

# CONTENTS

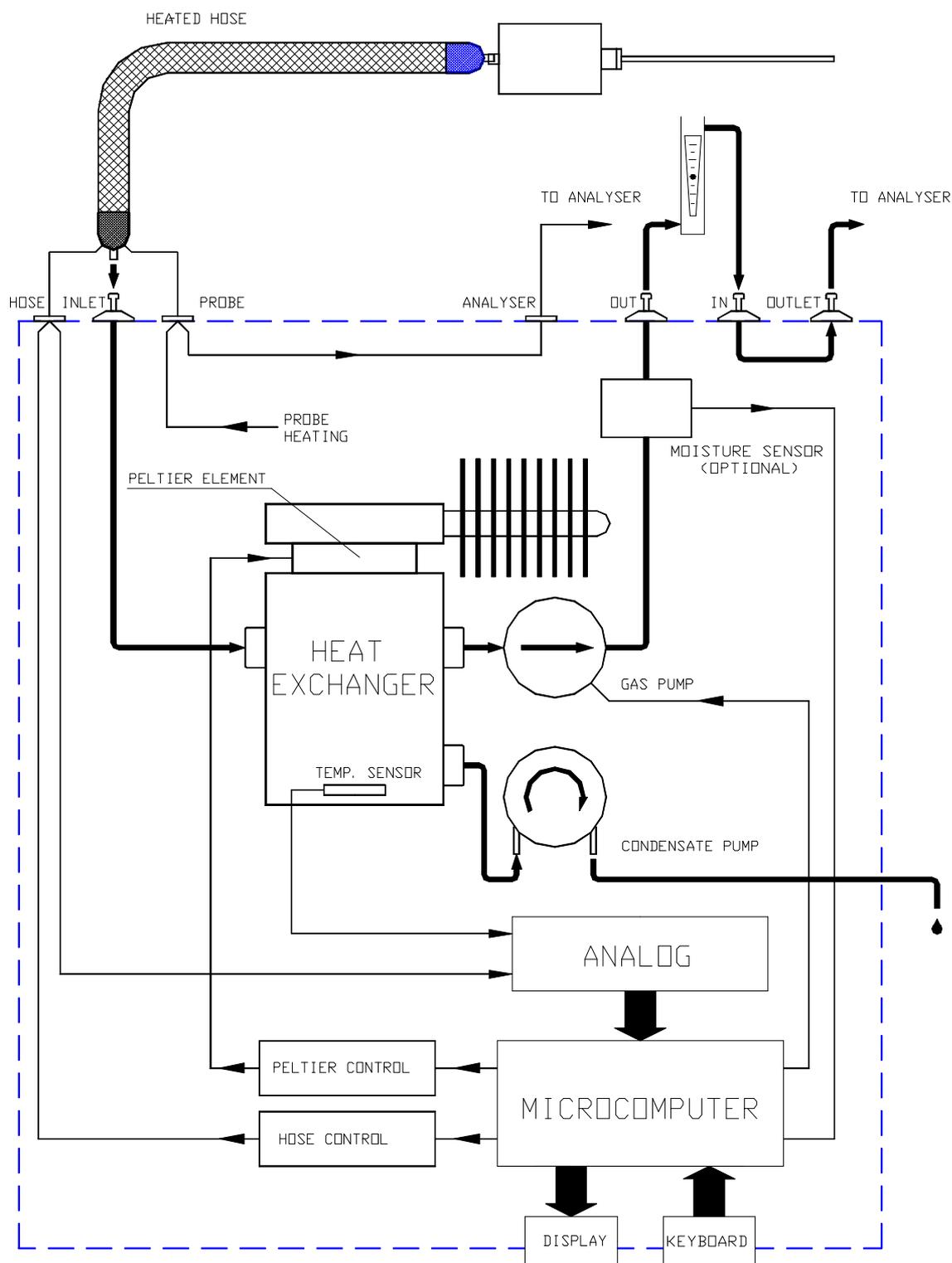
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# 1. GENERAL INFORMATION

## 1.1. Structure and function of the gas dryer GD-10

The working principle of the gas dryer is based on rapid cooling of the flue gases from about 200°C to about 4°C, causing the moisture content of the flue gases to condense quickly. This rapid cooling prevents the easily soluble gas components dissolving in the water and hence falsifying the results. The condensate formed is removed by a pump.

Figure 1 shows the gas dryer GD-10 in block form.



The flue gas is drawn in using a probe and heated hose with regulated, adjustable temperature. The hose is attached to the inlet stub mounted on the panel of the GD-10 marked *GAS INLET*. This stub has an M12 thread for connecting the hose. The gas then travels through the cooling chamber, which is fitted with a Peltier semiconductor cooling element. The excess heat is radiated and convected from the fins on the cooler body, which is fitted with a thermostatically controlled fan. Since the cooling chamber will be destroyed by overheating, it is especially important to check the function of the fan. The temperature of the chamber is controlled by an adjustable thermostat. The condensate is removed from the chamber by the pump mounted on the front panel of the gas dryer.

The dried gas is fed to a flow-meter and then to the outlet stub on the front panel marked *GAS OUTLET*. If necessary, a set of filters may be included in the system at this point.

The gas transport is ensured by a high-output rotary gas pump and the function of the gas dryer is controlled by a microprocessor.

The three sockets mounted on the front of the gas dryer marked *HOSE*, *PROBE*, and *ANALYSER* are for the connection of the heated hose, gas probe and the flue gas analyser respectively. The heated hose used with the gas dryer is fitted with control lines for the heating and the probe socket has the power supply (24 V) for the heated filter.

## 1.2. When to use the gas dryer GD-10

The gas dryer GD-10 is designed to prepare gases for measurement by flue gas analysers, especially the GA-40 and the GA-60.

When measurements of longer duration are carried out, and in all cases when easily soluble gases such as NO<sub>x</sub> and SO<sub>2</sub> are to be measured, the use of a gas dryer is highly recommended. This form of gas preparation protects the analyser and also ensures a higher degree of accuracy. The gas dryer is capable of providing a good level of moisture removal at the flow rates typical for these analysers; i.e. 1 - 2 l/min.

## 1.3. Delivery extent

The following articles are delivered with the gas dryer GD-10:

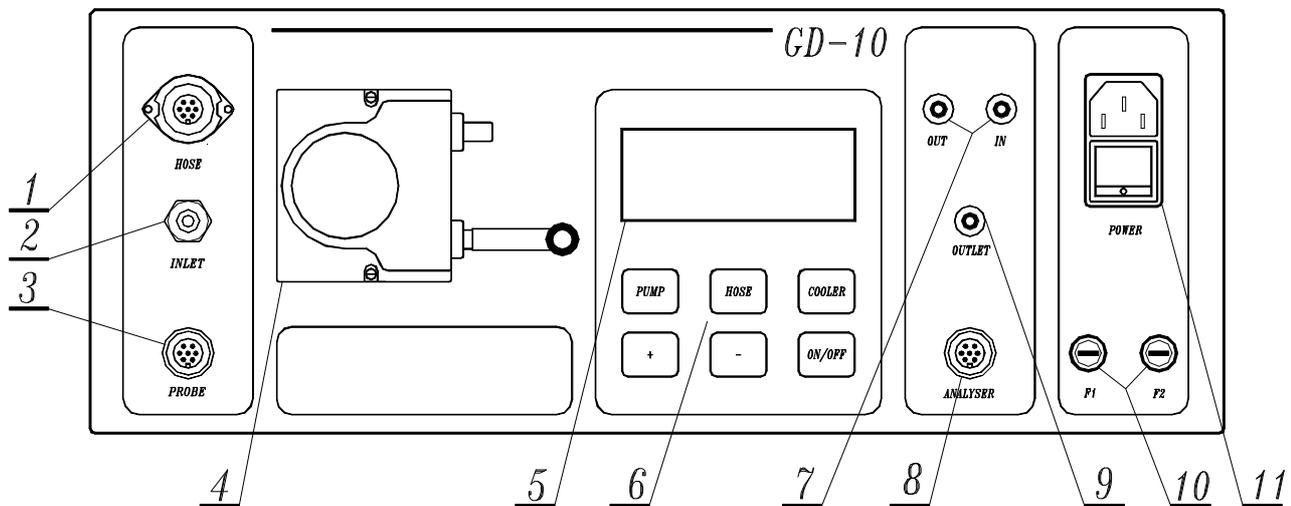
- Heated hose Ø 6 cm, length 3 m for a maximum temperature of 200°C
- Connecting cable for the analyser, length 1 m
- Gas hose for connection to the analyser, length 1 m
- Mains power cable
- Wrench for tightening the heated hose connection

The gas dryer can also be fitted with a moisture sensor, a set of filters at the outlet (8 µm and 25 µm) and a heated pre-filter. The moisture sensor is for extra protection of the analyser in cases where the water content is particularly high. If the sensor registers the presence of moisture in the outlet gas stream, then the GD-10 automatically cuts off the gas flow to the analyser. Such moisture may appear as a result of incorrect setting of the dryer parameters or due to a defect in the equipment.

## 2. OPERATING THE GAS DRYER GD-10

### 2.1. Description of the equipment

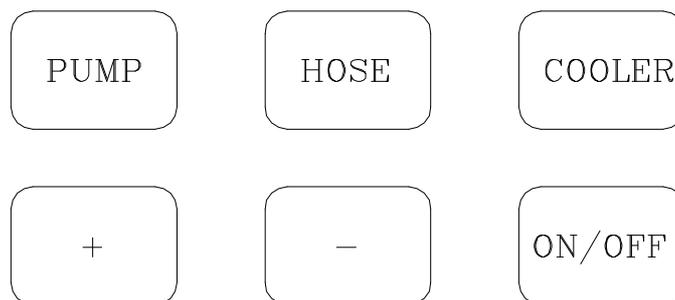
Figure 2 shows the control panel of the gas dryer GD-10 with the following features:



1. Socket for the heated hose control
2. Threaded gas inlet to dryer
3. Socket for gas probe handle connection
4. Condensate pump
5. Display
6. Keyboard
7. Connection stub for the flow-meter
8. Socket for connection to flue gas analyser
9. Gas outlet from gas dryer
10. Fuses
11. Mains socket and switch

### 2.2. Setting the parameters of the GD-10

Figure 3 shows the keyboard of the GD-10



The keyboard consists of two groups of keys:

A. Keys for choosing the quantity to be changed:

<i>PUMP</i>	changes the suction of the pump
<i>HOSE</i>	changes the temperature of the heated hose
<i>COOLER</i>	changes the cooler output temperature

B. Keys for changing the chosen quantity:

+	<i>increases the value</i>
-	<i>decreases the value</i>
ON/OFF	<i>switches the quantity on or off</i>

Pressing the following keys simultaneously gives access to further possibilities:

<i>PUMP &amp; HOSE</i>	<i>allows the display contrast to be adjusted "CONTRAST"</i>
<i>+ &amp; -</i>	<i>sets the quantity to the standard level "STANDARD"</i>
<i>PUMP &amp; ON/OFF</i>	<i>switches on the pump for 30 seconds to dry out the gas lines. The moisture sensor is switched off during this time.</i>

The lower row of keys remains inactive until one of the upper keys has been pressed, after which the desired value for the chosen quantity can be set using "+" and "-". When the writing in the lower half of the screen goes out, the information is transferred to the memory, where it remains even after the gas dryer has been switched off. When it is switched on again, these values are automatically read from the memory and made active again.

### **2.3. DISPLAY**

The first three lines of the display show the states of the variables *PUMP*, *HOSE*, *COOLER*. For the pump there is ON/OFF and the percentage of full power. The hose and cooler lines contain the set and present temperatures. When a quantity is chosen to be changed, then this is to be seen in the bottom line of the display. If no change is made to the quantity within three seconds, then this is taken to be the valid value and is stored in the memory. The message in the bottom line disappears.

The following ranges of adjustment are possible:

<i>pump</i>	<i>20% - 100% step 1%</i>
<i>hose</i>	<i>20°C - 195°C step 1°C</i>
<i>cooler</i>	<i>1°C - 30°C step 1°C</i>

The Info-line shows messages about the present state of the gas dryer. These messages can be separated into normal and error messages, where the error messages have priority over the normal messages. There is only space for one message, and these will generally replace the previous message, except when an error message is being displayed.

## **MESSAGES**

### **Normal messages**

- |                      |  |
|----------------------|--|
| 1. BLANK LINE        | To be seen when the dryer is working normally  |
| 2. COOLING           | to be seen when the dryer is cooling and the pump is switched off due to too high a temperature. Disappears when the set temperature has been reached and the pump has switched on automatically |
| 3. CLEANING          | Appears when the dryer is being purged   |
| 4. PUMP SETTING      | Appears during change of the pump setting  |
| 5. HOSE TEMP SETTING | To be seen when the set temperature of the heated hose is being changed  |
| 6. COOLING SETTING   | To be seen when the set temperature of the cooler is being changed   |
| 7. CONTR. SETTING    | To be seen when the display contrast is being changed  |

### **Error messages**

- |                      |  |
|----------------------|--|
| 8. hose conn. error! | Appears when the thermistor element in the hose is broken or short-circuited, or the hose is not connected     |
| 9. WET OUTGOING GAS! | Appears when moisture is detected in the gas at outlet. (Only applies when optional moisture sensor is fitted) |

10. COOLER FAULT!                      Appears when the set temperature in the cooler is not reached despite constant cooling. (cooler damaged or fan defective)
11. HOSE OVERHEATED!                If this message appears, then the gas dryer must be switched off immediately. This means that the hose temperature has exceeded 200°C, which could be due to a temperature control failure.

**ATTENTION!**

**The error messages always have priority over other messages**

If an error message appears, then the function of the gas dryer is automatically blocked until the problem has been solved or until the dryer has been switched off and then on again. Information about the present setting of the various adjustable quantities appears on the display after pressing the appropriate key (keys). The information remains on the display for three seconds. If no changes are made to the setting in this time, then the information disappears again. If changes are made, then these are visible on the screen and the information remains for a further three seconds. After this time the changes are taken over and stored in the memory. The same happens if one of the other quantities (e.g. *HOSE*) is chosen to be changed within this time.

## **2.4. Status after power-on**

### **Status COOLING**

start of the cooling process.

As soon as the gas dryer is switched on, and after a change in the setting of the cooler temperature, when the set temperature is lower than the actual temperature the gas dryer switches to the mode cooling. The pump is switched off and the moisture sensor is inactive. This mode of operation continues until the set temperature has been reached, after which the pump starts automatically.

### **Status CLEANING**

Directly after the cooling process has finished, the gas dryer goes to the CLEANING mode. Here the pump is switched on and the dryer is purged for 30 seconds. The moisture sensor is inactive. When the purging is finished, the dryer goes directly to the normal mode of operation. The moisture sensor, if present, is active.

**NOTE:** If a gas dryer fitted with a moisture sensor gives error No. 9 (**WET OUTGOING GAS!**), then the dryer can be switched to CLEANING mode by pressing the keys *PUMP* and *ON/OFF* simultaneously. When the 30 seconds are passed, the dryer automatically returns to the settings in use before.

### 3. USER MAINTENANCE

The operator should clean and check the condensate pump and piping regularly. For this purpose, the plastic cover of the pump must be removed. The fuses are to be found on the front panel by the socket for the mains cable. The cap of the fuse holder can be unscrewed to change the fuse cartridge

**NOTE; The position F1 contains a 6A fuse and F2 contains a 1.6A fuse.**

**THE DRYER MUST BE DISCONNECTED FROM THE MAINS  
BEFORE CHANGING THE FUSES!**

### 4. CONNECTING THE GD-10 TO THE ANALYSERS GA-60

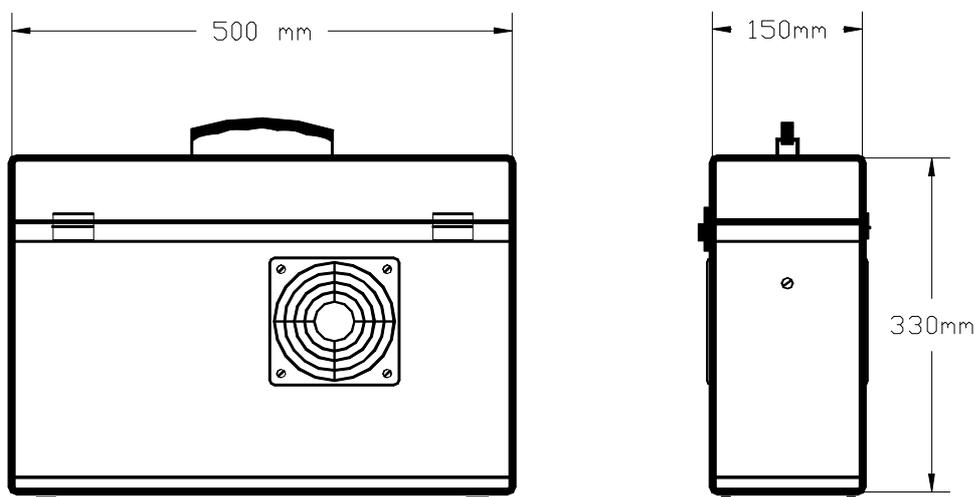
The connection between dryer and analyser is made in the following way:

1. Connecting the system
  - probe and heated filter (if used) are connected to the heated hose
  - the hose is connected to the dryer at the *GAS INLET* stub
  - the two plugs on the heated hose are connected to the sockets marked *HOSE* and *PROBE*. (It is not possible to confuse the two plugs).
  - the cable included with the gas dryer is used to connect the socket *ANALYSER* on the gas dryer with the socket *PROBE* on the analyser

**NOTE:** The gas pipe should not yet be connected to the analyser.
2. The dryer and analyser are switched on
3. The desired temperatures of hose and cooler are set. The dryer goes to the cooling mode
4. after the cooling and cleaning phases are finished, the flow rate of the dryer pump is adjusted to about 10% more than the flow rate shown by the analyser flow-meter
5. The gas line between dryer *OUTLET* and analyser *INLET* is connected

The measurements may now be carried out.

### 5. DIMENSIONS OF GD-10



## 6. TECHNICAL DATA

Parameter	Description
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### **Heated hose**

Gas inlet temperature	max. 200°C
Temperature of heated hose	20°C - 195°C, fully adjustable in steps of 1°C
Inside diameter of hose	6,0 mm
Hose length	Standard 3m, others to 20m on request

### **Peltier-cooler**

Dew point	independent of ambient temp. to 1°C±0.2°C
Ambient temperature	0°C - 50°C
Dead volume	~50 cm <sup>3</sup>
Ready for use after	~20 min., dependent on ambient temp.

### **vacuum pump**

Delivery	max. 5 l/min., fully adjustable
Pressure	0.5/1.6 bar abs

### **Condensate pump**

Delivery	~ 0.2 l/h
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### **Connections**

Power supply	230 VAC ± 10%, 50 /60 Hz
Power requirement - cooler	120 VA max. @ 230 VAC
power requirement - heater	1500 VA max. @ 230 VAC
Fuses	cartridges: F1 - 10 A , F2 - 1.6 A
Gas connection - inlet	threaded fitting inner Ø8 mm
Gas connection - outlet	stub Ø6 mm
Housing	W x H x D: 500 x 345 x 170 mm
Gross weight	~9 kg

We reserve the right to make technical changes without prior warning