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DMA 35N

Portable Density Meter

Firmware Version: V2.014

Instruction Manual

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1 Introduction

- The DMA 35N portable density meter measures the density of liquids in g/cm^3 or kg/m^3 according to the U-tube principle.
- Samples are filled into the measuring cell using the built-in pipette-style pump or a syringe.
- A temperature sensor measures the sample temperature right at the measuring cell. The temperature is displayed and can be used internally for automatic temperature compensation of the density reading.
- Once activated, automatic conversion of density into relative density, density at reference temperature or concentration (H_2SO_4, API number, °Brix, °Baumé, °Plato, % alcohol, etc.) is performed immediately.
- 1024 measuring results including temperature can be stored in the memory of the DMA 35N. Results can be recalled individually, or transferred to a printer or PC using an infrared/RS 232 interface port (option).

2 Safety Instructions

- This instruction manual does not purport to address all of the safety problems associated with the use of the instrument and samples. It is the responsibility of the user of the instrument to establish safety and health practices and determine the applicability of regulatory limitations prior to use.
- Before using the DMA 35N read the instruction manual.
- Anton Paar GmbH warrants the proper functioning of the DMA 35N, if no unauthorized adjustments have been made in mechanical parts, electronic parts and firmware, and the following points are adhered to.
- Follow all hints, warnings and instructions in the instruction manual to ensure correct and safe functioning of the DMA 35N.
- Do not use the DMA 35N for any purpose other than described in the instruction manual.
- Do not use any accessories other than those supplied or approved by Anton Paar GmbH.
- Do not operate the DMA 35N if a malfunction is suspected, or damages or injuries or loss of life of persons cannot be excluded under all circumstances.
- The digital density meter DMA 35N is suitable for use in hazardous areas **only** if the instrument is labelled with the ATEX registration number.
- Due to the nature of the measurement the measuring results not only depend upon the correct use and functioning of the DMA 35N, but may also be influenced by other factors. Therefore it is advised, that the analysis results are plausibility tested before consequential actions are taken.
- Follow the precautions below for the handling and measurement of inflammable samples and cleaning materials:
  - Store no inflammable material near the instrument.
  - Do not leave sample containers uncovered.
  - Clean all spillages immediately.
  - Ensure that the instrument is located in a sufficiently ventilated area, free from inflammable gases and vapours.
- Do not expose the instrument to temperatures below 0 °C (32 °F) if water is contained in the measuring cell or pump. Freezing water will cause rupture of the measuring cell.



Caution:
Do not drop the DMA35N! Vigorous vibrations and mechanical shocks will destroy the glass measuring cell. For extra protection against breaking the measuring cell when the instrument is dropped, use the optional rubber housing (see Appendix A).

2.1 Safety Measures for Use in Hazardous Areas

2.1.1 Starting Up and Starting Up after Service

- The DMA 35N is suitable for use in hazardous areas **only** if the instrument is labelled with the ATEX registration number (see Appendix D).
- The intrinsically safe DMA 35N can be used according to ATEX marking ⟨Ex⟩ II 2 G EEx ib IIC T5. All instructions given in the certificate of conformity have to be followed (see Appendix D).
- By labelling the intrinsically safe DMA 35N with the type plate according to ATEX, Anton Paar GmbH confirms that the instrument conforms with all documents submitted for receiving the certificate of conformity. Therefore, do not subject the intrinsically safe DMA 35N to alterations of any kind.
- Repaired instruments may be operated only if the repair was carried out by Anton Paar GmbH. The type plate according to ATEX still confirms that the intrinsically safe DMA 35N conforms with all documents submitted for receiving the certificate of conformity.

2.1.2 Battery Exchange

- Use only batteries of the same type and in the same level of charge.
- When exchanging the batteries, always check that the small parting plate is inside the battery compartment chamber and properly fixed.
- After the battery exchange (outside the hazardous area), close the battery cover and fix it with the Phillips screw.
- Check the function of the instrument: Turn the instrument on and check the display.

2.1.3 Infrared/RS 232 Interface Port

- **Never** use the infrared/RS 232 interface port in hazardous areas.

3 Symbols in the Manual

The following symbols are used in this instruction manual:



Warning:
This symbol calls attention to **the risk of accidental injuries or damage to goods**. Do not proceed until the indicated conditions for averting this threat are fully understood and met.

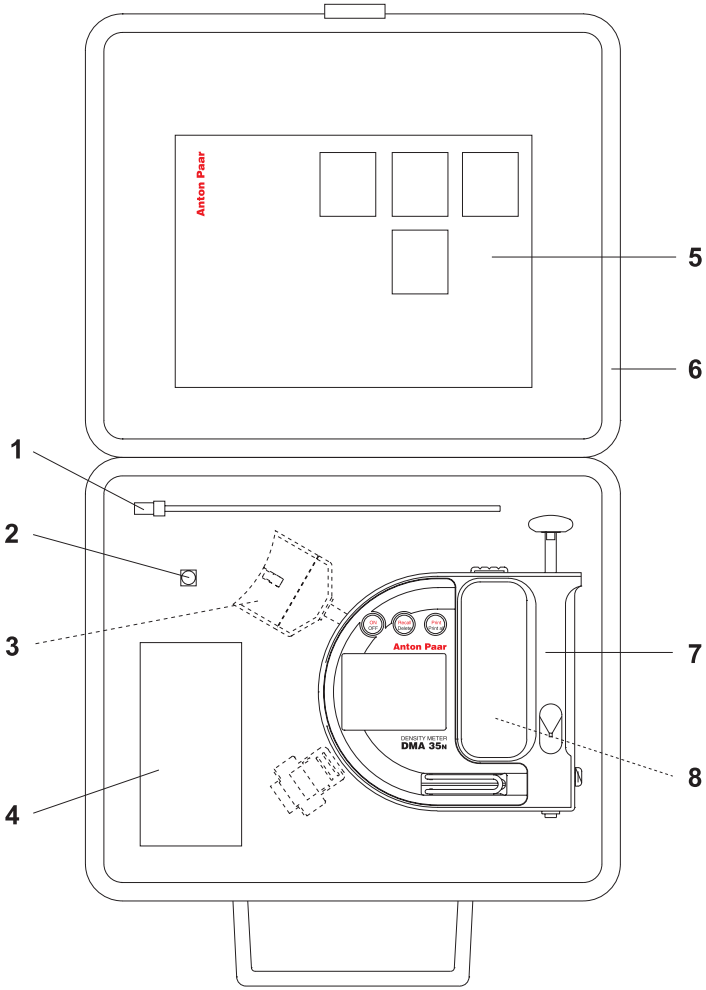


Caution:
This symbol calls attention to **the risk of instrument damage or measurement errors**. Do not proceed until the indicated conditions for averting this threat are fully understood and met.



Information:
This symbol calls attention to any **additional information** of use to the operator.

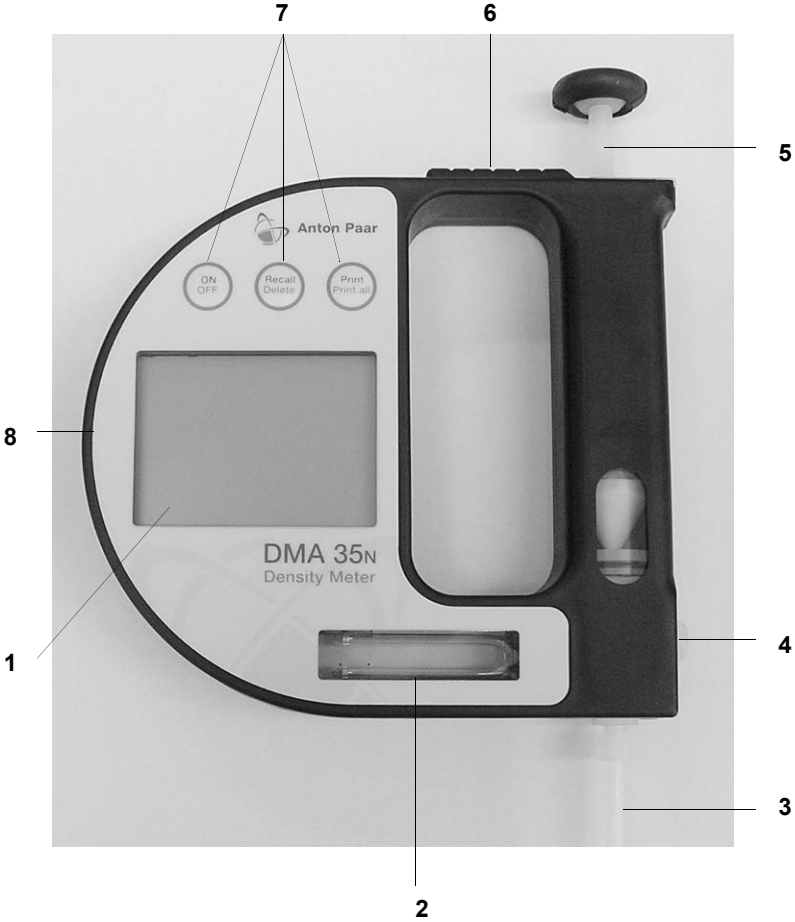
4 Supplied Items



1 Filling tube (standard) or long filling tube (option)
2 Adapter Luer 1/4" UNF (syringe filling)
3 Infrared/RS 232 interface port (option)
4 Plastic syringes
5 Instruction manual
6 Instrument box
7 DMA 35N
8 Adapter printer 25/9-pin (option)

5 Functional Description

5.1 Front View



1 Display
2 Measuring cell
3 Filling tube
4 Screw plug
5 Built-in pump
6 Pump lock
7 Operating keys
8 Infrared interface connection

5.2 Rear View

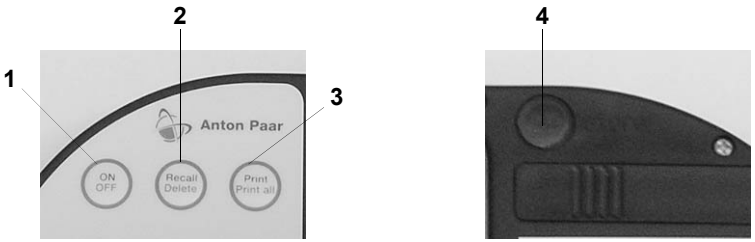


1 Data storage key
2 Battery cover
3 Screw for battery cover
4 Warning plate
5 Type plate
6 DKD calibration number (option)
7 Registration number and ATEX marking (only for DMA 35N Ex versions)

5.3 Keys

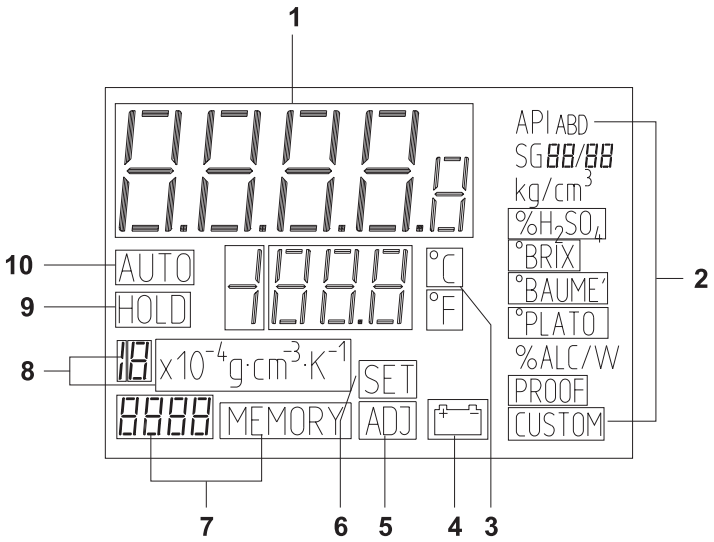
- All keys have multiple functionality.
- A short push of a key activates its primary function.
- A long push of a key activates its secondary function.
- Further functions can be activated by pushing 2 keys simultaneously.

Front **Rear**



1 "ON/OFF" key to switch the instrument on and off.
2 "Recall/Delete" key to recall or delete results stored in the memory.
3 "Print/Print all" key to transfer data to a printer or PC.
4 "store" key to store results in the memory.

5.4 The Display

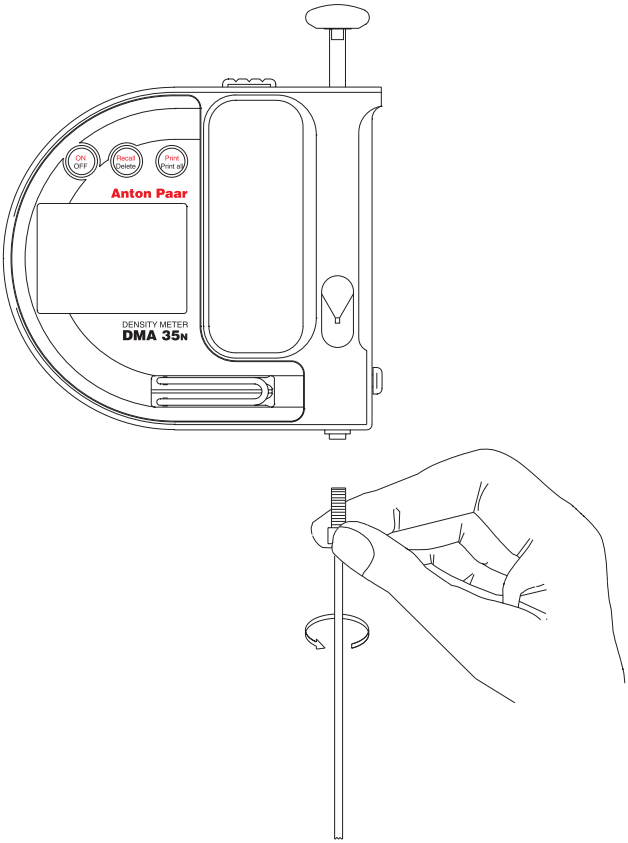


1 Measuring value
2 Units and custom functions
3 Temperature display °C/°F
4 Low battery indicator
5 Readjustment mode
6 Set mode
7 Consecutive number of values in memory
8 Temperature coefficient
9 Display frozen during storage procedure
10 Automatic data storage

6 Operating the DMA 35N

6.1 Connecting the Filling Tube

- Screw in the filling tube clockwise by hand until some resistance against turning can be felt.
- Do not use any tools to prevent damage of the thread.



6.2 Turning On the Instrument

- Push the "ON/OFF" key for at least 2 seconds.
- The instrument performs a short self-test procedure, all required segments of the display will light up.
- Subsequently, the °C (or °F) will start flashing, indicating that the instrument is in the measuring mode.

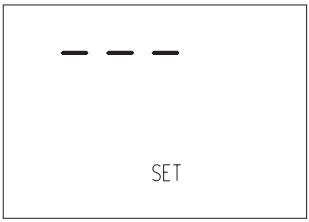
6.3 Turning Off the Instrument

- Push the "ON/OFF" key until "OFF" appears on the display, then release the key.
- The DMA 35N is automatically switched off if no key is pushed for 15 minutes.

7 Units and Custom Functions

7.1 Activating a Unit or Custom Function

- Pushing the "ON/OFF" and "store" keys simultaneously activates the "SET" mode. Display:



Information:
All stored results are deleted from the memory if the "SET" mode is activated.

- A long push of the "store" key activates the selection of the temperature unit (°C/ °F).
  - Toggle between °F and °C with a short push of the "store" key.
  - Store your selection and move further to activate density or a density-related custom function by a long push of the "store" key.
- Move through the list of choices by pushing the "store" key shortly.
- To activate the displayed function give the "store" key a long push.
- The instrument is automatically switched off, and after turning it on again the selected density or density-related function will be displayed.

7.2 Description of Units and Custom Functions

API A B D
Display of the API number for product group A, B or D, referred to reference temperature 15 °C or 60 °F.
Product group A: Crude oil
Product group B: Fuel
Product group D: Lubricants

API A B D
SG 15/15 ou 60/60
Display of the Specific Gravity for product group A, B or D, referred to reference temperature 15 °C or 60 °F.
Product group A: Crude oil
Product group B: Fuel
Product group D: Lubricants

API A B D
g/cm^3
Display of the Density in g/cm^3 for product group A, B or D, referred to reference temperature 15 °C or 60 °F.
Product group A: Crude oil
Product group B: Fuel
Product group D: Lubricants

API A B D
kg/m^3
Display of the Density in kg/m^3 for product group A, B or D, referred to reference temperature 15 °C or 60 °F.
Product group A: Crude oil
Product group B: Fuel
Product group D: Lubricants

SG (Specific gravity)
- Specific gravity or relative density is the density of the sample (at selected reference temperature) divided by density of water (at selected reference temperature).

- The influence of sample temperature is compensated using the temperature coefficient ($g \cdot cm^{-3} \cdot K^{-1}$).
  Examples for temperature coefficients of common samples at 20 °C:
  - Most aqueous solutions 0 to 20 %: $3x10^{-4}$
  - Most aqueous solutions 10 to 50 %: $5x10^{-4}$
  - Many organic liquids: $10x10^{-4}$
  - The temperature coefficient can be calculated according to the formula:

$$\text{Temperature coefficient} = \left| \frac{\rho_1 - \rho_2}{t_1 - t_2} \right|$$

ρ_1 ... density at temperature t_1
ρ_2 ... density at temperature t_2

- The reference temperatures (for example 20/04) and the temperature coefficient ($g \cdot cm^{-3} \cdot K^{-1}$) have to be entered.
  - The reference temperatures are entered in the unit selected (°C or °F), the temperature coefficient always has to be entered in the unit $g \cdot cm^{-3} \cdot K^{-1}$.
  - If $SG\,^{t1}/_{t2}$ is displayed in the "SET" mode, give the "store" key a long push. Now each of the four digits of the temperatures can be subsequently set using short pushes of the "store" key. Store each setting with a long push, this brings you to the next digit.
  - After setting the 2 reference temperatures, the temperature coefficient can be set (from 0 to $19x10^{-4}$). A short push of the "store" key increases the digit, a long push stores the selected number. Then the instrument switches off automatically.

g/cm^3 or kg/m^3
Measurement of true density in g/cm^3 or kg/m^3 at displayed measuring temperature.

%H_2SO_4
Display of concentration of sulfuric acid (battery acid) in % by weight at 20 °C derived from density at measuring temperature. The measuring range is 0 to 70 %w/w.

°BRIX
Display of Brix degrees (sucrose concentration in % by weight) at 20 °C derived from density at measuring temperature. The measuring range is 0 to 100 °Brix.

°BAUMÉ

- Display of Baumé degrees at 60 °F. The measuring range is 0 to 100 °Baumé.
- After storing the setting with a long push of the "store" key, the temperature coefficient can be set.
- Set the correct temperature coefficient (from 0 to $19x10^{-4}$) according to the following procedure:
  - A short push of the "store" key increases the digit.
  - A long push stores the selected number.
  - Then the instrument switches off automatically.

°PLATO

Display of Plato degrees at 20 °C derived from density at measuring temperature. The measuring range is 0 to 100 °Plato.

%ALC/V, %ALC/W

- Display of alcohol concentration of ethanol/water mixtures in % by volume or by weight at 20 °C derived from density at measuring temperature. The measuring range is 0 to 100 %v/v (%w/w).
- Switch from % by volume (V) to % by weight (W) using a short push of the "store" key.

PROOF

Display of Proof degrees at 60 °F derived from density at measuring temperature. The measuring range is 0 to 200 °Proof.

CUSTOM

A custom-tailored polynomial function can be stored. Please contact your local Anton Paar distributor.

PEr

Displays the period value of the measuring cell.

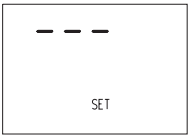
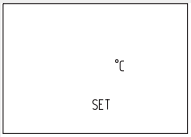
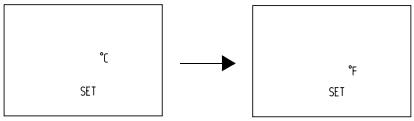
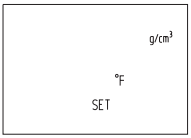
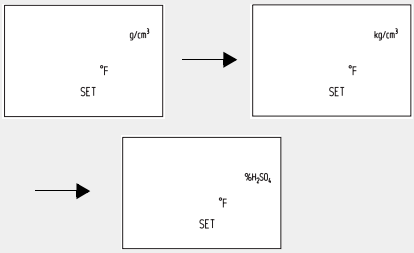
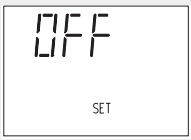
rES

Displays a value for the factory adjustment.

7.3 Examples for Setting the Custom Function

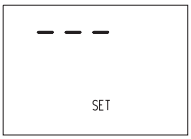
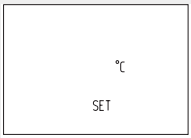
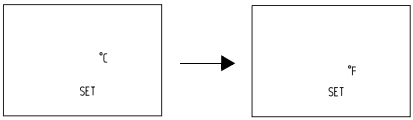
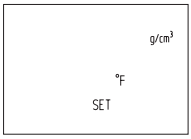
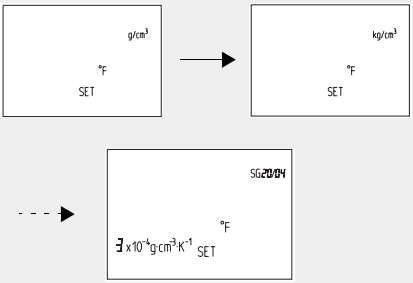
7.3.1 Example 1: Changing from Density (°C) to %H_2SO_4 (°F)

Switch off the DMA 35N.

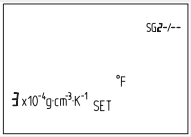
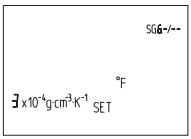
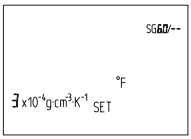
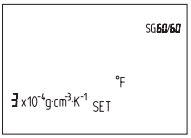
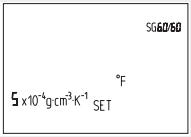
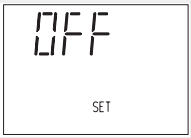
Action	Carry out	Result
Start the set mode	Press both store + ON/OFF for 3 seconds	
Enter the menu	Confirm by: Long press on store	
Select the temperature unit	Select by: Short press on store	
	and confirm by: Long press on store	
Select the custom function	Select by: Short press on store	
	and confirm by: Long press on store	

7.3.2 Example 2: Changing from Density (°C) to $SG^{60}/_{60}$ (°F, Temperature Coefficient $5 \cdot 10^{-4} \cdot g \cdot cm^{-3} \cdot K^{-1}$)

Switch off the DMA 35N.

Action	Carry out	Result
Start the set mode	Press both store + ON OFF for 3 seconds	
Enter the menu	Confirm by: Long press on store	
Select the temperature unit	Select by: Short press on store	
	and confirm by: Long press on store	
Select the custom function	Select by: Short presses on store (several times)*	

* Do not mix up the SG function with the API SG functions. The API functions are specially adapted to petroleum products and use specific temperature coefficients.

Action	Carry out	Result
Select the custom function	and confirm SG by: Long press on store	
	Set the first digit by: Short presses on store	
	and confirm by: Long press on store	
	Set and confirm the other digits in the same way	
	Set the temperature coefficient** by: Short presses on store	
	and confirm by: Long press on store	

** The temperature coefficient has to be entered in $g \cdot cm^{-3} \cdot K^{-1}$

7.3.3 Example 3: Calculation of the Temperature Coefficient

- Set the DMA 35N to g/cm³ (°C).
- Fill the sample at temperature 1.



Information:
Choose a temperature lower than the typical measuring temperature (e.g. 28 °C). Cool down the sample and fill it.

- Immediately after filling, read the density and temperature from the display and note down the values as ρ_1 and t_1, e.g. 0.9968 at 22.9 °C.
- Fill the sample at temperature 2.



Information:
Choose a temperature higher than the typical measuring temperature. Warm up the sample and fill it.

- Immediately after filling, read the density and temperature from the display and note down the values as ρ_2 and t_2, e.g. 0.9932 at 34.8 °C.
- Calculate the coefficient using the following formula:

$$\text{Temperature coefficient} = \left|\frac{\rho_1 - \rho_2}{t_1 - t_2}\right| = \left|\frac{0.9968 - 0.9932}{22.9 - 34.8}\right| = 3.02 \times 10^{-4}$$

- To set the temperature coefficient in the DMA 35N, use the result of the calculation, e.g. $3 \cdot 10^{-4}$ g·cm^{-3}·K^{-1}.

8 Measurement



Caution:

- Before any measurements are performed, check the resistance of all materials in contact with the sample
- Materials in contact with the sample are:
  - PTFE (pump piston, filling tube)
  - Borosilicate glass (measuring cell, pump cylinder)
- Before performing any measurements, prepare suitable cleaning agents or solvents.

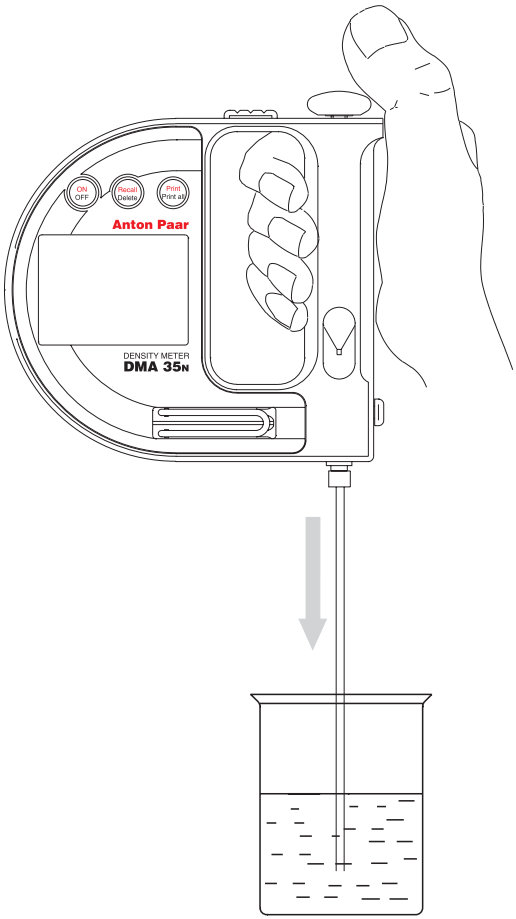


Information:

- The sample has to be filled into the measuring cell free of any bubbles. Bubbles seriously interfere with the measurement.
  Possible sources of bubbles are:
  - Leakage at the connection of the filling tube or the screw plug.
  - Gas bubbles contained in the sample.
- The measuring cell has to be completely filled.
- The sample temperature should not be lower than the ambient temperature.
- Carefully clean the measuring cell after each series of measurements to avoid deposit of coatings.
- The displayed temperature value is flashing as long as the temperature of the filled sample exceeds the temperature specification of the DMA 35N (0 to 40 °C). Measuring results will be displayed, but it is recommended to wait until the temperature display stops flashing.
- The flashing temperature unit (°C or °F) indicates the proper functioning of the instrument.

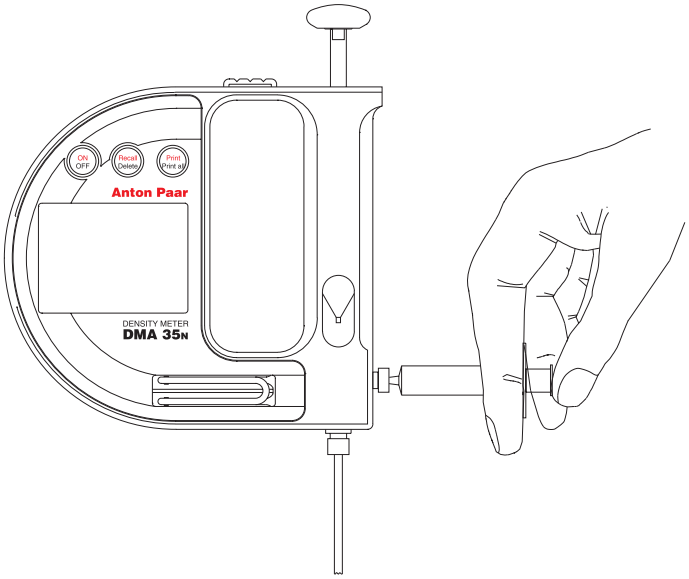
8.1 Filling with the Built-in Pump

1. Push down the lever of the pump.
2. Submerge the filling tube in the sample.
3. Slowly release the pump lever.



8.2 Filling with the Plastic Syringe

1. Remove the screw plug using a coin.
2. Screw in the adapter Luer 1/4" UNF (see Chapter 4).
3. Fill the sample into the measuring cell using the syringe.



Information:
Do not remove the pump when filling with a syringe, the pump is necessary to seal the filling system.

8.3 Storage of Measuring Results



Information:
- No storage is possible if the "low battery" sign appears on the display.
- Activating the "SET" mode deletes all stored results.

8.3.1 Manual Storage

- A long push of the "store" key immediately stores the current measuring result in the memory together with a sample number.
- "HOLD" is displayed.
- The sample number starts at 1 and is automatically increased by one with each new stored measuring value.
- 1024 results can be stored.

8.3.2 Automatic Storage

- A short push of the "store" key activates the automatic storage procedure.
- "AUTO" is displayed.
- The instrument automatically checks the temperature stability of the sample. If temperature is stable within 0.2 degrees for 10 subsequent measurements, then the value is automatically stored together with a sample number.
- A minimum of 15 seconds is required per automatic storage procedure.

8.4 Recalling Stored Results

- A short push of the "Recall/Delete" key shows the latest stored value on the display for 10 seconds.
- If the "Recall/Delete" key is pushed again shortly within this time, subsequently all stored results can be displayed from the latest to the oldest value.
- If the key is not pushed within 10 seconds the display is switched back to the current measuring value.

8.5 Printing Stored Results

- A short push of the "Print/Print all" key initiates the data transfer of the current measuring value to printer or PC.
- A long push of the "Print/Print all" key initiates the data transfer of all stored measuring values to printer or PC. The printed value is shown on the display.
- Stop the printout by switching the instrument off.
- **Example for a printout:**

#	T [C]	g/cm3
1	23.6	0.9973
2	23.9	0.9972
3	25.5	0.9961
4	.....	.....

8.6 Deleting Stored Results

- To delete the latest stored value, push and hold the "Delete" key. "Memory" will flash 4 times before the value is deleted.
- To delete all results push and hold the "Delete" and "Print/Print all" keys simultaneously until the countdown on the display starting from 9 has reached 0, and a peep sounds. Releasing the keys before 0 is reached does not delete the values.

9 Maintenance

9.1 Cleaning the Measuring Cell

Make sure to clean the measuring cell before storing the instrument. Depending on the application, also cleaning after each measurement may be required.



Caution:
Only use solvents or cleaning agents that do not attack any of the wetted parts of the DMA 35N.

- Fill the cleaning agent using the built-in pump or a plastic syringe.
- Repeatedly flush cleaning agent through the complete measuring system.

9.2 Cleaning the Built-in Pump

Clean the built-in pump in regular intervals depending on the application. If you measure aggressive samples, e.g. battery acid, clean the built-in pump more frequently.

- To clean the built-in pump, open the pump lock and remove the pump.
- Rinse the pump with tap water moving the piston up and down.
- Dry the pump using a lint-free cloth.
- Re-attach the pump and close the pump lock.

9.3 Battery Exchange

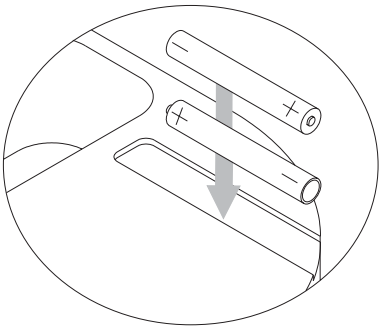
- When the "low battery" signal is displayed, no more data can be stored.



- The batteries must be exchanged.

Warning:
- Do not open the battery cover in hazardous areas.
- Only exchange the batteries outside the hazardous area.

Warning:
- When inserting new batteries check that the polarity is correct.
- Use only batteries of the same type and same level of charge.



Please note, when using the DMA 35N Ex or DMA 35N Ex Petrol:

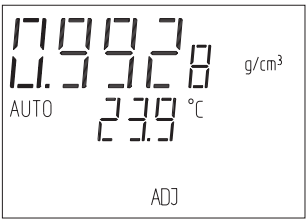
Warning:
- When exchanging the batteries, always check that the small parting plate is in the battery chamber and is properly fixed.
- After the battery exchange, close the battery cover and fix it with the Phillips screw.
- Check the function of the instrument: Turn the instrument on and check the display.

10 Readjustment

- Proper cleaning of the measuring cell is required before and after each series of measurements.
- Poor cleaning can result in the formation of deposits in the measuring cell. This can cause offsets of the density readings, and can be recognized by measuring distilled water.
- If the density value deviates more than ±0.001 g/cm³ from the theoretical value (see Appendix B), then a readjustment may be necessary.
- A readjustment is only possible if the density difference between measured and theoretical value is below 0.100 g/cm³, and the water temperature is between 15 and 25 °C.

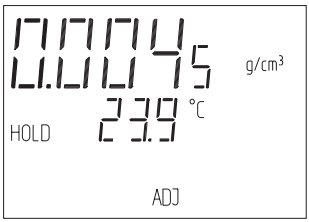
How to readjust:

1. Clean the measuring cell with a suitable cleaning agent until no more residues or deposits are visible.
2. Remove the cleaning agent completely from the measuring cell.
3. Fill distilled water of approx. 20 °C into the measuring cell, carefully avoiding the introduction of bubbles. The ambient temperature should be between 15 °C and 25 °C.
4. Turn the instrument off. Turn the instrument on again, pushing both the "ON/OFF" key and the "Recall/Delete" key at the same time.
5. The measured density and "ADJ" are displayed.



The water temperature has to be between 15 and 25 °C, the density must be between 0.900 and 1.100 g/cm³.

6. The instrument checks automatically the stability of the reading during 10 subsequent measuring sequences. Upon stability, the density deviation between the measured and theoretical water density are displayed:



7. • Store the readjustment with a long push of the "store" key.
   • If storing the readjustment is not desirable, then turn off the instrument.

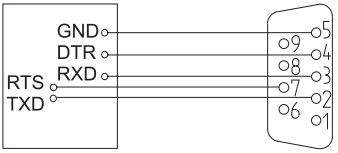
11 Data Transfer to Printer/PC

- For data transfer from the DMA 35N to a printer or PC the infrared/RS 232 interface port (option) is required.

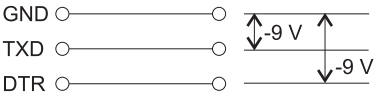
- **Interface plug:**

  Pin 2: TXD
  Pin 3: RXD
  Pin 4: DTR
  Pin 5: GND
  Pin 7: RTS

- **Interface plug** **Printer/PC**



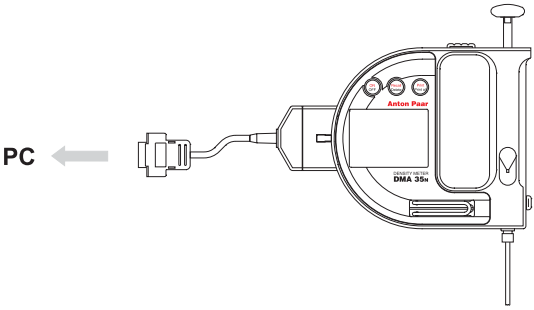
- **Printer requirements for the data transfer:**
  - Serial interface
  - Lines TXD and DTR must have a minimum voltage of -9 V.



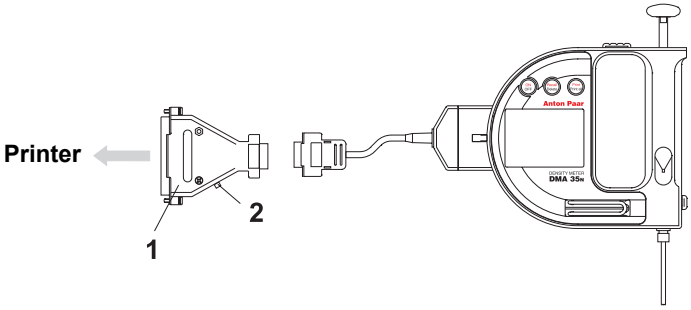
- **Connection of the printer/PC:**

Warning:
Never use the interface port in hazardous areas.

Connect the DMA 35N to the printer/PC using the infrared/RS 232 interface port.
- Slide the black connector from the rear of the DMA 35N into the 2 grooves on the side of the instrument until the catch spring locks.
- The lever of the spring has to be on the rear.



If the printer does not provide this voltage, then connect a standard 9 to 12 V_{DC} power supply to the supply inlet (2) of the printer adapter plug (1).



- **Specifications of the interface:**

  7 data bits
  1 parity bit, even parity
  1 stop bit
  9600 baud rate

- **How to transfer data to a PC:**

1. Select the correct data transfer setting on the PC.
   - A short push of the "Print/Print all" key initiates the data transfer of the **current** measuring value.
   - A long push of the "Print/Print all" key initiates the data transfer of all data from the memory of the DMA 35N to the PC.
2. Disconnect the connector by pushing the catch spring on the rear and simultaneously sliding back the connector.
3. Received and processed by standard terminal software (like Windows® Terminal, Procomm, Hyper Terminal, etc.).

12 Error Messages

Error message	Cause
OSC	No oscillation.
-,----	Measuring range exceeded.

13 Wetted Parts

The following materials are in contact with the samples to be measured and with the cleaning agents:

Material	Part
Borosilicate glass	Measuring cell, glass cylinder
PTFE (Polytetrafluoroethylene)	Filling tube, pump piston
PVDF (Polyvinyliden fluoride)	Connection block, screw
Viton	O-ring of DMA 35N
Kalrez	O-ring of DMA 35N Ex and DMA 35N Ex Petrol
PP (Polypropylene)	Housing of DMA 35N and DMA 35N Ex
Faradex	Housing of DMA 35N Ex Petrol

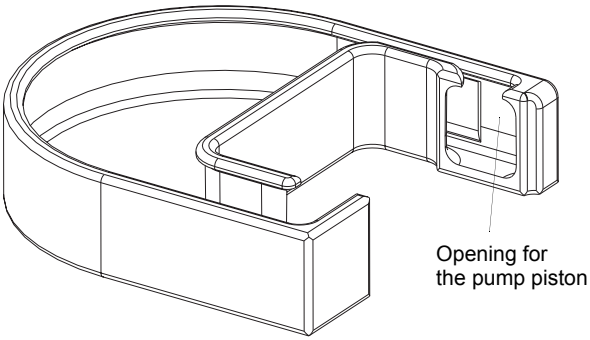
14 Technical Data

Measuring range:	
Density:	0 to 1.999 g/cm^3
Temperature:	0 to 40 °C, 32 to 104 °F
Viscosity:	0 to approx. 1000 mPa.s
Uncertainty of measurement:	
Density:	±0.001 g/cm^3
Temperature:	±0.2 °C
Repeatability:	
Density:	±0.0005 g/cm^3
Temperature:	±0.1 °C
Resolution:	
Density:	0.0001 g/cm^3
Temperature:	0.1 °C o 0.1 °F
Sample volume:	approx. 2 ml
Sample temperature:	0 to 100 °C
Ambient temperature:	0 to +40 °C
Air humidity:	5 to 90 % relative humidity, non-condensing
Protection class:	IP 54 (Use in light rainfall/snowfall possible)
Memory:	1024 values
Interface:	Infrared/RS 232
Power supply:	2x1.5 V Alkaline batteries Micro LR03 (Use only batteries of the same type and same level of charge)
Dimensions:	140x130x25 mm
Weight:	275 g (9.7 oz)

Appendix A: Optional Rubber Housing

The DMA 35N measuring cell is made of glass and will break if the instrument is accidentally dropped. For optimal protection against breaking the measuring cell, we recommend using an optional rubber housing.

Information:
The rubber housing does not improve the leak tightness of the instrument.



Mounting the rubber housing

- Remove the rubber cap from the top of the pump piston.
- Slip the pump piston through the opening in the rubber housing and fit the DMA 35N into the housing.
- Re-attach the rubber cap onto the pump piston.

Maintenance and cleaning

Caution:
Check periodically and make sure that no residues from liquids remain between the rubber housing and the instrument.

- To clean the rubber housing, take it off the DMA 35N. Clean and dry both the rubber housing and the DMA 35N housing using a cloth.

Appendix B: Density of Water (0 °C to 40 °C)

t°C	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	.99984	.99985	.99985	.99986	.99987	.99987	.99988	.99988	.99989	.99989
1	.99990	.99990	.99991	.99991	.99992	.99992	.99993	.99993	.99993	.99994
2	.99994	.99994	.99995	.99995	.99995	.99995	.99996	.99996	.99996	.99996
3	.99996	.99997	.99997	.99997	.99997	.99997	.99997	.99997	.99997	.99997
4	.99997	.99997	.99997	.99997	.99997	.99997	.99997	.99997	.99997	.99997
5	.99996	.99996	.99996	.99996	.99996	.99995	.99995	.99995	.99995	.99994
6	.99994	.99994	.99993	.99993	.99993	.99992	.99992	.99991	.99991	.99991
7	.99990	.99990	.99989	.99989	.99988	.99988	.99987	.99987	.99986	.99985
8	.99985	.99984	.99984	.99983	.99982	.99982	.99981	.99980	.99980	.99979
9	.99978	.99977	.99977	.99976	.99975	.99974	.99973	.99973	.99972	.99971
10	.99970	.99969	.99968	.99967	.99966	.99965	.99964	.99963	.99962	.99961
11	.99960	.99959	.99958	.99957	.99956	.99955	.99954	.99953	.99952	.99951
12	.99950	.99949	.99947	.99946	.99945	.99944	.99943	.99941	.99940	.99939
13	.99938	.99936	.99935	.99934	.99933	.99931	.99930	.99929	.99927	.99926
14	.99924	.99923	.99922	.99920	.99919	.99917	.99916	.99914	.99913	.99911
15	.99910	.99908	.99907	.99905	.99904	.99902	.99901	.99899	.99897	.99896
16	.99894	.99893	.99891	.99889	.99888	.99886	.99884	.99883	.99881	.99879
17	.99877	.99876	.99874	.99872	.99870	.99869	.99867	.99865	.99863	.99861
18	.99859	.99858	.99856	.99854	.99852	.99850	.99848	.99846	.99844	.99842
19	.99840	.99838	.99836	.99835	.99833	.99831	.99828	.99826	.99824	.99822
20	.99820	.99818	.99816	.99814	.99812	.99810	.99808	.99806	.99803	.99801
21	.99799	.99797	.99795	.99793	.99790	.99788	.99786	.99784	.99781	.99779
22	.99777	.99775	.99772	.99770	.99768	.99765	.99763	.99761	.99758	.99756
23	.99754	.99751	.99749	.99747	.99744	.99742	.99739	.99737	.99734	.99732
24	.99730	.99727	.99725	.99722	.99720	.99717	.99715	.99712	.99709	.99707
25	.99704	.99702	.99699	.99697	.99694	.99691	.99689	.99686	.99683	.99681
26	.99678	.99676	.99673	.99670	.99667	.99665	.99662	.99659	.99657	.99654
27	.99651	.99648	.99646	.99643	.99640	.99637	.99634	.99632	.99629	.99626
28	.99623	.99620	.99617	.99615	.99612	.99609	.99606	.99603	.99600	.99597
29	.99594	.99591	.99588	.99585	.99582	.99579	.99577	.99574	.99571	.99568
30	.99564	.99561	.99558	.99555	.99552	.99549	.99546	.99543	.99540	.99537
31	.99534	.99531	.99528	.99524	.99521	.99518	.99515	.99512	.99509	.99506
32	.99502	.99499	.99496	.99493	.99490	.99486	.99483	.99480	.99477	.99473
33	.99470	.99467	.99463	.99460	.99457	.99454	.99450	.99447	.99444	.99440
34	.99437	.99433	.99430	.99427	.99423	.99420	.99417	.99413	.99410	.99406
35	.99403	.99399	.99396	.99393	.99389	.99386	.99382	.99379	.99375	.99372
36	.99368	.99365	.99361	.99358	.99354	.99350	.99347	.99343	.99340	.99336
37	.99333	.99329	.99325	.99322	.99318	.99314	.99311	.99307	.99304	.99300
38	.99296	.99292	.99289	.99285	.99281	.99278	.99274	.99270	.99267	.99263
39	.99259	.99255	.99252	.99248	.99244	.99240	.99236	.99233	.99229	.99225
40	.99221	.99217	.99214	.99210	.99206	.99202	.99198	.99194	.99190	.99186

Appendix C: CE-Declaration of Conformity

Anton Paar

CE Declaration of Conformity

Density and concentration measurement

Dear customer,

Anton Paar GmbH hereby declares that the product listed below in the version offered for sale meets all the basic requirements of the applicable sections of the relevant EU directives in design and type.

This declaration will be deemed invalid should any unauthorized modifications be made to the product. Follow the information given in the instruction manual when setting up and operating the instrument.

Product designation:	**Density Meter**
Model:	**DMA 35N**
Manufacturer:	**Anton Paar GmbH**

The product meets the requirements of the following directives:

- **Equipment in potentially explosive atmospheres ATEX (94/9/EC)**

  Applied standards:

EN 50014:1997+A1+A2:1999	Electrical apparatus for potentially explosive atmospheres General requirements
prEN 50020:2001	Electrical apparatus for potentially explosive atmospheres Intrinsic safety "i"

  Notified body: TÜV Austria / 1230 Wien, Deutschstraße 10 / Identification number 0408

  EC-type-examination certificate: TÜV-A 03 ATEX 0014 X

- **Electromagnetic Compatibility (89/336/EEC)**

  Applied standards:

EN 50081-1:1992	Electromagnetic compatibility (EMC), Generic Emission Standard Part 1: Laboratory environment
EN 50082-1:1992 und prEN50082-1:1996	Electromagnetic compatibility (EMC), Generic Immunity Standard Part 1: Laboratory environment

Dr. Friedrich Santner
General Manager

i.A. Dipl.-Ing. Gerhard Murer
Department Manager

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E-mail: info@anton-paar.com
Web: www.anton-paar.com

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- Rheometry and viscometry
- High-precision temperature measurement
- X-ray structure analysis
- Microhardness testing
- Sample preparation
- CO_2 measurement
- Colloid science

B46 DMA 35N CE Declaration A.doc

2003-09-19

::: Great People | Great Instruments

Appendix D: EC Type Examination Certificate

TÜV Österreich, vom österreichischen Bundesministerium für wirtschaftliche Angelegenheiten akkreditierte Prüf-, Überwachungs- und Zertifizierungsstelle
TÜV Austria testing, inspection and certification body accredited by the Austrian Ministry for Economic Affairs

TÜV ÖSTERREICH

Zertifikat - Certificate

(1) **EC-TYPE-EXAMINATION CERTIFICATE**

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) No.: TÜV-A 03ATEX0014 X

(4) Equipment: Handheld measuring device for density DMA 35N

(5) Manufacturer: Anton PAAR GmbH

(6) Address: Anton-Paar-Straße 20, A-8054 Graz

(7) This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the document therein referred to.

(8) TÜV Austria, notified body No. 0408 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive. The examination and test results are recorded in the confidential report No. 2002-ET/PZW-EX-1007.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with

EN50014:1997 + A1:1999 +A2:1999 EN50020:2002

(10) If the sign „X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type examination Certificate relates only to the design and construction of the specified equipment or protective system in accordance with Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and supply of this equipment or protective system. These are not covered by this certificate.

(12) The marking of the equipment shall include the following:

Ex II 2 G EEx ib IIC T5

T_{amb} = 0 ... +40°C

19.9.2003
Datum der Ausstellung
Date of issue

Dipl.-Ing. D. Engel
Zertifizierungsbeauftragter
Certification representative

Ende der Gültigkeit
End of validity

„Auszugsweise Vervielfältigung nur mit Genehmigung des TÜV Österreich gestattet"
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e-mail: et@tuev.or.at
http://www.tuev.or.at

TÜV Österreich, vom österreichischen Bundesministerium für wirtschaftliche Angelegenheiten akkreditierte Prüf-, Überwachungs- und Zertifizierungsstelle
TÜV Austria testing, inspection and certification body accredited by the Austrian Ministry for Economic Affairs

(13) # SCHEDULE

(14) EC-TYPE-EXAMINATION CERTIFICATE TÜV-A 03ATEX0014 X

(15) Description of equipment

The handheld measuring device for density DMA 35N consists of a plastic material housing with display and entry keys. For measuring, small volumes of liquid can be brought into the glass oscillator with an integrated pipette pump.
The battery slot is at the back side of the housing, the cover is protected with a screw.

Electrical data:

Supply with two batteries alkaline, size AAA, 1,5V

Ambient temperature: 0 ... +40°C

(16) Test report

TÜV-A 2002-ET/PZW-EX-1007

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(17) Special conditions for safe use

1. Following wording has to be affixed visible and durable on the measuring device:

   „Do not change battery in hazardous area".

2. Only batteries type alkaline (alkali-manganese), size AAA, 1,5V may be used.

3. The infrared interface for transmission of stored data may be used outside hazardous area only.

(18) Essential health and safety requirements

Met by the standards mentioned above.

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