

StratoTest 4100

Technical Reference and Operating Manual

Advancing with Technology **ElektroPhysik**

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Short Instructions

1. Press ON/OFF to switch the gauge on.
2. Set reflector size (Table 1).
3. Select DIRECT mode.
4. Carry out Infinite calibration. For Infinite calibration (∞) the probe should always be placed in a distance of 1 meter away from the object to be measured (reflector). When using the trolley, use the clutch lever for lowering the probe down.

IMPORTANT NOTE:

Make sure there is no Aluminium foil placed underneath and there are no metal parts present within an area of approx. 1 meter.

5. Slightly lift the probe or use the clutch lever to position the probe correctly in the air.
 6. Search the center of reflector. As soon as the center is found, the analog bar reaches the read mark on the display (maximum indication).
 7. Lower the probe down. A reading is shown on display.
 8. Press MEAS-key to store the reading into statistics memory.
-

Step	Function in Direct Mode	Key Sequence / Action					
1	Setting Reflector Size	FUNC	REFLEC	↑↓	Select reflector size	REFLEC	continue with step 2
2	∞ Infinite calibration	DIRECT + ∞-key	InF flashing. Lower probe at a min. distance of 1m away from reflector		∞-key	continue with step 3	
3	Taking readings	----cm flashing	Search center of reflector Lower probe down	MEAS	Reading has been taken into statistics memory.		

Table 1

Function in Site Mode	Key sequence / Action						
Selecting Site Mode	FUNC + SITE	Use number keys to select 4-digit site code	SITE	"SC:" Use number keys "1" to "5" to select type of layer	SITE	"AP:" Use number keys "1" to "4" to select number of positions/station	SITE Continue with "Select Station"
Select Station	STATION "0.000" "Distance" flashes	<i>either</i> DELETE and select distance in km e.g. 1.150 Confirm with STATION	<i>or</i> Confirm distance with STATION	"Po: XX" flashes Confirm with STATION <i>or</i> DELETE and user number keys to select requested position	Seach center of reflector Lower probe down MEAS	Reading has been taken into statistics memory	

Table 2

Function	Key-sequence / Action			
Enter OFF-SET value	FUNC + OFFSET	use ↑↓ to adjust value	OFFSET	Please note: OFF-SET can only be changed if statistics memory is empty
Enter Limits	ON/OFF	LIMIT	use ↑↓ to adjust value	LIMIT

Table 3

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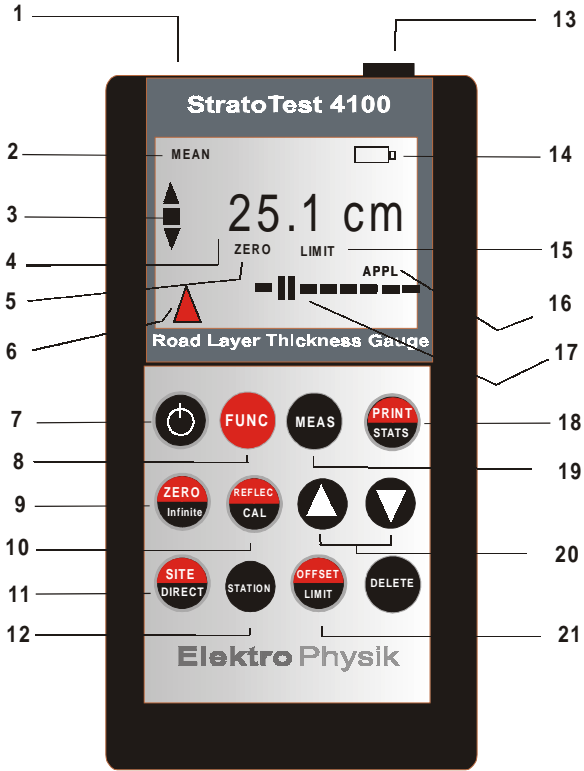
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Short instructions for placing measuring reflectors

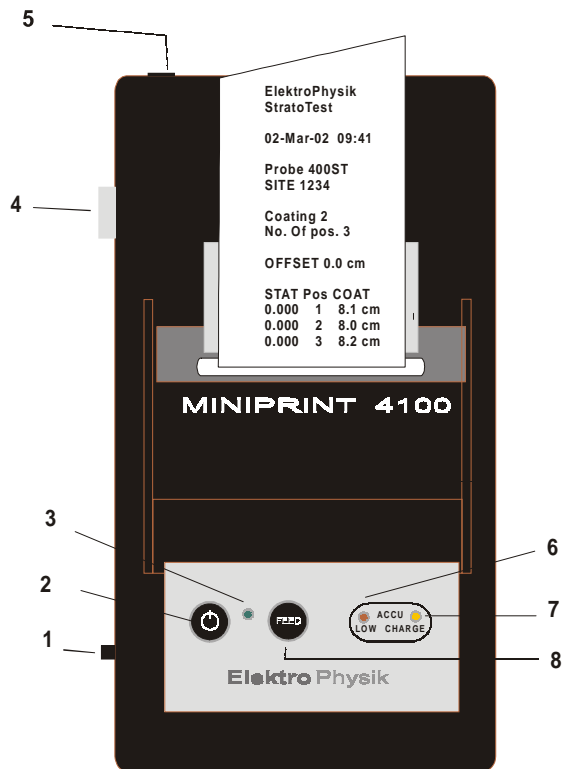
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StratoTest Front View



- 1 Power supply socket
- 2 Indicates what is currently being displayed (i.e. .mean value in this case.)
- 3 Tolerance indicator (above, below or within set tolerances)
- 4 LCD display with floating point digits
- 5 Zero reset indicator
- 6 Red marker (indicating center of measuring reflector)
- 7 ON/OFF -key
- 8 Function key for activating the red top key commands
- 9 Key for ZERO and Infinite (∞) calibration
- 10 Key for activating calibration and reflector size selection
- 11 Key for activating DIRECT or SITE mode
- 12 Key for activating the next STATION entry
- 13 Probe socket
- 14 Low battery indicator
- 15 Limit indicator: Limit has been set.
- 16 Display mode indication: SITE mode (application) has been activated.
- 17 Analog bar (visual search aid)
- 18 Key for printing or viewing statistics
- 19 Key for transferring readings into the data memory
- 20 Arrow keys
- 21 Key for activating OFFSET and LIMIT entries

MiniPrint Front View



- 1 Connector pin to StratoTest
- 2 ON/OFF key
- 3 Green LED for ON/OFF control
- 4 Interface
- 5 Power socket for charger unit
- 6 Low battery control
- 7 Battery charge control
- 8 Paper feed

General Operating Information

The StratoTest gauge offers two operating modes:

- DIRECT mode and
- SITE mode

The DIRECT mode is for direct measuring. The individual measured values and the calculated statistical values are stored for immediate or later printing. **Fig. 1** shows a data print-out with MiniPrint 4100 data printer in DIRECT mode.

In the SITE mode (SITE) measurements are stored after being assigned to the individual measuring positions, station and site. Statistical calculations which can be displayed or printed are produced from these measurements.

Using the STR4100 data transfer program, the readings can then be reformatted into a report form and used for invoicing. **Fig. 2** (next page) shows the print-out provided by the MiniPrint 4100 data printer in SITE mode.

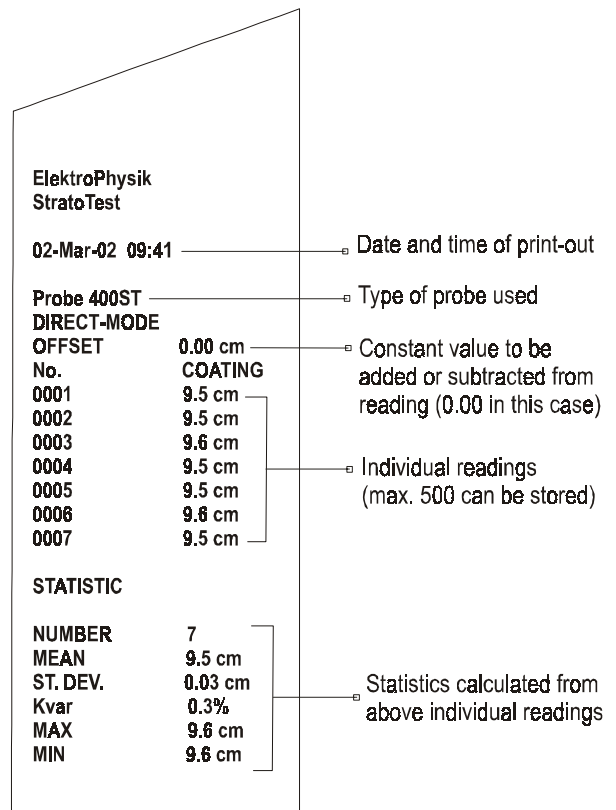


Fig. 1

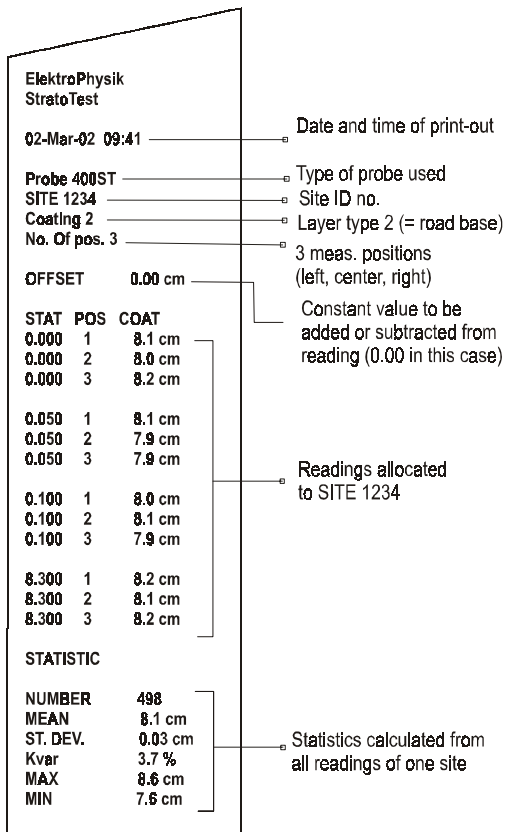


Fig. 2

Acoustic signals

Beeps normally indicate that a key has been depressed.

One short beep confirms a valid key activation.

Two short beeps confirm an invalid key activation.

Three short beeps

- show that information will be cancelled
- show that the probe is close to the measuring reflector when in measuring mode

A long beep confirms

- a) a successful deletion
- b) a successful TOTAL reset
- c) that the probe is moving away from a measuring reflector

Display prompts

Display prompts such as ZERO, APPL, LIMIT, MEAN, etc. assist the operator with the activation of the keys or during measuring. Below these prompts appear in square brackets i.e. [LIMIT] or [— cm].

Short or long key activation

Most functions are activated by a short key activation. Only the search for stored ID nos. and measurements is activated by keeping the SITE and STATION keys pressed down for about 2seconds.

Total reset

A total reset is recommended,

- a) if all registered and set values are to be erased.
- b) if operating functions are blocked and cannot be carried out

Display test

The function of all display components is checked as follows:

1. The device is switched off
2. Arrow key (up) is depressed, followed by the ON key and keeping both keys depressed.

Directory

When connected to the MiniPrint 4100 printer or a PC, all entered ID nos. of a site, layer type, number of measuring positions per station and the number of measured stations as well as the probe(s) used can be displayed. The contents are output as follows:

1. The device is switched off
2. Press DIRECT-key and followed by ON-key and keep both keys depressed.

Sun protection

The LCD must be protected from strong sunlight to avoid possible damage.

1. Introduction

1.1 Field of applications

Especially designed for non-destructive measurement of road layer thickness, the StratoTest 4100 gauge in connection with the 40 cm probe measures all kinds road layer materials, such as bituminous compounds, blast furnace slag, concrete, etc

Calibrating the gauge by means of calibration standards or spacer blocks is not necessarily required. Working on the eddy currents principle, the gauge requires a reflector to be placed under the road layer to be measured. In general, such measuring reflector is made of Aluminium foils or sheets and should be placed under the road layer to be measured during road construction.


1.2 Supply schedule

- StratoTest 4100 gauge
- N400ST measuring probe, measuring range from 0 to 40 cm
- steerable trolley including whether protection box
- test sheet

- head phones
- soft carrying case
- operating instructions

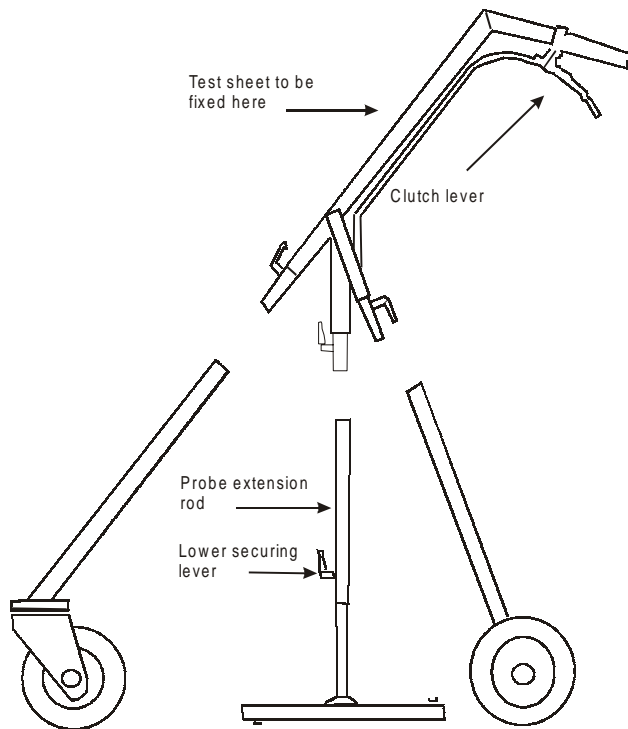
1.3 Adjusting date and time

Before setting the gauge into operation, the current date and time should be adjusted. On this purpose, the probe does not need to be connected.

1. Press ON/OFF-key + KAL keys simultaneously and keep pressed down for a few seconds.
2. Use arrow keys  to select the current year. Confirm by pressing KAL.
3. Proceed as above to adjust month/day/hour/minute .
4. Press KAL-key to confirm and complete setting procedure.

2. Mechanical set-up

Mount the probe to the measuring trolley. Please proceed as described below.

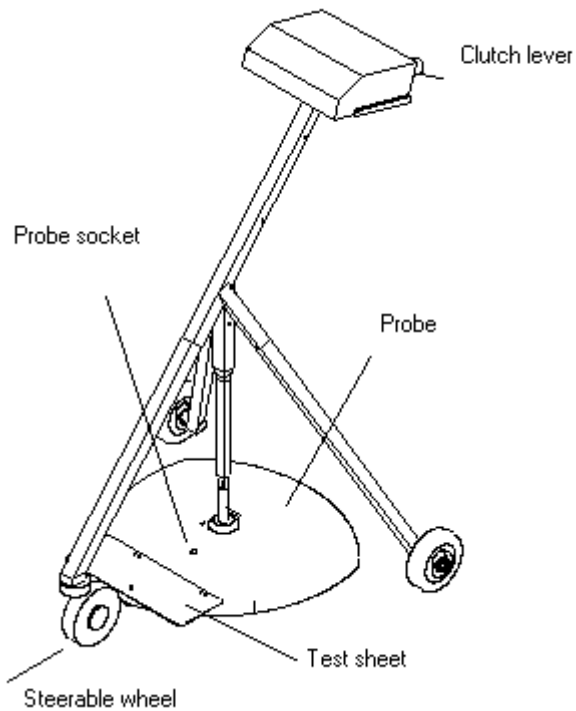


1. Connect the three legs to the upper part of the trolley. Make sure the steerable wheel is fixed to the correct position as shown in the drawing.
2. Use the securing levers to secure the legs properly.
3. Fix the probe extension rod to the center of the three legs.
4. The probe may now be fixed to the extension rod.

Please note:

When fixing the probe, make sure the probe socket is positioned to the right hand position.

5. Place the rubber pad into the weather protection case (see illustr. next page). Put the gauge onto the rubber pad.
6. The test sheet may now be fixed to the left side of the main trolley rod by using the two upper reception holes.
7. Insert probe cable through the opening of the weather protection case and connect the probe to the gauge.



Please note:

Make sure the cable end with the rubber protecting sleeve is connected to the probe socket.

2.1 Adjusting probe height

1. To adjust the probe to the correct height, tension and engage the clutch lever.
2. Loosen the lower securing lever in the elongated hole and lower measuring probe onto road surface. Tighten securing lever and release clutch lever.
3. The measuring trolley may now be moved for searching the measuring reflector with the probe suspended. For measuring, the probe may be lowered onto the surface by tensioning the clutch lever.

Please note:

You may also engage the second lock-in position of the clutch lever to make sure the probe gets in contact to the road surface.

3. Preparing measurement

Before taking readings, please carry out the following steps:

1. Infinite calibration (section 3.1)
2. Checking standard calibration using the test sheet (section 3.2)
3. Adjusting reflector size (section 3.3)
4. Locating and marking the measuring reflector positions (section 3.4)

3.1 Infinite calibration

Measurements can vary due to the different dielectric characteristics of the layer material, i.e. different bituminous compounds, temperature changes of the layer material, humidity in and on the mixture, water on the surface, etc.

When measuring over large distances it is possible that the dielectric material characteristics and consequently the interference may change. We therefore recommend to occasionally repeat the elimination process described below.

1. Position the measuring trolley on a point of the road surface, containing no metal parts and no measuring reflectors within an area of 1 m (the probe is thus at an "infinite" distance from the measuring reflector). This point should, however, be positioned no further than several meters from the measuring reflector.
2. Lower probe with clutch lever onto surface and engage.

In DIRECT mode:

3. Press Infinite-key (∞). „InF cm“ flashes on display.
4. Press Infinite-key (∞) again to complete the procedure.

In SITE mode:

3. Select site-no., type of layer (SC) and number of positions per station (AP).
4. Press STATION-key three times.
5. Press Infinite-key (∞) to complete the procedure.

Please note:

Over long distances, the dielectric properties of the layer material and consequently the inference may change. Therefore, we recommend to repeat Infinite calibration at regular intervals.

3.2 Checking standard calibration with the test sheet

The manufacturer's standard calibration can be checked or recalibrated with the test sheet supplied with the gauge. The test sheet contains 3 reception holes. By turning the board over it may be arranged in two different positions on the probe disc. If the gauge operates correctly, both control values must be accurately displayed.

1. Lower the probe down to the road surface with the clutch lever.
2. Position test sheet on both locations on the probe disc above the positioning pins.
3. Read off measurements and compare measurements with the control values on the test sheet, bearing in mind the reflector size.

Please note:

The difference between reading and the control value on the test sheet should not be more than $\pm 0,1$ cm. Excessive deviations can be remedied by recalibration (see section 9).

3.3 Adjusting reflector size

The StratoTest measures with all commonly used measuring reflectors. To take advantage of the guaranteed measuring accuracy, the gauge must be set to the size of the individual installed measuring reflector before the initial measurement.

In DIRECT mode:

1. Press FUNC followed by REFL-key.
2. Use $\uparrow\downarrow$ -keys to adjust reflector size.
3. Press REFL-key to confirm.

In SITE mode:

If you have selected site-no., type of layer (SC) and number of positions per station (AP), follow steps 1.-3. under DIRECT mode.

If no entry is made, the standard size 1,0 m x 0,3 m is automatically selected. To take advantage of the specified tolerances, we do however recommend to adjust the actual measuring reflector size.

Reflector size	Measuring range [cm]	Measuring uncertainty
0,7 m x 0,3 m 1,0 m x 0,3 m	0 ... 30	$\pm (0,1 \text{ cm} + 2 \% \text{ of reading})$
	30 ... 35	$\pm 2 \% \text{ of reading}$
	35 ... 40	$\pm 3 \% \text{ of reading}$
0,6 m x 0,6 m 1,0 m x 1,0 m (steel)	0 ... 30	$\pm (0,1 \text{ cm} + 2 \% \text{ of reading})$
	30 ... 35	$\pm 2 \% \text{ of reading}$
	35 ... 40	$\pm 2 \% \text{ of reading}$

Please note:

- The set reflector size remains in memory even after switching the gauge off and on.
- With increasing measuring reflector size the measurement becomes more accurate. Measuring reflectors below 70 cm cannot be checked for cracks and other faults once installed. If measured values seem incorrect, the measuring position must be skipped.

3.4 Locating and marking the measuring reflectors

In DIRECT mode:

1. Press ON/OFF-key followed by DIRECT-key. Continue with steps 2.-6.

In SITE mode:

1. Select station, type of layer and, and position of the measuring reflector. Press STATION-key two times. Po:1 flashes. Press STATION again and continue with steps 2.-6.

-
2. Release clutch lever and move trolley at slow walking speed diagonally (not longitudinally) over the installed measuring reflector until a triple tone signal (...) is audible (approaching a measuring reflector).
 3. Slow down immediately and continue at reduced speed until a single long tone is audible (moving away from the measuring reflector).
 4. Slowly reverse the trolley until the analog bar on the bottom of the display has reached the red mark. At the same time also the smallest thickness value is displayed (center line of measuring reflector). Mark this position. (with chalk, for instance).
 5. Now turn the trolley by 90° and drive longitudinally over the centre line of the inserted reflector Mark the position at the beginning and end of the reflector once the analog bar has reached approx. the centre of the display field
 6. Using the three markings, the centre of the reflector can be determined.

Please note:

We recommend to check the reflectors for breaks or other damage. To test the measuring reflectors, the suspended probe is driven over the marked longitudinal centre line. At the same time a near static numerical value or even length analogue bar must be displayed in the central area, approx. 30 cm from the reflector ends. Larger deviations, normally occurring after higher values or a shorter analogue bar indicate a broken reflector. Do not measure within ± 30 cm of a damaged area.

4. DIRECT mode operation

4.1 Taking measurements

1. Switch the gauge on and press DIRECT-key. Display flashes.
2. Guide the probe over the center of reflector until the first triple tone followed by a longer single-tone signal can be heard. The acoustic search aid operates only once during each measurement operation

3. Slowly reverse the trolley until the analog bar on the bottom of the display has reached the red mark and the smallest value is displayed.
4. Using the clutch lever, lower the probe down to the surface.
5. Press MEAS-key. The reading will be stored into the statistics memory.

Please note:

- To take advantage of the guaranteed measuring accuracy, it is recommended to repeat measurement once or twice per measuring point.
- In DIRECT mode operation, a maximum of 500 readings can be stored.

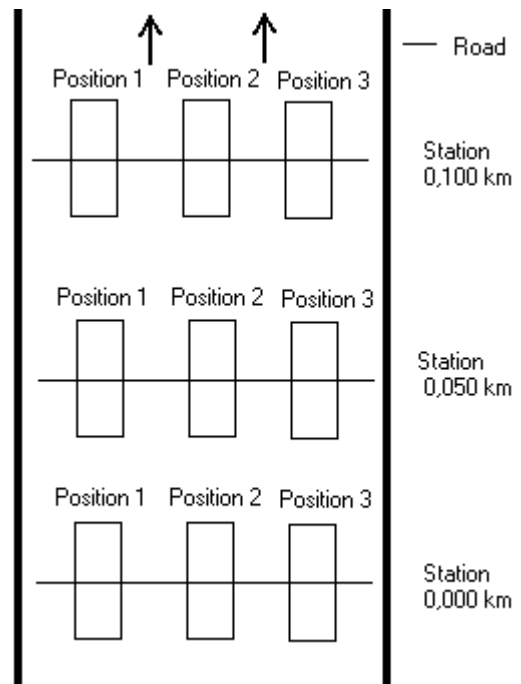
5. SITE mode operation

5.1 ID nos. of a site

Before taking measurements, ID nos should be given to a site in order to define the following parameters:

1. No. of site

2. Type of layer (e.g. wearing course or base course)
3. Number of measuring positions
4. Road section (Station)



5.1.1 Adjusting ID nos of a site

1. Press ON/OFF to switch the gauge on.
2. Press FUNC followed by SITE-key to activate SITE mode. „- - - „ appears on display with the first dash flashing.
3. Enter a 4-digit value through the numerical keys 0-9 (upper key-inscription) to define a site no.
4. Press SITE-key to confirm. „SC: - „ (=Schicht= layer) flashes. Enter a one-digit value from 1-5 to define the type of layer. False entries can be deleted by pressing DELETE-key. F.

1 = sub-base
2 = road base
3 = base course
4 = wearing course
5 = user-defined layer
5. Press SITE-key again. „AP: -“ flashes. Enter the number of measuring positions per station (max. 4). Press SITE to confirm.

1 = one measuring position

2 = two positions (left, right)

3 = three positions (left, center, right)

4 = four positions (left, center, center, right)

6. „cm“ or „inch“ flashes. Now you can take readings.

Please note:

If the gauge switches itself off during the adjustment, the process has to be restarted from the beginning as under 5.1.1.

5.2 Taking measurements

Before starting measurement, the following steps must be carried out:

- Infinite calibration (section 3.1)
- Setting reflector size (section 3.3)
- Locating and marking the measuring reflectors (section 3.4).

After this, please proceed as follows:

-
1. Press FUNC followed by SITE-key to select site mode operation. Now the keys change to numeric keys, for entering the following ID nos.: site number, type of layer and number of positions per station.
 2. Press STATION-key. Accept first station number of site at 0.000 (km) or press DELETE and enter another figure.
 3. Press STATION-key again. Accept number of measuring position 1 or press DELETE and enter another position number.
 4. Press STATION-key again to activate search mode.
 5. Move measuring trolley over the first measuring reflector, search for the centre and lower the probe as soon as the smallest value is shown and the analogue bar reaches its maximum. The thickness reading is shown on display. Press MEAS-key to transfer reading to the statistics.
 6. Press STATION-key to prepare the second measurement. Accept second station at 0.050 (km) (automatic setting) or press DELETE-key and

enter another distance. This value determines the distance to the next measuring stations.

Please note:

Continue with the relevant steps from step 3.

5.3 Searching a stored site ID no., layer type and measuring position

1. Press FUNC-key. Then press SITE-key for about 2 seconds until the last site no. appears on display.
2. Use **↑ ↓**-keys to select the required site-no.
3. Press SITE-key. The layer type „SC: XX “ appears on display.
4. Use **↑ ↓** to select required layer type. Press SITE to confirm.
5. Press STATION-key for about 2 seconds. The last station appears on display.
6. Use **↑ ↓** to search the required station. When pressing STATION again, the number of a measuring position appear (e.g. „Po: 1“).

-
7. Use **↑ ↓** to select required measuring position. By pressing STATION you can call the last reading.
 8. For deleting this reading press DELETE.
 9. For taking a new reading, press STATION and start measurement.

5.4 Printing out a station including readings and statistics

1. Connect StratoTest 4100 gauge MiniPrint 4100 data printer (see Accessories, section 13). Switch on both units.
2. Search required site (section 5.3).
3. Press FUNC and PRINT keys. All relevant single readings together with their assigned measuring positions, stations and statistics will be printed out. The print-out also includes date and time of print-out.

6. Enter limit and off-set values

6.1 Limit value

1. Switch to the required mode.

2. Press LIMIT-key. The end of measuring range value or the last set limit value appears.
3. Use **↑↓** to adjust required limit value.
4. Press LIMIT to confirm.

Please note:

- The gauge has been factory preset to **Limit = End of measuring range value** (e.g. 40 cm with the N400ST probe). If the probe approaches the measuring reflector at a distance which is smaller than the end of measuring range (e.g. nearer than 40 cm), the acoustic search aid sounds (triple-tone-signal). At the same time, the analogue bar increases from right to left.
- If the limit value is set to 12 cm, for instance, the search signal only sounds once the probe is closer than 12 cm to the reflector. By setting a limit value, the sensitivity for searching the smallest distance from probe to measuring reflector (Minimum) can be increased.
- The limit value should, however, not be set below 1,3 - 1,5 times the expected measuring value as

otherwise the triple-tone signal will not appear when approaching the measuring reflector.

6.2 OFFSET value

An OFFSET value can only be set when the statistical values are deleted in the relevant mode, i.e. no measurements are stored.

1. Switch gauge to the required mode and press FUNC followed by OFFSET-key.
2. Use \uparrow \downarrow to adjust required off-set value.
3. Press OFFSET to confirm setting.

The off-set value has the following effects:

- A set off-set value is automatically added to or subtracted from each measurement depending on whether the value is positive or negative.
- The value corrected by the off-set value will be stored.

- The adjusted off-set value is specified in the printout.

7. Statistics calculation

7.1 Viewing and printing statistics

1. Press STATS-key to view and scroll through the following statistics parameters:

N: number of readings

MEAN: mean value

Std.Dev: standard deviation

Kvar: Coefficient of variation

Max: maximum reading

Min: minimum reading

Please note:

If the MiniPrint 4100 data printer is connected, the statistics values can be viewed and printed simultaneously.

2. Press DIRECT to quit statistics.

-
- Statistics can be viewed at any time - also after each measurement.

7.2 Viewing statistics of a stored site-no.

1. Press ON/OFF + FUNC + SITE (for 2 sec.)
- 2- Select required site-no and press SITE to confirm.
3. Select layer („SC:“) and press SITE to confirm.
4. Press STATS-key for 2 sec.
5. Press STATS-key repeatedly to scroll through the individual statistics parameters.

8. Accuracy test with thickness standards

To check accuracy of the StratoTest 4100 gauge, a set of five plexiglass rings and one Plexiglass plate is available. The set is arranged in a carrying bag and conforms to the German TPD-Stb 89 requirements.

1. Take thickness standards from the carrying bag. Position a wooden board or chip board, approx.

100 cm x 30 cm (without metal edges or parts) onto the briefcase as support for the measuring reflector).

2. Remove probe and gauge from trolley. Move the measuring trolley as far away from the probe as the cable allows.
3. Position largest distance ring in the centre of the wooden board (without measuring reflector). Position the Plexiglas plate on the distance ring.
4. Prepare the measurement report form and enter the distance values (ring and plate).
5. Switch the gauge on and press FUNC and REFL/CAL-key subsequently.
6. Use $\uparrow \downarrow$ to select required reflector size. Press REFL-key to confirm required value.
7. Select DIRECT or SITE mode.
8. Press Infinite-key twice to eliminate the dielectric interferences of the Plexiglass plate.

-
9. Position measuring reflector evenly under the distance ring.
 10. Place the probe on the Plexiglas plate. Move back about 1 m.


Please note:

- Make sure all three probe feet are positioned on the plate.
 - Make sure the probe (not the distance ring) is arranged centrally over the measuring reflector.
11. Read off measurement and record.
 12. Position the next sized distance ring between the reflector and the board. Continue from step 1 ...

If the deviations exceed the permissible measuring uncertainty the gauge, it is recommended to return the gauge to the manufacturer for inspection or servicing.

9. Activating the standard calibration using the test sheet

The standard calibration should be checked by means of the test sheet. If an excessive deviation is confirmed, the StratoTest may be calibrated to one of the two control values in the following manner:

1. Place test sheet with the desired control value on the probe.
2. Switch gauge off and on
3. Press DIRECT/SITE key. Four beeps are audible. Measurement XX.X is displayed.
4. Press CAL-key twice and use  to set control value.
5. Press CAL-key. Calibration is finished.

10. Delete functions

10.1 Deleting the last reading

The last reading can be deleted by pressing DELETE-key before preparing the next measurement by pressing DIRECT or SITE key.

10.2 Deleting single readings and statistical values in DIRECT mode

1. Switch on gauge and press STATS-key. Display shows the number of readings.
2. Press DELETE-key to prepare deletion.
3. Press DELETE again to confirm deletion.

Please note:

This action deletes all single readings along with their statistical values.

10.3 Deleting individual and statistical values of a layer type assigned to a site number

1. Press FUNC-key.
2. Then press SITE-key for about 2 seconds to activate SITE mode. The last site number appears on display.
3. Use $\uparrow\downarrow$ -keys to select the required site no. to be deleted.
4. Press SITE-key again. Your selection appears on display.

Please note:

- 3 short beeps show that deletion is being prepared. Deletion can be interrupted by pressing SITE-key.
- 1 long beep shows that all readings of the layer type under the selected site number have been deleted.

10.4 Deleting limit settings

1. Switch to the required mode.
2. Press LIMIT-key directly followed by DELETE-key. Your limit setting has been deleted.

10.5 Deleting an off-set value

1. Switch to the required mode and press FUNC-key.
2. Press OFFSET-key. The set off-set value appears on display.
3. Press DELETE-key to delete this value.

10.6 Changing or deleting calibration and activating standard calibration

For deleting calibration make sure no metal parts are present with an area of approx. 1 m.

1. Switch gauge to required mode.
2. Press DIRECT or SITE-key. Four tones will sound.
3. Press CAL-key followed by DELETE-key to delete calibration.
4. Now standard calibration has been activated again.

11. Power supply

The StratoTest 4100 may be operated by a 9 V alkaline battery, by a 9 V storage battery or by a power supply for stationary operation.

Battery level is continuously checked during operation. A low supply voltage cannot cause faulty measuring.

Press ON. There are three display options:

- No information on display: No battery or storage battery connected or battery is insufficiently charged for operating the display
- No bAtt display: Battery is sufficiently charged
- Continuous bAtt-Anzeige: The gauge will switch off after approx. 1 sec. Change battery immediately.

11.1 Replacing the battery

1. Position the gauge upside down on the table.
2. The rear battery compartment can be accessed by undoing both recessed screws

-
3. Remove battery.
 4. Insert new battery. Observe correct polarity.
 5. Close battery compartment and tighten screws.

Please note:

When inserting new batteries observe correct polarity. An incorrect polarity may cause data loss.

The new battery must be inserted within 30 sec. from removal of the old battery as otherwise all stored and set values are lost.

12. PC connection

The StratoTest gauge contains a RS232C interface. Using the connecting cable and the MSave data transfer program all measuring and statistical values can be transferred to a PC for possible further processing.

13. Accessories

- MiniPrint 4100, portable data printer
- Thickness standards according to the German TPD StB 89 for checking accuracy and calibration

- N800ST probe, measuring range 0 to 80 cm
- STR4100, data transfer program
- MSave, data transfer program
- Power supply plug 230 V AC/12 V DC
- Charging unit including storage battery
- Interface cable RS 232C
- Aluminium foils and sheets of different sizes
- Foil cutting device

14. Trouble shooting

The following error list offers information for detecting and removing errors. All errors start with the letter E (Error).

The following errors deactivate the gauge:

E01: Probe not accepted.

Please contact your dealer.

E02: Probe is not connected.

Appears only if no probe is connected directly after the Total-RESET

E03: Faulty probe. Appears on switch-on (please return probe for repair) or

if the probe cable is pulled out during operation.

E04: Low battery. Please replace battery.

The following error messages only appear for approx. 1.5 seconds

E11: Full memory.

E12: The selected site number and type of layer have already been allocated.

E13: Zero setting not allowed.

E14: The selected site has already been assigned to another probe.

E15: Probe is not in the infinitive range.

15. Special functions

The gauge features 4 special function (automatic switch off, key-lock, display backlight, measuring unit).

Please refer to the table next page for your quick reference. For setting your required function mode, please proceed as follows:

1. Switch the gauge off.
2. Press FUNC + ON/OFF simultaneously until a beep sounds. Display shows setting of FUNC 1 (either 0 or 1).
3. Use $\uparrow\downarrow$ -keys to select your required setting (0/1). Press FUNC to proceed to the next special function mode.

After adjusting the gauge to the required settings, switch the gauge off.

FUNC		Setting	
1	0	Automatic switch off	after 3 minutes
	1		OFF
2	0	Key-lock	OFF
	1		ON
3	0	Display backlight	ON
	1		OFF
4	0	Measuring unit	metric
	1		imperial

16. Special hint

When measuring layers of more than 14 cm thickness and the probe approaches the measuring reflector, the reading is getting higher instead of smaller. This is due to a special physical effect and does not affect accuracy. The exact value is shown once the probe is completely positioned down to the layer surface.

17. Technical specification

17.1 Measuring principle

The working principle of the StratoTest 4100 gauge is similar to that of metal detectors as they are used for passenger checks at airports, for instance.

Whilst metal detectors only indicate the presence of metal, the StratoTest determines the exact distance to a metal base.

Working on the eddy currents principle, the StratoTest uses a measuring coil in a disk-shaped probe housing which is induced by a high-frequency current generating an electro-magnetic field. This electro-magnetic field is interfered by metallic parts, i.e. by the Aluminium measuring reflector foil. Coil frequency values change according to the distance to the measuring reflector and are converted to thickness values.

17.2 Table of technical data

Measuring principle:	eddy currents
Measurable layers:	All road layer materials, such as bituminous compounds, blast furnace slag, concrete, etc.
Measuring reflectors:	All types of reflectors commonly used such as aluminium foils or sheets or other steel bases.
Measuring ranges:	N400ST probe: 0 - 40 cm N800ST probe: 0 - 80 cm
Resolution:	depending on measuring range
Measuring uncertainty:	N400ST: depending on measuring range and reflector size (s. table under section 3.3) N800ST: ± (1 cm +3 % of reading)

Storage capacity in DIRECT mode operation:	Max. 500 single readings including statistics
Storage capacity in SITE mode operation:	Max. 600 single readings incl. statistics, subdivided into 5 sites with 300 stations each, with 4 measuring positions per each station and 5 layer types per measuring position
Power supply:	1 x 9 Volt alkaline battery
Battery life:	Approx. . 20 hours continuous operation
Ambient temperature:	Processing unit: 0° - 50° C Probe: 0° - 70° C

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Annexe

Short instructions for placing measuring reflectors

The measuring reflectors are made of Aluminium foils or sheets of 30 cm width. Aluminium foils are supplied as endless rolls (100 m or 50 m) or cut to size.

Aluminium sheets are supplied in lots of 50 pcs.

The standard sizes for one measuring spot measured are as follows:

Foils: 1000 mm x 300 mm, 30 microns thickness (self-adhesive)

Sheets: 1000 mm x 300 mm, 0,300 mm thickness (anti-corrosion coated on both sides)

For road layers up to 10 cm, also shorter measuring reflectors can be used (please refer to the manufacturer of gauge).

When using other road layer thickness gauges, the standard sizes of measuring reflectors for *one measuring spot* may vary according to model (please refer to the manufacturer of gauge).

The anti-corrosion coating protects the Aluminium foils or sheets from dissolution, especially if the Aluminium foils or sheets come into contact with the alkaline composites of the mortar layer.

1. Placing Aluminium foils

Make sure there are no metal objects such as manhole covers or other placed within a distance of 1 m around the measuring reflector.

For cutting the foils on site it is recommended to use the foil cutting device (see accessories) for clear and right-angled cutting of foils.

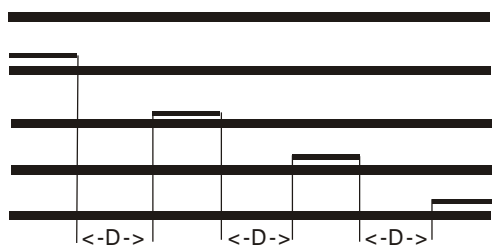
The self-adhesive Aluminium foils are generally placed on bitumen layers which already have been laid. When placing the foils make sure the total width of foil (30 cm) is placed evenly over the bitumen layer. The surface of foil should be dry and clean. For increasing adhesion properties, it is recommended to use a broom for brushing over the foil. Porosity which might be produced in the foil due to the spiky graining of the bitumen layer will not affect measurement. Ripping the foil, however, should be avoided since rips might result in measuring errors. If a foil has been ripped, a congruent piece of foil can be used for covering the defective spot.

The measuring reflectors are to be laid according to the laying instructions plan as described below. Once placed under the road layer, the measuring reflectors can easily be found by means of the laying instruction plan enabling you to allocate the readings to the relevant measuring spots.

The foils should be placed in longitudinal direction, i.e. in direction of traffic to prevent damage of the foil through the road grader. Occasional crossing over the measuring reflectors through the road construction vehicles does not damage the foil.

In case of multi-layers, the reflectors should be placed in longitudinal or cross direction in displaced arrangement at 1m minimum distances.

Staggered arrangement



D = Distance in longitudinal or cross direction
1m minimum

2. Placing Aluminium sheets

Due to their rugged nature, Aluminium sheets are more resistant to the coarse graining of road layer material. They are designed for being placed on the unbound sub-course. To ensure safe fastening, the sheets should be covered with the bituminous mixture or fixed at the end directed to the road grader using flat nails of at least 5cm length.

If the sheets are anti-corrosion protected on one side only, the coated side should be placed downward in order to protect the Aluminium sheet from dissolution. The Aluminium sheets should be arranged according to the layer instructions for Aluminium foils.

3. Single layer measurement

If the individual layers should be measured separately, one reflector should be placed for each layer. The reflectors are to be placed in staggered arrangement. This method guarantees highest measuring accuracy.

4. Total thickness measurement

For total thickness measurement, one single measuring reflector is placed at the deepest spot. After placing the

first layer, layer thickness should be measured (for instance 10 cm). Then the second layer is to be placed. Now take measurement. You can determine the thickness of the second layer by calculating the difference between the second measuring value minus the first measuring value. After this, the third layer is to be placed and so on.

Example:

Thickness layer 1: 10 cm

Total thickness after placing the second layer: 30 cm

Thickness of the second layer: $30 \text{ cm} - 10 \text{ cm} = 20 \text{ cm}$

The disadvantage of this method is that larger measuring errors might be involved due to less precise detection of the deeply laid measuring reflector, due to the absolute measuring error which increases with larger thickness values and due to error propagation in calculation of thickness difference.

Note:

Due to the above mentioned disadvantages, it is not recommended to use the total thickness measurement method for measuring base courses or wearing courses.

