

## *Slide Measuring Instrument GMG 200*



entsprechend DIN 51131 und EN 13893

## 1. Technical Data

The measuring instrument consists of an active sliding unit, a set of interchangeable sliders, fastening angle for the traction cable and pack of rechargeable batteries. The sliding unit contains the traction mechanism, sliding friction measuring electronics, LED indicators and a battery charger. The slide measuring instrument standard design **GMG 200** is for the routine control of sliding friction on various floor coverings. The sliders can be interchanged depending on the floor covering. The material of the sliders, the actual ambient temperature and humidity are also detected and recorded in the report. The LED indicators are a simple users guide, indication of actual working conditions and computed sliding friction coefficients.

The **GMG 200** allows a transfer of the measured values to a laptop or a PC, which enables a choice and precise evaluation of the measured traces of curves and deviations from nominal values to be made. A standard report can be printed. The necessary software **GMG – VD** is supplied together with the unit for an additional price. The instrument can store up to 90 measured curves (e.g. 18 measurements each with 5 curves).

- **one-hand battery-operated measuring unit**
- **robust design**
- **measured values and nominal value deviations in clear-text indicator**
- **operation display, indication „power on“ and status of battery charging**
- **free memory , slider materials and measuring distance**
- **simple activation of measuring mode after switching on by pressing the „Start“ button or by foot operation**
- **permanent storage of measuring curves also after unit has been switched off.**
- **RS-232 interface to PC or laptop**

### Simple activation by foot plate operation

1. switch on unit
2. activate push button „Seilauszug“ and extract steel strip to full length (or pull cable to required length and press the „Stop“ button)
3. fasten steel strip to the foot plate and step on foot plate to fix it in place
4. measurement is started by slightly stretching the steel strip using the foot plate
5. read measured value from the display or transfer data to PC or laptop for evaluation

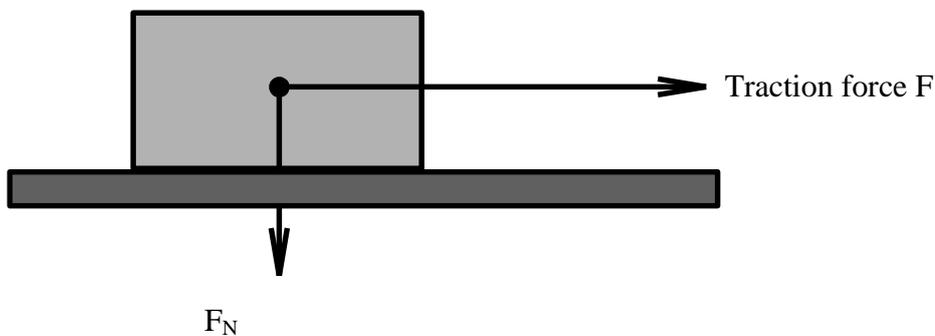
### Technical Data

Current supply	rechargeable batteries, 14V, exchangeable (sufficient for 50 measures)
Battery charger	230 V ac + 10/-15%, max 20 VA
Current consumption	<= 8 A at max. motor power
Interface	RS 232
Power connection (charger)	power supply plug
Memory for measuring curves	90 curves
Temperature range	-10°C – 40°C
Rel. humidity	20 – 90 % r.H (non condensing)
Dimension of measuring surface	10cm <sup>2</sup>
Dimensions of unit incl. handle	160 x 200 x 150 (mm) (l x b x h )
Weight	9000 – 9500 g
Traction speed	0,2 m/s +/- 0,01 m/s
Pressure on sliders	8 N / cm <sup>2</sup>
Range of friction coefficient	0,01 – 1 resolution 0,01
Accuracy	<+/- 1% of final value plus faults caused by vertical or horizontal off-track traction caused by floor conditions at site
Admissable vertical off-track traction	+/- 1cm on 1m
Admissable horizontal off track traction	+/- 1cm on 1m
Temperature measuring range	-10°C – 50°C +/- 1°C
Humidity measuring range	20 – 90 % +/- 7%
Protection class	IP20
<b>GMG-200 Special accessories:</b>	1 connection cable (data transfer)
	1 software for automatic data transfer to laptop or PC (memorizing of curves and reports (min Windows 98)

## 2. Introduction

The measurement of the friction coefficient  $\mu$  is used to determine the anti-slip properties of floor coverings. Physically seen, it is the sliding friction coefficient  $\mu$ , which in the case of most material pairings, is smaller than the static friction coefficient  $\mu_0$ . Normally, the sliding friction coefficient is determined separately for each material pairing. To calculate the sliding friction coefficient, the traction force  $F$ , which is necessary to drag a body with a known mass  $m$  over an area to be measured is calculated. This means:

$$F: \text{traction force } (= -F_R)$$
$$F_N = m \times g, (g = 9,806 \text{ m/s}^2)$$



$$\mu = \frac{F_R}{F_N}$$

According to CEN/TC 134 (Draft 134 WI 033) „Equipment for the Measurement of Sliding Friction Coefficient on Floor Surfaces“. the instrument used to measure the dynamic friction coefficient (sliding friction) has to fulfil the following criteria:

- sliders equipped with specified sliding friction material and form
- pressure on sliders between 8 and 10 N/cm<sup>2</sup>.
- total surface of sliders is larger than 5cm<sup>2</sup>. One slider larger than 2,5cm<sup>2</sup>
- the test unit has to be pulled along the floor covering to be tested at a constant speed
- evaluation as the average value over a minimal length of 50 cm at a constant speed
- climatic parameter recordings

### 3. Description

#### a) Basic Design:

The design of the slide measuring instrument GMG 200 is based on the integration of measuring mechanics and measuring electronics in the slide body, to obtain an easy-to-handle measuring system with only one system component. The instrument is equipped with 3 sets of interchangeable sliders with specified sliding material. The sliders are coded according to their material and are automatically recognised by the instrument.

#### Starting Measurement:

To prepare a measurement, the traction cable is extracted from the instrument and fastened to the foot plate – measurement then commences. A horizontal or vertical off-track traction should be avoided when choosing the measuring area. The instrument pulls itself along the measuring area, defined by the length of the steel strap, whilst computing the sliding friction coefficient.

#### b) Evaluation

At the end of each measurement cycle, the values are stored. One measurement should consist of 5 cycles (scans). In total 18 measurements with 5 scans each can be stored, as is stipulated in the EN-Standard (90 cycles). Evaluation and indication starts as soon as the setting speed is reached and held during a measuring distance of 50 cm. The actual sliding friction coefficient of the last successful scan of the total measurement is displayed. If 5 scans with valid values have been completed, the average value of the last 3 is also displayed. All data and the measured values can be transferred to a computer and, using special software, be further evaluated, filed or printed.

### c) Brief Operating Instructions

#### Measurement Preparation :

- place instrument on area to be measured and switch it on
- press button „Seilauszug“ (strap extraction)
- extract steel strap to full extent
- fasten steel strap to foot plate
- place foot on foot plate
- release strap for 3 sec

#### Measurement Commencement:

- tighten the cable slightly with foot plate. **Fix the foot plate firmly to the floor using full body weight**
- instrument starts automatically after 3 seconds

Alternatively, the instrument may be started by pressing the „Start“ button

- wait until route is completed
- read indicated measured value
- start new route by pressing „Seilauszug“ button
- extract steel strap
- etc.

#### Measurement Completion:

- if cable is extended to any position press „Start“ button
- steel strap is wound up completely
- switch instrument off

**For short measuring distances the cable can also be partly extended. The minimum extension is 33 %**

When required length is reached press „Stop“ button. The measurement can then be started as described above by tightening the cable using the foot plate or by pressing the „Start“ button.



## 4. Operating Instructions

### a) Starting up:

- Fix selected slider system to bottom plate. The instrument can be stood on both handles for easy access. The slider system is screwed to the bottom plate and connected to the instrument via a coding contact. The slider system consists of a plate with coding contact and 3 metal skids, to which the sliders are fixed.
- If required, loosen screw to exchange slider system.
- Select test area: do not test on sloped areas.
- The test area should be clear of dust and loose particles.
- For more details concerning the preparation of the sliders or the surface please refer to DIN 51131
- Do not use cleaning agents.
- Position the instrument ready for the test run.

### b) Switching-on:

- Switch instrument on using main switch "Ein"

```
GTE      Viersen
          GMG 200
          Instrument for
          Slide Measuring
```

- The following text appears in the display:

- After 5 seconds the display shows:

Line 1: Present force F and sliding friction coefficient  
*(The force of the coiled strap is > 0 N,  
as the cable is slightly stretched by the  
wind-up spring)*

Line 2: Type of sliders

Line 3: Actual temperature and relative humidity

Line 4: M: measurement number

S: number of completed scans

A new memory with max. 5 scans can be opened using the push  
button ‚Neue Messung‘ (*new measurement*)

```
F: 4 N      0,04
Slider: rubber
M: 1   S: 3
```

### c) Scan Preparation: Cable Extraction

- Press button ‚Seilauszug‘ (*cable extraction*)

The display shows actual memory situation  
and number of free scans.

```
Pull out strap !
      Then fix.

Cable length 67%
```

Extract cable from instrument. Under traction, the strap is  
automatically uncoiled until the cable is released. The  
length of the steel strap is indicated in the display during the procedure.  
Once the strap is fully extended it stops automatically.

The display shows:

```
to start scan:  
button 'Start'.  
M: 2   S: 0  
Cable length 100%
```

For short scans, the strap can be partially extracted, but the minimum is 40% (about 32 cm) of the total length.  
*Before starting a short scan the 'Stop' button must be pressed so that the instrument knows that no further cable extension is required.*

- Fasten the steel strap to the foot plate
- Place the foot plate in a position so that the instrument, strap and foot plate are in alignment (This prevents the steel strap being pulled out horizontally and crooked)



**Nevertheless you can measure shorter distances.**

**The minimum extension of the GMG 200 is 34% = ~30cm.**

**The distance for acceleration and retarding is ~5-10cm. Therefore there is a remaining distance of 10 – 20 cm, in which the demanded speed level and speed constancy is reached.**

**Also for these short distances, the friction values are correctly calculated and to indicate, that the values are not related to the standard distance, the values in the display are marked with “ \* “**

#### **d) Scanning Procedure:**

A scan can be started by:

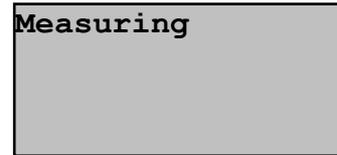
- Pressing the 'Start' button  
or
  1. Place foot on foot plate (or cable end)
  2. Release tension on strap for 3 seconds by pushing the foot plate towards instrument
  3. Put slight tension on strap for 3 seconds by pushing the foot plate away from instrument
  4. Scan is started automatically

```
to start scan:  
button 'Start'  
M: 2   S: 0  
free: 27 Scans
```

**Before start, the cable must be under slight tension.**

**Attention:** When the instrument starts, a force of up to 100 N – depending on slide friction – is applied to the foot plate. This is why the foot plate must be weighed down using full body weight!

Display during the scan:



**e) Measurement Results:**

After a successful scan, the slide friction measurement result is shown in the display and evaluated according to the following criteria:

During each scan the slide friction average, which has been measured on a part of the scanned area with a constant speed, is computed.

Display shows:

The number of the latest measurement,  
 the accompanying scan number and  
 the friction coefficient.  
 The last line shows the last scan result.

M: 4	Sc: 1	0,45
M: 4	Sc: 2	0,42
M: 4	Sc: 3	0,46
M: 4	Sc: 4	0,44

If a scan is invalid: Instead of friction coefficient,  
 the display shows:

,—‘

After 5 scans the average result of the last 3 scans is displayed in the last line. If one of the last 3 scans is invalid no average value is indicated and the measurement has to be repeated.

**f) Additional Measurements:**

By pressing the ‚Seilauszug‘ (*Strap Extraction*) button the next scan can be prepared. The scan number increases. The measurement number is increased by one automatically after 5 scans or by pressing the button ‚Neue Messung‘ (*New Measurement*)

Example 1:

For measurement 1,2 scans have been performed:  
 No. measurement 1: 2 scans for tests:

Display

Messg: 1 Scan Nr.: 1  
 Messg: 1 Scan Nr.: 2

subsequently 3 further scans (measuring routes):  
 Measurement 1 consists of 2 test scans and  
 3 measuring scans:

Messg: 1 Scan Nr.: 3  
 Messg: 1 Scan Nr.: 4

At the end of scan 5, the average value from  
 scans 3-5 will be displayed

Messg: 1 Scan Nr.: 5

If a new measurement is started or the button ‚Neue Messung‘  
 (*New Measurement*) is pressed:  
 the display shows:

Messg: 2 Scan Nr.: 0

Example 2:

For measurement 1, 2 scans have been performed:	Messg: 1	Scan Nr.: 1
No. measurement 1: 2 test scans:	Messg: 1	Scan Nr.: 2
The 3 actual measuring scans are to be stored in a new measurement.		
Press button ‚Neue Messung‘ (New Measurement):	Messg: 2	Scan Nr.: 1
Carry out 3 measuring scans:	Messg: 2	Scan Nr.: 2
	Messg: 2	Scan Nr.: 3

*In example 2 only 3 scans in 1 measurement were carried out. Therefore no average value from scans 3 - 5 can be made. The opportunity to make individual choices regarding the number of scans per measurement is included so that flexible research can be carried out over and above what is stipulated in the standards, or for test purposes. Software GMG VD for the GMG 100SC is available which allows further analytical evaluation of the friction coefficients over the complete test area to be made.*

Always carry out 2 test scans on the area to be measured to ‚run in‘ the sliders. 3 further scans are necessary, which have to show valid friction values. The final result for the area is formed by the average of these 3 scans.

Display after completion of a measurement consisting of 5 scans:

**Average values of scans 3 – 5 displayed →**

<b>M: 4</b>	<b>Sc: 3</b>	<b>0,43</b>
<b>M: 4</b>	<b>Sc: 4</b>	<b>0,44</b>
<b>M: 4</b>	<b>Sc: 5</b>	<b>0,48</b>
<b>MV</b>	<b>SCs 3-5:</b>	<b>0,45</b>

## 5. Changing the Sliders

The instrument has 3 sliders, fastened on a plate. This slider system is fastened to the bottom of the instrument. Each system is equipped with a specific slider material. When changing the slider system the instrument recognises the kind of material, shows it in the display and stores it with the corresponding measuring values. As an option, slider systems can be supplied without fitted slider material for uses requiring special materials, which can then be fitted.



## 6. Stopping a Measurement Scan

If the button ,STOP' is pressed, or a fault in the system is detected during a scan, the procedure is automatically immediately stopped. Afterwards, the ,Seilauszug' (*cable extraction*) button can be pressed to extend the strap further, or the ,Start' button can be pressed to wind the strap up slowly.

```
Cancel
Key 'Bandauszug'
or
'Start': meas.
```

```
Pull in strap
no measurement!
pulled out 20%
(required 33%)
```

## 7. Storing Measured Values

A maximum of 90 scans can be stored.  
 e.g. 30 measurements of 3 scans each or  
 18 standard conform measurements of 5 scans each etc.

```
F: 95 N      0,24
Slider:  rubber
M: 1  S: 3
```

The number of scans per measurement can be selected by pressing the button ,Neue Messung' (*New Measurement*) after the required number of scans (max. 5!). The number of completed measurements and the number of scans of the actual measurement are displayed.

```
To start scan:
key 'Start'
M: 2  S: 0
free: 27 scans
```

- Recall and read the stored values:  
The stored values (performed measurements, scans and measured values) can be recalled and read in the display by pressing the ‚Stop‘ button several times while the instrument is in idle mode.
- Recall Initial Display  
If the ‚Stop‘ button is pressed for longer than 3 seconds while the unit is in idle mode, the screen will show the current data.

**Attention:** If the steel strap is completely rewound the force value > 0 is displayed, because the strap end presses slightly against the buffer spring.

F: 4 N	0,04
Slider:	rubber
T: 20°C	rH: 57%
M: 1	S: 3

## 8. Transportation

To ensure safe transportation the steel strap should be wound up completely.  
Release strap from foot plate  
Press the ‚Stop‘ button  
Press the ‚Start‘ button, after which the cable will wind up slowly.  
Switch the instrument off.

## 9) Battery Charging

The instrument is equipped with a rechargeable battery to allow flexibility.  
If the energy value falls below a certain level the display shows ‚Battery low‘  
The remaining energy is sufficient  
a) to wind up the steel strap for transportation or  
b) to transmit data to a computer

Battery empty! key ‚Seileinz‘
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**Attention:** To recharge the battery the instrument **must be switched off**. While the instrument is switched off, insert the supplied power-unit cable into the instrument’s charging socket and the plug into a 230V main power socket.

***The battery can be charged at any time. Because of the applied battery type there is no unwanted memory effect.***

The charging time period is approximately 2-3 hours. If the battery is successfully recharged, the red power LED of the charging device is switched off.



The plug of the battery charger can be taken off at the end of the charging time period.

### **Self-discharge protection**

To prevent total discharge, the device has an automatic switching-off. If there is no action (press button or data communication) during a period of 10 min, the device is switched off automatically.

#### ***Please note!***

***The GMG 200 is a battery-powered device. To the optimal care of the battery the GMG should remain attached to the battery charger even if the unit is not in use for a longer time. In case the battery charger is not connected to the mains, the plug has to be removed from the GMG, so that the accumulator does not unload itself.***

***After an excessive idle time the battery potentially cannot be charged correctly. Therefore the sliding measuring instrument must be charged at least once in the month!***

## 10) Additional On-Screen Messages

- If the memory is so full that no complete further measurements can be stored, the ‚Start‘ button can be pressed and the following message is displayed:  
==> read memory and/or erase  
Button ‚Speicher löschen‘  
(Erase) for 3 seconds

Out of memory  
read or erase!

- \* If the permitted motor current is exceeded the following message is displayed:  
==> wind up cable

High motor power  
‘Start’: pull in

- In the case of a winding-up or counter fault the following message is displayed:  
==> wind up cable  
When switching on the instrument the same message appears on the screen, if the steel strap is not completely wound up.

Winding - error  
‘Start’: pull in

- If RAM or EEPROM data is inconsistent the following message is displayed:

EEPROM - error  
‘Start’: pull in