

Gas sample conditioner PGD-100

Manual

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madur[®]
E L E C T R O N I C S

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Introduction

The GD-10 and PGD-100 gas sample conditioners are used for the preparation of the gas sample, which means drying and removing the molecules of solids out of the sample. The drying process proceeds as the water vapours condense at low temperatures and filtration is performed with use of the mechanical gas filter.

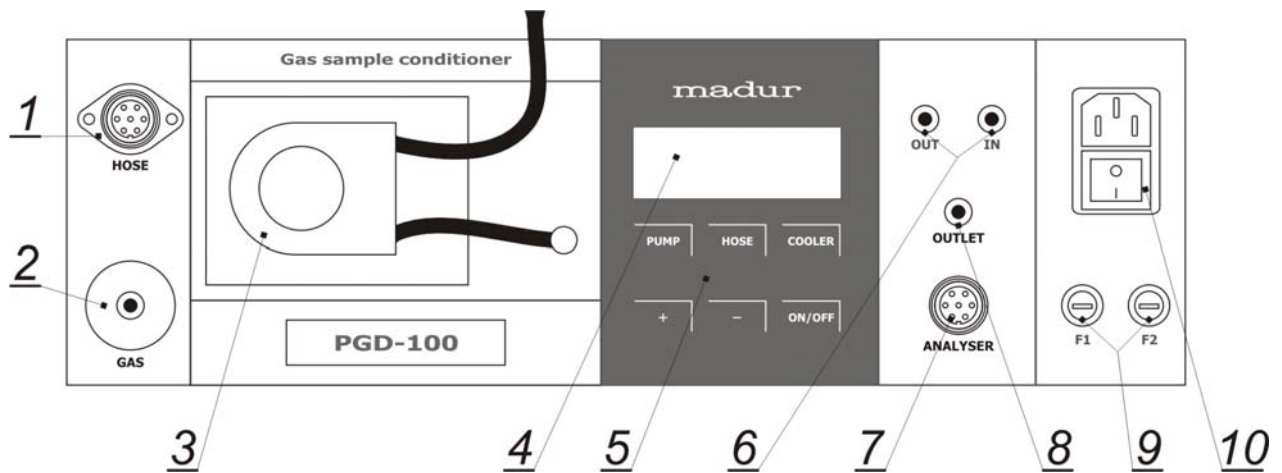
The GD-10 conditioner operates with the **madur** gas analysers using electrochemical sensors. The humidity content of the gas sample is reduced to a level safe for the sensitive sensors.

The PGD-100 conditioner is a further development of the GD-10 used for the preparation of the gas sample for the PHOTON analyser, which is equipped with IR sensors. The measurement procedure carried out by the PHOTON analyser requires that the sample humidity stays at a low, stable level. This can only be ensured with the help of two condensing coolers and a highly precise temperature stabilization algorithm. The humidity content of the gas sample dried by PGD-100 relates to the 1°C dew point.

The main element of the gas sample conditioner is the cooler in which, with the help of the Peltier module, the temperature is kept at a low, stable level enabling the water vapours to condense. The cooling process is rapid enough not to let the flue gases dissolve in the condensing water vapour.

1. Gas sample conditioner operation

2.1. Description of the device



The appearance of the PDG100/GD10 front panel

1. – the heated hose power cable socket
2. – the heated hose magnetic coupling
3. – the water pump
4. – the device display
5. – the keyboard
6. – the external filter connections
7. – the socket for communication with the analyser cable
8. – the outlet for dried gases
9. – the fuses
10. – the device on/off switch and the power cable socket

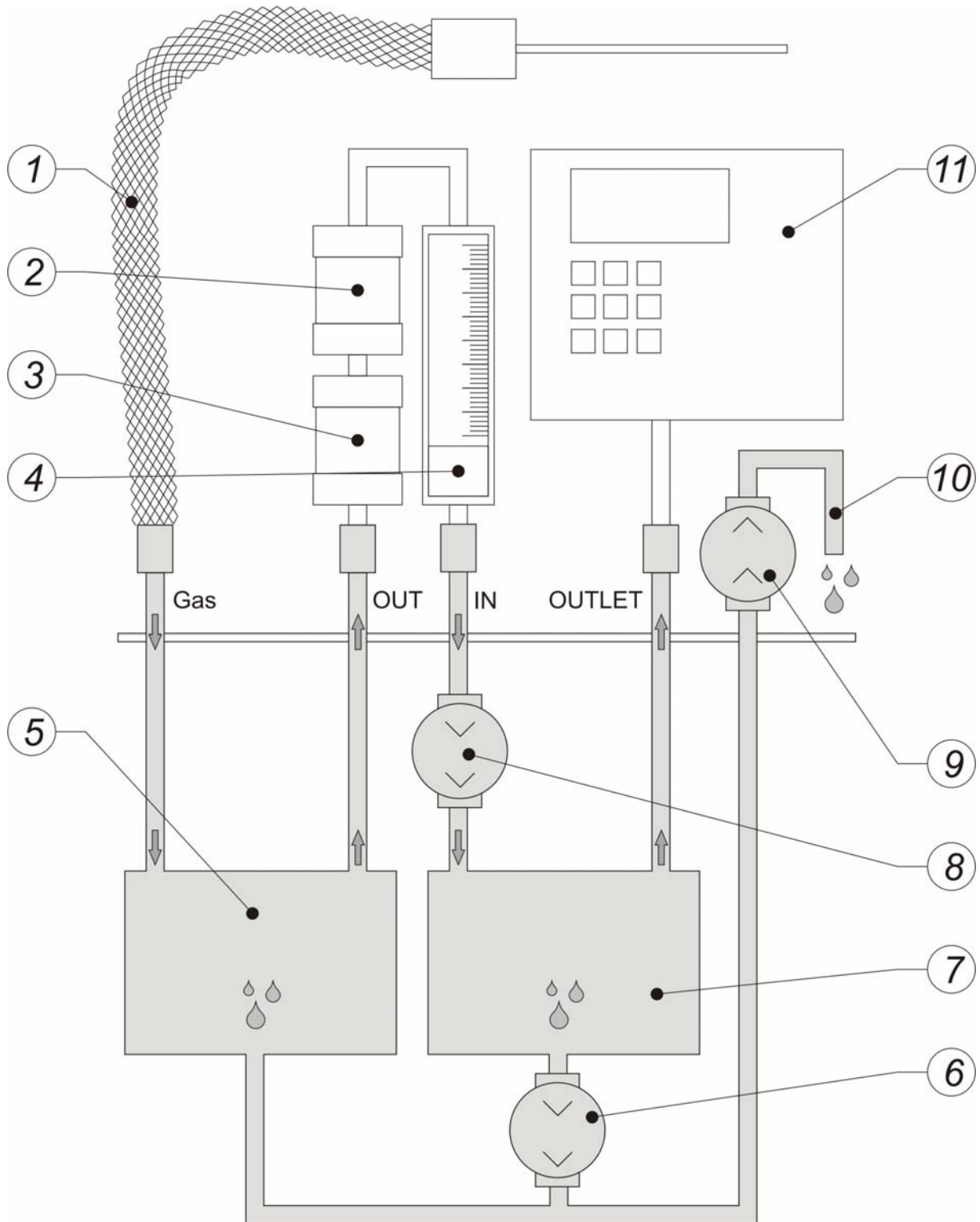
2.2. Additional equipment

The PGD-100/GD-10 dryer is equipped with the additional elements listed below:

1. The heated hose (Ø 6 cm, length of 3m, maximum temperature of 200°C)
2. The analyser communication cable (length of 1m)

3. The gas tube for the analyser – conditioner connection (length of 1m)
4. The power cable

2.3. The gas route of the PGD-100 conditioner



- 1. – the heated hose
- 2. – the external gas filter (permeability of 20um)

3. – the external gas filter (the permeability of 5um)
4. – the flowmeter
5. – the cooler #1
6. – the internal peristaltic pump (transporting the condensate from the cooler #2)
7. – the cooler #2
8. – the gas pump
9. – the external peristaltic pump (transporting the condensate out of the device)
10. – the tubing for water disposal
11. – the flue gas analyser

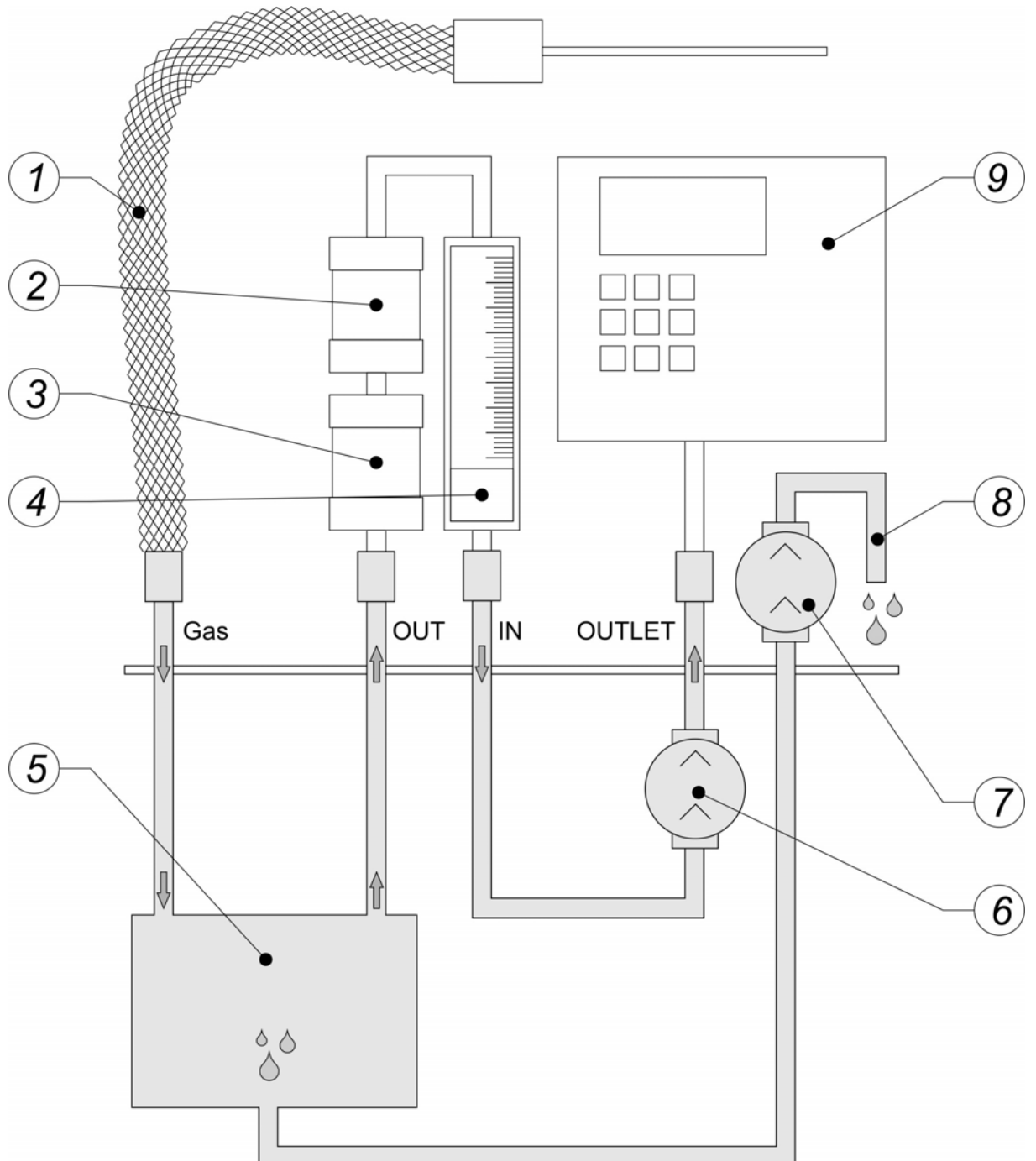
The flue gases are supplied to the conditioner through the heated hose (1), which prevents the water vapour from condensing prematurely and in an uncontrolled manner. The hose is also equipped with a heated filter which removes the molecules of solids from the sample. The hose temperature can be adjusted to the needs of the specific gas. The hose is connected to the PGD-100 gas inlet.

The gas is transported to the cooler #1 in which the initial drying process is performed. The working temperature can be set by the operator with use of the device keyboard.

The condensed water is later transported from the cooler to the main outlet tube. The gas sample is pumped (with the help of the internal gas pump – 8) through the external filters (2, 3) located in the device's casing cover. The flowmeter (4) whose readings are given in l/h is situated next to the set of filters.

Later the gas is transported to the cooler #2, whose temperature is about 1°C (the operator has no influence on the value of this temperature). The prepared gas sample is carried out of the device, to the analyser (11). The condensate from the cooler #2 is transported with the help of the pump (6) to the main outlet channel from where the external pump (9) takes it outside the device (through the duct for the water disposal – 10).

2.4. The gas route of the GD-10 conditioner



1. - the heated hose
2. - the external gas filter (permeability of 20 μm)
3. - the external gas filter (permeability of 5 μm)
4. - the flowmeter
5. - the cooler

6. – the internal peristaltic pump (transporting the condensate from the cooler)
7. – the external peristaltic pump (transporting the condensate out of the device)
8. – the duct for the water disposal
9. – the flue gas analyser

The flue gases are supplied to the conditioner with the help of the heated hose (1), which prevents the water vapour to condensate prematurely and beyond control. The hose is also equipped with the heated filter which removes the molecules of solids from the sample. The hose temperature can be adjusted to the needs of the drying process. The hose is connected to the GD-10 gas inlet.

The gas is transported to the cooler in which the drying process is performed. The working temperature can be set by the operator with use of the device's keyboard. The water condensed in the cooler is transported by the pump outside the device.

The gas sample is pumped through the external filters located in the device's casing cover. The flowmeter (4) whose readings are given in l/h is situated next to the set of filters. The gas sample is supplied to the analyser with the help of the internal gas pump.

2. Usage of the conditioner

3.1. Preparing the conditioner to work

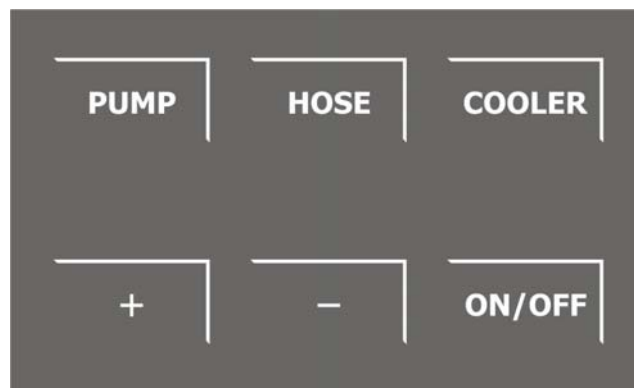
After the conditioner has been brought to the measurement area it is necessary to perform the following actions:

1. control the condition of the filters (replace if seriously dirty)
2. connect the power cable
3. connect the heated hose and the probe
4. switch the device on
5. make sure that the end of the duct for the water disposal is held in a distance from the device
6. set the hose temperature
7. set the cooler temperature
8. connect the conditioner to the analyser
9. switch the analyser on
10. wait until the device declares readiness for work

During the procedure of cooling of the conditioner and zeroing the analyser the gas probe must be removed from the stack.

3.2. The display and the keyboard of the device

The lines of the display refer to the pump settings (**Pump**), the heated hose (**Hose**) and the cooler (**Cool.**). In the column on the left-hand side the current values of the appropriate parameters are shown. In the right column the target values of the parameters are displayed.



To change the particular setting the user should press the appropriate key:

PUMP Enables the user to switch the pump on and off and define its efficiency in the 30 - 100 % range (30 %, 32 %, ..., 100 %)

HOSE The temperature of the heated hose can be set in the 100 - 195°C range. The heating of the hose is performed after the ON/OFF key has been pressed.

COOLER The user can set the cooler temperature In the 1 - 30°C range. The cooling process starts/stops after the ON/OFF key has been pressed.

In the PGD-100 conditioner the option of setting the cooler temperature refers only to the parameters of the cooler #1. The temperature of the cooler #2 is set at the factory and the user is unable to change it.

Choosing the particular module displays in the bottom line of the screen the note informing the user the parameters of which element can be

changed at the moment. The operations carried out with the help of the keys are then assigned to the parameters of the selected module.

Increasing and decreasing the values of the parameters can be performed with use of the +/- keys. The working of the module can be stopped with the **ON/OFF** key.

An additional option enables the user to change the display contrast and can be called up by pressing the **PUMP** and **HOSE** keys simultaneously. Changes to the contrast level can be then made with use of the +/- keys.

In the bottom line of the display the status bar is shown. The following information can be displayed:

PGD 100 READY*/*GD 10 READY - signalises the proper working of the device

pump setting/hose temp. setting/cooler setting/contr. setting – signalises setting the parameters of the pump/hose/cooler/display contrast

COOLING – the information is displayed when the device is working in the cooling mode, which means when the target temperature of the cooler is lower than the current temperature value; during the cooling process the gas pump is switched off

CLEANING – the message appears when the conditioner's cooler reaches the target temperature; the gas course is then ventilated

The information signalling setting the parameters of the particular module appears for three seconds. If the user manages to make all the desired changes within that time the device switches to the usual working mode and the changes made to the parameters values are stored. The editing of the parameters can always be lengthened by three seconds.

3.3. Signalising errors.

The user may encounter the following notes informing of the error in the usual working mode of the device.

hose conn. error! Appears when the hose thermistor has been damaged or short-circuited or if the hose has not been connected to the device in a proper way

WET OUTGOING GAS! Appears when moisture is detected in the gas sample at the outlet (only applies when optional moisture sensor is fitted)

COOLER FAULT! Appears when the target temperature of the cooler cannot be reached despite a constant cooling process (the cooler might be damaged or the fan might be defective)

HOSE OVERHEATED! If this message appears, then the gas dryer must be immediately switched off. The information means that the hose temperature has exceeded 200°C, which could be due to a temperature control failure.

The error messages always have priority over other messages

The appearance of an error message automatically holds usual working of the gas conditioner until the problem has been solved or the dryer has been restarted.

4. Principles of the choice of the hose and cooler temperatures

The heating of the hose prevents the water vapour from condensing before they reach the cooler. If the measurement concerns gases with a high content of sulphur compounds it is advisable to set the hose temperature in the 180 - 195°C range. In all the other cases a temperature of 150°C is suitable.

The minimum cooler temperature depends on the external temperature and the gas sample moisture level. If the external temperature is in the 20 - 25°C range, a cooler temperature of 4°C is suitable.