

BM X010 TURBO BRAKE TESTERS FOR LIGHT VEHICLES



USER MANUAL

BM1010 Turbo Brake tester
BM3010 Turbo Brake tester
BM4010 Turbo Brake tester
BM7010 Turbo Brake tester
BM9010 Turbo Brake tester

EDITION

08-2017 Version 6.0

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TO THE OPERATOR

It is strongly recommended that the operator read this manual carefully before any attempt to use the brake tester is made.

The manual might cover options and features not included in your machine.

TABLE OF CONTENT

| | | |
|----------|---|-----------|
| 1 | SAFETY | 5 |
| 1.1 | Symbols | 5 |
| 1.2 | Safety regulation for installation, commissioning and servicing | 5 |
| 1.3 | Safety regulation for usage | 5 |
| 1.4 | Safety regulation for operator maintenance and safety regulations | 5 |
| 1.5 | Safety precautions – brake testing area | 6 |
| 2 | GENERAL | 7 |
| 2.1 | Introduction | 7 |
| 2.1.1 | Slip system | 8 |
| 2.1.2 | Physical display | 8 |
| 2.1.3 | The BM250 Wheel play detector | 9 |
| 2.1.4 | The BM1010 Turbo | 11 |
| 2.1.4.1 | MC wheel clamp | 13 |
| 2.1.4.2 | BM1010 on-ground installation | 14 |
| 2.1.5 | The BM3010 Turbo roller bed | 16 |
| 2.1.6 | The BM4010 Turbo roller bed | 17 |
| 2.1.7 | The BM7010 Turbo roller bed | 18 |
| 2.1.8 | The BM9010 Turbo roller bed | 20 |
| 2.1.9 | Side slip and suspension tester | 22 |
| 2.1.9.1 | BM810 Side slip tester | 22 |
| 2.1.9.2 | BM910 Side slip tester | 23 |
| 2.1.9.3 | BM40010 suspension tester | 24 |
| 2.2 | The wireless remote controls and cable remote control | 26 |
| 2.2.1 | The PRINT key | 28 |
| 2.3 | Key in calculation weight | 29 |
| 3 | GENERAL TEST PROCEDURES BM3010 – BM9010 | 31 |
| 3.1 | Introduction | 31 |
| 3.2 | Guided mode | 31 |
| 3.3 | Manual mode | 32 |
| 3.4 | Single sided test | 33 |
| 3.5 | Automatic mode | 34 |
| 3.6 | Test of constant 4x4 driven vehicles | 34 |
| 3.7 | Test with side slip meter | 35 |
| 3.8 | Testing with pedal pressure meter | 36 |
| 3.9 | Using the BM01 brake pedal applicator | 37 |
| 3.9.1 | Placing the BM01 | 37 |
| 3.9.2 | Removing the BM01 | 38 |
| 4 | GENERAL TEST PROCEDURE FOR SIDE SLIP, SUSPENSION TESTER AND BRAKE TESTER | 39 |
| 5 | GENERAL TEST PROCEDURES FOR BM1010 MOTORCYCLE | 41 |
| 5.1 | Motorcycles with 2 controls | 42 |
| 5.2 | Motorcycles with linked or dual system | 43 |
| 5.3 | Workshop MOT test procedure with printout | 45 |
| 5.3.1 | Motorcycles with 2 controls | 45 |

| | | |
|-----------|---|-----------|
| 5.3.2 | Motorcycles with linked or dual system | 46 |
| 5.4 | General manual mode with automatic weight system | 48 |
| 5.5 | General manual mode with manual entry of total weight | 49 |
| 5.6 | Automatic mode | 50 |
| 5.7 | Using the pedal force meter | 50 |
| 6 | THE BM FLEXCHECK TL WINDOWS PROGRAM | 51 |
| 7 | SAFETY ASPECTS AND ERROR CODES | 54 |
| 8 | MAINTENANCE..... | 55 |
| 9 | MOUNTING, DISMOUNTING AND SERVICE | 55 |
| 9.1 | Use of service trolley | 55 |
| 10 | CALIBRATION | 56 |
| 10.1 | Integrated calibration printout | 56 |
| 10.2 | Calibration with rolling rollers..... | 56 |
| 10.3 | Brake force calibration procedure | 56 |
| 10.4 | Brake tester and suspension weight calibration procedure..... | 58 |
| 10.5 | Side slip calibration..... | 59 |
| 11 | SETTING THE TIME/DATE ON THE ELECTRONICS | 63 |
| 11.1 | Setting the time/date from a PC | 63 |
| 11.2 | Setting the time/date without PC | 63 |

1 SAFETY

Please read this manual thoroughly before using the equipment and make sure, that this manual is placed close to the equipment for reference. BM is not liable for equipment damages, service costs or personal injury caused by incorrect use of the equipment.

The BM brake testers are designed with safety precautions that comply with demands of greatest possible safety while operating the brake tester. Nevertheless, it is recommended that the owner and the operator are always aware of the danger present while operating the brake tester. The following outlines general safety precautions recommended when operating the brake tester.

1.1 Symbols



In-correct use according to instructions can cause damage to persons or equipment.



Information to the operator, which is of high importance for operating the equipment correctly.

1.2 Safety regulation for installation, commissioning and servicing

The equipment may only be installed, commissioned and maintained by BM authorised service engineers.



Gloves must be worn when handling the equipment, including but not limited to all cover plates, rails and drive on/off ramps.

1.3 Safety regulation for usage

Only operators trained by authorised BM Training Officers may use the equipment. Keep unauthorised persons away from the equipment.

1.4 Safety regulation for operator maintenance and safety regulations



The operator must check the chain tension once a week, and then fill in corresponding log-book.



In case of power failure, the operator must close BM FlexCheck RBT and close down PC within a maximum of 5 minutes after power failure, in order not to damage PC, BM FlexCheck or lose test data.



The operator must close BM FlexCheck RBT and close down the PC before the station is closed. Failure not to do so can in conjunction with a power failure cause damage to the PC, BM FlexCheck or loose test data.

SAFETY



The operator must follow the data back up procedure, when prompted by the BM FlexCheck RBT.



Always power off the PC when the GVTs station closes for the day.



Chain tension check must take place once a week.



Always follow procedure for backup of test data on PC.

1.5 Safety precautions – brake testing area



It is preferred to place the brake tester in a designated and clearly marked area:

“ TESTING AREA - FOR USE BY AUTHORISED PERSONNEL ONLY”



When the brake tester is NOT IN USE:

- A vehicle should never be left standing on the rollers as this can cause the rollers to start.
- If supplied, separate roller cover plates should always be placed over the rollers.



When the brake tester is IN USE:

- No unauthorised persons should be allowed near the rollers.
- No persons should be allowed examining or working on the wheels or under the vehicle for any reason at all.



The brake tester should not be left switched on while unattended.



Where the test area is indoor provision should be made to extract the exhaust gases

GENERAL

2 GENERAL

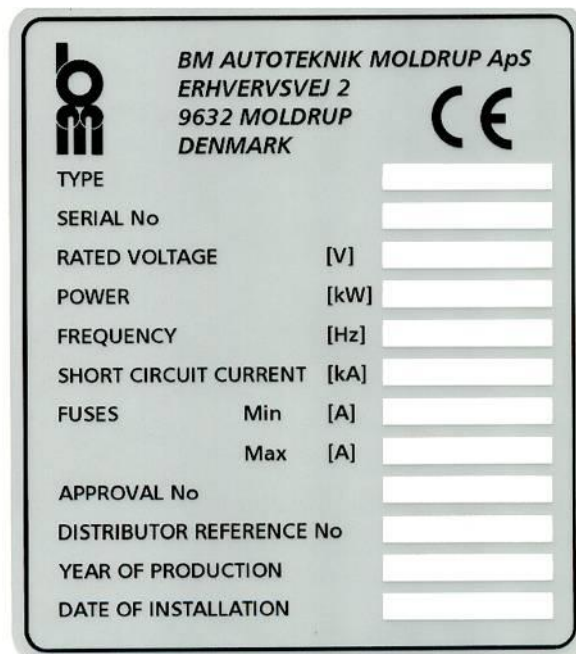
2.1 Introduction

The BM brake test series:

- BM1010 Turbo Brake tester
- BM3010 Turbo Brake tester
- BM4010 Turbo Brake tester
- BM7010 Turbo Brake tester
- BM9010 Turbo Brake tester

are advanced microprocessor based brake testers for test of light vehicles. The brake testers are – depending on model - designed for test of vehicles up to 5000 kg axle load.

The brake tester is marked with the following machine label, which shows electrical requirement:



The brake tester is operational within environmental temperature range from -10 °C to + 50 °C.

The brake testers consist of a roller set and a display. The roller set consists of an integral motorised gearbox, two main rollers and a spring loaded sensor roller, all placed in a galvanized steel frame.

The main rollers are supplied either with a synthetic coating made of an Epoxy/Flintstone compound, stretch metal or with a ripped steel cover. The main rollers are connected to the motorised gearboxes with a chain. The brake force is transmitted through the chains and the motorised gearboxes to the brake force transducers.

GENERAL

Optionally the models BM3010 Turbo, BM4010 Turbo and BM9010 Turbo can be equipped with an automatic weighing system, which can measure the test weight of the axle (and the vehicle).

2.1.1 Slip system

The brake testers are equipped with a speed sensing system, which enables control of the lock situation.

During a brake application, the brake tester determines the slip between wheel and main roller continuously. If the slip value exceeds a reference value, the computer automatically stops the gear motor. The reference value is set from factory, so slip is defined in range between 20 – 30 %.

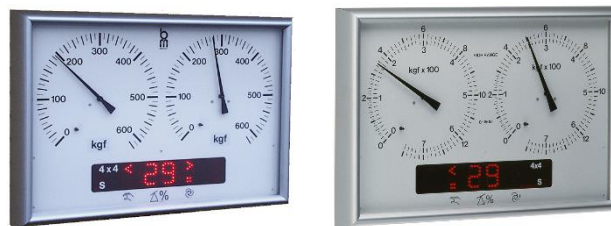
2.1.2 Physical display

The display is made of aluminum and contains a gauge with a brake force scale from 0 to 600 daN/kgf or 0 to 1500 daN/kgf.

The ARROWS in the digital windows shows when rollers are running and if one or both sides have locked. The DOTS in the digital windows shows if the brake tester is in manual or automatic mode.

The 2-digit display shows the brake force imbalance between left and right wheel as well as pedal pressure and possibly ovality by changing via the remote control unit.

On BM4010 4T and BM9010 Turbo, the display have a double scale. The outer scale automatically becomes active when brake force exceeds 750 daN. When the light between the two gauges is on, the outer scale is active.



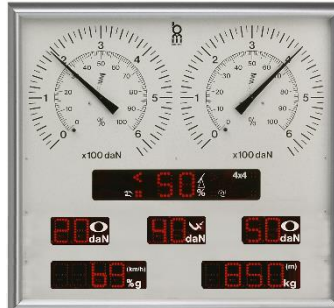
The display can be mounted either on wall, on the floor or on a mobile trolley:



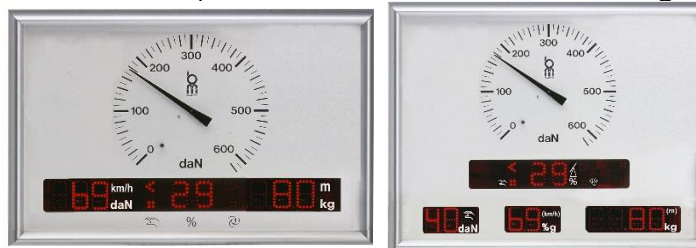
GENERAL

The display can be mounted as a special solution suspended from the ceiling. This requires an extra control box. Please enquire the manufacturer.

All models can optionally also be supplied with a large display, where more measurements are shown digitally and analogue:

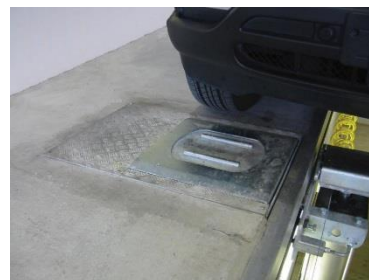


For BM brake tester for motorcycles, BM1010 Turbo, the following display is used:



2.1.3 The BM250 Wheel play detector

The BM250 wheel play detector is pneumatic operated equipment used for detecting play on vehicles up to 1000 kg wheel load. It can be installed in-ground or in lift.



The pneumatic operated plate consists of only one plate and is to be installed for either left or right wheel. A handheld integrated 24VDC flashlight and control unit is used to move the plate in different directions, which enables the operator to detect play.

The control system of the BM250 is powered by 240 VAC and the required air pressure source must be an 1/4" air tube and a 10 bar air reservoir.

Operating the BM250

The control unit (flashlight) is used to move the plate in two different ways:

GENERAL

- Sideways
- Twisting

The control unit is equipped with three operation buttons, S1, S2 and S3. Button S3 can be placed in position 1, 0 or 2 (these marks cannot be seen on the unit), which allows selection of operation mode:



Sideways - inward

With S3 in position 1, the plate moves inward, when S2 is pressed. This movement is often sufficient for inspecting load-carrying links (inclusive McPherson type) with radial play.

Sideways - forth and back

With S3 in position 1, the plate moves sideways forth and back, with S2 activated constantly and S1 pressed sequently.

Twisting

With S3 in position 2 a twisting movement is obtained, when S2 and S1 is controlled as above. Twist movements is used for inspection of steering system and even some types of non-carrying links of McPherson type.

The speed of the plate is stepless adjustable using the speed-regulator unit. High speed allows rocking of the vehicle to overcome loads that can hide possible play. Low speed, which should be used as standard, provides sufficient powerful movements enabling the operator to detect component play easily.

| BM250 DESCRIPTION | | |
|-----------------------------|-----------|--------------------|
| Subframe per side | L x W x H | 850 x 650 x 130 mm |
| Max. test wheel load | | 1000 kg |
| Max. drive over axle weight | | 1000 kg |
| Plate dimension | | 330 x 280 mm |
| Working air pressure | | Max. 10 bar |
| Power fuses | | 24 Vac |
| | | or |

GENERAL

| | | |
|--|--|--------------------------------------|
| | | 1 x 230 Vac + N +PE Minimum 4 Amp |
|--|--|--------------------------------------|

2.1.4 The BM1010 Turbo

The BM1010 Turbo roller bed is designed for brake test of motorcycles and can be installed both in-ground and on-ground:



GENERAL

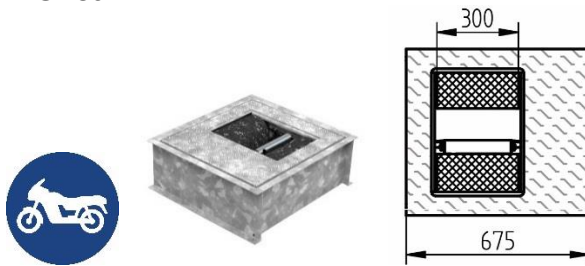
| BM1010 TURBO DESCRIPTION | | MODEL | |
|---|-----------------|--|---|
| One unit roller bed | L x W x H | Roller bed 300 mm Roller bed 300 and 600 mm Roller bed 300 and 1000 mm | 675 x 615 x 250 mm 975 x 615 x 250 mm 1375 x 615 x 250 mm |
| Roller diameter and length | | Roller bed 300 mm Roller bed 300 and 600 mm Roller bed 300 and 1000 mm | 182 mm 182 mm 182 mm |
| Roller length | | Roller bed 300 mm Roller bed 300 and 600 mm Roller bed 300 and 1000 mm | 300 mm 300 and 600 mm 300 and 1000 mm |
| Wheel span | | Roller bed 300 mm Roller bed 300 and 600 mm Roller bed 300 and 1000 mm | N/A 530 to 1730 mm 290 to 1590 mm |
| Maximum wheel weight | test/drive over | Roller bed 300 mm Roller bed 300 and 600 mm Roller bed 300 and 1000 mm | 500/750 kg 1000/1250 kg 1000/1250 kg |
| Friction coefficient of roller from factory | dry/wet | | Min 0.7/0.6 |
| Distance between roller centers | | | 350 mm |
| Gear motor size | | | 1.1 kW |
| Max brake force measurement | | | 400 daN |
| Test speed | | | 1.0 km/h |
| Display | L x W x H | | 735 x 500 x 140 mm |
| Display brake force scale | | | 0 – 620 daN |
| Brake force measuring accuracy | | | 0 – 100 daN: ± 2 daN > 100 daN: ± 2 % FS |
| Weight measuring accuracy | | | 0 – 100 kg: ± 2 kg > 100 kg: ± 2 % FS |
| Hand pedal force measurement accuracy | | | 0 – 100 daN: ± 1 daN |
| Power and fuses | | | 3 x 400 VAC + N + E Minimum 10 Amp 3 x 230 Vac + PE Minimum 16 Amp Minimum 10 Amp (MC) 1 x 230 Vac + N + PE Minimum 50 Amp Minimum 25 Amp (MC) |

Display units are also available in kgf or kN.

The BM1010 can be supplied for testing both MC, 3-Wheelers and ATV vehicles and the BM1010 is then supplied with 2 roller beds:

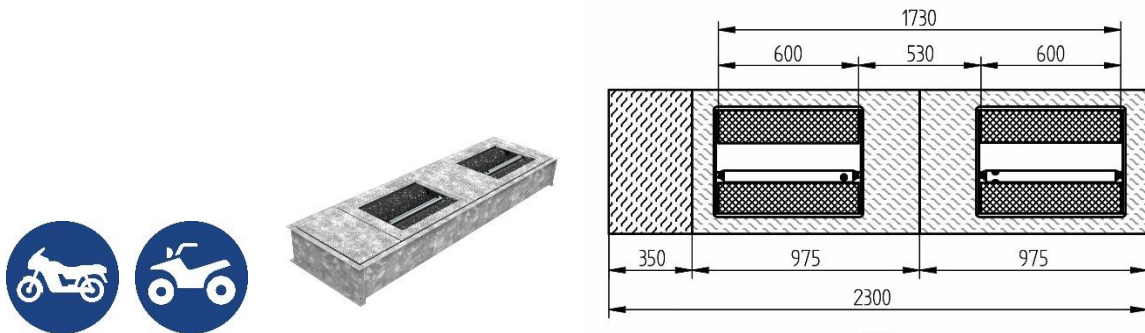
GENERAL

MC test



- The system consists of one hot galvanized roller bed with 300 mm rollers.
- Optional subframe for easy installation.
- Brake force reading 0-600 daN.

MC and ATV test



- The system consists of two hot galvanized roller beds with 600 mm roller.
- Optional subframe for easy installation.
- Brake force reading 0-600 daN each side.

MC, ATV and 3-wheeler test

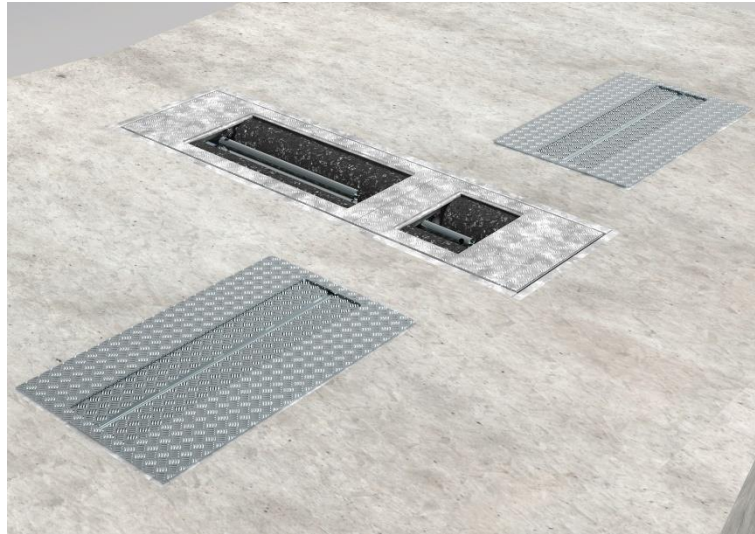


- The system consists of two hot galvanized roller beds with 300 mm respective 1000 mm rollers.
- Optional subframe for easy installation
- Brake force reading 0-600 daN.

2.1.4.1 MC wheel clamp

The BM1010 can be supplied with pneumatic wheel clamps:

GENERAL



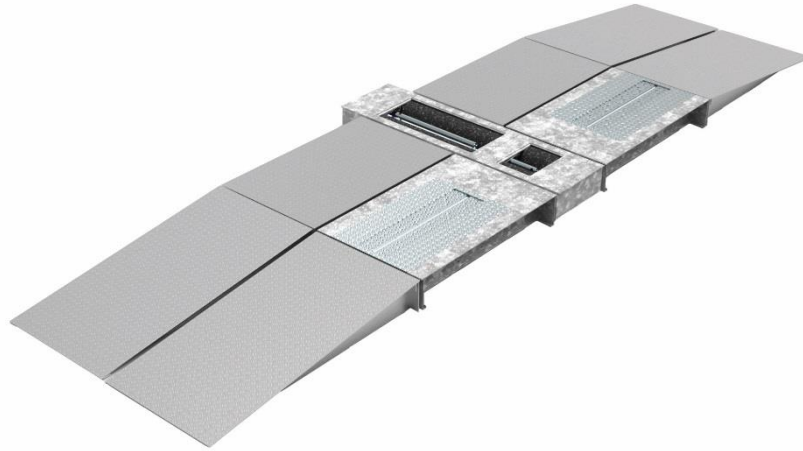
The design of this wheel clamp is unique, as the clamp pressure differentiate with size of wheel i.e. the bigger the wheel, the higher clamp pressure. Subject to the pneumatic air pressure level supplied to the system, the following table shows the clamp pressure in kg vs wheel size and 50 mm width respectively 180 mm width:

| Supply air pressure in Bar | Clamp pressure in kg at 50 mm wheel width | Clamp pressure in kg at 180 mm wheel width |
|----------------------------|---|--|
| 2 | 30 | 60 |
| 3 | 50 | 100 |
| 4 | 70 | 140 |
| 5 | 90 | 180 |
| 6 | 110 | 220 |
| 7 | 130 | 260 |
| 8 | 150 | 300 |

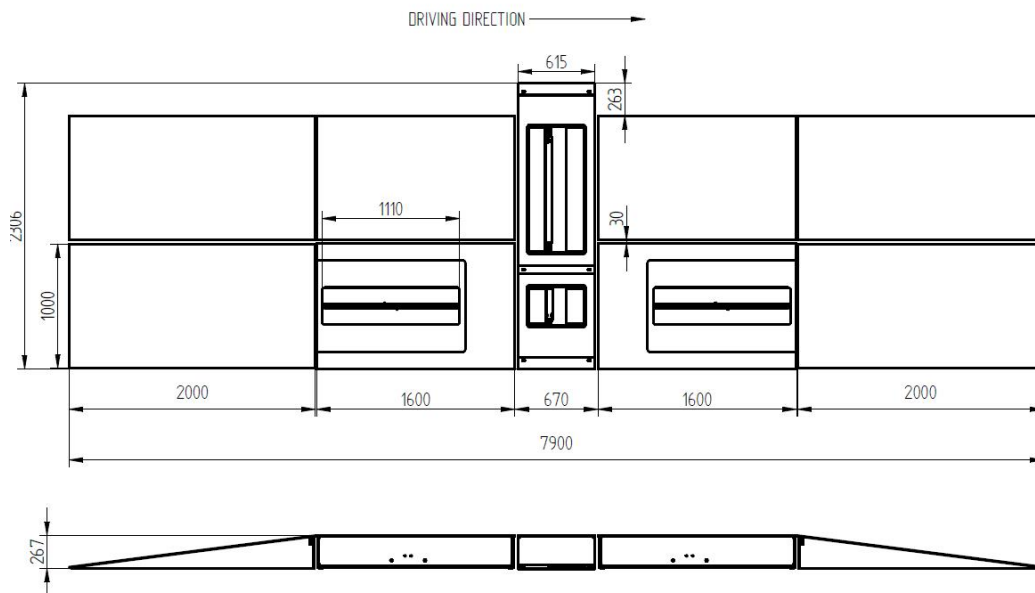
2.1.4.2 BM1010 on-ground installation

In all configurations the BM1010 system can be installed on-ground using drive on/off and extension ramps:

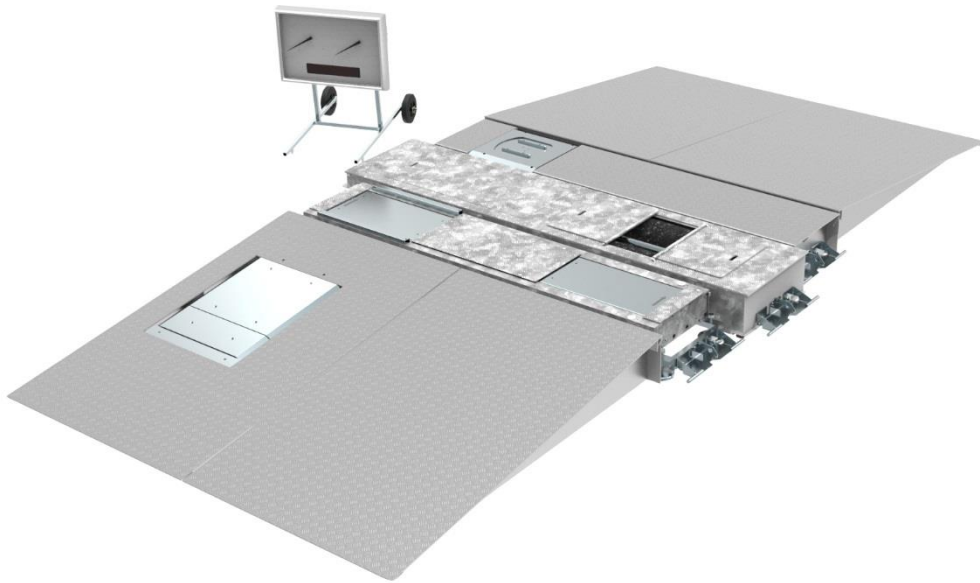
GENERAL



The ramp system represents a risk hazard and it is therefore strongly recommended to mark the testing area with warning signs.



Both the in-ground and on-ground concept can be expanded to also include wheel play detector, suspension tester and side slip meter for test:



2.1.5 The BM3010 Turbo roller bed

The BM3010 Turbo roller bed can be supplied and installed in an in-ground frame, on the terrain, in front of a lift or as a mobile solution.



Mobile – on-ground installation



In-ground installation

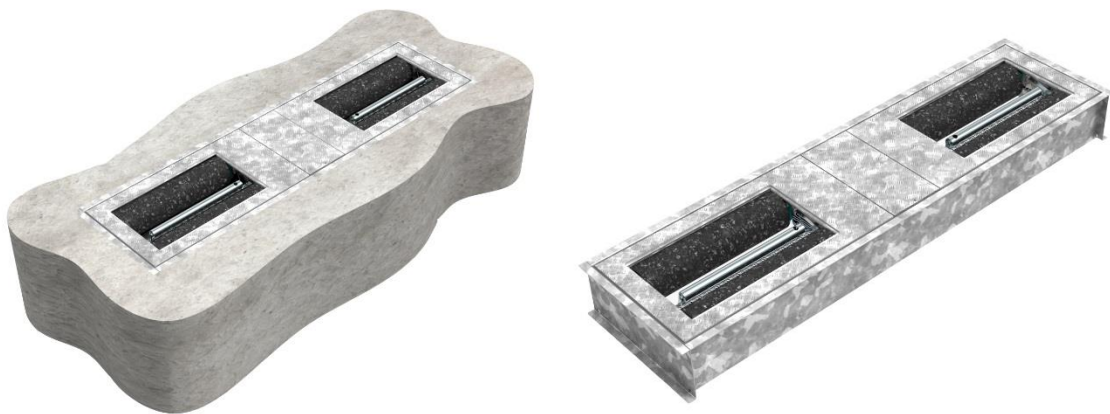
GENERAL

| BM3010 TURBO DESCRIPTION | | |
|---|--------------------------|---|
| One unit roller bed | L (ramp up/down) x W x H | 2360/3070 x 600 x 160 mm |
| Roller diameter and length | | 150 mm |
| Roller length | | 700/1000 mm |
| Friction coefficient of roller from factory | dry/wet | Min 0.7/0.6 |
| Wheel span | | 850 to 2250/2850 mm |
| Distance between roller centers | | 355 mm |
| Maximum test axle weight | | 3500 kg |
| Maximum drive over axle weight | | 4000 kg |
| Gear motor size | | 1.1 kW (3-phase) |
| Max brake force measurement | | 700 daN |
| Test speed | | 2.0 km/h |
| Display | L x W x H | 735 x 500 x 140 mm |
| Display brake force scale | | 0 – 600 daN |
| Brake force measuring accuracy | | 0 – 100 daN: ± 2 daN > 100 daN: ± 2 % FS |
| Weight measuring accuracy | | 0 – 100 kg: ± 2 kg > 100 kg: ± 2 % FS |
| Pedal force measurement accuracy | | 0 – 100 daN: ± 1 daN |
| Power and fuses | | 3 x 400 Vac + N + PE Minimum 10 Amp 3 x 230 Vac +PE Minimum 10 Amp |

Display units are also available in kgf or kN.

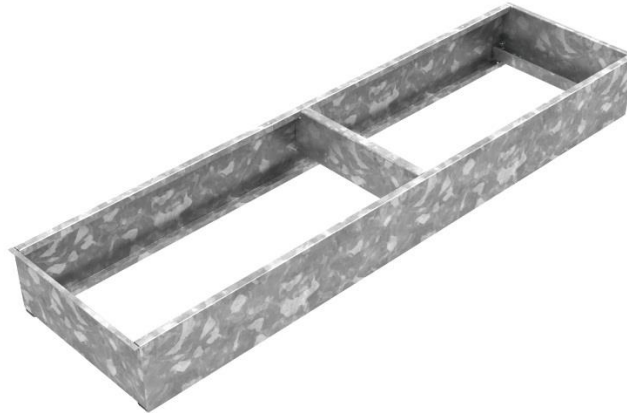
2.1.6 The BM4010 Turbo roller bed

The roller bed of BM4010 Turbo is in principle a split bed unit, which can be supplied both as a split bed installation and an one unit installation depending on how the roller bed is placed in the hole:



GENERAL

When supplied with automatic weight, a special weight transducer frame is required:



| BM4010 TURBO DESCRIPTION | | |
|---|-----------|--|
| Roller bed (600 mm rollers) | L x W x H | 2300 x 715 x 250 mm |
| Roller bed (750 mm rollers) | L x W x H | 2530 x 715 x 250 mm |
| Roller bed (1000 mm rollers) | L x W x H | 3030 x 715 x 250 mm |
| Roller diameter | | 182 / 204 mm |
| Roller length | | 600 / 750 / 1000 mm |
| Friction coefficient of roller from factory | dry/wet | Min 0.7/0.6 |
| Min. wheel span (can be customised) | | 880 / 800 / 800 mm |
| Max. wheel span (can be customised) | | 2080 / 2300 / 2800 mm |
| Distance between roller centres | | 354 mm |
| Max. test axle weight | | 3500 / 4000 kg (optional) |
| Gear motor size | | 2.2 kW / 3.8 kW (optional) |
| Max brake force measurement | | 625 / 1250 daN |
| Test speed | | 2.5 / 5.0 km/h |
| Display | L x W x H | 735 x 500 x 140 mm |
| Display brake force scale | | 0 – 620 / 1500 daN |
| Brake force measuring accuracy | | 0 – 100 daN: ± 2 daN > 100 daN: ± 2 % FS |
| Weight measuring accuracy | | 0 – 100 kg: ± 2 kg > 100 kg: ± 2 % FS |
| Pedal force measurement accuracy | | 0 – 100 daN: ± 1 daN |
| Power and fuses | | 3 x 400 Vac + N + PE Minimum 13/20 Amp 3 x 230 Vac + PE Minimum 20/35 Amp |

Display units are also available in kgf or kN.

2.1.7 The BM7010 Turbo roller bed

The BM7010 Turbo roller bed is a split bed. The split bed design allows for installation over the pit as well as customising the inner and outer wheel base when preparing the holes in the ground for installation. Below specifications on outer dimensions

GENERAL

are therefore a factory recommendation only.



BM7010 Turbo installed with wall mounted display.

| BM7010 TURBO DESCRIPTION | | |
|--|-----------|--|
| Roller bed per side | L x W x H | 910 x 800 x 220 mm |
| Subframe for split bed installation per side | L x W x H | 965 x 855 x 250 mm |
| Roller diameter | | 175 mm |
| Roller length | | 600 mm |
| Friction coefficient of roller from factory | dry/wet | Min 0.7/0.6 |
| Wheel span (can be customised) | | 880 to 2080mm (2500 mm with optional adjustable subframe) |
| Distance between roller centers | | 350 mm |
| Maximum test axle weight | | 3.500 kg |
| Maximum drive over axle weight | | 4000 kg |
| Gear motor size | | 3.8 kW |
| Max brake force measurement | | 750 daN |
| Test speed | | 4.5 km/h |
| Display | L x W x H | 735 x 500 x 140 mm |
| Display brake force scale | | 0 – 620 daN |
| Brake force measuring accuracy | | 0 – 100 daN: ± 2 daN > 100 daN: ± 2 % FS |
| Pedal force measurement accuracy | | 0 – 100 daN: ± 1 daN |
| Power and fuses | | 3 x 400 Vac + N + PE Minimum 20 Amp 3 x 230 Vac + PE Minimum 35 Amp |

Display units are also available in kgf or kN.

2.1.8 The BM9010 Turbo roller bed

The roller bed of BM9010 Turbo is a split bed unit:



The BM9010 Turbo can be supplied in two variations:

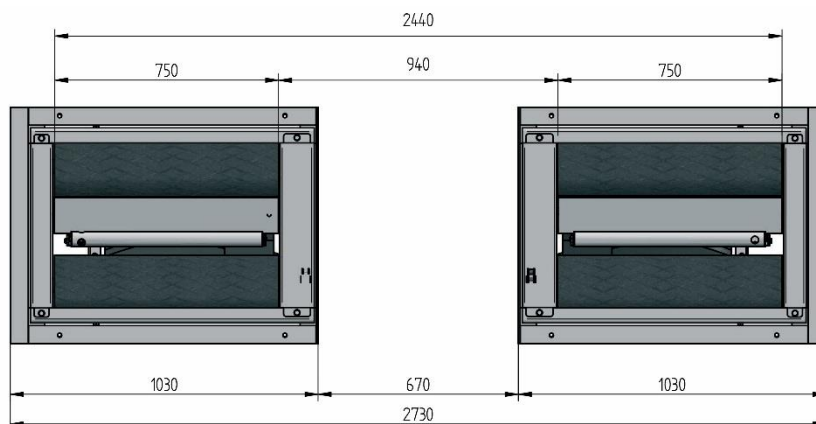
- Supplied with 750 mm rollers.
- Supplied with 1000 mm rollers, which allows for testing of all types of vehicles up to 5 ton axle weight.

The split bed design of both variations allows for installation over the pit as well as customising the inner and outer wheel base when preparing the holes in the ground for installation. Below specifications on outer dimensions are therefore a factory recommendation only.

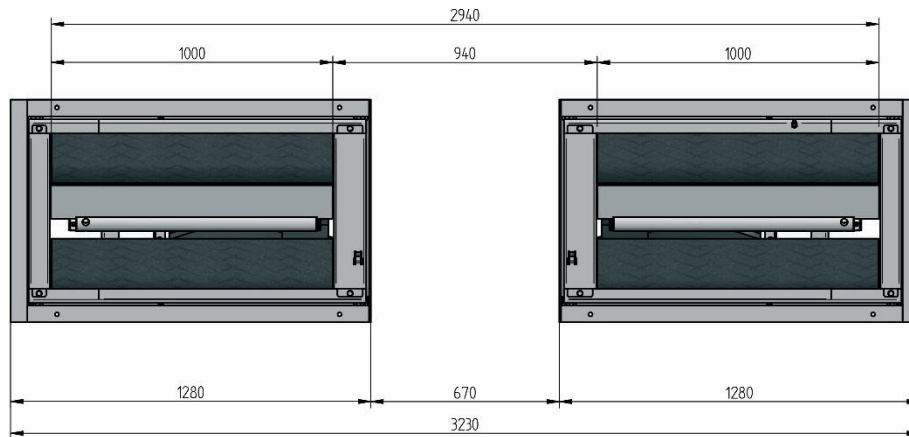
GENERAL

| BM9010 TURBO DESCRIPTION | | |
|--|-----------|--|
| Roller bed per side (750 mm rollers) | L x W x H | 652 x 950 x 455 mm |
| Roller bed per side (1000 mm rollers) | L x W x H | 652 x 1200 x 455 mm |
| Subframe for split bed installation per side (750 mm rollers) | L x W x H | 790 x 1030 x 495 mm |
| Subframe for split bed installation per side (1000 mm rollers) | L x W x H | 790 x 1250 x 495 mm |
| Roller diameter | | 208 mm |
| Roller length | | 750 / 1000 mm |
| Friction coefficient of roller from factory | dry/wet | Min 0.7/0.6 |
| Wheel span (Can be customised) | | 850 to 2430 / 2850 mm |
| Distance between roller centers | | 400 mm |
| Maximum test axle weight | | 5000 kg |
| Gear motor size | | 5.0 / 7.5 kW |
| Max brake force measurement | | 700 / 1100 / 2200 daN |
| Test speed | | 2.7 / 4.5 km/h |
| Display | L x W x H | 735 x 500 x 140 mm |
| Display brake force scale | | 0 – 750 daN 0 – 1500 daN |
| Brake force measuring accuracy | | 0 – 100 daN: ± 2 daN > 100 daN: ± 1 % FS |
| Weight measuring accuracy | | 0 – 100 kg: ± 2 kg > 100 kg: ± 2 % FS |
| Pedal force measurement accuracy | | 0 – 100 daN: ± 1 daN |
| Power and fuses | | 3 x 400 Vac + N + PE Minimum 25/35 Amp 3 x 230 Vac + PE Minimum 35/63 Amp |

Display units are also available in kgf or kN.



GENERAL



2.1.9 Side slip and suspension tester

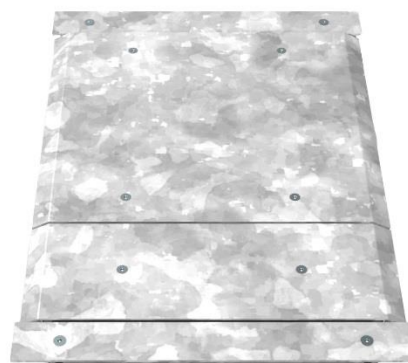
The brake testers can optionally be equipped with a side slip and/or a suspension tester.

2.1.9.1 BM810 Side slip tester

The BM810 side slip tester is designed for testing of light vehicles. The capacity of the unit is toe in/out values of +/- 12 mm/m and the value is shown in the digital IMBALANCE window of the display. At the same time the point meters of the display will indicate if the value is a toe-in or a toe-out.

The side slip meter is equipped with a "release plate" before the actual measuring plate. This plate releases the tension in the rubber of the tires and increases the accuracy and repeatability of the test result.

To obtain consistent readings it is important that the operator is not controlling the steering wheel while passing the side slip plate. Additional consistent values are better obtained when the side slip plate is passed with a constant speed between 3-6 km/h.

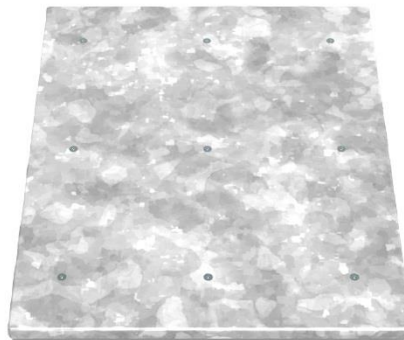


GENERAL

| BM810 DESCRIPTION | | |
|--------------------|-----------|--|
| Subframe | L x W x H | 916 x 650 x 40 mm |
| Side slip unit | L x W x H | 880 x 615 x 37 mm |
| Plate dimension | L x W | 528 x 615 mm |
| Maximum wheel load | | 2000 kg |
| Measuring range | | +/- 15mm/m (+/- 15 m/km) |
| Resolution | | 0.1 mm/m (0.1 m/km) |
| Accuracy | | +/- 0.5 mm/m (+/- 0.5 m/km) |
| Power and fuses | | 1 x 230 Vac + N + PE Minimum 4 Amp or powered from the brake tester |

2.1.9.2 BM910 Side slip tester

The BM910 side slip tester is designed for testing of both light and heavy vehicles. The capacity of the unit is toe in/out values of +/- 20 mm/m and the value is shown in the digital IMBALANCE window of the display. At the same time the point meters of the display will indicate if the value is a toe-in or a toe-out.



| BM910 DESCRIPTION | | |
|--------------------|-----------|--|
| Subframe | L x W x H | 1040 x 880 x 92 mm |
| Side slip unit | L x W x H | 1000 x 800 x 40 mm |
| Plate dimension | L x W | 1000 x 800 mm |
| Maximum wheel load | | 10000 kg |
| Measuring range | | +/- 20mm/m (+/- 20 m/km) |
| Resolution | | 0.1 mm/m (0.1 m/km) |
| Accuracy | | +/- 0.5 mm/m (+/- 0.5 m/km) |
| Power and fuses | | 1 x 230 Vac + N + PE Minimum 4 Amp or powered from the brake tester |

GENERAL

2.1.9.3 BM40010 suspension tester

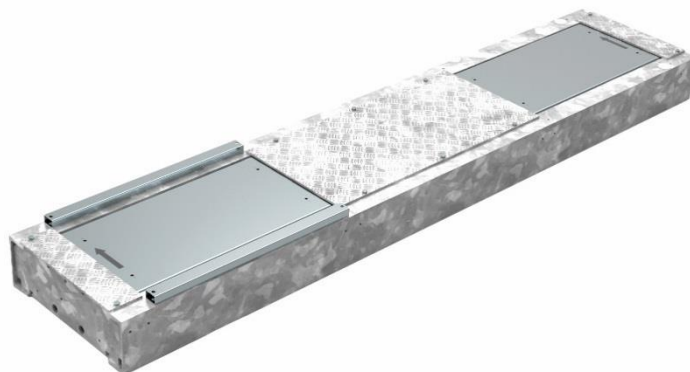
The BM40010 suspension tester is hot galvanized with large vibration plates to maximize the allowed wheel span dimension, which can be tested. The suspension tester can be used to test light vehicles and vans with axle weights of 2 ton (standard) and optionally 3 Ton.

The unit allows for “drive over” of axles with maximum 4000 kg without special cover plates. Vehicles with up to 13 Ton axle load can drive over the suspension tester when special cover plates are in place.

The measuring method is EUSAMA, where the suspension system of the vehicle is tested effectively over a frequency variation of 25 Hz down to 0 Hz. On the phone/tablet unit the test sequence is shown live and graphically. The weight value at the resonance frequency is determined as being the EUSAMA value – also known as the “road adhesion value”. The value is determined as a percentage relative to the static wheel weight. The EUSAMA values of the left and right wheels are presented on the display together with the percentage difference between left and right wheel.



The vibration plates are built in order to reduce their weight impact on the measurement and thus to increase accuracy of the EUSAMA value.



GENERAL

Optionally a split suspension tester can be supplied, which allows for the suspension of both wheels to be measured synchronically.



| BM40010 SUSPENSION TESTER DESCRIPTION | | |
|--|-----------|---|
| Subframes | L x W x H | 2456 x 595 x 173 mm |
| Subframes, split bed per side | L x W x H | 922 x 595 x 173 |
| Suspension tester | L x W x H | 2360 x 500 x 170 mm |
| Suspension tester, split bed per side | L x W x H | 865 x 500 x 300 mm |
| Plate dimension | L x W | 660 x 350 mm |
| Wheel span (can be customised on split bed model) | | 840 to 2150 mm |
| Maximum test axle load | | Standard 2 ton optional 3 ton |
| Maximum drive over axle load without cover plates | | 4 ton (optional) |
| Maximum drive over axle with cover plates (optional) | | 13 ton |
| Measuring range | | 0-25 Hz / 0-100% |
| Power and fuses | | 3 x 400 Vac + N + PE Minimum 13 Amp Minimum 20 Amp for split bed (sync) 3 x 230 Vac + PE Minimum 20 Amp Minimum 35 Amp for split bed (sync) Can be powered from the brake tester. |

As standard the suspension plates are started "single sided" and, depending on location, there is a warm up period from 2 – 10 seconds where the motor is driving the vertical movement of the plates. This period is primarily used to bring the suspension system in motion, but also to warm up the suspension components of the vehicle (country specific settings).

GENERAL

2.2 The wireless remote controls and cable remote control

The key label of the BM remote control unit (Infra Red, PDA, smartphone and tablet) is illustrated below.

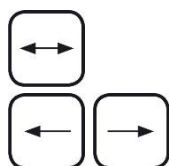
The infra red remote control has an operation distance of 15-20 meters, depending on the operation conditions.

When connected via WiFi, the PDA, smartphone and tablet has an operation distance of app 50 meters, depending on the operation conditions.

When connected via Bluetooth, the PDA, smartphone and tablet has an operation distance of app 10-20 meters, depending on the operation conditions.

DO NOT increase pressure on keys to increase range - it will only brake the key pad! Instead make sure that the remote control can transmit without physical obstruction.

Cable remote control has cable of 15 meters.



Start both roller sets.

Start left and right roller set (approval of gross vehicle weight).

GENERAL

| | | | | | | | |
|--|---|--|---|--|----|--|--------------------|
| | | Key in the gross vehicle weight. De- and increases with 50 kg. | | | | | |
| | | Printout of brake test data / transfers data to PC (numerical / graphical). | | | | | |
| | | Shift between automatic and manual test mode. | | | | | |
| | | Shift between reversible (4x4) and normal test mode. | | | | | |
| | | Start left or right roller set for reversible test mode. | | | | | |
| | | Stop roller set. | | | | | |
| | | Shift between difference and pedal force readout in digital display. After the test the display will <u>always</u> show difference values. | | | | | |
| | + | | , | | or | | Start motor brake. |
| | | Start suspension tester. | | | | | |
| | | Shift between normal and 3-wheel mode. | | | | | |
| | | Function key, hysteresis key and special printout, see below. | | | | | |
| | | Configuration keys. | | | | | |
| | | Raise / lower axle lift system. | | | | | |
| | | Delete axle data. | | | | | |



SPECIAL FUNCTIONS

Special printout



If only one axle is to be tested (caravan, trailer etc.), a special printout can be made which shows only axle one and the total result. Press .

Test in automatic mode

GENERAL

1. Press  on the remote control or  on the display.
2. Drive the axle on to the brake tester (the brake tester will start after 4 seconds) and perform the brake test.

2-way measurement

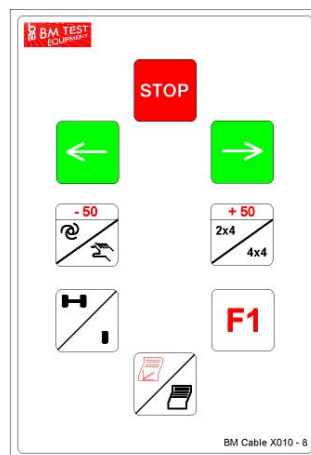
By test in reverse direction "B"-mode is activated by pressing  .

Ovality in difference display

Press  .



The key icons are similar on the two types of remote controls. However on the cable remote control unit following keys are "second value keys":

- + 50
 - + 50
- GRAPHIC PRINT



To activate one of these keys, the operator needs to press first "F1" and then the chosen key. DO NOT press both F1 and the chosen key at the same time!

2.2.1 The PRINT key





The  key will save test data each time the key is pressed. When the operator has tested the rear wheel and presses the  key the third time, the brake tester

GENERAL

will automatically print the total values.

The  key does the same as  key except that data will also be presented graphically as brake force vs. time.







Each time the operator presses a key the difference-display will flash as an indication. When numerical keys are pressed, the efficiency display will show the value keyed in.

If the test of an axle has failed, then the operator shall only avoid pressing the  or  key. Instead he just starts the rollerbed again. Only when he is satisfied with the test he presses the  or  key and not until then does the brake tester computer record the data.


2.3 Key in calculation weight


The brake tester can optionally be equipped with an automatic weighing system, which measures the test weight.

Using the remote control unit the brake tester also allows the operator to key in the total weight of the vehicle after the test. The brake tester will then use this weight instead of the automatic measured weight value to make a total efficiency calculation. This feature can be used if the brake tester is not equipped with automatic weighing system.



The  and  keys are used to key in a calculation weight. When pressing either the  or  key the first time, the gauge will show the current calculation weight. On the gauges 1 kgf equals 1 kg. Each press on the  key will increase the weight by 50 kg. Each press on the  key will decrease the weight by 50 kg. On the BM1010 roller brake tester the increase/decrease is by 10 kg.

The operator must key in this weight prior to starting the test of first axle/wheel.

When weight value is correct, the operator just presses  to activate the input.

If a more accurate weight is required, the operator can use the numeric keys, which are only located on the wireless remote control unit. Again pressing the  key activates the weight input.

GENERAL

To cancel a keyed in value, the operator must press  instead of . A new value can always be re-entered as long as the first wheel is not tested.

The brake testers can operate in manual, automatic and guided mode.

In **manual mode**, the operator controls the brake test procedure using the remote control.

In **automatic mode**, the testers start app 4 seconds after an axle is entered.

In **guided mode**, the PC or PDA/smartphone/tablet guides the operator through the test. The operator shall use the remote control (IR or PDA) to acknowledge, when prompted by the guide.



Optionally the brake tester can be supplied with options for test of 4x4 driven vehicles and also for bi-directional test.



3 GENERAL TEST PROCEDURES BM3010 – BM9010

This chapter is a general introduction to the use of BM brake testers.

3.1 Introduction

The general brake test procedure is:

- Test first axle and press the  key.
- Test parking brake and press the  key.
- Test second axle and press the  key.

If the test of an axle has failed, then the operator shall just start the roller bed again without pressing  key. Only when he is satisfied with the test he presses the  key and not until then are the data recorded by the brake tester computer.

The following describes the general use of the BM brake tester in the 3 modes:

- Guided mode
- Manual mode
- Automatic mode

Note, that the procedure includes the use of an integrated pedal pressure meter. In case your brake tester is not equipped with such a meter, please just ignore the steps concerning the pedal pressure.

In some cases where the vehicle is very light, vehicle brakes are insufficient and/or floor surface has a low friction coefficient, the vehicle can move backward when being tested to maximum brake forces and when test for imbalance and judder is made. BM suggests the use of wheel-chocks or similar to maintain the vehicle in the roller bed in such cases and BM also strongly recommends, that brake application is done very slowly and controlled – in particular during the test for testing imbalance and judder, as the operator shall reach 75 % of maximum brake force before the guide asks the operator to reduce brake force again.

3.2 Guided mode

From the PDA unit, infra red remote control unit, smartphone, tablet or the PC you can choose guided mode.

Most common method is to define a vehicle for test on the PC. The vehicle will now appear on the queuing list on both PC and PDA/smartphone/tablet unit.

When the operator chooses a vehicle on this list from either PDA or PC, the system automatically switches into guide mode. The operator shall now follow the instructions on either the PC, PDA, smartphone or tablet unit.

In guided mode the operator will prompt for action including actions on vehicle (move forward, apply brake etc.) as well as action on test results (save test, re-start brake tester etc.). If the brake tester is in auto-mode, it will automatically start, stop and save test, which means no remote control is needed.






To switch between Manual-mode and Auto-mode press .

The BM guided system is designed with the objective of minimising operator errors including his choice of command buttons on remote control system.

3.3 Manual mode

In principle the brake test is done in the following way:

1. Enter axle number 1 (front axle) into the roller bed.


2. Key in the calculation weight of the vehicle using the  or  keys on the remote control. Press ,  or  in order to acknowledge the keyed in weight.

3. Place the pedal pressure meter between your foot and the pedal.


4. Press the  key.

5. Wait approximately 3 seconds while the difference-display flashes as an indication that the roller-resistance is being measured.

6. In order to measure the ovality, increase the brake force up to the value where the ovality shall be measured. Keep the pedal pressure steady approximately 5 seconds. When the difference-display flashes the ovality of the brakes is measured.

7. Increase brake force until a slip condition occurs. If this is not possible then press the  key at highest obtainable brake force.

8. Press the  key which results in a print-out of the test data of the axle.

9. If there is a parking brake on this axle, then press the  key; apply the

parking brake until lock/stop and press the  key.

10. Enter the next axle into the roller bed. If it is a drawing axle that has to be removed from the roller bed then it can be convenient to start the brake tester before driving out of the roller bed. Note that the brake tester can optionally be supplied with an integrated brake, which support drive out of roller bed without start of rollers. The BM4010 is as standard supplied with such motor brake.

11. Repeat position 1-9 on the next axle.

12. Press  when all axles have been tested.

13. Remove the vehicle from the roller bed. If it is a drawing axle that has to be removed from the roller bed then it can be convenient to start the brake tester before driving out of the roller bed. Note that the brake tester can optionally be supplied with an integrated brake, which support drive out of roller bed without start of rollers. The BM4010 is as standard supplied with such motor brake.

3.4 Single sided test

In some cases it can be necessary to test one wheel at a time. This especially happens when testing the parking brake, since the vehicle in this situation often has a tendency to be forced out of the roller set during test of high brake forces.


Following describes how to do the test of an axle side by side:




1. Place the pedal pressure meter between your foot and the pedal.

2. Start left side by pressing the  key.

3. Wait approximately 2 seconds until the difference-display flashes as an indication that the roller-resistance has been measured.


4. In order to measure the ovality, increase the brake force up to the value where the ovality must be measured. Keep the pedal pressure steady approximately 5 seconds. When the difference-display flashes, the ovality of the brake is measured.

5. Increase brake force until a slip condition occurs. If this is not possible then press the  key at highest obtainable brake force.

6. Press the  key, which results in storing/printing of the test data for the left side.
7. Start right side by pressing the  key.
8. Repeat position 2-7 for the right side.
9. Press  key.








3.5 Automatic mode



In principal the brake test in automatic mode is done in the following way:



1. Enter axle number 1 (front axle) into the roller bed.
2. After a delay of 4 seconds both sides of the roller bed start.
3. Increase brake force until a slip condition occurs. If this is not possible then press the  key at highest obtainable brake force.
4. After a stop the brake tester will automatically start again after 4 seconds.

3.6 Test of constant 4x4 driven vehicles

This facility is used for testing constant 4x4 driven vehicles. In this test mode the rollers of one roller bed side will run in normal forward direction (the measuring side) and the rollers of the other roller bed side will run in reverse direction (none measuring side).

1. Press  for 4x4 mode. The lamp in the 4x4 display will light up .
2. Drive axle 1 (front axle) into the roller set (slowly with max. 4 km/h).
3. Place the pedal force meter between the pedal and the foot.
4. Key in gross vehicle weight using the  or  keys on the remote control (only analogue system). Press ,  or  in order to acknowledge the keyed in weight.

5. Press  to make the left side run in reverse direction. The right side will also start up but will run in normal direction.
6. Wait approx. 3 seconds (the digital display will flash) for measurement of rolling resistance. When the digital display stops to flash the rolling resistance has been measured.
7. Increase the brake effort **slowly** until you reach approx. 100 daN. In order to measure the ovality, maintain a constant pedal pressure for approx. 5 seconds (the digital display will flash).
When the digital display stops to flash the ovality has been measured.
8. Continue increasing the brake effort **slowly** until locking point is reached. If locking point cannot be reached, press .
9. **If the brake test was not performed correctly, then restart the brake tester and make a new test.**
A failed test is automatically cancelled - but if the test is approved then continue with the next step.

10. Press  to register the wheel that runs in the normal direction on axle 1.
11. Press  to make the right side run in reverse direction. The left side will also start up, but will run in normal direction.
12. Repeat step 6-10.
13. Repeat step 5-12 for parking brake.
14. Repeat step 5-12 for axle 2 (rear axle).

It is important for the printout that the hand brake is always tested between the service brakes.

To have a copy of the printout, press  or  before the brake tester is restarted.

Before exiting the roller set with a traction axle, you should either start the rollers or activate the built-in roller brake.

3.7 Test with side slip meter

You can equip your brake tester with a side slip meter, and make two types of test;


integrated or separate.

- **Integrated** side slip test means that you can make the test in combination with a suspension and/or brake test and have the test data on the same printout.
- **Separate** side slip test means that you can test front and rear axle without entering the roller set and have the test data printed out separately on one paper.

Integrated test:

1. Drive front axle over the side slip plate.
2. Drive front axle over the suspension tester.
3. Drive front axle into the roller set.
4. Test brakes on front axle.
5. Drive rear axle over the side slip plate.
6. Drive rear axle over the suspension tester.
7. Drive rear axle into the roller set.
8. Test brakes on rear axle.

Separate test:

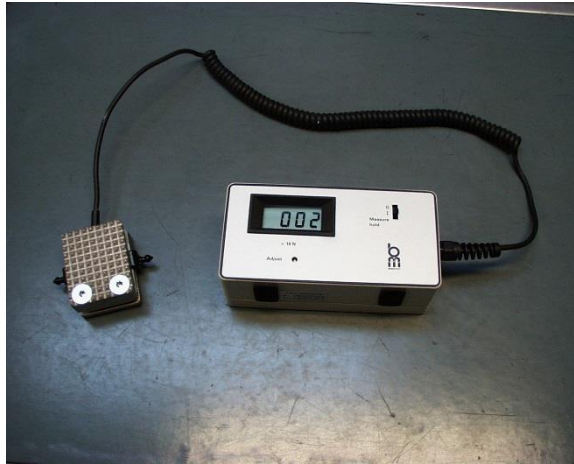
1. Drive front and rear axle over the suspension tester. Press .

3.8 Testing with pedal pressure meter

You can equip your brake tester with two types of pedal pressure meter:

Integrated pedal pressure meter, which can be connected to the brake tester. With this system the brake tester itself does the measurement and all pedal pressure values will be printed out.

Stand-alone pedal pressure meter, BM99. This pedal pressure meter cannot be connected to the brake tester, but it has its own readout display. During test the operator must look at this display and make notes for further analysing.



BM Autoteknik recommends in terms of accuracy and transparency of brake force the use of the integrated pedal pressure meter.

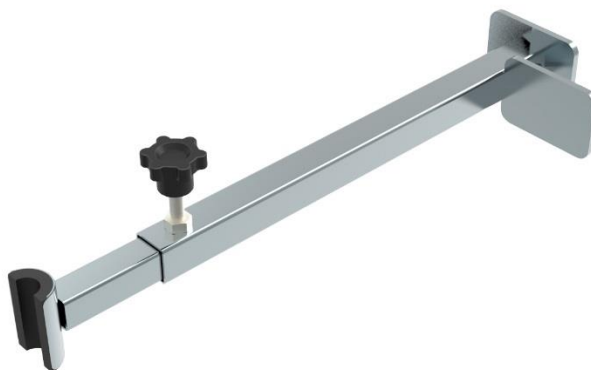
The pedal pressure meter is a very useful testing tool when a fast guiding diagnosing or a determination of an optimal division of brake force between front and rear axle is requested. The pedal pressure meter is also a good reference in connection with 4x4 test, where only one wheel is tested at a time.

Please remark that the brake tester must be turned on before the pedal pressure meter is active.

3.9 Using the BM01 brake pedal applicator

The BM brake testers can optionally be supplied with a BM01 Brake pedal applicator, when brake testers are used for ATL. The BM01 shall be used when testing the vehicle for play using a play detector.

The BM01 shall not be used when testing the brake performance on a brake tester.



3.9.1 Placing the BM01

1. Release the finger bolt on the side of the BM01 and decrease the length of the unit to minimum.











2. Place the BM01 on the brake pedal.
3. Place your foot on the platform and press the pedal to maximum position and hold pressure.
4. Place the other end to the steering wheel of the vehicle by adjusting the length of the unit.
5. Fix the position by tightening the finger bolt.

3.9.2 Removing the BM01







1. Place your foot on the platform and hold maximum pressure.
2. Release the fingerbolt on the side of the BM01 and reduce the length of unit to minimum.
3. Remove your foot and remove BM01.

GENERAL TEST PROCEDURES SIDE SLIP, SUSPENSION AND BRAKE TESTER

4 GENERAL TEST PROCEDURE FOR SIDE SLIP, SUSPENSION TESTER AND BRAKE TESTER

1. Press  on the remote control to clear all old data. 88 should be displayed on the laptop screen in the imbalance window.
2. Drive the vehicle over the side slip tester and onto the suspension tester and when you are satisfied that it is properly aligned, press  on the remote.
3. If you do not want to test suspension, press  on the remote to transfer the vehicle's front axle weight to the brake tester. Note: if you are testing suspension, the weight is automatically transferred to the brake tester so you do not need to press the print key on the remote.
4. Test front suspension (by pressing the ). The suspension test will start the vibration plates one side at a time and spin them up to a pre-determined vibration frequency and hold it there for 10 seconds (to allow the oil in the shock absorber to come up to a normal operating temperature). The motor will then stop, and the test results will start to be recorded. Once the first side is completed, the motor will start again and the other side of the vehicle will be tested.
5. Drive onto brake tester and test axle 1.
6. Press  to start the test. The rolling resistance of the vehicle will be tested first which takes a few seconds.
7. If you are checking for ovality press the service brake pedal until the needles on the display reach 1 Kn and hold the pedal steady until the ovality figures appear in the ovality windows on the laptop. Once the ovality is recorded, press the service brake pedal fully down.
8. Finally, press  to save the axle results (the display will flash 88 as it saves).
9. Apply motor brake and drive forward. This button  + ,  or  locks the rollers so they don't spin as you drive out.
10. Test rear suspension using the same process as for when you tested the front suspension then drive forward to test rear axle brakes.

GENERAL TEST PROCEDURES SIDE SLIP, SUSPENSION AND BRAKE TESTER

11. If you are not testing suspension, you still need to stabilise the rear axle on the suspension tester plates and press  to capture the axle weight for the second axle. Note: if you are testing suspension, the weight is automatically transferred to the brake tester so you do not need to press the print key on the remote.
12. Start both rollers  and test parking brake by applying it fully. Press . Roll back into rollers (display will flash 88 in the imbalance window to indicate a save).
13. Start both rollers again  and test ovality and service brakes for the second axle, press  to save (88 will again be displayed in the imbalance window).
14. Finally, press  again to finalise the test and bring up the printout.
15. From the PC display, click the print button, then click on the extra tests tab and click the print button again.
16. The test is now completed.

GENERAL TEST PROCEDURES FOR BM1010 MOTORCYCLE

5 GENERAL TEST PROCEDURES FOR BM1010 MOTORCYCLE

A motorcycle can be equipped with either:


“2 Controls”: The motorcycle has a brake actuator for front wheel brake (system 1) and rear wheel (system 2).

Linked/dual system: The motorcycle has a brake actuator for simultaneous activation of brake on both front and rear wheel (system 1) as well as a brake actuator of one wheel - typically front wheel (system 2).

In any case both system 1 and 2 must be tested and evaluated. Following are the procedures to be followed in order to perform a test according to above.

5.1 Motorcycles with 2 controls

Weight, bind and maximum brake force

1. Place the first wheel in the rollers.
2. Note the wheel weight.
3. Start the brake tester and allow for the front wheel to stabilise. Look for excessive bind.
4. With the rear brake fully applied, apply the front brake until maximum effort is achieved (and press ) or wheel locks and slips on rollers. Note the reading at which the maximum braking effort is achieved and release brake.

Brake force fluctuation

5. Start the brake tester and allow for the front wheel to stabilise.
6. With the rear brake fully applied gradually apply the front brake to about half of the maximum reading and observe the way it builds up. Hold steady and check for fluctuations. Release the brake and observe the way in which the braking effort reduces.
7. Move the motorcycle forward until rear wheel is located in the rollers.
8. Repeat step 2-6.

Evaluation


Efficiency is calculated as:

$$\text{Efficiency system 1} = \frac{\text{Maximum brake force wheel 1}}{\text{Measured weight wheel 1 + wheel 2}} * 100 \%$$

$$\text{Efficiency system 2} = \frac{\text{Maximum brake force wheel 2}}{\text{Measured weight wheel 1 + wheel 2}} * 100 \%$$

5.2 Motorcycles with linked or dual system


Wheel 1: Weight, bind and maximum brake force of linked and dual system

1. Place front wheel in rollers.
2. Note the wheel weight.
3. Start the brake tester and allow for the front wheel to stabilise. Look for excessive bind.
4. With control, which operates both front and rear wheel brake, apply gradually until maximum effort is achieved (and press ) or wheel locks and slips on rollers. Note the reading at which the maximum braking effort is achieved and release brake.

Brake force fluctuation

5. Start the brake tester and allow for the front wheel to stabilise.
6. Apply the front brake gradually to about half the maximum reading and observe the way it builds up. Hold steady and check for fluctuations. Release the brake and observe the way in which the braking effort reduces.

Testing 2nd system – usually front brake

7. Start the brake tester and allow for the front wheel to stabilise. Look for excessive bind.
8. With control, which operates both front and rear wheel brake, apply gradually until maximum effort is achieved (and press ) or wheel locks and slips on rollers. Note the reading at which the maximum braking effort is achieved and release brake.


Brake force fluctuation

9. Start the brake tester and allow for the front wheel to stabilise.
10. Apply the front brake gradually to about half the maximum reading and observe the way it builds up. Hold steady and check for fluctuations. Release the brake and observe the way in which the braking effort reduces.

Wheel 2: Weight, bind and maximum brake force of linked and dual system

11. Move the motorcycle forward until rear wheel is located in the rollers.
12. Note the wheel weight.
13. Start the brake tester and allow for the rear wheel to stabilize. Look for excessive bind.

GENERAL TEST PROCEDURES FOR BM1010 MOTORCYCLE

14. With control, which operates both front and rear wheel brake, apply gradually until maximum effort is achieved (and press ) or wheel locks and slips on rollers. Note the reading at which the maximum braking effort is achieved and release brake.

Brake force fluctuation

15. Start the brake tester and allow for the rear wheel to stabilise.
16. Apply the front brake gradually to about half the maximum reading and observe the way it builds up. Hold steady and check for fluctuations. Release the brake and observe the way in which the braking effort reduces.

Evaluation

Efficiency is calculated as:

$$\text{Efficiency system 1} = \frac{\text{Maximum brake force wheel 1 + wheel 2 (linked or dual readings)}}{\text{Measured weight wheel 1 + wheel 2}} * 100 \%$$

$$\text{Efficiency system 2} = \frac{\text{Maximum brake force wheel 1}}{\text{Measured weight wheel 1 + wheel 2}} * 100 \%$$


GENERAL TEST PROCEDURES FOR BM1010 MOTORCYCLE



5.3 Workshop MOT test procedure with printout

The following test procedure can be used to obtain a printout when testing MOT:

5.3.1 Motorcycles with 2 controls

Weight, bind, fluctuation and maximum brake force

1. Place first wheel in rollers.
2. Start the brake tester and wait two seconds while bind is measured.
3. Apply brake force slowly until app. 40 kgf and keep constant brake force to measure run-out in disk brake (fluctuating brakes). Wait until efficiency display flashes.
4. With the rear brake fully applied gradually apply the front brake until maximum effort is achieved (and press ) or wheel locks and slips on rollers. Note the reading at which the maximum braking effort is achieved and release brake.

5. Register/Print readings by pressing  or  on the remote control.
 - "Maximum brake force" is shown on analogue display.
 - "Test efficiency" of wheel is shown in digital window.
6. Move the motorcycle forward until rear wheel is located in the rollers.
7. Repeat step 2 – 5.

Evaluation

Efficiency is calculated as:

$$\text{Efficiency system 1} = \frac{\text{Maximum brake force wheel 1}}{\text{Measured weight wheel 1 + wheel 2}} * 100 \%$$

$$\text{Efficiency system 2} = \frac{\text{Maximum brake force wheel 2}}{\text{Measured weight wheel 1 + wheel 2}} * 100 \%$$

Printout


The values for system 1 and system 2 is automatically printed under section "Total" on the printout:



- "Efficiency system 1 (wheel 1)"
- "Efficiency system 2 (wheel 2)"

GENERAL TEST PROCEDURES FOR BM1010 MOTORCYCLE

5.3.2 Motorcycles with linked or dual system

Linked system: Weight, bind, ovality and maximum brake force of linked and dual system

1. Place first wheel in rollers.
2. Start the brake tester and wait two seconds while bind is measured.
3. Apply brake force slowly until app. 40 kgf and keep constant brake force to measure run-out in disk brake (fluctuating brakes). Wait until efficiency display flashes.
4. With the rear brake fully applied gradually apply the front brake until maximum effort is achieved (and press ) or wheel locks and slips on rollers. Note the reading at which the maximum braking effort is achieved and release brake.

5. Register/Print readings by pressing  or  on the remote control.
 - “Maximum brake force” is shown on analogue display.
 - “Test efficiency” of wheel is shown in digital window.
6. Move the motorcycle forward until rear wheel is located in the rollers.
7. Repeat step 2 – 5.

Evaluation

Efficiency is calculated as:

$$\text{Efficiency linked/dual system} = \frac{\text{Maximum brake force wheel 1 + wheel 2 (linked or dual readings)}}{\text{Measured weight wheel 1 + wheel 2}} * 100 \%$$

Printout


The values for system 1 and system 2 is automatically printed under section “Total” on the printout:



“Efficiency linked/dual system”

Single system: Weight, bind, ovality and maximum brake force of linked and dual system

1. Place first wheel in rollers.
2. Start the brake tester and wait two seconds while bind is measured.
3. Apply brake force slowly until app. 40 kgf and keep constant brake force to measure run-out in disk brake (fluctuating brakes). Wait until efficiency display flashes.

GENERAL TEST PROCEDURES FOR BM1010 MOTORCYCLE

4. With the rear brake fully applied gradually apply the front brake until maximum effort is achieved (and press ) or wheel locks and slips on rollers. Note the reading at which the maximum braking effort is achieved and release brake.

5. Register/Print readings by pressing  or  on the remote control.

- "Maximum brake force" is shown on analogue display.
- "Test efficiency" of wheel is shown in digital window.

6. Move the motorcycle forward until rear wheel is located in the rollers.

7. Press .

8. Press .

Evaluation

Efficiency is calculated as:

$$\text{Efficiency system 1} = \frac{\text{Maximum brake force wheel 1}}{\text{Measured weight wheel 1 + wheel 2}} * 100 \%$$


Printout




The values for system 1 and system 2 is automatically printed under section "Total" on the printout:



"Efficiency system 1 (wheel 1)"

5.4 General manual mode with automatic weight system

This test procedure assumes the brake tester is equipped with automatic weight and a remote control unit.

1. Place the first wheel in rollers
 - "Weight" is shown in analogue point meter. The last two digits of the weight are shown in the digital window for precision reading.
2. Start the brake tester and wait two seconds while bind is measured (optional test point).
3. Apply brake force slowly until app. 40 kgf and keep constant brake force to measure run-out in disk brake. Wait until efficiency display flashes (optional test point).
4. Apply brake force slowly until lock-up. If lock-up cannot be obtained then press  on the remote control at maximum brake force.



5. Register the reading by pressing  or  on the remote control.
 - "Maximum brake force" is shown on analogue display.
 - "Test efficiency" of wheel is shown in digital window.
6. Drive forward and place the second wheel in the rollers.
 - "Weight" is shown in analogue point meter. The last two digits of the weight are shown in the digital window for precision reading.
7. Start the brake tester and wait two seconds while bind is measured (optional test point).
8. Apply brake force slowly until 50 kgf and keep constant brake force to measure run-out in disk brake. Wait until efficiency display flashes (optional test point).
9. Apply brake force slowly until lock-up. If lock-up cannot be obtained then press  on the remote control at maximum brake force.

10. Register the reading by pressing  or  on the remote control.
11. Printing will now happen automatically.
 - Total weight of motorcycle is shown in the analogue point meter.
 - Total efficiency of motorcycle is shown in digital window.

5.5 General manual mode with manual entry of total weight


This test procedure assumes that the weight shall be entered by the remote control unit.

1. Place the first wheel in rollers.

2. Use  and  to enter total weight of motorcycle. Alternatively use numerical keys on infra red remote control to enter total weight of motorcycle.

3. Start the brake tester and wait two seconds while bind is measured (optional test point).

4. Apply brake force slowly until app. 40 kgf and keep constant brake force to measure run-out in disk brake. Wait until efficiency display flashes (optional test point).


5. Apply brake force slowly until lock-up. If lock-up cannot be obtained then press  on remote control at maximum brake force.

6. Register the reading by pressing  or  on the remote control.
 - "Maximum brake force" is shown on analogue display.

7. Drive forward and place the second wheel in the rollers.

8. Start the brake tester and wait two seconds while bind is measured (optional test point).

9. Apply brake force slowly until app. 40 kgf and keep constant brake force to measure run-out in disk brake. Wait until efficiency display flashes (optional test point).

10. Apply brake force slowly until lock-up. If lock-up cannot be obtained then press  on the remote control at maximum brake force.

11. Register the reading by pressing  or  on the remote control.

12. Printing will now happen automatically
 - Total efficiency of motorcycle is shown in digital window.

5.6 Automatic mode

This test procedure assumes that the operator sets the brake tester in automatic mode. The brake tester must not be used for MOT test in this mode.

1. Place first wheel in rollers.
2. Wait approximately 4 seconds and the brake tester will start automatically.
3. Observe in display for excessive bind (optional test point).
4. Apply brake force slowly until app. 40 kgf/daN and keep constant brake force. Observe display for run-out in disk brake (optional test point) .
5. Apply brake force slowly until lock-up. If lock-up cannot be obtained then drive out to stop motor.
6. Drive forward and place the second wheel in the rollers.
7. Wait approximately 4 seconds and the brake tester will start automatically.
8. Observe in display for excessive bind (optional test point).
9. Apply brake force slowly until app. 40 kgf/daN and keep constant brake force. Observe display for run-out in disk brake (optional test point).
10. Apply brake force slowly until lock-up. If lock-up cannot be obtained then drive out to stop motor.

5.7 Using the pedal force meter

The operator can use the pedal force meter simply by wrapping it around the hand prior to testing. The meter must be placed between the hand and the hand/pedal brake.

6 THE BM FLEXCHECK TL WINDOWS PROGRAM

The BM FlexCheck TL program, BM FC TL, is a Windows based software to be used with a combination of vehicle test equipment such as, but not limited to, brake tester, suspension tester, side slip tester etc.

The Graphical User Interface, GUI, guides the operator through the following basic functionalities:

1. Select type of vehicle and product.
2. Enter vehicle, customer, and test data.
3. Perform the test (using PDA/smartphone/tablet).
4. Preview, alter, finalize, and print test results.
5. Load previous tests from integrated database.

In principle, the BM FC TL consists of a menu template, with eight operation menus and a configuration menu system that is used to set up the program:

Menu 1: Create Vehicle

Menu 2: Queuing

Menu 3: Brake test display (includes display for other equipment than brake tester)

Menu 4: Printout

Menu 5: Analyse

Menu 6: Matching

Menu 7: Database

The equipment can optionally be supplied with a smart remote control unit such as PDA, smartphone or tablet, which are wireless connected to the equipment.

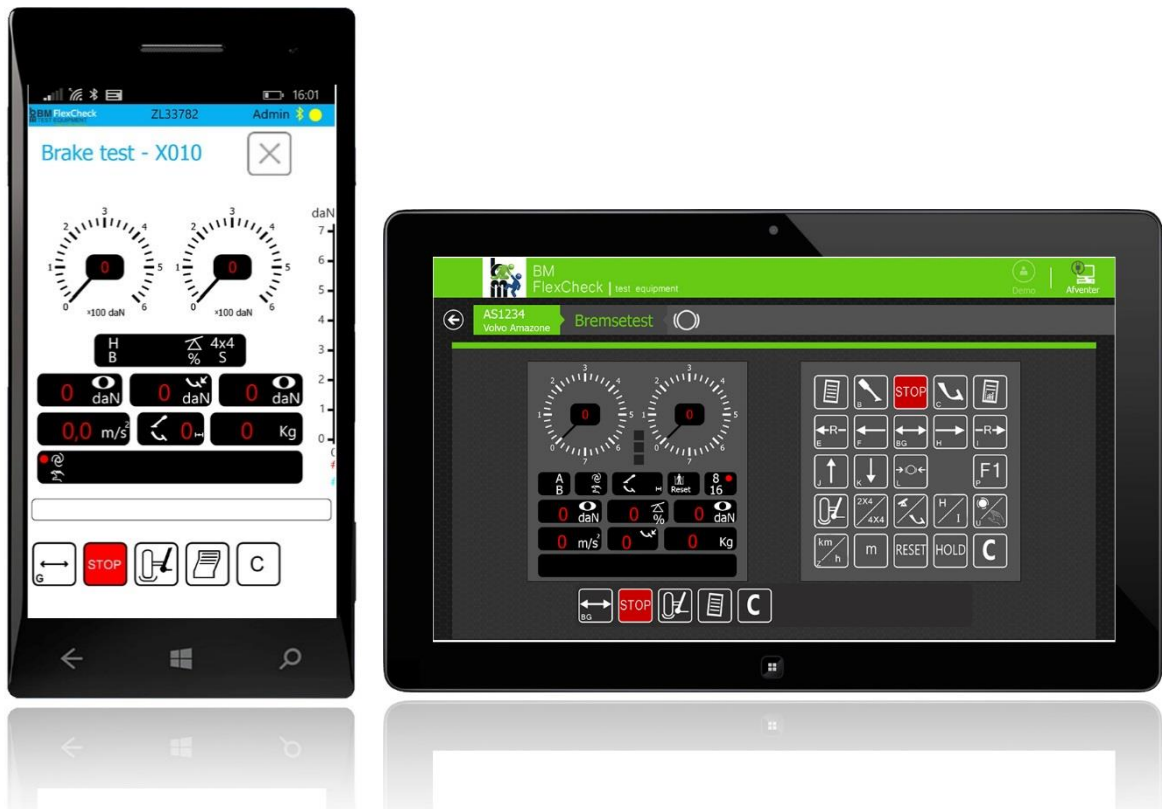
From the smart remote control units, the operator can operate the equipment and also see the live test results.

BM FLEXCHECK TL WINDOWS PROGRAM

BM supplies the application software for the PDA unit, which runs MS Windows CE OS system:



BM supplies the app software for the smartphone or tablet unit, which runs MS Windows PRT OS:



BM supplies the app software for the smartphone or tablet unit, which runs

BM FLEXCHECK TL WINDOWS PROGRAM

Android:



Please see the dedicated BM FlexCheck manual for more information.

7 SAFETY ASPECTS AND ERROR CODES

The BM brake testers have integrated safety systems which meets the highest safety demands.


The design is made with the objective to reduce the risk of having a foot damaged in the roller set. All gaps are minimised and the gear motor will only run if pulses are measured from the middle rollers. If middle rollers are stopped during test by a foot, the gear motors will stop.

The gear motors will only start when the middle rollers are detected to be in its down position (axle in the roller set). This detection is hardwired, which means that even though the machine was forced out of its normal program, the brake tester will still not start unless middle rollers are physically pressed down.


The imbalance window display is used to inform the operator of various situations:

Code 01:

In Manual and Automatic mode the two sensor rollers must be pressed down or released within 2 seconds. The imbalance-display will flash the ERROR CODE 01 if only one of the sensor rollers are pressed down or released in more than 2 seconds. Remove the vehicle from the roller bed in order to remove the ERROR CODE from

the imbalance-display or press . Error code 01 can also appear if an inductive on/off sensor is defective or a cable is broken. In this case the error doesn't disappear by removing car.

Code 02:


Will appear when you have chosen single sided test mode by pressing  and both sensor rollers are pressed down. Single sided test only allows you to test one wheel (press down one sensor roller).

Code 04:

If you start the tester and let it run for more than 1 minute without using it (the measured brake forces do not change), the brake tester will automatically stop the rollers and the imbalance-display will flash the ERROR-CODE 04. Remove the vehicle from the roller bed in order to remove the ERROR CODE from the

imbalance-display or press .

Code 09:

A status code indicating that the integrated calibration printout is active. After the calibration is finished, place the SERVICE SWITCH in position N and press .

Code 88:

Will appear when  is pressed and when data is sent to the printer / PC.

8 MAINTENANCE

In order to ensure a correct operation of the BM brake testers the following maintenance procedures are recommended:

EACH DAY:

Ensure that the chain is tightened. Loose chain is likely to cause gear motor failure. If the chain is loose then tighten it before use or call for service before use. Check for good condition of the feet on BM3010 model, when supplied as mobile.

3-MONTHLY:

Ensure there is no vehicle placed in the roller bed.

1. Power off the brake tester.
2. Check the general condition of the brake tester. Remove any mud, grease etc. from the rollers, roller bed and the pit. It is important to keep the draining holes in the bottom clear and free of dirt etc. in order for water to leave the brake tester. Otherwise the tester can be ruined by corrosion.
3. Ensure that nothing prevents the middle-rollers from revolving or from being pressed down.
4. Check the bearing bolts on the main rollers for tightness.
5. Check the chains for correct tension.
6. Lubricate the chains.
7. Garbage beneath the rollers can affect the weight measuring and potentially stop the drain. Clean garbage from the brake tester.

CALIBRATION:

1. It is recommended to perform a calibration check of the brake force and weight measuring system twice a year. The frequency of calibration is depending on national government requirements.

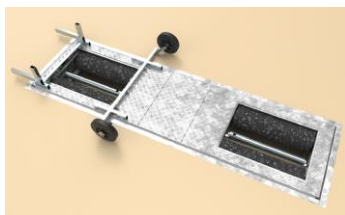
Furthermore it is recommended to arrange a service contract with your supplier of the BM brake tester.

9 MOUNTING, DISMOUNTING AND SERVICE

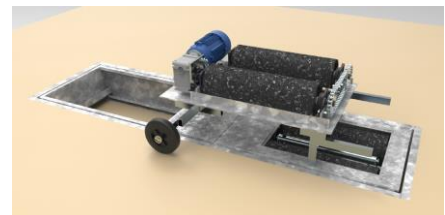
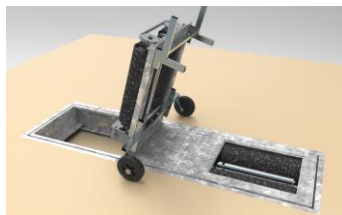
Only authorised personnel trained by BM can perform mounting, dismantling and servicing of the BM brake testers. Ensure that the service engineer is certified by BM Autoteknik Denmark. Please contact your supplier for further information.

9.1 Use of service trolley

A BM service trolley can be used for installation, service and calibration on the BM4010 and BM7010 roller brake testers.



Service trolley BM4010: CD325052
Service trolley BM7010: CD325202





CALIBRATION

10 CALIBRATION

10.1 Integrated calibration printout

During the calibration and using the remote control you can receive a complete calibration printout with all calibration values if a printer is connected. In order to

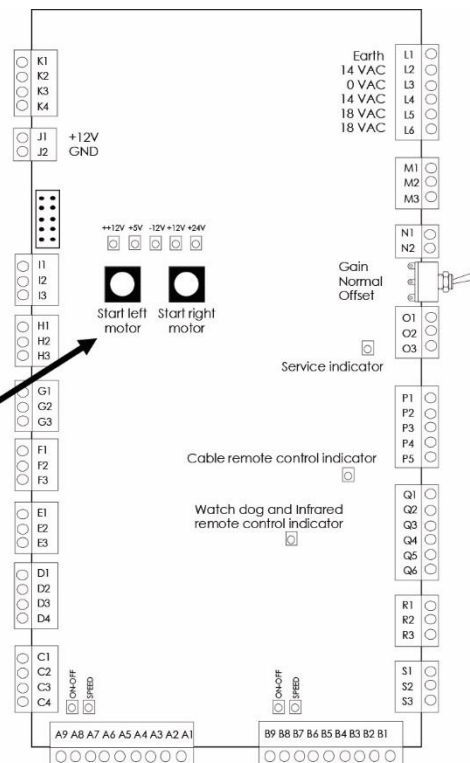
use this facility simply press the  key when the SERVICE switch is in position Z (ZERO) or G (Gain). For each press you will receive a table of data.

In order to finish the calibration printout you must end the calibration procedure by pressing the  key while the SERVICE switch is in mode N (Normal).

10.2 Calibration with rolling rollers

Calibrating the measuring system of the brake tester can be carried out with or without rolling rollers. In order to activate the gear motors during calibration, the operator must keep LEFT or RIGHT button on the MCPU computer pressed down. When the LEFT or RIGHT key is released, the gear motor (rollers) will stop immediately.

Manual start of gear motors
 (only in service mode)

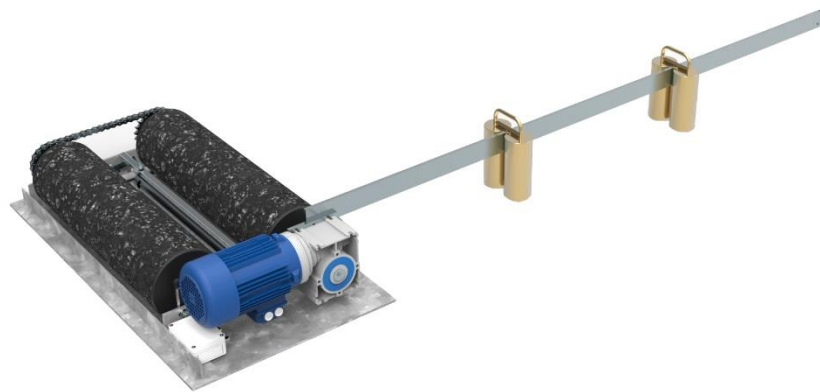


10.3 Brake force calibration procedure

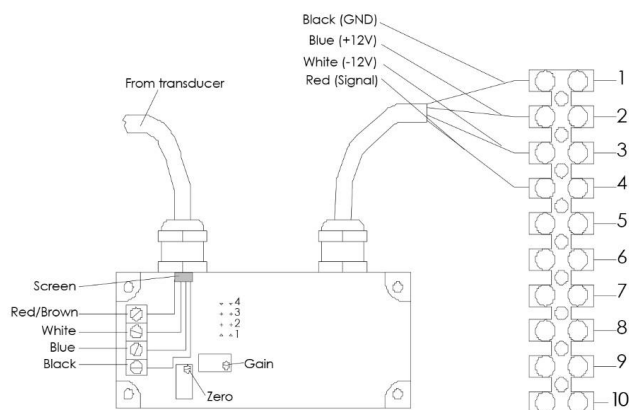
The following procedure describes how the brake force measurement system is calibrated.

CALIBRATION

1. Remove vehicle from the roller bed.
2. Power off the brake tester.
3. Take off the top of the brake force amplifier box, which is located just beside the gear motors.
4. Power on the brake tester.
5. In order to do a zero point adjustment, place the SERVICE SWITCH in position "Zero".
6. Adjust the "0-POINT" at the left side amplifier board on "Zero" potentiometer until the readout is **300 daN +/- 150 daN**.
7. Place the calibration rig in the roller set.



8. In order to do the calibration of the brake force gain, place the SERVICE SWITCH in position "Gain", This will auto-zero the force of the rig.




9. Place the loads at required "load marks", which is located on the arm of the

CALIBRATION

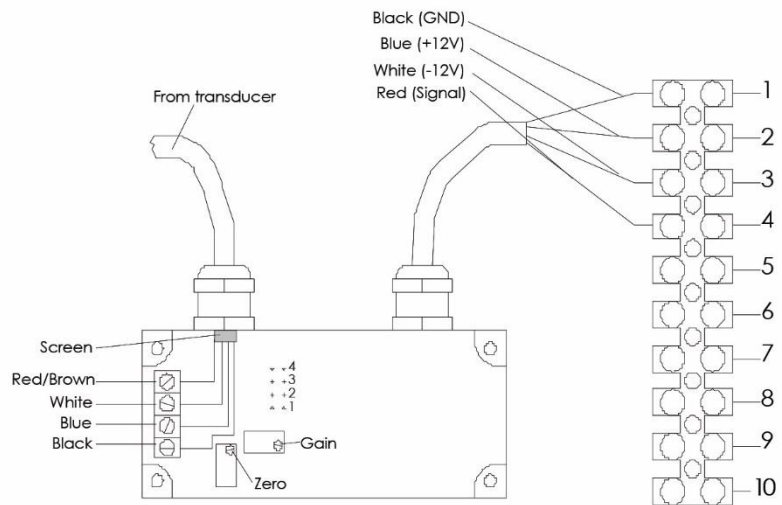
calibration rig. Make sure, that loads and arm is correctly marked for use with the particular model of brake tester.

10. Adjust the "GAIN" of the brake force amplifier board until the gauges read out a load corresponding to the "load marks" on the calibration rig.
11. Take off the load.
12. Place the SERVICE SWITCH in position "Normal".
13. Repeat step 8-12 if required, until no further adjustment is necessary.
14. Take off the calibration rig.
15. Repeat step 5-6.
16. Place the service switch in position "Normal".
17. Mount the top of the amplifier box again.

10.4 Brake tester and suspension weight calibration procedure

1. Remove vehicle from the tester (brake tester and suspension tester).
2. Power off the brake tester.
3. Take off the top of the weight amplifier box of LEFT side, which is located just beside the gear motors on the brake tester and between the plates on the suspension tester.
4. Power on the brake tester.
5. In order to do a zero point adjustment, place the SERVICE SWITCH in POSITION "Z".
6. Press the  key on the remote control unit. The AUTO/MANU light shall now be flashing!
7. Adjust the "0-POINT" gain of the weight amplifier board until the readout is **300** daN +/- 50 daN.
8. In order to do the calibration of the weight gain, place the SERVICE SWITCH in position G.

CALIBRATION

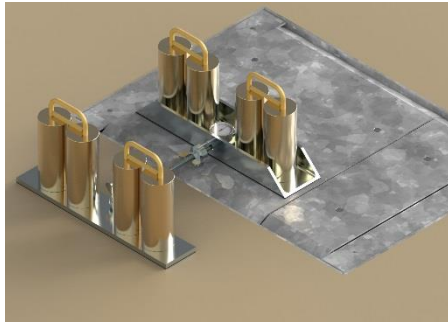


9. Place the required load(s) on the tester.
10. Adjust the "GAIN" of the weight amplifier board until the gauges read out a value corresponding to the load(s).
11. Take off the load(s).
12. Place the SERVICE SWITCH in position N (Normal operation).
13. Repeat step 8-12 until no further adjustment is necessary.
14. Take off loads.
15. Repeat step 5-6.
16. Place the service switch in position N (Normal operation).
17. Mount the top of the amplifier box again.

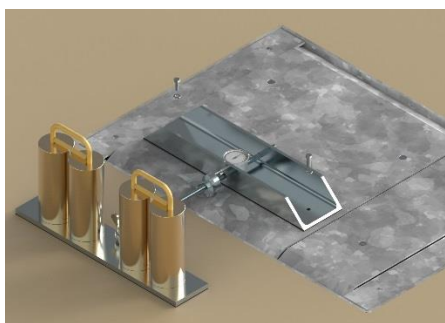
10.5 Side slip calibration

Place the side slip calibration rig as shown on the following drawing:

CALIBRATION



The steel parts have rubber path underneath to ensure a good friction, which will hold the steel part in place during calibration. However, an alternative to fixing the steel plate on the side slip plates two (2) bolts can be used for ensuring the fixation:



Start up the PC program for side slip calibration and enter the basic information data:

Service Mode

Braketeester | **Sideslip**

Distributor / Customer
 Distributer Name:
 Customer Name:
 Customer Address:

Certificate
 Certificate No:
 Date of certification:
 Calibration due date:

Calibration Tool
 Identification number:
 Deviation: mm Plate length: mm
 Temperature: °C

Calibrated Equipment
 Serial No:
 Make:
 Model:

Lane:
 HGV
 LGV

Engineer
 Initials:

| Tool | Ref.val. | Tool Adjust | Left | | Right | |
|---------------------------------|---------------------------------|--|----------------------|----------------------|----------------------|----------------------|
| | | | Before | After | Before | After |
| <input type="text" value="0"/> | <input type="text" value="0"/> | <input type="text" value="0,000"/> mm | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| <input type="text" value="5"/> | <input type="text" value="5"/> | <input type="text" value="2,643"/> mm | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| <input type="text" value="10"/> | <input type="text" value="10"/> | <input type="text" value="5,285"/> mm | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| <input type="text" value="15"/> | <input type="text" value="15"/> | <input type="text" value="7,928"/> mm | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| <input type="text" value="20"/> | <input type="text" value="20"/> | <input type="text" value="10,570"/> mm | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

Value

 m/km

Other
 Comments:

CALIBRATION

In the control box of the test lane place the service switch of the MCPU board to “zero” or “gain” position.

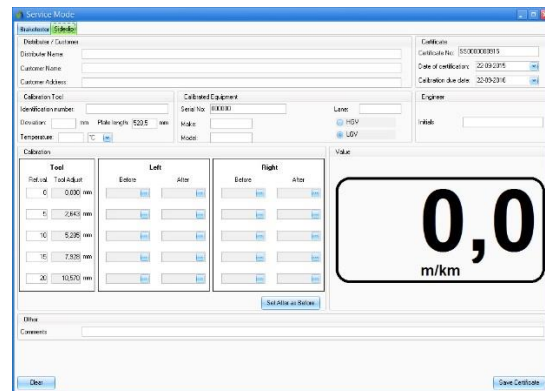
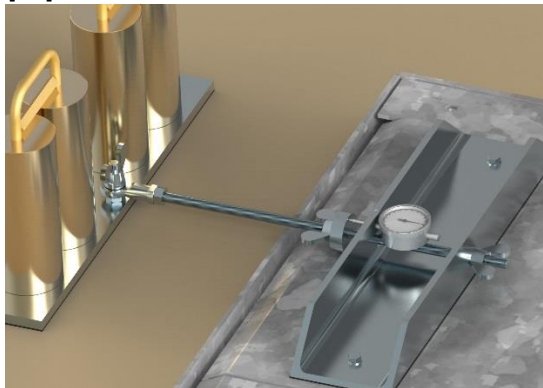
Press  on the remote control.

Under section tool, the operator can decide, which values the side slip shall be calibrated at – default ref. values are 0, 5, 10, 15 and 20. For each of these values, the software will automatically calculate how many millimeters the plate shall be adjusted using the adjustment nut (see below). This value is shown under the column “tool adjust” – measure the plate length and put this value in the box “plate length” under the column “calibration tool”.

After having placed the calibration equipment on the side slip meter and before start of a calibration sequence (for left respectively right movement) it is important

to ZERO the system by pressing the  button on the remote control.

For each of the calibration points, adjust the calibration nut to the informed value in box “Tool adjust”. When adjustment is done, result shall be registered by pressing [...].



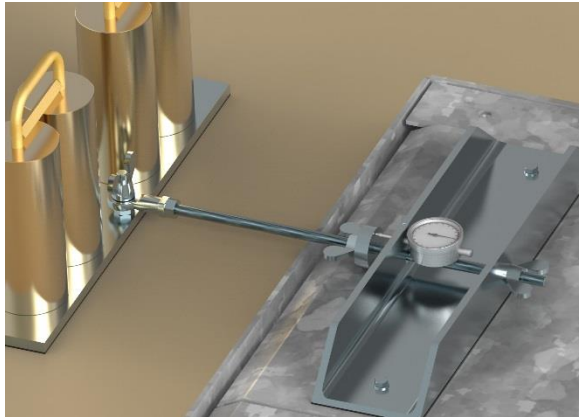
The actual measured value will be shown in the PC menu and when [...] is pressed, the value will automatically be registered in section “Left” or “Right”, subject to how in the procedure the calibration is.

When finished all “before” calibration points for left and right directions and no changes is required – you can use the “set after as before” button to fill in all the “after” values.

If some adjustments, changes etc. is required after the “before” calibration, you first have to solve that and then make a new “after” calibration.

Remember to ensure that the threaded calibration bar is horizontal by using the included washers, which can be placed above or below the bearing on the floor side.

CALIBRATION



It is important that the side slip plate is calibrated in both directions ("Left" and "Right" movements). When completed, print the calibration certificate from the PC program.

| Distributor: BM Autoteknik A/S | | Customer: Svends Autoværksted og Synshal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--------------------|--|--------------------|-------------------|--------------------|-----------------|--------------------|-----------------|--------------------|--|-------------------|--|--------------------|-------------------|--------------------|-------------------|--------------------|-------------------|--------|----------|----------|---------|-----------|----------|--|--|--|--|--------|----------|----------|---------|-----------|-----------|--|--|--|--|---------|----------|-----------|----------|------------|------------|--|--|--|--|---------|-----------|-----------|----------|------------|------------|--|--|--|--|---------|-----------|-----------|----------|------------|------------|--|--|--|--|--|
| | | Address: Nygade 28, 9600 Møldrup | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Calibration certificate for Side slip tester | | Certificate no: SS0012341504 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Date of Calibration: 30-04-2015 | | Information about calibrated equipment | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Calibration due date: 30-04-2016 | | Serial number: 001234 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Make: BM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Model: 12200 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Type: <input checked="" type="checkbox"/> HGV <input type="checkbox"/> LGV Lane: 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Calibration tool information | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Identification No: 4711-22315 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Deviation: 0,001 mm | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Temperature: 12 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th rowspan="2">Reference value</th> <th colspan="2">Left</th> <th colspan="2">Right</th> <th rowspan="2">Reference value</th> <th colspan="2">Before calibration</th> <th colspan="2">After calibration</th> </tr> <tr> <th>Before calibration</th> <th>After calibration</th> <th>Before calibration</th> <th>After calibration</th> <th>Before calibration</th> <th>After calibration</th> </tr> </thead> <tbody> <tr> <td>0 m/km</td> <td>0,0 m/km</td> <td>0,0 m/km</td> <td>-0 m/km</td> <td>-0,2 m/km</td> <td>0,0 m/km</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5 m/km</td> <td>4,8 m/km</td> <td>5,0 m/km</td> <td>-5 m/km</td> <td>-5,2 m/km</td> <td>-5,0 m/km</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>10 m/km</td> <td>9,8 m/km</td> <td>10,0 m/km</td> <td>-10 m/km</td> <td>-10,4 m/km</td> <td>-10,0 m/km</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>15 m/km</td> <td>14,8 m/km</td> <td>15,1 m/km</td> <td>-15 m/km</td> <td>-15,1 m/km</td> <td>-15,0 m/km</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>20 m/km</td> <td>19,8 m/km</td> <td>20,1 m/km</td> <td>-20 m/km</td> <td>-20,3 m/km</td> <td>-19,9 m/km</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> | | | Reference value | Left | | Right | | Reference value | Before calibration | | After calibration | | Before calibration | After calibration | Before calibration | After calibration | Before calibration | After calibration | 0 m/km | 0,0 m/km | 0,0 m/km | -0 m/km | -0,2 m/km | 0,0 m/km | | | | | 5 m/km | 4,8 m/km | 5,0 m/km | -5 m/km | -5,2 m/km | -5,0 m/km | | | | | 10 m/km | 9,8 m/km | 10,0 m/km | -10 m/km | -10,4 m/km | -10,0 m/km | | | | | 15 m/km | 14,8 m/km | 15,1 m/km | -15 m/km | -15,1 m/km | -15,0 m/km | | | | | 20 m/km | 19,8 m/km | 20,1 m/km | -20 m/km | -20,3 m/km | -19,9 m/km | | | | | |
| Reference value | Left | | | Right | | Reference value | Before calibration | | After calibration | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Before calibration | After calibration | Before calibration | After calibration | Before calibration | | After calibration | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 m/km | 0,0 m/km | 0,0 m/km | -0 m/km | -0,2 m/km | 0,0 m/km | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 m/km | 4,8 m/km | 5,0 m/km | -5 m/km | -5,2 m/km | -5,0 m/km | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 m/km | 9,8 m/km | 10,0 m/km | -10 m/km | -10,4 m/km | -10,0 m/km | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 m/km | 14,8 m/km | 15,1 m/km | -15 m/km | -15,1 m/km | -15,0 m/km | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 m/km | 19,8 m/km | 20,1 m/km | -20 m/km | -20,3 m/km | -19,9 m/km | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Comments | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Engineer: PL | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Date of issue: 30-04-2015 | | Signature _____ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>This Calibration Certificate is valid only for the calibrated equipment specified by the Make, Model and Serial number, for the timeframe specified by the Date of issue and Calibration due date.</p> <p>The Side Slip tester have been calibrated accordingly to the values in the table above, using the calibrate-tool (identified by its identification number). The recorded values before- and after a present above.</p> <p>The uncertainty of measurement is notes as the Deviation above. In case of deviation from normal calibration procedure the reason will be noted in the comments section of the certificate.</p> <p>Only signed Certificates are valid.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

To finalize the calibration, place the service switch back in middle position.

11 SETTING THE TIME/DATE ON THE ELECTRONICS

11.1 Setting the time/date from a PC

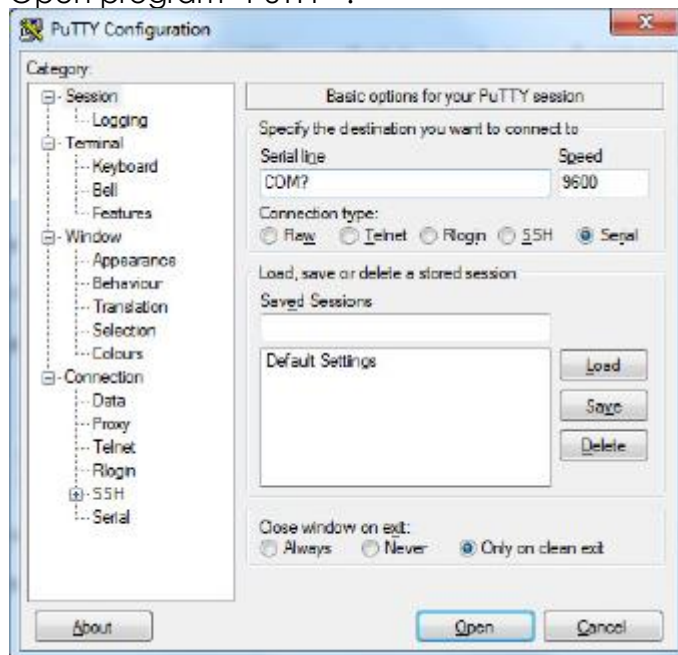
Do following on the X010:

1. Address 13 should be set to 0
2. Address 24 should be set to 0

Connect **RS232 X010 cable** from **PC** RS232 com port to **MCPU Printer port** or by USB to serial converter.

Download and install "PuTTY" (freeware) on your PC

Open program "PuTTY" :



1. Key in Com Port number under "Serial line"
2. Key in "9600" under "Speed"
3. Choose "Serial" under "Connection type"
4. Press [Open]

All that will normally be printed on paper will now be shown on your screen on PC and the watch setup procedure is the same with remote control as normal (pressing F1 when counting 11, 22 etc. for starting programming time etc., "jump" between year, date and time by using F1, change time, date etc. by using +50, -50).

This program can also be used for simulating "printer", it says that it can be used to check if data from MCPU is sent to printer etc.

11.2 Setting the time/date without PC

You should have a printer connected directly to the X010 electronics. If you use a Matrix printer, the printer will print for each step below. If you use a Laster printer,

SETTING THE TIME/DATE ON THE ELECTRONICS

then print out will not take place until you have finished the complete procedure.

1. During start-up (11-22-33 ...) press and hold the **F1** key until the printer prints (or you see the data) starting values for the clock's current setting:
Date / Time 01-02-2010 12:30
2. The first value that can be configured is year (highlighted). In order to change the year use keys **-50** and **+50**. **-50** will reduce the year by one. **+50** will increase the year by one.
3. When the year is set, press the **F1** key, then month (highlighted) can be configured . The keys **-50** and **+50** works the same way as in step 2.
4. When the month is configured press **F1** key and now day can be configured.
5. This is continued with hours and minutes.
6. Setting will automatically be finished and stored after the last setting.
7. Always remember to check that time is stored by powering off and on again.