

OPERATING INSTRUCTIONS

FOR CCM UNITS



DETERMINATION OF MOISTURE OF FOUNDATION MATERIALS AND BUILDING MATERIALS

ACCORDING TO THE **CALCIUM CARBIDE METHOD**



CLASSIC



**STANDARD
PRO**



BASIC CASE



BUSINESS



**COMPLETE SET
BUSINESS**



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PREFACE

The CCM units CLASSIC, STANDARD PRO and BUSINESS (with optional print log) are ideal moisture measuring instruments for determining the residual moisture of foundation materials in accordance with existing DIN regulations and/or ZTV SIB 90. They are also suitable for rapid determination of the moisture of other materials that do not react with calcium carbide.

As in all measuring methods based on a chemical reaction, special care is required in conducting moisture determination according to the Calcium Carbide Method. Please study these operating instructions prior to initial operation and follow in particular the safety instructions.

Persons who are not familiar with the operating instructions should not use the measuring instruments.

WARRANTY

The manufacturer provides you with a 1-year warranty from the date of purchase on defective parts as well as products with production flaws, apart from expendable material.

Important!

Please keep the operating instructions in a safe place. You can ascertain if any spare parts are required on the basis of the parts list.

The original log printout of the printer (*only Complete Set BUSINESS*) is your warranty certificate in the case of complaints and must be kept in a safe place.

USE OF THESE OPERATING INSTRUCTIONS

The information furnished in these operating instructions extensively supplements the short

manual. The operating instructions contain general instructions on the measuring method as well as information on the components used, the measurement and the technical data.

Text in italics contains more extensive information.

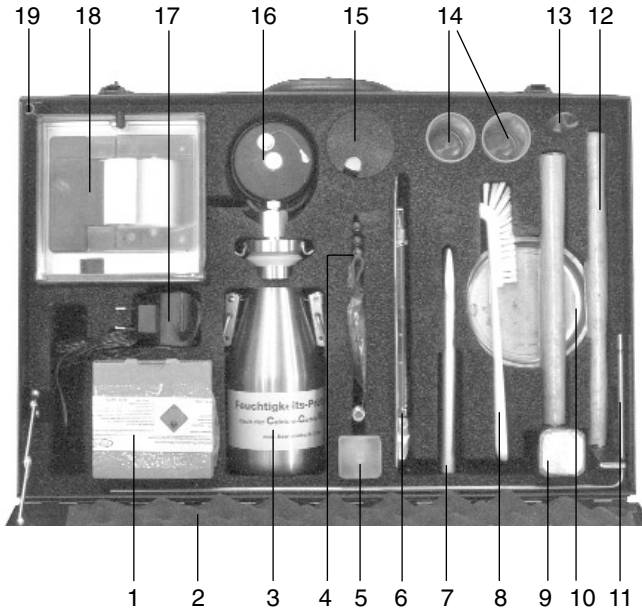
Particular consideration must be given to bold text.

Proper use and application on the basis of the operating instructions is binding for product liability and product warranty. Repair attempts by the user shall invalidate warranty claims.

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1. Edition 6/99

OVERVIEW OF THE COMPONENTS



- | | |
|---|---|
| 1) Set of 20 carbide ampoules (V) | 12) Fitter's hammer 300 g |
| 2) Operating instructions and cleaning device (V) under foam rubber cover | 13) Spoon for handling samples |
| 3) CCM pressure bottle | 14) 2 weighing cups |
| 4) 3 test ampoules (V), 3 replacement seals (V) each for manometer and CCM pressure bottle, control weight 20 g for weighing device, replacement battery (STANDARD PRO) | 15) Spare roll of heat-sensitive paper (only Complete Set BUSINESS) (V) |
| 5) 4 steel balls in slip-on lid box | 16) Digital manometer (STANDARD PRO or BUSINESS) or mechanical manometer (CLASSIC) |
| 6) High-precision weighing device with reading aid | 17) 220 V charger (only Complete Set BUSINESS) |
| 7) Flat chisel | 18) Battery-driven log printer with heat-sensitive paper (only Complete Set BUSINESS) |
| 8) Bottle brush | 19) Cut-out for weighing device rod |
| 9) Sledge hammer 1000 g | |
| 10) Crushing bowl | |
| 11) Weighing device rod | (V): Refers to expendable material |

REFERENCES TO HAZARDS

Before you conduct measurements with the CCM unit, please read the manual carefully. If you follow the instructions precisely, there is no risk of accidents. Therefore, please comply with the following instructions for use:

Always use the CCM unit in accordance with the operating instructions.

The pressure in the CCM pressure bottle is produced by the formation of small quantities of acetylene. After a measurement open the CCM pressure bottle so it is pointing **away from your face** and allow the **gas to escape slowly** (*you will then have fewer problems with the manometer because its mechanics are subject to less stress*).

The escaping **gas is flammable**:

- a) **Do not open** the CCM pressure bottle in **closed rooms**.
- b) **Do not smoke** and **do not work near an open flame or electrical installations**.
- c) If **fire breaks out**, **smother it with sand or a blanket**, do not extinguish with water.

Do not use any samples with more than 1.5 g of water (*excessive pressure may result, leading to an uncontrolled gas release through the manometer head or the seals*).

Conduct measurements using the CCM unit only with the materials provided for this purpose. If other materials are to be used, please send us a sample together with a description so we can advise you.

Additional instructions for the CCM units STANDARD PRO and BUSINESS and Log printer

The units with the CE mark meet the requirements of the EMC regulation adopted by the European Commission (89/336/EEC) EN-50081-1 and EN-50082-1.

The CCM unit STANDARD PRO and BUSINESS contains sensitive electronic components, which have to be handled carefully. Do not drop the manometer on the ground because it may otherwise be damaged (*if the front panel should become detached, simply attach it to the housing again and align it. If all data are visible in the display, you can assume that the manometer is not damaged*). Furthermore, protect the electrical parts against excessive moisture and extreme temperatures.

MEASURING INSTRUCTIONS FOR THE CCM-UNIT CLASSIC



- 1) First insert the precisely weighed sample quantity and the 4 steel balls into the CCM pressure bottle. Then hold the **CCM pressure bottle at an angle** and carefully let a CCM ampoule slide in.
- 2) The CCM pressure bottle is sealed with the cover and subsequently the CCM ampoule is smashed by **shaking vigorously**. It is advisable to note the time at the beginning of the measurement.
- 3) After that make **circular movements** with the CCM pressure bottle **for at least the first minute** in order to break up the sample material even more and mix it with the calcium carbide. Repeat this process every 5 minutes.
- 4) Prior to **completion of the measurement** (*which typically takes place after 15 to 20 minutes*) the CCM pressure bottle is shaken vigorously for at least 15 seconds and circular movements are carried out one more time just to be on the safe side. If the pressure has not changed significantly, the measurement can be regarded as completed. For the usual original sample weights of 20 g (red scale), 50 g (green scale) and 100 g (blue scale) the water

concentration (H₂O [%]) can be directly read off the manometer.

Unless specifically stated otherwise by the screed manufacturer, the measurement must be terminated after 10 minutes in the case of calcium sulphate screeds since a further pressure rise could occur. This rise is attributable to chemically bound water and must be ignored.

Important!

Differing measuring instructions of the manufacturer must be complied with in all cases.

The CCM pressure bottle must **not** be exposed to **direct solar radiation** during the measurement.

The temperature of the CCM pressure bottle must not exceed or drop below 20 ± 5 °C at the beginning and end of a measurement.

- 5) Draw up a hand-written log (see Page 21 --> Log form) to record the measurement result.

The following **conversion table: water concentration [CM%]** is based on an ambient temperature of 20 °C:

Manometer-scale [bar]	Original sample weight			
	10 g	20 g red	50 g green	100 g blue
	Water concentration [CM%]			
0.2	1.9	0.9	0.38	0.19
0.3	2.9	1.5	0.58	0.28
0.4	3.9	2	0.78	0.38
0.5	4.9	2.5	0.98	0.47
0.6	5.9	3	1.18	0.57
0.7	6.9	3.5	1.37	0.66
0.8	7.9	4	1.57	0.76
0.9	8.9	4.5	1.76	0.85
1	10	5	1.96	0.95
1.1	11	5.5	2.16	1.05
1.2	12	6	2.35	1.14
1.3	13	6.5	2.55	1.23
1.4	14	7	2.74	1.33
1.5	15	7.5	2.94	1.42

MEASURING INSTRUCTIONS FOR THE CCM UNIT STANDARD PRO



- 1) First insert the precisely weighed sample quantity and the 4 steel balls into the CCM pressure bottle. Then hold the **CCM pressure bottle at an angle** and carefully let a CCM ampoule slide in.
- 2) Switch on the manometer by briefly pressing the key (*the display first starts to blink and then displays the current pressure reading*). Choose the corresponding weighed portion and then reset the instrument to zero (see *Operating instructions, Page 12*). You can change the weighed portion at any time on the CCM unit STANDARD PRO.
- 3) The CCM pressure bottle is sealed with the cover and subsequently the CCM ampoule is smashed by **shaking vigorously**. At the start of measurement, it is advisable to note down the time.
- 4) After that make **circular movements** with the CCM pressure bottle **for at least the first minute** in order to break up the sample material even more and mix it with the calcium carbide. Repeat this process every 5 minutes.
- 5) Prior to **completion of the measurement** (*which typically takes place after 15 to 20 minutes*) the CCM pressure bottle is shaken vigorously for at least 15 seconds and circular movements are carried out one more time just to be on the safe side.
If the pressure has not changed significantly, the measurement can be regarded as completed (see *Tips & Tricks on Page 13 for "Online check"*).

Unless specifically stated otherwise by the screed manufacturer, the measurement must be terminated after 10 minutes in the case of calcium sulphate screeds since a further pressure rise could occur. This rise is attributable

to chemically bound water and must be ignored.

Important!

Differing measuring instructions of the manufacturer must be complied with in all cases.

The CCM pressure bottle must **not** be exposed to **direct solar radiation** during the measurement.

The temperature of the CCM pressure bottle must not exceed or drop below $20 \pm 5 \text{ }^\circ\text{C}$ at the beginning and end of a measurement.

- 6) Draw up a hand-written log (see Page 21 --> Log form) to record the measurement result (see Tips & Tricks on Page 13 for "Measured value storage").

MEASURING INSTRUCTIONS FOR THE CCM UNIT BUSINESS



- 1) First insert the precisely weighed sample quantity and the 4 steel balls into the CCM pressure bottle. Then hold the **CCM pressure bottle at an angle** and carefully let a CCM ampoule slide in.

- 2) Switch on manometer by pressing command button briefly (the display first begins to flash and then indicates the last measurement result).

Choose the corresponding weighed portion and then activate the pressure gauge with command "STRT" (see Operating instructions, Page 13).

Important!

On the CCM unit BUSINESS you **cannot change the weighed portion during a measurement** (this can be done only before or after a measurement).

- 3) The manometer is mounted on the bottle and the CCM ampoule is smashed by **vigorously**

shaking the bottle (as soon as a pressure rise of over 15 mbar is detected, the measurement begins automatically, i.e. the time is set to zero and the pressure rise in the display is indicated and/or saved).

- 4) After that make **circular movements** with the CCM pressure bottle **for at least the first minute** in order to break up the sample material even more and mix it with the calcium carbide. Repeat this process every 5 minutes.

"Online control":

After a measurement period of 5 minutes the **pressure rise during the last 3 minutes** is displayed alternately with the temperature. This makes it possible to track the reaction process. *The pressure rise declines more and more the longer the measurement period and with repeated shaking* (see Operating instructions, Page 13).

- 5) Prior to **completion of the measurement** (which typically takes place after 15 to 20 minutes) the CCM pressure bottle is shaken vigorously for at least 15 seconds and circular movements are carried out one more time just to be on the safe side. If the pressure has not changed significantly, the measurement can be regarded as completed. Finish the measurement with command "STOP" (ends automatically after 30 minutes).

Unless specifically stated otherwise by the screed manufacturer, the measurement must be terminated after 10 minutes in the case of calcium sulphate screeds since a further pressure rise could occur. This rise is attributable to chemically bound water and must be ignored.

Important!

Differing measuring instructions of the manufacturer must be complied with in all cases.

The CCM pressure bottle must **not** be exposed to **direct solar radiation** during the measurement.

The temperature of the CCM pressure bottle must not exceed or drop below 20 ± 5 °C at the beginning and end of a measurement.

- 6) Draw up a hand-written log (see Page 21 --> Log form) to record the measurement result.

Log printout with the CCM unit Complete Set BUSINESS:

- 1) Connect the manometer to the printer cable and switch on the printer. The lit LED lamp indicates the unit is ready to print (see *Operating instructions, Page 14*).
- 2) Print out any number of logs by selecting the "PRNT" command.



Important!

Print out the next log only after the printout of the last one has been completed.
Switch off the manometer after the log printout.

- 3) Fill out the log according to the "Operating instructions for the log" (see Page 15).
- 4) We recommend that you submit a completed log of the measurement to the client for signature as well as a copy for his records.

FIRST AID MEASURES

In case of skin contact:

Brush off well before you rinse with a large amount of water.

In case of eye contact:

Rinse out the eyes with a large amount of water.

In case of causticization:

This usually occurs only if adhering calcium carbide is not removed. In any case notify a doctor and show him the label from your calcium carbide box.

FINAL REMARKS

The data in the operating instructions conform with our current know-how and are intended to provide information on our products and their possible applications. They are not a guarantee of certain properties of the products or their suitability for a specific application. Any existing industrial property rights must be taken into consideration.

We are constantly endeavouring to improve our products. Therefore, we reserve the right to make changes and improvements to the products described in these operating instructions without prior notification.

TECHNICAL INFORMATIONS

You can find explanatory information on the following topics on the pages which follow:

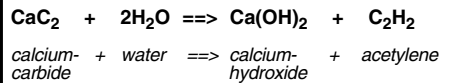
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1) GENERAL INFORMATIONS OF THE CARBIDE METHOD (CM)

Measuring principle:

The calcium carbide (*moisture-sensitive, granular*) in the CCM ampoules reacts with water - moisture of the samples - and forms acetylene thereby (*flammable, gaseous*), calcium hydroxide (*alkaline, powdery*) as well as energy (*the energy released can be perceived by virtue of the fact that the pressure bottle gets hotter*).

The equation below describes the reaction:



Course of the reaction:

The above described reaction takes place exclusively on the sample surface. The water must reach the surface from the interior of the sample in this case in order to be able to react (*like a drying sponge*). The **reaction becomes increasingly slower** if the water has to travel a long distance to the surface.

Reacted carbide, on the other hand, forms a **dust layer** (*calcium hydroxide*) on the carbide surface (*like the adhering ash of a burning cigarette*). The carbide underneath is thus screened and can no longer react; the pressure increase is thus slower.

To **prevent these effects**, you **need the steel balls**, which have three effects:

- 1) They **break** the carbide ampoule
 \implies **start effect**
- 2) They **crush** the sample material and the carbide
 \implies **grinding effect**
- 3) They **mix** the two solids together
 \implies **mixing effect**

Consequence:

Correct use of the steel balls enables the two solid substances to **mix with each other again and again and the reaction to continue. This means less time is required for the measurement.**

The acetylene that is formed builds up pressure in the pressure bottle that can be described on the basis of the law of gases. The water concentration of the weighed sample can be determined by means of the law of gases. Since the temperature also exerts an influence on the pressure in the bottle, a reference temperature of 20 °C was specified. This means that measurements must be conducted at 20°C as far as possible (*however, the error remains small as long as the measurement is conducted within a range of 20 ± 5 °C - for example, the pressure at 15 °C is 1.7% lower than at 20 °C. See also Error assessments, Page 19.*)

$$\text{Law of gases: } \Delta p \times V = n \times R \times T$$

wobei: Δp increase in pressure in the bottle
 V bottle volume
 n gas volume in the bottle
 R gas constant
 T temperature in the bottle

To ensure a reliable determination of the moisture, it is imperative that all components of the equipment are complete (**set of steel balls**) and in flawless condition (**weighing device, manometer and seals**). An incomplete set of balls or a set replaced by other objects leads to a change in the bottle volume and thus results in incorrect results.

The CCM units were **designed** for measurements at a **temperature of 20 °C**. For this reason, measurements should be conducted at this temperature ± 5 °C as far as possible.

Sampling:

Sampling must be **representative** to ensure reliable determination of the soil moisture. It is advisable to localize the moistest point first with an electric test apparatus (e.g. Caisson VI-D1) provided that no measuring point is provided (in the case of heating screeds).

The sample must be extracted, crushed, weighed and transferred to the bottle in short time in order to minimize the risk of premature evaporation of water.

The lower section (e.g. screed) contains the most moisture during the drying phase (*in the explanations regarding DIN 18365 and the comments on DIN 18356, inter alia, it is recommended that the sample be removed from the lower to middle screed layer.*)

2) OPERATING INSTRUCTIONS...

...sample preparation:

Crush the average sample taken in the dish to such an extent that complete comminution can be performed in the CCM unit with the balls.

The sample can be crushed in controlled manner by carefully striking it with the machinist's hammer.



...high-precision weighing device with weighing cup:

The high-precision weighing device is supplied with 2 weighing cups that can be fixed on the weighing device clamp. Despite its **precision** (max. error 0.3%) **the weighing device is extremely rugged**. The 20 g control weight is used to check the accuracy of the weighing device. The weighing device with weighing cup must be adjusted precisely before the control weight is placed in the cup.

The maximum error of the 20 g control weight is around ± 2.5 mg.

Freely turning scale

Turn clip and align scale to the front.



Taring

Suspend the weigher (see *recipe for weigher rod, Page 5*).

Empty and mount clean sample cup.

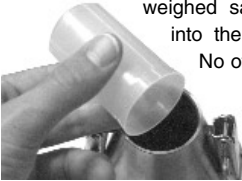
Adjust zero point while weighing device is suspended.

Eyes must be at the height of the scale (otherwise the value is read off incorrectly).



Weighing cup

The weighing cup is suitable for transferring the weighed sample material directly into the CCM pressure bottle. No other aids are required.



...mechanical manometer CLASSIC:

The manometer is equipped with a **colour reading aid** which allows you to read off the **moisture [CM%]** for the weights 20, 50 and 100g **directly at the manometer**.

The mechanical manometers used here are designed such that the **middle display range is most precise**. Therefore, it is recommended that in the case of a pressure of less than 0.2 bar the measurement be repeated with a larger original sample weight and in the case of a pressure greater than 1.5 bar it be repeated with a smaller original sample weight.



...digital manometer STANDARD PRO:

The digital manometer STANDARD PRO has two operating keys. The left key (SELECT) serves to select the functions and the pressure units. The right key (ENTER) activates the selected function or pressure unit. The right key is also used to switch between the MAX.- and MIN.-value.



Turn-on: Pressing the SELECT key turns the instrument on. The instrument subsequently displays the software version (year/week), the full-scale pressure range, the actual pressure (top display) and the last measured MAX.-value (bottom display).

The instrument has the following functions:

RESET: Max.-/Min.-value are set to the actual pressure.

OFF: Turns off the instrument.

MANO: Releases the following functions:

ZERO SET: Sets a new Zero reference. This procedure must be executed anytime **before starting a measurement**.

ZERO RES: Sets the Zero to factory setting.

...followed by the unit selection:

Bar, CM% at 100 g, **CM%** at 50 g, **CM%** at 20 g, **CM%** at 10 g sample weight.

Display of the minimum pressure value

When in the measuring mode (Display: Actual Pressure and Max.-value), you may display the Min.-value for 5 seconds by shortly pressing the ENTER-key.

Notes

- 1) The functions and units can also be called up by keeping the SELECT-key depressed. Releasing the key enables the displayed function or unit to be activated with the ENTER-key.
- 2) If the selected function or unit is not activated within 5 seconds with the ENTER-key, the manometer returns to the measuring mode without changing any settings.

- 3) The instrument automatically turns off 1 hour after the last key-activation. Turning the instrument on and off does not influence any of the previous settings.
- 4) If a pressure can not be represented on the display, **OFL** (overflow) or **UFL** (underflow) appears on the display.
- 5) If the actual pressure goes beyond the measuring range, the last valid pressure value starts flashing on the display.
- 6) If the pressure unit **Bar** is activated, it will be indicated on the top line of the manometer's display. If instead one of the units **100 g**, **50 g**, **20 g** or **10 g** is activated, the display of the actual pressure will switch every 7 seconds to indicate the selected sample weight for 1 second.

Tips & Tricks

1) "Online check"

You can read off the pressure increase in the selected weighed portion if you **set the unit to zero** again during the measurement. You can thus track the pressure increase again from 0.00 (bar or CM%).

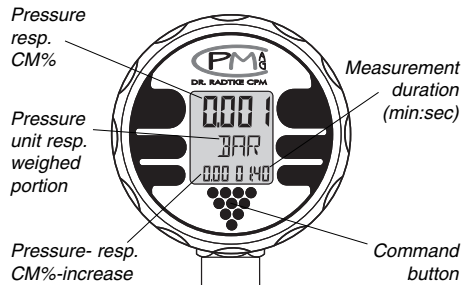
Important! This procedure means that it is absolutely essential that you **reset the unit to zero** again at the end of the measurement. The **final result** is then shown to you as a **negative value**.

2) "Measured value storage"

If the function RESET has been executed prior to the measurement, the maximal value can be read on the lower display after the measurement.

...digital manometer BUSINESS:

The digital manometer is **very precise** (maximum error 0.1%) and **robust**. The pressure sensor is isolated from its environment by means of a steel membrane. The pressure sensor is **insensitive to the chemicals** and solid substances inside the CCM pressure bottle and has a significantly **longer service life** compared to a spring-tube manometer. It is **unnecessary** to check the accuracy with **test ampoules**. The **display accuracy** also extends across the entire measurement range of the manometer from 0 to 2 bar.



Operating the manometer:

By keeping the command button depressed, the possible commands are displayed and can be selected and executed by releasing the button.

"START"

START: Beginning of a measurement. The manometer is activated and the time starts to run as soon as a pressure rise is detected (if there is no pressure rise within 5 minutes, the manometer automatically returns to its initial position and saved values are not overwritten).

"STOP"

STOP: Termination of a measurement or return

to initial position if the manometer has been activated (*a measurement is automatically terminated after 30 minutes at the latest*).

“PRNT”

PRINT: Printout of a log; the message “SEND” appears (*“SEND” indicates that data are sent from the manometer to the printer; the next log may not be printed until the printout of the previous one has been completed*).

“OFF”

OFF: The unit is switched off, the values remain saved until the next measurement.

“UNIT”

UNITS: Direct display of the measured value in CM%, referred to the preselected weighed portion (10, 20, 50 or 100 g).

NEXT: Switches from one weighed portion to the next.

Important: They weighed portion can only be changed **prior to or after** a measurement, but never during a measurement).

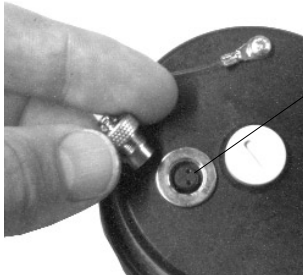
“SLCT”

SELECT: Selects the displayed weighed portion and returns to Display mode.

...log printer:

Switch on the printer with the master power switch and check whether the LED lamp lights up.

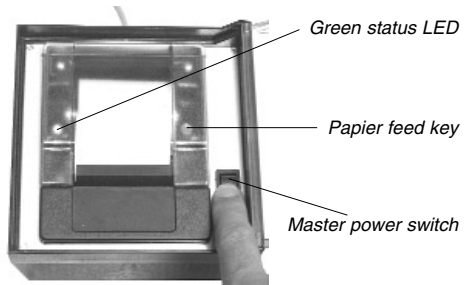
Unscrew the metal protective cap at the rear of the



Socket at the rear of the manometer.

manometer. Insert the printer plug into the socket with slight pressure and lock with screw connection.

Press the command button of the manometer until “PRNT” (PRINT) is displayed and then release. The log printout can easily be torn off along the black tear-off edge of the paper.



...log:

After a measurement is made, you can print out **as many logs as desired**. A numeric pair that occurs only once every 10,000 measurements is assigned to every measurement (4-digit log number and device number).

By means of the log, transfer and read-off errors are prevented and administrative work is facilitated through immediate availability at the construction site.

ADDITIONS

Project name designation of project

Test site designation of test site

Sampling depth also screed thickness

% Air humidity manually

Test material

Abbreviations used include:

SAND: sand
 SOIL: soil
 MORT: mortar
 STUC: stucco
 PLAS: plaster
 Other: freely definable

Table “Pressure after:”

The “Pressure after:” table permits an evaluation of the measurement procedure.

Original sample weight

The CM% moisture is **automatically printed out** for the following original sample weights: 10, 20, 50 and 100 g (*mark where applicable*).

Site, date, user, client

The lower section make the log a legally binding document if all information has been entered.

```

Dr. Radtke CPM Ltd.
CM-MOISTURE TESTER
MEASUREMENT LOG

Log Device N° : 0002
                0109
Projekt name :

_____

Test site :

_____

Sampling depth : _____
% Air humidity : _____
Sensor temp. °C : 0024

Test material :
SAND:__;SOIL:__;MORT:__;
STUC:__;PLAS:__;
OTHER:_____
(mark where applicable)

Pressure after :
t min : 0.499 _____
t min : 0.000 _____
t min : 0.000 _____
t min : 0.000 _____
t min : 0.000 _____
t min : 0.000 _____

Meas.time Min,Sec: 01,21
Final press. bar : 0,000
CM% at 10 g  : 00,00
CM% at 20 g  : 00,00
CM% at 50 g  : 00,00
CM% at 100 g : 00,00

(mark where applicable)

The underwriting parties
confirm the correctness
of the above statements.

Site :
_____

Date :
_____

User :
_____

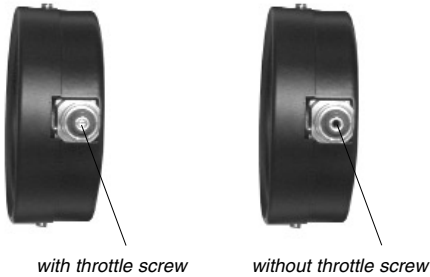
Date of :
_____
    
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3) MAINTENANCE INSTRUCTIONS

3.1) MANOMETERS

CLASSIC

The manometer contains a **throttle screw** (see figure below) that protects it against mechanical stresses (rapid pressure escape) and thus **improves the reliability** of the manometer considerably. The maximum deviation (or accuracy) of the manometer is around 1.6 % (**quality class 1.6**) based on the end value of the pressure scale. *This means that at a real pressure of 1.60 bar you may obtain a maximum displayed pressure of 0.0256 bar above or below that.*



Important!

- 1) Downfalls can damage the manometer. In such a case, check the manometer accuracy prior to judge any of the measurement results.
- 2) **Never blow out the manometer with compressed air** because the pressure used is frequently greater than the permissible 1.6 bar and the manometer may be damaged.
- 3) Always **unscrew the manometer only with a spanner (size 13) screwdriver**, never by hand! The housing may otherwise be bent and damaged.
- 4) We recommend that the CCM pressure bottle always be opened after a measurement such

- that the pressure can escape slowly for the protection of the manometer.
- 5) If the bottle is **turned upside down** during a measurement, solid matter may penetrate into the cover section. The penetration of solid particles into the manometer is prevented by the throttle,.

Use of the test ampoule

To **check** that the manometer and seals are in **proper operational order**, the CCM unit contains three test ampoules with 1.0 ml of water in the case.

Preparation:

Prior to execution of the functional check, you must check whether the CCM pressure bottle is clean and dry and the bottle seal is undamaged. Otherwise it must first be cleaned and dried again and the bottle seal must be replaced if necessary.

Execution:

To carry out this check, first insert the 4 steel balls in the CCM pressure bottle and then, instead of sample material, carefully let an ampoule with 1.0 ml of water as well as a CCM ampoule slide in. After that seal the CCM pressure bottle with the cover and proceed as described under the point regarding "Measuring instructions for the CCM unit CLASSIC, Page 6". After the reaction time the manometer should display 1.00 ± 0.05 bar. If the pointer indicates a pressure outside this range, the two seals must be replaced and the functional check repeated.

If the pressure range is not reached in the second test either, it must be assumed that the manometer is defective.

Note:

The displayed pressure may be too low if you wait too long or if splashes of water have accumulated under the cover. The latter are caused by too vigo-

rous shaking at the beginning of the measurement. If the bottle is "laid flat" and turned, this water may react with calcium carbide.

Important: There is a risk, however, that powder may penetrate into the manometer and impair its service life!

We recommend that the manometer be checked at least once a year. You can do this yourself with a test ampoule (in accordance with the above description) or you can send the manometer along with the cover to your dealer, who will carry out the check for you and put a new inspection sticker on the manometer.

STANDARD PRO

The digital manometer STANDARD PRO is essentially rugged and thus requires **no additional maintenance**. Turn the manometer off after the measurements.

When the battery starts weakening, a low battery warning (BAT LOW) will appear in the upper left corner of the display.

Battery change: Open the battery compartment and change the battery (type CR 2430).

The battery life is 1000 hours in continuous operation.



BUSINESS

The digital manometer BUSINESS is essentially rugged and thus requires **no additional maintenance**. The manometer must always be switched off after completion of the measurements.

The **service life of the battery** is sufficient for approx. 5'000 measurements. When the power starts to run out, the display on the manometer gets weaker (*you can*



then still carry out measurements, but remember to change the battery in time).

To change the battery, turn the front panel - **do not use force** - until the display is upside down. The front panel is then automatically detached (*by a catch*) and the battery can be replaced (*the data in the memory are not lost, only in the display*).

3.2) PRINTER/ LOG

The printer is installed such that it can be permanently left in the case.

If the paper feed button is pressed at the same time as the unit is switched on, the printer carries out a **self-test**.



The **LED lamp** lights up when the printer is ready for operation. If it flashes, a malfunction has occurred and the printer must be switched off. After about 15 seconds switch it on again and repeat the last step.

If the LED lamp starts flashing again, the **rechargeable battery** is dead and must be recharged (*after approx. 15 minutes logs can be printed out again*). The 220 V adapter provided is available as a **charging unit** (*the charging time for a dead battery is around 14 hours*).

If the printer is switched on for a long time without a charging unit, the battery will be discharged quickly and may suffer permanent damage as a result.

The red strip along the edge of the **heat-sensitive paper** indicates that the roll of paper is almost used up. Only use heat-sensitive paper that is specified for the printer (*57,5 ± 0.5 mm with 60 g/m²*).

To **insert the heat-sensitive paper**, first pull back the transparent cover and lift up. Then insert the new roll of paper with the shaft (*the outer side of*

the roll is the side that can be printed; do the fingernail test to make sure).

Cut off the end and insert in the paper feed. At the same time press the paper feed button until the paper appears above the printing head. Take hold of the paper and pull it out several centimetres.

The heat-sensitive paper must not be exposed to intensive **solar radiation** for a long period of time. Direct contact with PVC must also be avoided (*in both cases the quality of the paper is impaired*).

If stored protected against light, **a log will retain its quality for at least 4 to 5 years** (*however, we recommend that you make a copy of the document on copy paper --> which will retain its quality for even longer*).

4) MAXIMUM MOISTURE CONTENT

Maximum moisture content of heat and levelling screed recommended for laying of flooring:

	Moisture contents [vH] for...	
	...Cement screed	...Anhydride screed
Vapour slowing coverings (under-floor heatings)	less than 1.8	less than 0.3
Vapour slowing coverings	less than 2.0	less than 0.5
Vapour-permeable coverings	less than 2.5	less than 1.0
Source: Inter alia Bundesverband Estrich und Belag (BEB) (Screed and Flooring Association)		

5) TECHNICAL DATA...

...on CCM unit CLASSIC

Measuring range: 0 to 1,6 bar
 Display (scaling): 0,05 bar
 Overload proof up to 2 bar
 Accuracy: ± 1,6% typ.
 Operating temperature: -10 to 80 °C
 Manometer housing: Steel panel black
 Type of protection: IP32



...on CCM unit STANDARD PRO

Measuring range: 0 to 2 bar
 Display: 0,01 bar
 Overload proof up to 10 bar
 Accuracy: ± 0.1% typ.
 (± 0.2% max.) between 0 to 50 °C
 Measuring interval: 1/2 sec
 Operating temperature: 0 to 50 °C
 Supply: Battery type CR 2430
 Battery life: Approx. 1000 operating hours
 Manometer housing: Polyamide 12
 Type of protection: IP65



...on CCM-Gerät BUSINESS

Measuring range: -1 to 2 bar
 Display: 0,001 bar
 Overload proof up to 3 bar
 Accuracy: ± 0.1% typ.
 (± 0.2% max.) between 0 to 50 °C
 Measuring interval: 1 sec
 Operating temp.: -10 to 80 °C
 Supply: Lithium battery 3.6 V
 Battery life: ≈ 5000 measurements (1800 mAh)
 Manometer housing: Polyamide 12
 Type of protection: IP65



...on printer (only Complete Set BUSINESS)

Printing method: Moving heat-sensitive head
 Heat-sensitive paper: Heat-sensitive paper 57,5 mm ± 0,5 mm with 60 g/m²
 Characters per line: 24
 Operating temp.: 0 to 50 °C
 Moisture: 10% to 80% rel. humidity, no moisture condensation
 MTBF: 5x10⁵ lines
 Type of protection: IP42



Housing material: PE
 Charging unit: 220 V battery charger
 Charging current: 60 mA
 Charging time: Approx. 14 hours
 Battery: 4 NiCd cells (600 mAh)
 Logs per charging cycle: Larger than 100

Important!

When the battery is dead (flashing LED lamp), it is advisable to wait for at least 15 minutes of charging time before switching on the printer again.

6) ERROR ASSESSMENTS

Manometer

The indicating accuracy of the manometers is specified in accordance with DIN in so-called accuracy classes (e.g. Class 1.6).

This specification of the class refers to the maximum error (in %) of the manometer at its full-scale value. This error applies to the entire scale range of the manometer, i.e. also 0.3 bar.

Here are a few examples:

			Abs. error at 0.3 bar final pressure	
Class	Example	Full scale value bar	with portion 20 g CM%	with portion 100 g CM%
1.6	CCM unit CLASSIC	1.6	0.13	0.02
0.1	CCM unit STANDARD PRO	10	0.05	0.01
0.1	CCM unit BUSINESS	2	0.01	0.00

Consequence:

A manometer of class 0.1% (STANDARD PRO or BUSINESS) already provides a more precise result with a weighed portion of 20 g than is the case with the CCM unit CLASSIC with a weighed portion of 100 g.

Temperature

Owing to the Gas Law (*which was described under "General informations of the Carbide Method, Page 11"*), the temperature may influence the pressure and, thus, the measurement result. The error is approx. 1.7% for instance if measurement is conducted at 25 °C instead of at 20 °C.

Here are a few examples:

		Abs. error at 0.3 bar final pressure	
Temp. °C	Error with respect to reference pressure (at 20 °C) %	with portion 20 g CM%	with portion 100 g CM%
30	3.41	0.05	0.01
25	1.71	0.03	0.00
15	-1.71	-0.03	0.00

Weigher

Weighing the portion precisely is one of the most important factors in water determination with our measuring instruments. Consequently, when designing the weigher, we paid particular attention to ensuring that we developed a **very accurate and rugged** product. Thus, the maximum error is less than 0.3% of the weighed portion if the weigher is used correctly.

Besides product quality, the influence of the operator is also of great importance.

Here are a few examples:

		Abs. error at 0.3 bar final pressure	
Accuracy of the weigher %	Operator's portion weighing error in g	with portion 20 g CM%	with portion 100 g CM%
0.3	0	0.00	0.00
0.3	1	0.08	0.00
1	1	0.09	0.01

7) CLEANING

CCM pressure cylinder

The pressure cylinder must be cleaned dry using the supplied brush after each measurement.

Cleaning directly after the measurement prevents reagent residue solidifying (scaling), thus changing the volume of the cylinder. Should you ever detect solidified residue, please treat the cylinder with a descaling agent.

Set of balls

The set of balls must be cleaned dry with the supplied cleaning cloth after each measurement.

Cleaning directly after the measurement prevents reagent residue solidifying (scaling), thus changing the volume of the ball. Should you ever detect solidified residue, please treat the balls with a mild descaling agent.

Metal case

The foam inlay can be carefully removed in order to clean the metal case and remove any dirt which may have accumulated from the construction site.

The CCM pressure cylinder and the set of balls are arranged in the case so that no dirt can drop out if the case is upright.

8) LOG FORM

Client	:	_____		
Property	:	_____		
Screed:		ZE: <input type="checkbox"/>	heated: <input type="checkbox"/>	Age of screed: _____
		AE: <input type="checkbox"/>	unheated: <input type="checkbox"/>	Solidity class: _____
		AFE: <input type="checkbox"/>		
Compound screed:		on dam layer: <input type="checkbox"/>		
		on separate layer: <input type="checkbox"/>		

Rules of measuring according to DIN 4725 part 4 (warm water underfloor heating): At least 3 measurements per appartement per 200m² respectively should be done. The samples have to be collected from the thickness of the screed. The places where the samples can be collected have to be marked by the screed worker when underfloor heatings are in use.

Relevant moisture contents of screeds for the maturity of coverings:

Covering	Moisture contents (vH) for...	
	...Cement screed	...Anhydride screed
Vapour slowing covering (underfloor heatings)	less than 1,8	less than 0,3
Vapour slowing covering	less than 2,0	less than 0,5
Vapour permeable covering	less than 2,5	less than 1,0

Measurement	Location	Sample weight in g	Meas. Duration in Min.	Pressure in bar	Moisture in CM%
1					
2					
3					
4					
5					
6					

Screed surface to cover: _____ m²

Remarks/Present People: _____

Signature

Date

OVERVIEW OVER THE CCM-SETS AND UNIT-COMPONENTS

Detailed description of the set components

Basic Case (A)

1. Precision spring balance up to 100 g
 - Rugged design with extra-long scale for better reading
 - Maximum error $\leq 0,3\%$
 - 20 g calibration weight for checking the balance
2. Weighing beakers (2 ea.); the weighed portion can be added directly to the cylinder (practical since this prevents spillage)
3. Full tool kit for sample conditioning
4. Ball set with 4 steel balls (starting, mixing and grinding effect)
5. 20 carbide ampoules
6. 3 test ampoules with 1.00 g water for checking pressure gauge and checking for leaks
7. 3 spare seals, both for pressure gauge and for pressurised cylinder, spoon and cleaning brush
8. Clear instructions for use in addition to Quick-Start-Guide
9. Metal carrying case - everything in its place and protected during transport



Individual component equipment:

Description / Model

Pressure measurement principle
 Dependence of indicated pressure on ambient pressure
 Splashproof/dustproof

Online check
 Measurement duration indication
 Logging option on site
 Measured value storage
 Individual company logo
 Maintenance effort

Technical characteristics

Accuracy class manometer
 Measuring range
 Overpressure Protection
 Typ. error (mbar)

Direct read-off of CM% moisture

10 g
 20 g
 50 g
 100 g
 Other
 Electrical power supply

The CCM Complete Sets are available in four equipment versions:

1. Complete Set CLASSIC (A+B)

Consisting of basic case (A) and CM-measuring instrument CLASSIC (B)



2. Complete Set STANDARD PRO (A+C)

Consisting of basic case (A) and CM-measuring instrument STANDARD PRO (C)





CLASSIC (B)	STANDARD PRO (C)	BUSINESS (D)	CM-LOG PRINTER (E)
relative	absolute	absolute	<p>Complete with protective cover, charger (220 V) and spare paper reel. Prints the measurement results directly as a log.</p> <p>Option for more than one print-out of a measurement with log numbers.</p> <p>The log covers:</p> <ul style="list-style-type: none"> • Log header with preset company data • Selection list for measured test material • Pressure characteristic during measurement • Total measurement duration in minutes and seconds • Automatic computation of the CM% moisture for the weighed portions 10, 20, 50 and 100 g • Preset log footer for documentation and signature
correlated	none	none	
standard	very good (steel diaphragm)	very good (steel diaphragm)	
no	possible	yes	
no	no	yes	
no	no	yes	
no	yes	yes	
no	no	yes	
check regularly	very low	very low	
1.6	0.1	0.1	
0 to 1.6 bar	0 to 2 bar	-1 to 2 bar	
moderate	very good	good	
± 25.4	± 10	± 2	
–	x	x	
x	x	x	
x	x	x	
x	x	x	
no	bar	yes	
none	commercially available battery (≈ 1000 hours)	long-life battery (≈ 3000 hours)	

3. Partial Set BUSINESS (A+D)

Consisting of basic case (A) and CM-measuring instrument BUSINESS (D)



4. Complete Set BUSINESS (A+D+E)

Consisting of basic case (A), CM-measuring instrument BUSINESS (D) and CM-Log printer (E)



CCM-UNITS:

FOR FAST AND RELIABLE
MOISTURE DETERMINATION
IN CONSTRUCTION MATERIALS



REGARDLESS OF
WHETHER YOU CHOOSE THE CLASSIC,
STANDARD PRO OR BUSINESS - THE CCM COMPLETE SETS
ARE CONVINCING OWING THEIR EASE OF OPERATION AND HIGH PRECISION.