

Gas Sampling System

Salwico SW2020

User Manual



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Consilium Marine AB

P.O.Box 8763

SE-402 76 GÖTEBORG

SWEDEN

Tel: +46-31-710 77 00, Fax: +46-31-710 78 00

E-mail: cmab.got@consilium.se

Internet: www.consilium.se

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SE-402 76 Göteborg, Sweden

Contents

1. GENERAL INFORMATION

A

- 1.1 DESCRIPTION OF THE SYSTEM
- 1.2 GENERAL BLOCK DIAGRAM

2. INSTALLATION

B

- 2.1 CONTROL UNIT
- 2.2 ANALYZING UNIT
- 2.3 EXTERNAL ALARM PANEL
- 2.4 PIPE SYSTEM
- 2.5 FLAME TRAPS
- 2.6 MANUAL SHUT-OFF VALVES
- 2.7 SAMPLING PIPE ACCESSORIES
- 2.8 SAMPLING PONTS
- 2.9 OPTIONS

3. OPERATION

C

- 3.1 GENERAL PRINCIPLES
- 3.2 STANDBY
- 3.3 LISTS
- 3.4 SETUP - GENERAL SETTINGS
- 3.5 SETUP - SAMPLING POINTS
- 3.6 CONTROL UNIT PANEL
- 3.7 ACTION DESCRIPTION
- 3.8 THE MINI REPEATER UNIT - MN400

4. TECHNICAL DATA

D

- 4.1 INTERNAL CONNECTION
- 4.2 INTERNAL CONNECTION ON RIOK-40 AND RIOK-41
- 4.3 PNEUMATIC BLOCK DIAGRAM, ANALYSING UNIT
- 4.4 FLOW EXAMPLES
- 4.5 CALCULATION OF SAMPLING TIME
- 4.6 VACCUM PUMP
- 4.7 IR GAS DETECTOR GD10

5. SPARE PARTS LIST

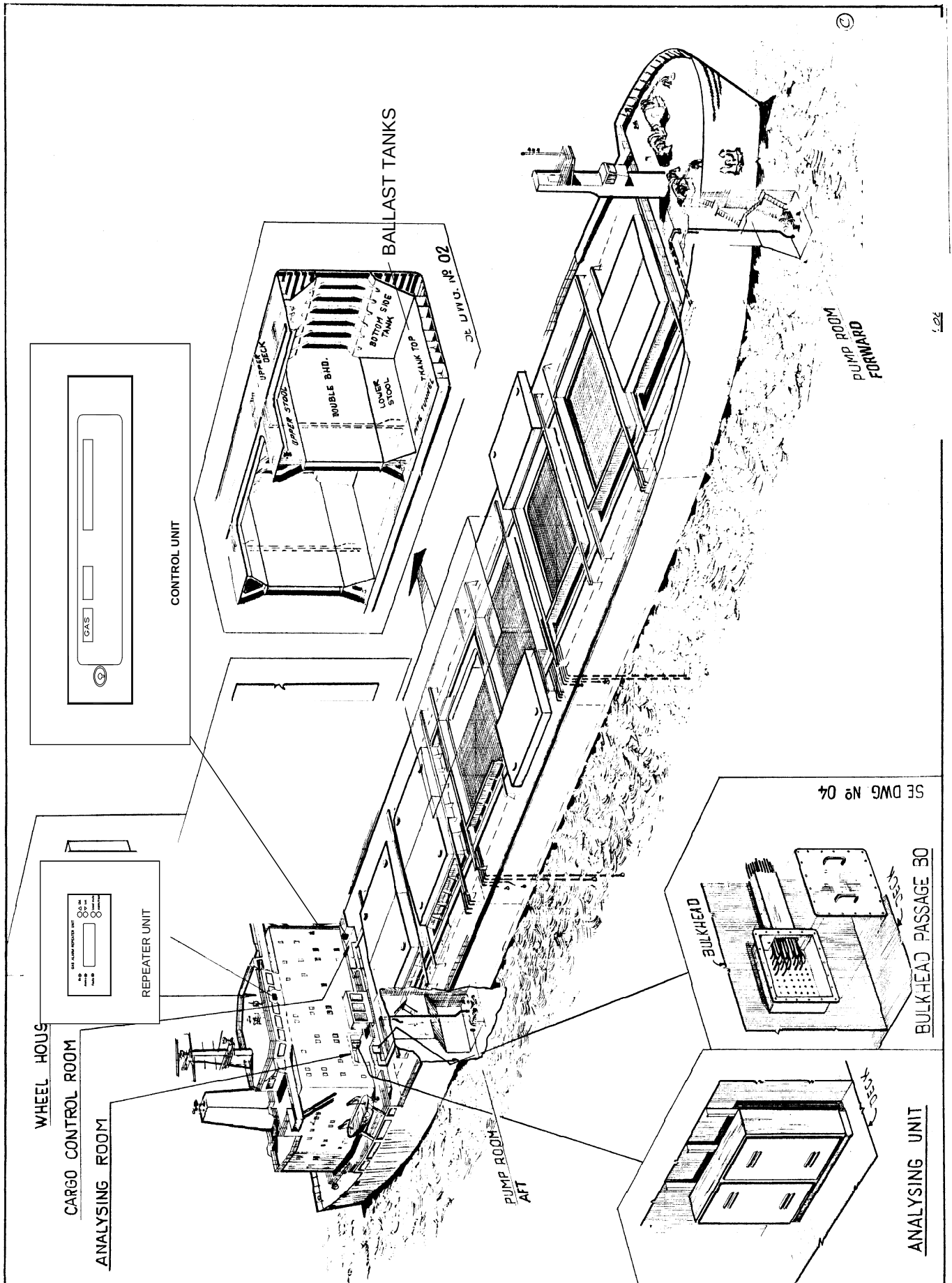
E

SPARE PARTS SET SW2020

6. PRODUCTS LIST

F

1. GENERAL INFORMATION



1.1 DESCRIPTION OF THE SYSTEM

The SW2020 Gas Sampling System is an automatically scanning Gas Sampling System permanent installed for a number of sampling points. The gas detectors are common for all sampling points, allowing the use of high quality gas detectors with good accuracy. A gas sample is taken from each sampling point in turn, according to the sampling sequence, and transported through the sampling pipe to the gas detectors. The sampling time for each point is individually adjustable corresponding to the pipe length of each sampling point. This gives an optimally short cycle time.

The SW2020 Gas Sampling System is intended for detection of explosive and toxic gases in cofferdams, pipe tunnels, stools, ballast tanks, slop tanks and other areas adjacent to cargo tanks. A pump room installation is normally a separate system. The SW2020 is designed to meet the requirements of IMO/SOLAS and classification rules.

Individual sampling point settings

Each sampling point can easily be operated from the control unit and it has individual settings for:

- Sampling time as a function of pipe length.
- Gas detectors (up to 4) connected for monitoring samples. For example %LEL, Vol% and ppm.
- Alarm levels for low and high alarm for each detector and each sampling point..
- Clear text information.

Programmable scanning sequence

Each sampling point can easily be operated from the control panel. For permanent installations in ballast tanks or other areas, which may periodically be filled with fluid, a counter pressure system is automatically protecting the pipes with a gentle flow of air, preventing clogging.

The sampling time for each disconnected sampling point is deducted from the cycle time, thus reducing the cycle time for the remaining sampling points.

The SW2020 Gas Sampling System also gives the possibility to define the sampling sequence enabling certain points to be sampled more frequently.

A flow fault on a sample point will activate the Automatic Pipe Cleaning System (APCS). The APCS will first attempt to remove the cause of the flow fault by flushing the sampling pipe and then try to obtain a new sample. The sampling point is automatically disconnected and the fault is transferred to the Fault List if the flow fault remains.

The last measured gas value for a sampling point can be viewed in the Sampling Point List. Manual Measurement and Purge on a selected sampling point are also done from this list.

A test gas cylinder is connected to or built into the system for calibration of the gas detectors.

The SW2020 system consists of four parts

Control Unit

The control unit contains control functions and display for the system and is normally located in a cargo control room.

Analysing Unit

The analysing unit contains all functions for detecting and transporting the test samples, as well as an internal sampling point for monitoring of internal gas leakage. The analysing unit is installed in a ventilated area with controlled temperature above main deck level, normally the Cargo Control Room.

Repeater Unit(s)

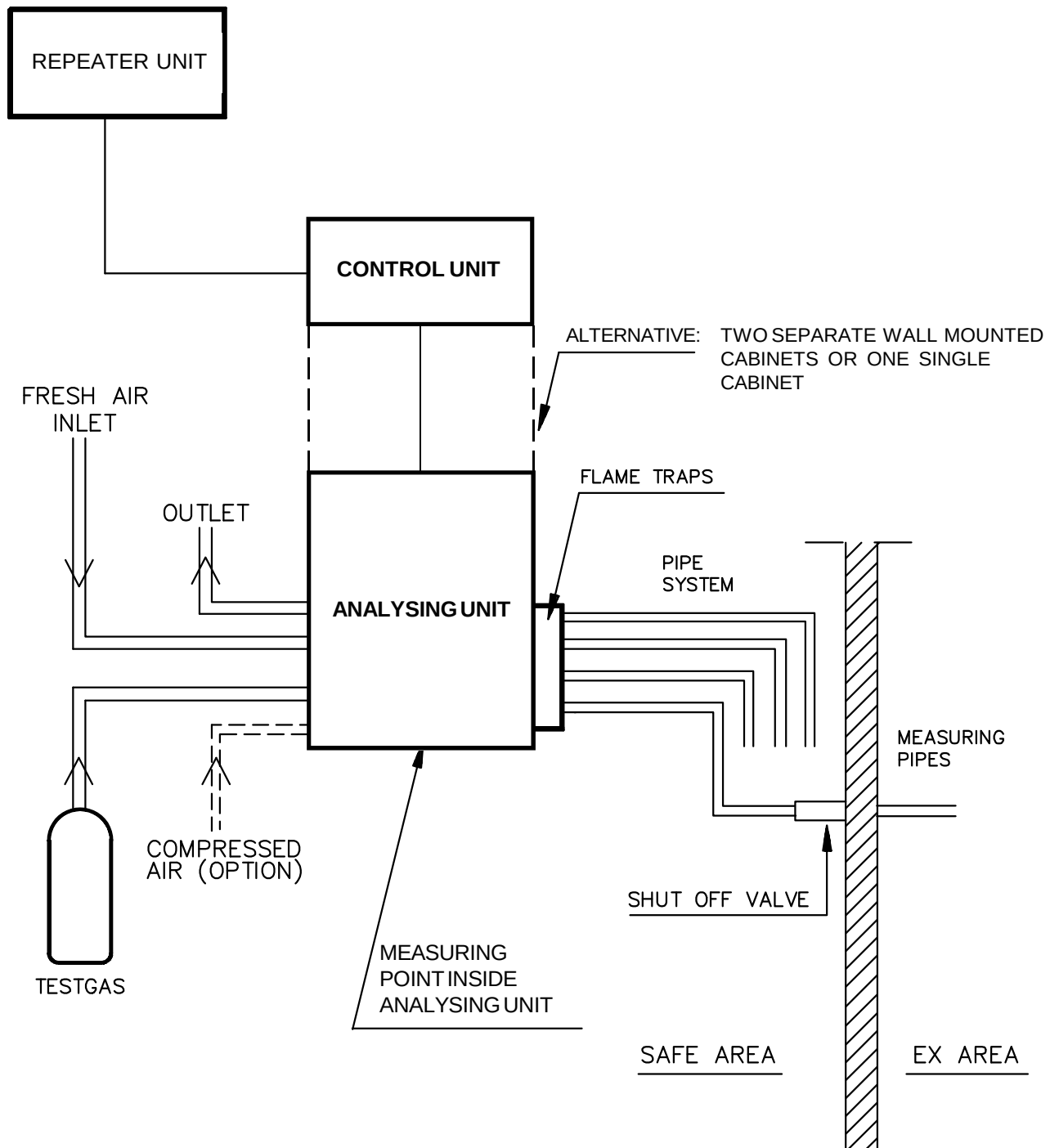
The repeater unit contains a clear text display for alarm and fault messages. One unit is normally located in the Wheel House.

Pipe System

The pipe system transports the test samples from the sampling points to the analysing unit. The pipe system includes shut off valves, flame traps, filters and cones (for WB tanks).

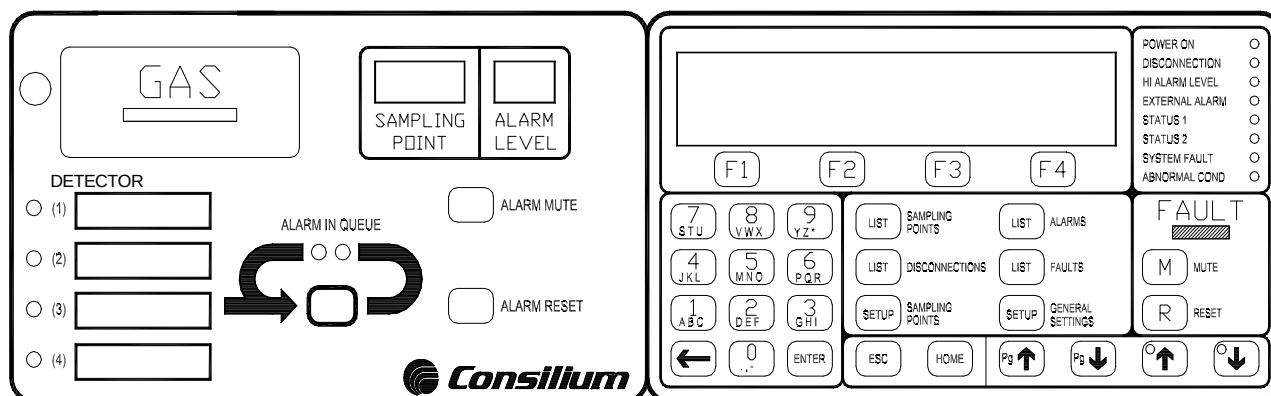
Recommended pipe size: OD 8 mm, ID 6 mm.

1.2 GENERAL BLOCK DIAGRAM



2. INSTALLATION

2.1 CONTROL UNIT



The control unit is the man-machine interface and controls the electronics in the analysing unit. It consists of a LCD clear text Display, LED Display, LED's, keyboard, microprocessor and memory for the software, definitions, additional texts etc. The unit is normally made for wall mounting and should be placed in a well visible position e.g. cargo control room. Electrical connection terminals to the analysing unit, the repeater unit and the optional printer are placed in the bottom of the control unit cabinet.

As an alternative both the control unit and the analysing unit can be delivered in one single cabinet.

The SW2020 control unit is divided into two parts; the gas alarm panel and the operating panel.

The gas alarm panel is activated when a gas alarm situation is detected in the system. The sampling point number, alarm level (LO or HI) and the actual gas detector in alarm are displayed.

There are three keys on the operating panel. The Alarm Mute key is used to acknowledge the gas alarm and the Alarm Reset key is used to reset the gas alarm. The third key Alarms in Queue is used to toggle the sampling points in alarm.

The Operating Panel continuously shows, in the clear text display, sampling point and the last measured value.

The Fault LED is lit and a fault message is shown in the clear text display when a fault alarm is generated.

The List and Setup keys are used to manage the gas sampling system. The numeric key pad is among other things used for value settings and clear text setup.

2.2 ANALYSING UNIT

The analysing unit contains all functions for detection and transport of the test samples. Its components comprise: gas detectors, solenoid valves, sampling and transport pump, flame traps, flow meter, remote I/O - PCB-boards, power supply unit and terminals for power supply, alarm outputs connection to the control unit and repeater unit as well as connections for all piping included in the system.

The analysing unit should be installed not less than 3 metres above the main deck in order to avoid air locks in the pipes and ensure the correct work of the automatic flow watching function. The area should be ventilated and temperature-controlled.

For installation and for the future service work, there must be enough space, approx. 0.5m, at the pipe connection side. Normally the left side.

There are removable plates intended for the installation of cable inlets on the underside of the cabinet, for electrical connections.

The electrical connections are made in accordance with the electrical drawing in this chapter.

2.2.1 Pipe Connections

Suction Pipes

The sampling pipes from the manual shut-off valves are connected to the premounted and numbered flame trap on the side of the analysing unit by means of the stainless steel connection nipples on the flame traps.

NB! These nipples should be tightened with a spanner, 1.25 turn only, from the hand tightening stop. If dismantled the nipple should be retightened to exactly the same position during re-mounting.

The pipes between the analysing unit and the normal shut-off valves should be mounted in such a way that air locks do not occur.

Also note that the pipes should be installed in such a way that service can be performed on an individual flame trap as well as on On-Line Filters without unnecessary dismantling of other pipes.

Exhaust Pipe

The exhaust pipe from the analysing cabinet is connected via a nipple at the intended site and should be mounted with a slope towards the exhaust point. Refer to page B4.

Fresh Air Pipe

The fresh air pipe to the analysing cabinet should be connected via a nipple at the intended site. The air inlet can open up directly into the room where the analyzing unit is installed, provided that the atmosphere in the room is clean and temperature controlled. Otherwise a pipe leading to such a space must be installed. Refer to page B4.

Calibration Gas Pipe

The calibration gas pipe from the calibration gas cylinder, with a relief valve and pressure gauge, is connected to the analysing cabinet via a nipple at the intended site. Refer to page B4. The pipe should be mounted in such a way that replacement of the calibration gas cylinder can be made without unnecessary strain on pipes and couplings.

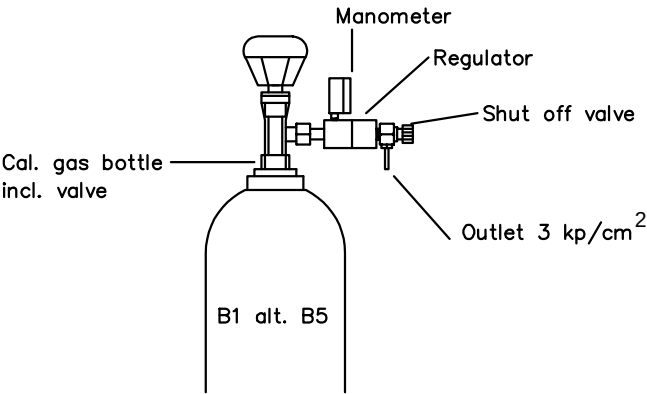
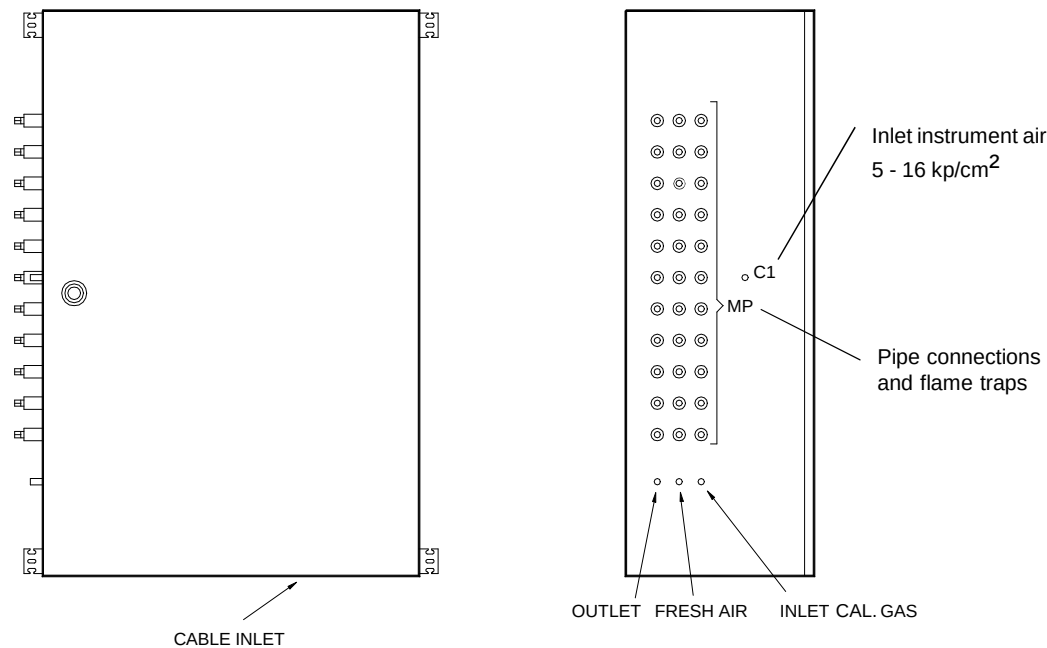
Instrument air 5 - 16 kp/cm² inlet

The inlet pipe for dry instrument air is connected to the analysing unit via a nipple at intended site. Refer to page B4.

2.2.2 Calibration Gas Cylinder

The calibration gas cylinder is mounted next to the analysing cabinet and fixed in the conventional manner for pressure vessels. The gas cylinder can alternatively be mounted inside the cabinet.

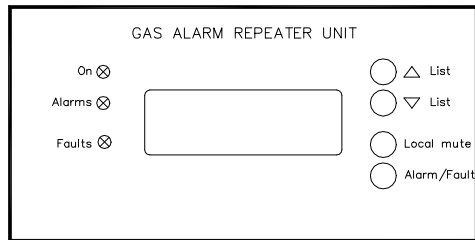
Analysing Unit



2.3 REPEATER UNIT

The function of the LCD repeater units is to indicate alarms and faults to the duty watch personnel. The unit is designed for wall or panel mounting and should first of all be placed on the bridge in a well visible and easily accessible location.

The LCD-display indicates in clear text the sampling point(s) in alarm, alarm level(s) and fault messages.



2.4 PIPE SYSTEM

The pipe system transports the test samples from the sampling points to the analysing unit. In addition to the piping, the system includes: shut-off valves, flame traps, pipe couplings, sleeves, filters and pipe terminations.

When the sampling pipes are installed, care should always be taken that the pipes are installed in such a way that the risk of air locks is avoided.

There are two main ways of installing the piping from the analysing unit to the various sampling points; either the pipes are installed above deck or through the pipe tunnel, or a combination of both methods. Note that pipes installed above deck must be protected against mechanical damage. Refer to drawing on page B7 of this manual.

All pipe couplings with conical seals forming part of the pipe system should always be sealed with Loctite 577. (NB! Not thread tape).

2.4.1 Pipe Suspension

Suspension of the pipe assembly or individual pipes should be made in such a way that the distance between the suspension points does not exceed 1 metre.

The pipes should also be fixed in such a way that vibrations or other similar actions do not damage them. When installing the pipes, care should be taken not to allow them to become deformed.

The drawing on page B16 of this manual shows a proposed method of suspension and fixing.

2.4.2 Sleeves and Bulkhead Passages

Some type of passage arrangement must be used when passing through deck or bulkhead plates. Such proposed units are shown on drawings on page B15 and B16 of this manual.

2.4.3 Pipe Couplings

Efforts should be made to ensure that as few pipe couplings as possible are used for each sampling pipe. This to avoid unnecessary air resistance in the pipes caused by turbulence due to unevenness of the joints, and also to reduce the possibility of leakage to a minimum.

When a pipe cut is necessary, make sure that the pipe is not deformed at the cut and that the air flow resistance is not increased. Also note that capillary connections has to be carefully soldered to avoid unnecessary air flow resistance.

Each manufacturer's individual recommendations on tightening should be observed when installing those pipe couplings that must be used.

2.4.4 Bending of Sampling Pipes

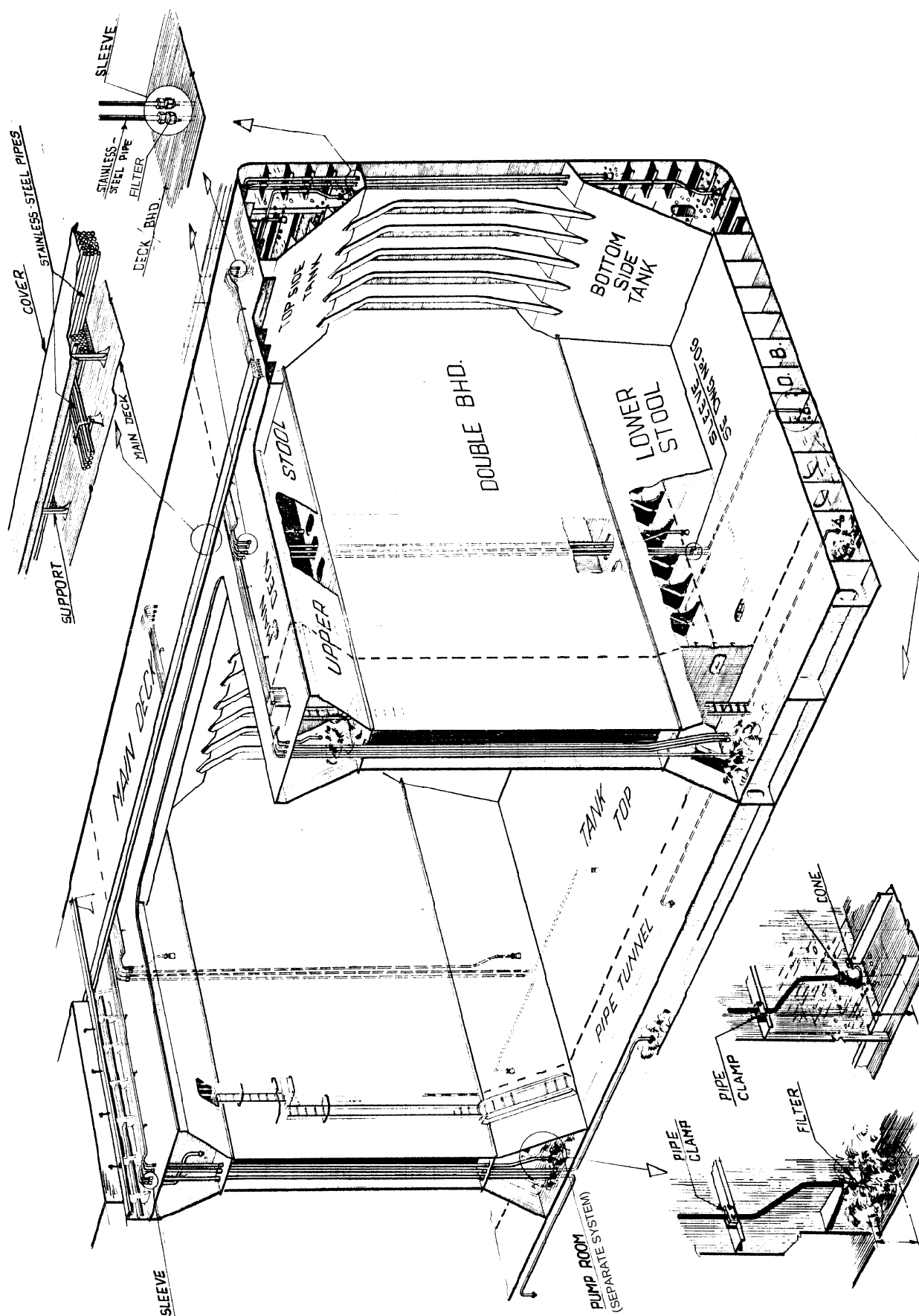
In order to avoid unnecessary air resistance in the sampling pipes and risk of deformation and the formation of fractures, a minimum bending radius of approx. 150 mm is recommended.

Refer to separate instructions for installation of other components of the pipe system.

- Flame Trap (analyzing unit) - Chapter 2.5
- Manual shut-off valves - Chapter 2.6

2.4.5 Pipe installation check

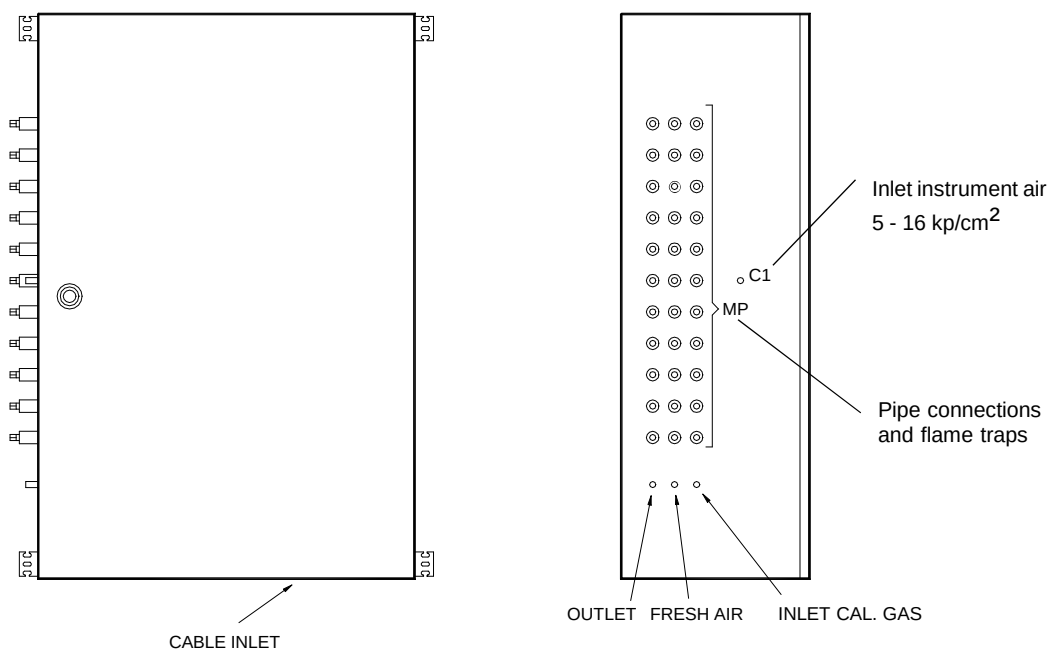
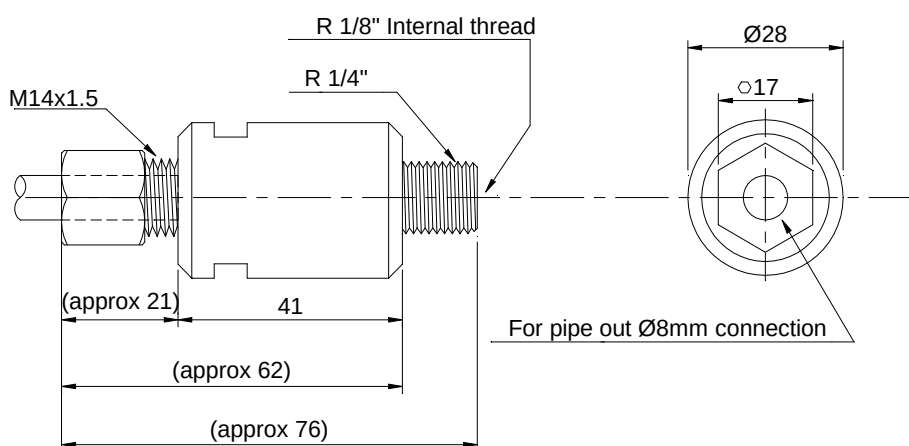
- NB. 1. Before connection of the sampling pipes to the Analysing Unit and to the On-Line-Filters:
Always flush the pipes with compressed air in order to clean them from dust and water. After cleaning, finish the complete connection between the Analysing Unit, Shut Off Valves, On Line Filters and Pipe end Accessories.
- NB. 2. A test has to be performed on every sampling pipe, to verify that there are no leakages. Also verify that each sampling point is correctly connected to the Analysing Unit. It is possible to do a test of the air tightness by disconnecting the tubes one by one inside of the cabinet and perform the test by connecting a manometer, shut-off valve and compressed air.



2.5 FLAME TRAPS

The flame traps are normally supplied fitted to the analysing unit. Refer to the installation instructions for the analysing unit in Chapter 2.2.1 for pipe connection instructions.

NB! The flame trap must be of an approved type.



2.6 MANUAL SHUT-OFF VALVES

The task of the manual shut-off valves is, where necessary, to shut off the pipe system in an explosion risk zone from the system in a safe zone. This may occur when a certain sampling area has a temporary high gas concentration or is filled with inert gas. The shut-off valves should also be used for service needs, such as replacement of flame traps, or if a certain sampling pipe is disconnected from the analysing unit.

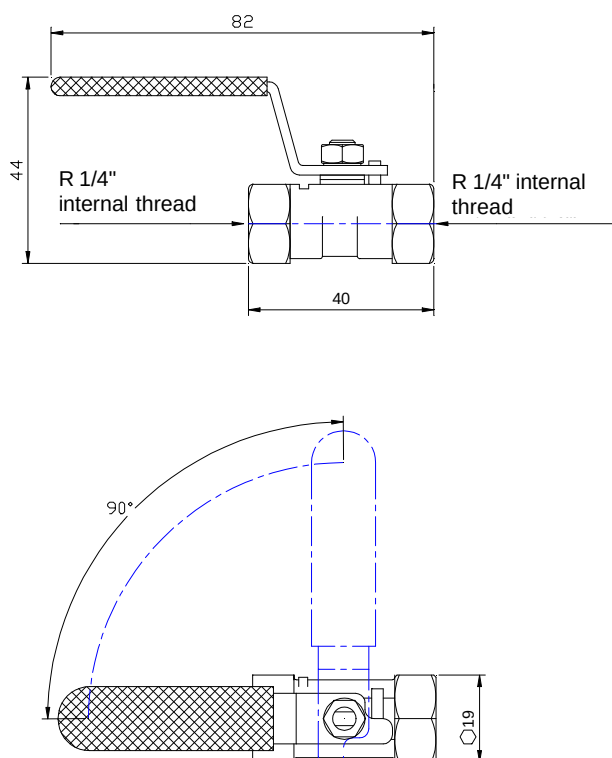
When there is no compressed air in the counter pressure system combined with water in the ballast tanks, a closing of the shut-off-valves is recommended to avoid water and dirt inside the sampling pipes. Notice that as long as there is compressed air to serve the counter pressure system in water filled ballast tanks, the shut off valves shall remain open.

Installation of the valves shall be made in the wall between the safe and explosive zones. Holes are cut for the insertion of welding sleeves with an internal thread, the shut-off valve then being screwed on from inside a safe zone by means of taper thread couplings supplied and sealed with "Loctite 577".

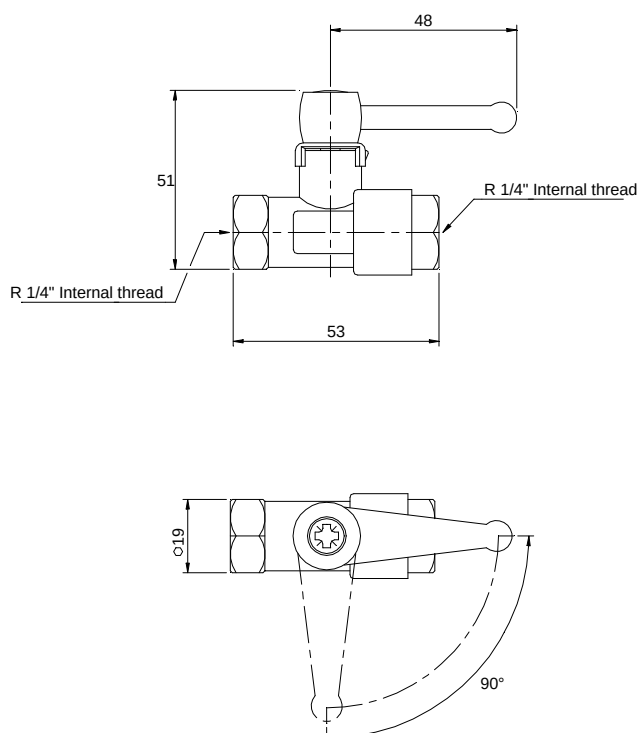
NB! All valves should be marked with the number of the corresponding sampling point.

It is important that the mutual distance between the valves is taken into consideration, and that the sampling pipes from the analysing unit are installed in such a way that any service on an individual shut-off valve can be carried out without any unnecessary dismantling of other pipes.

Stainless steel type



Brass type



2.7 SAMPLING PIPE ACCESSORIES

2.7.1 Filters

Each individual sampling pipe should be protected with filters in order to avoid fouling of both the pipes themselves as well as flame traps, valves, flow meter and detector.

Two types of filters have been developed for this purpose. One type for mounting on the pipe, "On-line filter", and a second for mounting at the end of the sampling pipe at the sampling point, "End-line filter".

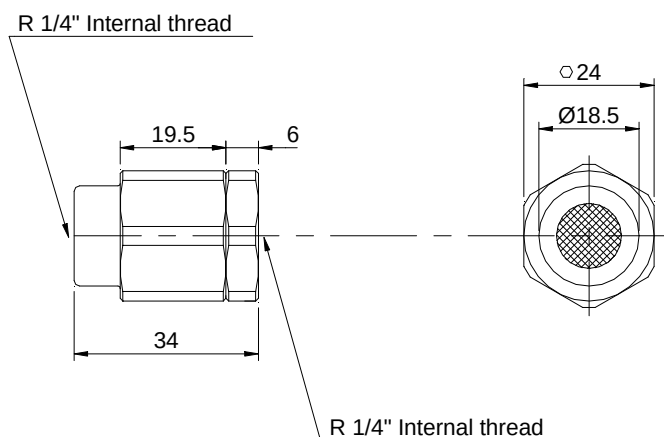
On-Line Filter

This filter is used for such sampling pipes where end-line filters cannot be used for a variety of reasons, such as

areas which may be temporarily water-filled or where access is for other reasons, so difficult that necessary filter replacement may be impaired or neglected.

Installation of on-line filters must be done in such a manner that the filter is easily accessible for replacement, without causing unnecessary strain on pipes and connections. The online filter should always be placed as close to the sampling point as is practically feasible. But never in a safe zone. The nipples should be tightened in accordance with pipe connections chapter 2.2.1.

We recommend that each individual filter should be marked with its corresponding sampling point number.

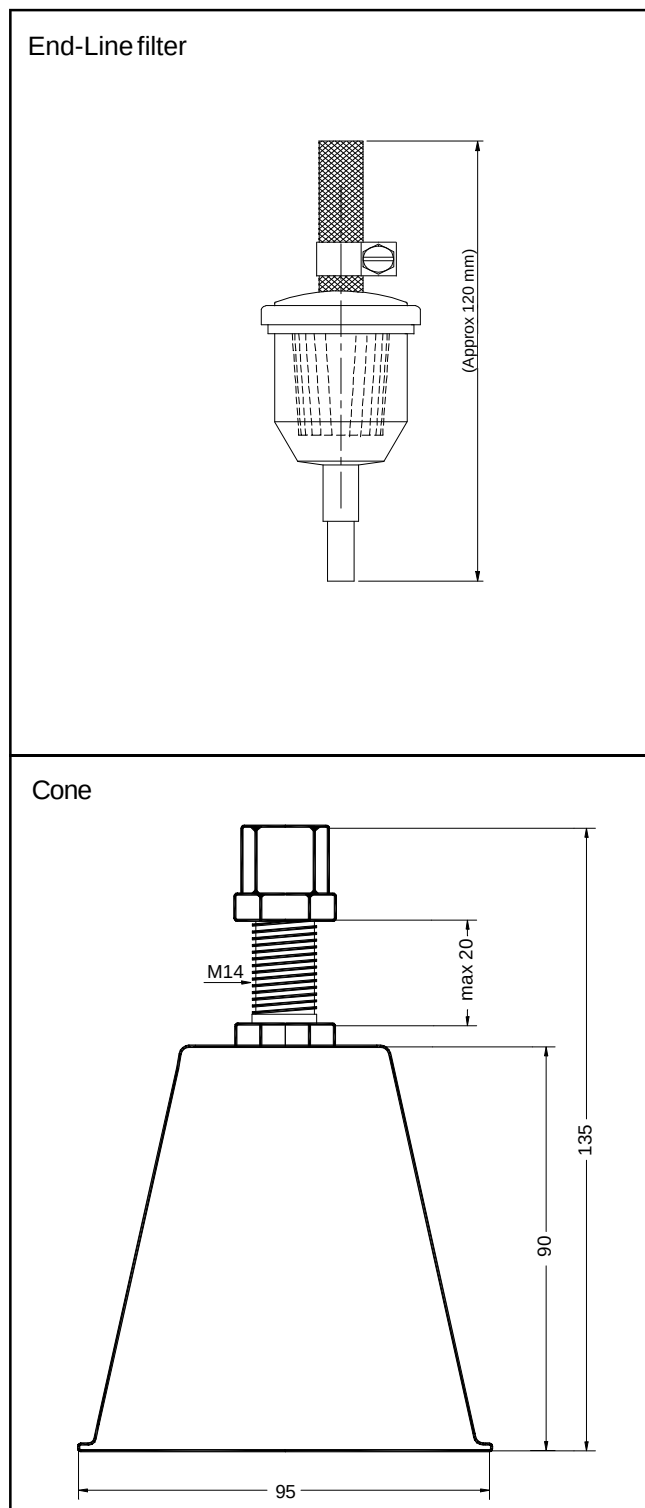


End-Line Filter

The end-line filter should always be fitted at a sampling point where it is practically feasible with regard to accessibility for future replacement. This is in order to ensure that as much of the pipe system as possible is protected.

Installation

The end-line filters are designed for installation directly on the pipe termination at the sampling point with a simple manual operation. Recommended types are shown below.



2.7.2 Options

Water Separator

In certain sampling points there may be risks that small accumulations of "splash" water will be sucked into the sampling tubes and thus preventing sampling from a low placed sampling point. The fitting of a special pipe termination section with a small hole, in correct relation to the suction inlet end and at a right distance above the pipe, prevents suction in this case. Should the splash water rise above the level of this extra hole, the automatic pump stop function comes into operation.

In those cases where the sampling pipe is terminated with a Salwico water separator, the end-line filter is placed between the pipe termination and the water separator.

Cone

For installation of sampling points with counter pressure function, it is recommended to fit the end with a cone designed for this purpose.



2.8 SAMPLING POINTS

2.8.1 Pipe Terminations

The pipe termination in the sampling area must be fixed so that the minimum distance from a bulkhead frame is 0,1 m and approx. 0,15 m from the bottom. In filter installation, e.g. end-line filter, the height above the bottom should be taken into consideration with respect to this.

In certain areas care must be taken to prevent oil or water from being sucked into the sampling pipes, and in such cases a height above the bottom of 0,5 m or more can be allowed. Corners, where the air circulation is low, should be avoided. Note that the last 0,2 m of the pipe termination end must point downwards.

Each pipe termination should be marked with the corresponding sampling point number.

Option

Refer to Chapter 2.7 for special pipe termination facility.

2.8.2 Location of the Sampling Points

In accordance with the regulations and draft proposals that have been drawn up by the classification societies, the following areas are to be monitored by the permanently installed gas sampling system:

- Cofferdams
- Pipe tunnels
- Ballast tanks and double bottoms
- Other empty areas adjacent to slop tanks
- Pump rooms, connected to a separate system.

In addition, it can be recommended that stool tanks and other empty areas adjacent to the cargo tanks are connected to the permanently installed gas sampling system.

In accordance with these rules it is essential that the planned number of sampling points and their location including the pipe installation should be evaluated and commented on by the classification societies prior to installation.

2.8.3 Marking of Sampling Points

Each sampling pipe must be marked with its number at the sampling point as well as the manual shut-off valve. (Each sampling point is numbered at the flame trap on the analysing unit.)

Salwico SW2020 always has one sampling point reserved for internal monitoring of the analyzing cabinet, normally the last sampling point.

2.9 OPTIONS

2.9.1 Counter pressure System

The counter pressure system is to be used for such sampling points which are located in areas that can be temporarily filled with water.

The counter pressure system, when supplied, is built into the Salwico SW2020 system. The operation of the counter pressure system is based on compressed air being automatically connected to sampling points, during the not sampling period and when the sampling point is temporarily disconnected from the automatic scanning.

Note! The hand maneuvered shut off valve in the bulkhead passage shall remain in open position when the sampling point is disconnected via the control panel. Only in case of loss of the supply of compressed air or when the pipes by some reason are mechanically disconnected between the analysing unit and the bulkhead, the shut off valves for safety reasons shall be closed.

Counter pressure system installation requires connection of compressed dry instrument air to the analysing unit.

Incoming operating pressure: 5 - 16 kp/cm².

Pressure regulator set to 3.2 kp/cm².

Max air consumption: approx. 10 - 20 litres/hour for each sampling point.

For cone connection refer to installation of cone in this chapter.

2.9.2 Pipe Cleaning System

A pipe cleaning system is recommended for blowing the pipes clear of water.

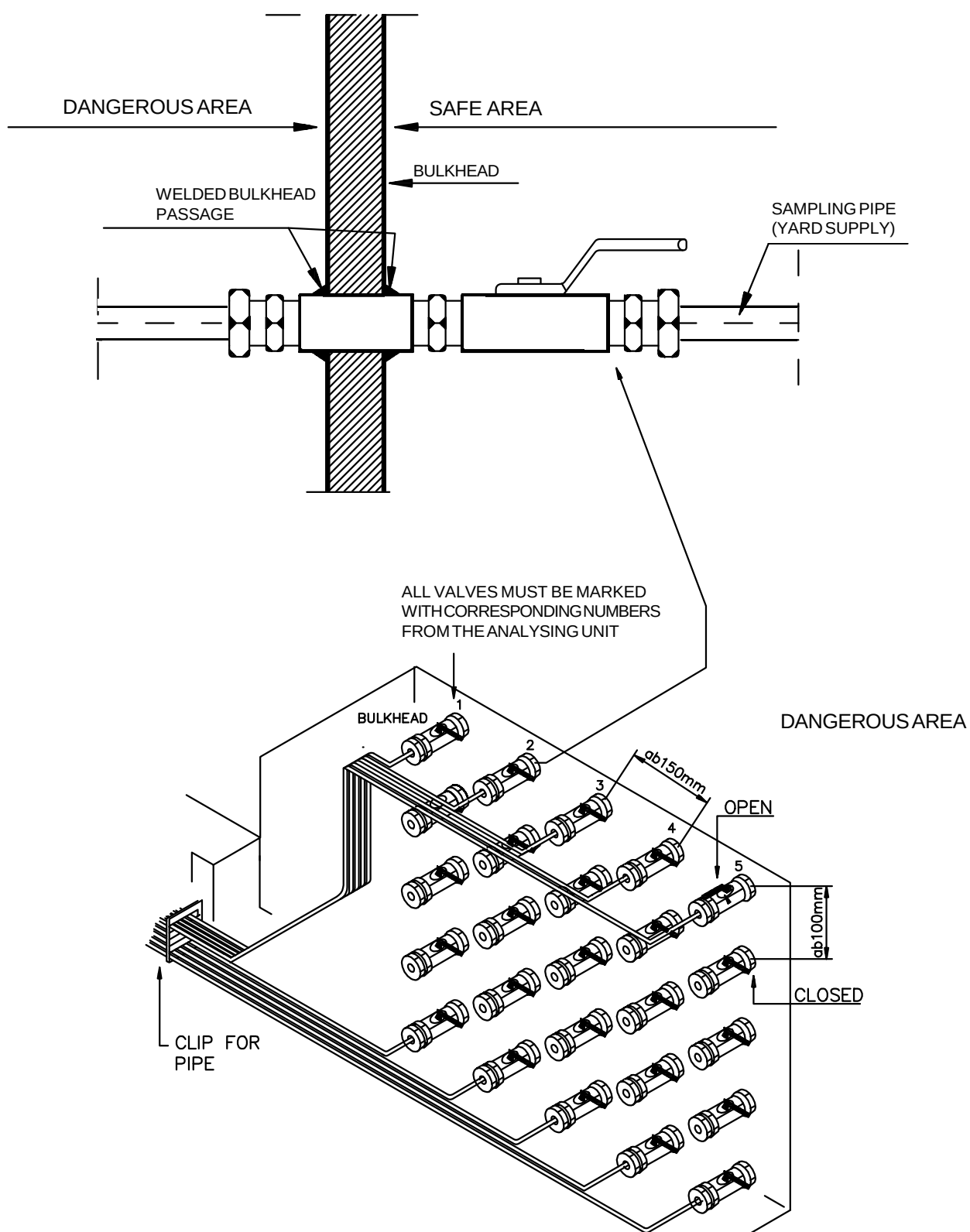
The pipe cleaning system, when supplied, is built into the Salwico SW2020 system. Its installation requires connection of compressed dry instrument air to the analysing unit.

Incoming operating pressure: 5 - 16 kp/cm².

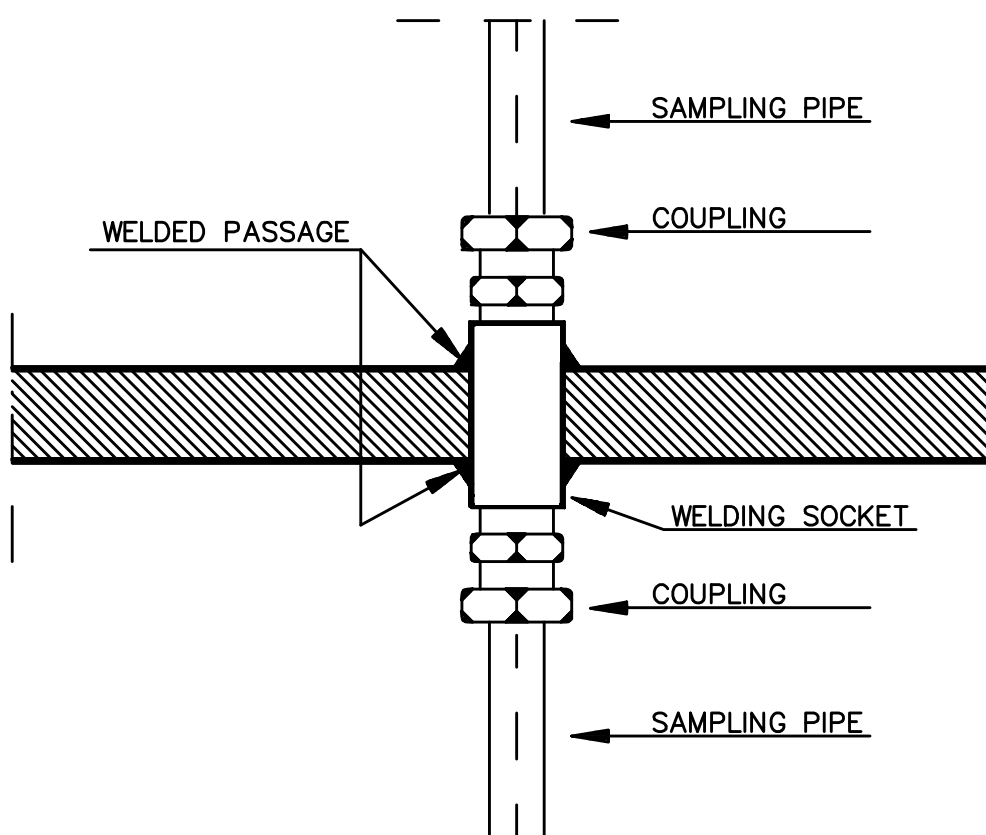
Pressure regulator set to 3.2 kp/cm².

Note! When both a pipe cleaning and a counter pressure system are included in the SW2020 the same compressed air connection is used jointly.

Shut-off valves

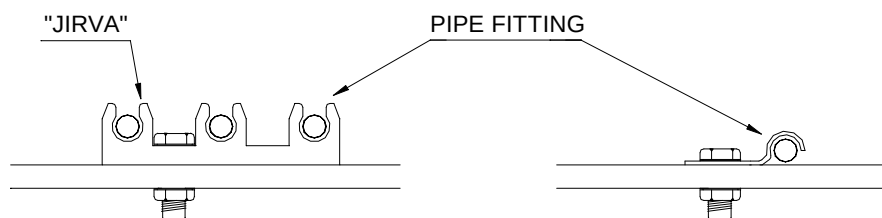


Deck bulkhead passage



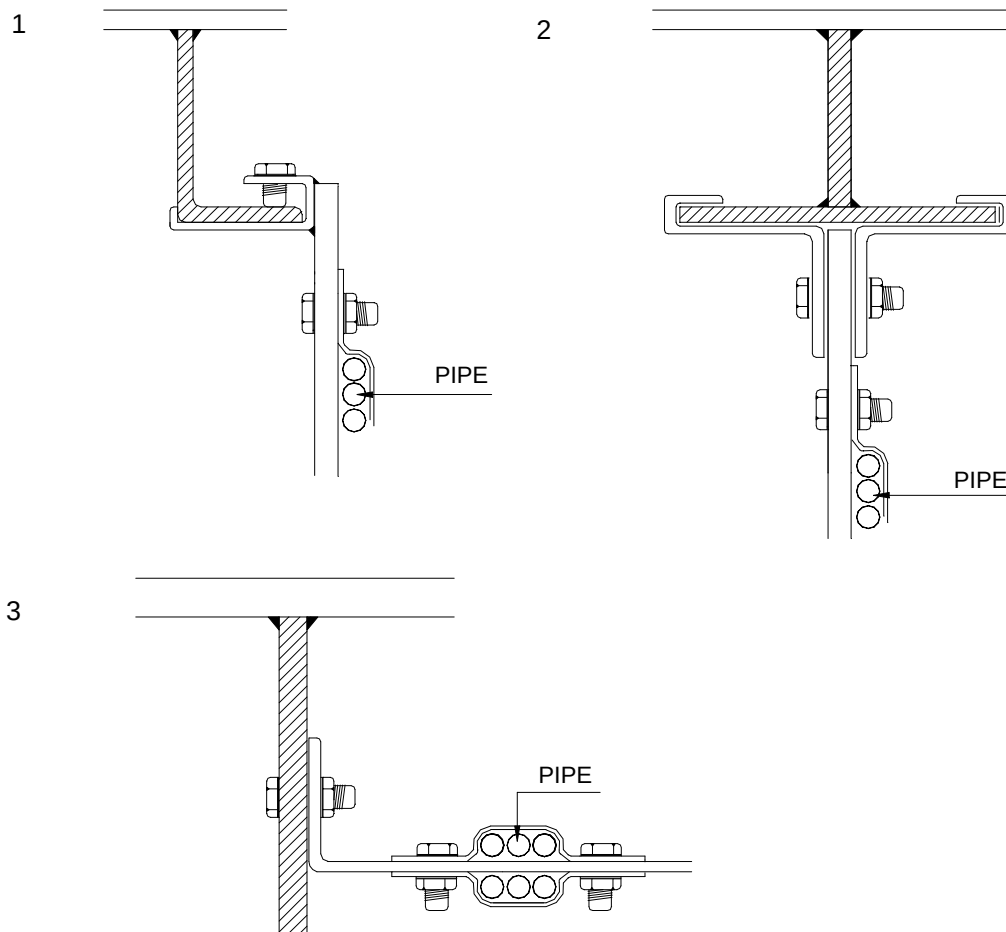
Suspension and fixing

CLAMP FOR PIPE on the deck/deckhouse



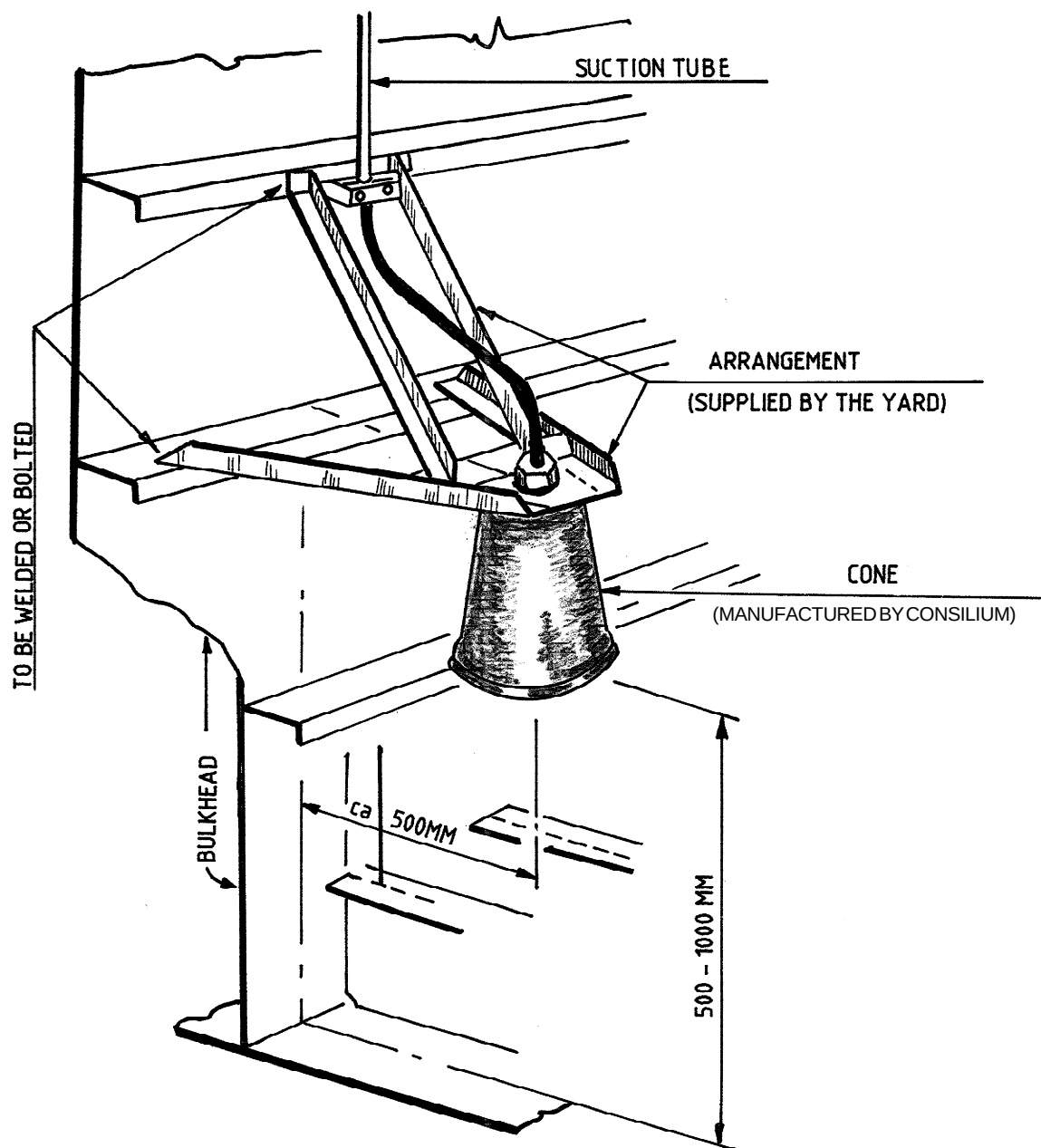
CLAMP FOR PIPE in the pipe tunnel/ cofferdams etc.

ALTERNATIVE:



Installation of cone

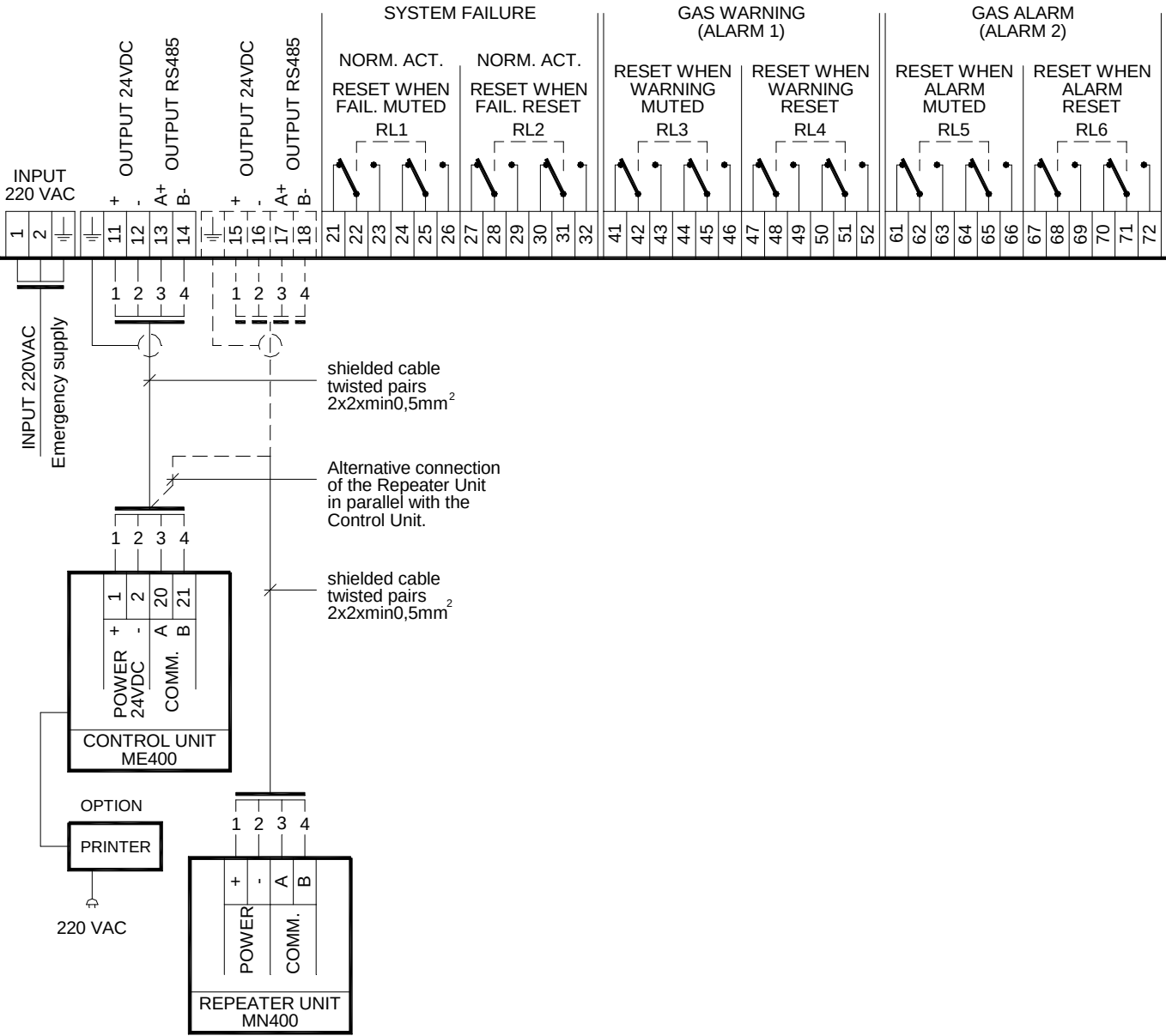
IN COMBINATION WITH COUNTER PRESSURE ARRANGEMENT



Electrical Connections

External connections

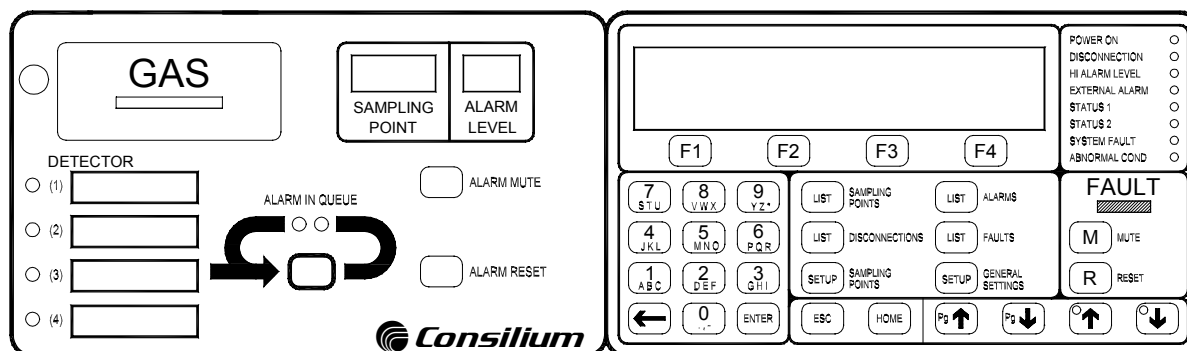
ANALYSING UNIT



GAS SAMPLING SYSTEM SW2020

	SAMPLING POINT COMMISSIONING DATE:			
POINT NUMBER	LOCATION	DISTANCE	SAMPLING TIME SET	
1				
2				
3				
4				
5				
6				
7				
8				
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10				
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3. OPERATION



3.1 GENERAL PRINCIPLES

The Control Unit of the SW2020 Gas Sampling System is divided into two separate parts.

The left-hand side contains only three keys: **ALARM MUTE**, **ALARM RESET** and **ALARM IN QUEUE**. The **ALARM IN QUEUE** key is used to find a gas alarm in the gas alarm list and the two other keys to either mute or to reset an alarm (the gas level is measured again to see if the alarm condition has disappeared).

The right-hand side is used for operation of the system. Just press one of the six **LIST** and **SETUP** keys to start managing the system. All six keys will open a list of items (sampling points, alarms etc.).

Use the four arrow keys to find the item you want and use the function keys to select an action to perform.

You could for instance make a manual measurement on sampling point number 5 (SP5) by first pressing **LIST – SAMPLING POINTS**, then choose SP5 with the arrow keys and finally press **F3 (MEASURE)** to start measuring on SP5. The display should now look like below.

```
sp5 - Water ballast tank 2 STB
Current: 5           New: _
Enter manual measurement time in minutes
MEASURE
```

Some menus require a numerical input. Manual measurement is one of them. Enter a new value with the numerical keyboard. Press **ENTER** to change the new value into the current value and press **F1** to start measuring.

Just press **F1** if you want to start measuring using the default value (5-minutes).

The display will now show the measurement value on the selected sampling point.

```
sp5 - Water ballast tank 2 STB
Remaining measurement time 4:43
12 %LEL CxHy
```

The system used in the examples in this manual consists of 60 sampling points and one detector measuring hydrocarbon gases (CxHy).

3.2 STANDBY

The control unit is in standby mode most of the time. The display below shows that the measurement sequence is running. The system always displays the last measurement.

```
** RUNNING **                <12:01:54>
sp5: Water ballast tank 2 STB
0 %LEL CxHy
```

The standby menu displays the system status. Another message could be:

```
** STARTUP **                <12:01:54>
      Please wait -
      System check in progress...
```

The standby mode can be identified by the clock in the upper right corner and can be reached by pressing the HOME key. The control unit will automatically return to standby mode 30 minutes after the last keyboard entry.

3.3 LISTS

All manipulation required by the average user can be performed from the four lists in the system.

ALARM LIST

The left-hand side of the control unit always displays the sampling point in alarm (1-60) and the alarm level (Hi or Low).

Mute gas alarms by pressing **ALARM MUTE** and reset gas alarms by pressing **ALARM RESET**. Press **ALARMS IN QUEUE** to display the next gas alarm (if any).

When you want more detailed information about an alarm press **LIST - ALARMS** on the right-hand side of the control unit. This list is opened automatically when a new gas alarm is detected. Use the arrow keys to display the next and previous alarms.

The display below shows the first alarm of three. The alarm occurred on sampling point 1, in water ballast tank no 1 STB side and 43 %LEL CxHy (Alarm level 'Hi') was measured.

```
** ALARM LIST 1(3) **
sp1: Water ballast tank 1 STB
43 %LEL CxHy(Hi)
```

FAULT LIST

Press **LIST - FAULTS**, on the right-hand side of the control unit, to display the faults in the system. This list is automatically opened when the system detects a fault.

The display below shows the first fault of two. Fault code 15 with an explanatory text is displayed.

```
** FAULT LIST 1(2) **
Fault(15) repeater unit 1 no answer
```

Mute faults by pressing the **FAULT MUTE** key and reset faults by pressing the **FAULT RESET** key.

Fault codes

The following faults can be detected. See section C, part 3.7, for a more thorough explanation of the fault codes

- (1) Analyse pump, flow failure
- (2) Bypass pump, flow failure
- (3) Analyse Pump or Internal Leakage
- (4) Calibration
- (5) Detector 1, (*Gas type + type of detector fault*)
- (6) Detector 2, (*Gas type + type of detector fault*)
- (7) Detector 3, (*Gas type + type of detector fault*)
- (8) Detector 4, (*Gas type + type of detector fault*)
- (9) Moisture in analysing unit (option)
- (10) High temperature in analysing unit (option)
- (11) Power fault (option)
- (12) Flow fault on SP #
- (13) Fuse fault in control unit
- (14) Low 5 volt in control unit
- (15) Repeater unit # no answer
- (16) Repeater unit # booted
- (17) Analyse unit no answer
- (18) Analyse unit booted
- (19) No custom setup, using factory (or default) setup
- (20) Flash memory error in control unit
- (21) Negative drift, analyser 1 (Abnormal condition)
- (22) Negative drift, analyser 2 (Abnormal condition)
- (23) Negative drift, analyser 3 (Abnormal condition)
- (24) Negative drift, analyser 4 (Abnormal condition)

SAMPLING POINT LIST

Press **LIST - SAMPLING POINTS** to enter the Sampling Point List.

Select a sampling point with the arrow keys (sampling point 5 is selected in the example below) and then use the function keys to perform an action.

```
** SAMPLING POINT 5(60) **
sp5: Water ballast tank 2 STB

VALUES  DISCONNECT  MEASURE  PURGE
```

The following actions can be performed on a sampling point:

- **VALUE** – Display the value of the last gas measurement
- **DISCONNECT** – Disconnect for a period of time or forever (OFF).
Before ballasting: Always disconnect the corresponding sampling

points. The counter pressure will automatically engage for sampling points with this feature.

- **MEASURE** – Start measuring the gas concentration. Make a prompt check of the actual gas concentration on the selected sampling point. The measurement time can be set in minutes but never below the set-up time (depending on the pipe length). The gas value(s) are continuously updated during the measurement and a Gas Alarm (high or low) will be generated if the corresponding value is still exceeded when the measurement value is stable.
- **PURGE** – Clean the pipe for that particular sampling point during 2 minutes. An automatic decompression is done through the internal sampling point, to protect the pressure switch and pump membrane before commencing the measurement sequence. The decompression time is 10 seconds.

Actions such as purge and manual measure can not be performed on a disconnected sampling point. The only action allowed on a disconnected sampling point is RECONNECT.

After a MEASURE or PURGE manoeuvre, the normal measuring sequence is commenced at the sampling point where the sampling was interrupted.

IG Mode (option)

IG (Inhibit Gas-Alarm) Mode is a type of disconnection used for areas where high contamination levels are expected. The detectors in IG Mode are still measuring but are prevented from giving alarm. These detectors are configured on delivery.

IG Mode is typically used for measuring gas levels in tanks with inert gas. In this case, for instance O₂-detectors are prevented from generating alarms when the sampling point is in IG Mode.

```

** SAMPLING POINT 5(60) **
sp5: Water ballast tank 2 STB

VALUES   DISCONNECT   MEASURE   PURGE

```

Pressing **F2** (DISCONNECT) in the menu above will result in an additional option on button F2 (IG-MODE):

```

Sp5: Water ballast tank 2 STB
Current: Forever      New:
Enter disconnection time in minutes
DISCONNECT   IG-MODE

```

Pressing **F2** will now put the selected SP in IG Mode.

In contrast to SP's disconnected in the traditional way (the airflow is stopped) it is still possible to manipulate the SP.

```

** SAMPLING POINT 5(60) **
sp5: Water ballast tank 2 STB

VALUES   RECONNECT   MEASURE   PURGE

```

Sampling Point Groups (option)

Sampling point groups are used in installations with many sampling points to make the daily handling of disconnecting and reconnecting sampling points more efficient.

Sampling points 1 to 8 are members of group 1 in the example below. The group members and the free text on row 2 (STB Water ballast tanks, SP 1-8) are configurable in SETUP but requires access level 2.

A group can be disconnected:

```
** GROUP 1(3) **
Grp1: STB Water ballast tanks, SP 1-8
DISCONNECT
```

And reconnected again, the user will be asked to automatically purge all sampling points in the group (recommended). Take care when reconnecting a whole group - make sure that all areas are empty and do not require IG Mode (if that option is implemented).

```
** GROUP 1(3) **
Grp1: STB Water ballast tanks, SP 1-8
RECONNECT
```

Sampling points belonging to a group can still be disconnected or reconnected individually, this makes the situation below valid since the sampling points in a group can have mixed disconnection status.

```
** GROUP 1(3) **
Grp1: STB Water ballast tanks, SP 1-8
RECONNECT DISCONNECT
```

DISCONNECTIONS LIST

Press **LIST - DISCONNECTIONS** to enter the Disconnection List.

Disconnected sampling points are listed here. Reconnect the chosen sampling point by pressing **F1** (RECONNECT).

```
** DISCONNECTION LIST 1(3) **
sp 5 disconnected
sp5: Water ballast tank 2 STB
RECONNECT
```

IG Mode (option)

Sampling points in IG Mode are added to the Disconnection List.

```
** DISCONNECTION LIST 2(3) **
sp 6 disconnected (ig mode det 2,3,4)
sp6: Water ballast tank 3 STB
RECONNECT
```

3.4 SETUP – GENERAL SETTINGS

The system changes the access level and enters CONFIGURATION MODE when the correct access code for level 2, 3 or 4 is entered. The system will not start until the user chooses to start the system again (the access level is automatically changed back to 1) or the user timeout expires after 30 minutes.

Choose a menu with the **Arrow Keys**. The menu numbers in this document are shown between brackets in each header.

General settings - access level 1

Change access level (1)

Enter a 4-digit access code and push **↵**. The result of the operation is displayed on row 3. The sampling sequence is stopped when the access level is changed to 2 or higher.

```
(1) Change access level
Current: ****          New:
Enter a 4-digit access code
```

Change access level code (2)

Enter the access level you want to change access code for, push **↵** and then **F1** to continue. The code can only be changed for access levels lower or equal to the current access level (level 2 in the example below).

```
(2a) Change access level code
Current: 2          New:
Enter an access level (1-3)
CONTINUE
```

Enter the new 4-digit access code, push **↵** and then **F1** to continue.

```
(2b) Change access level code
Current:          New:
Enter the 4 digit access code
CONTINUE
```

Enter the same access code again and push **↵**. The result of the operation is displayed on row 3.

```
(2c) Change access level code
Current:          New:
Enter the same 4 digit code again
```

Change time of day (3)

Enter the time of day (HHMMSS, 24-hour clock) and push **↵**. The result is displayed on row 3.

```
(3) Change time of day
Current: 121629      New:
Enter a new time of day (HHMMSS)
```

Change the date (4)

Enter the date (YYYYMMDD) and push ↵. The result is displayed on row 3.

```
(4) Change the date
Current: 19970101   New:
Enter a new date ..... (YYYYMMDD)
```

Change LED intensity (5)

Enter a new intensity and then push ↵ to change the intensity of the LED's.

```
(5) Change LED intensity
Current: 5          New:
Enter a new value (1..5)
```

Print the system configuration (6)

Push **F1** to print the system configuration. Printing the systems configuration can, needless to say, only be done when there's a printer in the system.

```
(6) Print the systems configuration

PRINT
```

Test pixels and LEDs (7)

Push **F1** to test LED's and pixels on the control unit.

```
(7) Test pixels and LED's

TEST
```

Test the local buzzer (8)

Push **F1** to test the local buzzer.

```
(8) Test the local buzzer

TEST
```

Check the valves for internal leakage (9)

Push **F1** to check the system (valves and connections) for internal leakage.

```
(9) Start checking the valves
Status: ABORTED

START      STOP
```

General settings - access level 2

Restart the system, save current setup (10)

Push **F1** to restart the sampling sequence. The system will change back to access level 1 and save the current system configuration.

(10) Restart the system
- Save the current setup,
return to access level 1
RESTART

Restart the system without saving (11)

Push **F1** to restart the sampling sequence. The system will change back to access level 1 but will **not** save the current system configuration. All changes to the system configuration will be lost.

(11) Restart system without saving
- Don't save the current setup,
return to access level 1
RESTART

Calibrate span on a gas detector (12)

Gas detectors must be calibrated with two different gas concentrations: Zero and a Span gas value determined by the user (the span gas value must be in the area 25-100% off the highest measurement for the gas detector).

Calibration of span is only accepted when dS , in figure 1, is within 10% of the expected value.

Successful calibration of a detector will result in correct presentation of gas values on the control unit.

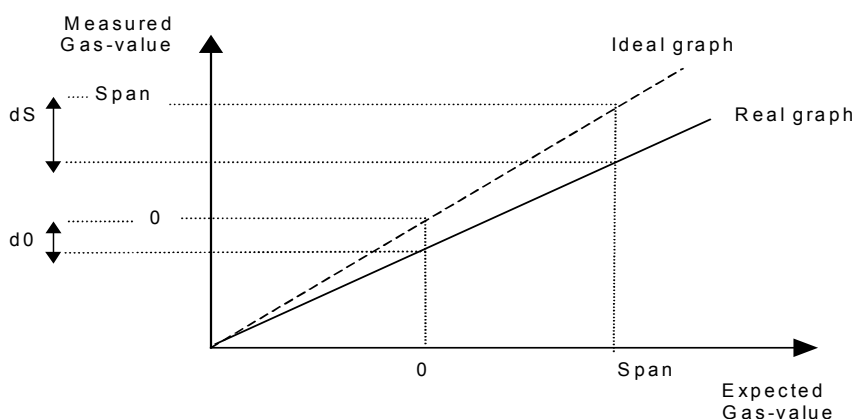


Figure 1: Two-point calibration. "Gas-values" below 0 are interpreted as "negative drift" or as a fault condition.

Select one detector (1-4) to calibrate by entering a numeric input and ↵. Push **F1** to continue.

(12a) Calibrate span on a gas detector
Current: (1)CxHy New:
Enter detector no (1 - no of detectors)
CONTINUE

Enter the concentration of the span-gas. Push **F1** to continue. Note that the procedure for calibrating span for Oxygen will differ.

(12b) Calibrate span on a gas detector Current: 50 New: Enter test gas value in %LEL CONTINUE

Open the valve(s) connecting the test-gas bottle to the test-gas tube in the analysing unit. Push **F1** to continue.

(12c) Calibrate span on a gas detector Open test gas valve to start calibration START

Start the calibration procedure and change to menu 12d by pushing **F1**.
The measured gas-value can now be seen on row 2.

Wait until the measured gas-value has stabilised and then calibrate the detector with **F1**.

If calibration fails:

- Check the span gas tube.
- Calibrate the gas detector manually or exchange any active cells (The procedure depends on the brand and type of gas detector).

Exit menu 12d with **F2**.

(12d) Calibrate span on a gas detector Measured: 49 %LEL CxHy CALIBRATE EXIT

Close the test-gas valve(s) and exit with **F1**.

(12e) Calibrate span on a gas detector Remember to close the test gas valve(s) EXIT

Adjust zero on a gas detector (13)

Calibration of zero for a gas detector is done with air from the fresh air inlet (except for atmospheric gases).

(13a) Adjust zero on a gas detector Current: (1)CxHy New: Enter detector no (1 – no of detectors) CONTINUE
--

Select one detector (1-4) to calibrate by entering a numeric input and ↵.
Push **F1** to continue.

(13b) Adjust zero on a gas detector Measured: 1 %LEL CxHy ADJUST
--

Calibrate the detector with **F1** when the measured value is stabilised.

If zero calibration fails:

- Make sure the fresh air inlet is not blocked.
- Calibrated the gas detector manually or exchange any active cells (The procedure depends on the brand and type of gas detector).

Exit with **ESC**.

Undo calibration on a gas detector (14)

Select one detector (1-4) to undo calibration by entering a numeric input and ↵. Push **F1** to undo calibration of the chosen detector. The previous value is presented on the control unit.

(14) Undo calibration on a gas detector Current: (1)CxHy New: Enter detector no (1 - no of detectors) UNDO
--

Number of groups in the system (15)

Change the current number of groups with a numeric input and ↵. A group is a collection of Sampling Points, the groups defined in this menu are configured individually in the Sampling Points Setup, see **3.5**.

(15) No of groups in the system Current: 0 New: Enter the number of groups (0..8)
--

General settings - access level 3

Change the start-up time (16)

Change the current start-up time with a numeric input and ↵. The start-up time determines how long the SW2020 will wait after power-on before starting the sampling sequence (to allow warm-up of gas detectors).

(16) Change the startup time
Current: 10 New:
Enter startup time in seconds

Change the alarm delay time (17)

Change the current alarm delay time with a numeric input and ↵. The alarm delay time determines how long the SW2020 waits before measuring after gas from the correct Sampling Point has arrived at the detector(s).

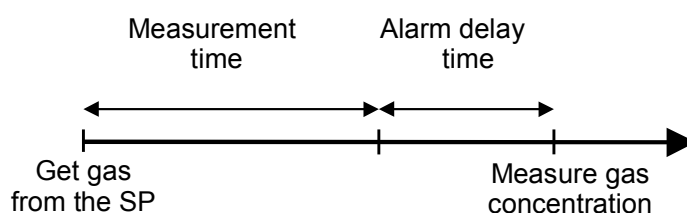


Figure 2: Measurement on a sampling point.

This time should be equal to the reaction time of the **slowest** gas detector in the system

(17) Change the alarm delay time
Current: 5 New:
Enter alarm delay time in seconds

Same measurement time all SPs (18)

Change the current measurement time for all sampling points with a numeric input and ↵. The measurement time for a Sampling Point is the time it takes for the gas to arrive from the SP to the detector(s). See figure 2

Observe that measurement times for individual measurement points will be lost.

(18) Same measurement time all SP's
Current: 11 New:
Enter the measurement time in seconds

Same alarm level all SPs (19)

Change the current alarm level for all sampling points. Observe that alarm levels for individual measurement points will be lost.

Choose a gas detector with a numeric input and **↵**. Continue with **F1**.

```
(19a) Same alarm level all SP's
Current: (1)CxHy      New:
Enter detector no (1 - no of detectors)
CONTINUE
```

Choose the alarm level to change (High or Low) with **F2** and **↵**. Continue with **F1**.

```
(19b) Same alarm level all SP's
Current: Lo           New:
Toggle the alarm level with <F2>
CONTINUE TOGGLE
```

Enter the new alarm level with a numeric input and **↵**. Exit with **F1**.

```
(19c) Same alarm level all SP's
Current: 20           New:
Enter Lo alarm level for det. 1 in %LEL
DONE
```

Change the sampling sequence (20)

Enter the new sampling sequence length with a numeric input and **↵**. Continue with **F1**.

```
(20a) Change the sampling sequence
Current: 24           New:
Enter the sequence length
CONTINUE
```

Menu 20b is a list where the index in the sampling sequence is chosen with the arrow keys; the current sequence index can be seen on row 3. The sampling point corresponding to a sequence index is changed with a numeric input and **↵**. Abort definition of the sampling sequence with **F1** and save the current sequence with **F2**.

```
(20b) Change the sampling sequence
Current: 1             New:
Enter a SP for sequence index no: 1
ABORT    SAVE SEQ
```

Restart with factory settings (21)

Push **F1** to change back to access level 1 and restart the sampling sequence with the configuration that was defined at the factory.

All custom settings (changes in the configuration after delivery) will be lost.

```
(21) Restart with factory settings
- WARNING, all custom settings
  will be lost !
RELOAD
```

3.5 SETUP - SAMPLING POINTS (ACCESS LEVEL 2)

Push **SETUP - Sampling Points** and then use the **Arrow Keys** to choose the sampling point (or group) to configure. Access level 2 is required to enter the Sampling Points Setup.

Configuring a Sampling Point

Use the **Arrow Keys** to select a sampling point.

```

** SAMPLING POINT SETUP 3(6) **
sp3: Water ballast tank 2 STB

TEXT    ALARM LVL    M.TIME    DET.ON/OFF
  
```

Push **F1**, **F2**, **F3** or **F4** to configure the chosen Sampling Point.

Change the free text associated with a sampling point (TEXT)

Push **F1** to change the free text.

```

Change free text
Now: Water ballast tank 2 STB

CONTINUE
  
```

Push **F1** again to change the free text.

```

Change free text
New: _

ABORT    SAVE
  
```

The new text is entered with the alpha - numeric keyboard and the backspace key (←).

Push an alpha - numeric key until you see the desired symbol and then wait for the timer to expire (about one second) to add the symbol to the free text.

The symbols associated with each alpha – numeric key are written on the keys. Note that upper and lower case letters as well as the numeric itself is available for each key.

Save the new free text with **F2** or return to previous menu without saving with **F1** (or **ESC**).

Change the alarm levels for a detector (ALARM LVL)

Push **F2** to change the alarm level. Choose a detector with a numeric input and ↵. Push **F1** to continue.

```

Sp3: Water ballast tank 2 STB
Current: (1)CxHy    New:
Enter detector no (1 - no of detectors)
CONTINUE
  
```

Choose the alarm level to change with **F2** and ↵. Push **F1** to continue.

```

3(6) Water ballast tank 2 STB
Current: Lo    New:
Toggle the alarm level with <F2>
CONTINUE TOGGLE
  
```

Enter a new alarm level with numeric input and ↵. Push **F1** to finish.

```
3(6) Water ballast tank 2 STB
Current: 20           New:
Enter Lo alarm level for det. 1 in %LEL
DONE
```

Change the measurement time for a sampling point (M.TIME)

Push **F3** to change the measurement time. Enter a new measurement time with numeric input and ↵. Push **ESC** to finish.

The measurement time for a Sampling Point is the time it takes for the gas to arrive from the SP to the detector(s). See figure 2.

```
sp3: Water ballast tank 2 STB
Current: 11           New:
Enter new measurement time in seconds
```

Disconnect a gas detector for a certain sampling point (DET.ON/OFF)

Push **F4** to disconnect a detector. Choose a detector with a numeric input and ↵. Push **F1** to disconnect the chosen detector for that particular Sampling Point. The detector is reconnected again by pushing **F1** one more time.

```
sp3: Water ballast tank 2 STB
Current: (1)CxHy     New:
Enter detector no (1 - no of detectors)
DISCONNECT
```

Configuring a Group

If a number of groups are configured in the system (see 3.4.), they will be present in the Sampling Point List. Use the **Arrow Keys** to select a Group.

```

** GROUP SETUP 3(3) **
grp3: Water ballast tanks STB

TEXT    DEFINE
  
```

Push **F1** or **F2** to configure the chosen Group.

Change the free text associated with a group (TEXT)

Push **F1** to change the free text.

```

Change free text
Now: Water ballast tanks STB

CONTINUE
  
```

Push **F1** again to change the free text.

```

Change free text
New: _

ABORT    SAVE
  
```

The new text is entered with the alpha - numeric keyboard and the backspace button (←).

Push an alpha - numeric button until you see the desired symbol and then wait for the timer to expire (about one second) to add the symbol to the free text.

The symbols associated with each alpha – numeric button are written on the buttons. Note that upper and lower case letters as well as the numeric itself is available for each button.

Save the new free text with **F2** or return to previous menu without saving with **F1** (or **ESC**).

Define Group Members (DEFINE)

Push **F1** to ADD a Sampling Point to the Group. Push **F2** to remove the last Sampling Point from the Group and push **F3** to exit the menu.

```

Define group 3
Sp:1,2,3

ADD SP  REMOVE LAST  DONE
  
```

Push **F1** to ADD Sampling Point 4 to the group or enter a new Sampling Point with numeric input and ↵. The **ESC** button will return to the previous menu without adding a new sampling point.

```

Add Sampling Point to Group no 3
Current: 4          New:

ADD
  
```

3.6 CONTROL UNIT PANEL

The function of each individual key on the control unit is described below.

Key	Function
LIST – SAMPLING POINTS	List all sampling points in the system. Use ↑, →, Pg↑ and Pg↓ to choose a sampling point.
LIST – DISCONNECTIONS	List all disconnected sampling points and detectors. Use ↑, →, Pg↑ och Pg↓ to choose an entry.
LIST – ALARMS	List all gas alarms in the system. Use ↑, →, Pg↑ and Pg↓ to choose an entry.
LIST – FAULTS	List all faults in the system. Use ↑, →, Pg↑ och Pg↓ to choose a fault.
SETUP – SAMPLING POINTS	List all sampling points in the system. Use ↑, →, Pg↑ and Pg↓ to choose a sampling point. Access level is required to change settings.
SETUP – GENERAL SETTINGS	List all general settings in the system. An access level above 1 is required to change most settings.
F1 ,F2 ,F3, F4	Function keys. Push here to perform an action.
0, 1, 2 – 9	Numeric input buttons
↵ (ENTER)	Used to accept a numeric input
ESC	Go to the previous menu.
HOME	Go to the standby menu.
↑	List the next list entry. The LED is lit when the button is active.
	List the previous list entry. The LED is lit when the button is active.
Pg ↑	Display the fifth list item to come (the list must have more then 5entries).
Pg ↓	Display the fifth previous list item.
M – FAULT MUTE	Mute all faults in the system.
F – FAULT RESET	Reset a fault in the fault list.
ALARM MUTE	Mute all gas alarms in the system.
ALARM RESET	Reset the displayed sampling point in alarm.
ALARM IN QUEUE	Display the next gas alarm in the alarm list.

3.7 ACTION DESCRIPTION

Gas Alarm

With reference to the alarm list:

1. When the "Alarm Mute" button is pressed, the acoustic alarm stops and all alarm outputs with mute functionality are deactivated. The scanning cycle continues and will give new alarms for each sampling point exceeding the alarm level. The alarms are stored in the Alarm List and the sampling point of the last occurred alarm is shown as well as the alarm level "LO" or "HI".
2. Activation of the "Alarm Reset" button starts a revaluation of the sampling point in alarm. An "Alarm Reset" request will stop the sampling sequence and make a new measurement. This revaluation is to be able to accept an alarm reset on the sampling point if the level is now below the alarm level. If You push the "Alarm in Queue" button and make a Reset of all sampling points in alarm, the system will start re-evaluating these sampling points one by one. It may therefore take a while to complete alarm reset for several sampling points.

The revaluation sequence can be interrupted by manual measurement or purge. (See the Sampling Point List).

Fault Alarm

With reference to the Fault list:

1. *An Analys pump, flow failure* is caused by the pressure switch PS and stops the pump and scanning sequence if the system does not have the pump redundancy option. The PS is detecting that the pump pressure is too low. The cause is probably a membrane leakage of the pump or a fault of the PS itself. Service is needed if the fault can not be reset.
2. *A Bypass pump, flow failure* is caused by pressure switch PS2. The scanning cycle continues. The bypass pump stops. The cause for this fault is the same as described for the analysing pump.
3. *Analys Pump or Internal Leakage* is indicated when the automatic leakage control fails. This control is automatically done once per 24 hours by closing all the sampling valves, running the analysing pump and checking that the vacuum switch VS1 is activated. If the VS1 is not activated the cause is a leakage at the vacuum side of the pump from pipes, solenoid valves, pipe couplings or the VS1 itself.
4. *Calibration*. This fault indicates that zero or span calibration is not completed due to a value that is out of range, either due to a gas detector fault or a test gas fault. The bottle might be empty or the test gas mixture is not corresponding to the value that is set for span calibration.
- 5-8 *Gas Detector 1-4*. Indicates a fault depending on which type of detector that is in use. There might be a loss of power, a dirty mirror in an IR-detector or a sensor failure etc.
9. *Moisture fault* (Option). Indicates that condense water is sucked into the pipe system of the analysing unit.
10. *High temperature in the analysing unit* (Option).
11. *Power fault* (Option). As indicated if there are two independent power supplies and one fails.

12. *Flow fault on SP#*. Indicates a flow fault on the sampling point listed. Before indication of a flow fault the automatic pipe cleaning function first attempt to remove the cause of the flow fault by flushing the sampling pipe during 15 seconds and then tries to obtain a new sample. If the flow fault still remains the sampling point is automatically disconnected and a flow fault alarm is generated and listed in the fault list. The scanning cycle continues to the next sampling point. As long as the flow fault for a certain sampling point is listed in the fault list the fault remains. To be able to reset the flow fault the cause has to be removed. If a mistake was done concerning a sampling point in a ballast tank that should normally had been disconnected before ballasting the sampling point has to be disconnected via "List Sampling Point" Key.
13. *Fuse fault* as indicated. Switch off the main power and change the broken fuse.
14. *Low voltage 5V in the control unit*. Service or exchange of the unit might be necessary.
15. *Repeater unit # no answer*, indicates that there is no contact with the repeater unit indicated. There might be a damage, fuse fault, power loss or a cable brake.
16. *Repeater unit # booted*, indicates that the fault message according to 15 is reset.
17. *Analysing unit no answer*, indicates that there is no contact with the PCB – RIOK-40. The reason might be a function fault, power fault, fuse fault or a cable brake.
18. *Analysing unit booted*, indicates that the fault message according to 17 is reset.
19. *No custom set-up*, using factory (as default) set-up, indicates that custom related settings are not done. This normally only occurs the first time the system is started at the workshop.
20. *Flash memory error in control unit* indicates a faulty flash memory. Exchange of the same might be necessary. Consult the service department for assistance.
- 21-24.
Negative drift, analyser 1-4 (Abnormal condition). Calibrate the detector.

3.8 THE MINI REPEATER UNIT – MN400

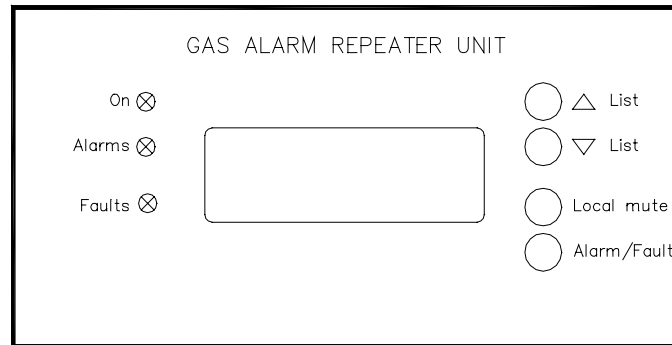


Figure 3: The Mini Repeater - MN400

The Man - Machine Interface

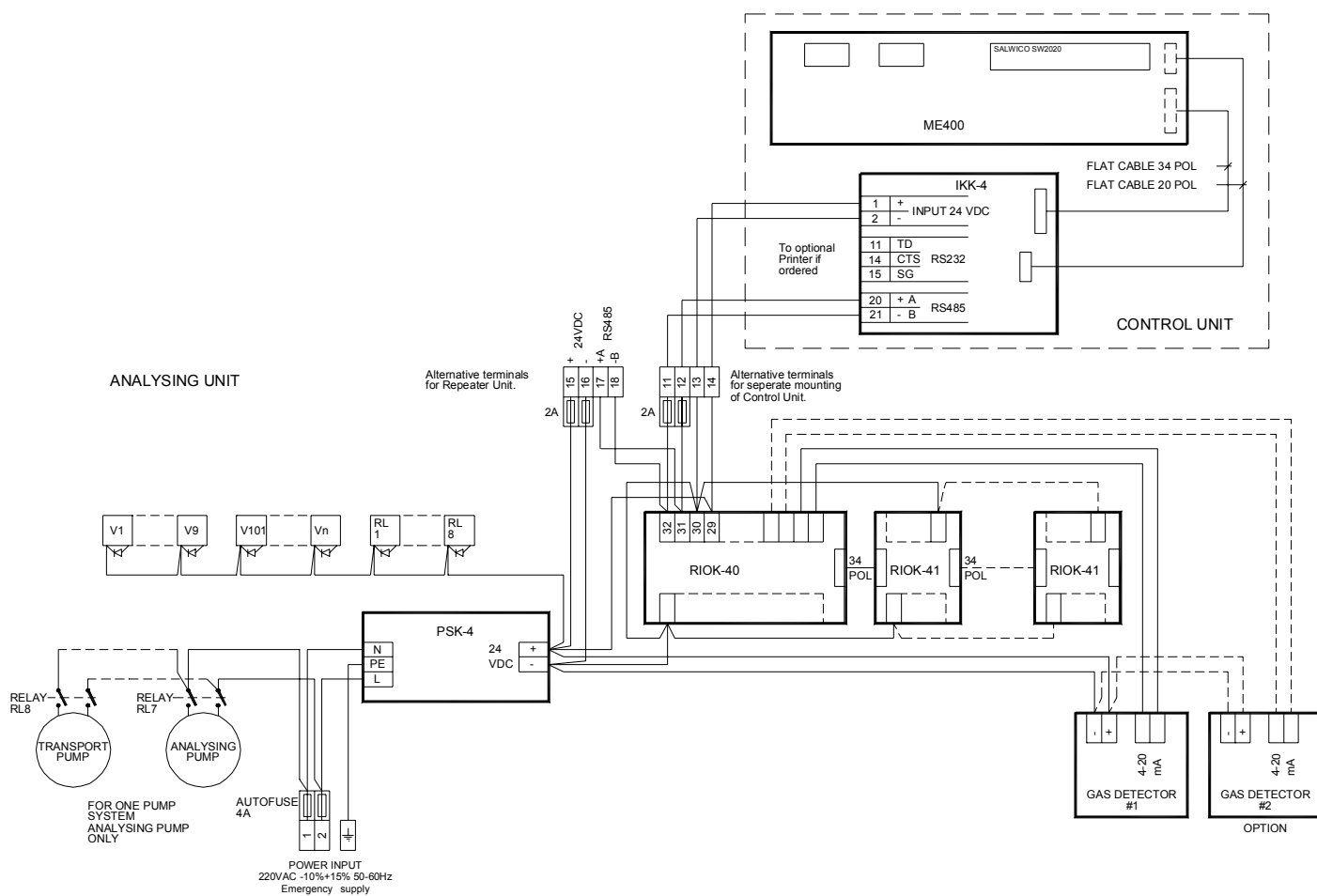
- Gas alarms are shown on the Mini Repeater.
- The previous and next alarms (if any) can be listed with the Arrow Keys.
- Faults are shown when there are no unmuted gas alarms in the system
- The previous and next faults (if any) can be listed with the Arrow Keys.
- The clock is shown when there are no alarms or faults in the system.
- The Local mute button has dual functions
– It mutes the local buzzer if there are any entries in the fault or alarm lists
– It will light the LCD-display, all LED's and sound the buzzer for 15 seconds if there are no entries in the Gas alarm or Fault alarm lists
- The user can access the fault list with the Alarm/Fault button if the MN400 is presently showing the Gas Alarm List. The MN400 will return to the Alarm list after 15 seconds if no buttons are touched.

LEDs

- The ON LED – Is lit when the MN400 is running
- The ALARM LED – Is lit when there is a Gas Alarm in the system
- The FAULT LED – Is lit when there is a Fault Alarm in the system

4. TECHNICAL DATA

4.1 INTERNAL CONNECTION



4.2 INTERNAL CONNECTIONS ON RIOK-40 AND RIOK-41

Analogue inputs on RIOK-40

<u>Input</u>	<u>Terminal</u>	<u>Pos</u>	<u>Description</u>
AN1	19-20		Gas Detector 1
AN2	21-22		Detector 2 (option)
AN3	23-24		Detector 3 (option)
AN4	25-26		Detector 4 (option)

Digital inputs on RIOK-40

<u>Input</u>	<u>Terminal</u>	<u>Pos</u>	<u>Description</u>
0	1-2	PS 1	Fault Analysing Pump
1	3-4	PS2	Fault Transport Pump (option)
3	5-6	VS1	Fault Analysing Flow
4	7-8	VS2	Fault Transport Flow (option)
5	9-10		Fault Gas Detector (option)
6	11-12		Fault Moisture (option)
7	13-14		Fault Temperature (option)
8	15-16		Fault Power (option)

Digital outputs from RIOK-40

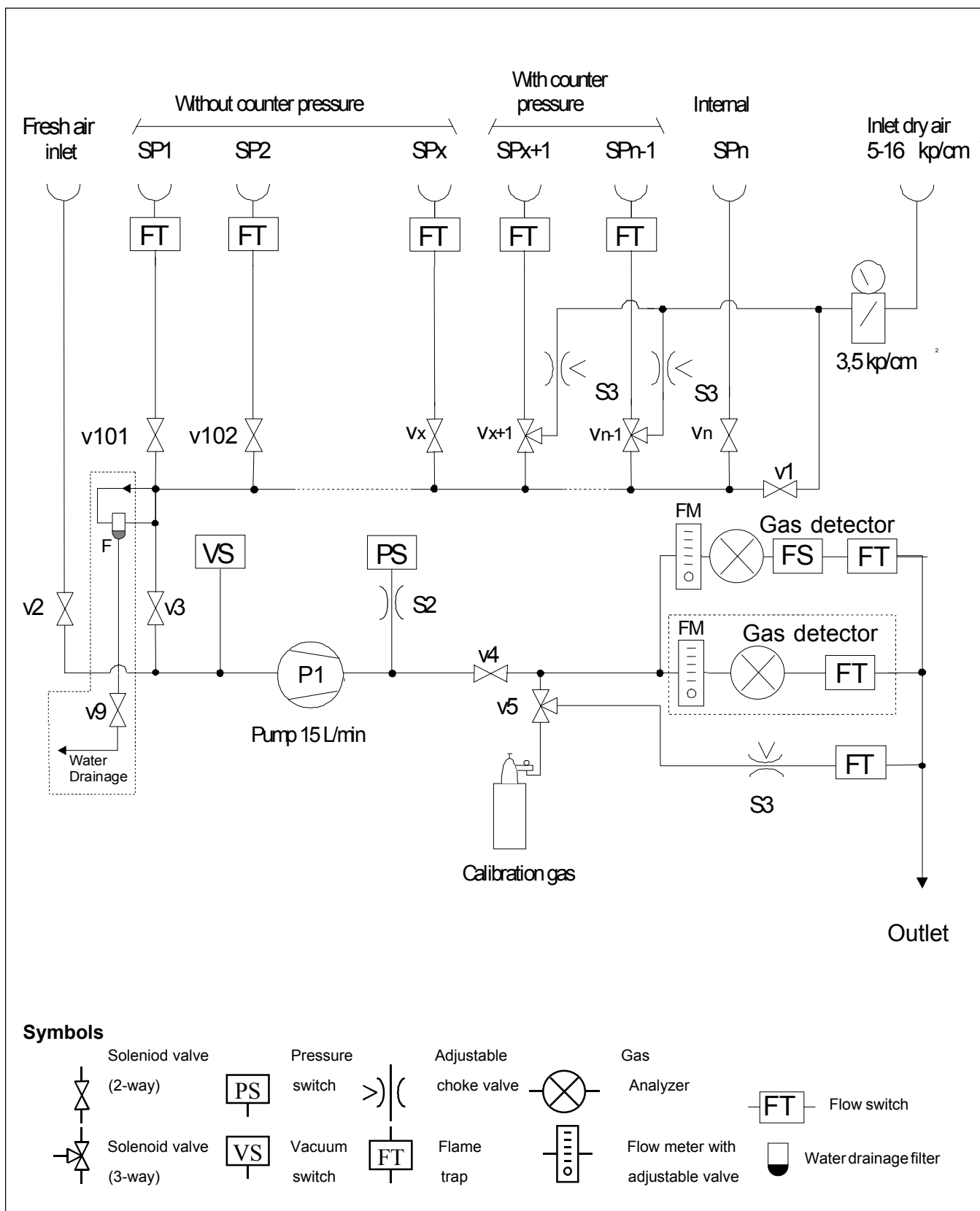
<u>Output</u>	<u>Terminal</u>	<u>Pos</u>	<u>Description</u>
0	35	RL1	Fault alarm with mute function
1	37	RL2	Fault alarm
2	39	RL3	Gas alarm Low level with mute function
3	41	RL4	Gas alarm Low level
4	43	RL5	Gas alarm High level with mute function
5	45	RL6	Gas alarm High level
6	47	V1	Soleniod valve
7	49	V2	Soleniod valve
8	51	V3	Soleniod valve
		alt. V8	Soleniod valve. Pump redundance. (option)
9	53	V4	Soleniod valve
10	55	V5	Soleniod valve
11	57	V6	Soleniod valve for Two pump system
12	59	V7	Soleniod valve for Two pump system
13	61	V9	Soleniod valve. Water trap drainage (option)
14	63	RL7	Controller Relay for Analysing Pump
15	65	RL8	Controller Relay for Transport Pump (option)

Outputs on RIOK-41's

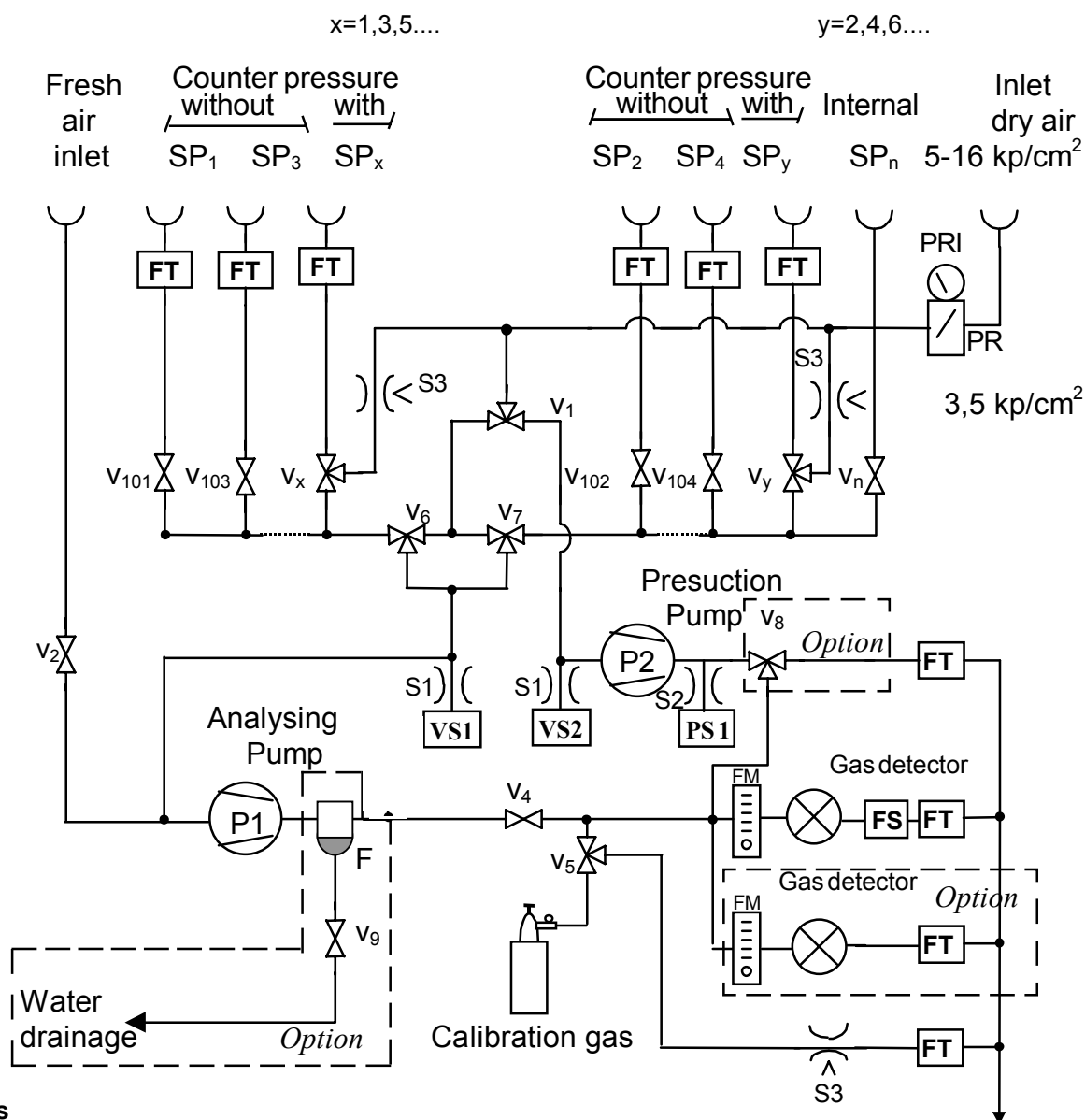
<u>Output</u>	<u>Terminal</u>	<u>Position</u>	<u>Description</u>
16	2	V101	Solenoid Valve Sampling Point 1
17	4	V102	Solenoid Valve Sampling Point 2
18	6	V103	Solenoid Valve Sampling Point 3
19	8	V104	Solenoid Valve Sampling Point 4
20	10	V105	Solenoid Valve Sampling Point 5
21	12	V106	Solenoid Valve Sampling Point 6
22	14	V107	Solenoid Valve Sampling Point 7
23	16	V108	Solenoid Valve Sampling Point 8
24	2	V109	Solenoid Valve Sampling Point 9
25	4	V110	Solenoid Valve Sampling Point 10
.		.	
.		.	
.		.	
n		Vn	Solenoid Valve Sampling Point n

4.3 Pneumatic diagram, Analysing unit

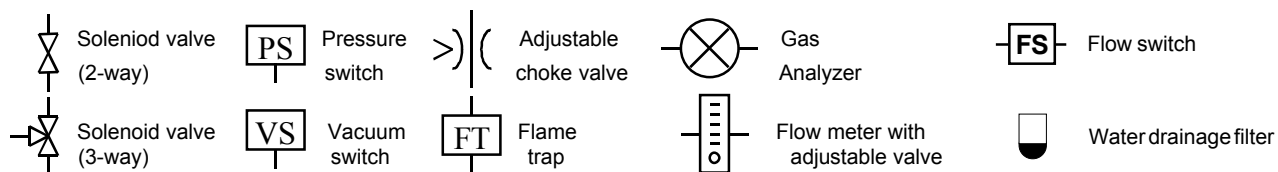
4.3.1 One pump system



4.3.2 Two pump system



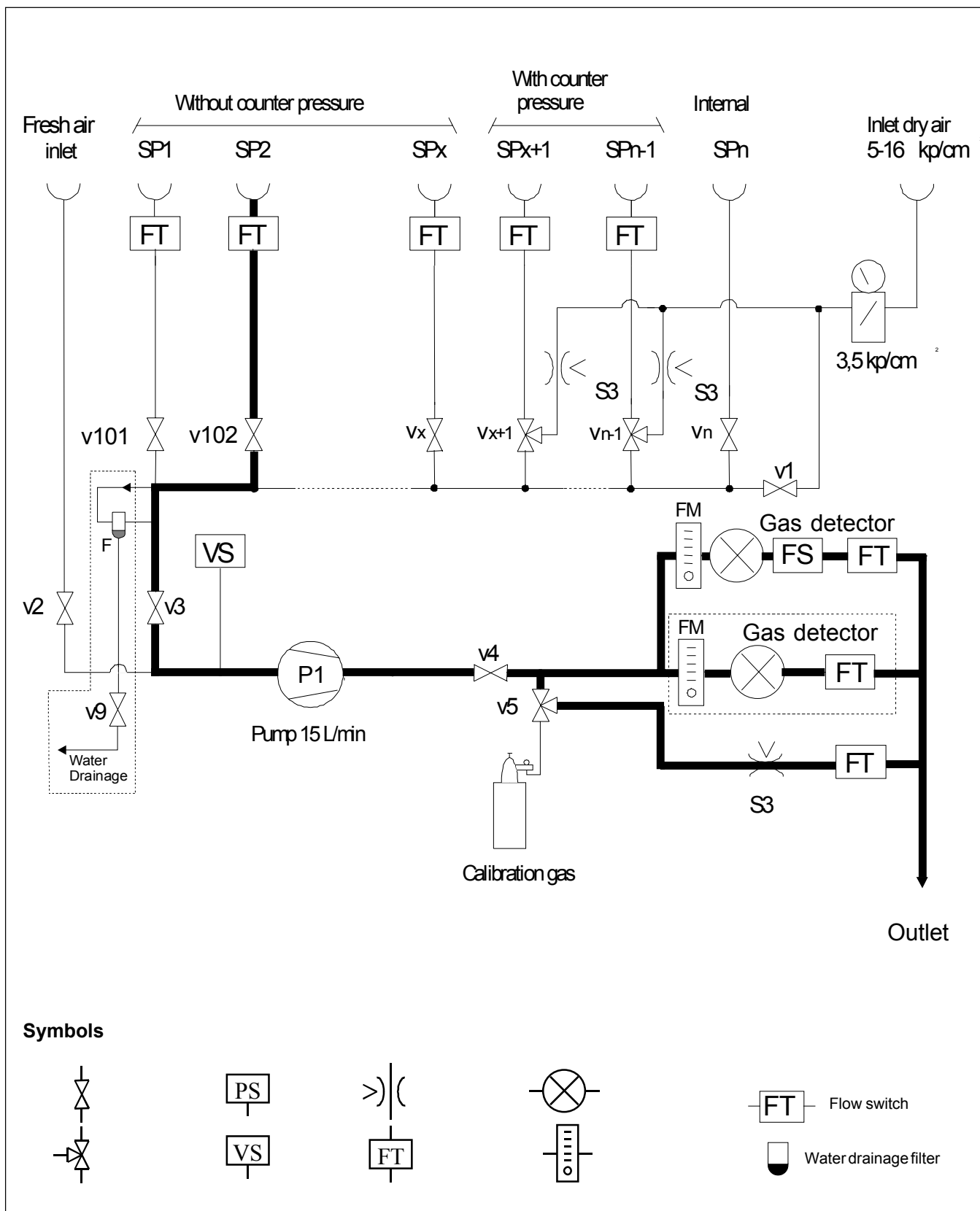
Symbols



4.4 Flow examples

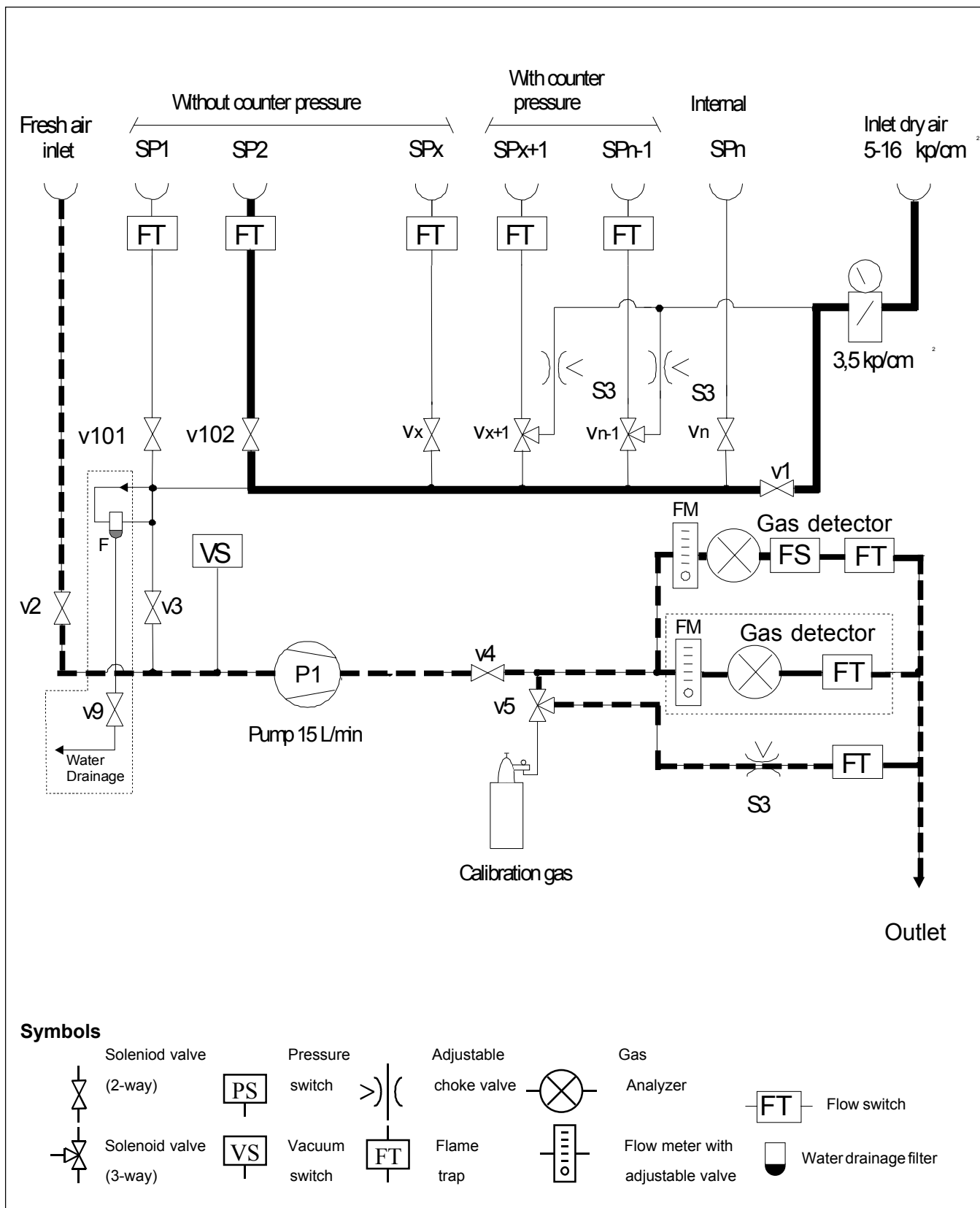
4.4.1 One pump system

Normal operation, sampling and analysing of sampling point no 2 (SP2)



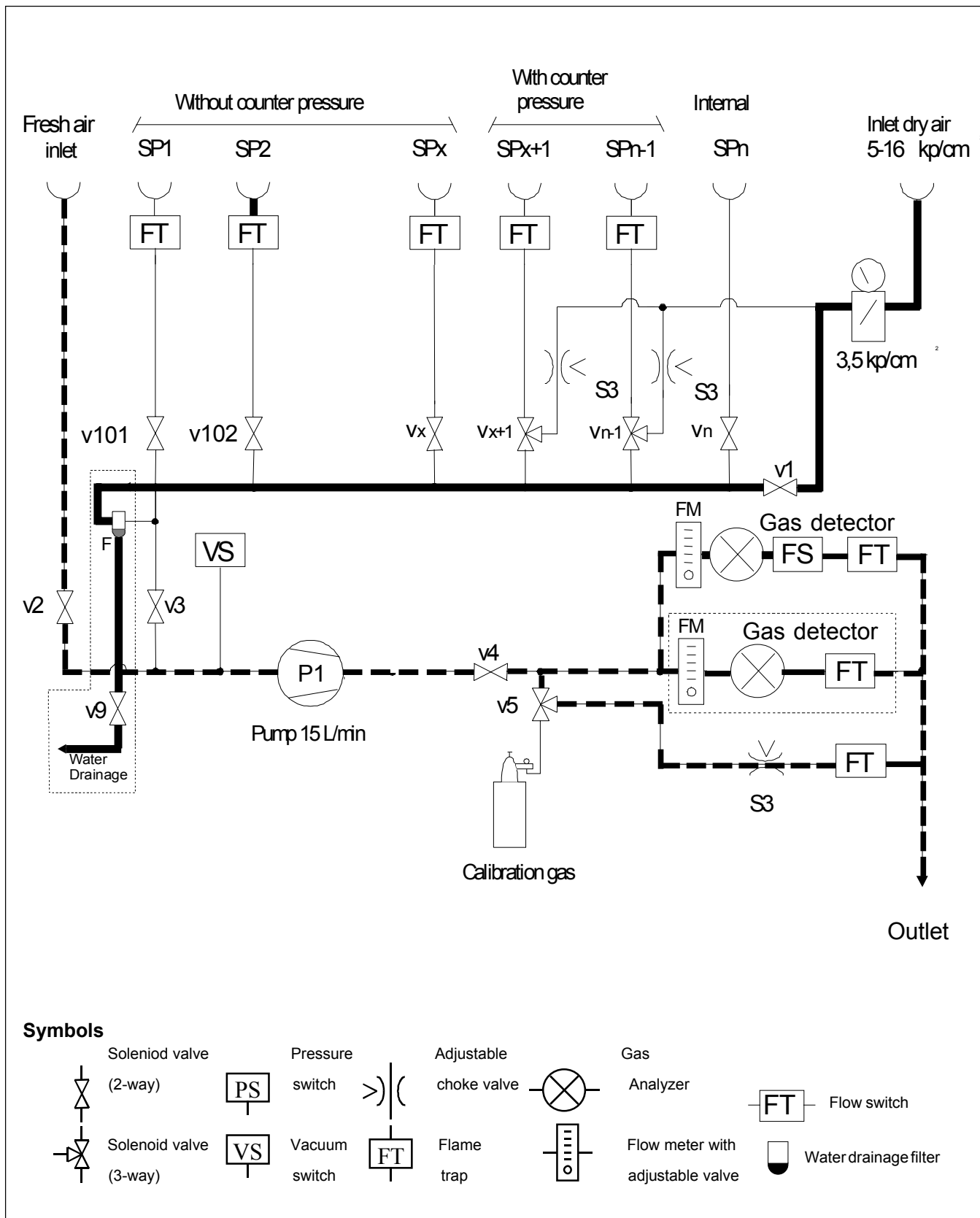
4.4.2 One pump system

Pipe cleaning function on sampling point no 2 (SP2). Pump connected to fresh air inlet.

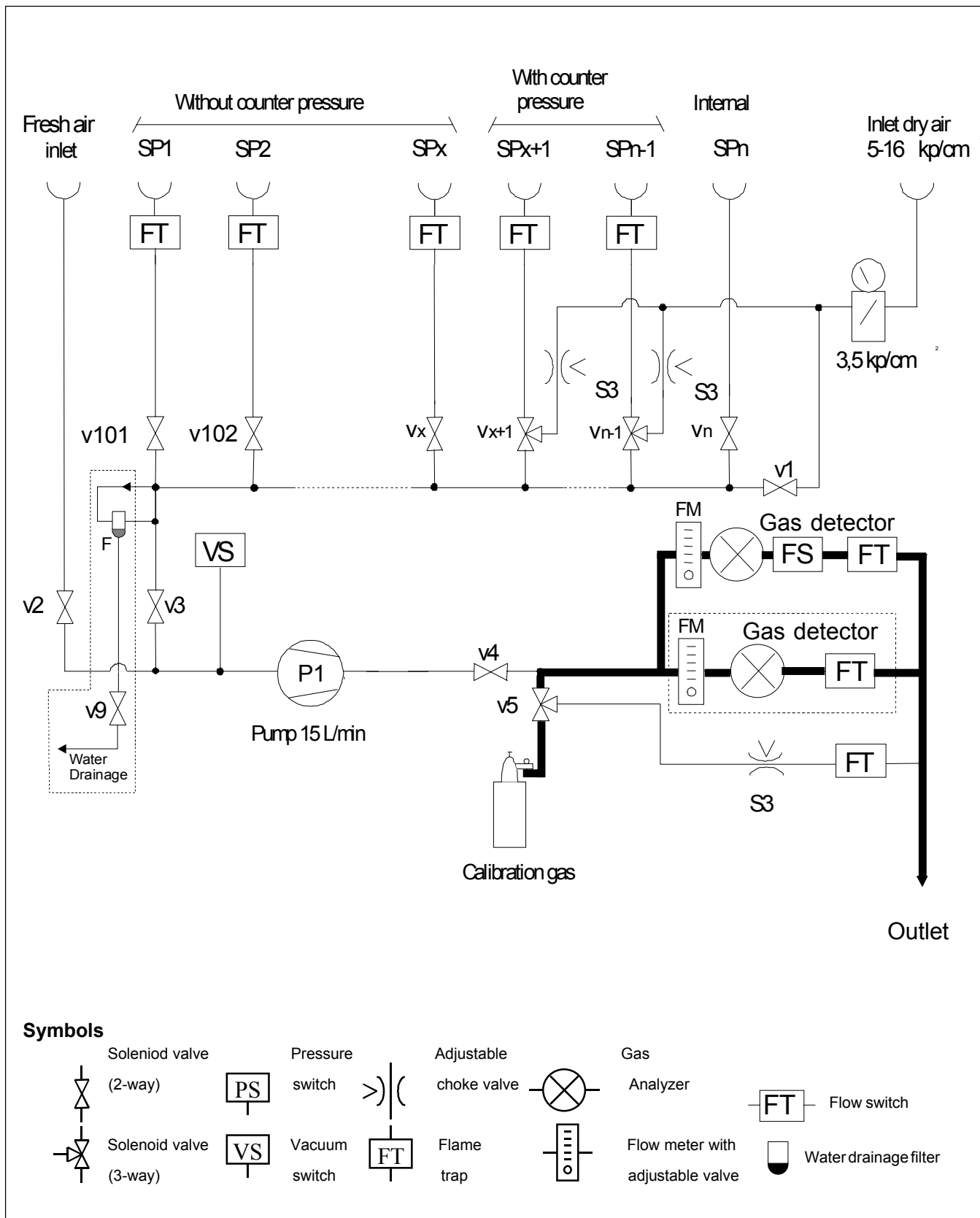


4.4.3 One pump system

Draining of water drainage filter. Pump connected to fresh air inlet.



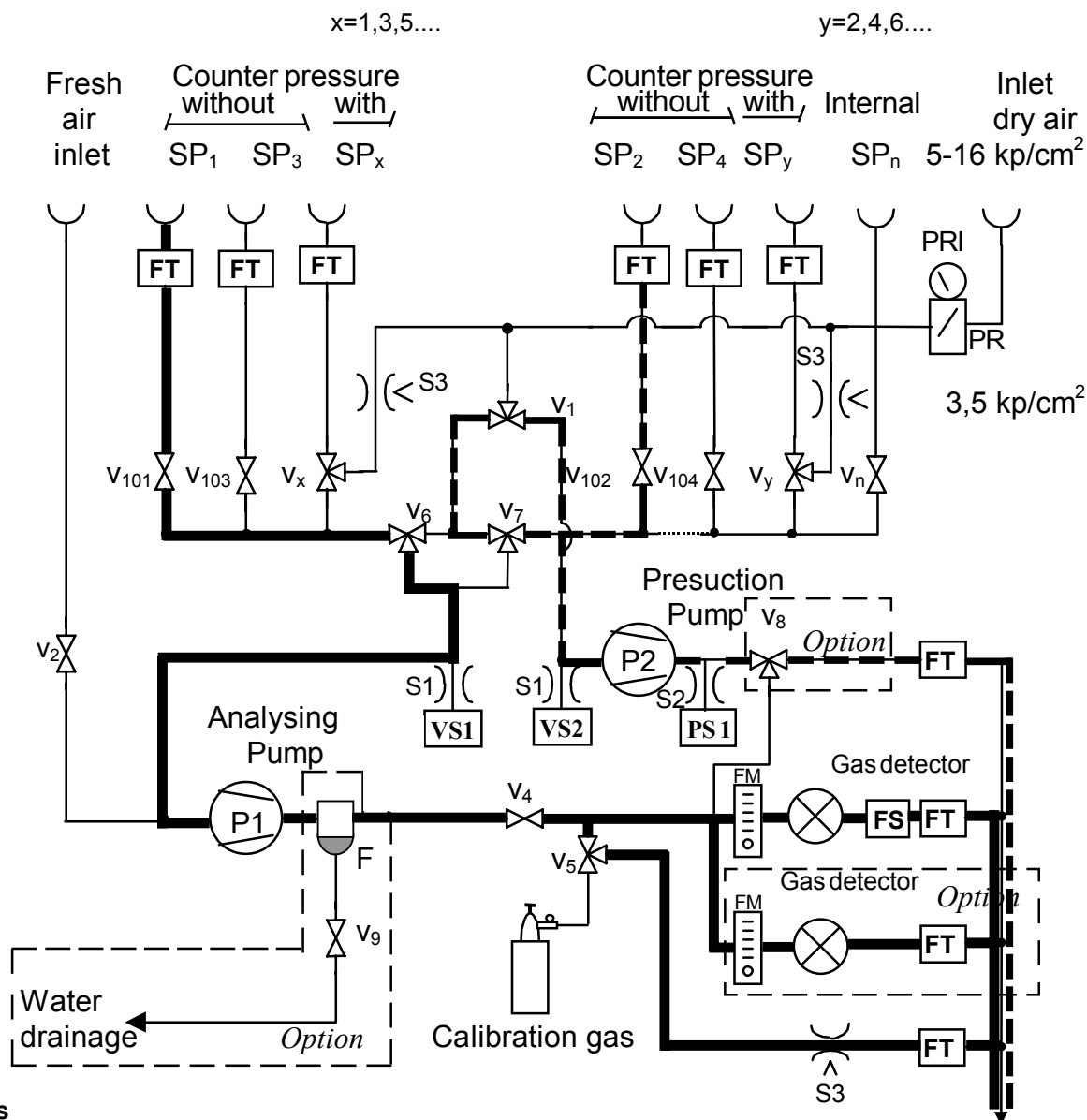
4.4.4 One pump system Calibration with test gas.



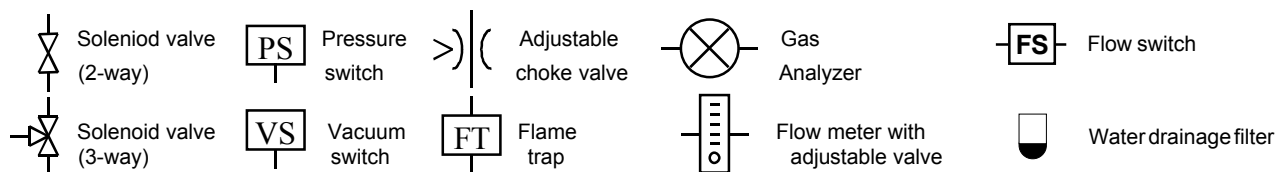
4.4.5 Two pump system

Sampling and analysing of sampling point no 1 (SP1) and presuction of SP2.

— Analysing
- - - Presuction



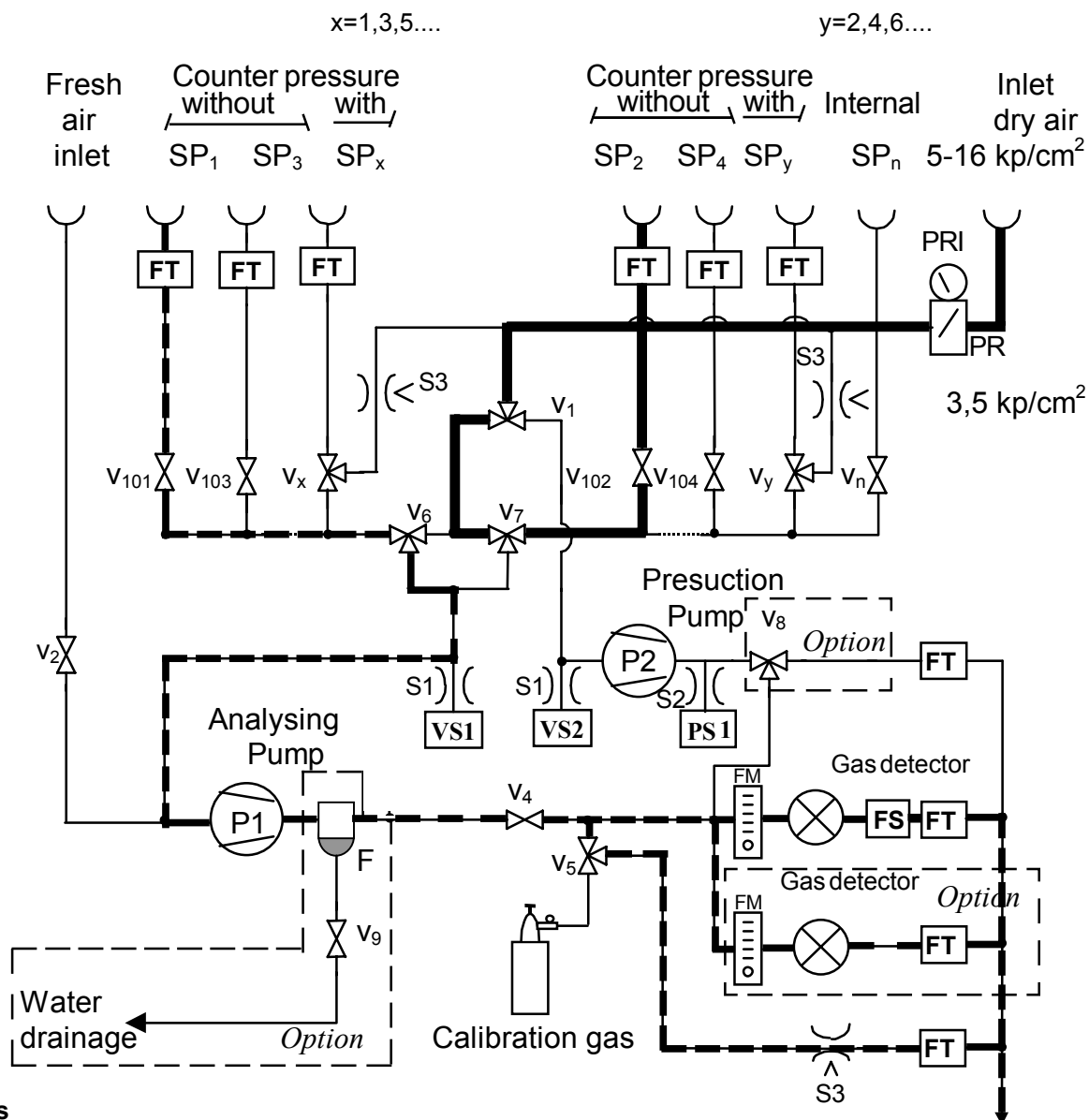
Symbols



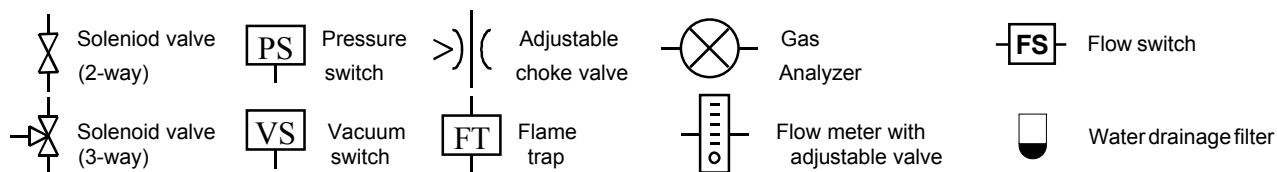
4.4.6 Two pump system

Pipe cleaning of sampling point no 2 (SP2) and analysing of sampling point no 1 (SP1).

———— Analysing
- - - - - Presuction



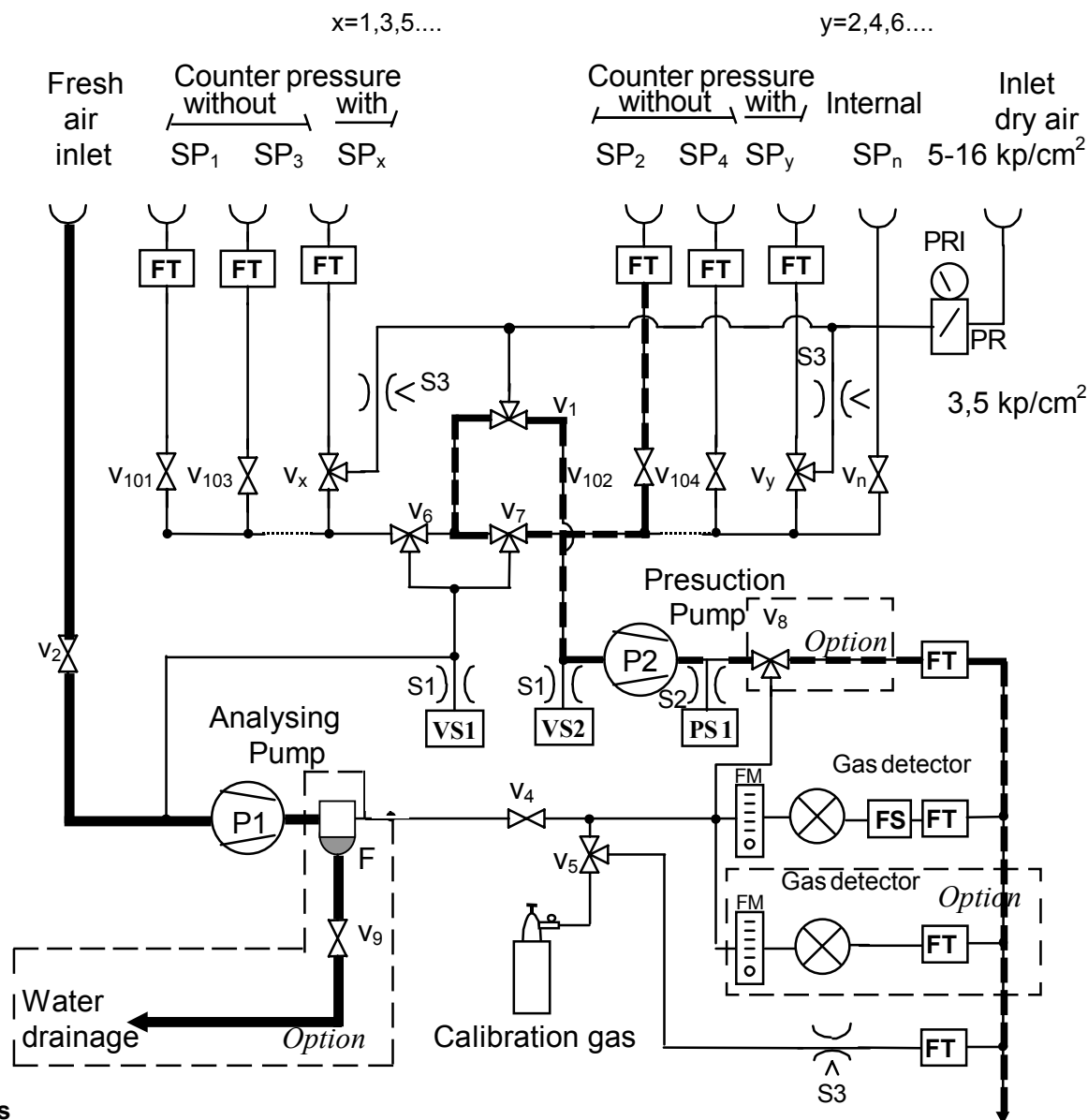
Symbols



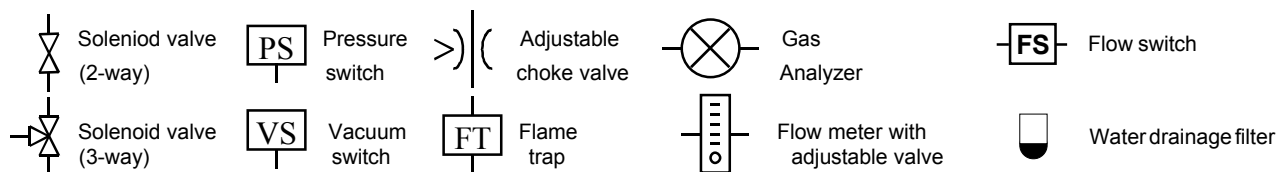
4.4.7 Two pump system

Draining of water drainage filter and presuction of sampling point no 2 (SP2).

———— Draining
- - - - - Presuction



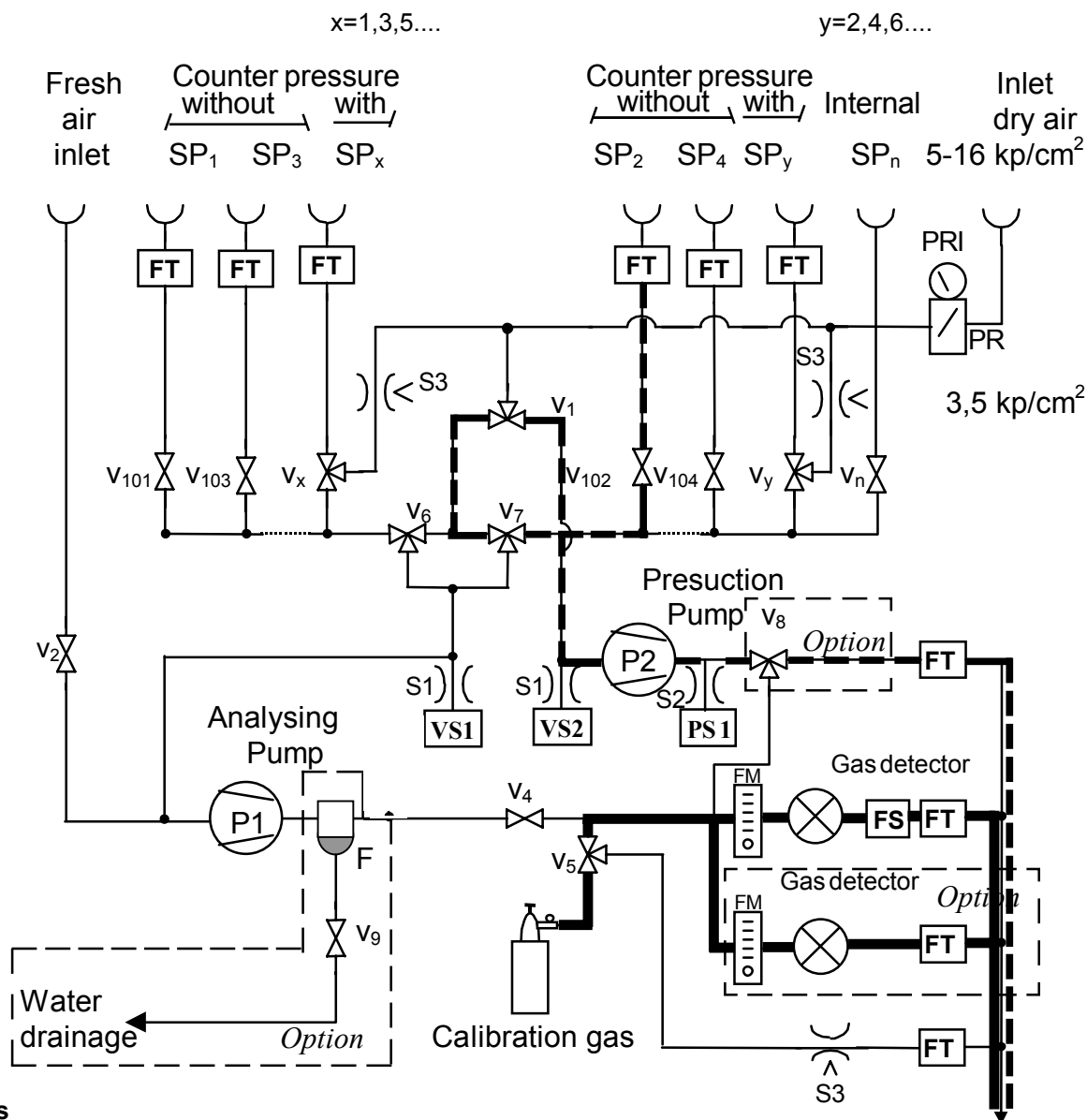
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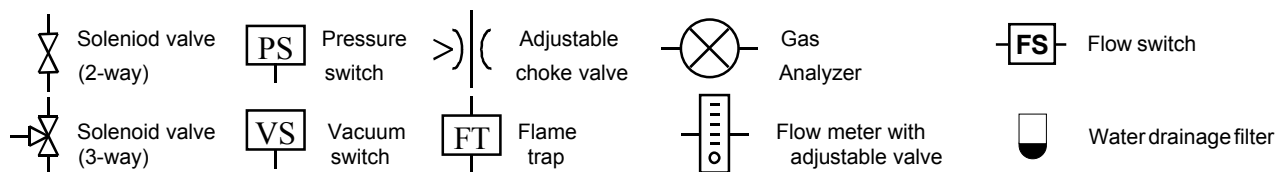
4.4.8 Two pump system

Calibration with test gas and presuction of sampling point no 2 (SP2).

———— Calibration
- - - - - Presuction



Symbols

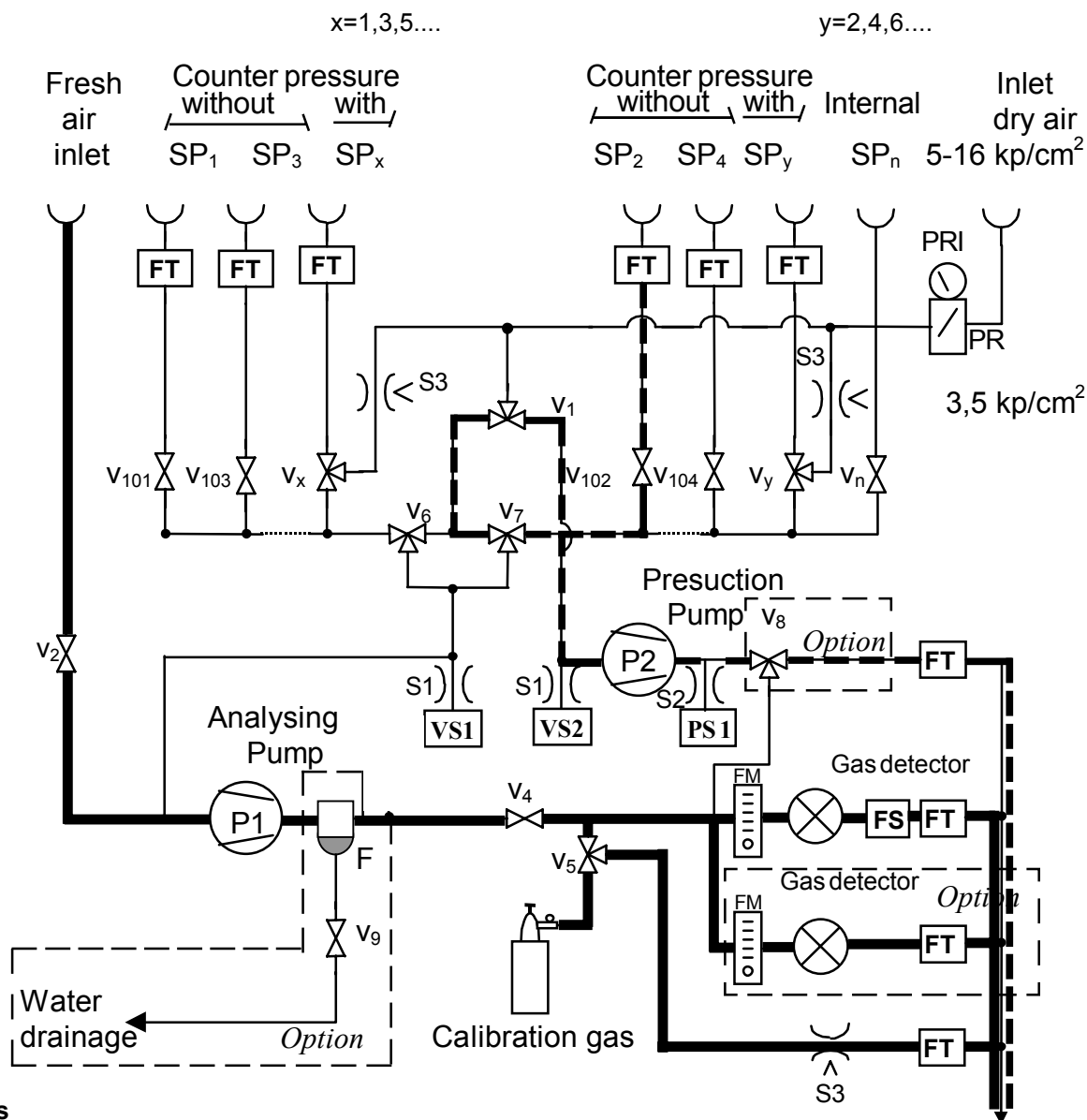


4.4.9 Two pump system

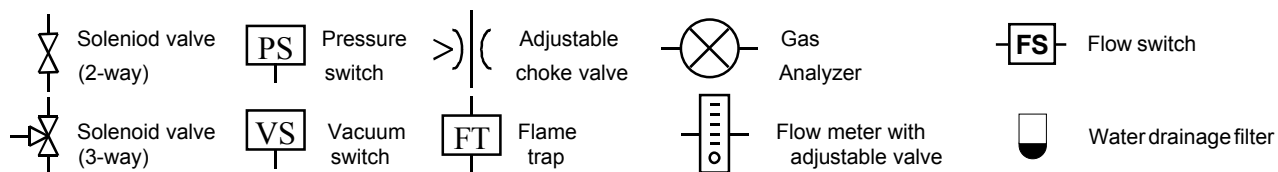
Calibration of zero with fresh air and presuction of sampling point no 2 (SP2).

———— Zero calibration

- - - - - Presuction



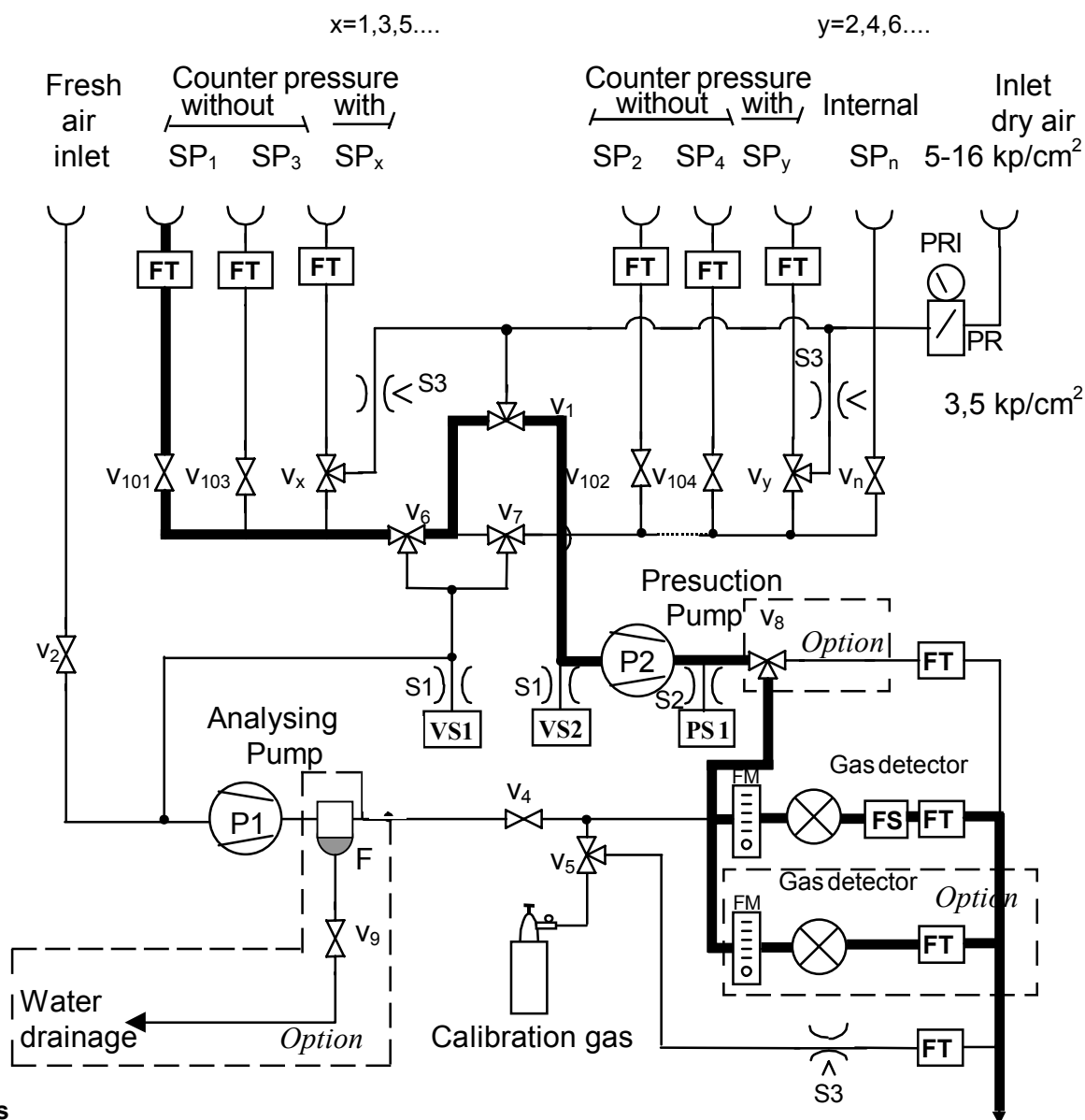
Symbols



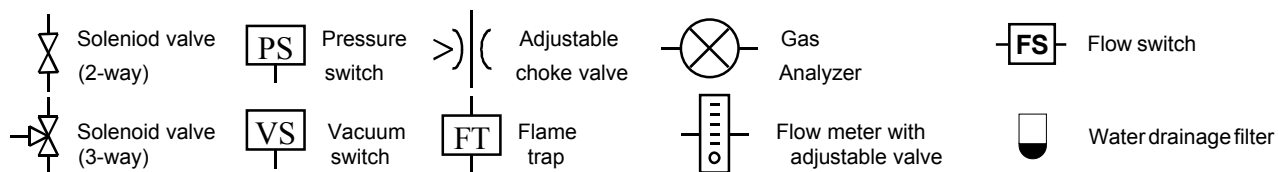
4.4.10 Two pump system

Pump redundancy function (when analysing pump has failed).

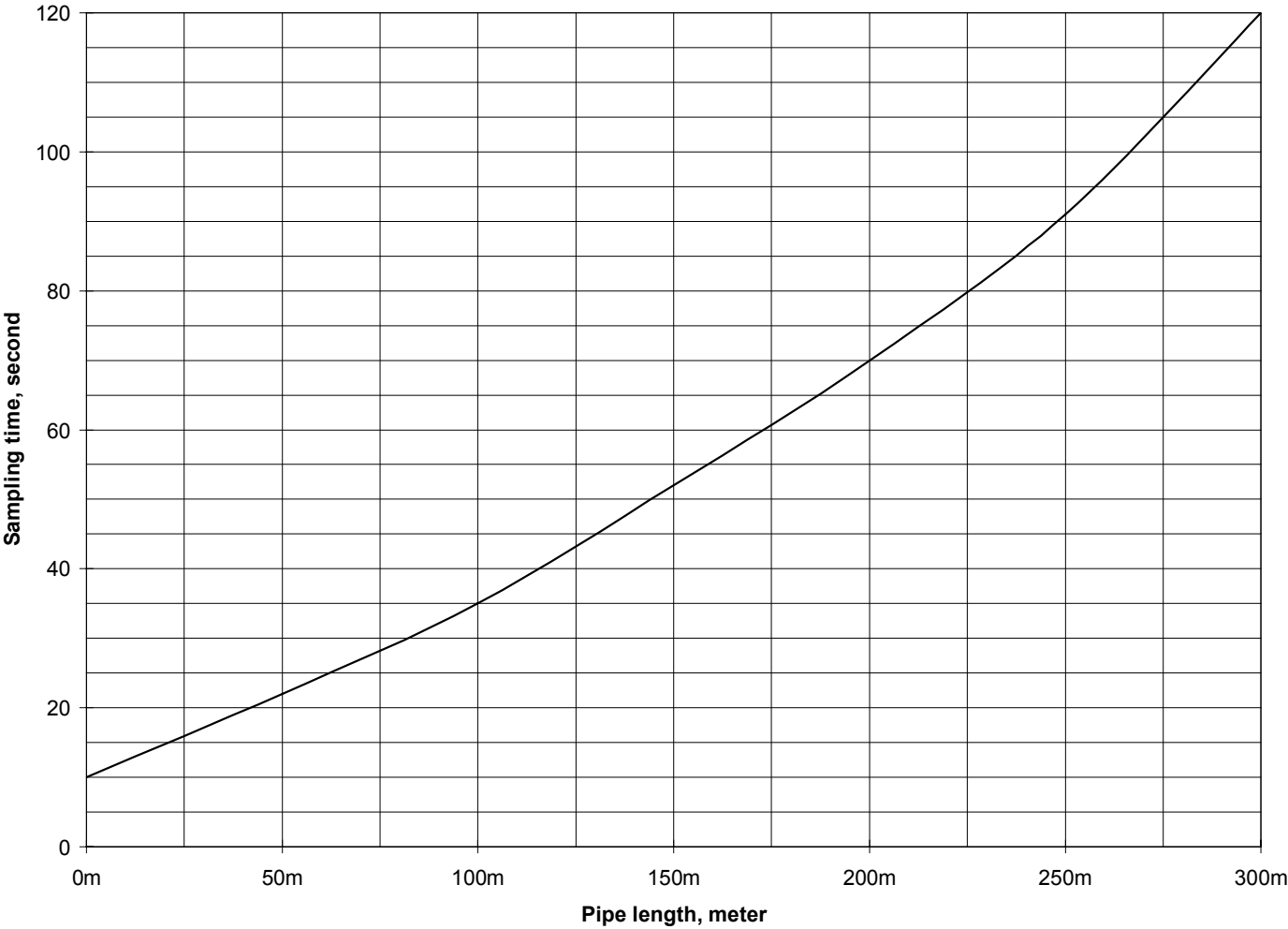
Sampling and analysing of sampling point no 1 (SP1).



Symbols



4.5 CALCULATION OF SAMPLING TIME



Sampling pipe length, m	0	25	50	75	100	125	150	175	200	225	250	275	300
Sampling time, sec	10	15	22	28	35	43	52	61	70	80	91	105	120

Diagram for calculation of the optimal sampling time corresponding to the sampling point length. The pump capacity is 15 L/min and the sampling pipe inner diameter

is 6 mm. For a SW2020-system with two pumps the sum of presuction and analysing time is the total sampling time to insert in the setup for the sampling points.

4.5 Vacuum pump



1419 ILLINOIS AVE., SHEBOYGAN, WI 53082
(414) 457-4891

MODEL NUMBERS:

107CA 107CAB 107CB 107CC 107CD 107BA 107BD 107CCD

Read and understand the following information and instructions included with this product before using. This information is for your safety and to prevent damage to this product.

⚠ CAUTION: To reduce risk of electrical shock . . .

1. Do not disassemble. Disassembly or attempted repairs if accomplished incorrectly can create electrical shock hazard. Refer servicing to qualified service agencies only.
2. If this plug is supplied with a three pronged plug, connect unit to a properly grounded outlet only.

⚠ WARNING: To reduce risk of electrocution . . .

1. This product should never be left unattended when plugged in.
2. Always unplug this product immediately after using and store in dry place.
3. Do not use this product in or near area where it can fall or be pulled into water or other liquids.
4. Do not reach for this product if it has fallen into liquid. Unplug immediately.
5. Never operate this product outdoors in the rain or in a wet area.

⚠ DANGER: To reduce risk of explosion or fire . . .

1. Do not use this product in or near explosive atmospheres or where aerosol (spray) products are being used.
2. Do not pump anything other than atmospheric air.
3. Do not pump combustible liquids or vapors with this product or use in or near an area where flammable or explosive liquids or vapors may exist.
4. Do not use this product near flames.

⚠ CAUTION: To prevent injury . . .

1. Close supervision is necessary when this product is used near children or invalids. Never allow children to operate the unit.
2. Never operate this product if it has a damaged cord or plug. If it is not working properly. If it has been dropped or damaged. Or if it has fallen into water, return the product to a service center for examination and repair.
3. Keep the cord away from heated surfaces.
4. Never block any air openings (inlet) of this product or place it on a soft surface where the openings may be blocked. Keep all air openings free of lint, dirt and other foreign objects.
5. Never use while sleeping or drowsy.
6. Never drop or insert fingers or any other object into any openings.
7. Do not operate this product where oxygen is being administered.
8. This unit may be thermally protected and can automatically restart when the protector resets. Always disconnect power source before servicing.
9. Wear safety glasses or goggles when operating this product.
10. Use only in well ventilated areas.
11. Do not use any tools or attachments without first determining maximum air pressure for that tool or attachment.
12. Never point any air nozzle or air sprayer toward another person or any part of the body.
13. All electrical products generate heat. To avoid serious burns never touch unit during or immediately after operation.

Failure to observe the above safety precautions could result in severe bodily injury, including death in extreme cases.

SAVE THESE INSTRUCTIONS



Warning: Thomas compressors are precision-made, and carefully assembled and wired. Therefore do not disassemble or attempt to repair these products. Only qualified personnel should perform repair service.



IMPORTANT NOTICE TO PURCHASER: WARRANTY AND EXCLUSIVE REMEDIES

Thomas finished OEM products, when properly installed and under normal conditions of use, are warranted by Thomas to be free from defects in material and workmanship at time of shipment. Warranty claims regarding OEM limited products must be asserted within 13 months (the "warranty period") from date of manufacture encoded on the product (unless otherwise agreed in writing or specified in a Thomas OEM Quotation). The customer's exclusive remedy against Thomas for a warranty claim or otherwise, shall be limited to repair or replacement of the subject OEM finished product if it is shown to have been defective in material and workmanship at time of shipment, and then only if the claim is asserted during the warranty period. Thomas maximum liability under this exclusive remedy shall never exceed the cost of the subject product and Thomas reserves the right, at its sole discretion, to refund the purchase price in lieu of repair or replacement. Except for such warranty and exclusive remedy as stated (and except for the express warranty of title) THOMAS DISCLAIMS ALL OTHER WARRANTIES WITH RESPECT TO ITS OEM FINISHED PRODUCTS, WHETHER IMPLIED, AND SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR

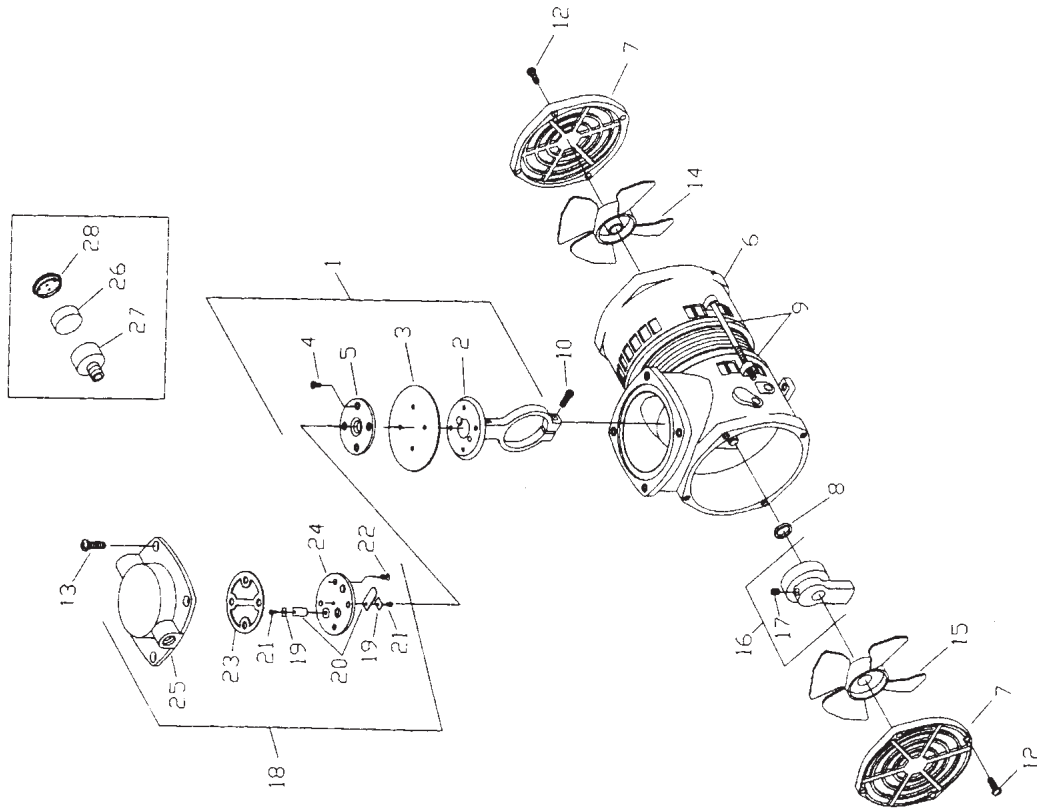
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CUSTOMER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF OUR PRODUCTS FOR CUSTOMER'S USE OR RESALE, OR FOR INCORPORATING THEM INTO OBJECTS OR FOR APPLICATIONS WHICH CUSTOMER DESIGNS, ASSEMBLES, CONSTRUCTS OR MANUFACTURES.

DRAWING AND PARTS LIST

Item No.	Part No.	Component No.	Description	Qty.
1	607180		Connecting Rod Assembly	1
2		607139	Connecting Rod	1
3		608148	Diaphragm	1
4		625540	Screw - Hold Down Plate	4
5		654649	Diaphragm Hold Down Plate	1
6	614425-504		Motor End Cap Assembly	1
7	614609		Vented Cover - Front & Rear	2
8	615403		Spacer - Eccentric	1
9	624444-504		Adapter Ring	2
10	625114		Connecting Rod Screw	1
12	625266		Front Cover Screw	8
13	625444		Head Screw	4
14	633544		Fan - CW Natural	1
15	633545		Fan - CCW Gray	1
16	See Chart		Eccentric & Bearing Assembly	1
17		625244	Eccentric Set Screw	1
18	660873-504		Head & Valve Plate Assembly	1
19		617045	Valve Keeper Strip	2
20		621102	Valve Flapper	2
21		625160	Valve Flapper Screw	2
22		625606	Screw - Valve Plate	4
23		633439	Valve Plate Gasket	1
24		654129	Valve Plate	1
25		660131-504	Head	1
26	641034		Filter - Foam	1
27	660763		Filter Body	1
28	660767		Filter Cap	1
29	633267		Bushing (Not Shown)	1
N.S.	633584		Cord Assembly	1



Model No.	Stator No.	Voltage
107CA	608102	115/60
107CD	608107	230/50
107CB	608152	115/50
107CC	608129	230/60
107BD	608107	230/50
107BA	608102	115/60
107CCD	608865	230/50
107CAB	608118	115/60

Eccentric Assembly No.	Eccentric No.	Bearing No.	Stroke
645584	645410	646069	.050
645599	645354	646069	.110
645298	645214	646069	.140
645372	645215	646069	.160
645373	645216	646069	.180
645374	645217	646069	.200

107BA				107BD			
Delete	Item No.	Part	Add	Delete	Item No.	Part	Add
607139	1	Connecting Rod	607142	607139	1	Connecting Rod	607142
	N.S.	Hose Connector	607019		N.S.	Hose Connector	607019
	N.S.	Nut-Hose	626455		N.S.	Nut - Hose	626455
	N.S.	Felt	641020		N.S.	Felt	641020

4.6 Gas detectors

4.6.1 Simrad GD10 IR Gas Detector

4.6.1.1 Data sheet

Main features include:

Increased reliability and long-term stability

The all solid-state electronic design results in improved reliability, long term stability and accuracy.

The infrared source is electronically chopped eliminating the need for moving parts.

As the source is a solid-state silicon based component and not a filament lamp, replacement or calibration will not be necessary during sensor lifetime.

The IR source has a much higher resistance to vibration and shock than the filament in a filament lamp.

Automatic self test

The detector provides automatic self test of its sensing and calibration functions. Malfunction warnings are provided.

Fail-safe operation

Unlike most gas detectors in use today, the GD10 will give an error signal and not cause gas alarm in case of detector failure.

Faults in electronics, optical parts or contamination of optics will cause fault signals which are presented at the output.

Poison-proof operation

Conventional catalytic gas detectors suffer from reduced sensitivity and zero point drift due to poisoning by silicone vapours, hydrogen sulphide (H₂S) and other agents widely used offshore. These problems are eliminated with a gas detector based on IR-absorption.

No saturation effects

High gas concentrations will not saturate the detector, as opposed to conventional catalytic and semiconductor detectors.

Reliable readings even when highly contaminated

All vital functions are maintained even with 70% reduction in transmittance caused by accumulation of dirt on IR windows. Warning of window contamination is provided ("clean optics").

The mirror is heated to prevent formation of moisture and ice.

Functional in inert gas atmosphere

The GD10 can be used to detect gases where oxygen is not present such as subsea production units.

Housing

The GD10 contains both an explosion-proof EExd compartment made of stainless steel and an EExe terminal compartment. The EExe compartment eliminates the added cost of a special cable termination.



SIMRAD GD10 WITH WEATHER PROTECTION

The external optical surfaces are made of sapphire which withstands high-pressure water and abrasive cleaning.

The GD10 can be easily cleaned and is resistant to humid and corrosive environments.

Simple retrofit ability

The GD10 has been designed to be interchangeable with catalytic detectors using the existing cabling and a separate bridge interface.

Gas sampling

For applications where it is required to perform periodic checks of the gas monitoring system, a version of the GD10 has a small gas cell in the detection path. This cell permits functional checks by using only a small volume of gas.

A sample flow housing for aspirator system applications is available.

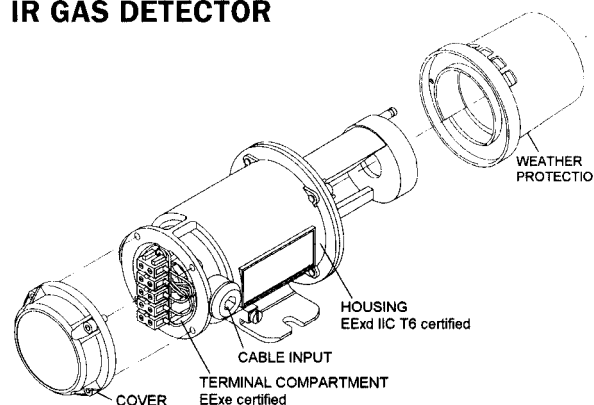
Other gases: The GD10 is available for a wide range of different gases and concentrations.

Cost effective solution

A gas monitoring system equipped with GD10 Gas Detectors saves operational costs as it requires no regular field maintenance.

The gas detector is simple to install and operate.

GD10 IR GAS DETECTOR

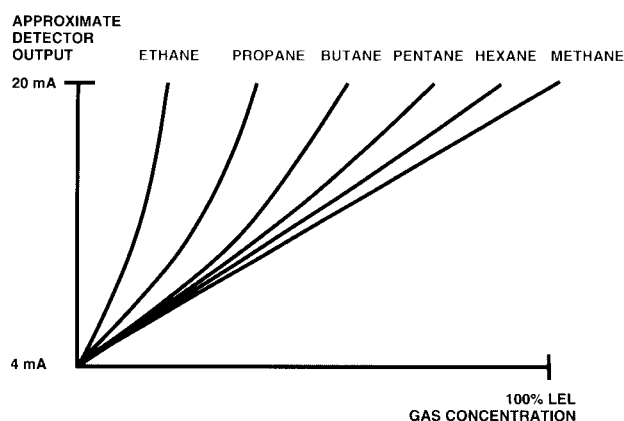


Additional Equipment:

- Sample flow housing
- Duct mounting bracket
- Bridge interface assembly
- Interface bracket

Special features include:

- Proven high reliability and long-term stability
- No calibration or maintenance required during equipment lifetime
- Automatic self test
- Failure will not give gas alarm
- Immunity to poisoning from H_2S , silicone and other agents
- No saturation effects from high gas concentrations
- Easily retrofitted into existing systems

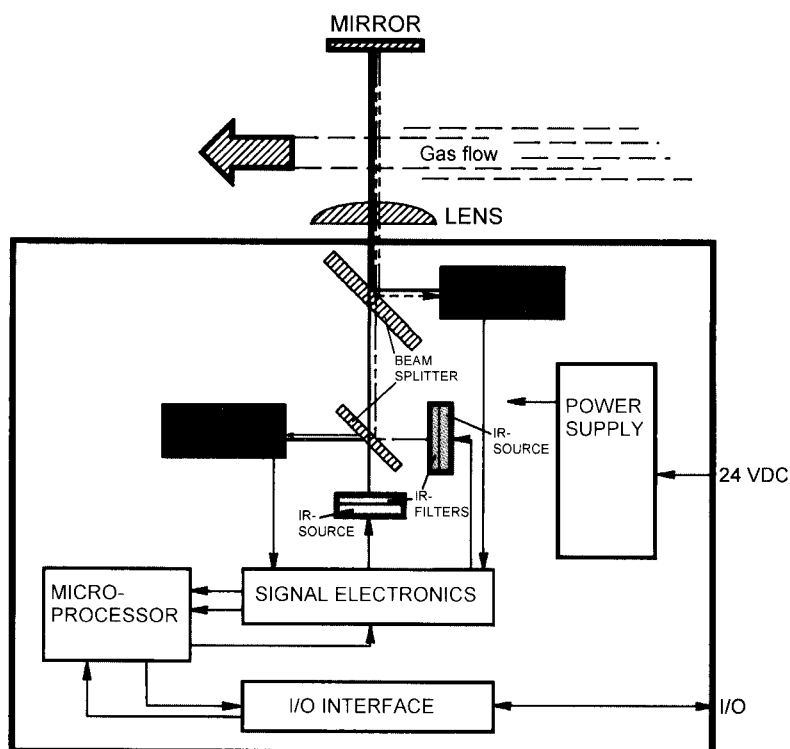
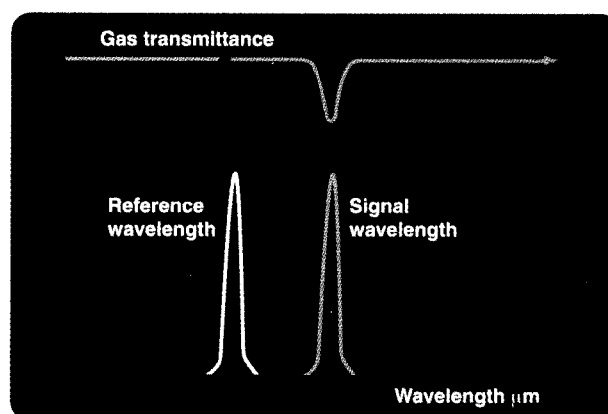


Detector Concept

The Simrad GD10 concept is based on measurement of infrared radiation passing through a volume of gas. Since most gases have unique absorption spectra, they can easily be identified by proper selection of an infrared wavelength at which absorption is measured. Radiation at another wavelength measures the overall transmission through the optical system and the air volume. By comparing the transmission at the two wavelengths, the gas concentration in the air is determined. Having chosen a wavelength which is characteristic of one type of gas, other gases will not cause false alarms.

Using a solid-state IR source instead of a lamp ensures high reliability and long-term stability with no maintenance required during equipment lifetime.

Transmittance as a function of wavelength.



The GD10 Gas Detector consists of three main units; optical unit, electronics unit and power unit, all housed in the explosion-proof housing. Modulated radiation from two IR-sources at two different wavelengths is transmitted through a lens and reflected by a mirror mounted outside the enclosure.

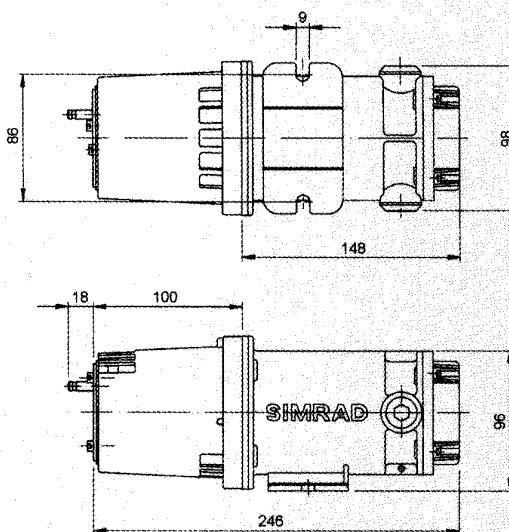
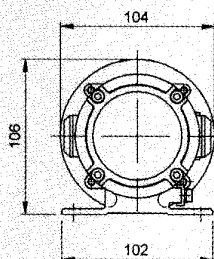
The reflected IR-radiation is received by a main detector while IR radiation from an internal compensation path hits the compensation detector. These signals are amplified and fed to the microprocessor for gas concentration calculations and fault detection.

TECHNICAL DATA SIMRAD GD10 IR GAS DETECTOR

General

Detection range	0-100% LEL (0-5% Vol) Methane
- option	0-100% Vol Methane
- option	Other gases on request
Long term stability	Better than $\pm 5\%$
Accuracy	Better than $\pm 3\%$ of full scale between 0-50% reading Better than $\pm 5\%$ of full scale between 50-100% reading
Response time	5 seconds - (Option: 1 second)
Start-up time	< 60 seconds
Self test	Continuous
Calibration	Factory set
Output signal:	
Standard	Current source 4-20 mA, max total load impedance 500 Ω
- option	Current sink 4-20 mA
- option	Digital bus RS485
Sensor warnings:	
- clean optics	Dirt accumulation on windows
- sensor failure	Internal malfunction in the sensor.
Electrical:	
Power supply	24 V DC (Range: 18-32 V DC)
Power consumption	Approx 3.5 W
Electrical connection	3 wires
Temperature range:	
Operating	-20°C to +45°C
Operating (option)	-30°C to +60°C
Storage	-40°C to +70°C
Humidity (operation)	99% RH
Certification:	
Main compartment	Ex EExd IIC T6 (CENELEC)
Terminal compartment	Ex EExe (CENELEC)
Ingress protection	IP 66 / IP67 DIN 40050
Enclosure	
Housing material	Stainless steel SIS 2343 (ASTM 316)
Weight incl. Weather Protection	Approx 2.9 kg
Accessories	Weather Protection Sample Flow Housing Duct Mounting Brackets

Outline dimensions in mm.



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P3351E March 1997/DL GRAFISK A/S

Simrad Optronics ASA

P.O.Box 6114 Etterstad
0602 Oslo, NORWAY

Telephone: +47 22 67 04 90
Telefax: +47 22 19 29 91/22 67 63 14

Optronics

Extensive world-wide network of authorized distributors and agents

4.6.1.2 Performance characteristics

Gas data

The GD10 standard version is factory calibrated and linearized with methane gas in the 0-100 % LEL range. Calibration/linearization to other gases or concentrations can also be done.

Accurate measurements can only be achieved by having the detector calibrated for the gas it is intended to measure.

Gases such as ethane, propane and butane are also detected by the GD10. A GD10 calibrated for methane has a higher sensitivity to these gases than to methane. This means that explosion danger from other HC-gases will always be detected by the GD10.

Because of tolerances in the infrared filters, readings of other gases than methane will not be exact when the detector is calibrated to 100% LEL methane.

Converting % LEL to % v/v is based on ISO10156, Second edition 1996-02-15: "Gases and gas mixtures - Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets".

The GD10 is designed for normal atmosphere pressure variation, but it is certified for pressure limits from 86 to 108 kPa.

Cross interference to other gases

Hydrocarbon gases such as methane, ethane, propane and butane are absorbing at a signal wavelength of 3.3 μm . These gases do not interfere at the reference wavelength at 3.0 μm . If the atmosphere to be monitored contains gases such as acetylene that absorb at the reference wavelength of 3.0 μm , misleading measurements may be obtained depending on the interfering gas concentration. In such cases, contact Simrad Optronics for information. A modified GD10 using another reference wavelength will eliminate the problems.

Water vapour, carbon dioxide, oxygen, nitrogen and other gases, which are present in normal air will not influence the measurements.

Gas detection system

Since the GD10 is a point detector, it must be mounted where gas leakage is most likely to occur. It should be considered whether the gas in question is heavier or lighter than air. The number of sensors recommended depends on room size, shape, airflow and so on. The GD10 can also be mounted on an air duct wall. For this purpose, duct mounting kits are available.

Owing to high reliability and extensive self-testing, the GD10 dramatically reduces the number of sensors needed, and voting between sensors is no longer necessary. As a result, maintenance routines can be relaxed without losing system confidence and repair work is reduced to a minimum.

4.6.1.3 Operation

Start-up procedure

Ensure that system wiring and control system are in working order before switching on power to the detector.

The detector will then perform self-test and internal signal adjustments lasting for approx. 60 seconds and switch to measuring mode.

The output signal from the detector during this period is shown in Figure below (current output of the GD10 standard version). Signal output before 60 seconds is 0 mA, and signal output after 60 seconds is 4 mA (if no gas is present).

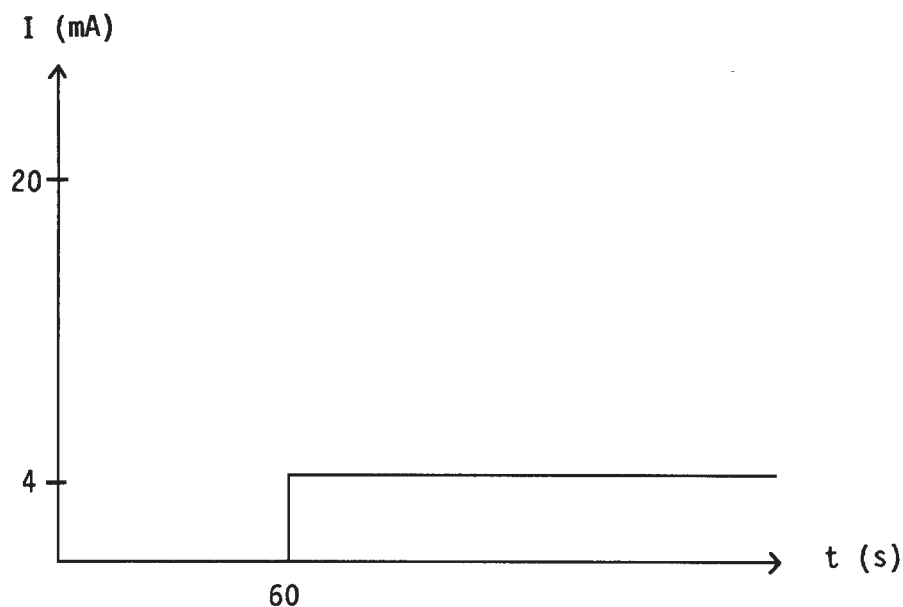


Figure: Signal output during start-up period

4.6.1.4 Maintenance

NOTE: The GD10 has no user adjustable parts. It is not recommended to open the GD10, as this will change the internal atmosphere, and the initial calibration could be affected.

General

The GD10 has been designed to require a minimum of maintenance. The only necessary maintenance is to inspect visually that the Weather Protection is not clogged in heavily contaminated areas.

Failure indications

The internal microprocessor performs continuous self-testing of optical and electronic functions.

If transmittance in the optical path should be reduced with more than 70%, the processor will generate a 1 mA output signal. This signal, "CLEAN OPTICS", indicates that the window and mirror of the detector need to be cleaned to restore normal operation.

If a fatal error should occur in the electronics or optics, the processor will generate a 0 mA output signal, indicating sensor failure.

The detector should then be checked according to Figure on the next page. Do not return the instrument to Simrad Optronics for repair if this test has not been performed.

NOTE: Avoid direct light on lens and mirror if testing without the Weather Protection.

NOTE: Ensure that no gas is present in the measuring chamber when testing.

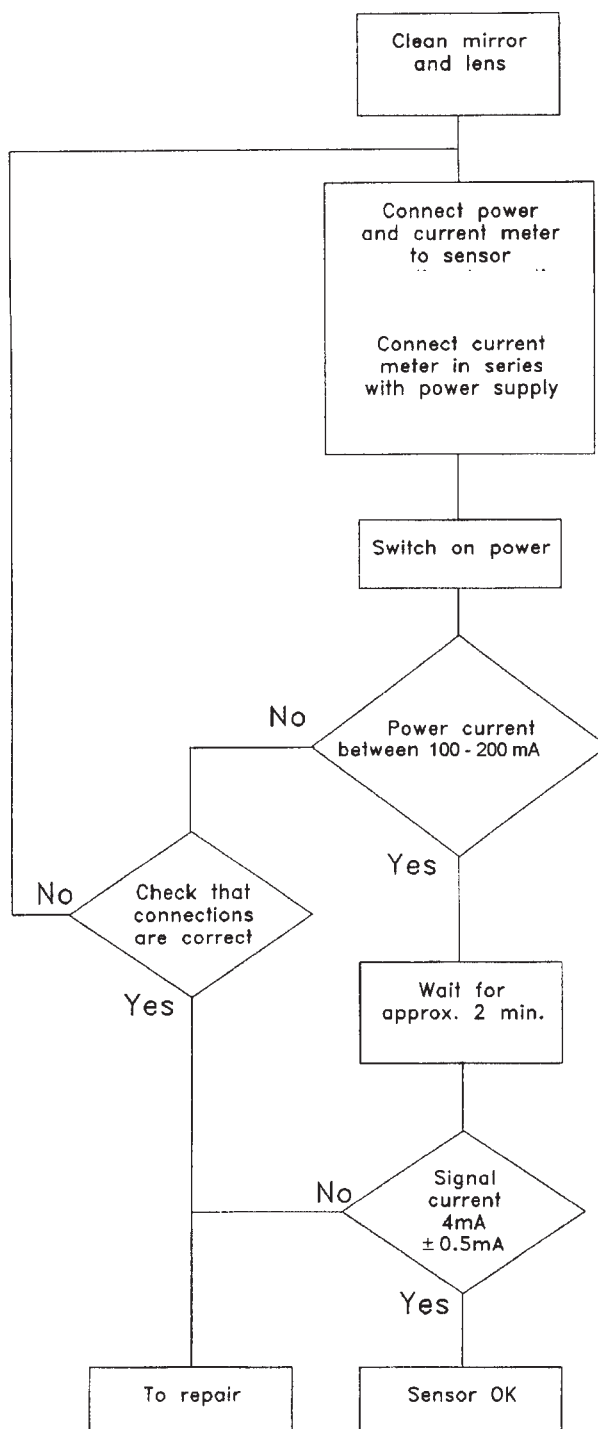


Figure: Test procedure

Cleaning of optical window and mirror

If the optical window and mirror have to be cleaned, use a soft and clean tissue to rub off the contamination. The window and mirror are made of sapphire, which is highly resistant to rubbing. Make sure that the whole optical surface is clean.

NOTE: For difficult contaminants the mirror and lens can be cleaned with an equal-part mixture of isopropyl alcohol and water. Do not perform any testing of the sensor before cleaning solution is dried away.

5.SPARE PARTS LIST

SPARE PARTS SET SW2020
ART. NO 1710

Description	Q'ty	Art. No
Solenoid valve 3-way 6014-T-2.0 / 6014-D-2.0	1	4652
Solenoid valve 3-way 6014-T-2.0 / 6014-C-2.0	1	4652/4653
Solenoid valve 2-way 6013-A-2.0	1	4651
Solenoid valve 2-way 6013-A-2.0 5 W	1	4654
Manual shut-off valve	1	4232
Flame trap FTH-8	2	4256
On-line filter SS	2	4230
Hose coupling 6/4 - 1/8"	5	4270
Loctite 577	1	4236
Teflon hose 6/4	2 m	4219
Viton hose 7/5	0.2 m	4220
Vacuum meter	1	4246
Gasket set for 15 L pump 7350	1	7351
Pressure Guard	1	7303
Relay 24V / 2P-5A	2	12015
Fuse 500 mAT 5 x 20	10	8200
Fuse 100 mAT 5 x 20	10	8218
Fuse 315 mAT 5 x 20	10	8219
Fuse 3.15 AT 5 x 20	10	8204
Fuse 4 AT 5 x 20	10	8225

6. PRODUCTS LIST

ANALYZING UNIT

Standard one pump system

Pos	Description	Code	Type	Data	Art. No
1	Pump	P1, P2	107 CCD20	15 l/min, 230V 50/60 Hz	7350
2	Solenoid Valve	V_1 (one pump syst.)	6013-A-2.0	24 V=, 8W, 0-10 bar	4651
3	Solenoid Valve	V_1 (two pump syst.)	6014-T-2.0 or 6014-C-2.0	24 V=, 8W, 0-4 bar or 0-10 bar	4652/4653
4	Solenoid Valve	V_2	6013-A-2.0	24 V=, 5W, 0-10 bar	4654
5	Solenoid Valve	V_3	6013-A-2.0	24 V=, 8W, 0-10 bar	4651
6	Solenoid Valve	V_4	6013-A-2.0	24 V=, 5W, 0-10 bar	4654
7	Solenoid Valve	V_5	6014-T-2.0 or 6014-C-2.0	24 V=, 8W, 0-4 bar or 0-10 bar	4652/4653
8	Solenoid Valve	V_6	6014-T-2.0 or 6014-C-2.0	24 V=, 8W, 0-4 bar or 0-10 bar	4652/4653
9	Solenoid Valve	V_7	6014-T-2.0 or 6014-C-2.0	24 V=, 8W, 0-4 bar or 0-10 bar	4652/4653
10	Solenoid Valve	V_8	6014-T-2.0 or 6014-C-2.0	24 V=, 8W, 0-4 bar or 0-10 bar	4652/4653
11	Solenoid Valve	V_9	330-D-2.0	24 V=, 8W, 0-10 bar	4655
12	Solenoid Valve	$V_{101} - V_{104}$	6013-A-2.0 or 6014-T-2.0 alt 6014-D-2.0	24 V=, 8W, 0-10 bar or 0-4 bar alt 0-10 bar	4651/4652
13	Solenoid Valve	V_x	6013-A-2.0 or 6014-T-2.0 alt 6014-D-2.0	24 V=, 8W, 0-10 bar or 0-4 bar alt 0-10 bar	4651/4652
14	Solenoid Valve	V_{x+1}	6013-A-2.0 or 6014-T-2.0 alt 6014-D-2.0	24 V=, 8W, 0-10 bar or 0-4 bar alt 0-10 bar	4651/4652
15	Solenoid Valve	V_{n-1}	6013-A-2.0 or 6014-T-2.0 alt 6014-D-2.0	24 V=, 8W, 0-10 bar or 0-4 bar alt 0-10 bar	4651/4652
16	Solenoid Valve	V_n	6013-A-2.0 or 6014-T-2.0 alt 6014-D-2.0	24 V=, 8W, 0-10 bar or 0-4 bar alt 0-10 bar	4651/4652
17	Pressure Guard	PS	620.9100	2-8 mbar	7303
18	Vacuum Guard	VS, VS1, VS2	VCM 095		7306
19	Choke Valve	S1, S2		0,5 mm	7342
20	Flow Meter	FM	Brooks 2700	0-300 l/h	7310
21	Detectors		Custom designed	Required	

Pos	Description	Code	Type	Data	Art. No
22	Filter/Pressure Reg.	PR	N1204-D00	0 - 4 kp/cm ²	7307
23	Pressure Instrument	PRJ	M043	0 - 4 kp/cm ²	7308
24	Filter	F	N204-F00		7309
25	Choke Valve	S3	SCO - 604 - 1/8"	Adjustable	7241
26	Flame Trap Outlet	FT	FTH - 6		4245
27	Flame Trap Sampling Point	FT	FTH - 8		4256
28	Power Supply Unit	PSK - 4	PSK - 4	220 VAC ± 10-15% / 24 VDC	53000
29	Automatic Fuse		E21 12250	4 A	12001
30	Relay	RL1 - RL8	E40 06823	24VDC 2P5A	12015
31	Remote Input/Output PCB	RIOK - 40	RIOM - 40		19240
32	Remote Output PCB	RIOK - 41	RIOM - 41		19241
33	Flow Switch	FS	LPH - 125		7301
CONTROL UNIT ME400					
34	Control panel	GSM - 3150	GSM - 3150		51000
35	I/O board	IKK - 4	IKK - 4		52000
36	Comm. board	AKK - 2	AKK - 2		52100
REPEATER UNIT MN400					
37	Repeater panel	MN400			51500
TEST GAS ACCESSORIES					
38	Test gas bottle B5 with 1.1% propane in air				9955
39	Test Gas bottle B5 with 1.1% propane, 20 ppm H ₂ S in N ₂				9961
40	Test gas pressure and flow regulator valve with manometer for 1.1% propane in air				9954
41	Test gas pressure and flow regulator valve with manometer for 1.1% propane, 20 ppm H ₂ S in N ₂				9960