



Instruction Manual

DS 2005

Specific Gravity Meter



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Attention:

**Read the entire Manual
and Safety Instructions
in chapter 1 before
installation of the unit.**

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1. Installation location

Before the instrument is taken into operation the manual should be read. The indications and warnings have to be observed.

Installation:

The electrical connection of the device may only be carried out by a qualified person. When connecting the device attention should be paid to the correct supply voltage according to the type plate. In any case the applicable national regulations and prescriptions have to be observed.

Maintenance Works:

For personal protection, maintenance works may only be carried out with electrical power to the device switched off.

During maintenance works and before start-up as well as for unforeseen reasons the process gas should be turned off.

When working with toxic or flammable gases, all applicable safety regulations must be observed. Because of the considerable dilution of the gas flow with air, non-toxic gases are considered harmless.

Gas Connections:

The gas connections may only be carried out by qualified personnel. The guidelines applicable for the installation location must be observed.

The gas conducting components have been tested for gas leak proofness at 1.3 times operating pressure. A highly sensitive gas monitor is checking for leaks. As the unit is permanently fed with flammable gases highest precaution is recommended.

The device may only be operated within the permitted temperature range. The instrument may be installed and operated in an enclosed environment only. Moisture influence will destroy the device.

After installation all gas conducting parts must be tested for leak proofness. The local conditions should be taken into consideration.

Cooling or heating systems can be supplied as an option. Moisture inside the Instrument will damage the device.

The process gas has to be dry. The type of contaminants and their concentration in the process gas will determine any necessary filtering and drying. After installation, all gas-bearing parts must be leak tested. All applicable onsite rules and regulations have to be observed. Since the instrument carries out its measurements optically and electrochemically, special attention must be paid to rules and regulations pertaining to the installation of electrical equipment in classified areas.

2. Function of the DS 2005

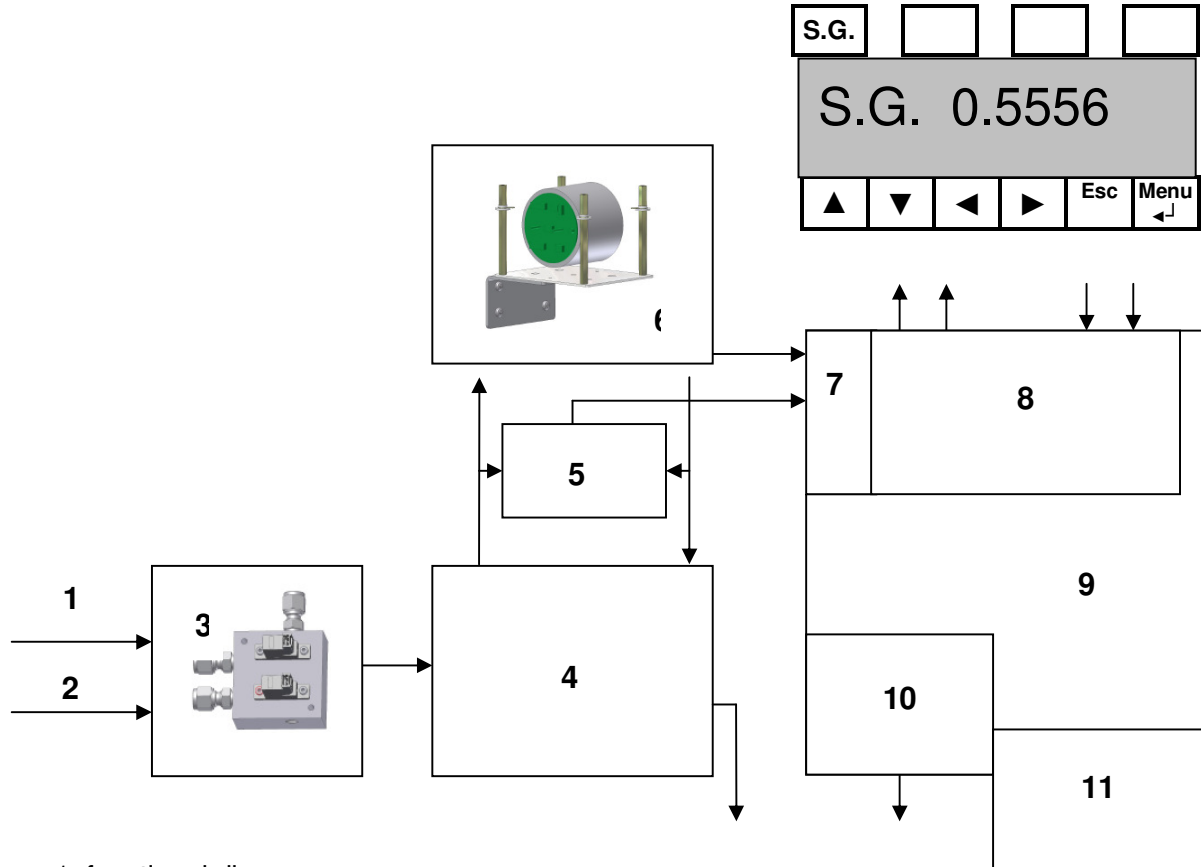


Figure 1: functional diagram

1	Inlet process gas	2	Inlet calibration gas
3	Solenoid valves process/calibration gas	4	Pressure control unit
5	Differential pressure control	6	Specific Gravity Sensor
7	Gas pressure sensor	8	Display with keys
9	Micro controller	10	Status signals
11	Outlet 4..20 mA		

Valve (1) is feeding process gas to the unit and valve (2) calibration gas. The valve unit (3) is switching between process gas and calibration gas. Unit (4) is creating the differential pressure by means of the specific gravity sensor and is thus determining the flow through the gravity sensor. The differential pressure sensor (5) is measuring the differential pressure through the specific gravity sensor and transports the measuring value to the electronics (7). A micro controller is processing the data from the differential pressure sensor (5) and the Specific Gravity Sensor (6) to a gravity related signal in the electronics (7). Menu entries of calibration data and pressure by means of a keyboard (8) are also processed in the micro controller. This unit is controlling the status signals (10) and the outlets for specific gravity and for differential pressure as signal 4 – 20 mA in line with measuring range.

Various specific gravities of the process gas are crucially affecting the gas consumption of the system. The following table shows the gas consumption in relation to specific gravity. Calculation basis is the flow rate through the dimensioning nozzle in the nozzle unit of 0.60 mm

Specific Gravity	Gas consumption l/h
0,20	39
0,70	21
0,12	16
1,70	13
2,20	12

This table is important for the estimation of time delay and visual time of the measuring. A fast visual time is received by a small volume in the pulse line.

After the measurement gas is flowing into the open air with an overpressure of some mbar, it can be burned or diverted to a hazard-free place.

3. Function of the Specific Gravity Sensor

Process gas is flowing through the measuring chamber of the density analyzer. The vibrations of a transmitter diaphragm with constant amplitude and frequency are communicated to a pressure transducer.

The amplitude of the signal received at the pressure transducer is directly related to the density of the process gas. The inherently vibrating signal is amplified and processed in order to receive a continuous output signal in Volt.

The expansion of the sonic waves in the analyzer is related to gas density, viscosity and heat conductivity. The selective reliance of the analyzer from gas density is depending on the geometric formation.

The long thermal stability is achieved through an equation chamber which is comparing the measurement with air in ambient conditions. The signal is controlling the amplitude with the transmitter diaphragm. The stabilization of the amplitude makes the specific gravity analyzation insensitive to small particles on the oscillating diaphragm.

ATTENTION! Gas pressure in the measurement chamber may not deviate from pressure in the reference chamber.

The inherent sensitivity of the analyzer to external mechanical shocks or internal pressure surges is minimized by the large mass suspended on shock dampened mountings and electronic noise filtering.

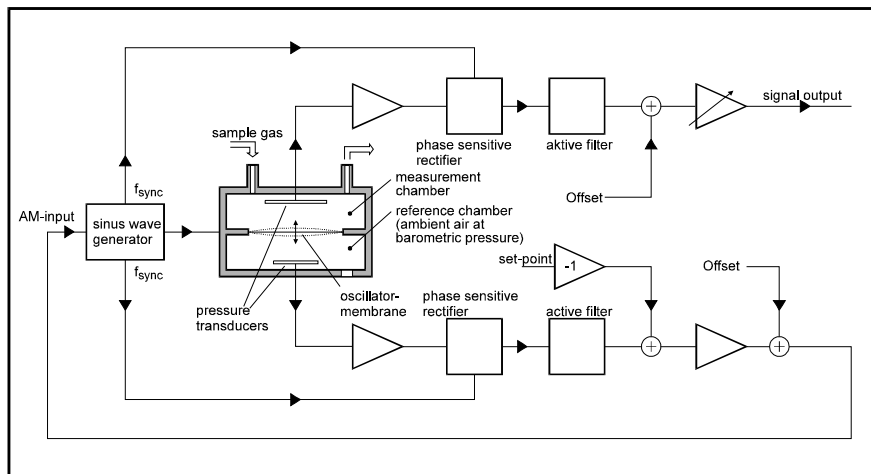


Figure 2: Function of the specific gravity sensor

The measured data are stored in the signal processor and is indicated on the display. A 4 - 20 mA output signal is available for each channel. Using additional relays, minimum and maximum values can be monitored. Measured data can also be communicated via bus structures to networks. Ask your manufacturer for further options.

4. Technical Specifications

Enclosure

Dimensions	Width	610	mm
	Depth:	210	mm
	Height:	610	mm
	Weight:	20	kg

Material	S.G.Cell SST
	Enclosure Aluminum

Ranges	0,2...2,20 dv
	0,0....2.0 dv

Connections Gas

	Input	6x1 mm Swagelock
	Output	6x1 mm Swagelock
	Input calibration gas	6x1 mm Swagelock
Accuracy	± 1,5% full scale	
Ambient Temperature	± 0°C to +45°C	
Resolution	± 0,001 full scale	
Gas Pressure Input	+30-60 mbar max 100 mbar	
Output Analog	4...20 mA, load Ω	
Indication Times	Response time:	5 sec
	Time Delay:	10 sec
	Warming up time:	45 min
Power Supply	90...260 V/50/60HZ	
Electronic Data	4 lines to 20 digits	

Entry options for choosing calibration time and repeating time.

5. Technical Construction

The DS 2005 unit is mounted on a base plate and can be dismantled from the enclosure by unscrewing the connections. All components are installed for easy access. The ventilator is soaking air from the ground which is flowing into the enclosure on the back side.

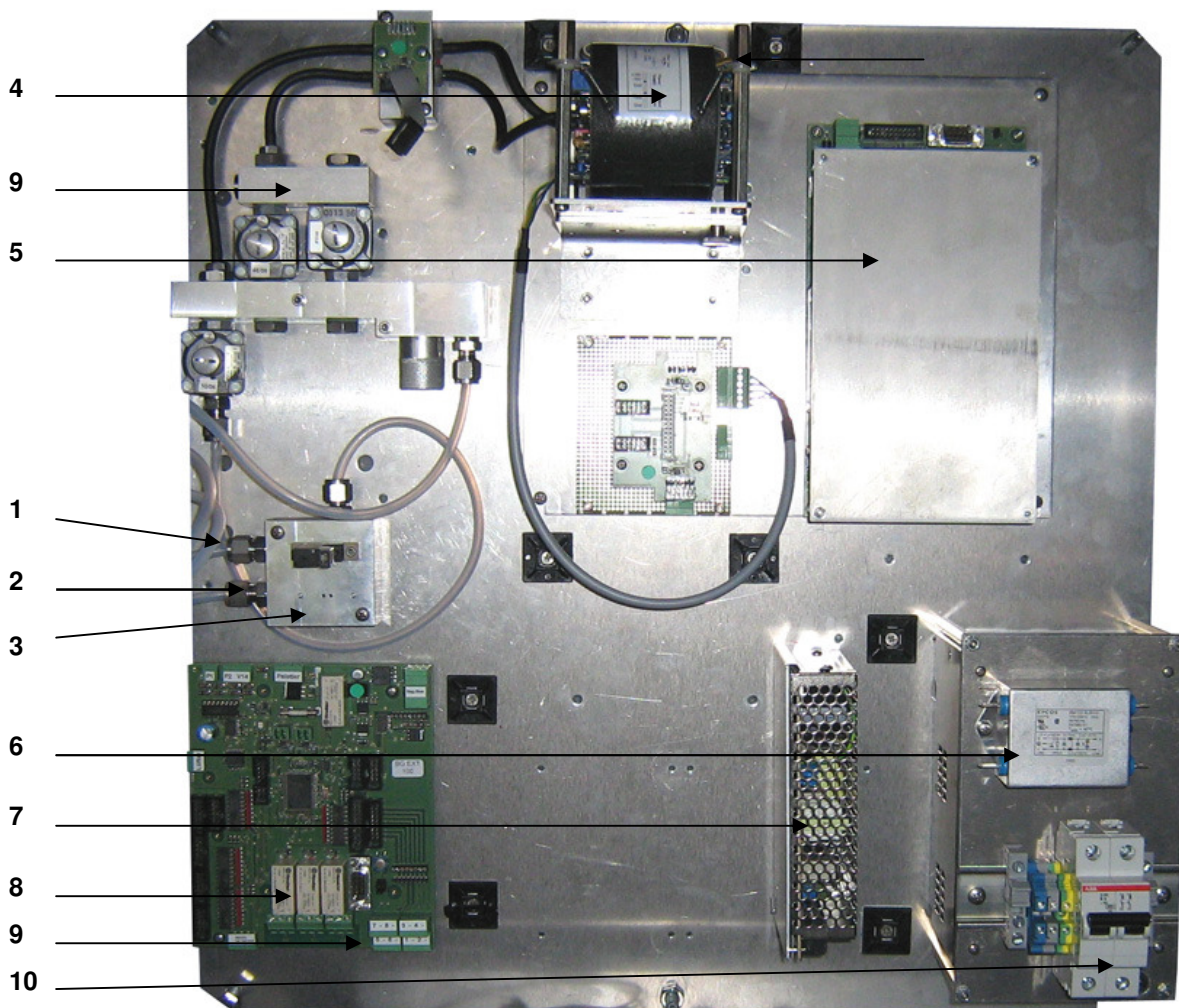


Figure 3: Function parts on mounting plate

1	Input process gas	2	Input calibration gas
3	Output process gas	4	S.G. Cell
5	Microprocessor electronic	6	Power Supply Processor
7	Power supply S.G. Cell	8	Status signals
9	4..20 mA	10	Main switch

6. Installation of DS 2005

The shipping container has to be opened carefully and all packing material must be removed. Please check if the analyzer is supplied as ordered and that all parts listed on the packing list are delivered.

6.1. Installation location

The installation location must be protected against rain. The left side of the enclosure should be freely accessible so that all connections can be comfortably mounted. The right-hand side needs enough space to open the door. The measured process gas leaking is connected to a hose and led into the open air or is burned under supervision.

6.2. Wall mounting of the DS 2005

The DS 2005 meter is prepared for wall mounting. Install the supplied wall brackets (1) (as shown in figure 4) into which the unit is then placed. Distance elements (6) ensure a horizontally balanced level.

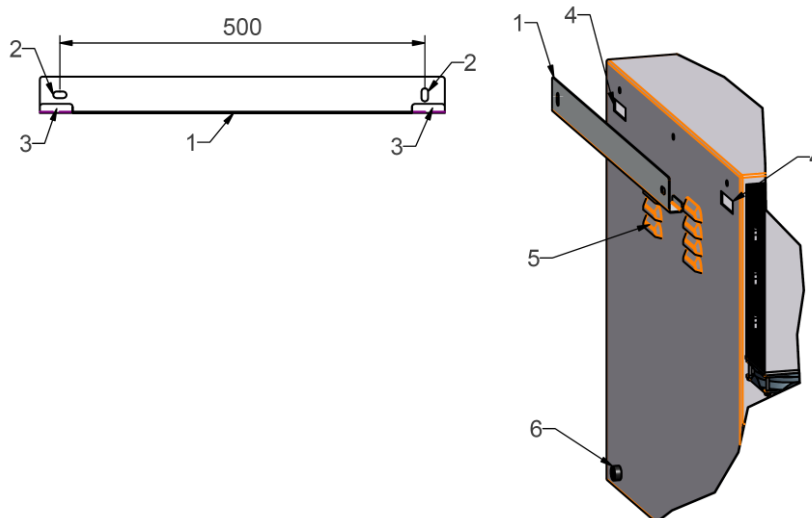


Figure 4: Enclosure fixing device

1	Wall bracket	2	Fixing Holes
3	Fixing Elements	4	Holes for mounting
5	Blower Inlet	6	Distance Elements

6.3. Gas Connections

The DS 2005 meter is supplied with Gyrolock 6x1 mm tube fittings. A 6x1 mm tube is connected.

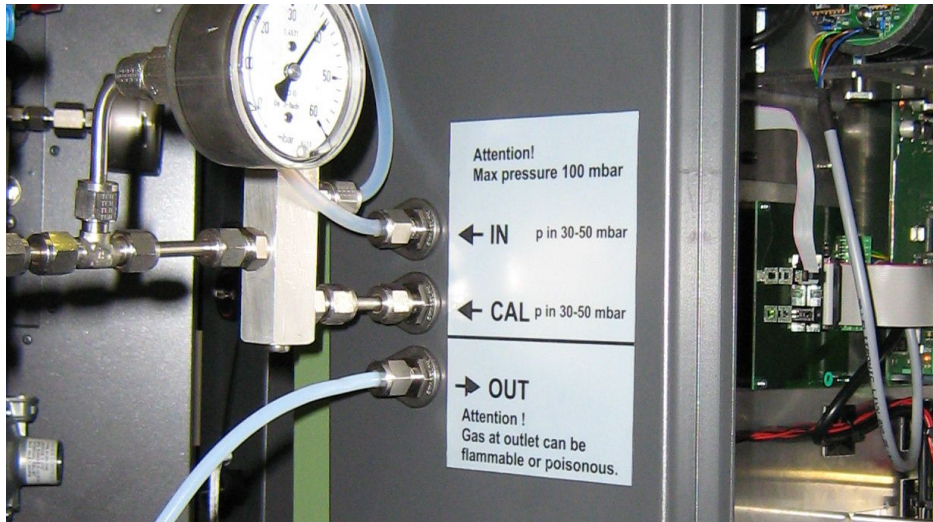


Figure 4: left side of enclosure

- | | | | |
|---|--------------------|---|-----------------------|
| 1 | Input process gas | 2 | Input calibration gas |
| 3 | Output process gas | | |

For the connection of process gas a pressure control unit with pressure gauge as well as an inline filter is recommended. The Inlet pressure of the pressure control can be adjusted according to the process gas pressure.

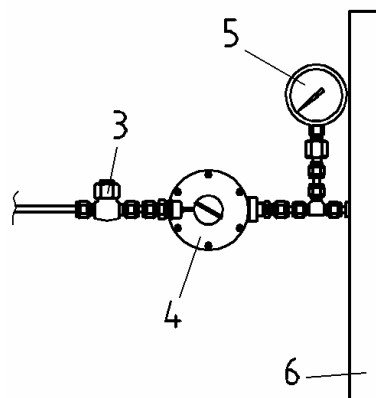


Figure 5: left side of enclosure

- | | | | |
|---|----------------|---|---|
| 3 | Inline Filter | 4 | Pressure Control,
max18 bar/ 50 mbar |
| 5 | Pressure Gauge | 6 | DS 2005 |

6.4. Electrical Connections

The DS 2005 Meter is equipped with a universal power supply for AC 90 ... 260 V, 50/60 Hz. The connection is made as shown in the diagram below (figure 7). A built in inline filter prevents malfunctions. The power supply is located below the connection panel and is fixed with stud bolts.

Warning!!! Life-threatening hazard: The power supply unit can carry a voltage of up to 250 VAC. Any work carried out may therefore only be carried out subject to local and national conditions and standards, i.e. VDE 0100; NEC; etc.

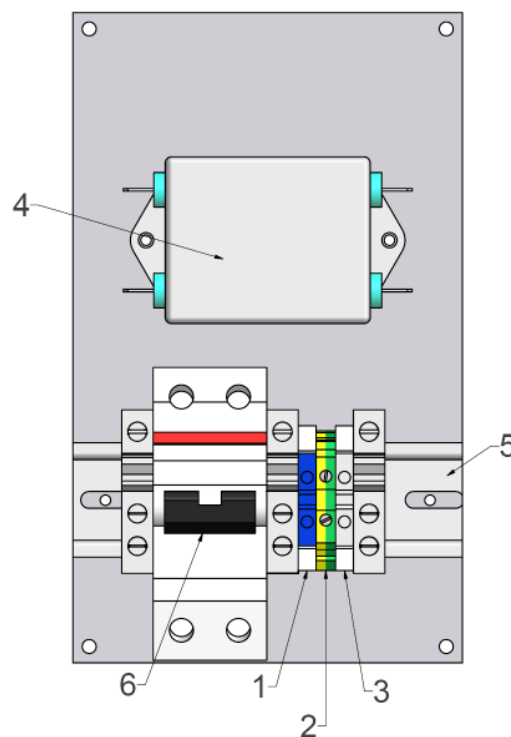


Figure 6: Connection panel inside the enclosure

1	Neutral (N)	2	Earth Ground (PE)
3	Phase (L)	4	Capacitor
5	Mounting Rail (DIN Rail)	6	ON OFF Switch

6.5. Commissioning

When all electrical and gas connections have been completed and tested in accordance with all instructions, codes and regulations then the instrument is ready to be powered up.

The following work must be carried out when commissioning the unit:

Remove the transport tie wraps and transport screws from the specific gravity cell. The body of the cell must hang free on the springs and not come into contact with the sides of the bracket. The screw should be removed and stored and the following diagram illustrates the process.

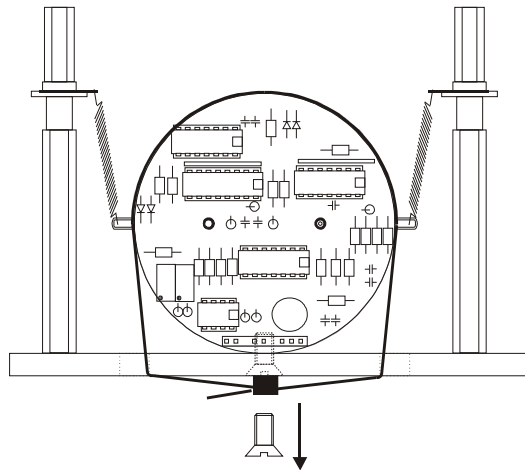


Figure 7: Specific Gravity cell shown locked for transport

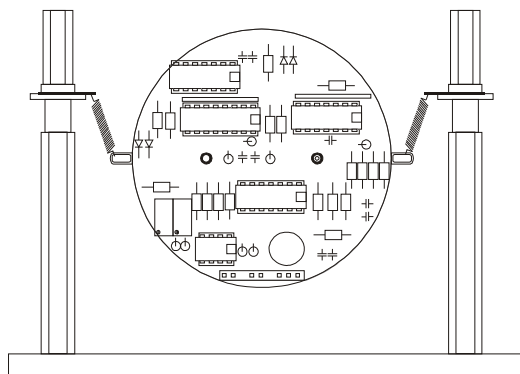


Figure 8: Specific Gravity cell shown in its operating position

Remove the transport packing from the gas pressure regulator. Polystyrene foam is located beneath the removable regulator cover and must be removed before use.

Check the process and calibration gas connections for tightness and correct connection. Check any carrier gas or second calibration gas connection if supplied.

Switch on the power switch. After a short delay while the unit powers up, the main screen will illuminate. An information field in the top right hand corner will show status. After a short purge period the gas valve will open and the ignition will start automatically (Note: This is only possible with the door closed as a safety switch inhibits ignition with the door open). Once the flame is lit, the door can be opened without creating a flame out condition.

The device will start up and after short warm-up period (20-30 minutes during first commissioning from cold) will reach the correct process gas calorific value.

All software, measuring ranges and any other specified options have been pre-set at the factory (see datasheet and memory stick supplied with the unit).

Following start-up, the gas pressure indication on the screen will read 4 mbar, and the cooling air differential pressure gauge (blue) will also show 4 mbar. If the gas pressure needs adjustment add or subtract weights from the precision weight loaded regulator. The air pressure should need no adjustment by the user, as control is by the variable speed air fan. Check the specific gravity differential pressure indication on the screen reads 4 mbar and adjust if necessary, see section 9.2.4 for more details.

After the warm-up period, the instrument will show the Calorific Value, Wobbe Index Value and Specific Gravity, numerically in the display and a visual trend will be developed onscreen.

The menu system is described in Chapter 6, and this describes how the user enters their application specific values into the various menus. Be sure to read this chapter to gain some familiarity with the equipment before any ad-hoc experimentation or adjustment to the menus.

If the unit should fail to power-up, open the main door and check inside the door that the power supply ribbon cable connections are firmly attached to the power supply as sometimes these have detached during rough shipment and handling.

If questions arise during start-up contact the factory with serial # for further advice.

The unit is supplied factory calibrated and field calibration should only be attempted by users, with a source of calibration gas with known values.

See section 6.2.1.2 for more details.

Check the calibration gas data and enter the values in the correct menu. If only the gas component percentage is known, the correct Wobbe Index value must be calculated from the individual components. The use of cylinders with vendor supplied certified values for BTU and Specific Gravity is recommended as the accuracy of the calibration depends on the accuracy of the gas standards used for calibration.

7. Output and Status Signals

The DS meter has relays for the status information like “in operation” and “disturbance”. The 4 20mA output give analogy information about density and pressure.

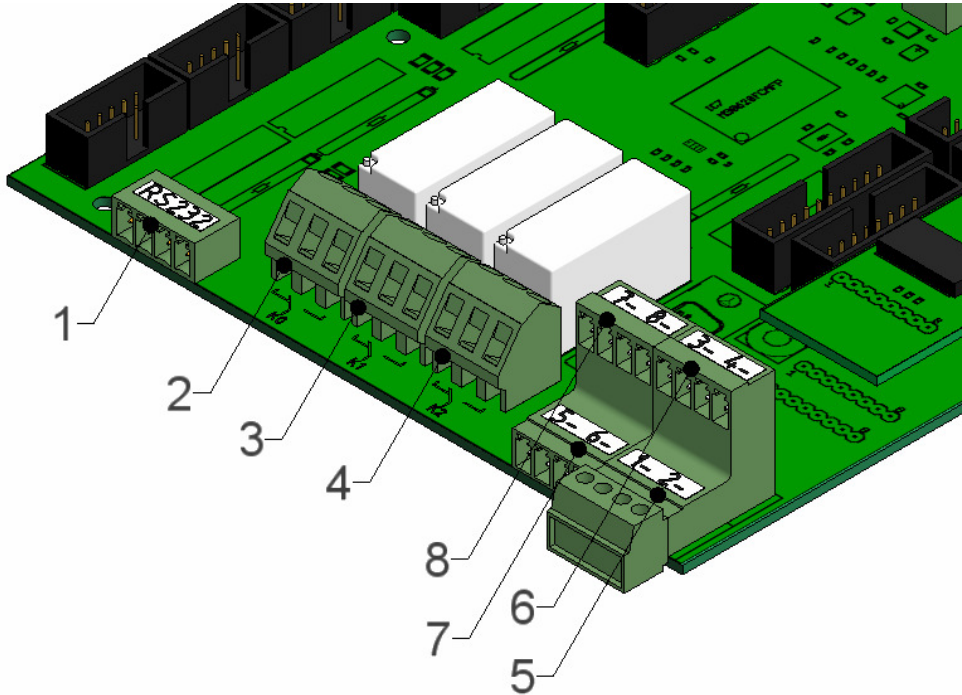


Figure 9: Connection panel inside the housing left down

1	RS 232	2	not in use
3	in operation	4	disturbance
5	outputs 2x4.-.20 mA	6	not in use
7	not in use	8	not in use

The connection 1 – and 2 – (at position 5) is for the two outputs. The Connections 3 – and 4 – are without function and not in use.

- 1 - specific gravity
- 2 - differential pressure

The original plug (Phönix contact) is still put in the connection (5). Pull out the plug at position (5) and connect the wires for Specific Gravity (1 and -) and for the differential pressure (2 and -). After connecting the plug again the signals are online.

Contacts

At 3	middle - right	normally opened	in operation
At 4	left - middle	normally closed	disturbance

The DS 2005 Meter can be supplied with many options which have to be ordered in addition.

7.1. Analog connections 4...20 mA

The output 4 ... 20 mA represents the S.G. signal linear to the range. The load of the signal is 500 Ohm.

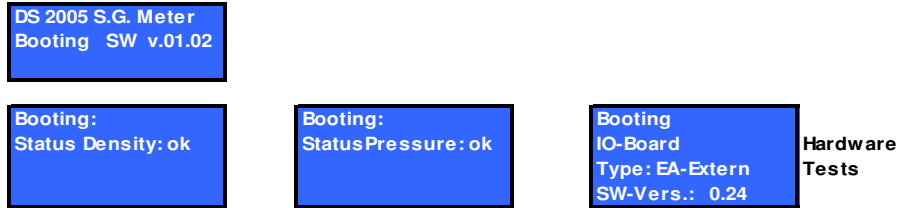
7.2. Digital Connections

Different digital signals are available as options. The RA 232 is provided as standard and has to be activated with order. Other interfaces have to be ordered separately (i.e. Profibus and others).

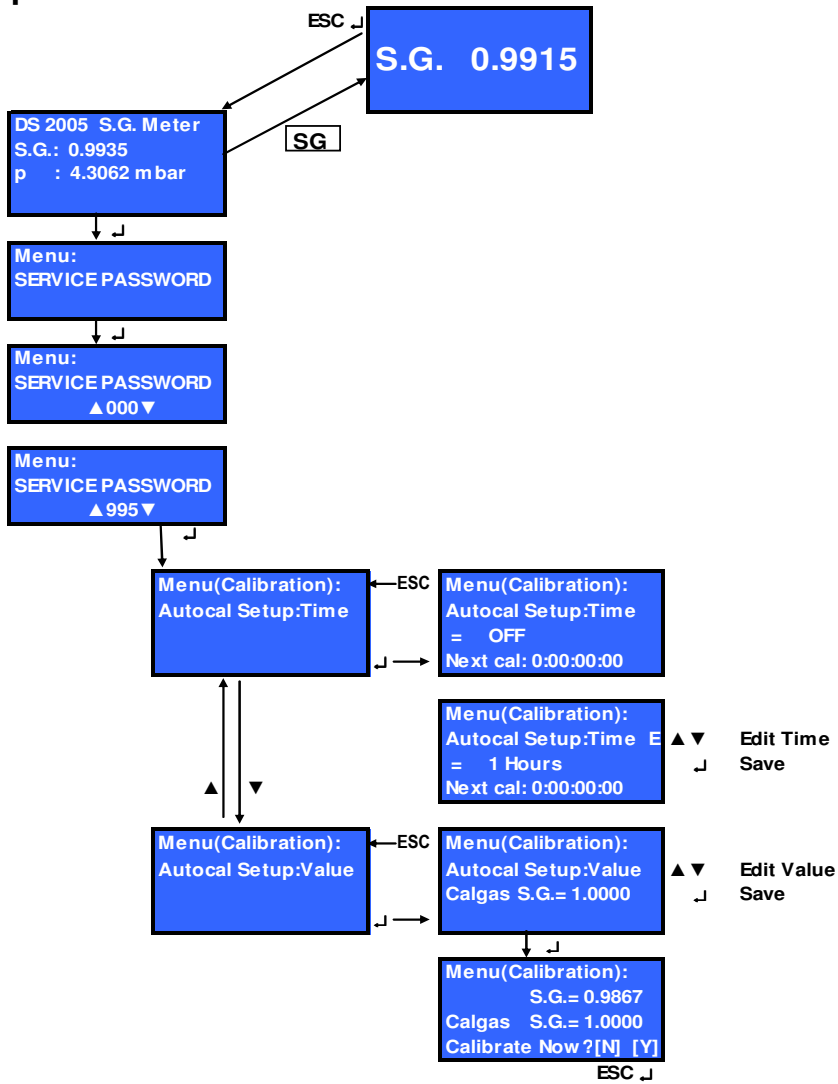
8. Menu

8.1. Menu Overview

Warmup:



In Operation:



8.2. Menu Display

Button SG shows density in big characters. The display is always accessed from the upper menu level. The blank buttons show service information which is not important for normal operation.

Signification of function keys:



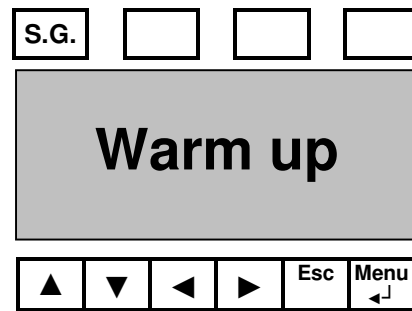
Arrows left, right, up, down move the cursor into the direction indicated or open a menu screen on the same level.

„**Menu/Enter**“ moves to the next level, „**Esc**“ moves step by step to the next higher level until the top level. Button SG shows the actual specific density.



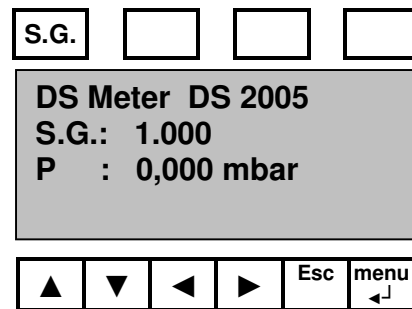
After power-on, the display shows in short sequences (approx. 2 sec.) 4 displays. First shown is the Software Version (actually 1.02), after that the density sensor, the differential pressure transducer and the I/O board are running a self test.

After the tests the display shows „**warm up**“ for 20 to 45 minutes until the warm up is finished. Especially the density sensor needs time until the heating has reached the necessary temperature (35 °C) and the heating control is working steadily.



Warm up is completed when the display shows S.G: 1.000 and P: 0,000 mbar (with no gas connected). When gas is connected the display shows the actual specific gravity of the process gas and the pressure at the density sensor. It should be about 4 mbar.

The range is dv: 0.200 to 2.200 with an output of 4 ... 20 mA and a pressure of p: 0.00 mbar to 6.000 mbar with an output of 4 ... 20 mA.



Pushing the „S.G.“ key will display „S.G. 1.000“ (for dv air = 1) in big characters.

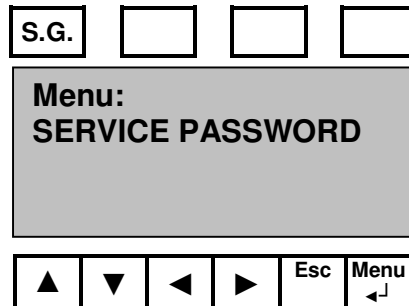
Next Stepp is connecting calibration gas N₂, pure CH₄ and process gas.

Input pressure has to be between 30 mbar and 60 mbar. **It may not exceed 100 mbar (16 in WC).**

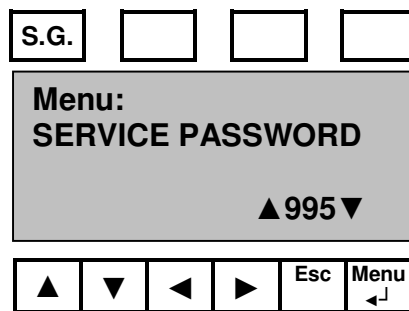
Higher input pressure can destroy the instrument. A pressure control with an output of 50 mbar and a display should be installed. This can be ordered from manufacturer.

8.2.1. Password

Push key “**Menu/Enter**” and the display shows menu: „**Service Password**“.



“**Menu/Enter**” is asking for the password. For the selection use cursor *up* ▲ and *down* ▼. The system is counting from 0 to 995 (995 is the actual preset password). Push button “**Menu/Enter**” and the password is confirmed.



Attention: These menus have stored important data for the system. Changing these data may lead to measuring errors.

8.2.2. Automatic Calibration

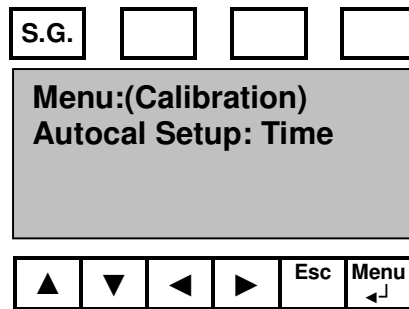
The submenu „**Calibration**“ contains the functions:

“Autocal” and „Value“

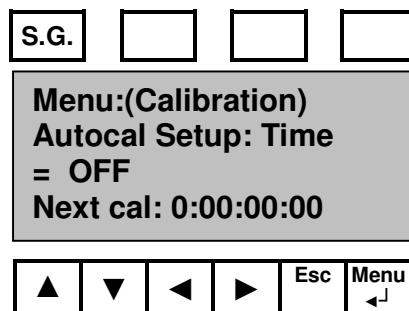
The „**Autocal**“ function allows switching the gas input from process gas to calibration gas in free selectable time intervals of one hour or switching-off the calibration process by selecting set up time „**off**“.

8.2.2.1. Setup Time

Menu “**Autocal Setup: Time**” is selecting the time interval for the calibration of the Gravity Meter DS 2005. Display „next cal“ calculates the time for the next calibration.

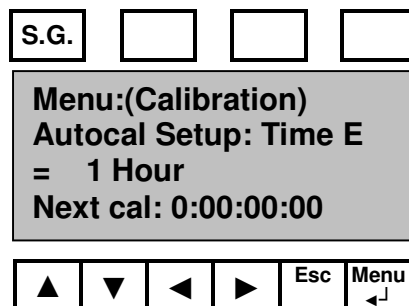


Key “**Menu/Enter**” confirms the menu settings for „**Calibration**“.



Use cursors *up* ▲ and *down* ▼ to preset the periodic calibration time. „Next cal“ shows the remaining time until the next calibration is starting. Letter E in the display shows the actual issue. Confirming with “**Menu/Enter**” is saving the selected values.

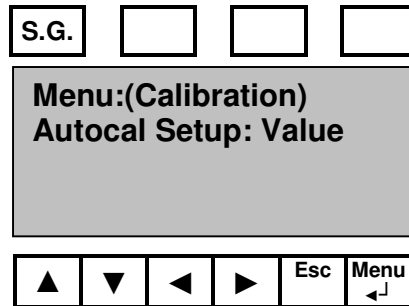
The ex factory presettings for the auto calibration is switched *off*, the display shows „OFF“. For example:



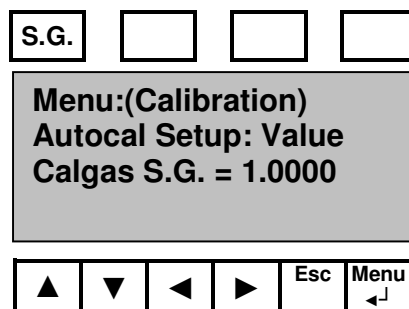
Key “**Menu/Enter**” confirms the settings. By switching from editing mode to confirmation the letter E disappears.

8.2.2.2. Setup Value

To get to menu level “**Autocal Setup: Time**” push key “**Esc**” several times and the display menu shows “**Autocal Setup: Value**”. Here ist he setting for the calibration gas (calculated specific gravity). The calibration gas should have a similar density as the process gas.



Pushing key “**Menu/Enter**” confirms the menu setting „**Value**“.



Cursors *up* ▲ and *down* ▼ select the calibration mark as reference point for specific gravity. This calibration mark is the reference point for every automatic calibration until a new calibration gas with different specific gravity is connected and a new reference point has to be set.

Key “**Menu/Enter**” confirms the menu settings „**Calgas S.G.**“.

S.G.					
Menu:(Calibration) S.G. = 0.9876 Calgas S.G. = 1.0000 CalibrateNow? [N] [Y]					
▲	▼	◀	▶	Esc	Menu ↵

To reset the settings push key “**ESC**“. To confirm the specific gravity settings push button “**Menu/Enter**“.

In this menu calibration can be started directly. Button “**ESC**“ means [N] no and button “**Menu/Enter**“ means [Y] yes. Selecting [Y] is directly starting a single calibration. Preset time for calibration is approx 5 min. The preset time cannot be changed by the user.

Important: Before starting the calibration, the gas needs to flow through the instrument for at least 5 min. After 5 minutes the unit is adapted to the new gas tape. Non-observation may result in calibration errors.

9. Maintenance and Service

The design of the instrument is clearly based on a series of modular components. Normal maintenance and service can be performed by the operator, without outside assistance.

9.1. Maintenance

The instrument is equipped with several jets and tubes with small diameter for controlling the flow and the operating pressure. Dust and other contaminants in the instrument have to be avoided. A Filter gas pressure regulator is highly recommended.

In case of problems please contact the manufacturer. The 5 digit serial number is necessary.

9.2. Service

9.2.1. Gas Cleaning

The pre-filter should be opened and checked from time to time. The instrument is soiled as soon as the differential pressure is slowly decreasing.

9.2.2. Software Update

Development on the DS 2005 instrument is an ongoing process. New requirements for processes, control- and regulation functions are coming up and there will be regular software updates.

The new version of the software can be loaded to the DS 2005 locally onsite.

For the software update a customary RS232 Null modem cable is required as well as a PC with RS 232 interface and an operating system Windows 98 or higher.

With Windows NT problems may occur. These problems are caused by the drivers and cannot be solved by the manufacturer of the transfer software.

Open the enclosure of the DS 2005 unit and switch off power supply. Connect interface RS 232 with the PC, i.e. interface COM1.

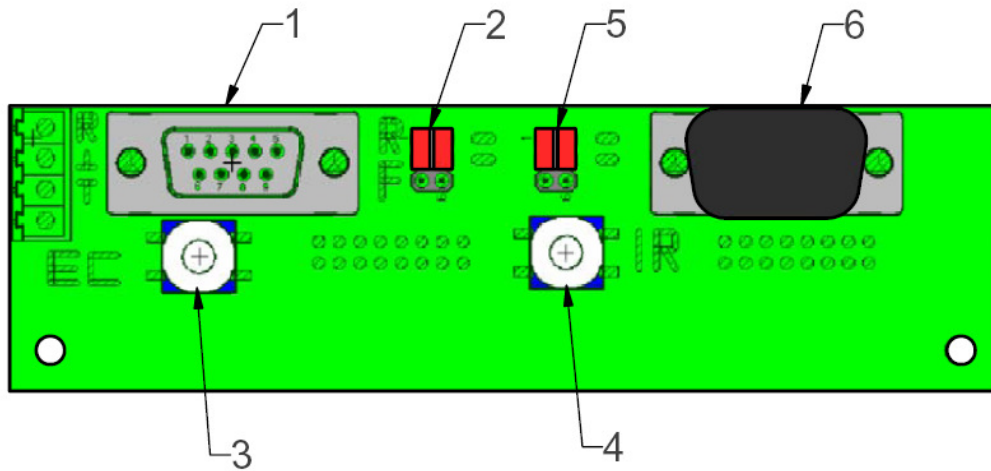
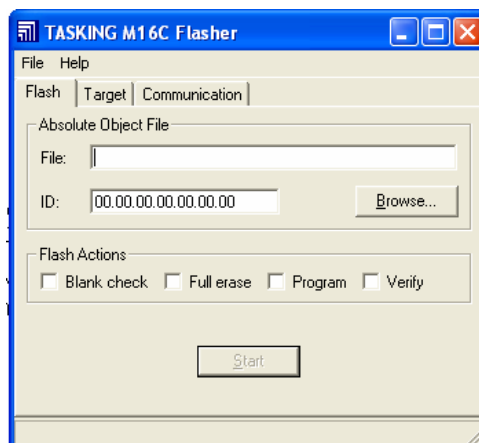


Figure 10: right side of enclosure

- | | | | |
|---|---------------------|---|--------------------|
| 1 | RS 232 | 2 | Jumper |
| 3 | Reset | 4 | Reset (not in use) |
| 5 | Jumper (not in use) | 6 | RS 232 (not use) |

Only the EC space of the board is equipped. The Jumper interface (1) is placed in the lower position. Switch on power supply of the DS 2005 unit and push reset button. The PC software is customary Flasher Software (Software UP Date Program) of the microprocessor manufacturer.

The program is started by double clicking the file name **FLASHM16.EXE**. The screen display shows the following dialog:



The settings should be chosen according the screen display.

The file loaded via the browser is depending on the new software version.



With the command “Start” the new software is transferred into the instrument (flashed). After the flashing the jumper is replaced in the upper position. After a new start of the instrument the display shows the version number of the new software.

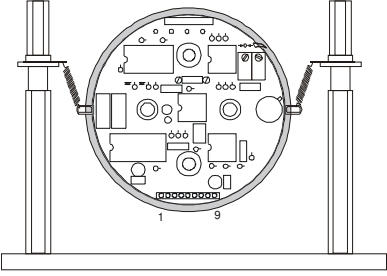

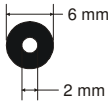
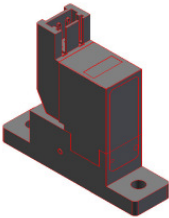
9.3. Troubleshoot List

The differential pressure of the gravity sensor is measured and surveyed. During calibration the differential pressure has to be at least 2 mbar, otherwise calibration is cancelled and the old calibration value is maintained. If for the next calibration differential pressure is as specified calibration is performed normally.

Errors caused by lower pressure during calibration are displayed on the screen.

The list is regularly updated.

10. Spare Parts List

	<p>Specific Gravity Sensor</p> <ul style="list-style-type: none"> - heated - +/-15V / 7VA - Range 0,2 – 2,2 dv <p>Weight: 1700 grams</p>
<p>Order description: Specific Gravity Sensor heated</p> <p>Order number: 02402199978 range 0,2 – 2,2 dv</p>	
	<p>Nozzle (Gas consumption)</p> <p>Material Aluminum/ Perbunan NBR</p> <p>Diameter 0,6 mm</p> <p>Weight: 3,5 grams</p>
<p>Description: Nozzle Gas (Gas consumption)</p> <p>Order Number: 02401199988 x.xx mm</p>	
	<p>Neoprene tube 6 x 2 mm, black, lenght1 m</p> <p>Compatible to Union instruments CW95/CWD2000/2005/DS2005</p> <p>Weight: 30 gram</p>
<p>Order description: Neoprene tube 6x2,1m, to instrum. CW95/CWD2000/DS2005</p> <p>Order number: 02401199998</p>	
	<p>3/2 way solenoid valve, 24 Volts</p> <p>Size 1,35 mm</p> <p>Type SC S067A 118</p> <p>Material: PEEK, EPDM</p> <p>Weight: 11,7 gram</p>
<p>Description: Solenoid valve Type SC S067A 118</p> <p>Order Number: 08402199999</p>	