.8 Sound Alarms

MGD-1-S Gas Detector has two types of sound alarms: intermittent and continuous. The sound alarms will work when the AUDIO swtich is ON. When an alarm sound is heard, there is always an information text in the LCD display as well. When a gas is detected, the name and the concentration are shown, and if a malfunction occurs, the failure message is shown.

When a set alarm limit is exceeded and a gas is recognized, the detector alarm sound is intermittent. The alarm sound will continue until the concentration decreases below the alarm limit. When a malfunction occurs, the alarm sound is continuous. The sound will continue until the failure is corrected, or the AUDIO/POWER is switched to OFF

2.9 Troubleshooting

If a failure message is displayed, always perform the following checks:

1. Inspect to see if both air inlet and outlet are open and free from blockages.
2. Check that the internal filter and the external pump protection caps are tightly closed.
3. Check that the used filters are at the proper condition (not blocked or dirty).

2.9.1 The Detector does not Start

If there is no text in the LCD display and/or the sound of the internal is not heard, ensure that the battery is charged and the battery or other power source is connected correctly. After charging or replacing the power source, start up again. If the failure is not corrected, contact the authorized service agency

2.9.2 Vbatt Failure / Voltage too low, Turn MGD Off!

VBATT FAILURE occurs when the battery voltage is too low. The detector will operate and measurements can be continued for a short time after this failure message appears in the LCD display. Replace or recharge the battery as soon as possible. After a short time the detector will automatically shut down and the message VOLTAGE TOO LOW, TURN MGD OFF! is shown in the LCD display. Now the battery should be replaced or recharged.

2.9.3 Flow Failure

The air flow is blocked. Check if the protection caps of air inlet and outlet are fully open. Check if the protection cap of external pump and internal filter are tightly closed. If filters (external or internal) are used, check if they are blocked or dirty and renew them if necessary. If the failure is not corrected by this procedure, contact the authorized service agency.

2.9.4 IMCell Failure

There is a malfunction in IMCELL™ operation. Shut down the detector for a couple of minutes and take the detector to a place where the chemical concentrations are at a minimum. After a couple of minutes, start up the detector again. If the failure is not corrected and you do not have the MGD-UIP Program, contact the authorized service agency.

If you have the MGD-WinUIP program, try the Decontaminate function (see Chapter 6.5.9 WinUIP/ Decontaminate). The chamber temperature should rise up to maximum (+80°C) for 10 minutes. After decontamination, wait a couple minutes before starting up the detector. If you start up too quickly the TEMP FAILURE will occur. If the failure is still not corrected, contact the authorized service agency.

2.9.5 Temp Failure

The temperature is not within the specified temperature. There is ambient air or sample gas in the measurement cell which temperature is not in the allowed range (+15...55°C). If you have the MGD-WinUIP program, check the set IMCell temperature value. If the temperature has been too high, try to cool the measurement cell to a lower temperature by letting cool air through the device and wait until the failure is over. Repeating the detection in the same circumstances will usually cause the same failure in a very short time. Try to measure in a cooler area or with cooler gas. If the temperature stays under +20°C, contact the authorized service agency.

2.9.6 RAM Failure

There is a malfunction in RAM memory. Contact the authorized service agency

2.9.7 SCCell Failure

The SCCell sensor is not working correctly. Contact the authorized service agency.

2.9.8 EPROM Failure

There is a malfunction in EPROM functions. Contact the authorized service agency.

3 Testing with Gas Detector

3.1 General

The testing is needed when changing the parameters of gas library or when teaching a new gas profile for the detector. The target for this kind of testing is to create similar circumstances as there shall be when measuring with the detector. Normally this means tracing the humidity ranges but sometimes also creating a special background air. The number of different testing conditions depends on application. Concentration calibration requires more testing than so called ON-OFF system calibration.

3.2 Simulating Circumstances

Almost in every cases so called vapor generation system is needed when simulating measuring conditions. Exceptions are testing on site, when the process conditions will be automatically taken into account. Such testing is usually so called sniff test, where the sample gas is sniffed directly from a bottle or other container. Naturally this disables the concentration measurements. The sniff tests are used only in cases where alarm detection (ON/OFF) is enough.

Three essential elements of the vapor generation system:

1. It has to be possible to generate the wanted process etc. conditions which means correct temperature, humidity, background level etc.
2. The system itself is not allowed to give any response, which means that all the pipes, tubes, surfaces etc. has to be clean.
3. It has to be possible to change one parameter in time (or several if it's necessary)

In the figure 3 there is a schematic diagram of the vapor generation system which meets the above mentioned requirements. The benefits of this system are for example the possibility to keep humidity constant when adding sample gas; possibility to create relative humidity ranging from 0 to 100%; short pipe lines after adding sample gas (which minimizes the contamination of surfaces thus optimizing the response and regressing time to be result of the MGD-1-S device not the system) and the possibility to generate several different kinds of test samples.

3.2.1 Operation of the Environics Oy's Vapor Generation System

System description

The air for the system should be available either from a compressor or equal. A pressure valve prevents any undesired pressure effects to the system. It is recommended to use an oil less compressor to avoid traces of oil in the sample air. Any remaining impurities is purified with a charcoal filter and the air is dried with a silica gel. The charcoal filter is recommended to be replaced twice a year, the silica gel can be regenerated by heating or renewed whenever the desired humidity cannot be reached anymore.

The purified and dried air is humidified by transmitting it partially through a water bubbling bottle. The amount of air through the bubbling bottle is controlled with a valve. The humidification effect can be increased by heating up the bottle. It is recommended to use distilled water in the bottle in order to avoid background signal from the possible contaminants in the water.

The air with the adjusted humidity is next transmitted to a T-piece where from the air is either going straight to the MGD-1-S as a dilution air, or to an agent generation line. As a key feature of the system the air source for both lines (dilution and agent lines) have the same humidity. In the agent generation line the desired amount of test agent is being mixed into the air. The mixing can take place in several ways, usually an infusion pump is being used for liquids. In the infusion pump the piston of a syringe is being pushed with a known velocity. From the parameters such as piston size, speed and total air volume the concentration of the sample gas can be calculated. A heating/cooling oven can be used for solid compounds. The sample is placed into the oven and the concentration is controlled with a temperature of the oven and with the air volume through the system. It is also possible to use commercially available diffusion tubes.

In order to avoid any time delays (system effects) in the response and recovery times of the MGD-1-S the agent line is connected to the dilution line just before the MGD-1-S. If desired an external humidity sensor can be connected to the air line after the MGD-1-S.

All the materials in the vapor generation system should not absorb gases and they should not cause any signal to the MGD-1-S. Teflon, glass and stainless steel are suitable materials.

The vapor generation system described above is available from Environics Oy. Please contact the nearest authorized service agency.

3.3 Testing instructions

1. Connect the MGD-1-S in the vapor generation system, start the air flow and the MGD-1-S. By this way the MGD-1-S samples purified air right from the start.
2. Test the system background by turning the 3-way valve on and off. The response in the MGD-1-S should not exceed 10 bits and the humidity should be steady. If this cannot be achieved the system may be contaminated and needs to be purified.
3. Start testing with the chemical.
4. When finished test the background signal again in order to make sure that all the sample has been vaporized out from the system.

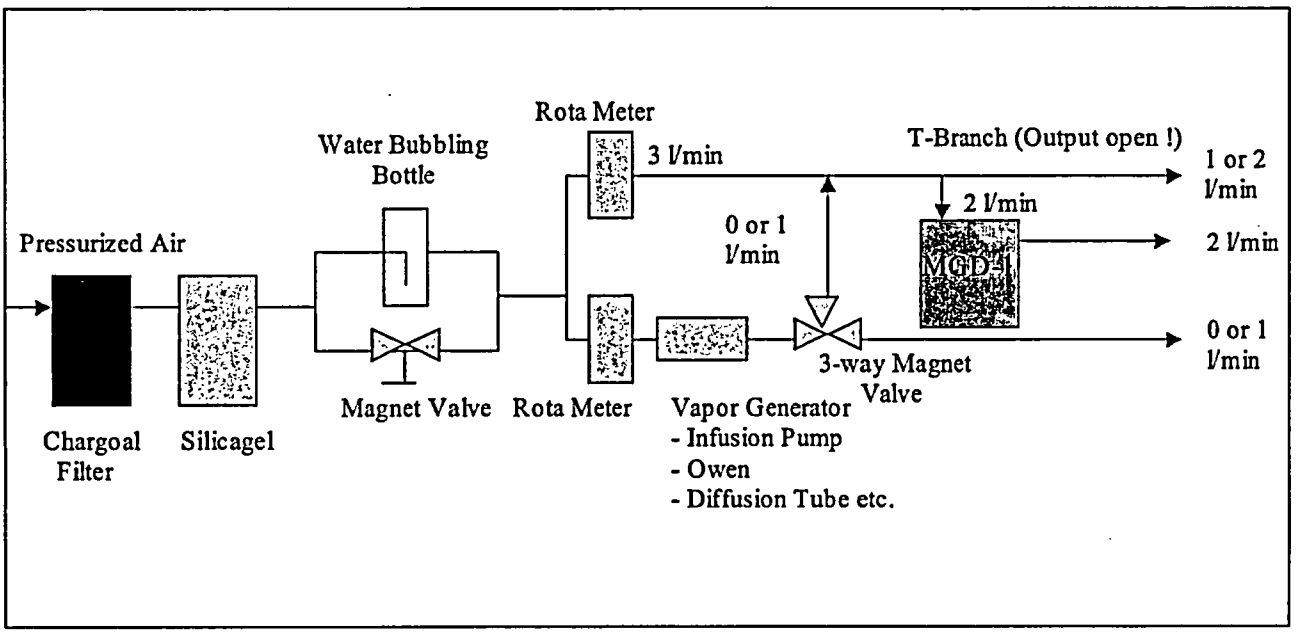


Figure 3. Operation principal of the vapor generation system

4 Service and Maintenance

4.1 Cleaning

Before cleaning the detector, check that all air and electric protector caps are tightly closed and the power is turned off. The exterior of the detector may be cleaned by spraying it gently with solution containing mild dish soap and water, or with a damp soapy cloth and finally drying its surface.

If the detector needs to be cleaned inside and you do not have the MGD-WinUIP User Interface Program, contact the authorized service agency. The cleaning by using the MGD-WinUIP is described in chapter 6.5.9/Decontaminate. Do not open the detector yourself!

4.2 Testing the Detector

The operation of MGD-1-S gas detector can be tested with a test gas, which gas profile has been saved to the memory of the device. Test as follows:

1. Have the detector operating for at least 30 minutes.
2. Bring the tester next to the air inlet (figure 4).
3. The detector should recognize the chemical within ten seconds. After recognition (the name of the chemical is shown on the LCD display) remove the test sample
4. If it is not recognized, remove the test sample and wait for at least 2 minutes. Then repeat from step 2 onwards by bringing the sample nearer to the inlet.

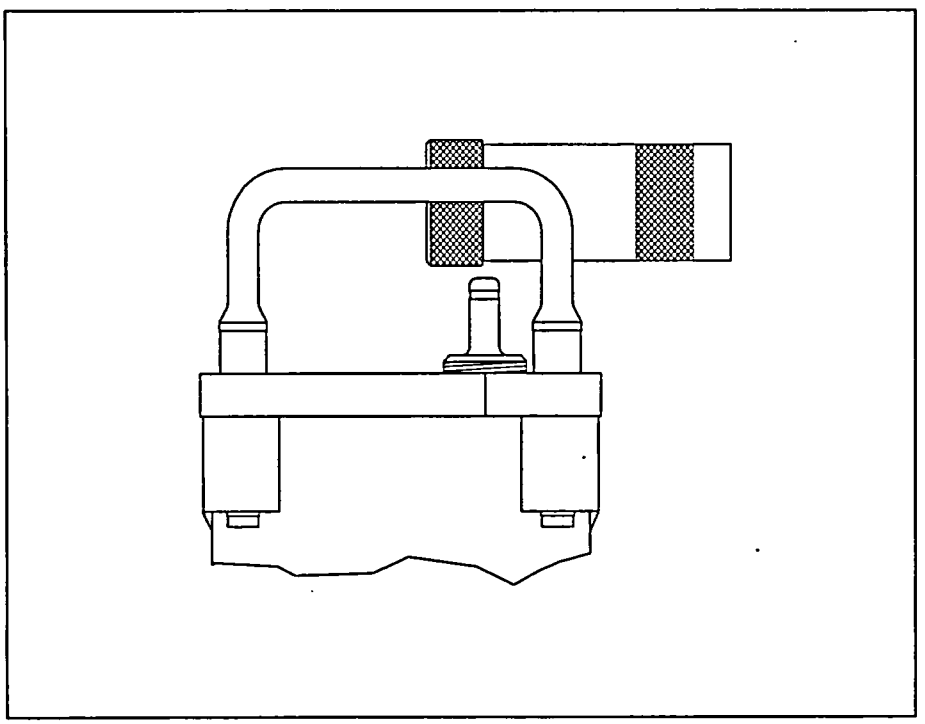


Figure 4. Giving a test gas sample to the detector

4.3 External Filter Replacement

With continuous use, the external filter must be replaced at least every 12 months or as necessary. After long storage periods the condition of the filter should be checked before taking it back to use. If the filter is blocked or contaminated it must be replaced immediately.

CAUTION! Filters have a limited life, and the use of old filters might cause damage to the detector. Use always new and original filters!

4.4 Power Source Replacement

The power source of the gas detector can either be a battery or a main power supply unit. Both power units are connected in the same way to the bottom of the detector. They are replaced as follows (figure 5):

1. Ensure that the POWER switch is OFF.
2. Turn the detector upside down on the table or any other flat surface. Open the brackets (1) on the sides of the detector. Remove the cover of the battery box (2) and carefully remove the battery.
3. Insert a new or serviceable battery or a power supply unit carefully into its place. Note that the power unit can be placed in only one position Be sure that the battery electrical connector fits into the battery or power supply unit. Do not use excessive force.
4. Gently close the brackets and turn the detector back to normal position.

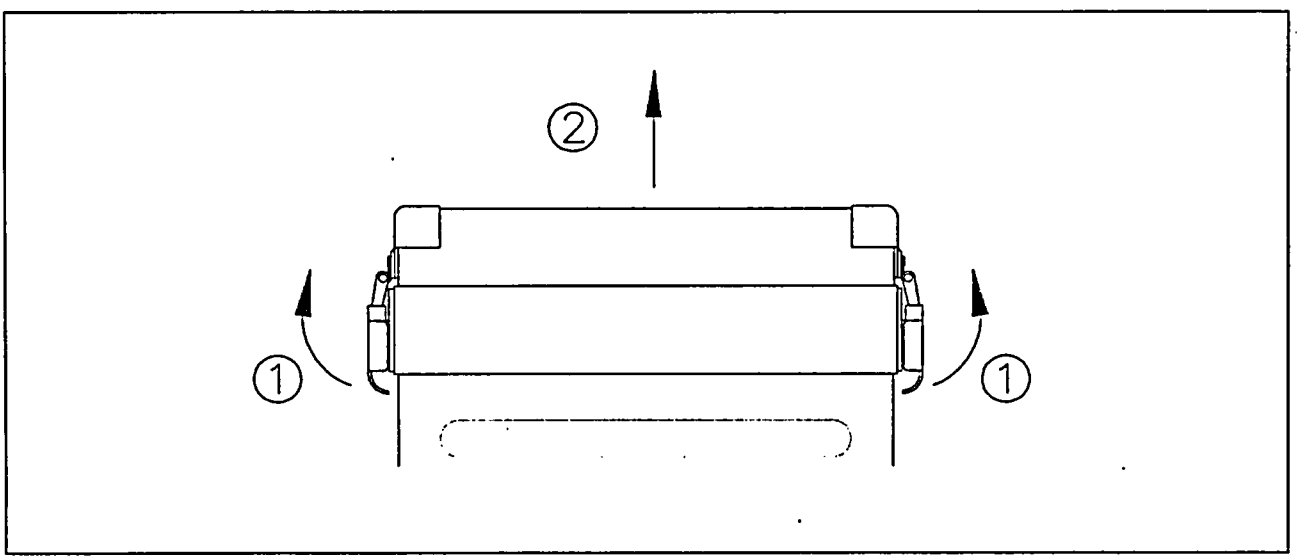


Figure 5. Replacing the power source

4.5 Charging the Batteries

Important when charging:
Recharge only NiMH batteries with the BC1 charger. It is not recommended to use this charger with other types of batteries because they might have different charging current.

When connected to a power supply, the battery charger charges a battery continuously. To recharge the battery, proceed as follows:

1. Plug the battery charger lead into the battery.
2. Plug the battery charger into the power supply socket (85...264 Vac).
3. A red led of the charger indicates the state of charging operation. If the battery is deeply discharged the red led blinks rapidly few minutes and then turns automatically on normal charging mode with a continuously illuminating red light.
4. The recharging time for the completely exhausted batteries are approximately six hours. When the battery is recharged the charger turns itself into trickle current mode and the led is blinking slowly. In this mode the charger keeps the battery fully charged and ready for operation.

NiMH battery can be charged and discharged hundreds of times, but finally its ability to be recharged declines. When the detector's operation time with a battery is considerably shorted, it is time to have a whole new battery. Used batteries should be recycled or disposed in a proper way.

5 Equipment

5.1 Carrying Bag

The carrying bag is designed for the MGD-1-S detector. It is intended for the storage and carrying of the detector. The shoulder sling strap facilitates the carrying of the detector over the shoulder. Backpack straps located in the rear pocket enable the detector to be carried as a front or rear backpack.

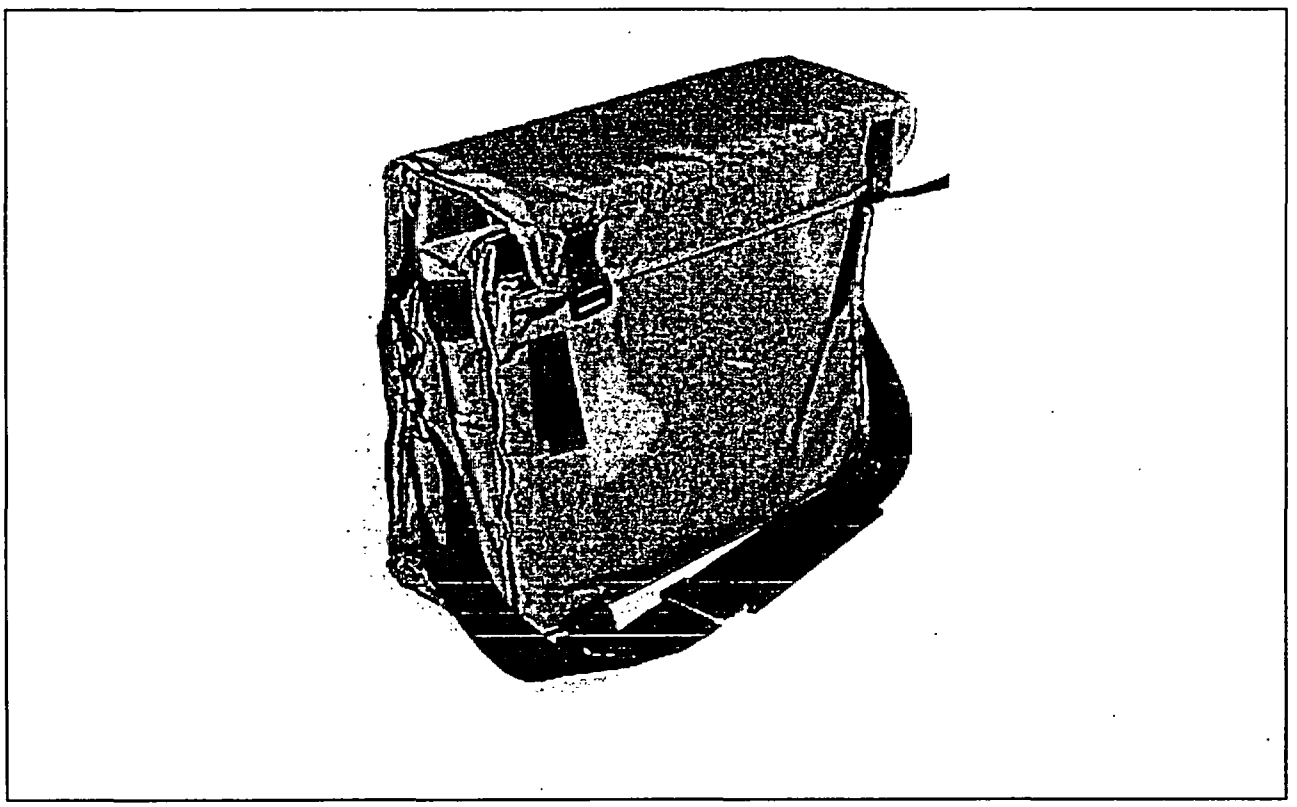


Figure 6. Carrying Bag

5.2 MGD-1-S Inlet Tube

The chemical sampling tube (Teflon, app. 1,5 m) is used with the detector in the chemical monitoring mode. The tube provides the possibility to monitor specific areas, for example, if a tube/valve is leaking. The tube is attached to the air inlet valve with a screw collar prior to the starting of the MGD-1-S. Under dusty conditions, the Micro Filter is attached to the tube. Do not use any other tubes in place of the MGD-IT Inlet Tube, because they might cause malfunctions during detection. If the tube needs to be replaced or extended, please, contact the supplier

5.3 Power Sources

The MGD-1-S is capable of operating with several types of batteries. In portable use the power source is battery. In fixed installation the main power unit is used.

The standard delivery of the MGD-1-S gas detector includes a rechargeable NiMH battery.

5.3.1 Rechargeable NiMH Batteries

The NiMH battery will operate MGD-1-S at room temperature continuously for about eight hours. At lower temperatures the operating time is shorter. It is not recommended to use MGD-1-S with a battery at temperatures below -5°C (23 F).

5.3.2 Mains Power Supply Unit (extra equipment)

The mains power supply unit is used in fixed installations or when having a longer term monitoring application. The power unit is attached in place of the battery and is held in place by using the battery cover holding clamps. The mains power unit can operate on the range of 85...264 volts (AC).

5.3.3 Vehicle Power Supply Unit (extra equipment)

The vehicle power supply is an DC/DC converter which converts a 10...32 V DC to the correct working voltage for the detector. The power supply is attached to a standard cigarette lighter connector, making it capable of being powered via the sockets in most vehicles. **CAUTION!** The vehicle power supply will operate the detector and charge a battery concurrently. Do not plug in and try to recharge batteries that are not rechargeable as they might explode when attempt to charged.

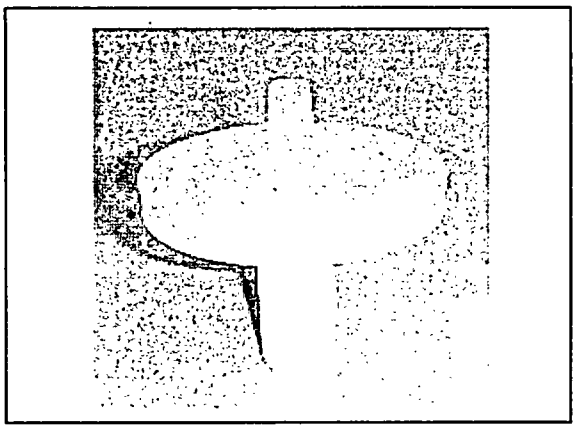


Fig. 7. External Filter with Adaptor

5.4 External Filter (extra equipment)

The external filter is installed over the air inlet of the detector. The filter is used to prevent small particles of dirt and dust from contaminating the detector. The external filter is used mainly in fixed installations but also with inlet tube. It should always be used when detecting under dusty conditions.

5.5 Battery Box

The battery box is needed when using NiMH batteries.

5.6 Battery Charger

The battery charger is designed to recharge one NiMH battery at a time. It requires app. 6 hours to fully recharge a discharged NiMH battery, less time if there is still some charge remaining on the battery. The batteries may be charged only when the temperature is between 0°C (32°F) and 40°C (104°F) and the working conditions are safe.

5.7 Communication Cable (extra equipment)

The communication cable is used to connect PC to the detector via the Data/Power connector. For communication the MGD-WinUIP user interface program is required.

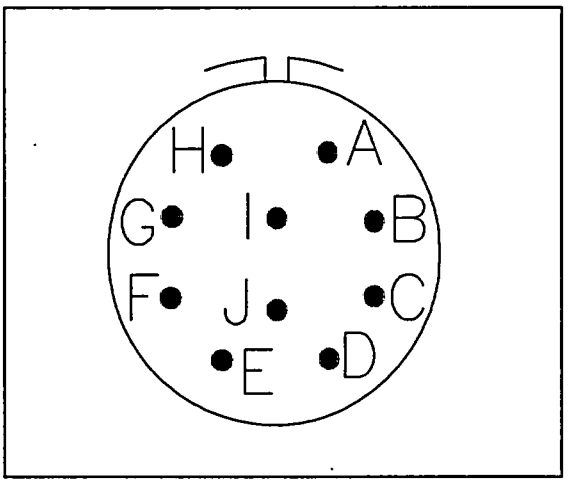


Figure 8. Data/Power Connector (front view)

There are 10 pins at data/power connector, which are marked from A to J as follows:

- Pin A: External System Control
- Pin B: External System Control
- Pin C: data interface, either TxD (RS232) or A (pos.terminal/RS485)
- Pin D: data interface, either RxD (RS232) or B (neg.terminal/RS485
- Pin E: Communication Type Selection (RS232/RS485)
- Pin F: PORTABLE/FIXED (fixed installation when grounded)
- Pin G: EXT PUMP CONTROL (control voltage to external air pump in fixed installation)
- Pin H: Analog Output (1 – 5 VDC)
- Pin I: Vms (power supply and charge in fixed installation or vehicle use)
- Pin J: GND

6 MGD Windows User Interface Program (MGD-WinUIP)

The MGD-WinUIP user interface program is a personal computer software program which is needed for communication between MGD-1-S gas detector and a PC. With this software it is possible to adjust and set working parameters, to save and monitor measured information in real-time, to manage the internal data libraries and to teach new gas profiles to the detector.

Note! The M90-WinUIP software used in Environics M90 CWA detectors is incompatible with the MGD-WinUIP.

6.1 General

The MGD-WinUIP software will run in PC type computer with Windows95, Windows98 or Workstation NT 4.0 operating system. A free RS232 serial port for connecting MGD-1-S detector is needed and the computer should have at least 16 Mb RAM memory.

6.2 Operating Levels

The MGD-WinUIP program has two levels, operator level and service level. The operator level enables communication with the MGD-1-S detector as well as monitoring and saving the measured data. At the operator level the changing of operating parameters of the detector and adding/changing/deleting internal gas libraries is disabled. At the service level it is possible to do above mentioned operations and to teach new gas profiles to the detector. The both levels are protected with a password. It is highly recommended to participate to a MGD-WinUIP training course before operating at the service level. At the table below there are listed enabled operations at different user level.

Operation	Operator Level	Service Level
Measuring	x	x
Decontaminating	x	x
Data Logging	x	x
Monitoring Parameters	x	x
Changing Parameters		x
Changing Libraries		x
Teaching New Gases		x

Table 1. Operating Levels

6.3 Installation

Insert the MGD-WinUIP installation disk into your floppy drive. Open the Setup program from the Start Menu by clicking on Run... Type a:\setup.exe and press enter. The installation will start immedialy. During the installation it can be chosen in which folder the program will be installed.

6.3.1 Starting the Program

Before you start the MGD-WinUIP program a MGD-1-S detector must be connected to a COM port of your PC. The MGD-WinUIP program can be started from Start Menu or if there is a shortcut on desktop by clicking it twice. The authorization window will appear and by entering a correct password the Start Window will appear. Default password for operator level is MGDWINUIP (uppercase!).

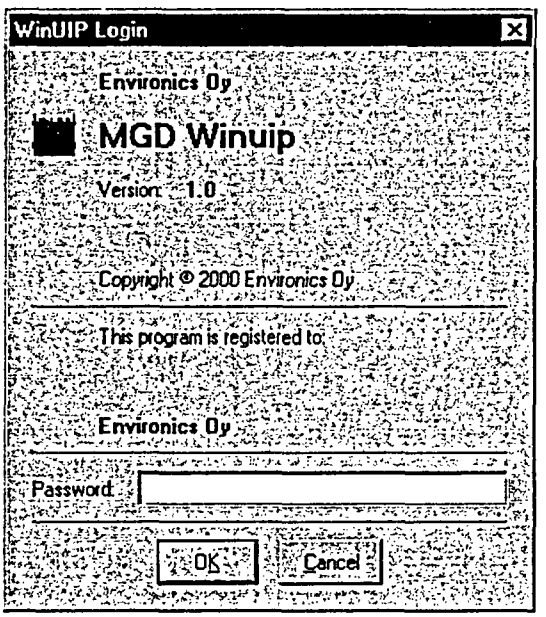


Figure 9. Authorization Window

Switch now the MGD on and wait some seconds. When MGD has done its initializations the MGD software version should appear on the Start window. If not, there is a communication failure between MGD-1-S and PC.

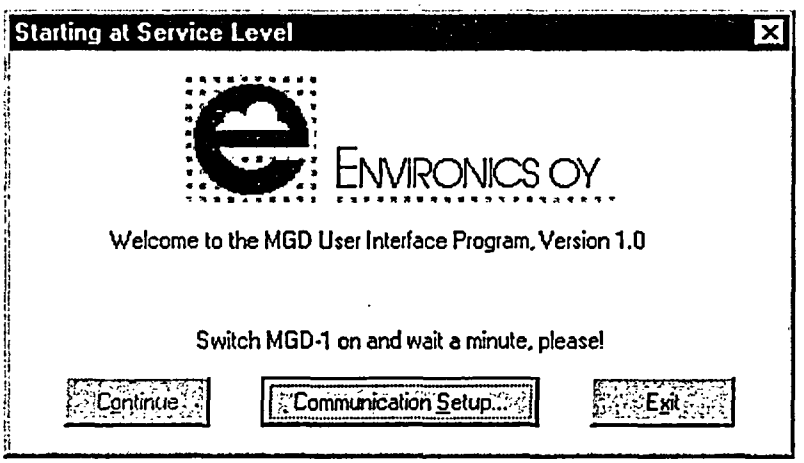


Figure 10. Start Window

Startup Window activates the Communication Setup button if there are some problems with communication between PC and MGD-1-S. By pressing the button, the Communication Setup window appears. There user can change the COM port by which the MGD-UIP program tries to communicate with MGD or the connection type. Normally the direct connect type is used. When an error message is displayed at MGD-WinUIP start-up, the connect type should be changed or the serial communication port is used by another device and should be changed. Other communication setup settings can only be changed by manufacturer.

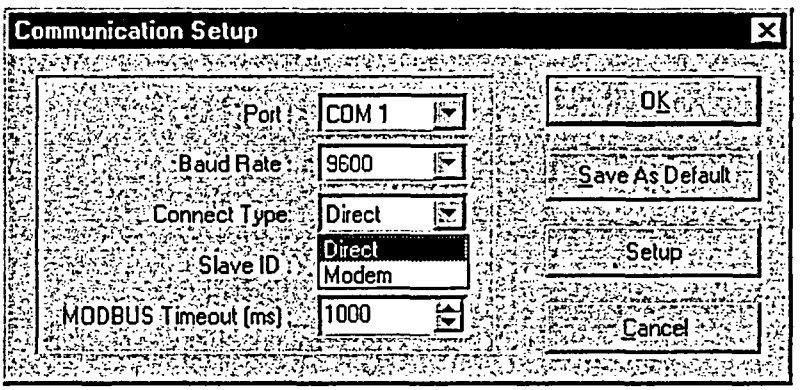


Figure 11. Communication Setup Window

When the communication succeeds the MGD software version is displayed on the middle text row. You cannot proceed from this window until MGD is heated up for correct operation. When MGD is ready for operation the PC will beep and enable the Continue button. Click the button to proceed MGD-WinUIP.

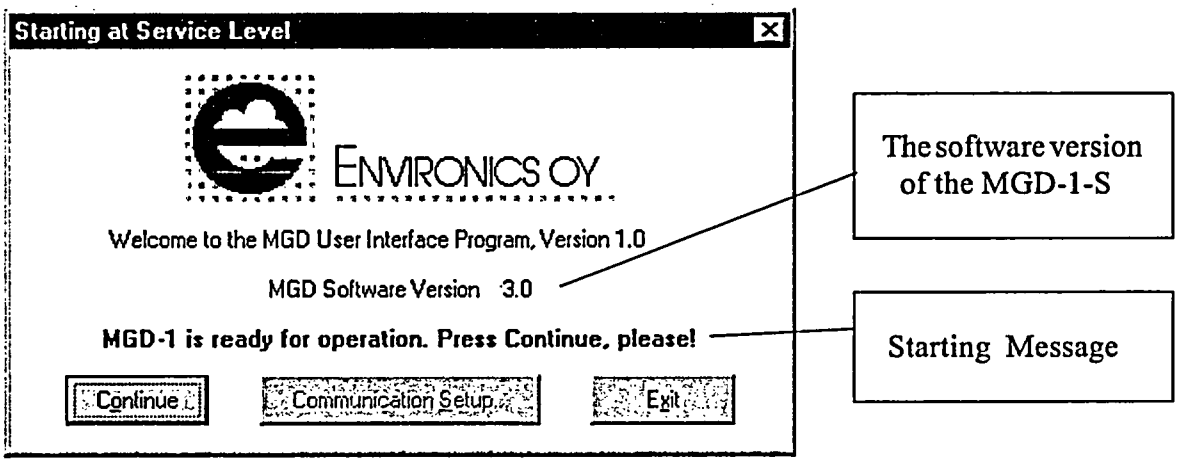


Figure 12. Message showing when the detector is ready for operation

The program can be closed by pressing the Exit Button.

6.4 MGD-WinUIP Main Window

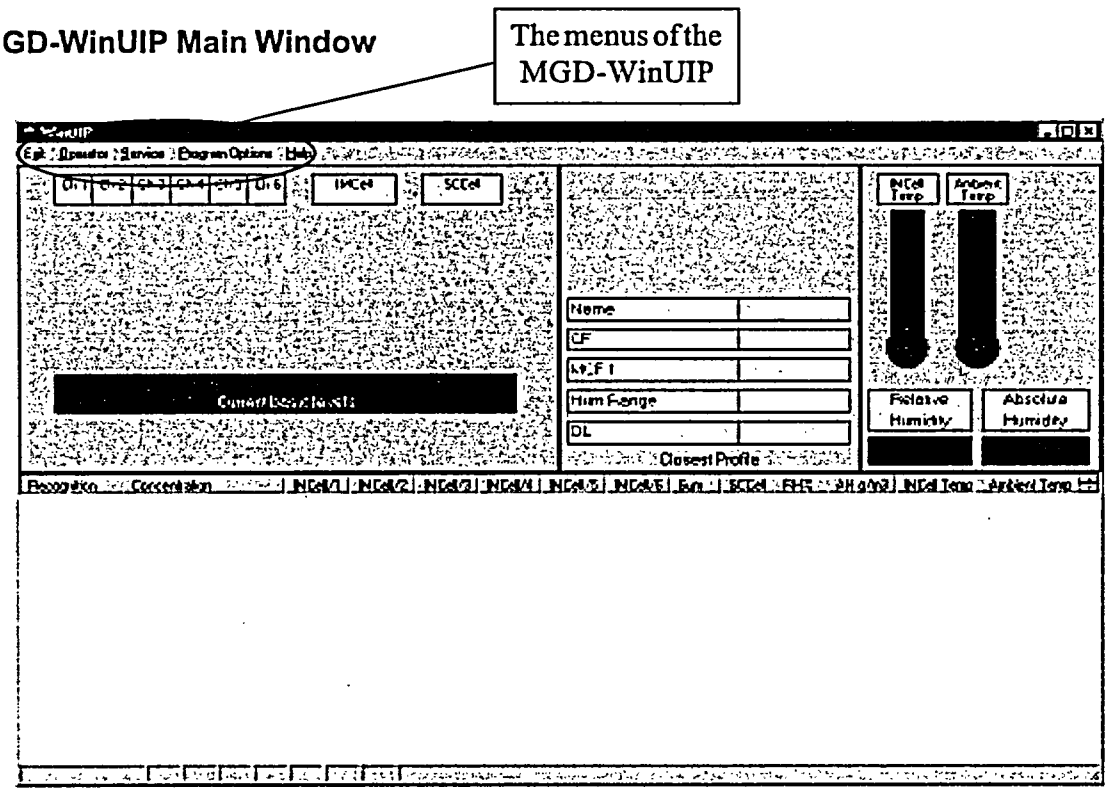


Figure 13. Pull down menus and the measurement display.

The MGD-WinUIP main window can be displayed either in terminal mode (as in picture) or in trend mode (see items 6.5.4 and 6.5.5). The lower part displays measure data numerically in terminal mode or as graphs in trend mode. The pull down menus of the main window are:

Exit	the MGD-WinUIP software can be terminated from Exit menu
Operator	
- Start/Stop Measure	starting/stopping the measurements
- Measure Options	setting of measured data type and basic level display
- Trend Options	selecting items to be shown on the trend display
- Terminal/Trend Display	toggling between terminal and trend display
- File Logging	saving the measured information
- File Logging Options	selecting the information to be saved
- Save Terminal	to save the last 200 rows into a file (only in terminal display)
- Decontaminate	starting decontaminate process of the sensor
Service	
- Adjust (Flow, Gain, Offset)	Setting and adjusting the working parameters
- Data Library Management	Managing the data libraries and teaching new gas profiles
Program Options	
- Password	Changing the used passwords
- Communication Setup	Changing the communication parameters
Help	
- Contents	Help topics
- About	MGD-WinUIP software version

6.5 Operator Menu

All of the submenus under operator menu are available to every user.

6.5.1 Start Measure

When the measuring is started from the Start Menu the program reads the memory of the MGD-1-S detector and a message box is displayed. This asks the user to select if basic levels should be calculated before starting measurement or not.

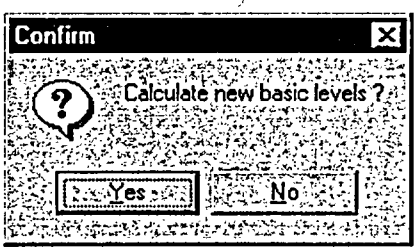


Figure 14. Confirm Window for Basic Level Calculation

When the measurement starts, the measured data is displayed on the lower part of the main window. The data will be showed numerically in terminal mode and graphically in trend mode (see items 6.5.4 and 6.5.5)

6.5.2 Measure Options

The IMCell™ signals can be displayed on the main window in two ways. They can be shown as relative to basic levels or as absolute readings. The selection is made in Measure Options dialog. When normal measure data type is selected IMCell™ signal levels are displayed relative to the basic levels. The response value can be negative or positive. Possible recognition and the closest profile are displayed only in this mode. When absolute is selected IMCell™ signals are displayed as absolute response levels above zero. In this mode any recognition information and the Closest Profile are not shown.

The Default Display group box allows you to select, which kind of measurement display, trend or terminal, is shown on the lower half of the measurement window as default. When basic levels have been selected to be displayed, they are displayed on the main window status line during measurement.

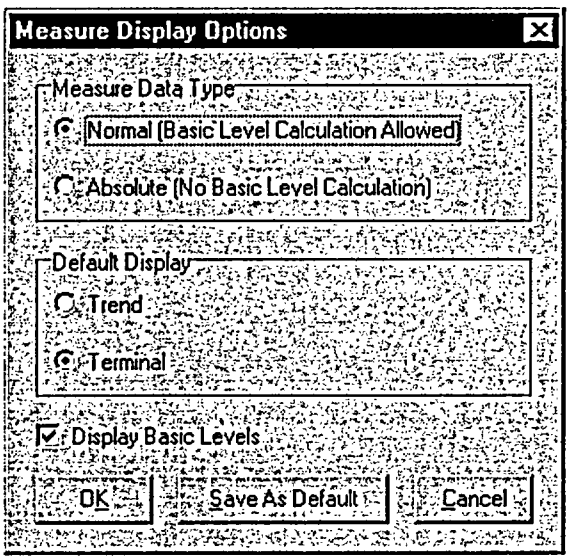


Figure 15. Measure Options

Note: The measure options cannot be changed during measurements.

6.5.3 Trend Options

On Trend Options dialog you can select which items will be shown on the trends (see item 6.5.5).

You can set the interval of how often the trend display is updated. If the trend update interval is more than one, you can select here which values are displayed on the trends. When selecting the Interval **Average**, the average value of the intervals is calculated for every item shown on the trends. If **Maximum** Sum of the Interval is selected, the signal values of an interval which are shown are the values of the moment when the sum was highest. When selecting **The Last Measurement** of the Interval, the last measurement values of the given interval are shown on the trends.

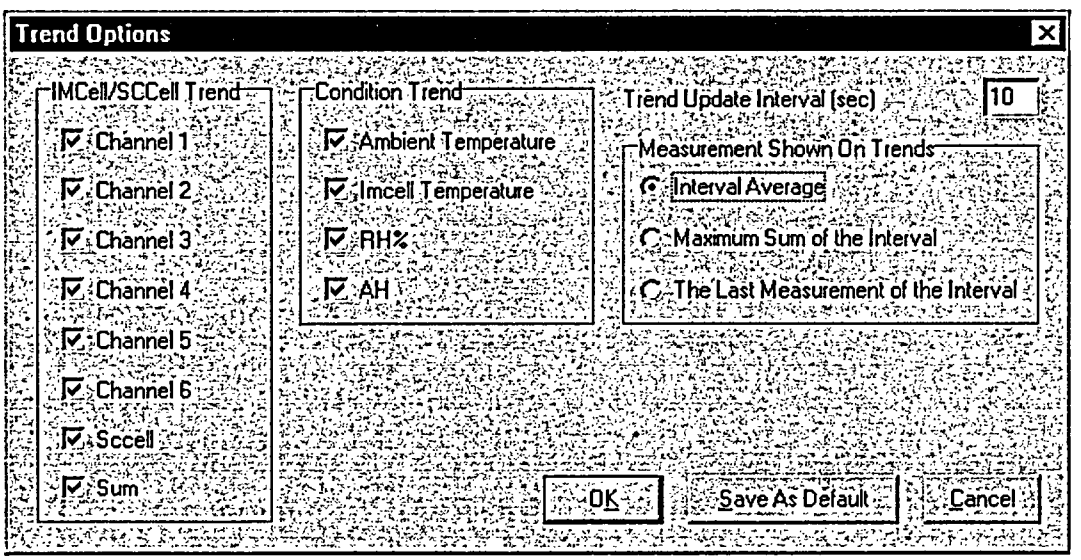


Figure 16. Trend Options Dialog

6.5.4 Terminal Display

When MGD-WinUIP is set to measurement state, it displays measurement results in the main window. The main window is divided to two parts horizontally. The upper part displays the measured data graphically and it is divided into three parts. The lower half displays measurement data numerically in terminal mode. The following information is available in main window, when measuring using terminal display:

1) The current data window at the leftmost displays graphically and numerically the responses of the six IMCell™ channels and the sum signals of the IMCell™ and SCCell

2) The closest profile window at the middle part shows the pattern and some other data of the profile which correlates best to the measured IMCell™ signals

3) The condition window at the right part displays measured condition signals, temperatures and sample humidity as relative and absolute.

4) The basic levels are shown only numerically. When any profile is recognized, its information is shown on the red background.

5) In terminal mode the measuring results are displayed in columns. The headers for these columns are shown on the header bar of the terminal display. Column widths of the terminal display are adjustable. The screen is updated once a second. Normally the following values are displayed:

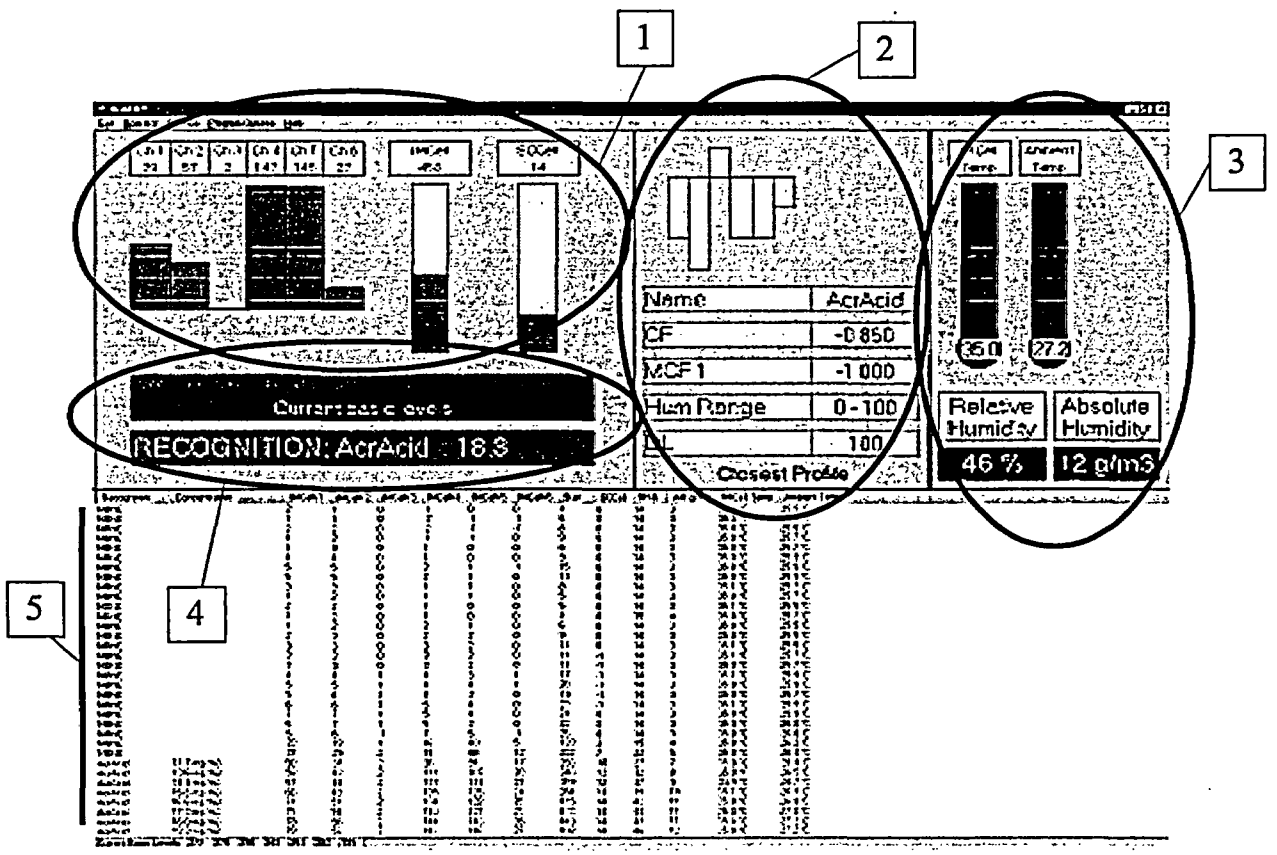


Figure 17. Measurement Display in the Main Window

- recognized profile name
- concentration
- signals of the six IMCell channels
- the absolute value sum of the IMCell values
- SCCell response
- IMCell RH%
- absolute humidity (g/m^3)
- IMCell temperature
- ambient temperature

Note that when MGD-1-S recognizes nothing the profile name NONE is displayed and no concentration value is shown.

6.5.5 Trend Display

The only difference between terminal and trend display mode is the lower part of the window. In the trend mode the measured signals are displayed graphically as a function of time. The left trend shown on the lower half of the main window is called IMCell™/SCCell Trend. The scale of the sum is shown on the right side of the trend and the scale for other signals is shown on the left side of the trend. The right trend shown on the lower half of the main window is called Condition Trend. The scale of the temperature signals is shown on the left side of the trend and the scale for the humidity signals is shown on the right side of the trend. As default the y-axis scaling of the trend displays is automatic, so that all measured signal values are shown on trends. The automatic scaling can be set off separately for each of the four scales.

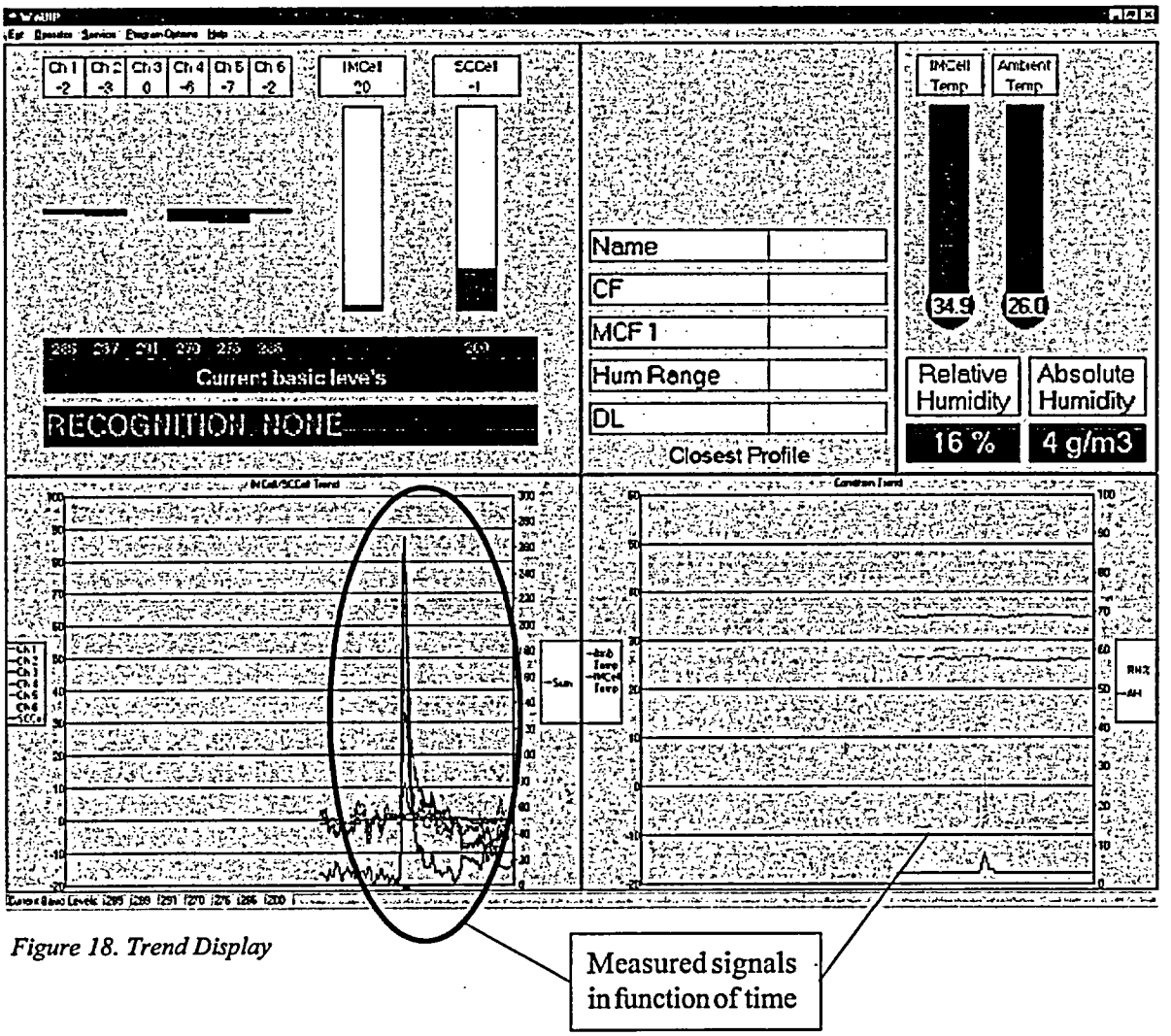


Figure 18. Trend Display

6.5.6 File Logging

The measured data including with date and time can be saved to a file if wanted. From Operator - File Logging menu the file logging can be set ON or OFF. The check mark on the File Logging menu item indicates that file logging is ON. During the measurement state the name of log file is blinked red on the status line when file logging is ON. When logging data an interesting measured signal row can be tagged in that file by pressing M-button.

The program always uses file extension LOG for files where measurement data is saved. Note that during file logging the basic levels are logged to a file which has the same name as measurement data file but extension BLC instead of LOG. And if MGD-1-S failure situations are detected during file logging, the failure data is logged to a failure log file which also has the same name but extension FLR instead of LOG.

When the file logging is set on the MGD-WinUIP displays a Data Logging dialog which shows the current setup for file logging. These options can be changed by pressing Change Options button of the Data Logging dialog. The same options can also be changed from Operator - File Logging Options menu.

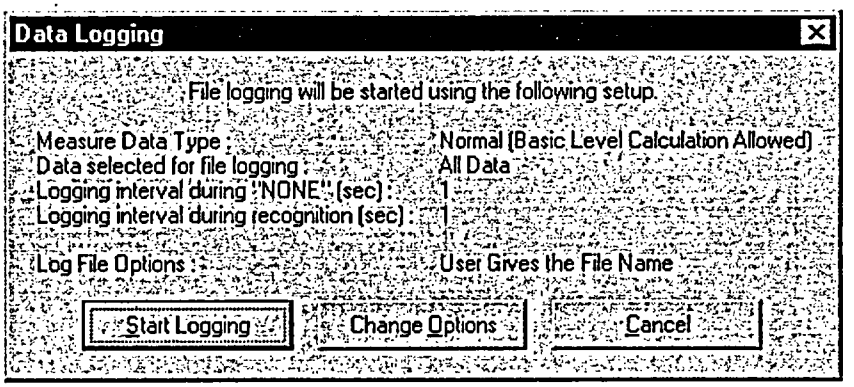


Figure 19. Data Logging Dialog

6.5.7 File Logging Options

When file logging is to be started the MGD-WinUIP opens a File Open dialog through which the user can enter the name for the file where measure results are logged into. This can also be automatic, where MGD-WinUIP itself generates the filename from the current date and time. The name of the log file will have the format YYMMDDA.LOG or YYMMDDP.LOG. When the MGD-WinUIP will be logging data for a long period, the program will change the filename at about 12 o'clock (according to the time set in the PC). An "A" in the file name indicates time before twelve o'clock and "P" past it. So one log file can not contain measure data more than for a half day.

When the log file option "File per Measure Period" is selected the program automatically generates filenames from the date and time. The names of log files will have format YYYY-MM-DD HH-NN-SS.LOG, where YYYY = the year with four digits MM = the month with two digits DD = the day with two digits HH = the clock hours with two digits NN = the minutes with two digita SS = the seconds with two digits In this mode the MGDUIP program saves the measurement data between two basic level calculations to an own file. Every time when MGD calculates the basic levels during measurement state the new file with a unique time stamp as the file name will be created.

User can select which data should be saved. When All Data is not checked you can select item by item what you want to be logged. Note that when MGD-1-S recognizes nothing the profile name is logged as NONE and no concentration is logged.

Also intervals on which data is logged to file can be selected. The value of During "NONE" edit box is used as log interval when MGD-1-S does not make recognition to any profile. The value of During Recognition edit box is used as log interval when MGD-1-S recognizes a profile. The selection of File Logging Options box is meaningful only if at least either of the logging intervals is greater than one. (see item 6.5.3) When selecting **Average**, the average of the measurements on the logging interval is saved to the log file. If **Maximum** is selected, the measurement data on the interval is from that point, where the sum signal is the highest. When selecting **Current Value**, the last data of the logging interval is saved to the log file.

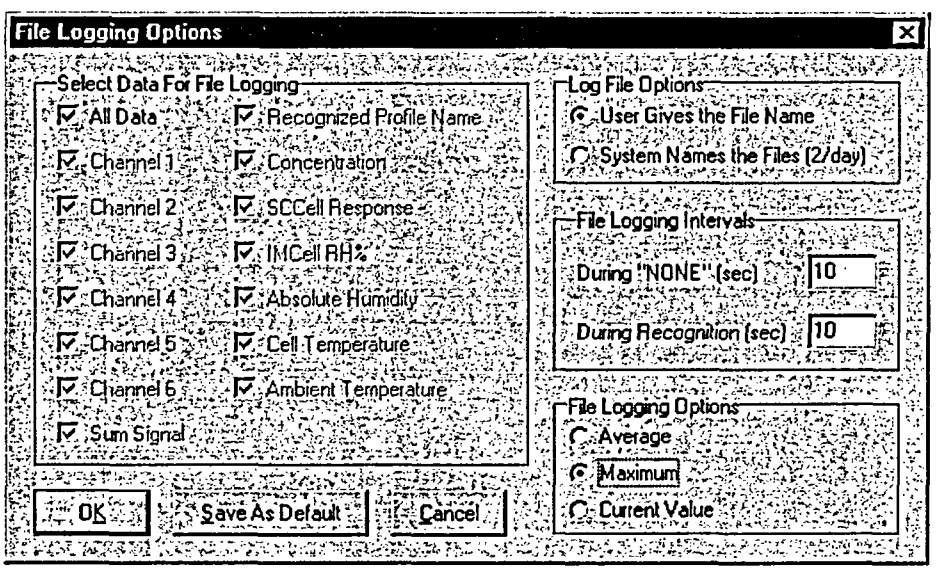


Figure 20. File Logging Options

6.5.8 Save Terminal

When the terminal mode is selected for displaying the measurement data, the Save Terminal function can be used to save the 200 last data rows into a file (also including date and time). This function can be activated from Operator - Save Terminal menu or by pressing F4 function key.

6.5.9 Decontaminate

Decontamination process will heat the MGD's sensor chamber up to +80 C. The heating will speed up the removal of all the traces of any contaminant from the chamber (for example condensate water).
The decontamination process is started by pressing F7 or from Operator – Decontaminate menu. The Decontamination dialog will appear. There you can select the heating time from one minute to 30 minutes or the continuous decontaminating. By pressing Start button the decontamination process will start. During the heating process and during the stabilization the responses of all six IMCell™ channels and SCCell are displayed on the main window with RH and temperature values. The heating of IMCell™ continues until the selected heating time is passed. Then the heating will be stopped and the stabilization process will be started. During the stabilization process the IMCell™ temperature will stabilize back to the set value (normally +35°C). The stabilization will always take 20 minutes.

The heating process can be aborted by Abort button. The button press will stop the heating and change decontamination process to stabilization phase. When the continuous decontaminating is selected, it will last until the user aborts it. At any phase you can close the Decontamination dialog by Exit button. If you exit during heating phase the heating will be stopped and the temperature begins to stabilize towards the normal operating value.

Note! If you exit before the stabilization is completed you must not start new measurements until the IMCell™ temperature is back again at the normal operation temperature level.

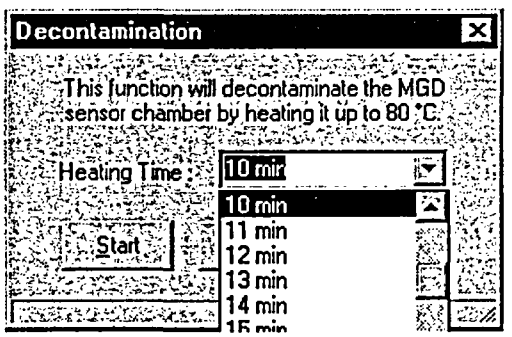


Figure 21. Decontaminate Window

6.6 Service –valikko

Service Menu is available only when you have started the program with the service level password. Under the Service menu you can set and adjust parameters (Adjust) and modify gas libraries (Gas Library Management)

6.6.1 Adjust

The subitems below Service - Adjust menu are meant only for fully qualified service personnel. They are used at workshop maintenance and repair levels of the device. From the submenu you can select Flow, Gain and Offset parameters to be adjusted.

6.6.1.1 Flow

On Flow Adjust dialog the current sample flow value is updated continuously. It is shown as units read from an A/D converter which converts the voltage given by a flow meter to digital units between 0 and 1023. The pump is controlled digitally by writing a value to a D/A converter. This converts the digital value (0..4095) to voltage which controls the pump rotating speed. The pump control value is also displayed as per cents of the control range.

The sample flow can be increased and decreased by sliding the track bar up and down. You can also use keyboard to control the sample flow. You must first set the focus on the track bar. Then up and down arrow keys change the input value of the pump controlling D/A converter by one unit. Using keys PgDn and PgUp the value can be changed by 10 units per a keystroke.

The OK button accepts the changes and saves new values into the memory of the device. It is recommended to save the new values to permanent memory inside the MGD. By pressing Cancel button all changes to flow are discarded and the dialog is closed.

Note! Changing the flow rate changes also the calibration of the device. The validity of gas profiles with new settings has to be checked and if necessary, the detector has to be retrained. The gas libraries that are created with different flow settings are incompatible. The manufacturer has set the flow by using a special calibration gas. This enables the device independence of internal gas libraries and similar measurement results with each detector.

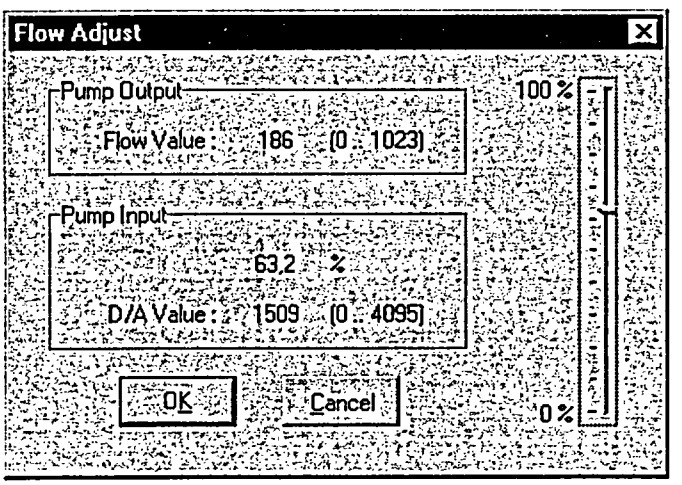


Figure 22. Flow Adjust

6.6.1.2 Gain

Selecting the Gain submenu item from the Adjust menu opens the Gain Adjustment dialog. This shows the existing gain values for different IMCell™ channels. You can select any of five gains for every channel. The gain values can be increased and decreased by sliding the track bar up and down. The values represent the following amplification factors respectively.

Gain	Amplification factor
1	x 1
2	x 2
3	x 4
4	x 8
5	x 16

Table 2. Gain amplification factors

By changing the gains the sensitivity of the detector can be controlled. By using relative gain series (112223, 223334 or 334445) the standard internal gas libraries can be used for recognition. Otherwise the detector has to be retrained with new gain values. The gas libraries which are created with different gain settings are incompatible. OK button accepts the changes and writes the new values into the MGD memory. It is recommended to save the new values permanently to the MGD. After the gain data is saved at MGD-1-S, the Offset Adjust Method dialog will appear for you to select if it is necessary to adjust offsets.

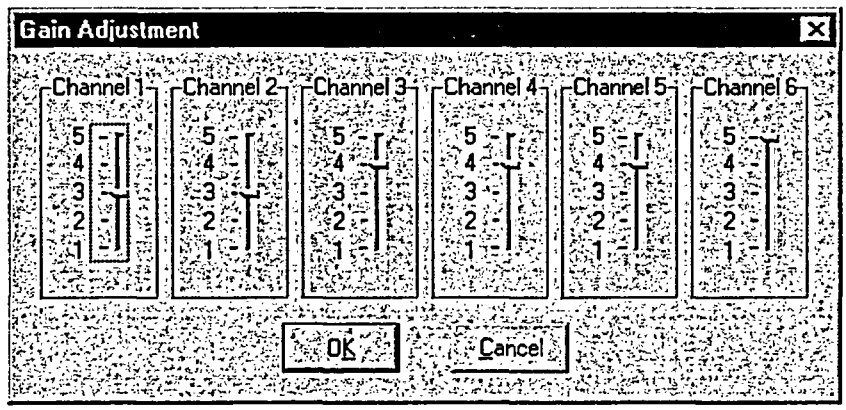


Figure 23. Gain Adjustment

6.6.1.3 Offset

When offsets are adjusted clear air must be pumped through MGD-1-S. By offset adjustment the signal levels of IMCell™ channels can be adjusted to any level wanted. Normally the signal levels are adjusted at about 300 units (see item. 6.6.2.1.4). This allows to detect both positive and negative responses generated by a gas sample.

Selecting Offset from Adjust submenu opens Offset Adjustment dialog. The signal levels for every of the six IMCell™ channels are displayed in A/D units (0 .. 1023). The display is updated continuously with current signal level values. By the track bars you can increase or decrease the signal level for each channel.

OK button accepts the changes and saves new values into the MGD memory. When OK is pressed after modifications, a message box appears and asks if user wants to save the data temporarily or permanently in the MGD. It is recommended to select permanent saving to store the new values to non-volatile memory at MGD.

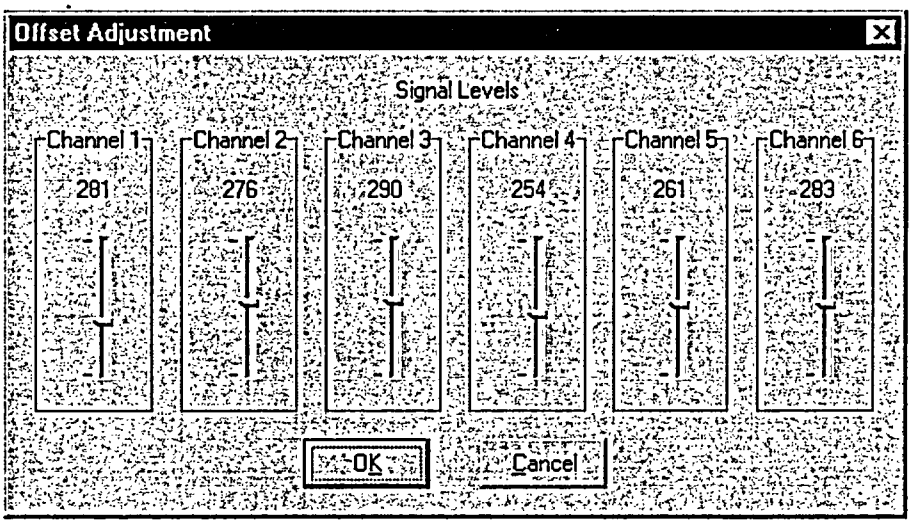


Figure 24. Offset Adjustment

6.6.2 Data Library Management

MGD Data Library Management means the controlling and modifying of the information held in the non-volatile memory of the MGD-1-S detector. The information in the MGD-1-S's memory is called the data library. You can open the Data Library dialog by selecting the Data Library Management from the Service menu. There are three items in the submenu:

1. **New** fills Data Library dialog with a default data library.
2. **Open File** gives you a possibility to open Data Library dialog with data which has been previously saved to a file.
3. **MGD Data Library** reads the current data library from MGD-1-S detector.

6.6.2.1 New

New loads the Data Library dialog with a default data library. This dialog contains File menu, through which data libraries can be saved to and read from files as well as to send to and read from MGD-1-S. When saving a data library to a PC the extension "EEP" is always added to the file name. The data library dialog box contains following sheets: Profiles ,Offset & Gain, Device Data, Basic Levels, SCCell, Failures and Startup.

6.6.2.1.1 New Data Library/Profiles

On the profile sheet a user can select any of the 30 profiles and proceed to edit the profile dependent data on Edit Profile Data dialog by pressing the Edit button or by double-clicking the chosen profile number. By pressing the Print button the sheet image can be printed.

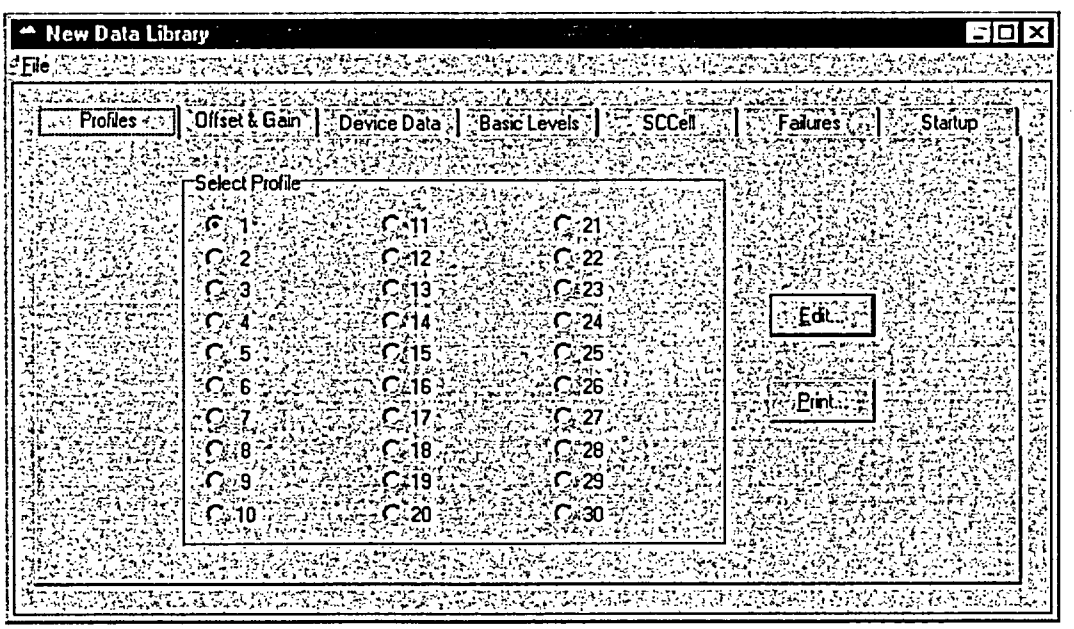


Figure 25. Data Library Dialog Box

6.6.2.1.1.1 Edit Profile Data

The Edit Profile Data dialog contains four sheets: General profile data, Profile Pattern, Concentration data and Correlation Factors. From the File menu it is possible to open and save gas profile files (PC) and read and write gas profiles from MGD-1-S. From the Edit menu gas files can be copied and pasted, gas files can be scanned (next, previous, select gas) and a default setting for a gas profile can be returned.

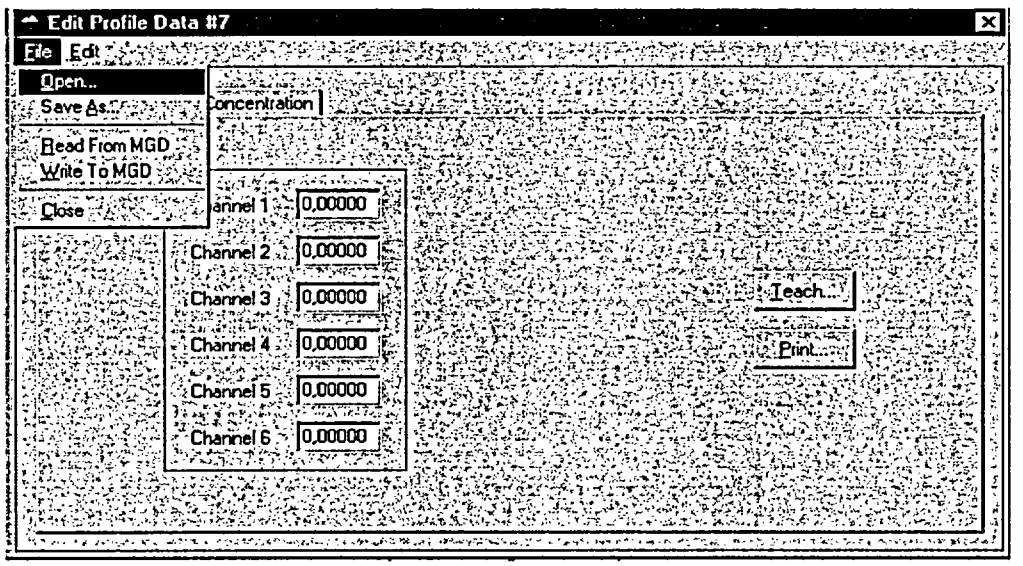


Figure 26. Editing a gas profile – File menu

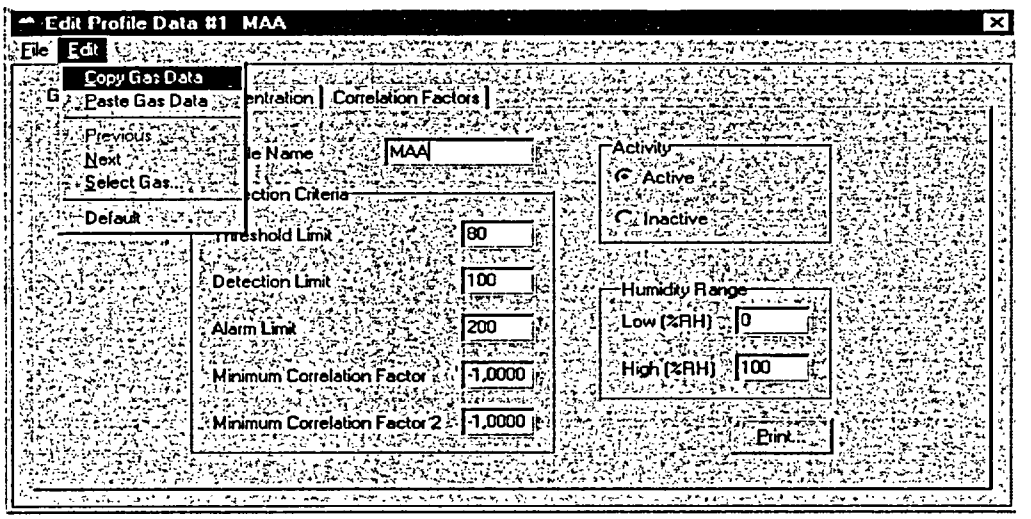


Figure 27. Editing a gas profile – Edit menu

On the **General sheet** a user can name the profile and set the detection parameters. The maximum length of the name is 8 characters.

Recognition to a profile is possible only when the sum signal is above the Detection Limit of the profile and the correlation of measured projection to the profile is greater than Minimum Correlation Factor.
When the profile has been recognized once, the recognition will be on as long as the sum signal is above the Threshold Limit and the correlation of measured projection to the profile is greater than Minimum Correlation Factor 2. The recognition can be changed to another profile only, if the sum signal is above the Detection Limit and the correlation of measured projection to the other profile is greater than to the firstly detected profile and greater than the Minimum Correlation Factor. The recognition is finished when the sum signal goes below the Threshold Limit or the correlation of measured projection to the detected profile goes below the Minimum Correlation Factor 2 and none of the other profiles are detected. When a recognition occurs and the sum signal is above Alarm Limit the sound alarm is generated.

Only those profiles which are marked as Active (written red) has possibility to be recognized. When a profile is marked as Inactive (name of the profile is blue) it is left out from the identification process and will not be shown in the closest profile window.

The Humidity Range defines low and high limits between which the profile is valid.

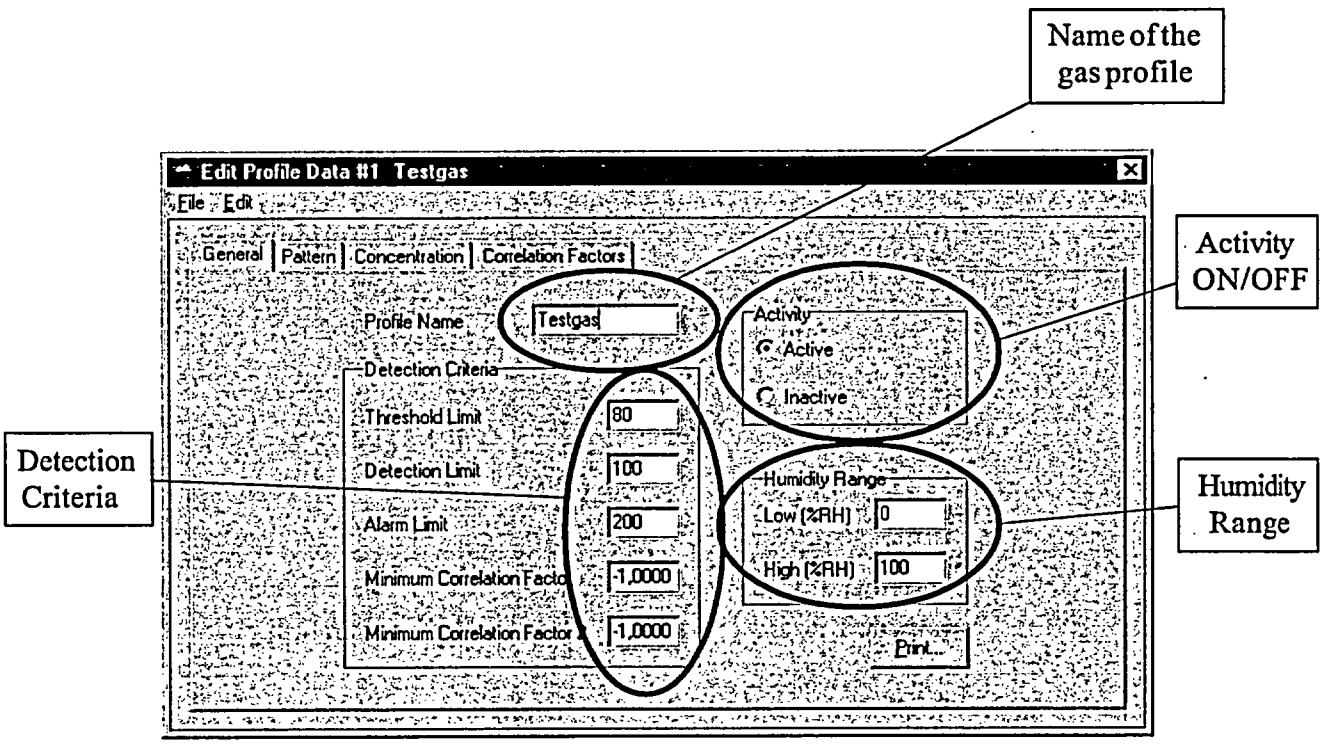


Figure 28. General Information Sheet of the Gas Profile

The **Pattern sheet** contains scaled measurement signals of the six measured channels, so called fingerprints of the profile and their normalized values. When editing a new gas profile, these values are zero and the fingerprint area is empty. Normalized values should not be entered through this dialog. The right way to generate a pattern is to teach it.

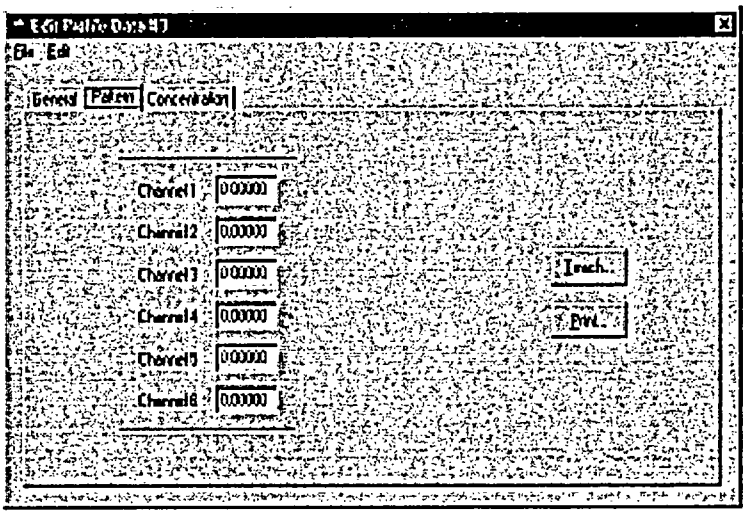


Figure 29. Pattern Sheet

By pressing the Print button it is possible to print out the gas profile pattern. To open Teach dialog press the Teach button:

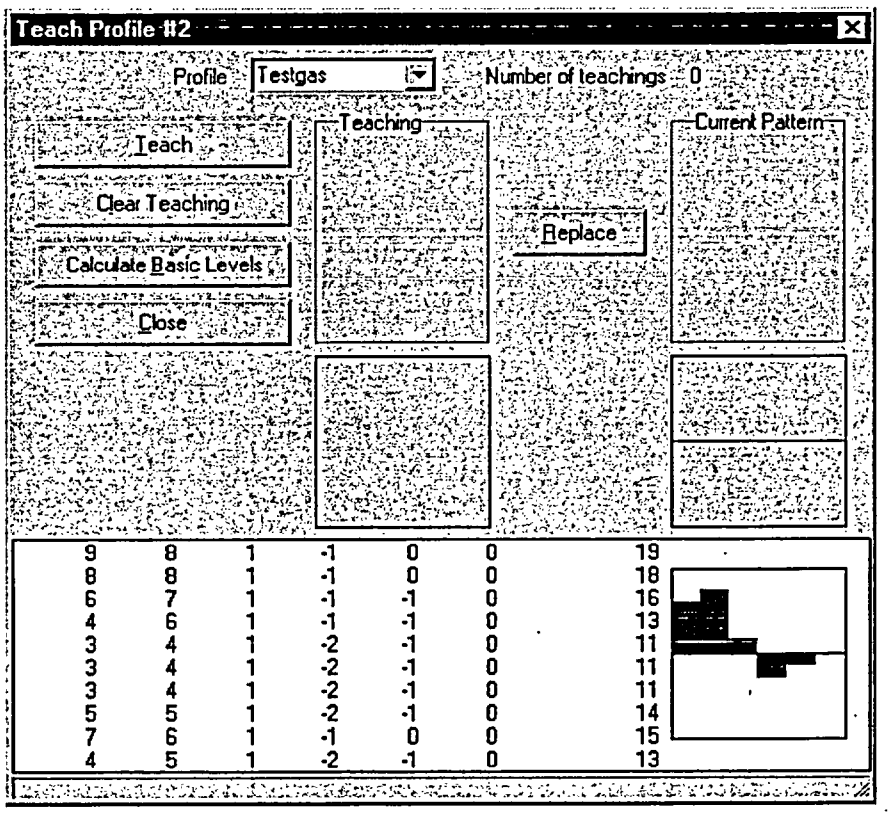


Figure 30. Teaching Window

The Teach dialog allows the user to teach - to enter the identification criteria of new gases or gas mixtures etc. - the MGD-1-S detector to recognize different gases. When the Teach dialog opens, the IMCell™ channel responses and the sum signal are displayed in the dialog.

Select the profile you want to teach from Profile combo box. The combo contains an item for every of the 30 profiles, so it is possible to teach several new gas profiles without closing the window. The items are named according to the corresponding profile names, but if any profile is not yet named the corresponding item of the combo box is blank. Note that on the Caption of the Teach dialog you can see the number (1 .. 30) of the profile which is selected on the Teach dialog.

Before teaching a new profile it is recommended to calculate new basic levels by pressing Calculate Basic Levels button.

When the gas exposure begins, the gas can be taught by pressing the Teach button. The Teach button should be pressed only after the channel signals have stabilized during the exposure. If you want, you can press the Teach button several times. MGD-WinUIP calculates an average profile of the teachings. When you are satisfied with the teaching, you can set it as current identification pattern of the selected profile by pressing Replace button. Note that the current pattern is totally discarded and replaced with the taught pattern.

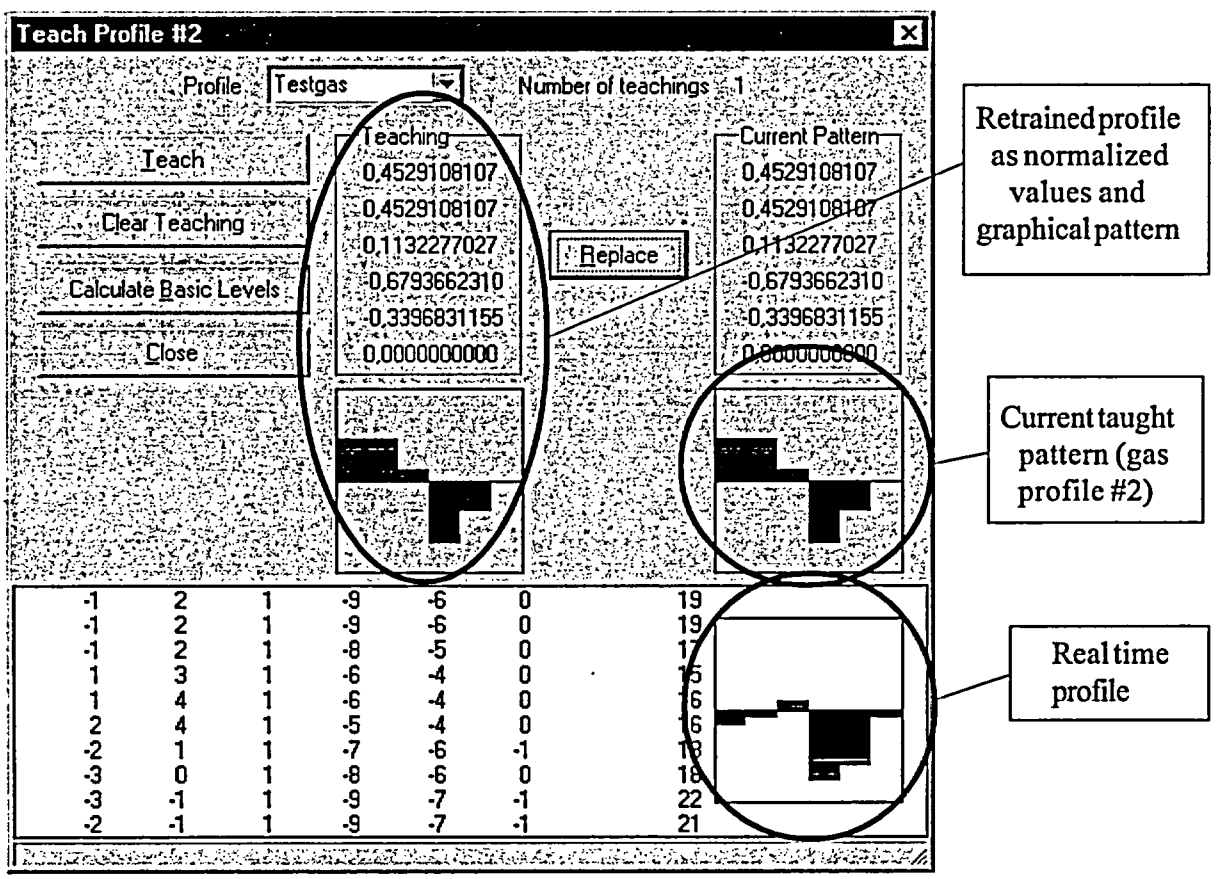


Figure 31. Teaching a gas profile

The teaching process is closed by pressing the Close button. Note! It is possible to save individual gas profiles as *.gas-files to the PC (File menu ->Save As) or write them to the memory of MGD-1-S (File menu -> Write to MGD).

In the **Concentration sheet** the concentration calculation equation is defined. The unit edit box allows you to name the concentration unit of the profile. Eight characters can be used. Through the Equation box the equation for the signal, which is used in concentration calculation, is defined. In the most cases the sum signal is used as the variable in concentration calculus. But the Equation edit box gives the user the possibility to define any arithmetical equation instead of a sum (E.g. sum-ch6). In the equation you must use only the symbols and operators found in the combo box right to the Equation edit box. By clicking a symbol in the combo box it is added as rightmost symbol in the equation.

The max concentration value defines the limit where the concentration measurement is out of the recommended measuring range This is shown on the LCD display by a graphic bar (see chapter 2.5.1 figure 2).

Coefficients 'a' to 'd' are for the concentration calculation equation $y=ax^3+bx^2+cx+b$. The variable x is the value which is calculated from IMCell™ responses according to the equation defined in the Equation edit box. The concentration is calculated only during recognition.

The parameters are determined by measuring the IMCell™ response with chemical in question by at least three known concentrations.

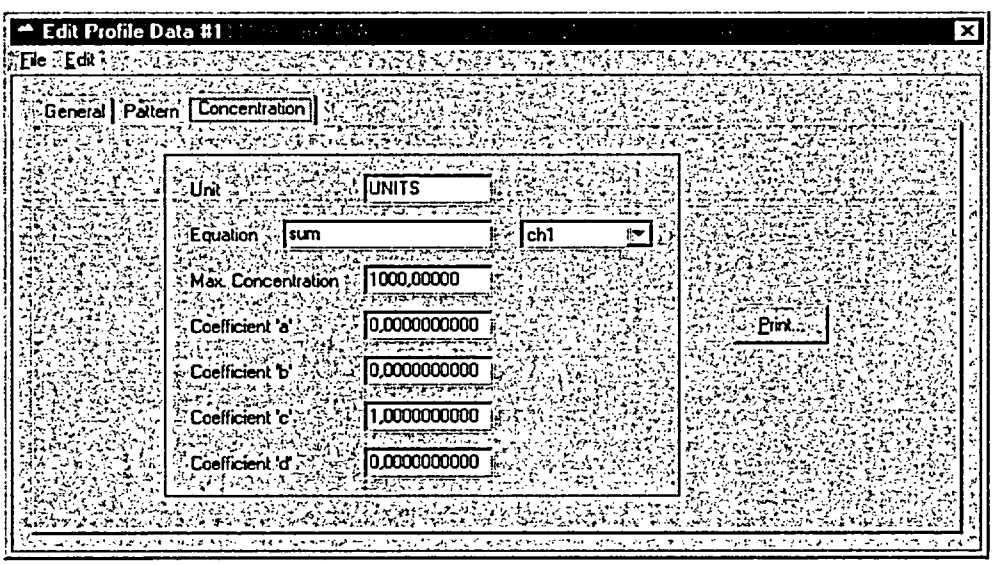


Figure 32. Concentration Sheet

This information can be printed by pressing the Print button.

The **Correlation Factors sheet** displays how the pattern of the profile named on the Edit Profile Data dialog caption correlates with the patterns of the other profiles. If the pattern of the profile named on the dialog caption contains only zero data then the Correlation Factors sheet is not displayed. If the correlation factor compared to a gas profile itself is other than 1.000 some malfunction during teaching process has occurred and the gas profile remains inactive.

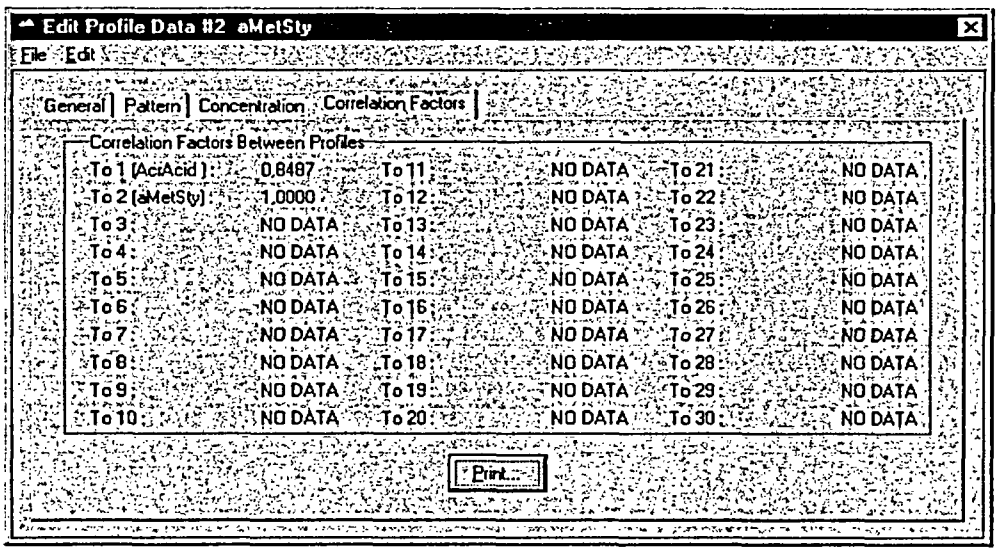


Figure 33. Correlation Factors Sheet

6.6.2.1.2 New Data Library / Offset & Gain

The IMCell™ channel offset and gain values are displayed on the Offset & Gain sheet of the Data Library dialog. The offset/gain values can not be changed here. The current offset/gain values of the MGD-1-S can be read from the detector by pressing Read From MGD button. If you need to adjust the offset values this is done via the Offset Adjustment dialog, which can be opened from Service - Adjust - Offset menu.

Typically when the MGD-1-S detector is started, the offset values are calculated only during startup. They are not recalculated during operation. By offset calculation the IMCell™ channel signals are set at startup to levels which are displayed inside the frame Basic Levels at Startup on Basic Levels sheet. If it is needed to recalculate offset values also during operation the check box Adjust Offset During Operation must be checked, so the offsets are recalculated every time when basic levels are calculated.

This sheet can be printed by pressing Print button.

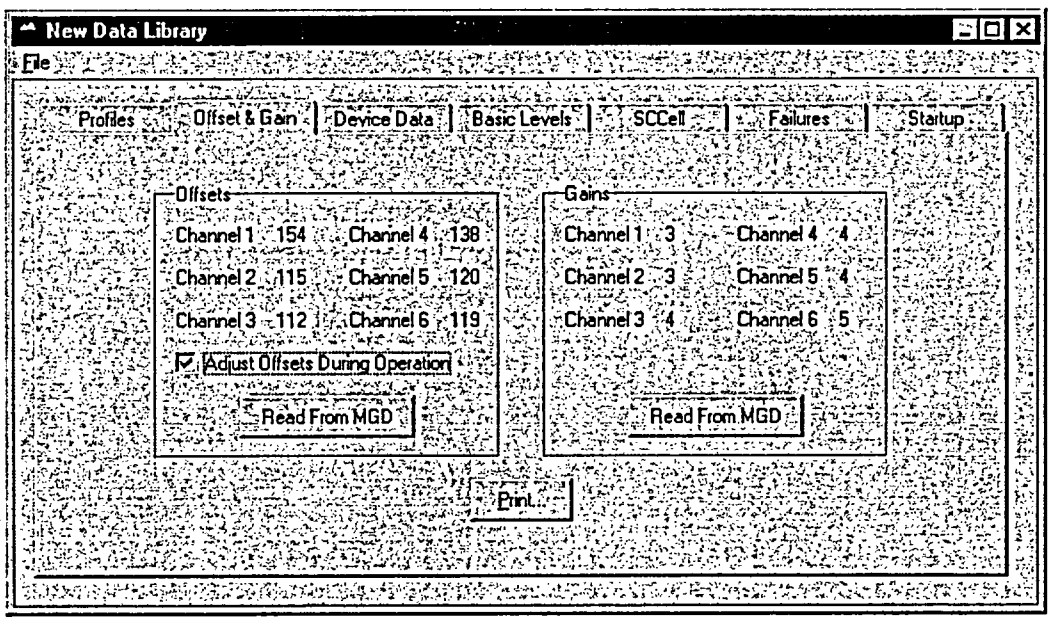


Figure 34. New Data Library / Offset&Gain Sheet

6.6.2.1.3 New Data Library / Device Data

Device Data sheet of Data Library dialog displays the parameters which are device oriented.

The Pump Control value is the percentage value of the voltage by which the pump is controlled. Pump rotating speed is controlled by this voltage. The Flow Value displays the current sample flow set point as units read from the flow meter. The Pump parameters can not be set on the Data Library dialog, but the current values can be read from the MGD by pressing Read From MGD button. If you need to adjust the flow parameters this can be done via the Flow Adjustment dialog, which can be opened from Service - Adjust -.Flow.

IMCell™ Temperature is the set value at which the MGD-1-S keeps the sample temperature during the operation. This is the only value which can be changed on this sheet, the allowed range being +15...55°C.

Serial Number field displays the serial number of the MGD-1-S detector. Operating Hours frame contains the times how long the IMCell™, pump and SCCell have been in operation. The values can be changed only by authorized dealer or manufacturer of the device.

Communication parameters are only displayed here. They can be changed via Communication Setup dialog opened form the Communication - Setup menu. This sheet can be printed by pressing the Print button.

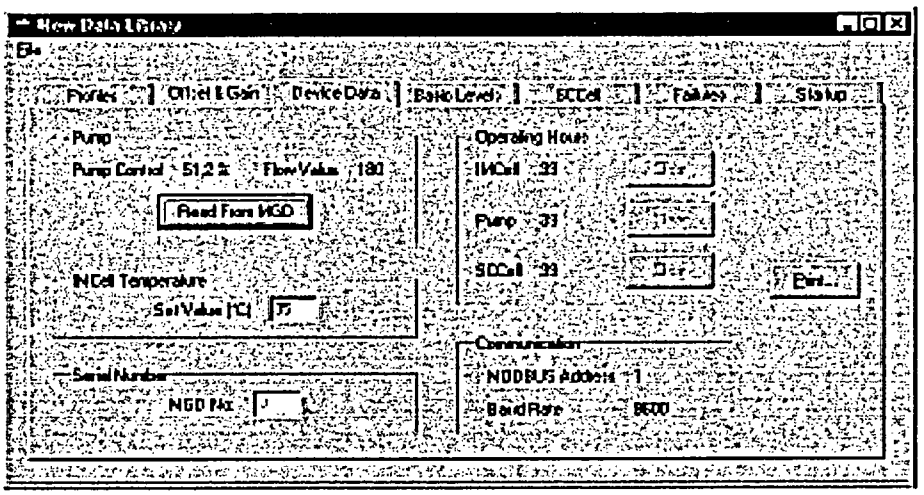


Figure 35. New Data Library/ Device Data

6.6.2.1.4 New Data Library / Basic Levels

The basic levels represent IMCell™ signal levels to which the measured IMCell™ signal levels are compared during the identification process. If the measured level of an IMCell™ channel is below basic levels of the channel, the response of that channel is negative. If the measured level of a IMCell™ channel is above the basic levels of the channel, the response of the channel is positive. These responses are the basis for the profile identification process.

Frame Basic Levels at Startup defines which are the target values for the basic levels when MGD-1-S is started. If the MGD-1-S Startup Mode is Adjust Offsets and Basic Levels on Startup, MGD-1-S sets the basic levels to these values every time when it is started. A typical value for basic levels is 300.

Portable Use of MGD-1-S

In portable use the basic levels are calculated during operation at time intervals defined in Calculation Interval edit box. The default value 60 s is optimal in most cases. If you want that the basic levels will not be calculated during operation, the item Automatic Basic Level Calculation should be unchecked. Note that in every case a recognition of a profile disables the basic level calculation for the time the recognition lasts.

MGD-1-S at Fixed Installations

When MGD-1-S is connected to an external pump, MGD-1-S has an output signal by which an external valve can be controlled to two positions, for sample and for reference air. Normally the valve position is for sample, but when MGD-1-S begins to calculate basic levels it controls the valve for reference air before calculating and back to sample after calculation.

1. By parameter Pump Reference Air Before Basic Level Calculation a time delay can be set. When the valve is switched for reference air the time delay defined by this parameter is passed before the MGD-1-S starts the basic level calculation.
2. By parameter Pump Sample After Basic Level Calculation another time delay can be set. When the valve is switched back for sample after basic level calculation the time delay defined by this parameter is passed before the MGD-1-S starts the detection process again.
3. Parameter Freeze Analog Output After Basic Level Calculation is also a time delay. When the detection begins after basic level calculation the time delay defined by this parameter is passed before the MGD-1-S starts analog output update again.
4. Parameter Measure Time sets the time how long MGD-1-S will measure between basic level calculations during normal operation. If the Automatic Basic Level Calculation is unchecked, MGD-1-S will not calculate basic levels during normal operation.

This sheet can be printed by pressing the Print button.

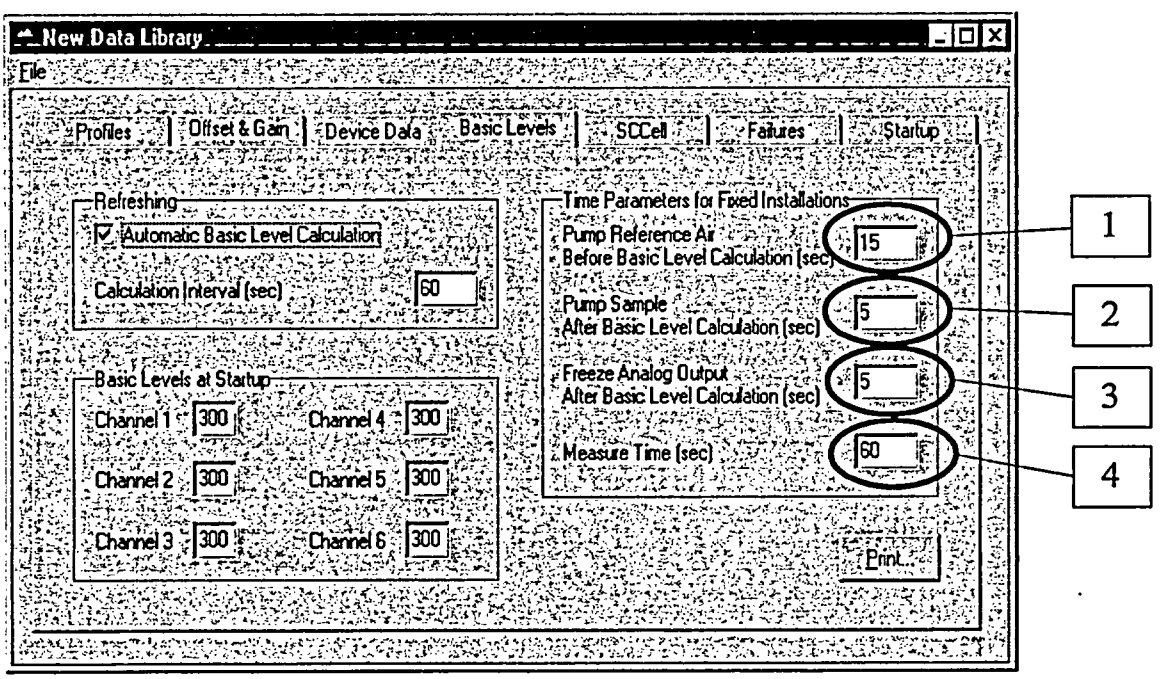


Figure 36. New Data Library / Basic Levels

6.6.2.1.5 New Data Library / SCCell

If there is a semiconductor sensor (SCCell) in the MGD-1-S device, it is possible to determine several parameters for it. Name allows the user to enter the name for a gas which will be detected by the SCCell. The maximum length of the name is 8 characters. The Detection Limit defines the response level for the SCCell in AD units which must be exceeded to indicate detection. Alarm Limit defines the response level for the SCCell in AD units which must be exceeded to give a sound alarm. Preheat Time at Startup defines how long SCCell is heated without flow at MGD-1-S startup. It is also possible to define an equal concentration calculation equation to SCCell as for IMCell™ (see chapter 6.6.2.1.1.1/Concentration)

This sheet can be printed by pressing the Print button.

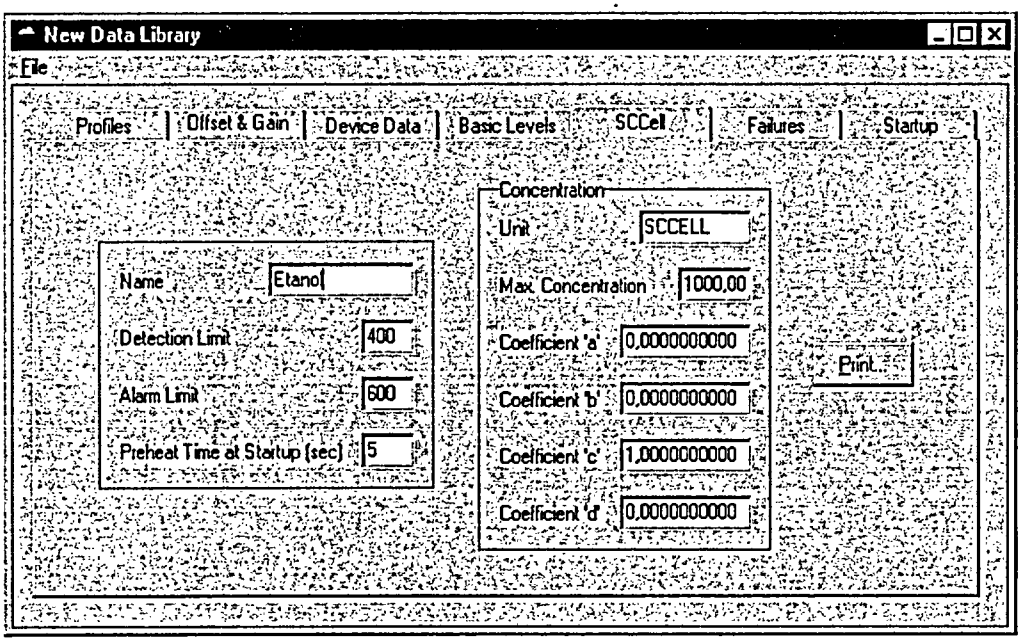


Figure 37. Adjustable Parameters of the Semiconductor Sensor (SCCell)

6.6.2.1.6 New Data Library/Failures

MGD-1-S program has a failure control task, which monitors those signals which are selected for monitoring in Select For Monitoring frame. MGD-1-S compares the measured signals to defined low and/or high limits and gives an failure alarm when the signal is detected to be below low limit or above high limit.

Flow Failure:	*The air flow can not be adjusted according to set parameters*
IMCell Failure:	*There is a malfunction in IMCELL™ operation*
Temperature Failure:	*The temperature is not within the specified temperaturerange*
Voltage Failure:	*Operating voltage malfunction*
SCCell Failure:	*The SCCell sensor is not working correctly*

Note! If the calibration is inaccurate, the detector must be checked with a test gas. Inaccurate calibration is not classified as a failure, therefore it is not included in this register.

Through Ignore Flow Failure edit box you can give a time value of how many seconds flow failure can exists without alarm. When flow failure state lasts longer than the time an alarm is given.

Statistics frame gives information about the failures MGD-1-S has detected. The statistics can be cleared only by an authorized service agency.

This sheet can be printed by pressing the Print button.

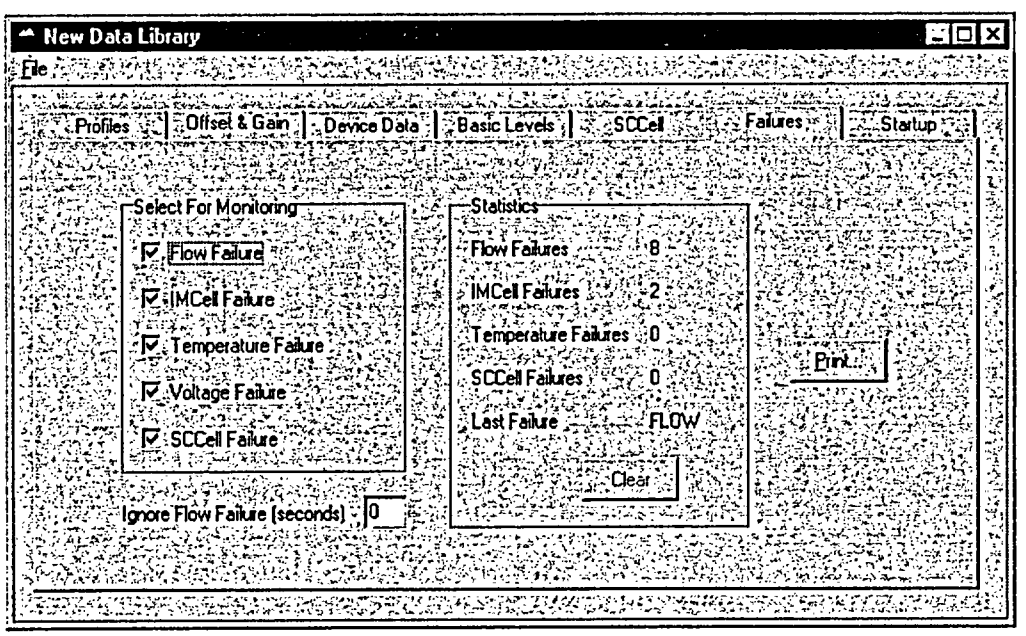


Figure 38. New Data Library/ Failures

6.6.2.1.7 New Data Library/Startup

MGD-1-S can be started by three different ways.

1. Adjust Offsets and Basic Levels at Startup is used in the majority of cases. In this mode the offsets and basic levels are adjusted at every startup.
2. Copy Offsets and Basic Levels from MGD at Startup mode forces offsets and basic levels to the values which are read from MGD-1-S non-volatile memory.
3. Do not Set Offsets and Basic Levels at Startup is the mode where offsets and basic levels are not set at all.

This sheet can be printed by pressing the Print button.

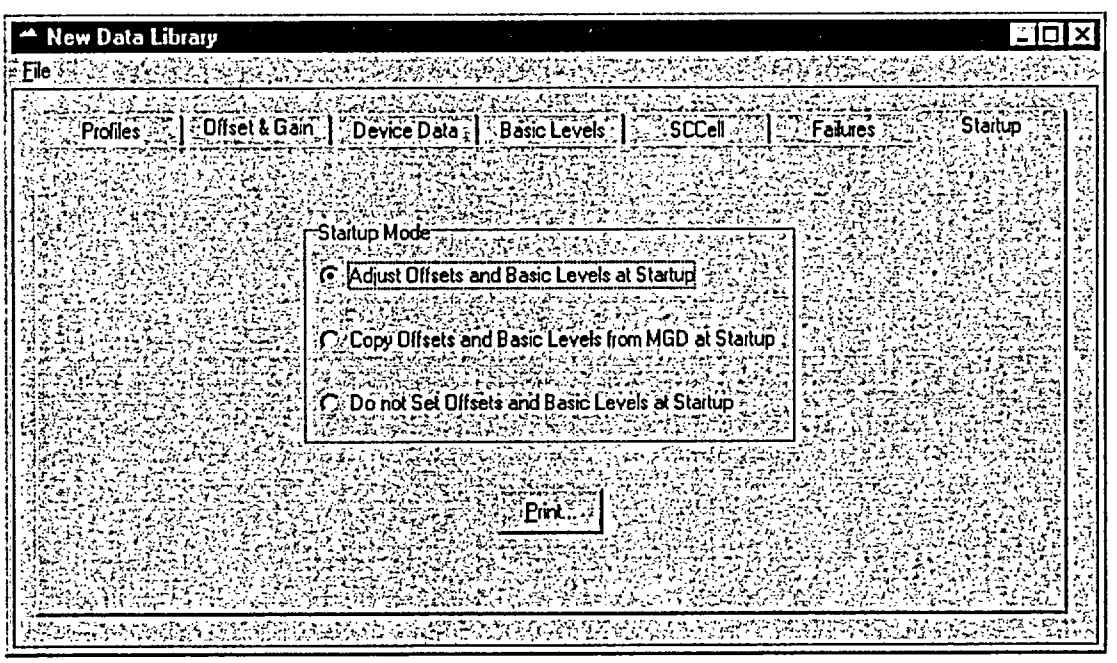


Figure 39. New Data Library/ Startup

6.6.2.2 Data Library Management/Open File

Open File gives you a possibility to open Data Library dialog with data which has been previously saved to a file (*.EEP-files). Opened Data Library can be edited as explained in chapter 6.6.2.1.1

6.6.2.3 Data Library Management/MGD Data Library

MGD Data Library reads the current data library from MGD-1-S detector. Opened Data Library can be edited as explained in chapter 6.6.2.1.1

6.7 Program Options

From the Program Options Menu the passwords and communication setup can be changed.

6.7.1 Password

If you are operating on the operator level, you can change the password of this level by typing the new password twice and pressing OK.
If you are operating on the service or the developer level, you have ability to change both the operator level and the service level password.

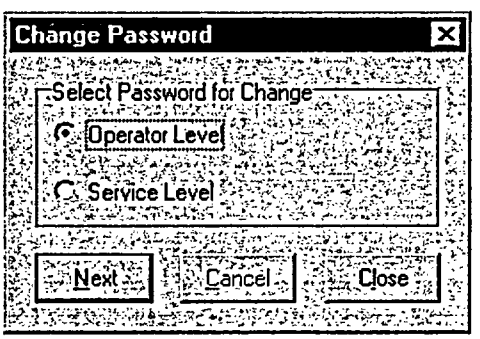


Figure 40. Changing a Password

6.7.2 Communication Setup

The Communication Setup dialog allows you to change the serial port used and connection type. Other parameters related to the serial communication between your PC and MGD-1-S are able to be changed only by authorized service agency.

Pressing button OK sets the communication parameters both at MGD-1-S and PC and exits the dialog. It is recommended to save data permanently in the MGD-1-S.
Notice: The changes made in the MGD-WinUIP program settings are saved permanently by pressing first Save as Default button and then OK. By pressing just OK the setting will be changed temporary. Pressing Cancel discard changes and closes dialog.

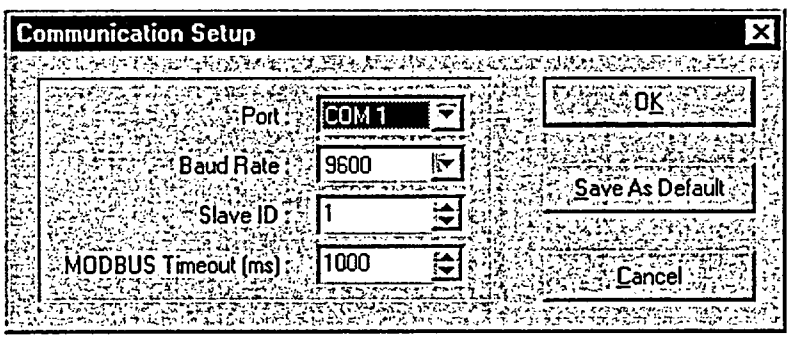


Figure 41. Communication Setup Window

6.8 Help

6.8.1 Contents

Online Help describes the essential parts of the MGD-WinUIP program. From Help Topics the specific assistance can be found with Index or Find tabs.

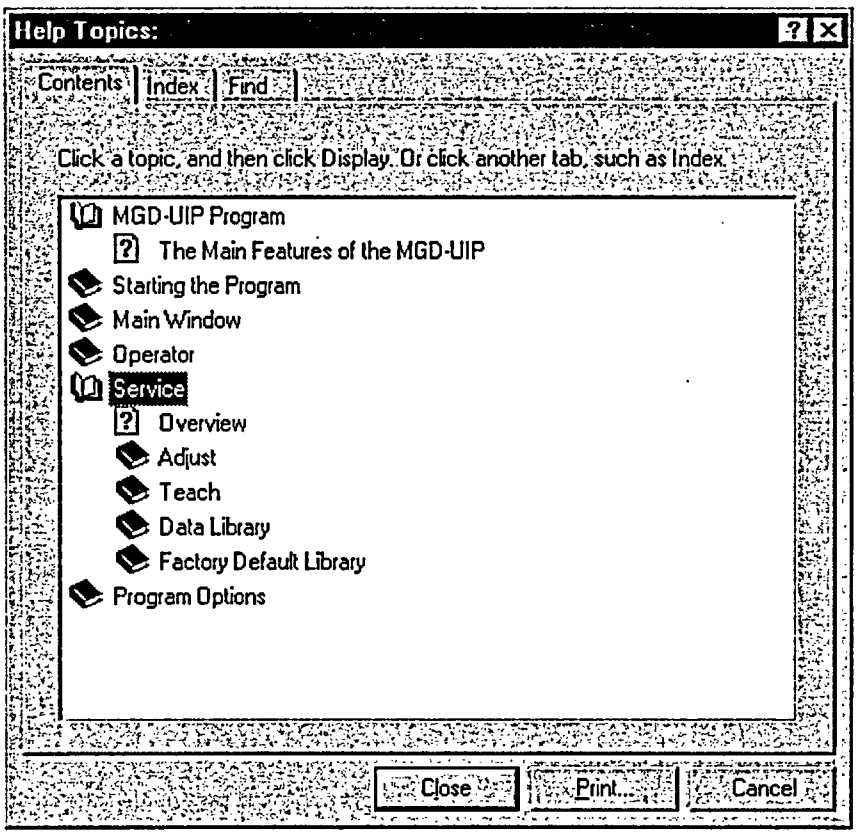


Figure 42. Help Topics Window

6.8.2 About

About the WinUIP window displays the version of the MGD-WinUIP program and required software version.

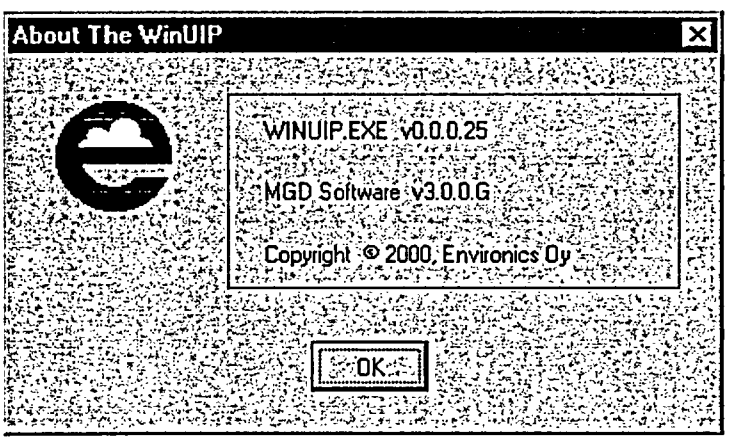


Figure 43. About Window

Appendix 1. MGD-1-S Technical Information

Weight	4,7 kg
Weight with battery	6,8 kg (7kg, NiMH)
Weight with battery and carrying bag	7,3 kg (7.5kg, NiMH)

Dimensions:

• Length	280 mm
• Width	105 mm
• Height	280 mm

Possible power sources:

- Main Power Supply 85...264Vac, 50...60Hz
- Vehicle Power Supply (9...32 Vdc)
- NiMH Battery 12 V

Temperature range	-20°C...+50°C
Humidity range	< 99% RH

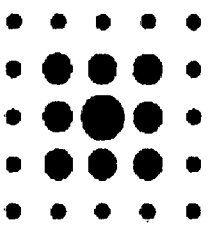
Appendix 2. List of Spare Parts and Accessories

External Spare Parts	Part No.
Air inlet and filter cap set	A2201
Air outlet and external pump cap set	A2205
Switch knob	E6-5581.4631
Multipurpose connector	E6-3102A18-1
Multipurpose connector cap (incl. chain)	E6-25043-18D
Detector front mask	H708403V0210
Detector handle	J32SMB447221
Detector case	J310PRC77MGD

Internal Spare Parts	
Internal air pump	B0066
Internal tubing set	B0600
Sensor unit	B0010
Frame O-ring	N1NB12030030
Internal Filter	A2303
Internal filter plug	H100213V0210
Venturi Tube	H804501V2111

Electronics	
Controller board	CIP500040
Display board	CXC800700
Power board 1	CXC800130
Power board 2	CXC800136
Buzzer	G5-080835X
Power/Audio switch	E6-EY233551
Battery connector	E6-SMC447075

Accessories	
NiMH Battery	M90-NMB
Battery Charger	M90-BC1
Battery Case	MGD-BB
Carrying Bag	M90-CB
Inlet Tube	MGD-IT
Mains Power Supply	M90-MP3
Vehicle Power Supply	M90-VP1/C
External Micro Filter	M90-MF
Communication Cable; 1,5 m	M90-CC



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STUK
Radiation and Nuclear Safety
Authority in Finland

PROTOCOL OF MEASUREMENT (1,2)

April 2, 2002 XX/XXX/02

DOSE RATE MEASUREMENTS OF CHEMICAL WARFARE AGENT DETECTOR

Instrument: Chemical Warfare Agent Detector
Type: M90-D1-C
Serial number: 90 C 2351N
Manufacturer: Environics Oy
P.O.BOX 349
FIN-50101 Mikkeli, Finland
Radiation source: 5.9 MBq (160 µCi), Americium-241 (maximum activity) (AMM by AEA Technology)
Date of measurement: 22 March, 2002
Place of measurement: STUK, Helsinki, Finland
Measured by: Senior physicist Seppo Väisälä
Measuring equipment: Smart ION Model 2100, (Mini Instruments Ltd, Morgan Nuclear Safety Products, Great Britain), Serial Number 2144, Window 7 mg/cm^2, (Calibrated 20 March,2002, Calibration sheet MN/13/02 attached).

Following measurements were made:

1. External dose rate on various sides of the instrument
2. External dose rate on various sides of the sensor unit detached from the instrument
3. External dose rate on various sides of the source box detached from the sensor unit

Results of measurements

Local background (0.15 µSv/h) is subtracted. For the symbols of measuring directions, see attached drawings (pictures 1 and 2).

1. Dose rates (µSv/h) outside the instrument (picture 2):

Measuring direction	A	B	C	D	E	F
at the surface	0.1	<0.1	<0.1	<0.1	0.2	<0.1
at 10 cm distance	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

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2. Dose rates (μSv/h) outside the sensor unit (picture 1):

Measuring direction	A	B	C	D	E	F
at the surface	0.2	0.1	<0.1	0.1	0.3	<0.1

3. Dose rates (μSv/h) outside the Teflon source block :

measuring direction	A	B	C	D	E	F
at 5 cm distance	0.2	0.1	0.2	10	1.0	<0.1
at 10 cm distance	<0.1	<0.1	<0.1	3.8	0.3	<0.1

The maximum dose rate straight outside the Teflon source block, 10 μSv/h, was detected at the 5 cm distance from the surface (in direction D).

Seppo Väisälä
Senior physicist

Attachments:
Pictures 1-2
Calibration sheet MN/13/02.

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April 2, 2002 XX/XXX/02

DOSE RATE MEASUREMENTS OF CHEMICAL WARFARE AGENT DETECTOR

Instrument: Chemical Warfare Agent Detector
Type: M90-D1-C
Serial number: 90 C 2414N
Manufacturer: Environics Oy
P.O.BOX 349
FIN-50101 Mikkeli, Finland
Radiation source: 5.9 MBq (160 µCi), Americium-241 (maximum activity)
(**NRD A-001 by NRD,LLC, USA**)
Date of measurement: 22 March, 2002
Place of measurement: STUK, Helsinki, Finland
Measured by: Senior physicist Seppo Väisälä
Measuring equipment: Smart ION Model 2100, (Mini Instruments Ltd, Morgan Nuclear Safety Products, Great Britain), Serial Number 2144, Window 7 mg/cm^2, (Calibrated 20 March,2002, Calibration sheet MN/13/02 attached).

Following measurements were made:

4. External dose rate on various sides of the instrument
5. External dose rate on various sides of the sensor unit detached from the instrument
6. External dose rate on various sides of the source box detached from the sensor unit

Results of measurements

Local background (0.15 µSv/h) is subtracted. For the symbols of measuring directions, see attached drawings (pictures 1 and 2).

4. Dose rates (µSv/h) outside the instrument (picture 2):

Measuring direction	A	B	C	D	E	F
at the surface	0.1	<0.1	<0.1	<0.1	0.2	<0.1
at 10 cm distance	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

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5. Dose rates (μSv/h) outside the sensor unit (picture 1):

Measuring direction	A	B	C	D	E	F
at the surface	0.2	0.1	<0.1	0.1	0.3	<0.1

6. Dose rates (μSv/h) outside the Teflon source block :

measuring direction	A	B	C	D	E	F
at 5 cm distance	0.2	0.1	0.2	11.5	1.0	<0.1
at 10 cm distance	<0.1	<0.1	<0.1	4.5	0.3	<0.1

The maximum dose rate straight outside the Teflon source block, 11.5 μSv/h, was detected at the 5 cm distance from the surface (in direction D).

Seppo Väisälä
Senior physicist

Attachments:
Pictures 1-2
Calibration sheet MN/13/02.

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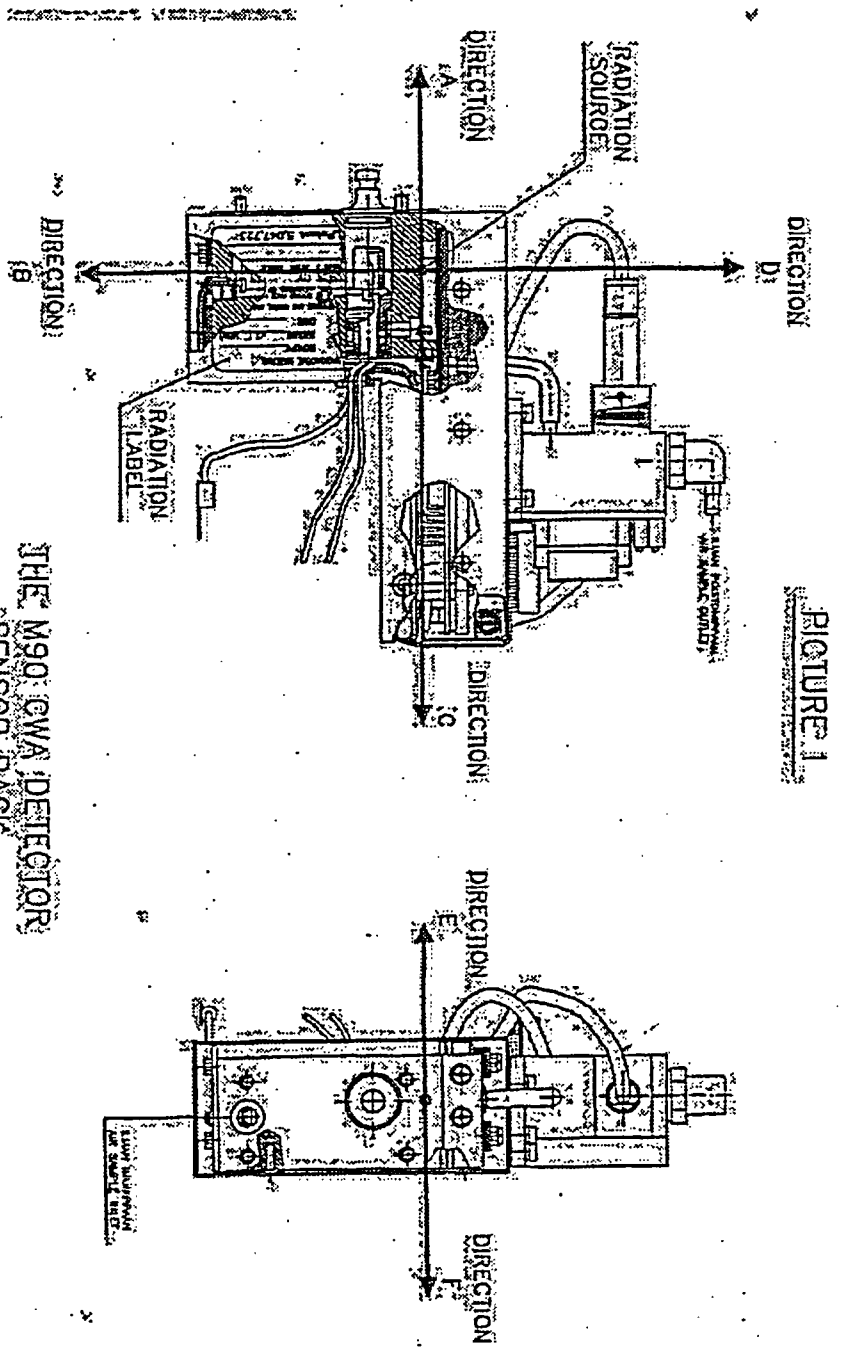

THE M90 CWA DETECTOR SENSOR PACK

FIGURE 1.

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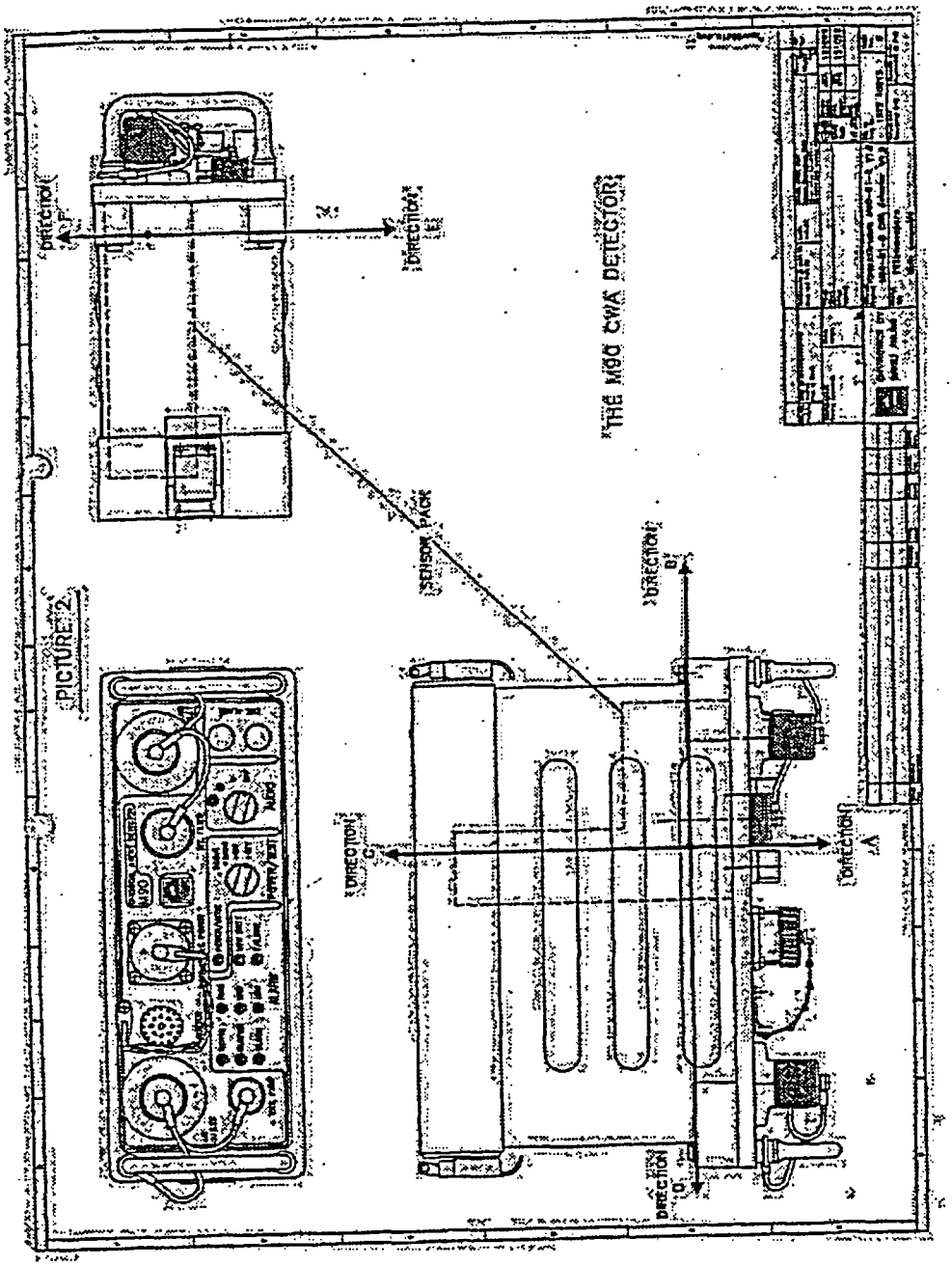

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PROTOCOL OF INSPECTION

8.10.1996 4748/T1/96

MEASUREMENTS OF STRAY RADIATION OF GAS DETECTOR MGD-1

Instrument	Gas Detector
Type:	MGD-1 and MGD-1EX
Manufacturer:	Environics Industry Oy
	P.O.Box 1750, FIN-70211 Kuopio, Finland
Source type:	AMM.2 (Amersham International plc)
Radionuclide:	^{241}Am
Activity:	5.9 MBq
Date of measurement:	9. October 1996
Measuring equipment:	Smart ION Model 2100 with ionization chamber detector (window weight 7 mg/cm^2 or 300 mg/cm^2)
Measured by:	Seppo Väisälä

Based on the application and the sample instrument (the MGD-1 gas detector) submitted by Environics Industry Oy and the performed inspection and measurements, it was found as follows.

1. The instrument includes one piece of a foil, size 10 x 20 mm^2 and type AMM.2, which contains 5.9 MBq of radioactive material ^{241}Am.

2. The radiation source is fastened permanently into plastic source bed in the metal box of the sensor pack inside the instrument. Nobody can come into contact with the radiation source without disassembling the instrument. The radiation source cannot get outside the instrument even if it would come off the fasteners.

3. The highest dose rate caused by the radiation source outside the instrument (on the front side at the distance of appr. 5 cm from the top panel by the POWER switch) was 0.3 µSv/h. On the top panel at the point of POWER switch the dose rate was 0.1 µSv/h. In all directions at the distance of 10 cm from the outer surface of the instrument the dose rate was less than 0.1 µSv/h. Based on the above mentioned measurements the radiation shielding of the instrument is sufficient to guarantee the safe use of the device.

4. Inside the casing of the detector, on the surface of the metal box containing the radiation source, is a sticker including a warning sign for ionizing radiation, information of the radionuclide and its activity as well as of the manufacturer.

Chief inspector Seppo Väisälä