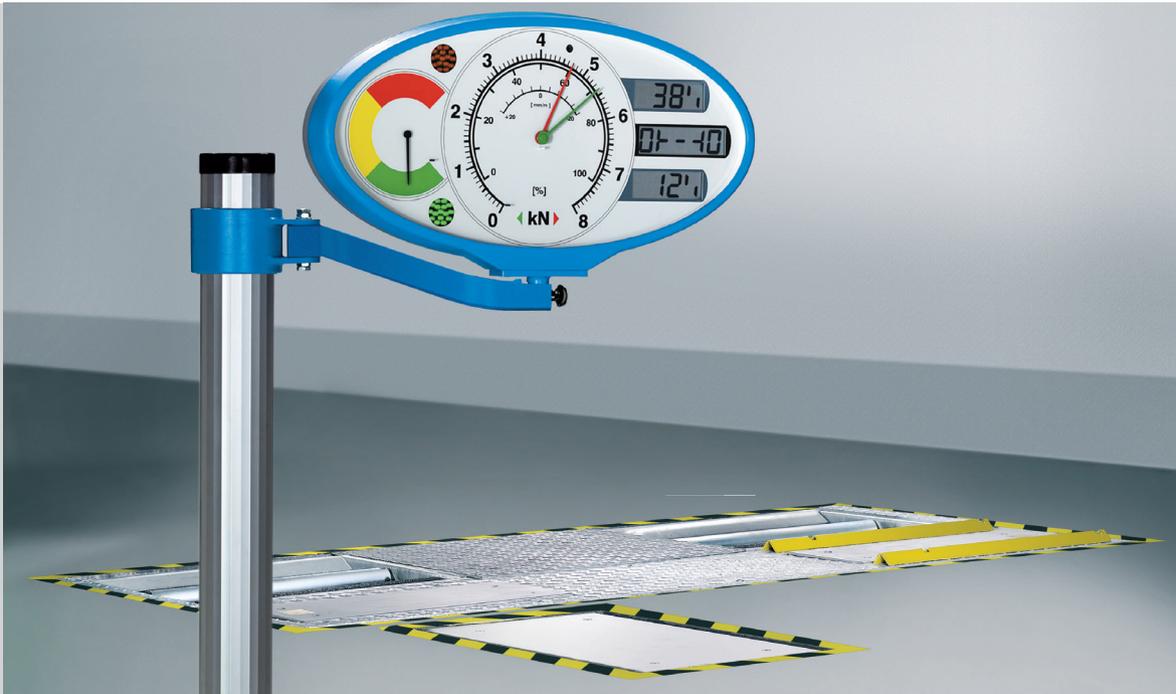


Prüfstraße TL 6xx

Test Lane TL 6xx



de Originalbetriebsanleitung
Prüfstraße mit Analoganzeige für Pkw

es Manual original
Línea de comprobación con indicación analógica para turismos

nl Oorspronkelijke gebruiksaanwijzing
Teststraat met analoge weergave voor personenauto's

da Original brugsanvisning
Testlinie med analogdisplay til personbiler

tr Orijinal işletme talimatı
Otomobil için analog göstergeli test hattı

en Original instructions
Test lane with analog display for passenger vehicles

it Istruzioni originali
Linea di prova con display analogico per autovetture

pt Manual original
Linha de teste com mostrador analógico para veículos de passeio

pl Instrukcja oryginalna
Linia diagnostyczna ze wskaźnikiem analogowym do samochodów osobowych

el Πρωτότυπο εγχειρίδιο χρήσης
Διαδρομή ελέγχου με αναλογική ένδειξη για επιβατικά οχήματα

fr Notice originale
Ligne d'essai avec afficheur analogique pour VP

sv Bruksanvisning i original
Rullande landsväg med analogvisning för personbilar

fi Alkuperäiset ohjeet
Henkilöautojen testausrata, analoginäyttö

cs Původní návod k používání
Zkušební linka s analogovým ukazatelem pro osobní vozy

zh 原始的指南
适用于轿车的装有模拟显示的测试道

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 These operating instructions describe standard test procedures. These standard test procedures may differ from country-specific test procedures

1. Symbols used

1.1 In the documentation

1.1.1 Warning notices - Structure and meaning
Warning notices warn of dangers to the user or people in the vicinity. Warning notices also indicate the consequences of the hazard as well as preventive action. Warning notices have the following structure:

Warning symbol **KEY WORD – Nature and source of hazard!**
Consequences of hazard in the event of failure to observe action and information given.
➤ Hazard prevention action and information.

The key word indicates the likelihood of occurrence and the severity of the hazard in the event of non-observance:

Key word	Probability of occurrence	Severity of danger if instructions not observed
DANGER	Immediate impending danger	Death or severe injury
WARNING	Possible impending danger	Death or severe injury
CAUTION	Possible dangerous situation	Minor injury

1.1.2 Symbols in this documentation

Symbol	Designation	Explanation
!	Attention	Warns about possible property damage.
i	Information	Practical hints and other useful information.
1. 2.	Multi-step operation	Instruction consisting of several steps.
➤	One-step operation	Instruction consisting of one step.
⇨	Intermediate result	An instruction produces a visible intermediate result.
→	Final result	There is a visible final result on completion of the instruction.

1.2 On the product

! Observe all warning notices on products and ensure they remain legible.

2. User information

2.1 Important notes

Important information on copyright, liability and warranty provisions, as well as on equipment users and company obligations, can be found in the separate manual "Important notes on and safety instructions for Beissbarth Brake Test Equipment". These instructions must be carefully studied prior to start-up, connection and operation of the BD 6xx / TL 6xx and must always be heeded.

2.2 Safety instructions

All the pertinent safety instructions can be found in the separate manual "Important notes on and safety instructions for Beissbarth Brake Test Equipment" (user information, order number 1 691 696 920). These instructions must be carefully studied prior to start-up, connection and operation of the BD 6xx / TL 6xx and must always be heeded.

2.3 Other applicable documentation

All documents for series BD 6xx / TL / SL 6xx:

Document	Order number
User information	1 691 696 920
Product description	
• Brake tester BD 6xx	1 691 606 220
• Suspension tester SA / SN 6xx	
• Side slip tester ST 600	1 691 626 220
• IR remote control	1 691 636 220 1 691 696 225
Operating instructions	
• with analog display	1 691 696 020
• with PC	1 691 706 020
• with external test software	1 691 696 012
Test log book de / en	1 691 696 620 / 1 691 696 621
Brief instructions de / en	
• BD 6xx stand alone	1 691 606 420 / 1 691 601 421
• Testlane TL / SL 6xx	1 691 696 420 / 1 691 696 421
Planning folders	
• BD 6xx stand alone (not BD 66x)	
de	905 607 040
en	905 607 041
es	1 691 606 303
• BD 66x stand alone de/en	905 607 050 / 905 607 051
• SA / SN 6xx stand alone	905 627 011 / 905 627 012
• Testlane TL / SL 6xx	
de	905 697 021
en	905 697 022
es	1 691 696 302
EU Declaration of Conformity	
• BD 6xx stand alone	1691 696 921
• Testlane TL / SL 6xx	1691 696 921

2.4 Configuration

! Only Service personnel are authorized to make all the necessary configuration settings and calibrate the sensors.

3. Product description

3.1 Intended use

Information on the intended use of the BD 6xx / TL 6xx can be found in the product descriptions for each of the components.

3.2 Measurement quantities

The following quantities can be measured:

- Braking force in kilonewtons [kN].
- Braking force difference in percent [%].
- Axle weight in kilograms [kg].
- Deceleration in percent [%].
- Out-of-roundness in percent [%].

Suspension tester SA / SN 6xx:

- Road surface adhesion in percent [%].
- Resonant frequency in hertz [Hz].

Noise simulator SN 640:

- Resonant frequency in hertz [Hz].

Side slip tester ST 600:

- Toe measurement in millimeters [mm].

3.3 Display functions

Details of the analog display can be found in the product description for the BD 6xx.

The following illustration shows the various elements of the analog display 8 kN.

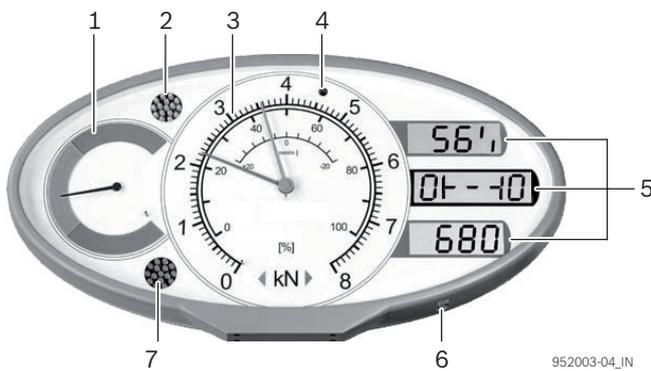


Fig. 1: Elements of analog display 8 kN

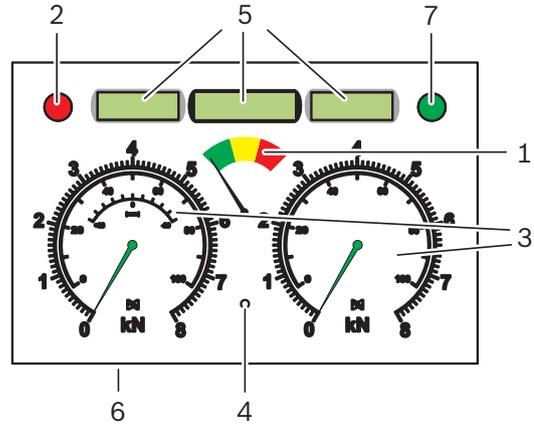


Fig. 2: Elements of analog display 2x8 kN

- 1 Evaluation display (hour-glass)
- 2 Warning lamp (red)
- 3 Measured value scales for braking force (kN), road surface adhesion (%) and toe (mm)
- 4 Infrared receiver
- 5 Digital display (LCD)
LCD 1: top / left, LCD 2: center, LCD 3: bottom / right
- 6 Automatic button
- 7 Indicator lamp (green)

3.4 Device symbols

The tester selected is indicated by a device symbol on the center LCD:

Device symbol	Tester	Passenger Vehicles	Motorcycle
	Brake dynamometer series BD 6xx		x
	Brake dynamometer series BD 6xx	x	
	Suspension tester SA / SN 6xx	x	
	Noise simulator SN 640	x	
	Side slip tester ST 600	x	

- In the case of single wheel measurements, the left or right element of the device symbol flashes to show which wheel is being measured.
- In super automatic and all-wheel super automatic modes, the current sub-task is displayed in the center of the device symbol.

3.5 Check of calibration and configuration

The following data is displayed at startup (optional):

LCD display	Explanation
	LCD 1: Firmware version
	LCD 2: Last calibration date
	LCD 3: Counter for configuration changes of the brake tester

These data are important for customer service and routine testing.

3.6 Main switch box

 The brake tester/test lane is supplied depending on the version with the main switch box or electrical cabinet.

The main switch box contains the main switch for switching ON and OFF the brake tester/test lane and is supplied BD 6xx / TL 6xx with electrical power.

 The main switch box assumes the EMERGENCY STOP function, in case there is no EMERGENCY STOP button (optional).

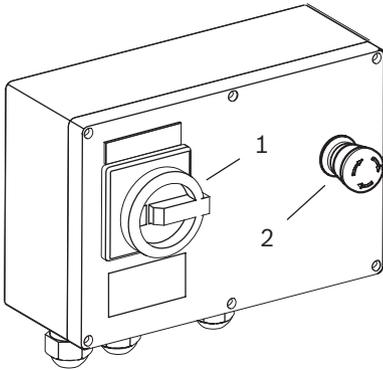


Fig. 3: Main switch box
 1 Main switch (with EMERGENCY STOP function)
 2 EMERGENCY STOP button (optional)

 The main switch box may be opened only by a qualified electrician or a certified service technician. Before the box is opened, it must have been disconnected from the power supply.

3.7 Electrical cabinet

 The brake tester/test lane is supplied depending on the version with the main switch box or electrical cabinet.

The electrical cabinet contains the main switch for switching ON and OFF the brake tester/test lane and is supplied BD 6xx / TL 6xx with electrical power.

 The main switch box assumes the EMERGENCY STOP function, in case there is no EMERGENCY STOP button (optional).

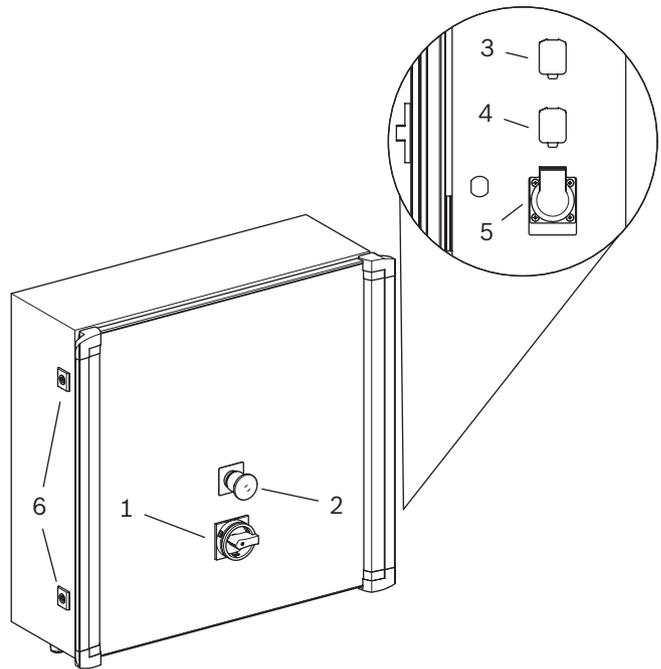


Fig. 4: Electrical cabinet
 1 Main switch (with EMERGENCY STOP function)
 2 EMERGENCY STOP button (optional)
 3 Connecting socket ASA Livestream (country specific)
 4 Connecting socket Service (standard) / USB (optional)
 5 Outlet (optional)
 6 Lock (2 x) electrical enclosure door

 The electrical cabinet may be opened only by a qualified electrician or a certified service technician. Before the cabinet is opened, it must have been disconnected from the power supply.

 The operator of the brake tester/test lane must ensure that the electrical cabinet is locked and the key to the electrical enclosure door is kept protected from unauthorized access.

4. Operation

4.1 Switching the BD 6xx / TL 6xx on and off

- BD 6xx / TL 6xx switch on and off using the main switch on the main switch box/electrical cabinet.

4.2 Operating modes

The tests and functions vary depending on the mode selected:

Mode	Test sequence	Save	Print	Single wheel	All wheel
Manual mode (normal operation)	M	M	M	M	M
Automatic mode	A	-	-	-	-
Super automatic mode	A	A	A	-	-
All-wheel super automatic mode	A	A	A	A	A

Tab. 1: Operating modes

- A Automatic
- M Manual
- Not possible

4.3 Brake test sequence

1. Select a test routine (refer to Section 4.5).

 Selection is only possible if additional test routines have been configured by Service personnel.

2. Select an operating mode and perform the measurements.
 - Manual mode (refer to Section 5).
 - Automatic mode (refer to Section 6).
 - Super automatic mode (refer to Section 7).
 - All-wheel super automatic mode (refer to Section 8).

 Factory default settings:
Test routine P1 (brake test) or L1 (test lane) and manual mode (normal operation).

The following brakes can be measured:

- Front axle service brake.
- Rear axle service brake.
- Parking brake.

The brake test sequence can be selected by the operator in manual and automatic mode. Compliance with the brake test sequence is essential in super automatic and all-wheel super automatic mode (sub-tasks).

-  The weight is required for calculation of deceleration. The weight can be entered or measured as follows:
- Manual entry using remote control unit (refer to Section 5.3.1).
Manual weight entries have precedence over measured weight values.
 - Axle load scales in brake dynamometer (special accessory).
Use is automatically made of the measured weight if the weight has not been entered manually.
 - Manual transfer of weight from suspension tester (refer to Section 5.2.2, step 3).

4.4 Notes on operation

-  When performing tests pay attention to the following information on **correct operation**.

Remaining hazard warning!



The possibility of remaining hazards cannot be excluded when using the brake dynamometer.

- Heed the safety instructions given in the "User information" manual 1 691 696 900!
- Wear protective clothing and equipment!

4.4.1 General information

- Always keep the vehicle straight when driving onto the dynamometer.
- Ensure compliance with the permissible test and driveover load (refer to technical data).
- Check the tire inflation pressure before starting measurement.
- The vehicle must be unladen when testing.
- Remain in the vehicle during the test.

4.4.2 Notes on brake testing

- Make sure tires do not scrape against the frame of the dynamometer.
- Keep to the maximum speed of 10 km/h when driving onto or over the roller mechanism.
- Avoid abrupt steering action when checking the front axle.
- Brake testing can only be performed if both the wheels of one axle press the slip rollers down within 5 seconds.

i In the event of an excessive difference between roller and wheel speed (>25%), the frictional force between the wheel and test roller is measured instead of the braking force. This measurement result is of no use for brake testing.

! Only drive off the set of rollers whilst the test rollers are turning, i.e. measurement mode must be active (manual operation in axle measuring mode or automatic operation).
Driving off with the test rollers stationary would damage the mounts of the dynamometer motors.

Shut-off criteria:

- If the vehicle runs off the set of rollers during the brake test, causing the slip rollers to move upwards, the drive rollers are automatically deactivated.
- If the braking force exceeds the frictional force between the wheel and the test rollers, the wheel starts to slip (lock up). The drive rollers of the BD 6xx are automatically deactivated to avoid damaging the tires.

4.4.3 Notes on brake testing for four-wheel drive vehicles

- All-wheel measurements are intended for vehicles with permanent four-wheel drive.
- The left and right test rollers are operated in opposite directions to guard against overloading of the vehicle limited slip differential.
- The braking forces are measured on the side turning forwards.

! Also heed the test instructions in the 4WD vehicle operating manual.

4.4.4 Notes on motorcycle brake testing

- !** Motorcycle brake testing on the car brake tester is only performed on the left roller and only in manual mode.
- Use the motorcycle cover on the left side of the rollers.
 - Use the standard cover (clipped in or hinged) on the right side of the rollers.
- !** For the „Motorcycle“ test routine, the analogue display must be equipped with LCD.

4.4.5 Notes on suspension tester

SA / SN 6xx

- Refer to the product description for setting the zero point of the axle load scales.
 - The left and right sides of the chassis are tested separately.
 - Chassis testing cannot be performed until both the wheels of one axle are positioned on the shaker plates.
 - If the vehicle runs off the set of shaker plates during the chassis test, the drive motors are automatically deactivated.
- Apply the brake during testing.

4.4.6 Notes on noise simulator

- The noise simulation function is only ever to be activated as briefly as possible.
- Heavy vehicles and low frequencies exert the greatest load on the device.
- The noise simulation function is not to be activated for more than 20 minutes per hour, taking care to ensure even distribution of the operating times and intervals (ideally: 3 minutes operation, 6 minutes interval).
- If a motor overheating smell becomes apparent, terminate the application immediately for at least 15 minutes. To permit further operation of the cooling fans, the system should not however be switched off at the master switch.

4.4.7 Notes on side slip tester

- Drive both axles at a constant speed (max. 15 km/h) over the side slip tester, taking care to keep the vehicle straight.

4.5 Selecting test routine

 Test routines contain test steps with fixed and configurable parameters (e.g. peak value display time). After switching on the BD 6xx / TL 6xx, the test routine P1 (brake test) or L1 (test lane) is selected automatically. If required, additional test routines can be configured by Service personnel.

Step	Without remote control	With remote control	Result / Analogue display
1. Start test routine selection.	 Press for 15 seconds	 +  Press one after the other	⇒ LCD 1: Current test routine. ⇒ Measurement mode is terminated. ⇒ Indicator lamp flashes. ⇒ LCD 2: Corresponding device symbol ⇒ Both pointers vertically upwards.
2. Select test routine.	 Briefly pressing button switches forwards	 or  Press one of these buttons until the required routine is displayed	⇒ 1LCD : Test routine selected. ⇒ LCD 2: Corresponding tester.
3. Confirm test routine selected.	 Press for 5 - 7 seconds	 Press Enter button	⇒ Indicator lamp ON. ⇒ Both pointers on "0" / Car Left pointer on "0", right pointer on end stop / Motorcycle ⇒ Test routine starts. ⇒ LCD (top); Drive-on prompt  → Test routine selected.

5. Manual mode (normal operation)

 Manual mode is required for the performance of single wheel measurements or for noise simulation.

Principal features:

- Test sequence can be selected by user.
- Measurements must be started manually.

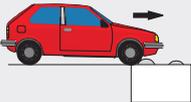
- Measurement results can be stored.
- Measurement results can be printed out.
- Single wheel measurements are possible.
- Suitable for four-wheel drive vehicles.
- Suitable for noise simulation

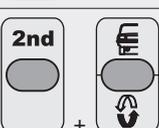
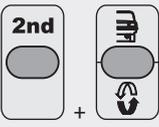
5.1 Mode activation and deactivation

Manual mode is the standard factory default setting. Following termination of other modes, the BD 6xx / TL 6xx returns to manual mode.

5.2 Brake dynamometer

5.2.1 Test sequence vehicle

Step	Analog display	Remote control unit	Result / Analog display
1. Check prerequisites: <ul style="list-style-type: none"> • No vehicle on brake dynamometer! • Test routine selected. 			⇨ Warning lamp OFF. ⇨ LCD 1: Drive-on prompt.  ⇨ LCD 2: "Brake dynamometer" device symbol. 
2. Drive vehicle onto dynamometer. <ul style="list-style-type: none"> ➤ With the axle to be measured first and keeping the vehicle straight. ➤ Disengage gear. ➤ Release brake pedal.  <p>! If the vehicle is not straight on the set of rollers, it will slide off to the side. Counter-steer until the vehicle returns to straight position on the set of rollers. Measurement is not to be started before this has been done.</p> <p> It may be necessary to drive off the set of rollers and then drive the vehicle back on.</p>			⇨ Axle to be measured is positioned on set of rollers. ⇨ If use is being made of axle load scales (special accessory): LCD 3: Axle load in kilograms. 

Step	Analog display	Remote control unit	Result / Analog display
3. Select measurement mode: – Axle measuring.	 1 second		⇒ Announcement phase: – Warning lamp flashes. – The dynamometer motors start up, the test rollers turn. – The rolling resistance is measured.
– Left single wheel measurement.	 2 x 1 second		→ Ready for braking force measurement. i The measurement can be terminated at any time with the Automatic button or the STOP button.
– Right single wheel measurement.	 3 x 1 second		
– Left 4WD single wheel measurement. i 4WD single wheel measurements are only possible with the remote control unit.			
– Right 4WD single wheel measurement. i 4WD single wheel measurements are only possible with the remote control unit.			
4. Measure out-of-roundness (optional): ➤ Press brake pedal and hold steady at a braking force greater than 500 N. ➤ Press out-of-roundness button. i This measurement is only possible with the remote control unit.		 Out-of-roundness button	⇒ The out-of-roundness of the brakes is measured for 5 seconds. ⇒ The LCD indicates the measurement result. Out-of-roundness measurement is over.
5. Measure braking forces: ➤ Slowly and steadily depress brake pedal until maximum braking force (slip) is attained. ➤ Release brake pedal again. i Shut-off criteria: – Wheel lock-up (slip monitoring). – Vehicle out of position (slip rollers no longer pressed). – Maximum braking force (slip) not attained on braking and braking action remains at rolling resistance level for more than six seconds.			⇒ Peak values are displayed (for approx. 5 seconds) – Pointer: Maximum braking force on left and right. – LCD: Value displayed depends on display option set. Refer to Section 5.3.6. → The measured values can now be stored. Refer to Section 5.3.2.
6. End of measurement for tester without motor brake. ➤ Start "Axle measuring" measurement mode ➤ Drive vehicle off set of rollers.	 1 second		→ Braking force measurement is over.

5.2.2 Motorcycle test routine

! Heed the Motorcycle test procedure safety instructions given in the "User information" manual 1 691 696 920.



Risk of motorcycle tipping over due to lateral drifting of the front wheel.

! Use the motorcycle cover on the left side of the rollers. Use the standard cover (clipped in or hinged) on the right side of the rollers.

i The motorcycle test procedure can only be implemented in manual mode.

i The weight is required for calculating the braking factor. The weight can be entered or measured as follows:

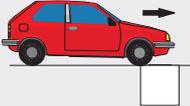
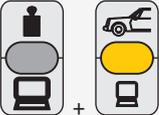
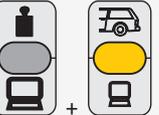
- Manual entry by way of remote control.
Manual weight entries have precedence over measured weight values.
- Axle load scales in brake tester (special accessory).
Use is automatically made of the measured weight if the weight has not been entered manually.

Step	Analogue display	Remote control	Result / Analogue display
1. Check prerequisites: <ul style="list-style-type: none"> • No motorcycle on brake tester • Test routine selected. • Pointer for right side of rollers on right end stop. 			⇨ Warning lamp OFF. ⇨ 1LCD: Drive-on prompt  ⇨ LCD 2: "Brake tester" device symbol. 
2. Drive motorcycle onto tester. <ul style="list-style-type: none"> ➢ Drive on with the wheel to be measured first and keeping the motorcycle straight. ➢ Disengage gear. ➢ Release brake pedal.  <p>! If the motorcycle is not straight on the set of rollers, it will slide off to the side. Counter-steer until the motorcycle returns to straight position on the set of rollers. Measurement is not to be started before this has been done.</p> <p>i It may be necessary to drive off the set of rollers and then drive the motorcycle back on.</p>			⇨ Wheel to be measured is positioned on set of rollers. ⇨ If use is being made of axle load scales (special accessory): 3LCD: Wheel load in kilogrammes. 

Step	Analogue display	Remote control	Result / Analogue display
<p>3. Start of measurement</p>			<p>⇒ Announcement phase:</p> <ul style="list-style-type: none"> – Warning lamp flashes. – The tester motor starts up, the test roller turns. – The rolling resistance is measured. <p>→ Ready for braking force measurement.</p> <p>ⓘ The measurement can be terminated at any time with the Automatic button or the STOP button.</p>
<p>4. Out-of-roundness measurement (optional):</p> <ul style="list-style-type: none"> ➤ Press brake pedal and hold steady at a braking force greater than 500 N. ➤ Press out-of-roundness button. <p>ⓘ This measurement is only possible using remote control.</p>		 <p>Out-of-roundness button</p>	<p>⇒ The out-of-roundness of the brakes is measured for 5 seconds.</p> <p>⇒ 2LCD shows the measurement result.</p> <p>10.--</p>
<p>5. Braking force measurement:</p> <ul style="list-style-type: none"> ➤ Slowly and steadily depress brake pedal until maximum braking force (slip) is attained. ➤ Release brake pedal again. <p>ⓘ Shut-off criteria:</p> <ul style="list-style-type: none"> – Wheel lock-up (slip monitoring). – Motorcycle drift (touch roller no longer pressed). – Maximum braking force (slip) not attained on braking and braking action remains at rolling resistance level for more than six seconds. 			<p>⇒ Peak values are displayed (for approx. 5 seconds).</p> <ul style="list-style-type: none"> – Pointer: Maximum braking force – LCD: Value displayed depends on display option set <p>→ The measured values can now be stored.</p>
<p>6. End of measurement for tester without motor brake.</p> <ul style="list-style-type: none"> ➤ Start of measurement ➤ Drive motorcycle off set of rollers. 			<p>→ Braking force measurement over.</p>

5.2.3 Test sequence for suspension tester

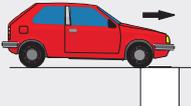
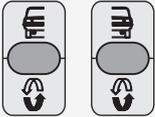
 The suspension tester is always provided with axle load scales.

Step	Remote control	Result / Analog display
1. Check prerequisites: <ul style="list-style-type: none"> • No vehicle on dynamometer! • Test routine selected 		⇨ Warning lamp OFF ⇨ LCD 1: Drive-on prompt  ⇨ LCD 2: "Suspension tester" device symbol 
2. Drive onto the suspension tester with the axle to be measured first and keeping the vehicle straight . Press the brake to stop the vehicle moving. 		⇨ Axle to be measured is positioned in suspension tester. ⇨ LCD 3 indicates axle load (kg). 
3. Store axle weight.  If the suspension tester is only being used to measure the axle weight for a brake test:	 Front axle load  Rear axle load	⇨ Axle weight is stored. ⇨ Continue with step 6.
4. Select measurement mode: <ul style="list-style-type: none"> • Axle measuring • Left single wheel measurement • Right single wheel measurement 	 Axle measuring  Left single wheel  Right single wheel	⇨ Announcement phase: <ul style="list-style-type: none"> - Warning lamp flashes - Device symbol flashes → Ready for chassis measurement  The measurement can be terminated at any time with the Automatic button or the STOP button.

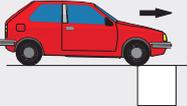
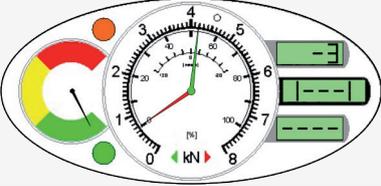
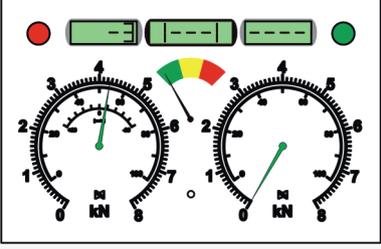
Step	Remote control	Result / Analog display
<p>5. Shaker plate motor starts up.</p> <p> For axle measuring, the left side is measured first and then the right side.</p>		<ul style="list-style-type: none"> ⇒ Warning lamp OFF. ⇒ Flashing side of device symbol indicates active shaker plate. ⇒ Vehicle is caused to oscillate. ⇒ Motor stops after approx. 4 seconds. ⇒ Measurement commences. ⇒ Peak values are displayed (for approx. 5 seconds). <ul style="list-style-type: none"> – Evaluation display: Qualitative assessment of road surface adhesion. – Pointer: Left and right side road surface adhesion in percent. – LCDs switch between road surface adhesion (%) and resonant frequency (Hz). <p>LCD 1: Left side</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px; background-color: #d9ead3;">74.1</div> <div style="border: 1px solid black; padding: 2px 5px; background-color: #d9ead3;">16Hz</div> </div> <p>LCD 3: Right side</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px; background-color: #d9ead3;">68.1</div> <div style="border: 1px solid black; padding: 2px 5px; background-color: #d9ead3;">15Hz</div> </div> <p>→ The measured values can now be stored. Refer to Section 5.3.2.</p>
<p>6. Drive vehicle out of suspension tester.</p>		<p>→ Chassis measurement is over.</p>

5.2.4 Noise simulator test sequence

 The noise simulator can only be used in manual mode.

Step	Remote control	Result / Analog display
1. Check prerequisites: <ul style="list-style-type: none"> • No vehicle on dynamometer! • Test routine selected. 		⇨ Warning lamp OFF. ⇨ LCD 1: Drive-on prompt.  ⇨ LCD 2: "Noise simulator" device symbol. 
2. Drive onto the suspension tester with the axle to be measured first and keeping the vehicle straight . Press the brake to stop the vehicle moving. 		⇨ Axle to be measured is positioned in noise simulator.
3. Select measurement mode: <ul style="list-style-type: none"> • Left single wheel measurement. • Right single wheel measurement. 		⇨ Announcement phase: <ul style="list-style-type: none"> - Warning lamp flashes. - Device symbol flashes. ⇨ Ready for noise measurement.  The measurement can be terminated at any time with the Automatic button or the STOP button.
4. Motor of selected shaker plate starts up.  The motor runs until the maximum test time is completed (standard value 180 seconds).		⇨ Warning lamp OFF. ⇨ Vehicle is caused to oscillate. ⇨ Flashing side of device symbol indicates active shaker plate.
5. Vary the frequency and listen for noise.	 0.5 Hz higher  0.5 Hz lower	⇨ LCD 3: Frequency (Hz).  The measured values can now be stored. Refer to Section 5.3.2.
6. Drive vehicle out of noise simulator.		→ Noise measurement is over.

5.2.5 Test sequence for side slip tester

Step	Result / Analog display
<p>1. Check prerequisites:</p> <ul style="list-style-type: none"> • No vehicle on dynamometer! • Test routine selected. 	<p>⇒ Warning lamp ON.</p> <p>⇒ LCD 1: Drive-on prompt.</p>  <p>⇒ LCD 2: "Side slip tester" device symbol.</p>  <p>⇒ Ready for toe measurement.</p>
<p>2. Keeping the vehicle straight, drive both axles at a constant speed over the side slip tester. Speed max. 15 km/h.</p> 	<p>⇒ Front axle toe is measured.</p> <p>⇒ Peak value display (approx. 5 seconds).</p> <ul style="list-style-type: none"> – Evaluation display: Assessment of toe. – Pointer on toe value scale: Toe value (mm). – LCD 1: Toe value (mm).   <p>→ The measured values can now be stored. Refer to Section 5.3.2.</p> <p>→ Toe measurement is over.</p>

5.3 Remote control options

5.3.1 Manual entry of weights

! Manual weight entries have precedence over measured weight values.

Step	Remote control unit	Result / Analog display
1. Start weight entry. ⓘ Pressing the button again terminates the entry without making any changes.		⇨ LCD 3: "0". 
2. Enter weight. Example: 1235 = 1x1000, 2x100, 3x10, 5x1 ⓘ CL (Clear Last) button resets the weight to 0 kg.	    	⇨ LCD 3: Weight entered in kg. 
3. Store the weight. <ul style="list-style-type: none"> • Total weight (vehicle weight + weight of operator). • Axle weight/front axle. • Axle weight/rear axle. • Axle weight/parking brake. ⓘ Weight entry: <ul style="list-style-type: none"> - Weights can be overwritten. - Storing a weight of 0 kg deletes the last entry. 	   	→ Weight entered is stored.

5.3.2 Storing measured values

Step	Remote control unit	Result / Analog display
➤ Assignment and storage of current measured values: <ul style="list-style-type: none"> • Front axle. • Rear axle. 	 	→ The current measured values are stored.
• Parking brake: <ul style="list-style-type: none"> - Default: parking brake rear axle - Assignment of the parking brake to the front axle 	  + 2 s + 	ⓘ Assignment of the parking brake to the front axle is only possible within 5 seconds after pressing the button. → The current measured values are stored.

5.3.3 Display repetition

Step	Remote control unit	Result / Analog display
➤ Display measured values stored: <ul style="list-style-type: none"> • Front axle service brake. • Rear axle service brake. • Parking brake. 		➔ The stored brake measured values are displayed.
➤ Display out-of-roundness.		➔ The out-of-roundness is displayed.
➤ Display stored total weight.		➔ The stored total weight is displayed.

5.3.4 Deleting stored values

Step	Remote control unit	Result / Analog display
➤ Deletion of last measured value stored (CL = Clear Last).		⇒ The last measured value stored is deleted (e.g. rear axle service brake measured value).
➤ Deletion of all stored values (CA = Clear All).		⇒ All the stored values are deleted (weights, measured values).

5.3.5 Displaying total deceleration

The total deceleration is the end result of the brake test.

Step	Remote control unit	Result / Analog display
➤ Display total deceleration: <ul style="list-style-type: none"> • Service brake. • Parking brake. 		➔ The calculated total brake deceleration is displayed.

5.3.6 LCD switching

Step	Remote control unit	Result / Analog display
<p>➤ LCD switching:</p> <ul style="list-style-type: none"> • Braking force difference in %. • Pedal force. • Weight. • Deceleration in %. 	 <p>Switch to next value (cyclical)</p>	<p>➔ The LCD indicates the designation and then the value of the measurement quantity.</p>    

5.3.7 Print-out of measurement results

 Print-out is only possible if a printer set is available (special accessory).
Only stored values can be printed out.

Step	Remote control unit	Result / Analog display
1. Make sure the printer is switched on.		⇒ Printer is switched on
<p>2. Start print task.</p> <p> oFF appears on the LCD if no printer is found.</p>		<p>⇒ LCD 2:</p>  <p>⇒ LCD 3: Printer symbol and number of started print-outs (number of printers x number of print-outs).</p>  <p>⇒ Measurement results are printed out.</p>

6. Automatic mode

 Automatic mode is recommended for rapid performance of one or more measurements not requiring verification of the measured data.

Principal features:

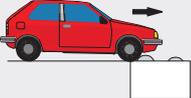
- Test sequence can be selected by user.
- Automatic starting of measurements.
- No storage of measurement results.
- No print-out of measurement results.

6.1 Activating and deactivating automatic mode

Step	Analog display	Remote control unit	Result / Analog display
➤ Automatic mode activation.	 Press for 1 second		⇒ Warning lamp ON. ⇒ LCD 1: <i>Auto on</i>
➤ Automatic mode deactivation.	 Press for 1 second		⇒ Warning lamp OFF. ⇒ LCD 1: <i>Auto off</i>

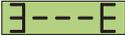
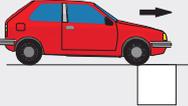
6.2 Test sequence

6.2.1 Brake dynamometer test sequence

Step	Result / Analog display
1. Check prerequisites: <ul style="list-style-type: none"> • No vehicle on dynamometer! • Test routine selected. • "Automatic" mode selected. 	⇒ Warning lamp ON. ⇒ LCD 1 Drive-on prompt.  ⇒ LCD 2: "Brake dynamometer" device symbol. 
2. Drive vehicle onto dynamometer. <ul style="list-style-type: none"> ➤ With the axle to be measured first and keeping the vehicle straight. ➤ Disengage gear. ➤ Release brake pedal.  <p>! If the vehicle is not straight on the set of rollers, it will slide off to the side. Counter-steer until the vehicle returns to straight position on the set of rollers. Measurement is not to be started before this has been done.</p> <p> It may be necessary to drive off the set of rollers and then drive the vehicle back on.</p>	⇒ Axle to be measured is positioned on set of rollers. ⇒ If use is being made of axle load scales (special accessory): LCD 3 indicates axle load (kg).  ⇒ Announcement phase: <ul style="list-style-type: none"> – Warning lamp flashes, device symbol flashes. – The dynamometer motors start up, the test rollers turn. – The rolling resistance is measured. ⇒ Ready for braking force measurement.

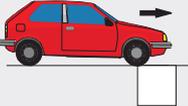
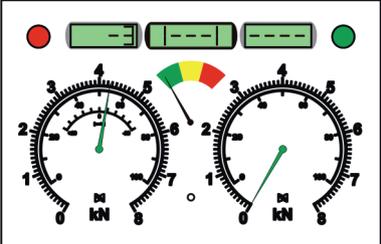
Step	Result / Analog display
3. Automatic brake test commences.  Measurements are only possible on an axle basis in Automatic mode.	⇨ Warning lamp ON.
4. Measure out-of-roundness (optional): ➤ Slowly press brake pedal until braking forces on left and right are greater than 1000 N. ➤ Reduce braking force back down to rolling resistance.	⇨ The brake dynamometer recognizes this action as the starting signal for measuring out-of-roundness. ⇨ Out-of-roundness measurement starts 3 seconds after releasing brake pedal.
➤ Press brake pedal and hold steady at a braking force greater than 500 N.	⇨ The out-of-roundness of the brakes is measured for 5 seconds. ⇨ The LCD indicates the measurement result. 
5. Measure braking forces: <ul style="list-style-type: none"> • Slowly and steadily depress brake pedal until maximum braking force (slip) is attained. • Release brake pedal again.  Shut-off criteria: <ul style="list-style-type: none"> – Wheel lock-up (slip monitoring). – Vehicle out of position (slip rollers no longer pressed). – Maximum braking force (slip) not attained on braking and braking action remains at rolling resistance level for more than six seconds. 	→ Out-of-roundness measurement is over. ⇨ Peak value display (approx. 5 seconds). <ul style="list-style-type: none"> – Pointer: Maximum braking force on left and right. – LCD: Value displayed depends on display option set (refer to Section 5.3.6).
6. Wait until set of rollers starts up again automatically. Then drive vehicle off set of rollers.	→ Braking force measurement is over.

6.2.2 Test sequence for suspension tester

Step	Result / Analog display
1. Check prerequisites: <ul style="list-style-type: none"> • No vehicle on dynamometer! • Test routine selected. • "Automatic" mode selected. 	⇨ Warning lamp ON. ⇨ LCD 1: Drive-on prompt.  ⇨ LCD 2: "Suspension tester" device symbol. 
2. Drive onto the suspension tester with the axle to be measured first and keeping the vehicle straight . Press the brake to stop the vehicle moving. 	⇨ Axle to be measured is positioned in suspension tester. ⇨ LCD 3: Axle load (kg).  ⇨ Announcement phase: <ul style="list-style-type: none"> - Warning lamp flashes. - Device symbol flashes. - Hour-glass starts to run down. ⓘ If the vehicle is removed from the suspension tester before the hour-glass has run down, the axle weight is stored (the suspension tester is only used to measure the axle weight for a brake test). ⇨ Ready for chassis measurement.
3. Shaker plate motor starts up. ⓘ For axle measuring, the left side is measured first and then the right side.	⇨ Flashing side of device symbol indicates active shaker plate. ⇨ Vehicle is caused to oscillate. ⇨ Motor stops after approx. 4 seconds. ⇨ Measurement commences. ⇨ Peak values are displayed (for approx. 5 seconds) <ul style="list-style-type: none"> - Evaluation display: Qualitative assessment of road surface adhesion. - Pointer: Left and right side road surface adhesion in percent. - LCDs switch between road surface adhesion (%) and resonant frequency (Hz). LCD 1: Left side   LCD 3: Right side  
4. Drive vehicle out of suspension tester.	→ Chassis measurement is over.

6.2.3 Test sequence for side slip tester

 If no subsequent measurement is taken, the first toe measurement is identified as an incorrect measurement and is rejected.

Step	Result / Analog display
<p>1. Check prerequisites:</p> <ul style="list-style-type: none"> • No vehicle on dynamometer! • Test routine selected. • "Automatic" mode selected. 	<p>⇒ Warning lamp ON</p> <p>⇒ LCD 1: Drive-on prompt.</p>  <p>⇒ LCD 2: "Side slip tester" device symbol.</p>  <p>⇒ Ready for toe measurement.</p>
<p>2. Keeping the vehicle straight, drive both axles at a constant speed over the side slip tester. Speed max. 15 km/h.</p> 	<p>⇒ Front axle toe is measured.</p> <p>⇒ Peak value display (approx. 5 seconds).</p> <ul style="list-style-type: none"> - Evaluation display: Assessment of toe. - Pointer on toe value scale: Toe value (mm). - LCD 1: Toe value (mm).   <p>→ Toe measurement is over.</p>

7. Super automatic mode

 Super automatic mode is recommended for full testing of a vehicle requiring verification of the measured data.

Features of super automatic mode:

- Specified test sequence (sub-tasks).
- Automatic starting of measurements.
- Automatic storage of measurement results.
- Automatic print-out of measurement results.

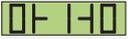
-  The following applies in super automatic mode:
- Termination of the test sequence (Automatic button or **STOP**) causes all the stored values to be deleted (Clear All).
 - If the test sequence is not continued, the BD 6xx / TL 6xx returns to manual mode after approx. 5 minutes. The stored values are deleted (Clear All).
 - Auto-termination of the order after a pre-configured time period.

-  Special features of ST 600 test sequence
- Automatic resetting of incorrect measurements: If no subsequent measurement is taken, the first toe measurement is identified as an incorrect measurement and is rejected.

7.1 Activating and deactivating super automatic mode

Step	Analog display	Remote control unit	Result / Analog display
➤ Activate super automatic mode.	 Press for 3 seconds	 + 	⇒ Warning lamp ON. ⇒ LCD 1: <i>Auto on</i>
➤ Deactivate super automatic mode.	 Press for 1 second		⇒ Warning lamp OFF. ⇒ LCD 1: <i>Auto off</i>

7.2 Test sequence

Step	Result / Analog display
1. Check prerequisites: <ul style="list-style-type: none"> • No vehicle on dynamometer! • Test routine selected. • "Super automatic" mode selected. 	⇒ Warning lamp ON. ⇒ LCD 1: Drive-on prompt.
 It is essential to comply with the test sequence (sequence of sub-tasks).	 ⇒ LCD 2: Device identifier and current sub-task (flashing): 1 = Front axle. 2 = Rear axle. P = Parking brake.
	

The rest of the test sequence is similar to Automatic mode (Section 6).

7.3 Brake test options

7.3.1 Repetition of sub-task (Clear Last)

 This option is deactivated in the standard configuration.

Step	Result / Analog display
<ul style="list-style-type: none"> ➤ After end of peak value display 	<ul style="list-style-type: none"> ⇨ The dynamometer motors start up, the test rollers turn
<ul style="list-style-type: none">  The Clear-Last-Option is displayed for 3 seconds. 	<ul style="list-style-type: none"> ⇨ LCD 3: "CL" on (Clear Last) <div style="text-align: center; margin-top: 5px;">  </div>
<ul style="list-style-type: none"> ➤ Give a brief braking pulse (braking force is configurable). 	<ul style="list-style-type: none"> ⇨ Results of the current sub-task (1, 2 or P) are deleted. ➔ The current sub-task is repeated.

7.3.2 Parking brake on front axle

 This option is deactivated in the standard configuration.

Step	Result / Analog display
<ul style="list-style-type: none"> ➤ Option appears after the peak values or the Clear-Last-Option of the front axle (sub-task 1) were displayed. 	<ul style="list-style-type: none"> ⇨ The dynamometer motors run, the test rollers turn ⇨ LCD 1:"[]" <div style="text-align: center; margin-top: 5px;">  </div>
<ul style="list-style-type: none">  The option „parking brake on front axle“ is displayed for 3 seconds. 	
<ul style="list-style-type: none"> ➤ Give a brief braking pulse (braking force is configurable). 	<ul style="list-style-type: none"> ⇨ Switching to parking brake. (test procedure 1-2-P ⇒ 1-P-2) ➔ Parking brake measurement commences.

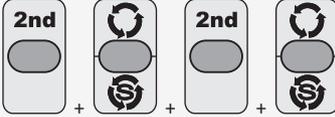
8. All-wheel super automatic mode

 All-wheel super automatic mode is recommended for full testing of a four-wheel drive vehicle requiring verification of the measured data.

Principal features:

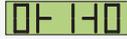
- Specified test sequence (sub-tasks).
- Automatic starting of measurements.
- Automatic storage of measurement results.
- Auto-termination of the order after a pre-configured time period.
- Automatic print-out of measurement results.
- Suitable for four-wheel drive vehicles.

8.1 Activating and deactivating all-wheel super automatic mode

Step	Remote control unit	Result / Analog display
➤ Activate all-wheel super automatic mode.	 Press one after the other	⇨ Warning lamp ON. ⇨ LCD 1: <i>Auto on</i> ⇨ LCD 3: <i>4--4</i>
➤ Deactivate all-wheel super automatic mode.		⇨ Warning lamp OFF. ⇨ LCD 1: <i>Auto off</i>

8.2 Test sequence

 Also heed the test instructions in the 4WD vehicle operating manual.

Step	Result / Analog display
1. Check prerequisites: <ul style="list-style-type: none"> • No vehicle on dynamometer! • Test routine selected. • "All-wheel super automatic" mode selected. 	⇨ Warning lamp ON. ⇨ LCD 1: Drive-on prompt. 
 Each sub-task consists of two single wheel measurements with direction reversal.	⇨ LCD 2: Device identifier and current sub-task (flashing): <i>1</i> = Front axle. <i>2</i> = Rear axle. <i>P</i> = Parking brake.
 It is essential to comply with the test sequence (sequence of sub-tasks)!	

The rest of the test sequence is similar to super automatic mode (Section 7).

9. Fault procedure

9.1 General information

A warning or fault is displayed in the event of a malfunction in a system component or a problem with the test sequence.

Warnings

Warnings can be acknowledged. Restricted BD 6xx / TL 6xx operation is still possible following acknowledgement of the warning.

The following example illustrates the analog display when a warning has occurred.

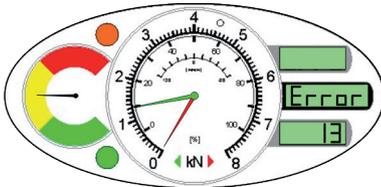


Fig. 5: Analog display in the event of a warning (example)

- Assessment scale: Yellow.
- Green pointer: Message number (e.g. 1.3 kN = 13).
- LCD: **Error** and message number.

Faults

Faults cannot be acknowledged. Operation is no longer possible after a fault.

The following example illustrates the analog display when a fault has occurred.

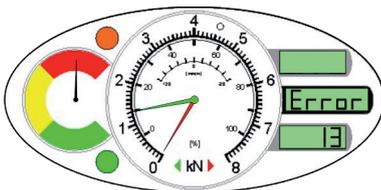


Fig. 6: Analog display in the event of a fault (example)

- Assessment scale: Red.
- Green pointer: Message number (e.g. 1.3 kN = 13).
- LCD: **Error** and message number.

9.2 Acknowledgement of warnings

Warnings must be acknowledged by the user to permit further operation of the BD 6xx / TL 6xx. The following methods can be used to acknowledge warnings:

- Analog display:
Press the Automatic button.



- Remote control:
Press the **STOP** button.



9.3 Brake dynamometer series BD 6xx

9.3.1 Warnings

Error	Explanation
1	Vehicle on set of rollers when switched on
2	Front left scales sensor cable break
3	Rear left scales sensor cable break
4	Front right scales sensor cable break
5	Rear right scales sensor cable break
7	Zero point too high – left braking force sensor
8	Zero point too high – right braking force sensor
9	Zero point too high – front left scales sensor
10	Zero point too high – rear left scales sensor
11	Zero point too high – front right scales sensor
12	Zero point too high – rear right scales sensor
13	Zero point too high – pedal force sensor
14	Different position of slip rollers in automatic / super automatic mode
15	Not possible to store measurement
16	Direction reversal not supported by power box

9.3.2 Faults

Error	Explanation
1	Left braking force sensor cable break
2	Right braking force sensor cable break
3	Left wheel slip roller cable break
4	Right wheel slip roller cable break
5	Left slip roller cable break
6	Right slip roller cable break
7	Amplifier defective – left wheel slip roller
8	Amplifier defective – right wheel slip roller
9	Amplifier defective – left slip roller
10	Amplifier defective – right slip roller
11	Slip roller spring broken
13	Sensor defective – left slip roller
14	Sensor defective – right slip roller
15	Write error in configuration memory (EEPROM) of tester
16	Vehicle in the rollerset when the test program starts
17	Motor controlling failed

9.4 Suspension tester SA / SN 6xx

9.4.1 Warnings

Error	Explanation
1	Vehicle on suspension tester when switched on
2	Zero point too high – left scales sensor
3	Zero point too high – right scales sensor
4	Measured values invalid
5	No valid data available
6	No vehicle on suspension tester
10	Measured value buffer overflow
11	Power box temperature exceeded Wait approx. 30 minutes before continuing with measurement. Keep measurement cycles as short as possible.
15	Filing error

With SN 640 additionally:

Error	Explanation
12	Temperature exceeded – left motor
13	Temperature exceeded – right motor
50	Communication problem with frequency converter. Operation no longer possible
51	Initialization error: No valid baud rate found. Operation no longer possible

! To protect the motors of the suspension tester against overheating, the software terminates operation of the device as soon as the set running time (standard = 180 sec) is exceeded. Renewed switch-on is possible. Always heed the information in the product description.

! Temperature monitoring SN 640 V2 (optional)
If equipped with temperature monitoring (temperature sensors at motors), the device can no longer be switched on as of a motor temperature of 90 °C. The motors must first be allowed to cool down to 60 °C.

9.4.2 Faults

Error	Explanation
1	Left scales sensor cable break
2	Right scales sensor cable break

9.5 Side slip tester ST 600

9.5.1 Warnings

Error	Explanation
1	Zero point invalid – toe sensor

9.5.2 Faults

Error	Explanation
1	Toe sensor cable break
2	Amplifier defective – toe sensor

10. Appendix

10.1 Setting the date and time

The date and time must be set in the following situations:

- For print-out.
- After a power cut.
- When switching from summer to winter time.

 The date and time can only be set by way of remote control.
 Only makes sense if there is a analog display with LCD.

Step	Remote control	Result / Analog display
1. Exit from test routine.	 + 	⇒ Indicator lamp flashes. Warning lamp OFF. ⇒ Current test routine is displayed (e.g. <i>P 1</i>).
2. Select configuration mode for time and date.		⇒ Warning lamp ON. ⇒ Hours and minutes are displayed (e.g. <i>12 . 10</i>).
3. Enter hours and minutes. Example: 12:35 = 1x1000, 2x100, 3x10, 5x1	   	⇒ Time is entered (e.g. <i>12 . 35</i>).
4. Confirm entry.		⇒ Month and day are displayed (e.g. <i>10 . 03</i>).
5. Enter month and day and confirm entry.	See step 3 and 4.	⇒ Month and day are entered. ⇒ Year is displayed (e.g. <i>2009</i>).
6. Enter year and confirm entry.	See step 3 and 4.	⇒ Year is set.
7. Store all settings.		⇒ Return to operating system. ⇒ Warning lamp OFF. ⇒ Current test routine is displayed (e.g. <i>P 1</i>). → Date and time are set.

10.2 Calculation methods

10.2.1 Deceleration

Deceleration is a measure of the performance of a braking system. It is specified as the percentage ratio of braking force to weight.

Axle deceleration

$$Z = \frac{F_{\text{axis}}}{G_{\text{axis}} * g} \times 100 \%$$

Z	Deceleration in percent
F_{axis}	Axle braking force
G_{axis}	Axle weight
g	Acceleration due to gravity

Total deceleration

$$Z = \frac{F_{\text{front}} + F_{\text{rear}}}{G_{\text{total}} * g} \times 100 \%, \quad G_{\text{total}} = G_{\text{vehicle}} + G_{\text{test person}}$$

Z	Deceleration in percent
F_{front}	Front axle braking force
F_{rear}	Rear axle braking force
G_{total}	Total weight
G_{vehicle}	Vehicle weight
$G_{\text{test person}}$	Weight of tester
g	Acceleration due to gravity

Parking brake deceleration

$$Z = \frac{F_{\text{hand}}}{G_{\text{total}} * g} \times 100 \%, \quad G_{\text{total}} = G_{\text{vehicle}} + G_{\text{test person}}$$

Z	Deceleration in percent
F_{hand}	Braking force of parking brake
G_{total}	Total weight
G_{vehicle}	Vehicle weight
$G_{\text{test person}}$	Weight of tester
g	Acceleration due to gravity

10.2.2 Out-of-roundness

The pedal force is kept constant. The BD 6xx / TL 6xx measures the resultant minimum and maximum braking force. The out-of-roundness is calculated as follows:

$$(\sim) = \frac{F_{\text{max}} - F_{\text{min}}}{F_{\text{max}}} \times 100 \%$$

(~)	Out-of-roundness in percent
F_{max}	Maximum braking force
F_{min}	Minimum braking force

10.2.3 Road surface adhesion

Road surface adhesion is calculated as the ratio between the minimum dynamic wheel load in the resonant range and the static wheel load.

$$(\downarrow) = \frac{RD}{RS} \times 100 \%$$

(↓)	Road surface adhesion in percent
RD	Minimum dynamic wheel load
RS	Static wheel load (weight)

(↓)	Evaluation	Evaluation display (analog display)
60 – 100 %	Good	Green
40 – 59 %	Adequate	Yellow
20 – 39 %	Critical	Red
0 – 19 %	Inadequate	Red