Dynamometer

ASM Performance

ASM Performance Plus

for passenger cars

Technical Handbook

English

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TABLE OF CONTENTS

1 Safety 1

1.1 Safety Instructions 1
1.2 Safety Instructions for Operation 4

2 Installation 5

2.1 Introduction 5
2.2 Installation Instructions 6
2.2.1 Test Stand Installation and Anchoring 6
2.3 Positioning Suggestion 7
2.3.1 Installation of the Anchor Plates 9
2.4 Foundation Plan 10
2.5 Connection ASM-P/PLUS 11
2.6 Technical Data 12
2.6.1 General Data 12
2.6.2 Roller Set 12
2.6.3 PC Minimum Requirements (Status: June 2005) 12
2.6.4 Lifting Bar 12
2.6.5 Eddy Current Brake with Flywheel 13
2.6.6 Drive 13
2.6.7 Weighing System (Optional) 13
2.7 Transport 14
2.8 Lifting Bar / Pressure Measurement Cell (Optional) 15
2.8.1 ASM-P 15
2.8.2 ASM-P-Plus 16
2.9 Lifting Bar Connection 16
2.9.1 Lift Bar Pressure Adjustment 18
2.10 Weighing System 19
2.11 Restraint-System 20
2.12 Ventilator Installation with ASM-P/PLUS 21

3 Description of the PCB 23

3.1 Installation and Connection of the Frequency Converter 23
3.2 Description of the ASM-V1.5 PCB 24
3.2.1 Description of the Connector 25
3.2.2 Connector Strip ST1 28
3.2.3 Test Points 29
3.2.4 Fuses and Grounding on the ASM PCB 30
3.2.5 LEDs on the PCB 31
3.3 Description of the ASM-IGBT-V1.5 PCB 32
3.3.1 Connector Description 33
3.3.2 PCB Grounding 35
3.3.3 Potentiometer of the PCB 35

4 PC-Interface Protocol 37

4.1 General Information 37
4.1.1 Serial Interface Configuration 37
4.1.2 Data Set Transmission 38
4.1.3 Data Record Structure 38
4.1.4 Control Words 39
4.2 Data Record Set-Up 40
4.2.1 Transmit Test Values 40
4.2.2 Transmit Status 41
4.2.3 Read Variables 42
4.2.4 Write Variable 43

4.3 Send Control Words ... 44
4.4 Example of a Data Record ... 46

5 Test Stand Control ... 49

5.1 Target Value for Speed Regulation ... 49
5.1.1 Procedure ... 49
5.2 Target Value for Torque Regulation ... 51
5.2.1 Procedure ... 52
5.3 Vehicle Mass for Drive Resistance Regulation ... 52
5.3.1 Setting Variable 202 ... 52
5.4 Vehicle Resistance Coefficients ... 53
5.4.1 Vehicle Resistance Coefficient C_V ... 53
5.4.2 Vehicle Resistance Coefficient B_V ... 53
5.4.3 Vehicle Resistance Coefficient A_V ... 54
5.5 Eddy-Current Brake Function Test (Variable 106) ... 54
5.5.1 Setting Variable 206 ... 55
5.6 Tire-Roll Losses GTRL (Generic Tire Roll Losses) ... 55
5.6.1 Tire-Roll Losses Coefficient A_t ... 55
5.6.2 Tire-Roll Losses Coefficient B_t ... 56
5.6.3 Tire-Roll Losses Coefficient C_t ... 56

6 Service Program ... 57

6.1 ASM Installation Program ... 57
6.2 Call up Menu Points ... 58
6.2.1 End ASM-P/PLUS PC-Program ... 58
6.3 Program Variable ... 58
6.4 Program Soft-Dips ... 59
6.5 Display Test Values ... 62
6.5.1 Select Command ... 62
6.5.2 Select Regulator ... 63
6.6 Determine Parasitic Losses ... 64
6.7 Determine ASM Losses ... 64
6.8 Calibrate Test Stand ... 65
6.9 Display ASM Status ... 65
6.10 Read Error Memory ... 65
6.11 Read RAM Variables ... 66
6.11.1 Page Through Variables ... 66
6.11.2 Select Variable ... 66
6.11.3 Change Variables ... 66
6.12 Load Check ... 67
6.13 Variable Load Test ... 68
6.14 Weighing Scale Calibration ... 68
6.14.1 Calibrate ‘Total Weight’ ... 68
6.14.2 Calibrate ‘Separate’ ... 68

7 Calibration ... 69

7.1 Preparation ... 69
7.2 ASM Calibration ... 70
7.2.1 ASM Calibration Device ... 70
7.2.2 ASM Calibration Device Installation ... 71
7.2.3 Description ... 72
7.2.4 Procedure ... 72
7.3 Weighting Scale Calibration ... 74
7.3.1 Weighing Scale Calibration Device ... 74
7.3.2 Installation of the Weighing Scale Calibration Device ... 75
7.3.3 Description ... 76
7.3.4 Procedure ... 76

8 Maintenance 79

8.1 Maintenance Work on the Toothed Belt 79
8.1.1 Tension Load Tester Optibelt 80
8.1.2 Tension Load Tester SEEM 81
8.1.3 Set the Tension of the Toothed Belt 84
8.2 Toothed Belt Exchange 87
8.2.1 Toothed Belt Data 88
8.3 Impulse Sensor Exchange 88
8.3.1 Impulse Sensor Removal 89
8.3.2 Impulse Sensor Installation 89
8.4 Strain Gauge Exchange 90
8.4.1 Strain Gauge Removal 90
8.4.2 Strain Gauge Installation 91
8.5 Exchanging the Tension Set 92
8.6 Eddy-Current Brake Exchange 93
8.6.1 Removal of the Eddy Current Brake 93
8.6.2 Installation of the Eddy-Current Brake 96
8.7 Working on the Lift Beam 104
8.7.1 Lift Beam Structure 104
8.7.2 Weighing Cell Replacement 105
8.7.3 Air Bellow Replacement 106
8.7.4 Adjustment of the Lifting Beam 108
8.7.5 Brake Shoe Replacement 109
8.8 Exchange of the Roller Bearing 110
8.8.1 Roller Bearing of Roller 1 110
8.8.2 Roller Bearing of Roller 2 111
8.8.3 Roller Bearing of Roller 3 112
8.8.4 Roller Bearing of Roller 4 114
8.9 Exchange of the Brake Bearing 115
8.10 Three-Phase Motor Exchange 116
8.10.1 Three-Phase Motor Removal 116
8.10.2 Three-Phase Motor Installation 118

9 List of Variables 121

9.1 EEPROM Variables 121
9.1.1 Read-Only Variables 124
9.2 RAM Variables 125

1 Safety

1.1 Safety Instructions

Safety instructions are provided to warn about dangerous situations and to help avoid injury to people.

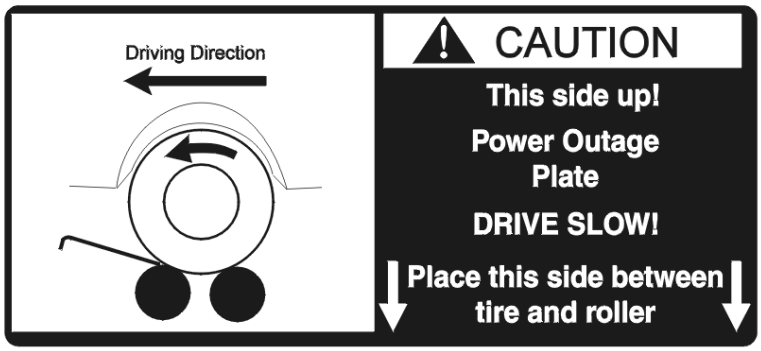
Only trained authorized personnel may operate the test stand

Rotating rollers are highly dangerous!
Hands, feet and clothing should never come into contact with rotating rollers!

test stand is equipped with an internal drive for coast-down and warm-up procedures and it is therefore very important that even in a standstill state no one walks on the rollers!

Risk of injury!
Safety goggles should be worn at all times!
Check the tires and remove any particles which may become loosened and fly off.
Check the balancing weights on the rim to make sure they are securely attached.

At power outage a drive-off assistance plate is needed for both tires to remove the vehicle from the roller set.
The flat edge should be positioned between roller and tire.
Pay close attention that the bent edge is always positioned down!
Drive off slowly.

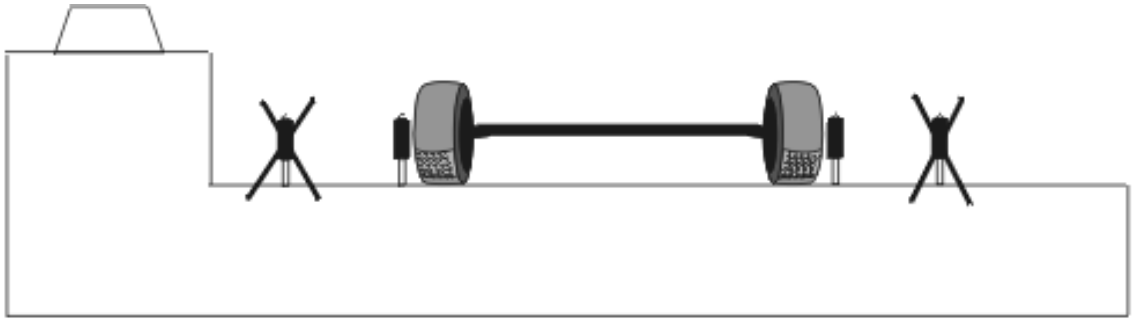


Potential carbon monoxide poisoning!
The test stand should only be erected in rooms which it is guaranteed that the air supply is exchanged at least 4times per hour.

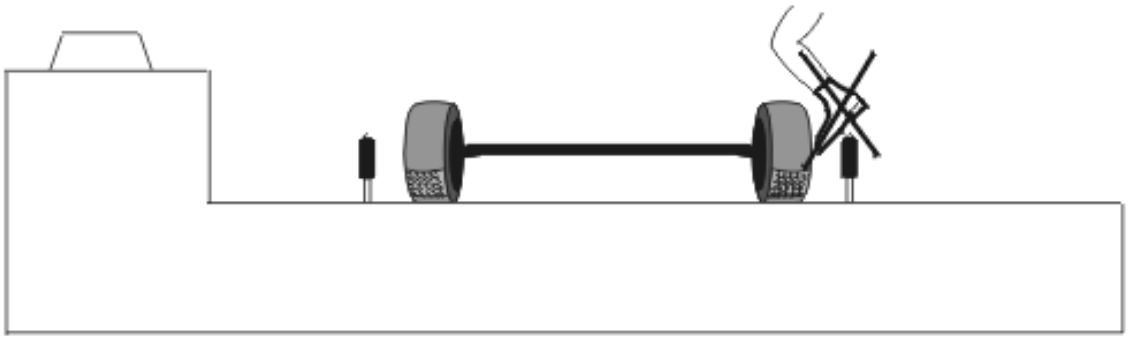
Running motors can be dangerous! Potential carbon monoxide poisoning!

Risk of explosion!
The test stand is not to be erected in rooms liable to contain explosive mixtures!
Standard test stands have no EX-protection!

Pay close attention that the restraint rollers used in the restraint system are placed in the hole closest to the tire!



Never put your foot between or near the restraint roller and the tire!



1.2 Safety Instructions for Operation

- All official Accident Prevention Regulations must be thoroughly complied with!
  The Accident Prevention Regulations of the country in which the test stand is being operated apply.
- Noise emission protection!
  The working area around the test stand should be protected from noise.
- Use ear protection!
  Appropriate ear protection must be used.
- Never step onto the rollers or the lifting bar!
- Before repair-/maintenance-/set up work, turn off main switch and secure against tampering
- Never do adjustment or maintenance work when rollers are turning!
- All work done on electrical parts of the equipment is to be carried out by trained, qualified electricians or service technicians only! Unskilled electrical work can be life threatening.
- Protect all parts of the installation from humidity and moisture!
- All work done on impulse sensors and proximity switches should be carried out by trained electricians.
- Keep the test stand and the surrounding work area clean.
- The test stand may only be operated within its power capacity limits!
- Avoid tire damage!
  Regularly check the tightness of the fastening screws on the cover plates.
- Test vehicles must be deemed roadworthy before they are tested!
- The vehicle should be driven slowly onto the test stand to avoid putting any unnecessary strain on vehicle or test stand.
- Damage to low-lying vehicle parts are not covered by warranty!
- The test stand should be secured and/or covered when not in use and when located in an area to which the public has access.
- Only drive onto or exit the test stand when the lifting bar is in the upper most position
- The roller set **may not** be braked by using the vehicle brakes!
  Very intense torque and forces act on the test stand if a braking procedure or panic braking using the vehicle brakes is done. This leads to damage on the test stand. The tension set is arranged in sucha away that it slips through at the support roller to prevent massive damage, Afterwards it must be exchanged.

2 Installation

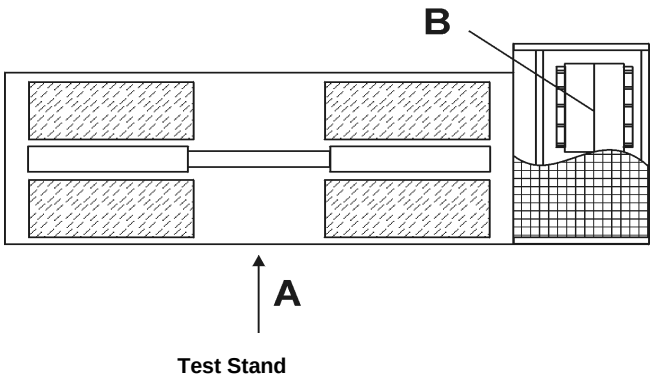
2.1 Introduction

The ASM-P -Performance dynamometer (**A**cceleration **S**imulation **M**ode-**P**erformance) is a combined exhaust/Performance roller test stand.

The test stand has been specially developed to meet the specifications of BAR 97 for an exhaust emission test.

A driving direction

B eddy-current brake



The ASM-P is installed in a foundation.
This type of installation is called In Floor.
The test stand can be operated bi-directionally under certain conditions

The ASM-P/PLUS power absorption is dependent upon the driving direction (due to belt connection).
Power absorption: forward driving direction max. 500 hp
reverse driving direction max. 150 hp

Eddy current brake	Constant Power Absorption
25 hp: ∞ constant	250 hp: 5 min
50 hp: 15 min	350 hp: 3 min
100 hp: 7.5 min	500 hp: 1 min

The type of testing can be set via a softdip

2.2 Installation Instructions

The ASM-P test stand should always be securely attached in the foundation.

When installing the test stand attention should be paid that the test stand sets accurately in the foundation. After installation, the test stand must be aligned. The foundation dimensions and measurements may be taken from the appropriate foundation plans.

The danger of frame distortion may lead to mechanical failure during test stand operation!
The preparatory work on the foundation pit should be carried out with the greatest care and accuracy. (exact level positioning) If this is not observed, the positioning of the roller set may not be as accurate as required!
This can lead to twisting on the roller set frame and consequently to operational malfunctions.

2.2.1 Test Stand Installation and Anchoring

1 Clean the test stand foundation, especially the supporting platform and remove any remaining cement

Pinching risk!
Pay close attention to the electrical connections when lowering the roller set.

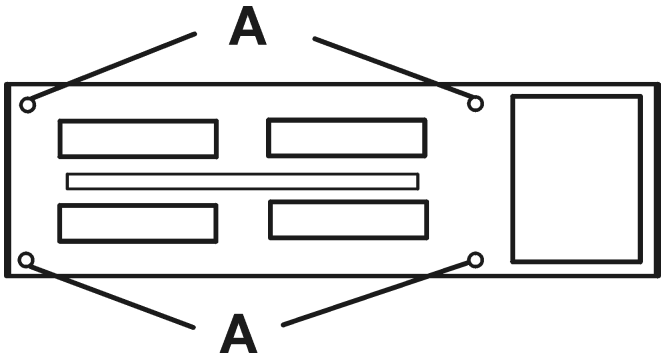
2 Place the test stand in the foundation (see paragraph).

3 Align the test stand in the foundation.

4 Make sure the test stand is centered properly in the gap which is between the roller set and foundation.

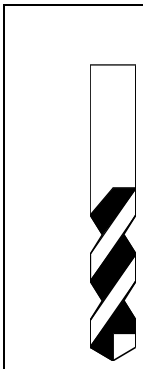
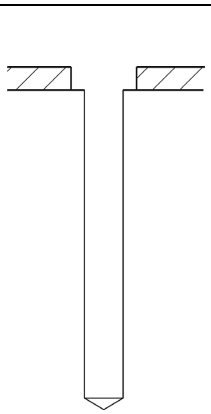
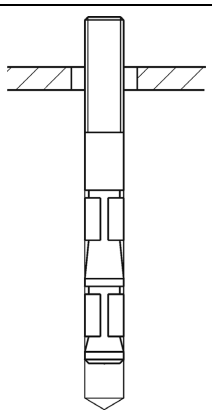
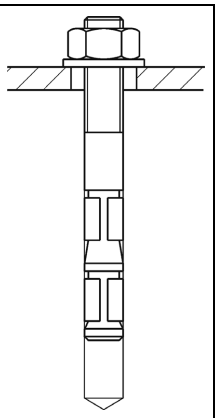
5 Align the roller set horizontally using a spirit level. If necessary, place metal plates underneath.

6 Anchor the roller set in the foundation on the four points (A) with dowels and screws Express Anchors 10/90 (i.e. ϕ 10 mm and 90 mm long) and M10 screws.



Anchoring points of the ASM

The test stand must be re-calibrated after succesful installation

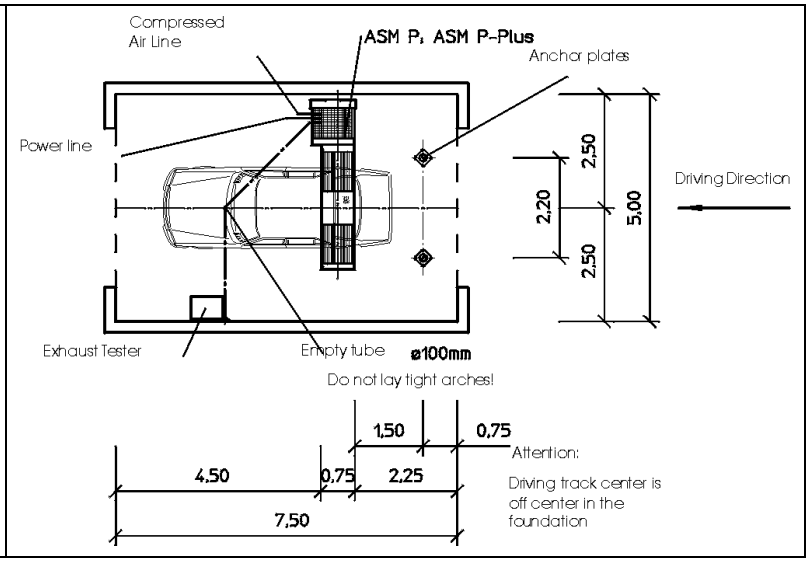
			
Set drilling hole	Clean hole	Place anchor through the component into drilling hole	Tighten nut and screw with tested torque wrench (torque 45 Nm).

2.3 Positioning Suggestion

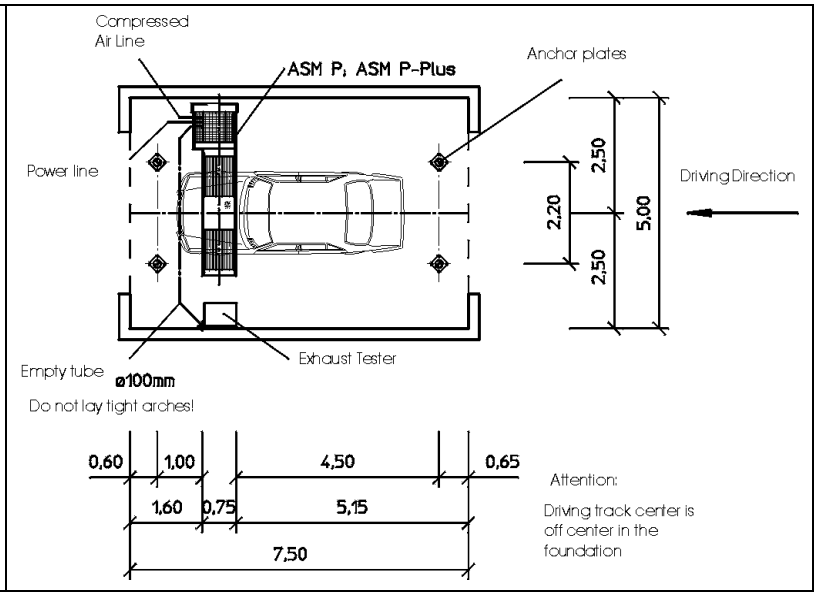
Our positioning plans represent non-binding recommendations. We do not accept liability that the installation plans provide for an effective and trouble-free operation.

Noise protection planned. Plan for fresh air feed and suction. Plan for allowances with extra large vehicles. The owner of the system is responsible for adhering to local and federal regulations.

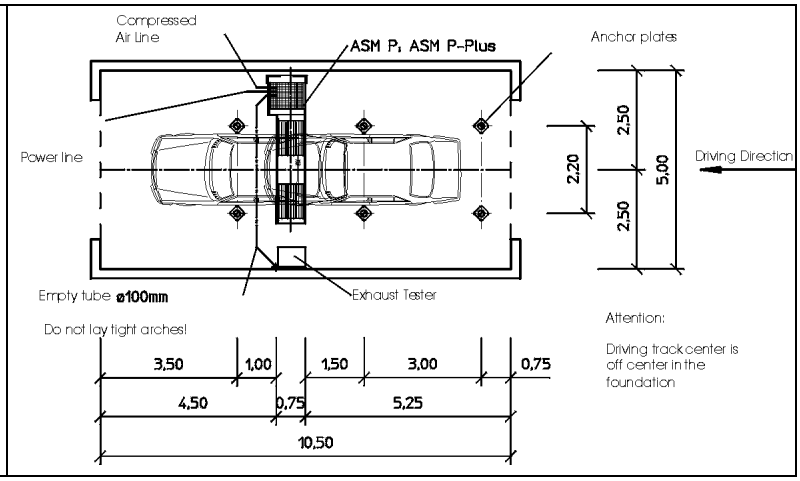
Rear drive only



Front drive only

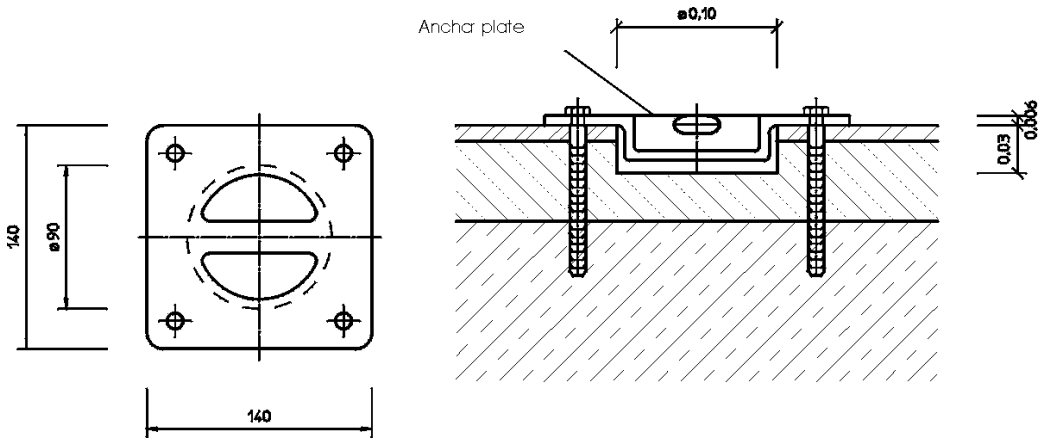


Front and rear drive combination



2.3.1 Installation of the Anchor Plates

Our positioning plans represent non-binding recommendations. We do not accept liability that the installation plans provide for an effective and trouble-free operation.



1 Position anchoring plate.

2 Mark drilling holes.

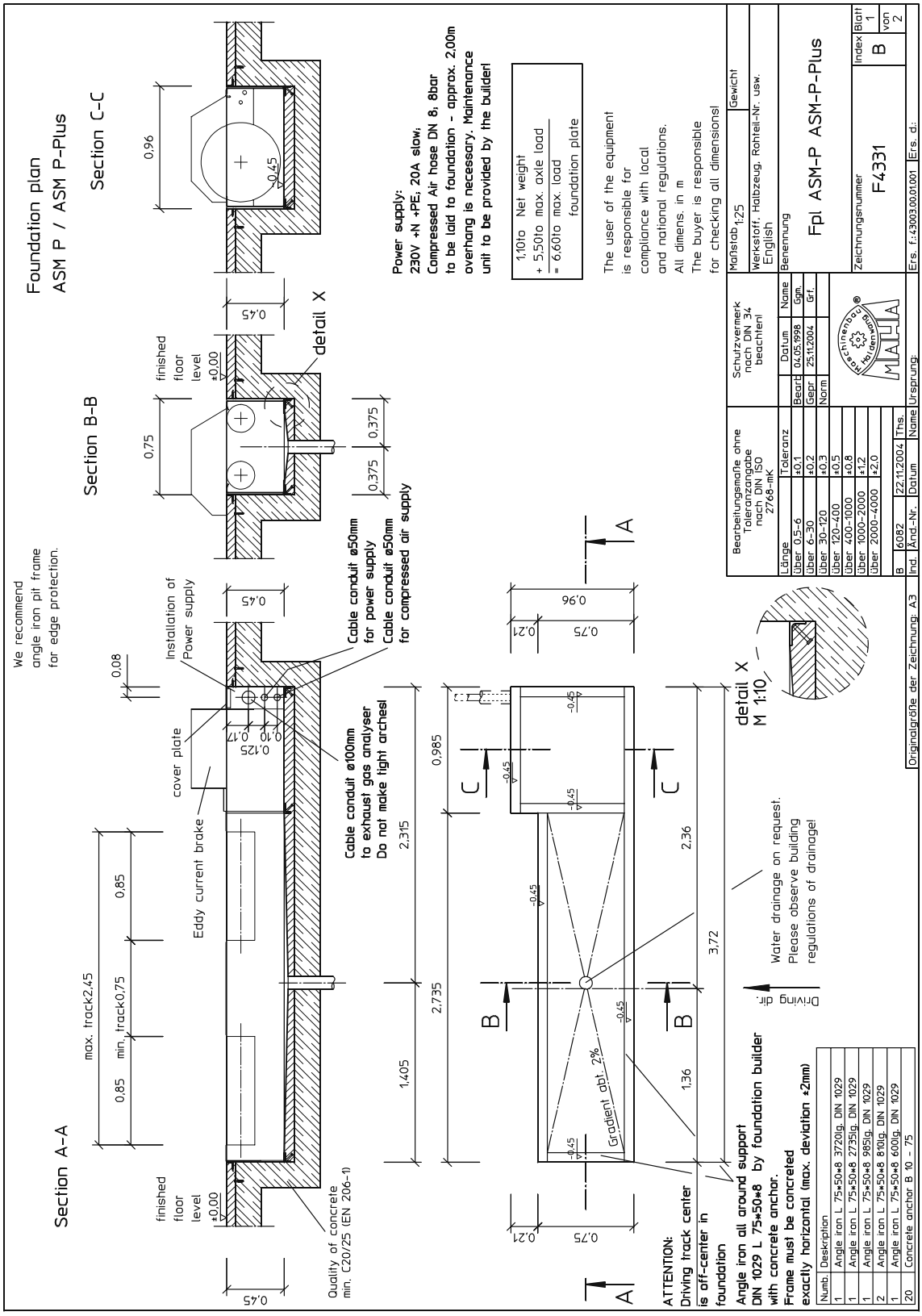
3 Remove anchor plate.

4 Drill holes and clean them.

5 Insert dowel.

6 Place and screw in achor plate.

2.4 Foundation Plan



2.5 Connection ASM-P/PLUS

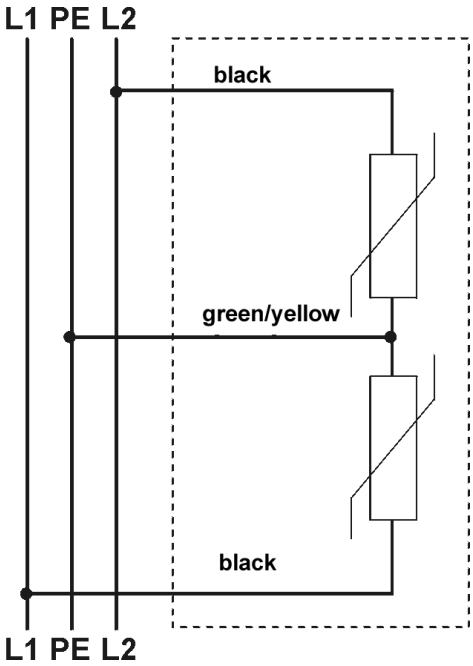
1 Connect RS232 cable with RS232 interface connection (a).

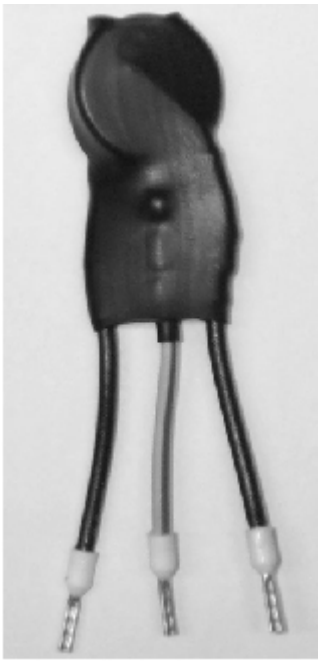
2 Connect power connection cable to power connection socket (230V/20A/60Hz) (b) (green: GND)

3 Connect 1/4" NPT-sleeve (c) with compression air hose.

4 If necessary use adapter (MAHA Art.No. 61 ASM1 ADAP) (e.g. Korea).

5 Install lightening protection assembly set (MAHA Art.No. 61 ASM1 VAR1).





Description of the Adapter connections

ASM			RS232	
PIN1	TxD	———	**PIN2**	RxD (Red)
PIN2	RxD	———	**PIN3**	TxD (Black)
PIN3	Shield	———	**PIN5**	GND (Green)
PIN4	GND	———	**Test stand frame**	

2.6 Technical Data

2.6.1 General Data

Nominal voltage	230V ± 10%
Nominal current	20 A
Frequency	60 Hz
Fuse protection	20 A slow
Axle load	6000 lbs (2722 kg) or P-plus (12125 lbs (5505 kg))
Test stand weight	2161 lbs (980 kg)

2.6.2 Roller Set

Test speed	max. 120 mph (193 km/h)
Roller set length	139.3 inch (3539 mm)
Roller set width	28.3 inch (718 mm)
Roller set height	17.7 inch (450 mm)
Roller diameter	8.56 inch (217 mm)
Roller separation	17.3 inch (439 mm)
Roller length	33.5 inch (850 mm)
Inner track width vehicle	30 inch (762 mm)
Outer track width vehicle	100 inch (2540 mm)
Roller surface	powder coated
Driving direction	bi-directional (limited)
Operating temperature	35°F to 110°F (1.7°C to 43.3°C)

2.6.3 PC Minimum Requirements (Status: June 2005)

CPU	Processor from 1.6 GHz
Motherboard	USB connection
Working memory	256 MB
Hard drive	> 4 GB
Drives	CD-ROM > 32x, Disc drive 1.44''
Graphic card	Resolution 800x600 with 64k colors, Memory 4 MB
Operating system	Windows 2000, XP Professional

2.6.4 Lifting Bar

Construction	one piece
Operation	pneumatic
Compressed air ca.	87-116 psi (6 -8 bar) max. 145 psi (10 bar)

2.6.5 Eddy Current Brake with Flywheel

Type ..... Pentar P-5.1-206
Number of coils ASM 8
max. current per coil ..... 2,5 A
Voltage per coil ..... 96 V
Rane of flywheel mass (traction mode) ..... 2000 lbs - 6000 lbs (907 kg - 2722 kg)
Mechanical flywheel ..... 2000 lbs ± 40 lbs (907 kg ± 18 kg)
Brake width ..... 36.6 inch (930 mm)
Brake height ..... 28.5 inch (725 mm)

2.6.6 Drive

Three phase motor ..... with 2 shaft ends between roller pair
Power ..... 2.2 kW
Speed max. ..... 31 mph (50 km/h)

2.6.7 Weighing System (Optional)

Sensors ..... integrated in the lifting bar
Weighing range Performance ..... 800 lbs - 6000 lbs (363 kg -2722 kg)
Weighing range Performance Plus ..... 800 lbs - 12125 lbs (363 kg -5505 kg)
Accuracy ..... ± 100 lbs ± (45 kg)

1 lbf ≙ 4.44 N
1 lbs ≙ 0.454 kg
1 hp ≙ 0.74 kW
1 mph ≙ 1.609 km/h
1 inch ≙ 25.4 mm
1 psi ≙ 0.06895 bar

2.7 Transport

Lifting devices or cranes must have a min. lifting capacity of 2204 lbs (1t) !

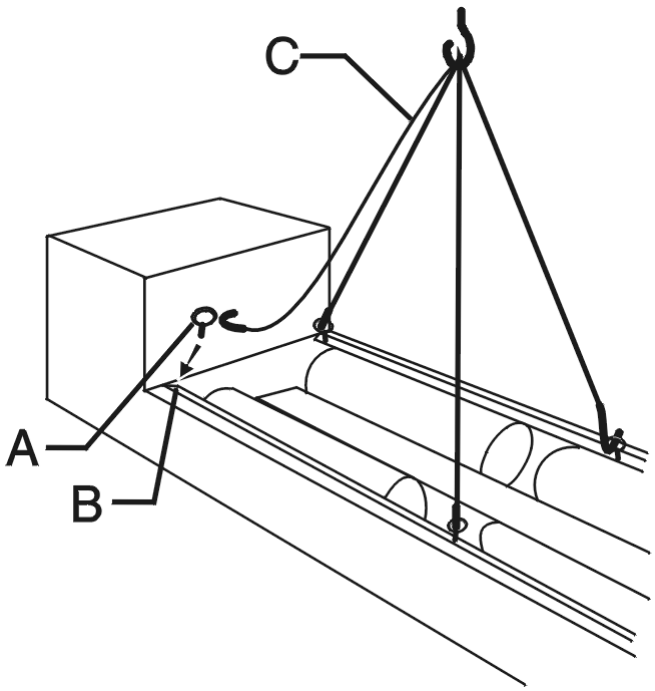
The test stand center of gravity is not in the middle. Pay attention to the center of gravity marking on the packing box.

Steel cable or chain must have sufficient load capacity for the roller set weight.

1 Screw in the ring bolts (A) included in the packaging into the proper threaded holes (B).

2 Attach steel cable or chain (C) to the 4 bolts.

3 Lift the roller set.



Transport of the roller set

2.8 Lifting Bar / Pressure Measurement Cell (Optional)

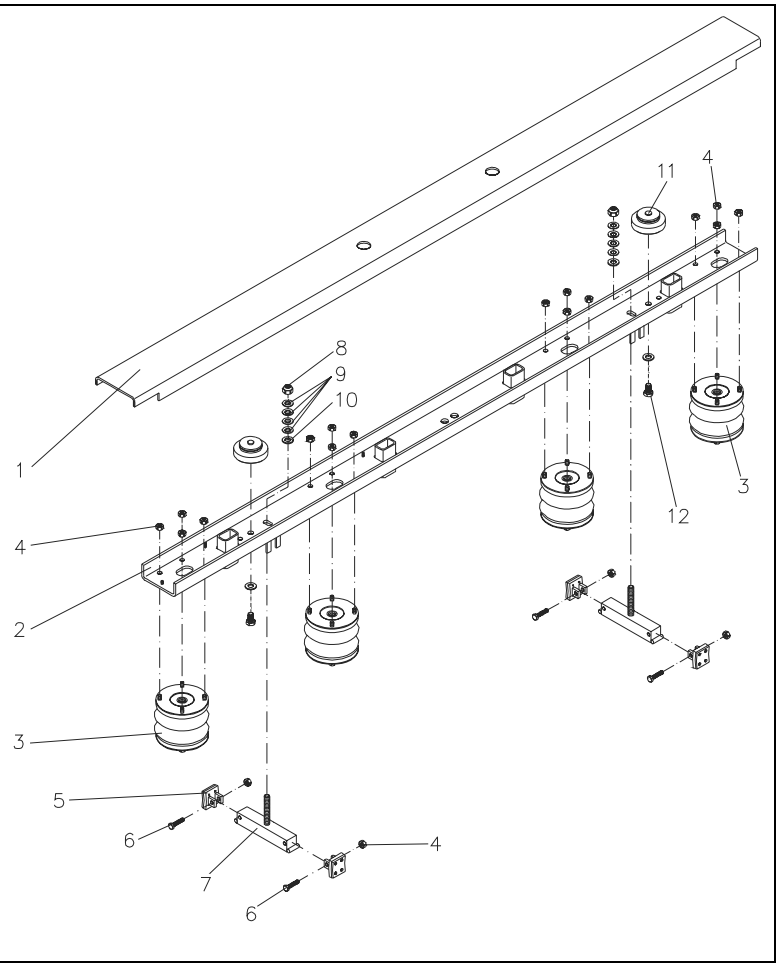
The weighing system/pressure measurement cell is used for determining the axle weight of the drive axles. The axle weight is used then for compensating the tire roller losses.
Measurement range of the axle weight Performance : 800 lbs - 6000 lbs
Measurement range of the axle weight Performance Plus : 800 lbs - 12125 lbs
Measurement accuracy : ± 100 lbs

The weighing system is integrated into the lifting bar.

To access this, the center cover must be removed.

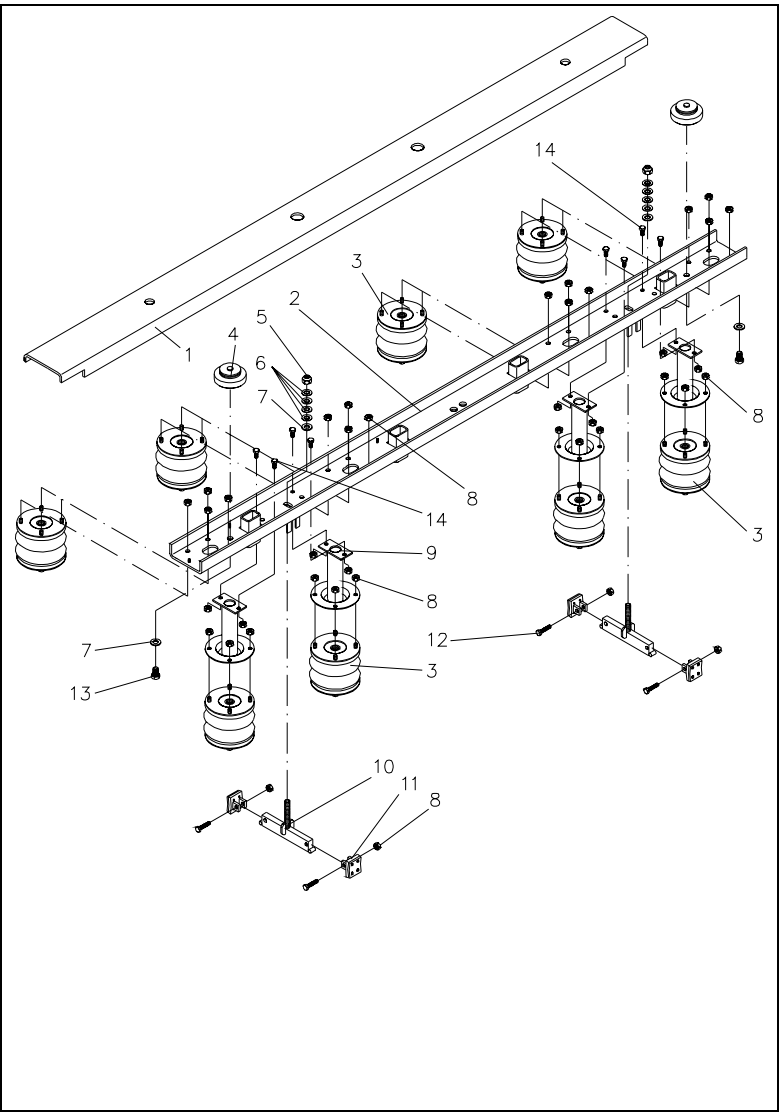
2.8.1 ASM-P

Pos.	Designation
1	Lifting bar upper part
2	Lifting bar support
3	Air spring bellows Pneuride 6x2
4	Hexagonal nut M10
5	Brake shoe
6	Hexagonal screw M10x45
7	Brake bar 540
8	Hexagonal nut M16 self-securing
9	Disc spring 31,5x16,3x2
10	Disc A17
11	Bushing Pressure measurement cell Weighing device
12	Hexagonal screw M16x25



2.8.2 ASM-P-Plus

Pos.	Designation
1	Lifting bar upper part
2	Lifting bar support
3	Air spring bellows Pneuride 6x2
4	Pressure measurement cell (weighing device)
5	Hexagonal nut M16 self-securing
6	Disc spring 31,5x16x2
7	Disc A17
8	Hexagonal nut M10
9	Air spring bellows
10	Brake bar 540
11	Brake shoe
12	Hexagonal screw M10x45
13	Hexagonal screw M16x25
14	Hexagonal screw M10x22



2.9 Lifting Bar Connection

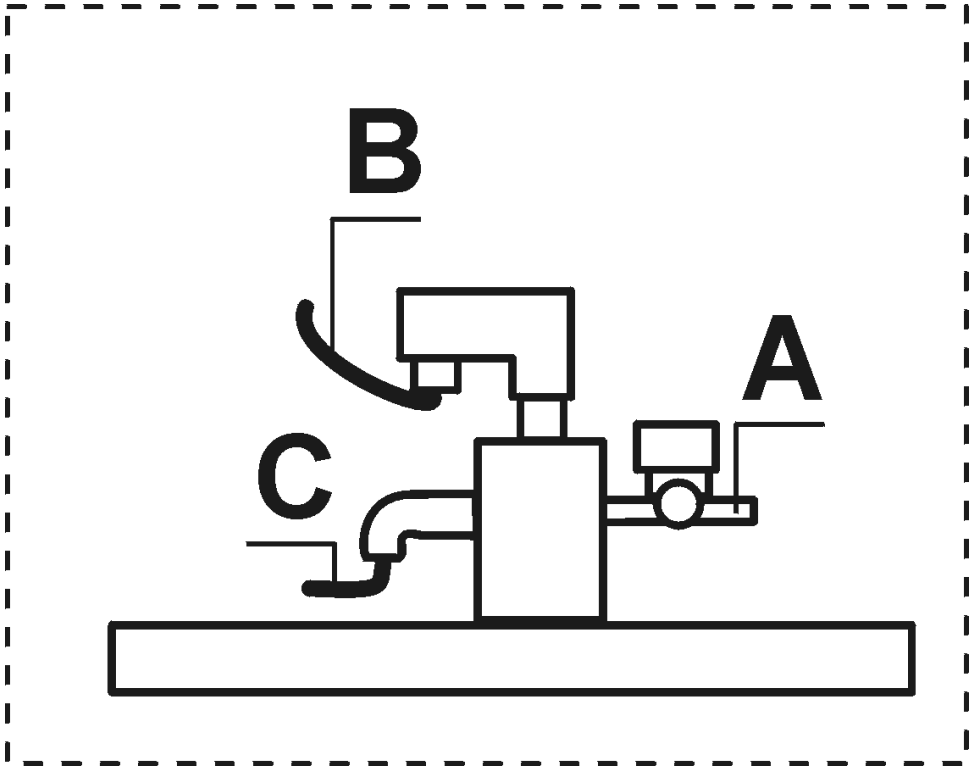
The connection of the lifting bar is located on the outside of the eddy current brake.

At connection (A) the workshop compressed air is connected to the compressed air hose. Connection (A) leads out of the side cover.

Depending on local conditions a pressure regulator or a servicing unit should be installed.

Cable (B) leads to the electrical connection of the lifting bar to the control PCB.

Hose (C) leads to the air bellows of the lift beam.



Connection of the lifting bar

A Compressed air supply

B Plug magnet valve

C To lifting bar

	bar	**Psi**
Connection pressure	max. 10	max. 145
Adjustable pressure range	6 - 8	87 – 116
Operating pressure of the lifting bar	6 - 8	87 – 116

2.9.1 Lift Bar Pressure Adjustment

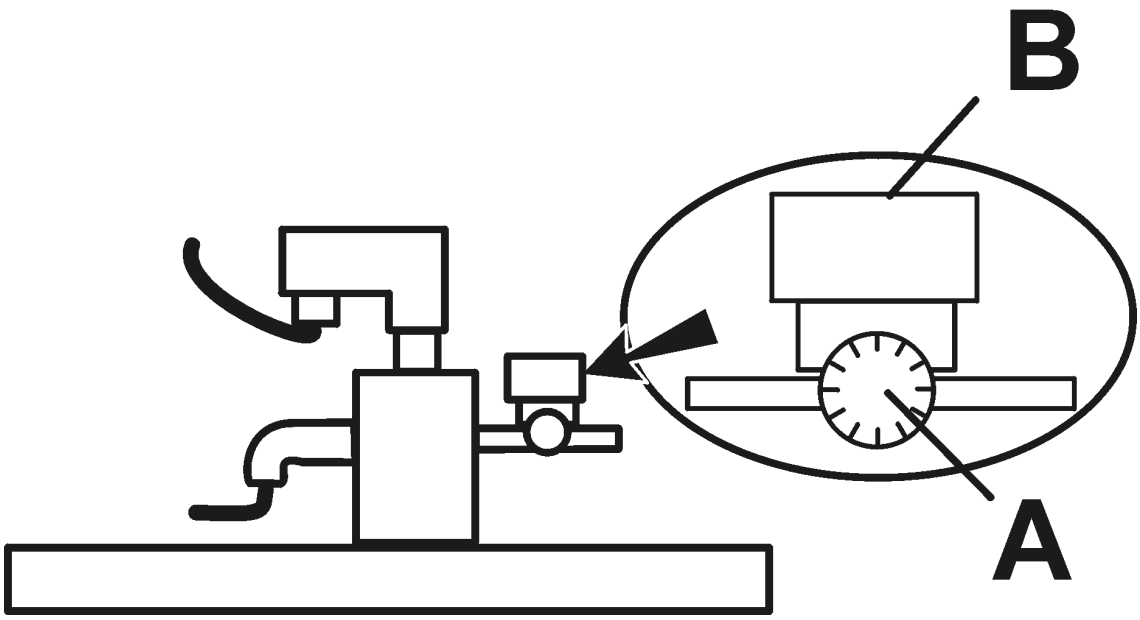
The operating pressure of the lift beam is set with the black adjusting screw (A). The pressure can be checked on the indicator (B).

1 Pull out the black adjustmen screw. (A)

The pressure on the pressure connection may not exceed 145 psi (10 bar).

2 Adjust pressure; read on indicator (B).

3 Push in black adjustment screw again.



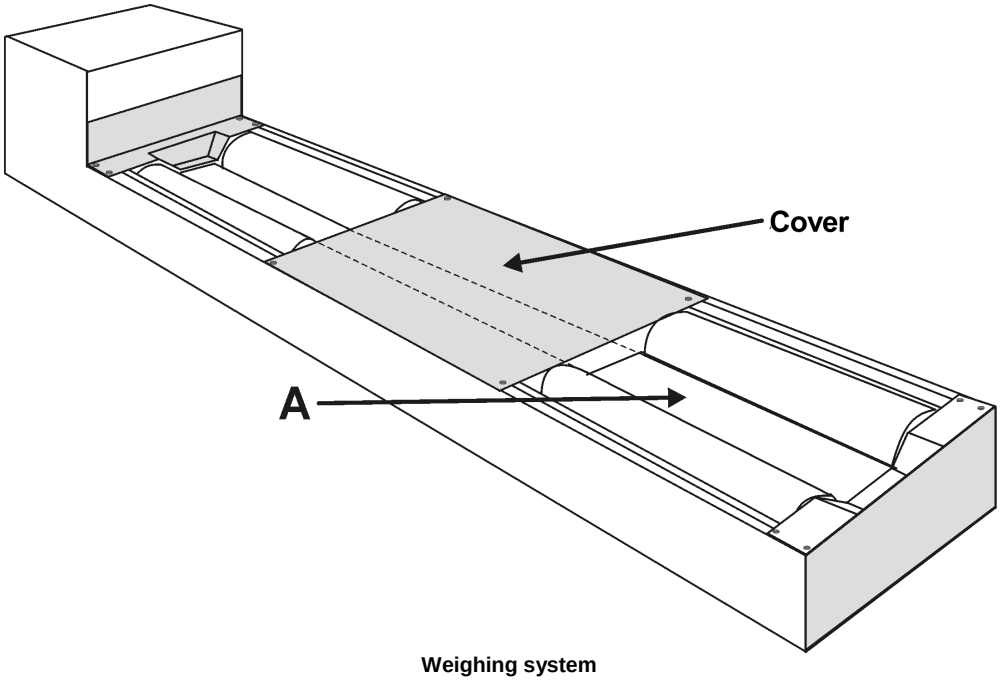
Set lifting bar pressure

2.10 Weighing System

The weighing system is used for determining the axle weight of the drive axles. The axle weight is used then for compensating the tire roll losses.
Measurement range of the axle weight : 800 lbs - 6000 lbs
Measurement accuracy : ± 100 lbs

Remove the test stand cover to access the lifting bar.

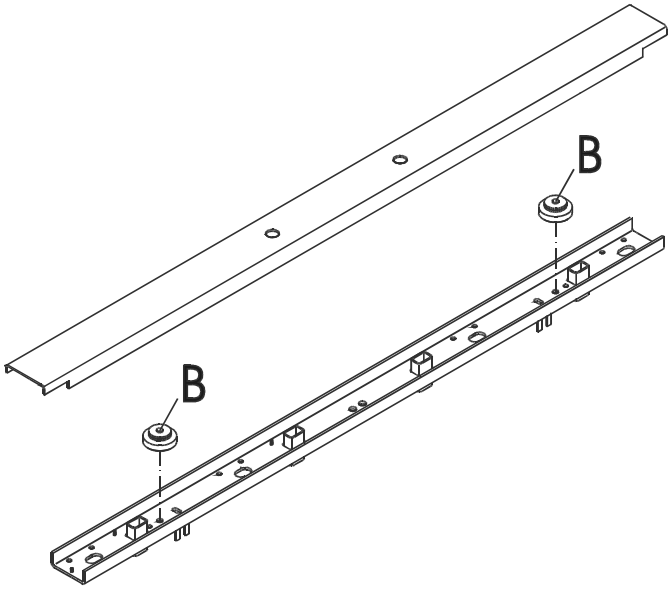
The weighing device is integrated in the lifting bar (**A**).



Weighing system

A Lifting bar

The weighing cells (**B**) are located under the lifting bar cover.

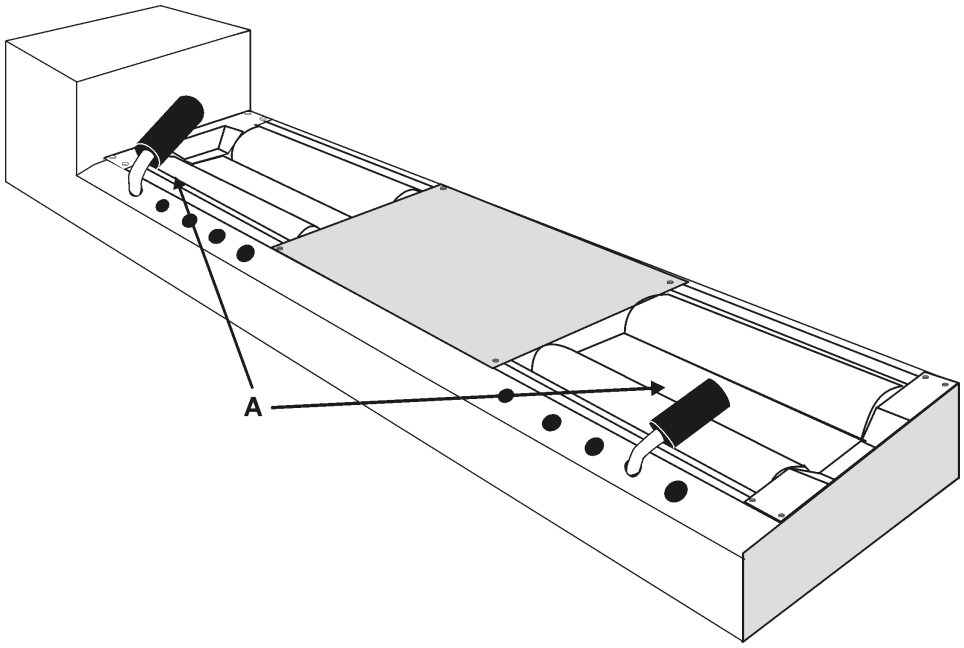


Weighing cells

B Weighing cells

2.11 Restraint-System

The restraint-system is a safety feature and prevents the vehicle from skidding off the rollers.



Restraint-System

A Restraint rollers

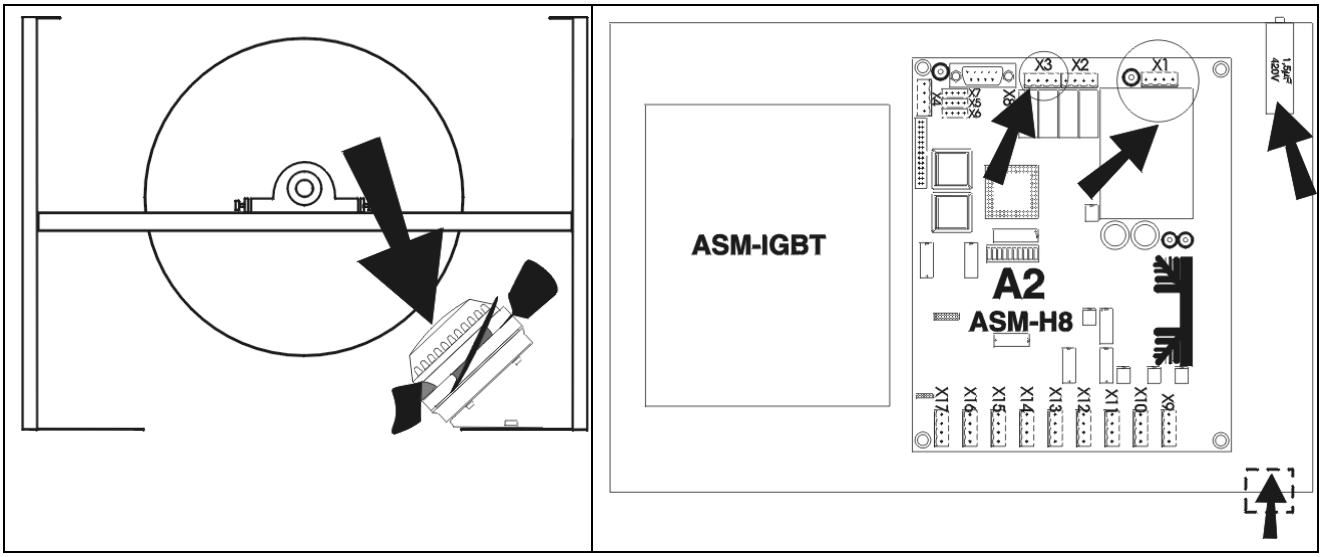
Insert each restraint roller into the positioning hole which is positioned closest to the tire..

1 Insert one restraint roller on the left side and one on the right side (A) into the positioning holes of the roller set frame.

Holes should always be well lubricated so that the restraint roller slips on easily.

The restraint rollers are equipped with a monitoring system, i.e. the status is signalized via interface when the restraint rollers are properly positioned.

2.12 Ventilator Installation with ASM-P/PLUS



Ventilator **connection to PCB**

The connection of the ventilator is at PCB A2 (ASM-H8).

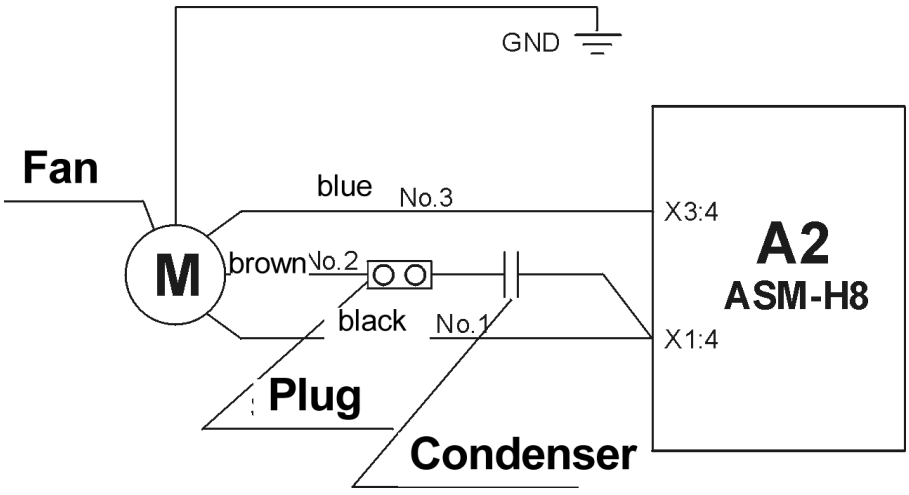
1 Fixing of the condensator on upper right-hand side of the circuit box.

2 Pull in the cable through the opening intended for that purpose on the circuit box

3 Connect the ventilator electrically.

4 Control: the ventilator must start up briefly after ‚LoadCheck 30/20'.

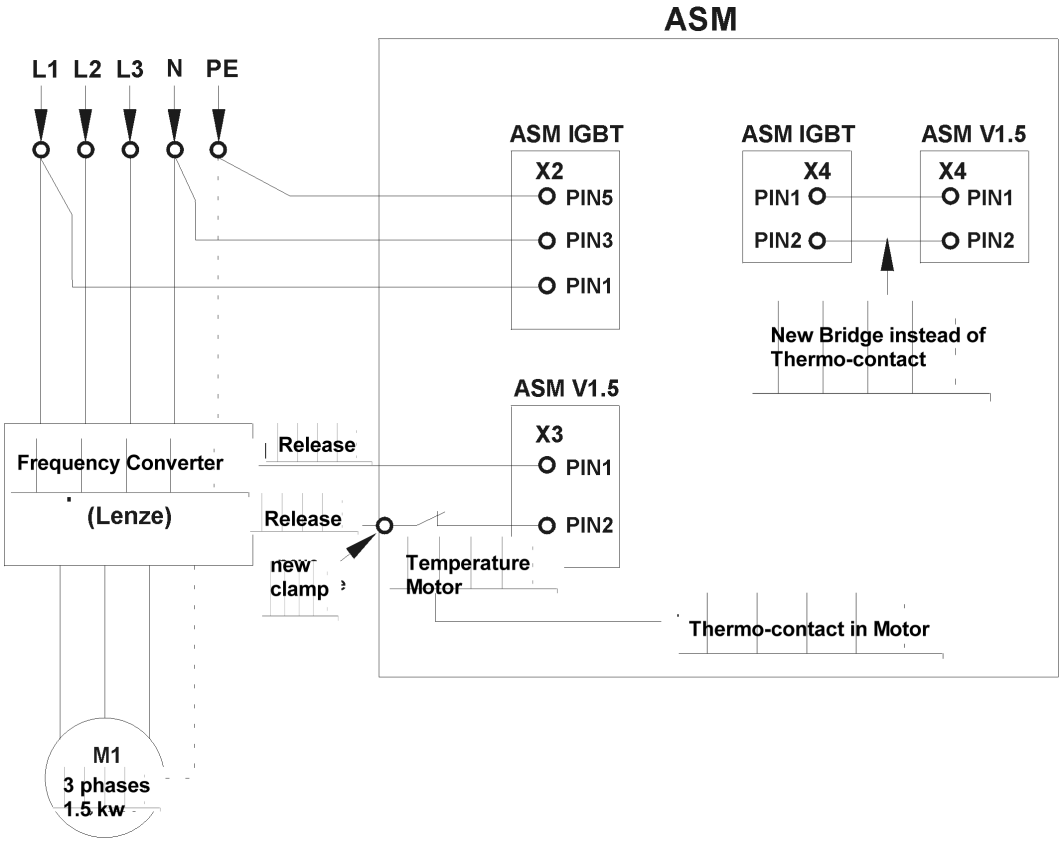
The ventilator is switched using the software. It runs after a certain load has been reached. The length of the running time depends upon the length of the load.

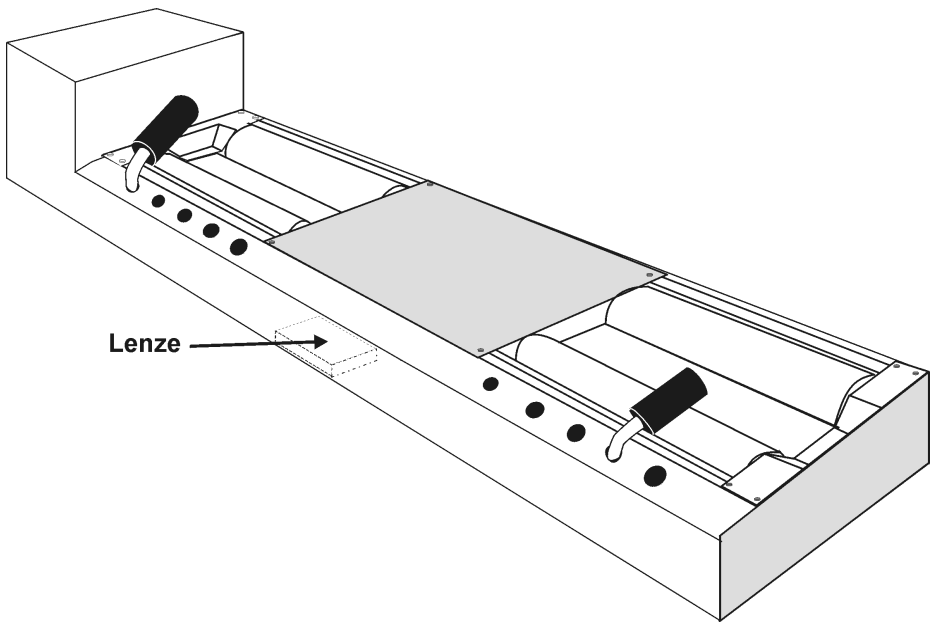


Electrical connection

3 Description of the PCB

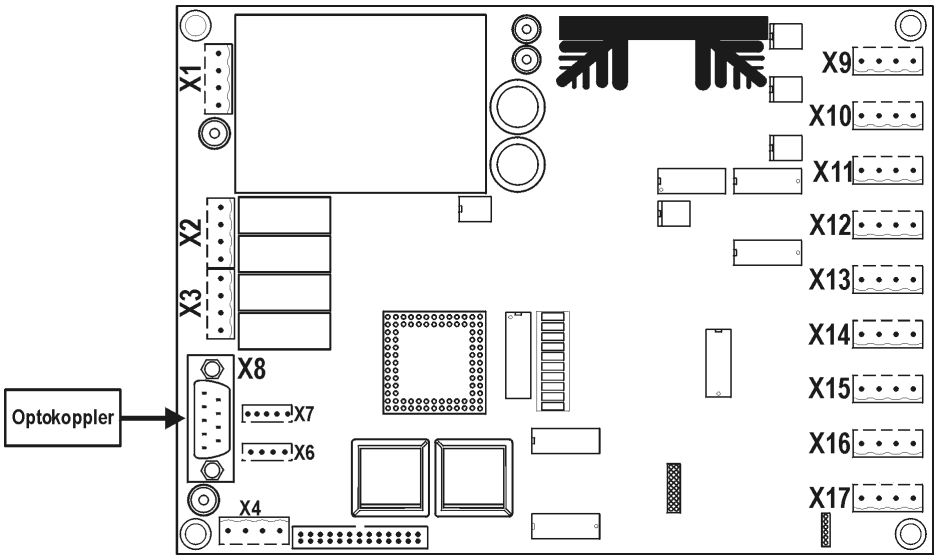
3.1 Installation and Connection of the Frequency Converter





3.2 Description of the ASM-V1.5 PCB

The ASM-V1.5 circuit board controls the test stand and the digital proccessing of the measured data. There are 17 different connectors located on the circuit board.



Connector Location

X1	Electrical power supply	X10	Scale left
X2	Lifting bar/ sliding unit	X11	Connection DMS
X3	only for 4WD test stands	X12	Impulse sensor support roller
X4	ASM-IGBT PCB supply	X13	Restraint-System
X5	not used	X14	not used
X6	not used	X15	not used
X7	RS232 interface (JST)	X16	Temperature sensor
X8	Connection Optokoppler	X17	not used
X9	Scale right		

3.2.1 Description of the Connector

3.2.1.1 Stecker X1 (Connection of electrical power supply)

Pin	Signal
1	Connection 230 V, Phase
2	bridged to Pin 1, ⇒ bridged to X3, Pin 3
3	connection 230 V, zero conductor
4	bridged with Pin 4, ⇒ Bridge to condensator ventilator

3.2.1.2 Connector X2 (Connection of the lift bar)

Also intended for connection of the wheel-base adjuster on 4WD test stands

Pin	Signal
1	Connection lifting bar (+24V)
2	Connection lifting bar (GND)
3	Connection display lamp (OUT)
4	Connection display lamp (+24V)

3.2.1.3 Connector X3 (connection of 4WD functions) Connection of the Ventilator

Pin	Signal
1	release Lenze Relay K4 (potential-free)
2	release Lenze Relay K4 (potential-free)
3	connection relay K3 (potential-free), Ventilator
4	connection Relay K3 (potential-free), Ventilator

3.2.1.4 Connector X4 (18V AC supply voltage for ASM-IGBT PCB)

ASM Performance Plus

Pin	Signal
1	18V~
2	0V
3	not used
4	not used

ASM Performance

Pin	Signal
1	18V~, Phase, ⇒ Temperature switch Motor
2	0V, zero conductor
3	not used
4	not used

3.2.1.5 Connector X5

Not used

3.2.1.6 Connector X6

Not used

3.2.1.7 Connector X7 (RS232 interface)

Parallel to Connector X8.

Pin		Signal
1	——	TxD
2	——	RxD
3	——	CTS (not used)
4	——	RTS (not used)
5	——	GND

3.2.1.8 Connector X8 (connection opto-coupler)

Pins not assigned are not listed.

Pin		Signal
2	——	RxD
3	——	TxD
5	——	GND
7	——	RTS (not assigned)
8	——	CTS (not assigned)

3.2.1.9 Connector X9 (connection scale right-hand)

Pin		Signal
1	——	+12V
2	——	+ Input scale right-hand
3	——	- input scale right-hand
4	——	GND

3.2.1.10 Connector X10 (connection scale left-hand)

Pin		Signal
1	——	+12V
2	——	+ input scale left-hand
3	——	- input scale left-hand
4	——	GND

3.2.1.11 Connector X11 (connection of the strain gauge meter)

A 500 Ω resistor must be soldered between PIN 2 and 3 (parallel to power sensor)

Pin		Signal
1	———	+12V (red)
2	———	+ input DMS (white)
3	———	- input DMS (green)
4	———	GND (black)

3.2.1.12 Connector X12 (Connection of the impulse sensor for speed measurement)

Pin		Signal
1	———	+ input support roller (black)
2	———	- input support roller (brown)
3	———	not used
4	———	not used

3.2.1.13 Connector X13 (inputs for the Restraint-System)

Pin		Signal
1	———	not used
2	———	not used
3	———	Restraint-System rear (black)
4	———	GND (brown)

3.2.1.14 Connector X14

Not used.

3.2.1.15 Connector X15

Not used.

3.2.1.16 Connector X16 (Temperature sensor eddy current brake and DMS-Sensor)

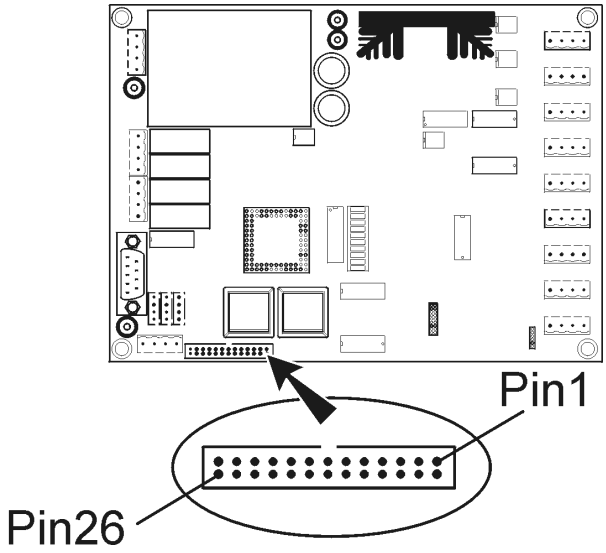
Pin		Signal
1	———	Temperature sensor brake / DMS (black)
2	———	GND (Temperaturfühler Bremse) / DMS (brown)
3	———	Temperature sensor DMS-Sensor / Lager (black)
4	———	GND (Temperature sensor DMS-Sensor) (brown)

3.2.1.17 Connector X17

Not used

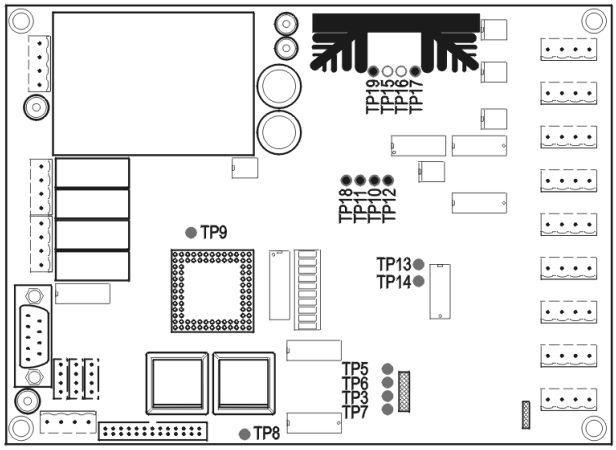
3.2.2 Connector Strip ST1

The 26-pin connector strip connects the ASM PCB with the ASM-IGBT PCB.



Pin		Signal
1	———	TEMP-KK (heat sink)
2	———	ERROR (H8)
3	———	GND
4	———	PWM1 H
5	———	GND
6	———	PWM2 H
7	———	GND
8	———	PWM3 H
9	———	GND
10	———	PWM1 L
11	———	GND
12	———	PWM2 L
13	———	GND
14	———	PWM3 L
15	———	GND
16	———	PWM-Brake
17	———	GND
18	———	IGBT-current
19	———	GND
20	———	intermediate circuit
21	———	+ 5 V
22	———	+ 12 V
23	———	not used
24	———	not used
25	———	not used
26	———	not used

3.2.3 Test Points

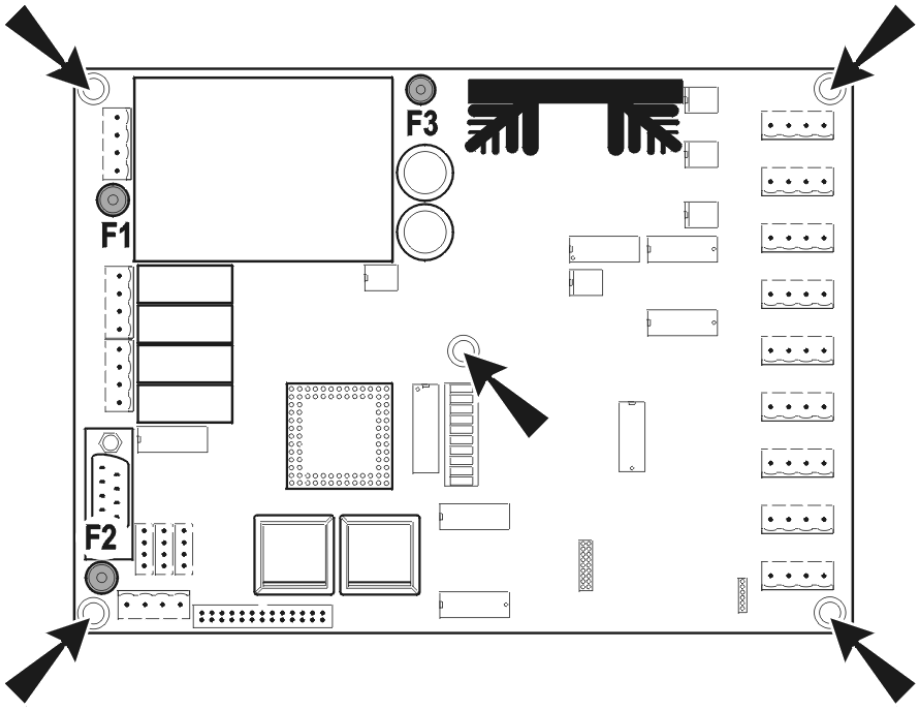


Test points

Test Point	Remark	Signal
3	Eddy current brake control signal	
5	Impulse Roller	
6	Impulse Roller	
7	Not used	
8	IGBT-current on connector strip ST1	
9	TEMP-KK applied to H8	
10	Signal scale left	
11	Signal scale right	
12	Signal strain gauge	
13	Signal temperature sensor Brake	
14	Signal temperature sensor strain gauge	
15	Internal supply voltage	+ 24 V
16	Internal supply voltage	+ 12 V
17	Internal supply voltage	+ 5 V
18	Internal supply voltage	+ 5 V-Reference
19	Internal supply voltage	GND

3.2.4 Fuses and Grounding on the ASM PCB

The PCB must be connected to the unit-housing ground. The grounding points are marked with arrows.

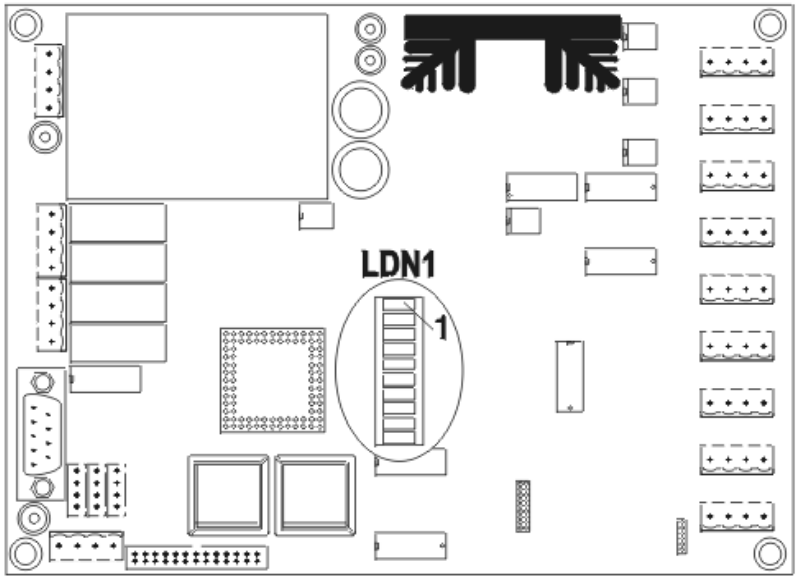


Fuses and grounding points

Fuse	Nominal current	Remark
F1	0.4 A slow	Input Transformer
F2	1.25 A slow	Output 1 Transformer
F3	1.25 A slow	Output 1 Transformer

Fuses cannot be exchanged separately. The complete PCB must be exchanged

3.2.5 LEDs on the PCB



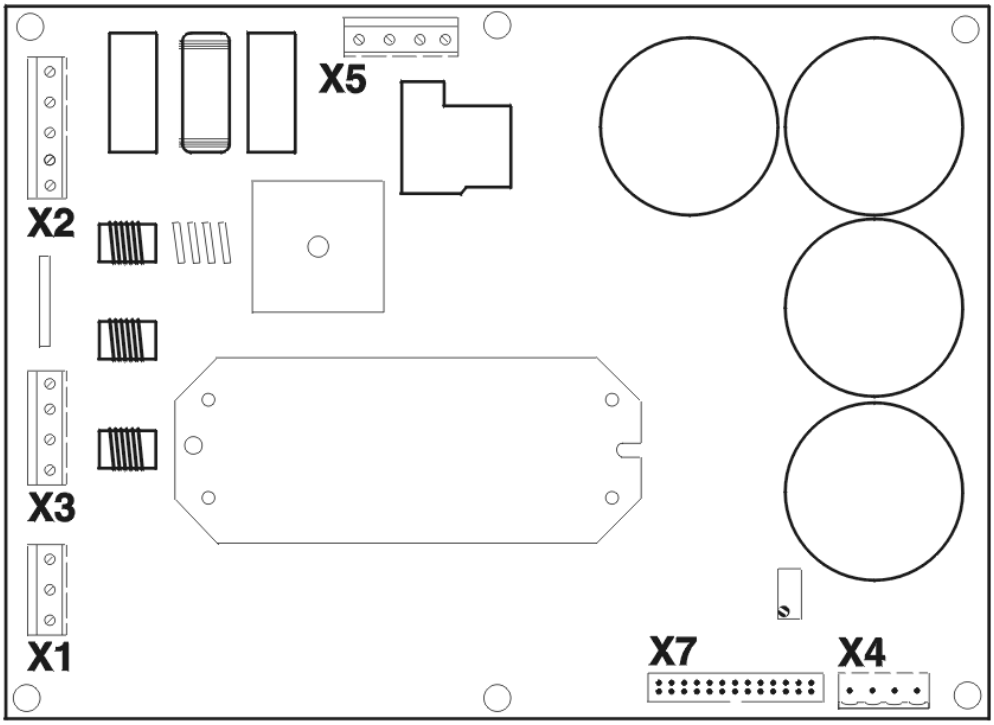
LEDs

LED	Function
1	Lifting bar upper (Relay K2)
2	Between 3 mph and 9mph
3	Approval Lenze (P-Plus) / Coast Down Motor on (K4)
4	Fan eddy current brake on (K3)
5	Intermediate circuit relay on the ASM-IGBT PCB
6	Not used
7	Restraint -System front (X13)
8	Not used
9	Not used
10	Not used

3.3 Description of the ASM-IGBT-V1.5 PCB

The ASM-IGBT-V1.5 PCB controls the performance of the test stand.

There are 6 different connectors mounted on the PCB.



Connector location

X1	controls eddy current brake	X4	PCB supply voltage
X2	mains supply	X5	connection for choke coils
X3	controls three-phase motor	X7	connector strip for connection to ASM PCB

3.3.1 Connector Description

3.3.1.1 Connector X1 (Control and power supply of eddy-current brake)

Pin		Signal
1	———	eddy current brake Phase
2	———	eddy current brake neutral conductor
3	———	PE

3.3.1.2 Connector X2 (Connection of 230 V supply voltage)

Pin		Signal
1	———	P
2	———	bridged to Pin 1, ⇒ Bridged to X1, Pin 1
3	———	N
4	———	bridged to Pin 3, ⇒ Bridged to X1, Pin 3
5	———	PE

3.3.1.3 Connector X3 (Control and power supply of three-phase motor)

Pin		Signal
1	———	L1
2	———	L2
3	———	L3
4	———	PE

3.3.1.4 Connector X4 (18V AC supply voltage for Connector X4 on the ASM PCB)

ASM Performance Plus

Pin		Signal
1	———	18 V~, Phase
2	———	0 V, Neutral conductor
3	———	PE
4	———	PE

ASM Performance

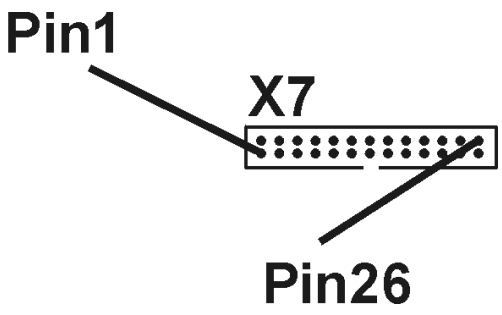
Pin		Signal
1	———	18 V~, Phase of temperature switch Motor
2	———	0 V, Neutral conductor
3	———	PE
4	———	PE

3.3.1.5 Connector X5 (Connection of choke coils)

Pin	Signal
1	choke 1
2	choke 1
3	choke 2
4	choke 2

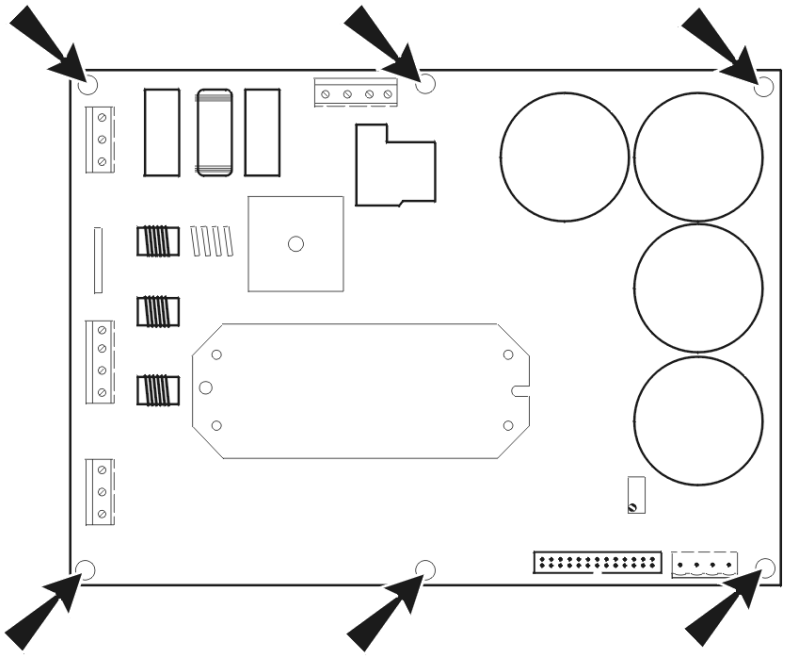
3.3.1.6 Connector X7 (Connection to ASM PCB)

Pin	Signal
1	TEMP-KK
2	ERROR (H8)
3	GND
4	PWM1 H
5	GND
6	PWM2 H
7	GND
8	PWM3 H
9	GND
10	PWM1 L
11	GND
12	PWM2 L
13	GND
14	PWM3 L
15	GND
16	PWM-Brake
17	GND
18	IGBT-current
19	GND
20	Intermediate circuit
21	+ 5 V
22	+ 12 V
23	not used
24	not used
25	not used
26	not used



3.3.2 PCB Grounding

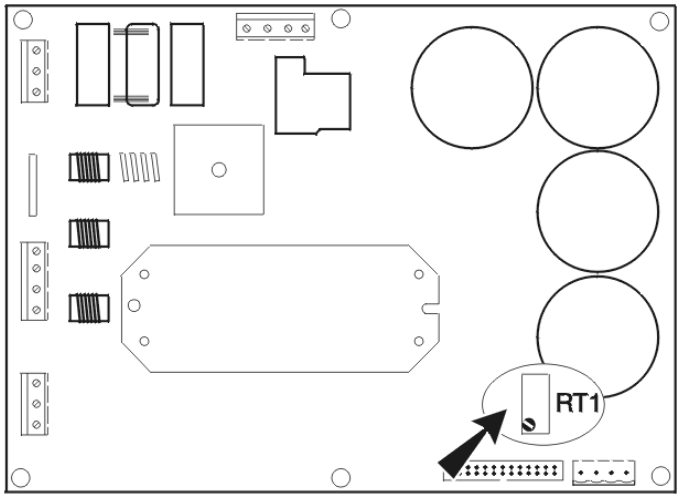
The PCB must be connected to the unit-housing ground. The grounding points are marked with arrows.



Grounding points

3.3.3 Potentiometer of the PCB

The potentiometer RT1 adjusts the measurement current that is evaluated by the H8-processor.



Potentiometer

Do not adjust R1. The potentiometer has been set at the MAHA factory.

4 PC-Interface Protocol

4.1 General Information

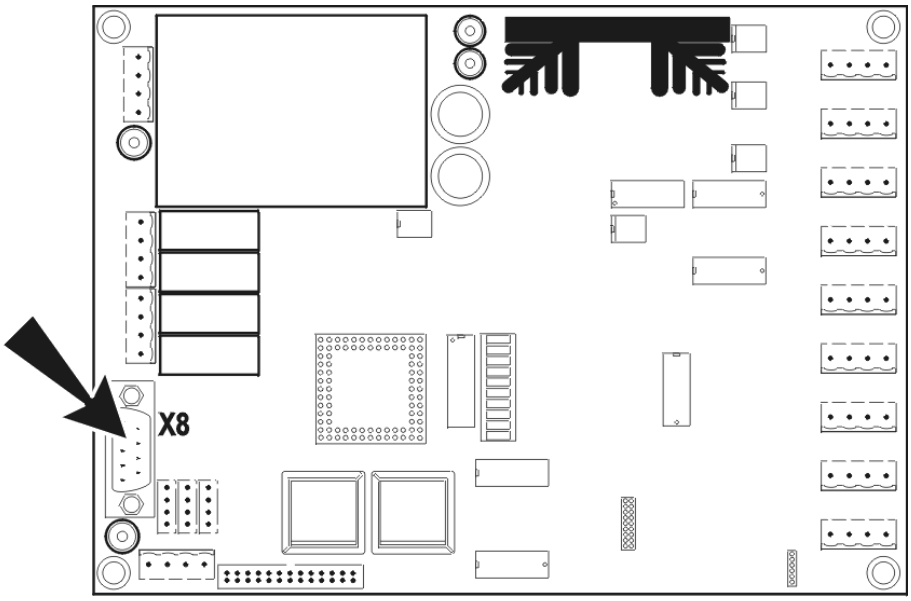
4.1.1 Serial Interface Configuration

- V.24-interface RS 232C
- Start/Stop
- ASCII-Code
- 9600 Baud
- 8 Datenbits
- 1 Startbit
- 1 Stopbit
- no Parity

Control signals such as RTS, CTS, DTR are not used
The pin assignment corresponds with a 9-pin plug on IBM-PC:

- Pin 2 = RxD
- Pin 3 = TxD
- Pin 5 = ground
- Screened cable

The interface is located on the ASM-V1.4 board at connector X8



Interface of the ASM-V1.4 PCB

4.1.2 Data Set Transmission

The ASM Dyno-Controller is ready to receive the data record mode only after it has been given the test machinery address. The ASM has B4 hex as an address.

If the control word has been selected the corresponding data record will be transmitted after each prompt from the PC (ENQ). If no data is available the command NAK is used. The control word determines the data to be transmitted or received.

PC		**ASM**
1. ADR	==>	
2. DC1	==>	
3. Steuerwort	==>	
4. ENQ	==>	
	<==	NAK, if data record is not ready

if NAK, then a renewed try after 0,2 second

5. ENQ	==>	if test is completed
	<==	STX Data ETB CKS $

If transmission OK

6. ACK	==>	Data record is deleted

If not OK

7. NAK	==>	repeat starting at point 5

4.1.3 Data Record Structure

A data record begins with STX, followed by the data.
Data records end with ETB.

Then the check sum follows. (XOR coupling of all output characters).

$ is sent as final character.

Data transmission:

STX - Data - ETB - CKS - $

4.1.4 Control Words

Control words characterize the data record to be transferred.

For the data transmission between PC and ASM four data sets are available.

At request and/or transfer of data the control word must also be transmitted.

Identification	Data set
C (ASCII)	Send measurement values
D (ASCII)	Send Status
E (ASCII)	Read Parameter
F (ASCII)	Receive Parameter

In addition to the four control words listed above there are 21 more control words to control the test stand functions.

4.2 Data Record Set-Up

In the following tables the format will be generally given in ASCII code. Formats in hex code will be marked separately. The identification <CR> means the transmission of the sign Carriage Return, the identification _ the transmission of a space.

4.2.1 Transmit Test Values

	Transmission	Format	Length
	PC => ASM		
1	Address	B4 hex	1 Byte
2	Control sign	11 hex	1 Byte
3	Control word	C	1 Byte
4	ENQ Data request	05 hex	1 Byte
	ASM => PC		
5	STX Begin Data set	02 hex	1 Byte
6	Power (RAM-Variable 211)	211=±xxx.x_hp<CR>	14 Bytes
7	Torque (RAM-Variable 221)	221=±xxxx.x_lbf<CR>	16 Bytes
8	Speed (RAM-Variable 209)	209=xxx.xx_mph<CR>	15 Bytes
9	ETB End Data set	17 hex	1 Byte
10	Checksumme EXOR-coupling from STX to ETB	xx	2 Bytes
11	$ End transmission		1 Byte

4.2.2 Transmit Status

	Transmission	**Format**	**Length**
	PC => ASM		
1	Address	B4 hex	1 Byte
2	Control sign	11 hex	1 Byte
3	Control word	D	1 Byte
4	ENQ Data request	05 hex	1 Byte
	ASM => PC		
5	STX Begin Data set	02 hex	1 Byte
6	1 lift beam up 2 lift beam down 3 torque too high 4 ASM-speed too high 5 augmented breaking enabled 6 power too high 7 brake excess temperature 8 impule sensor error 9 short circuit 10 auto-offset-error 11 roller covers 12 restraint-system 13 bearing excess temperature 14 converter motor current and temperature 15 reserve 16 driving motor running	0 / 1	16 Bytes
7	ETB End of data set	17 hex	1 Byte
8	Check sum EXOR-coupling from STX to ETB	xx	2 Bytes
9	$ End transmission		1 Byte

4.2.3 Read Variables

The PC reads out the RAM-variable (starting from variable 200) indicated by the ASM.

	Transmission	Format	Length
	PC => ASM		
1	address	B4 hex	1 Byte
2	control sign	11 hex	1 Byte
3	control word	E	1 Byte
4	variable number	xxx	3 Bytes
5	ENQ data request	05 hex	1 Byte
	ASM => PC		
6	STX Begin Data record	02 hex	1 Byte
7	Variable	xxx=xxxx.x_xx<CR>	
8	ETB End Data record	17 hex	1 Byte
9	Check sum EXOR-coupling from STX to ETB	xx	2 Bytes
10	$ End transmission		1 Byte

4.2.4 Write Variable

The RAM-variable concerned (starting at number 200) will be overwritten.

	Transmission	**Format**	**Length**
	PC => ASM		
1	Address	B4 hex	1 Byte
2	Control sign	11 hex	1 Byte
3	Control word	F	1 Byte
4	indication of the variable number, which will be overwritten and indication of the new value	xxx=xx.xx_xx<CR>	
5	ETB End Data record	17 hex	1 Byte
6	Checksumme EXOR-coupling from DC1 to ETB	xx	2 Bytes
7	$ End transmission		1 Byte

The ASM checks the check sum and indicates to the PC with ACK (ok) or NAK (not ok), if the check sum was correct.
If not, the data transmission will be repeated.

Example:

Variable 203 (air resistance power loss) should be changed.

The transmission 4 has now the following format

	Transmission	**Format**	**Length**
4	Variable number and value	203=xx.xx_hp<CR>	13 Bytes

4.3 Send Control Words

Control word in ASCII-	Command	Requirements
0	Regulator off	
1	Speed regulator on	Variable 200 (set value for speed regulation) must be set.
2	torque regulator on	Variable 201 (set value for torque regulation) must be set
3	drive-resitance simulation regulator on	Following variables must be set: 202 (vehicle mass), 203 (air resistance), 204 (flex resistance), 205 (rolling resistance-power loss), 212 (A_t), 213 (B_t) and 214 (C_t)
4	ASM-Regulator on	
5	Lift beam up	If this command is carried out, the rollers of the test stand must be at standstill.
6	Lift beam down	If this command is carried out, the rollers of the test stand must be at standstill.
7	Restraint-System up	If this command is carried out, the rollers of the test stand must be at standstill.
8	Restraint-System down	If this command is carried out, the rollers of the test stand must be at standstill.
9	Reset distance measurement	
A	Augmented Braking enable	
B	Augmented Braking disable	
C	Described in paragraph 4.4	
D	Described in paragraph 4.5	
E	Described in paragraph 4.6	
F	Described in paragraph 4.7	
G	Restraint-System stop	If this command is carried out, the rollers of the test stand must be at standstill.
H	Stop watch enable	Variable 207 (start speed for the stop watch 1) and 208 (final speed for the stop watch 1) must be set.
I	Stop watch disable	
J	Drive motor on	If this command is carried out, the rollers of the test stand must be at a stand still and the lift beam must be down (status lift beam down = ASCII 1).
K	Drive motor off	
L	Calibrate zero point	If this command is carried out, the rollers of the test stand must be at standstill.
M	Calibrate amplification	If this command is carried out, the rollers of the test stand must be at standstill.

Control word in ASCII-	Command	Requirements
N	terminate zero point-/amplification calibration by storing	
O	Switch on IGBT-Test	Set variable 206 (control for the brake-test).
P	Switch off IGBT-Test	
Q	Switch on Variable-Load Regulator	
R	Stop watch 2 enable	Variable 234 (start speed for stop watch 2) and 235 (end speed for stop watch 2) must be set.
S	stop watch 2 disable	
T	switch on auto-offset-adjustment defined	
U	switch off auto-offset-adjustment defined	
V	put auto-offset-adjustment to normal function	
X	switch on 12 V voltage	
Y	switch off 12 V voltage	
a	belt compensation on	
b	belt compensation off	

After getting the command, the test stand is sending ACK.

If the command cannot be carried out because the requirements "rollers must be at standstill" (v-test stand ≠ 0) or "lift beam up" are not fulfilled, the test stand reports NAK.

Example:

Enable brake test

	Transmission	Format	Length
	PC => ASM		
1	address	B4 hex	1 Byte
2	control sign	11 hex	1 Byte
3	control word	O	1 Byte
	ASM => PC		
4	ACK	06 hex	1 Byte

4.4 Example of a Data Record

PC sends data record to start the ASM regulator at the Dyno.

Default:

Tire-roller losses at 15mph	=	1.14 hp
ASM power at 15 mph	=	8.50 hp
Speed ASM50/15	=	15.0 mph

Before starting the ASM 50/15 following variables must be set:

- tire-roller losses
- ASM speed and
- ASM power

The ASCII-data record is set up as follows:

- the dyno responds to address B4
- the control sign DC1 announces a data record
- the control word ´F´ signals the Dyno that the PC is sending parameters

- a parameter value consists of:
  the variable number
  he sign ´=´
  a parameter value with values before the decimal point, the decimal point and values after the decimal point
  a blank ´_´
  and the unit.

  The parameter value ends with carriage return <CR>.
- Now other parameter values may follow:
  end of data transmission (ETB)
  check sum to check the data record (2 bytes)
  the sign $, which signals the end of the data record.

Once the Dyno has received the data record, *ACK* is sent if check sum is OK, *NAK* if check sum is not OK.

	PC	**Prüfstand**
1.	address of the Dyno (Hex B4)	
2.	DC1 (Hex 11)	
3.	´F´ (PC sends parameters to dyno)	
4.	229=1.14_hp<CR> (tire-roller losses = 99.99_hp<CR>)	
7.	ETB (Hex 17)	
8.	XX (2 bytes check sum in ASCII, EXOR-coupling from DC1 to ETB)	
9.	$	ACK ACK if check sum OK End of transmission NAK if check sum not OK Repeat transmission starting from point 3.
10.	address of the dyno (Hex B4)	
11.	DC1 (Hex 11)	
12.	´F´ (PC sends parameters to dyno)	
13.	230=15.0_mph<CR> (speed ASM=999.9_mph<CR>)	
14.	ETB (Hex 17)	
15.	XX (2 bytes check sum in ASCII EXOR- coupling from DC1 to ETB)	
16.	$	ACK ACK if check sum OK End of transmission NAK if check sum not OK Repeat transmission starting from point 12.
17.	address of the dyno (Hex B4)	
18.	DC1 (Hex 11)	
19.	´F´ (PC sends parameter to dyno)	
20.	228=8.50_hp<CR> (speed ASM=99.99_hp<CR>)	
21.	ETB (Hex 17)	
22.	XX (2 bytes check sum in ASCII EXOR- coupling from DC1 to ETB)	
23.	$	ACK ACK if check sum OK End of transmission NAK if check sum not OK Repeat transmission starting from point 3.

After setting the RAM variables, the ASM regulator is switched on with a control word:

	PC	**Test stand**
1.	Address (Hex B4)	
2.	DC1 (Hex 11)	
3.	´4´ (ASM-Regulator ON)	
4.		ACK

5 Test Stand Control

The ASM roller set may not be brake using the vehicle brakes!
To achieve a quick deceleration after a test, a function must be programmed into the respective software which decelerates the roller set in an uncritical manner via a defined ramp.

5.1 Target Value for Speed Regulation

The aaplied load to the test stand may not exceed 500 hp at 125 mph (200 km/h) !

In this mode any target speed can be preselected (RAM-Variable 200). Once the vehicle reaches this speed, the eddy current brake is activated holding the pre-selected speed constant. (maximum brake power of the test stand 500 hp @ 125 mph).

See speed regulator also.

The test cycle is started by driving the desired speed with the vehicle.

The regulator is activated when the pre-set speed set in Variable 31 is reached (EEPROM) (Default value: 5 km/h).

The adjustable target speed range is between 6 and 200 km/h.

5.1.1 Procedure

RAM Variable 200 for the target speed may only be set when the test stand rollers are at standstill.

5.1.1.1 Set Variable 200

1 Variable 200 (target value for speed regulator) .

Example

The variable value should be set to 40 km/h, i.e. the speed regulator will be started at 40 km/h.

	Transmission	**Format**
1	Address	B4 hex
2	DC1	11 hex
3	Control word	F = 46 hex
4	Set target speed	200=_40.0_kmh<CR> = 2 = 32 hex 0 = 30 hex 0 = 30 hex = = 3D hex _ = FF hex 4 = 34 hex 0 =≙30 hex . = 2E hex _ = FF hex k = 6B hex m = 6D hex h = 68 hex <CR> = 0D hex
5	ETB End Data set	17 hex
6	Check sum EXOR-coupling from DC1 to ETB	00 hex
7	$ End of the transmission	

The unit in which the measurement values are transferred depends on the setting of variable 36 (variable 38 = 0 -> SI-units, variable 38 = 1 -> USA-units);
In the example the variable 38 has to be 0.

2 Check Variable 31.

5.1.1.2 Activating the Speed Regulator

The speed regulator is activated by sending the control word.

The speed regulator should only be activated, if the test stand rollers are at a standstill. Otherwise the ASM transmits an error message (NAK).

1 Activate speed regulator with control word.

	Transmission	**Format**
	PC => ASM	
1	Address	B4 hex
2	Mode	11 hex
3	Control word	1 = 31 hex
	ASM => PC	
	Transmission	Format
4	ACK	06 hex

5.2 Target Value for Torque Regulation

The applied load to the test stand may not exceed 500 hp!

In this mode any torque can be preselected (variable 201). Once the vehicle reaches a preset speed (variable 30, default-value 15 km/h), the eddy-current brake is activated holding the preselected torque constant (maximum brake power of the test stand 500 hp @ 125 mph).

See torque regulator also.

The target torque range which can be set is between 0 N and 8000 N.

5.2.1 Procedure

The target values may be set only while the test stand rollers are at a standstill!
The regulator is activated when the speed set in variable 30 (15 km/h) is reached.

5.2.1.1 Set Variable 201

1 Variable 201 (target value for torque regulator).

2 Check Variable 30.

5.2.1.2 Activating the Torque Regulator with Control Word

1 Activate the torque regulator with the control word.

5.3 Vehicle Mass for Drive Resistance Regulation

This value is necessary to initiate a proportional torque from the eddy-current brake at a preselected acceleration determined by the vehicle.

torque F $\sim$ acceleration a

$F\,[N] = m\,[kg] \cdot a\,[m/s^2]$

Torque selection is possible between 0 kg and 4000 kg.

5.3.1 Setting Variable 202

1 Data set "Write variables "
(4) 202=1250_kg<CR>

If this value is assigned to the variable, a target vehicle mass of 1250 kg is preset.

5.4 Vehicle Resistance Coefficients

The vehicle loading coefficients are set in the variables 203 - 205. The total resistance coefficient is calculated as follows:

$$THP = A_V + B_V + C_V$$

$$THP = IHP + PLHP + GTRL$$

THP	=	Total horsepower
IHP	=	Indicated horsepower
PLHP	=	Parasitic loss horsepower
GTRL	=	Generic tire roll losses

5.4.1 Vehicle Resistance Coefficient C_V

The value C_V is required for the calculation of the air-resistance power loss. During the drive resistance simulation test, this value is used to simulate the vehicle resistance C_V which arises at the preselected speed v_ref
(50 mph; 80 km/h).

The preselection is possible between 0 and 99,99 hp.

5.4.1.1 Setting Variable 203

1 Data set "Write variables"
(4) 203=30_hp<CR>

If this value is assigned to variable 203, C_V = 0,3 hp is preset.

5.4.2 Vehicle Resistance Coefficient B_V

This value is required for the calculation of the flex resistance power loss. During the drive resistance simulation test, this value is used to simulate the vehicle resistance B_V which arises at the preselected speed v_ref
(50 mph; 80 km/h).

The preselection is possible between 0 and 99,99 hp.

5.4.2.1 Setting Variable 204

1 Data set "Write variables "
(4) 204=100_hp<CR>

If this value is assigned to variable 204, B_V = 1,0 hp is preset.

5.4.3 Vehicle Resistance Coefficient A_V

This value is required for the calculation of the rolling resistance power loss. During the drive resistance simulation test, this value is used to simulate the vehicle resistance A_V which arises at the preselected speed v_ref
(50 mph; 80 km/h).

The preselection is possible between 0 and 99,99 hp

5.4.3.1 Setting Variable 205

1 Data set "Write variables"
(4) 205=80_hp<CR>

If this value is assigned to variable 205, A_V = 0,8 hp is preset.

5.5 Eddy-Current Brake Function Test (Variable 106)

The eddy-current-brake function test (IGBT-Test; Insulated Gate Bipolar Transistor) is designed for test and service purposes only. The IGBT-test checks the power controller with the eddy-current-brake.

Only specially trained service technicians are allowed to use the IGBT-test!
The IGBT-test should not be used during a normal vehicle test cycle!

Variablen 206 controls the IGBT-Test. It is possible to set a value between 0 (no control) and 255 (corresponds to 100% control).

The IGBT-Test is activated/deactivated with control words.

5.5.1 Setting Variable 206

Example:

1 Data set "Write variables
(4) 206=255<CR> ⇒ 100%-control = 100% power

2 Activate IGBT-Test: Data set "Send control word": (3) O

3 Deactivate IGBT-Test: Data set "Send control word": (3) P

Eddy-current brake control	Variable value 206
0%	0
10%	26
20%	51
30%	77
40%	102
50%	128
60%	153
70%	179
80%	204
90%	230
100%	255

5.6 Tire-Roll Losses GTRL (Generic Tire Roll Losses)

5.6.1 Tire-Roll Losses Coefficient A_t

This value is needed when doing a driving resistance simulation to compensate for the losses which occur between tires and test stand rollers. (e.g. tire/roll loss)

Preselection is possible between 0 and 99,99 hp.

5.6.1.1 Setting Variable 212

1 Data set "Write variables"
(4) 212=80_hp<CR>

If this value is assigned to variable 212, A_t = 0,8 hp is set.

5.6.2 Tire-Roll Losses Coefficient B_t

This value is needed when doing a driving resistance simulation to compensate for the losses which occur between tires and test stand rollers. (e.g. tire/roll loss)

Preselection is possible between 0 and 99,99 hp.

5.6.2.1 Setting Variable 213

1 Data set "Write variables"
(4) 213=100_hp<CR>

If this value is assigned to variable, B_t = 1,0 hp is set.

5.6.3 Tire-Roll Losses Coefficient C_t

This value is needed when doing a driving resistance simulation to compensate for the losses which occur between tires and test stand rollers. (e.g. tire/roll loss)

Preselection is possible between 0 and 99,99 hp.

5.6.3.1 Setting Variable 214

1 Data set "Write variables "
(4) 214=30_hp<CR>

If this value is assigned to variable 214, C_t = 0,3 hp is set.

The GTRL can be determined depending on the axle weight of the test vehicle. This requires a weighing device which is optionally available.

6 Service Program

6.1 ASM Installation Program

Insert the ASM installation CD. The automatic setup starts.

When installing the ASM program under Windows, the directory "asm" will automatically be created

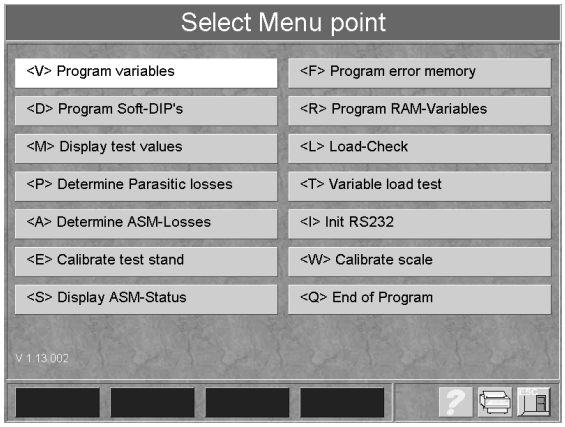
The program group ASM is automatically estabalished in the program ASM in the program manager.

The start file can be found in the directory c:\ASM\bin\asm.exe.

The connection to the ASM is via the 9-pin D-sub socket of the ASM-PCB. (Connector X8) and the serial interface of the PC.

In ASM-P/PLUS Program the file c:/asm/bin/asm.ini is given as basic setting of interface COM 2. If this interface is not available on the PC, the program will have to be changed accordingly.

<V> Program Variables
<D> Program Soft-Dip's
<M> Display test values
<P> Determine parasitic losses
<A> Determine ASM-losses
<E> Calibrate test stand
<S> Display ASM status
<F> Program error memory
<R> Program RAM variables
<L> Load-Check
<T> Variable load test
<I> Init RS 232
<W>Calibrate scale
<Q> Program end



6.2 Call up Menu Points

6.2.1 End ASM-P/PLUS PC-Program

1 Press <Q> button.

or

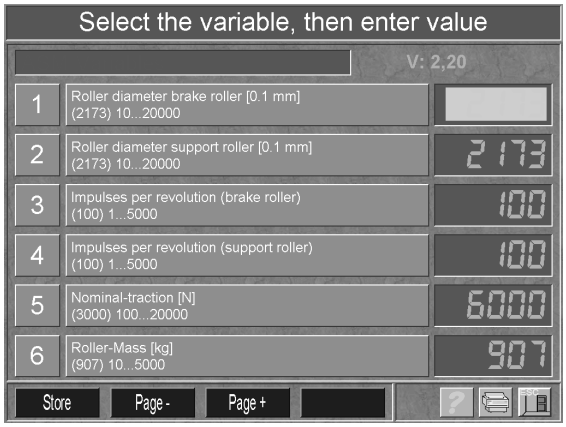
2 Click menu point <Q> Program end.

The  button is deactivated.

The program can not be exitted once this button has been clicked on.

6.3 Program Variable

After this menu point has been selected, the ASM-Variables (EEPROM) will be loaded.



1 Page forward through variable:
Press <F7> ,
page back through variable:
Press <F6> ,
go to first screen:
Press <Pos1>,
go to last screen:
Press <End>

2 Click "Page -" to display the next page,
Click "Page +" to display the previous page.

Select Variable

1 Use Cursor keys <⇓> or <⇑> .

2 Click on the value of the respective variable.

Change Variable

The variable value can be changed once the variable has been selected. The value will then be highlighted red. A black cursor is located after the variable value.

1 Change variable.

2 Use the < ← > or < → > key to position the cursor at the desired position.

3 Enter the new value using the digit keys.

Return to Main Menu without Storing

1 Press key.

2 Click 

button.

Storing the changed variables

1 Press <F5>.

2 Enter Code : **9864**.

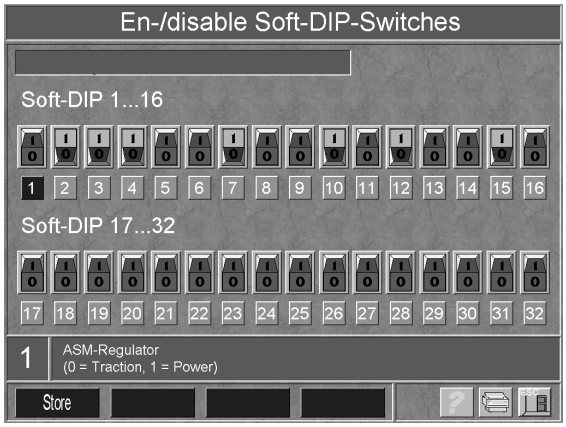
Confirm with <Enter> .

3 Click "Store" button.

The changed values are stored and the menu point is ended.

6.4 Program Soft-Dips

The soft-dip switch will be displayed after selecting this menu point.



1	ASM-regulator	**0** = torque 1 = power
2	speed reference from variable load-regulator	0 = speed from the table **1** = actual speed
3	torque display	0 = torque not displayed at 0 km/h **1** = torque displayed at 0 km/h
4	auto-offset-alignment of torque with rollers at standstill	0 = not possible **1** = possible
5	compensation methods of parasitic losses during ASM-test	**0** = parasitic losses at 15/25 mph 1 = compensation with ABC-coefficients
6	reverse calibration	**0** = forward calibration 1 = reverse calibration
7	automatic lift beam down	0 = disable **1** = enable
8	polynom degree for determination of parasitic losses	**0** = polynom 2nd degree 1 = polynom 3rd degree
9	scale on	**0** = disable 1 = enable
10	belt protection	0 = not possible **1** = possible
11	speed sensor check	**0** = not possible 1 = possible
12	acceleration plausibility check	0 = not possible **1** = possible
13	performance dyno	**0** = no 1 = yes
14	limitation of neg. nominal data for drive resistance regulator	**0** = no 1 = yes
15	Lenze on Coast Down	0 = no **1** = yes (only for ASM Performance Plus)

Select Soft-Dip

1 Use the < ⇐ > or < ⇒ > key to position the cursor at the desired position.

2 Click the number of the desired softdip. The Soft-Dip will be simultaneously toggled.

The selected softdip will be highlighted green.

Enable/Disable Soft-Dips

1 Press <Enter> and/or <Return> .

2 Click on the number of the desired Soft-Dips.

Return to Main Menu without Storing

1 Press <ESC> .

2 Click 

button.

Storing Changed Soft-Dip Settings

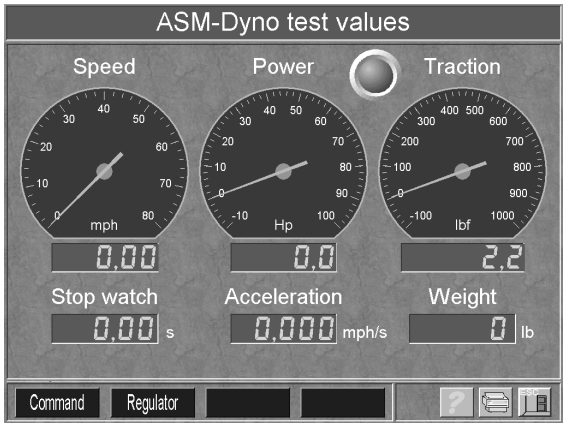
1 Press <F5> .

2 Click "Store" button.

The changed settings of the soft dips are stored and the menu points ended.

6.5 Display Test Values

The menu point "Display Measurement Value" is displayed.



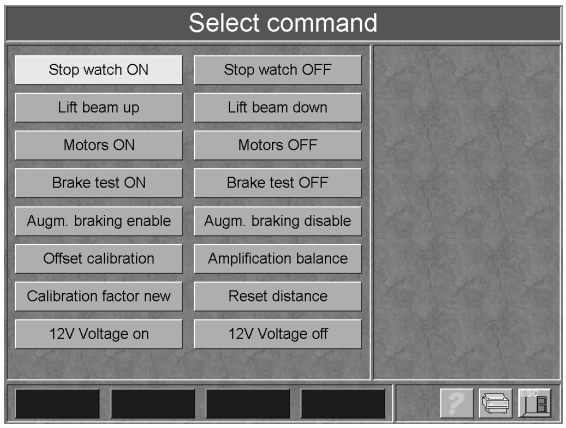
6.5.1 Select Command

The following screen appears after calling up the menu point "Command".

Various commands can be given.

1 Select command with the cursor keys and start with the <Return> or <Enter> key.

2 Click desired command.



Text	Description
Stop watch ON/OFF	Switch stop watch on-/off
Lift beam up/down	Lifting beam up/down
Motors ON/OFF	Switch motors on-/off
Brake test ON/OFF	Switch brakes on-/off
Agm. Braking enable/disable	Switch brake in connection with regulator on -/off
Offset calibration	Set zero point
Amplification balance	Amplification (without function)
Calibration factor new	New calibration factor (without function)
Reset distance	Reset distance to zero
12V Voltage on/off	Switch 12V on-/off (without function)

6.5.2 Select Regulator

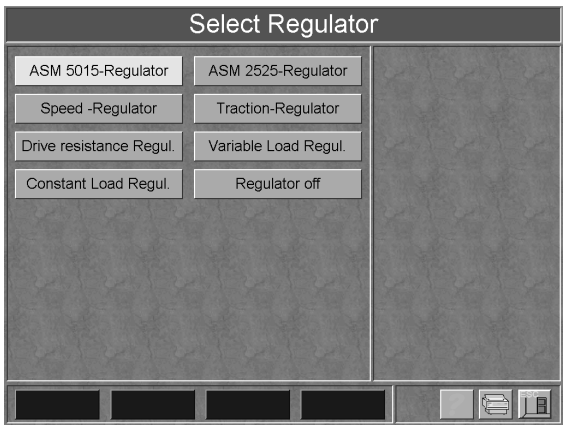
If the total torque is exceeded (6000N) , an optical warning signal appears on the scree.

After calling up the menu point "Regulator" the following screen appears.

Various regulators can be given.

1 Select regulator with the cursor key and start with <Return> or <Enter> .

2 Click the desired regulator



The following regulators are important for ASM operation:

- ASM 5015
- ASM 2525

Dependent upon the selected regulator, data must be entered:

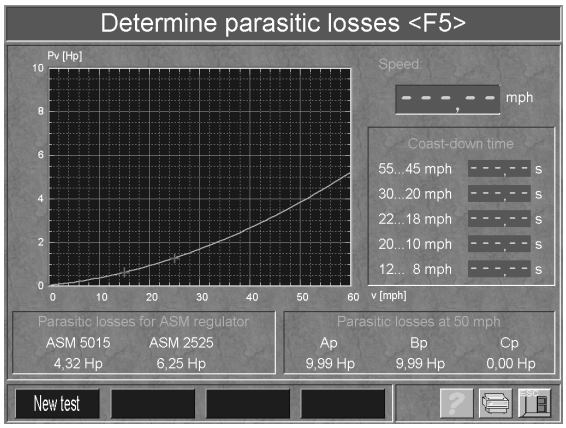
ASM 5015-Regler hp-Setting Losses Tires/Roller [hp]	**ASM 2525-Regulator** hp-Setting Losses tires/Roller [hp]
Speed-Regulator Speed regulator Speed target value [mph]	**Torque Regulator** Torque regulator Target value of the torque At, Bt, Ct:losses tires/Roller [hp]
Drive resistance Regulator Drive resistance regulator Mass [lb] Roller resistance-loss power Av Flex resistance- loss power Bv Air resistance-loss power	**Variable Load Regler** Constant Load Regler hp-Setting loss tires/Roller [hp]
Constant Load Regulator Constant load regulator e.g. 20 hp	**Regulator off** Regulator off

With data entry, the respective variables are set accordingly.

6.6 Determine Parasitic Losses

Only for approvals!

After calling up the menu point "Determine Parasitic Losses" the following screen appears.



1 Calibration of the measurement sensor.

2 Determining the parasitic losses.

3 Conduct a Load-Check to check the losses.

The rollers are accelerated to a speed of 56 mph for the coast down trial used to determine the parasitic losses. The regulator is switched off once the speed is reached. The time it takes to reach the various speeds is monitored using the internal stop watch.

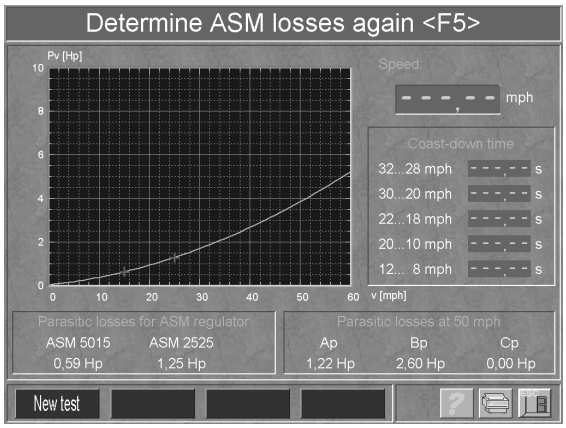
This trial is carried out for various speed ranges.

The parasitic losses are determined using these time values. The variable 51 51 (A_p), 52 (B_p) and 53 (C_p) are described using these losses.

6.7 Determine ASM Losses

The ASM-losses will only be defined if the rollers are at standstill when point *New Test* was selected.

The determination of the ASM losses must be done after each installation / commissioning /calibration or after a failed Load-Check.



The ASM-losses are also determined by a coast down trial. The rollers are accelerated to a speed somewhat higher than 30 mph through the built in motors. After the speed has been reached the regulator will be switched off. An internal stop watch monitors the time it takes to reach the speed of 20 mph. This trial will also be conducted for the speed range 20 mph - 10 mph.

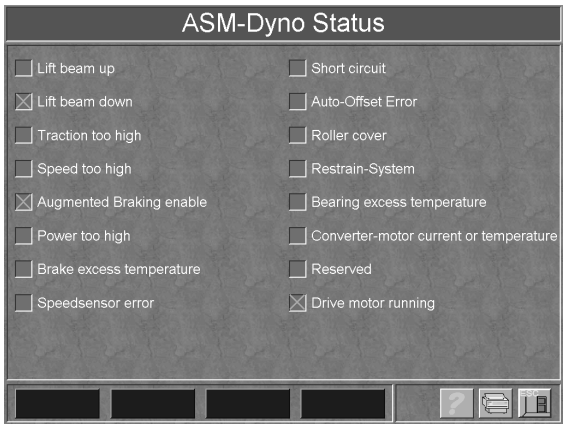
The ASM losses with the reference speeds of v = 25 mph and v = 15 mph are set with help of the determined time values.

6.8 Calibrate Test Stand

The calibration is described in Chapter Calibration.

6.9 Display ASM Status

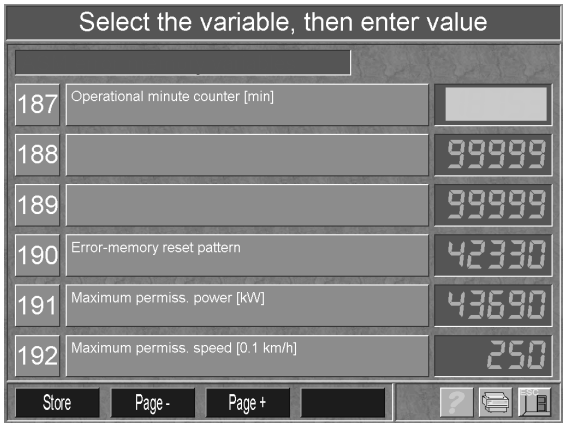
The status of the test stand is displayed using this menu point.



6.10 Read Error Memory

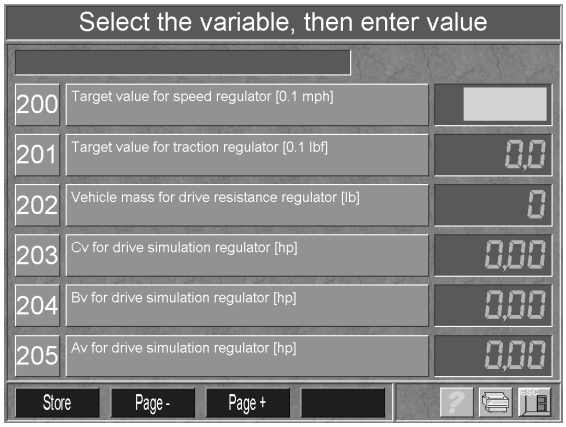
After selecting this menu point the EEPROM-Variables 187 - 199 are loaded. A list of the EEPROM-Variables can be found in the appendix.

These variables can only be read. A password is necessary in order to re-set the error variables.



6.11 Read RAM Variables

The RAM variables are loaded after selecting the menu point. A list of the RAM variables can be found in the appendix.-



6.11.1 Page Through Variables

1 Page forward through 20 variables: press <F7> ,
Page backwards through 20 variables: press <F6> ,
go to first screen: press <Pos1> ,
go to last screen: press <End> .

2 Display next page: Click on <Page -> button
Display previous page: Click on <Page +> button.

6.11.2 Select Variable

1 Use Cursor keys <⇓> or <⇑> .

2 Click on the desired variable value

6.11.3 Change Variables

The variable value can be changed once the variable has been selected. The value will then be highlighted red. A black cursor is located after the variable value.

1 Select variable.

2 Use the < ⇐ > or < ⇒ > key to position the cursor at the desired position

3 Enter the new value using the digit keys.

6.11.3.1 Return to Main Menu without Storing

1 Press <ESC> .

2 Click 

6.11.3.2 Storing Changed Variable Values

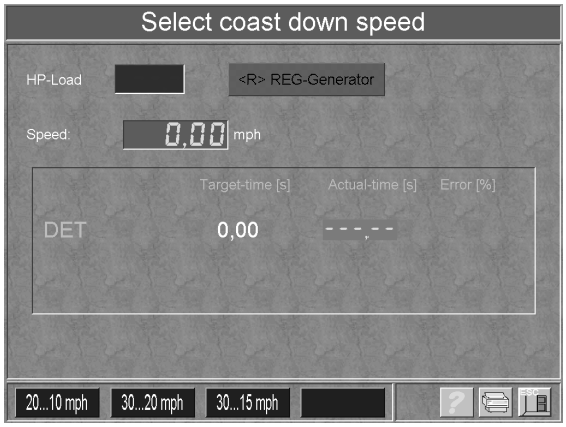
1 Press <F5> .

2 Click "Store"

The changed variable values are stored and the menu point is ended.

6.12 Load Check

The load check must take place in the pre-set time intervals set down in the BAR 97-specifications. A power of between 8 - 18 hp can be entered for the load check or can be set using the random sequence generator.



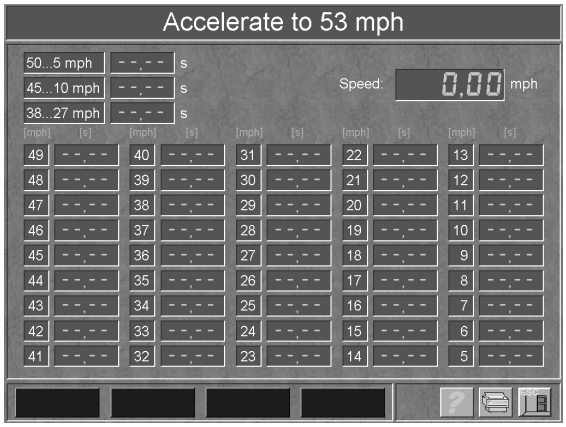
The coast down times DET (25 mph / 15 mph) are determined under load by a coast down trial. Depending on the pre-selected power there is a target time for these times. The test stand determines the actual time using an internal stop watch. The error is calculated in % using both these times. This error must be within the pre-set error tolerance limits specified in BAR 97 specifications.

If this limit is exceeded the test stand must be calibrated again..

6.13 Variable Load Test

Used for approvals only!

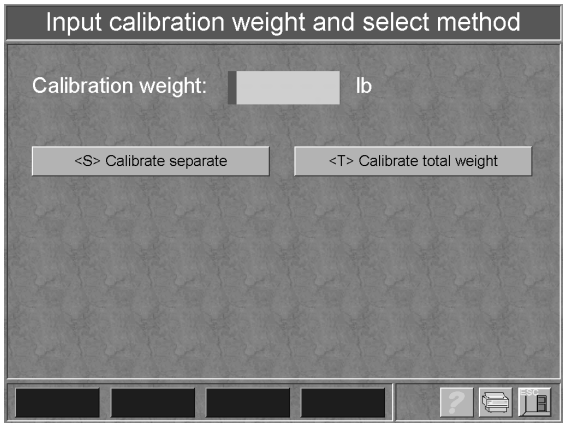
The test stand is accelerated with an external drive to ca. 53 mph. After the drive has been switched off the roller set is allowed to coast down. The Variable-Load-Regulator is triggered at 50 mph. The times in the respective speed windows is determined by decelerating the test stand.



6.14 Weighing Scale Calibration

Periodically it may be necessary to verify that the weighing scales accurately measure the weight that is placed onto the dyno. For that purpose, weight scale calibration is possible.

There are two possible ways of calibrating for accuracy the weighing scales; calibrate total weight and calibrate separate.



6.14.1 Calibrate ‘Total Weight’

For this method, a known reference weight, such as a car axle, is used and confirmed on the scales.

6.14.2 Calibrate ‘Separate’

For this method a calibration tool, specifically designed for this purpose, is used.

7 Calibration

At the beginning of a calibration, all variables must be checked for their correct setting.

7.1 Preparation

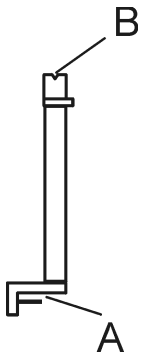
Before the electronic calibration may be started, some settings must be checked and set, if necessary.

- The play between force sensor and upper roller bearing must be < 0.1 mm .
- The roller set must move freely.
- Do EEPROM reset (all variables are set to the default values).

7.2 ASM Calibration

7.2.1 ASM Calibration Device

The test stand will be calibrated with the help of a special calibration device. The stator of the eddy-current brake will be loaded with a pre-determined force. The applied force is measured by a wire strain gauge and can be used as a reference value.

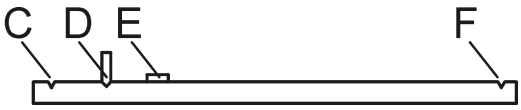


The calibration device consists of:

Pick up attachment for the calibration arm

A fasten the pick-up attachment to the side plate of the ASM

B take-up for the calibration arm



Calibration arm

C Notch for turnbuckle

D place the calibration device onto the pick- up attachment

E spirit level

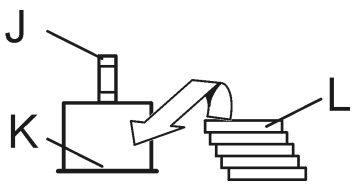
F notch for calibration weight box

Tension belt

G Fasten to the calibration arm

H Turnbuckle

I Fasten to stator of the eddy current brake



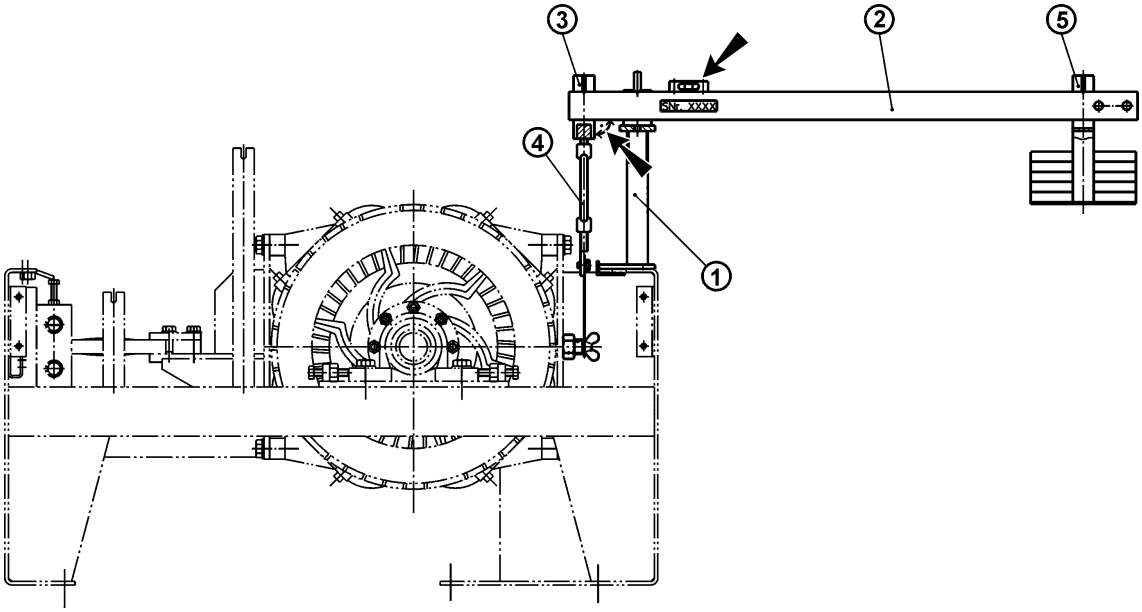
Box for the calibration weights

J Hook up to the calibration arm

K Surface for wheel weights

L Weights
Each weight simulates a test stand torque of 360N.

7.2.2 ASM Calibration Device Installation



Installation of the calibration device

1 Fasten tension belt (4) to turnbuckle (3) .

2 Hook up the turnbuckle onto the calibration arm..

3 Shift the pick-up attachment (1) for the calibration arm to the side plate.
Pay attention to the guide rail of the pick-up attachment.
Pick-up attachment and stator must be aligned with each other.

4 Position the calibration arm (2) onto the respective marking and align the arm centrally.
Make sure that the calibration arm does not touch the lateral sides of the pick-up attachment.

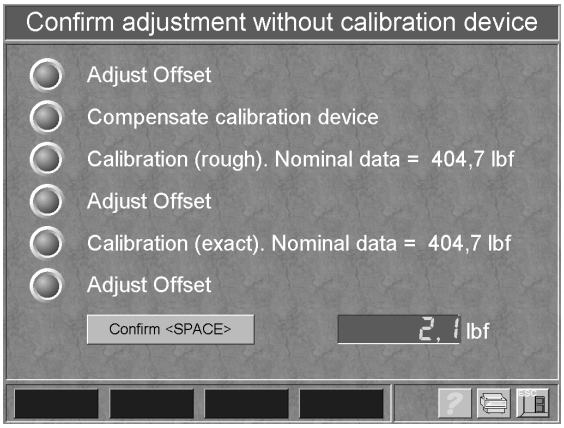
5 Now adjust the calibration device by using a spirit level.
Adjust the calibration arm to a horizontal position by using the tightener (4).

6 Hook up the calibration weight box (5) onto the respective marking and align the calibration device again.

7.2.3 Description

The calibration is executed in the Service-Program after the menu point *Calibrate Test Stand* has been called up.

The instructions appearing in the status line of the screen will guide the user through the calibration program. A light control method indicates if the test stand has terminated the respective calibration step (the light switches to green) or not (light switches to red).



7.2.4 Procedure

1 Do EEPROM-Reset (set Variable 50 to 42330).

2 Call up menu point Program Variable and change following variables:

Variable	Setting
05	6000
10	900
16	2000
17	250
18	200
26	160
27	250
34	40
74	9999
85	28
89	26

3 Call up calibration menu.

4 Press "Space" key.
ADJUST OFFSET is displayed.

5 Install and level calibration device completely, as described already.

6 Press "Space" .
COMPENSATE CALIBRATION DEVICE is displayed.

7 Place five weights, level.

8 Press "Space" key.
CALIBRATION ROUGH is displayed.

9 Remove all weights and level.

10 Press "Space" .
ADJUST OFFSET is displayed.

11 Place five weights and level.

12 Press "Space" key.
CALIBRATION EXACT is displayed.

13 Remove weights and calibration device completely.

14 Press "Space" key.
ADJUST OFFSET is displayed.

15 Do Load Check

If an EPROM-Reset was done before calibration, the specific variables for the ASM-P/PLUS Performance, must be re-set.

7.3 Weighting Scale Calibration

7.3.1 Weighing Scale Calibration Device

The weighing scale will be calibrated with the help of a calibration device. During calibration, the weighing cells will be loaded with a predetermined force.

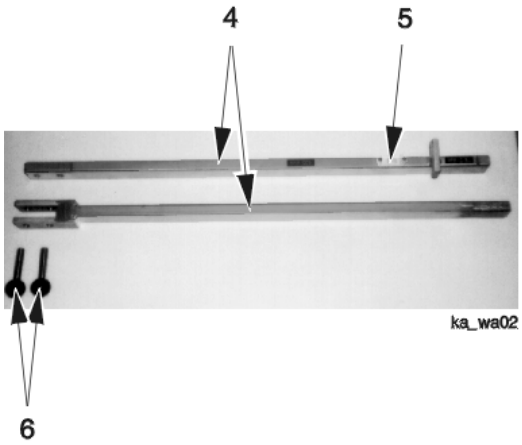
The calibration device consists of:

Pick-up attachment for the calibration arm

1 + 3 take-up for the calibration arm

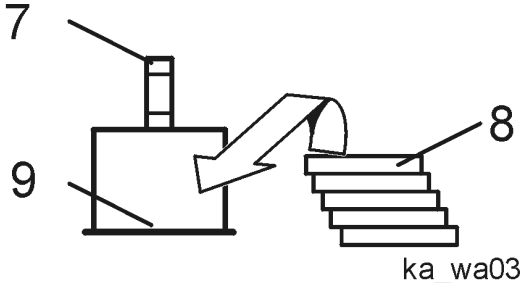
2 hook up the calibration device onto the square tube

Calibration arm



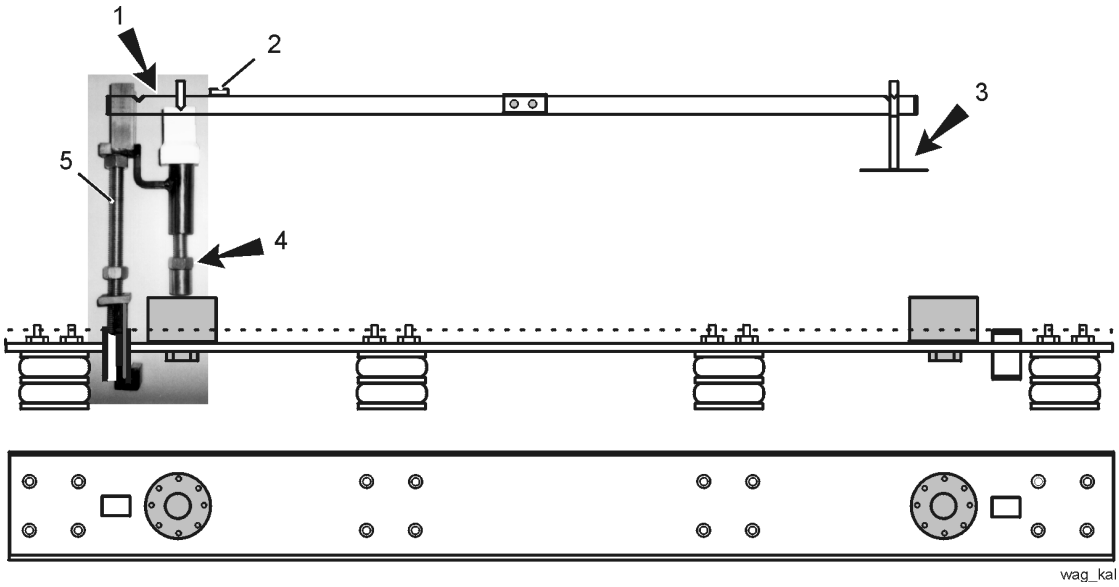
4	Calibration arm
5	Libelle
6	Insert pins

Box for calibration weights



7	hook up the box onto the calibration arm
8	Weights (per weight 1970 g)
9	Surface for weight discs

7.3.2 Installation of the Weighing Scale Calibration Device



Installation of the calibration device

1 Remove the center cover of the test stand.

2 Remove the cover of the lifting beam.

3 Insert the calibration device into the square tube and lock with a nut.

4 Hook up the calibration arm (1) and align the arm centrally.
Make sure that the calibration arm does not touch the lateral sides of the pick-up attachment.

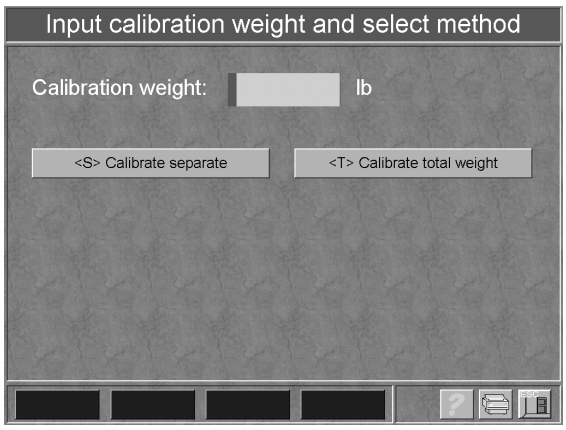
5 Adjust the calibration device using a spirit level (2).
Adjust the calibration arm to a horizontal position by using the adjustment screw (4).

6 Hook up the calibration weight box (3) onto the respective marking and align the calibration device again.

7.3.3 Description

The calibration is executed in the Service-Program after the menu point *Calibrate Scale* has been called up.

The instructions appearing in the status line of the screen will guide the user through the calibration program. A light control method indicates if the test stand has terminated the respective calibration step (the light switches to green) or not (light switches to red).



7.3.4 Procedure

The calibration of the scale can be carried out "separate" (left and right scale will be individually calibrated) or "total" (a known reference weight is used, e.g. a vehicle, of which the weight has been determined before in a reference test).

The reference test on an external scale must be carefully executed.
(Pay attention to the operating instructions of the scale-manufacturer!)

During the reference test and during the scale calibration, the vehicle’s angle of slope must be identical. Different angles of slope will lead to inaccurate calibration results.

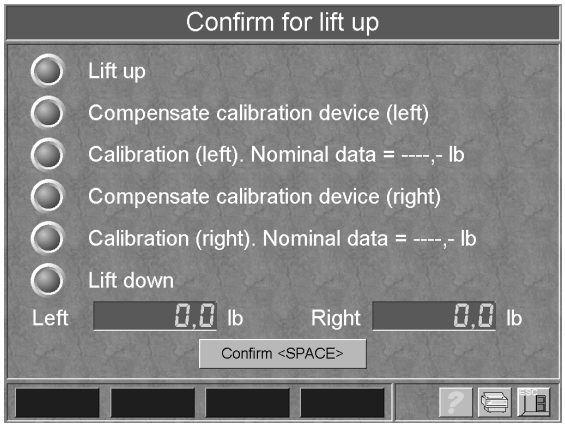
7.3.4.1 Calibration separate

1 Enter weight.
440,92 lb (5 weights)

2 Press "Enter" .

3 Select *Calibration Separate*.
The following menu appears:
LIFT UP is shown.

Following screen appears after calling up the menu point "Calibration Separate".



4 Press "Space" .
COMPENSATE CALIBRATION DEVICE (LEFT)
is displayed.

5 Install calibration device on the left side and balance

6 Press "Space" .
CALIBRATION (LEFT) is displayed.

7 Place 5 calibration weights and balance.

8 Press "Space" .
COMPENSATE CALIBRATION DEVICE (RIGHT)
is displayed.

9 Install calibration device on the right side and balance.

10 Press "Space" .
CALIBRATION (RIGHT) is displayed.

11 Place 5 calibration weights and balance.

12 Press "Space" .
LIFT DOWN is displayed.

13 Remove weights and the calibration device.

14 Press "Space" .
ADJUST COMPLETED is displayed.

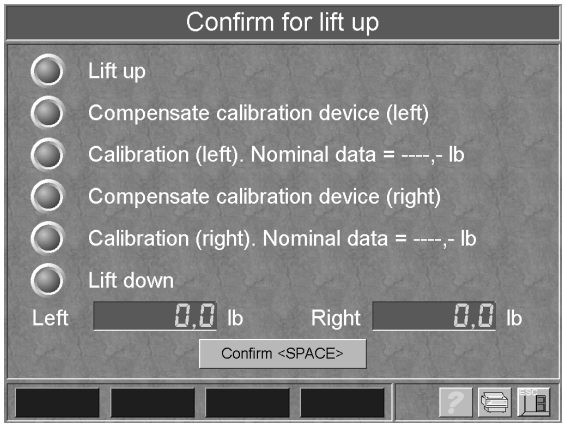
7.3.4.2 Calibration total weight

1 Enter weight.

2 Press "Enter" .

3 Select "Calibrate total weight"
Following menu appears:
LIFT UP is displayed.

After calling up the menu point "Calibration total weight" the following screen appears.



4 Press "Space" .
OFFSET ADJUST
is displayed.

5 Press "Space" .
CALBRATION
is displayed.

6 Place calibration weight (e.g. vehicle) .

7 Press "Space" .
ADJUST OFFSET
is displayed.

8 Press "Space" .
LIFT DOWN is displayed.

9 Remove calibration weight.

10 Press "Space".
Lifting beam lowers.

8 Maintenance

8.1 Maintenance Work on the Toothed Belt

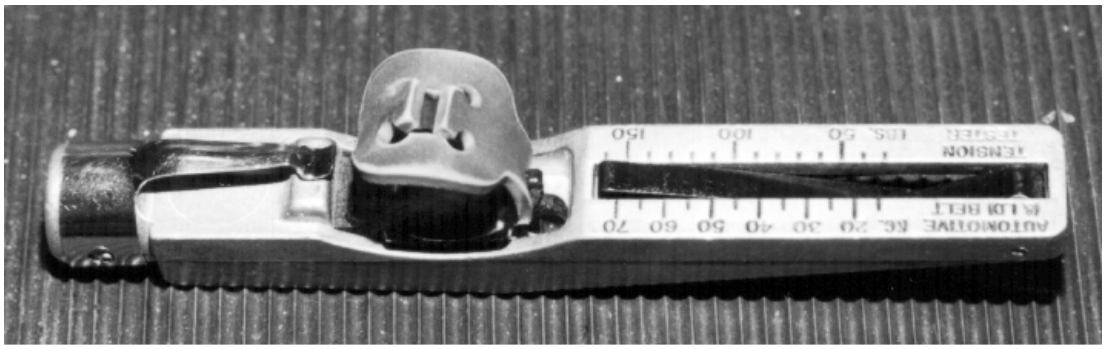
In order to maintain an optimal transmission of power between the drive roller and the eddy-current brake special care should be taken to maintain a correct belt tension at all times.

A reduced transmission of power will be the result due to damaged or loose belts.
Belts which have too much tension tend to wear out quickly and may cause premature bearing failure. In addition, Load-Check and ASM losses are not possible because the test stand runs too hard due to increased friction.

8.1.1 Tension Load Tester Optibelt

The tension load tester consists essentially of:

- a frame with scale
- a measuring spring and drag pointer
- a finger lashing

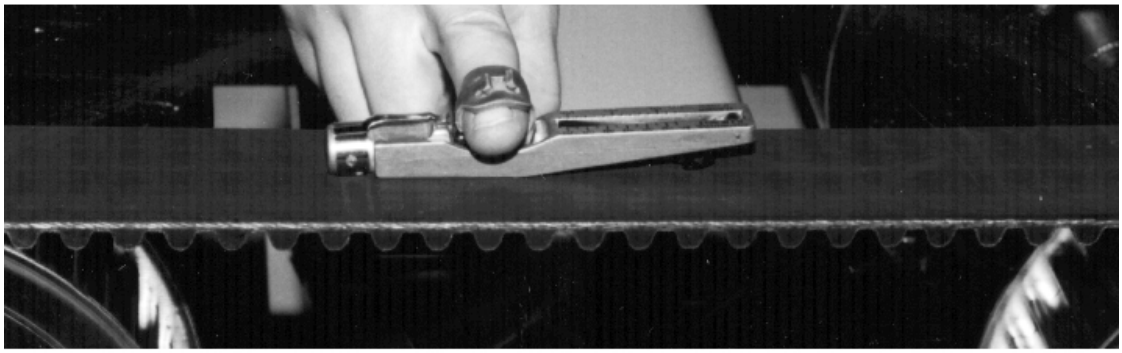


9-08

Tension load tester

The tension load tester should be used as shown.

Once a certain pressure is applied with a finger on the tension load tester a clicking sound can be heard.



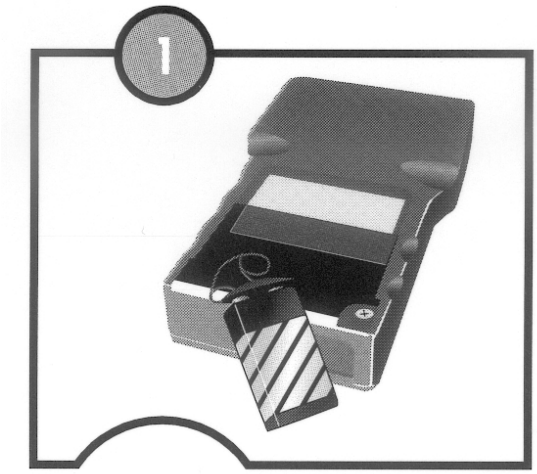
9-09

Tension load test

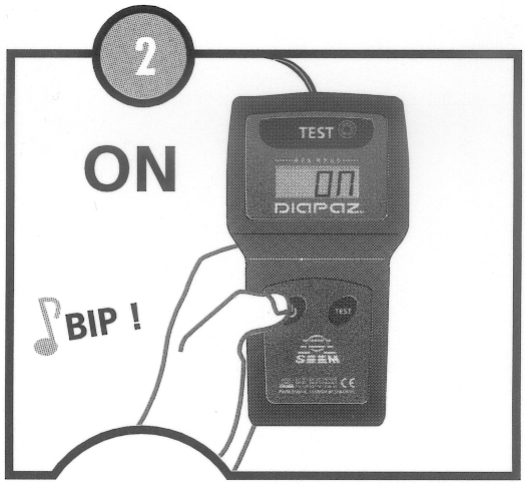
The point where the drag pointer intersects with the scale graduation indicates the measured tension.

8.1.2 Tension Load Tester SEEM

1 Open battery cover and insert battery.



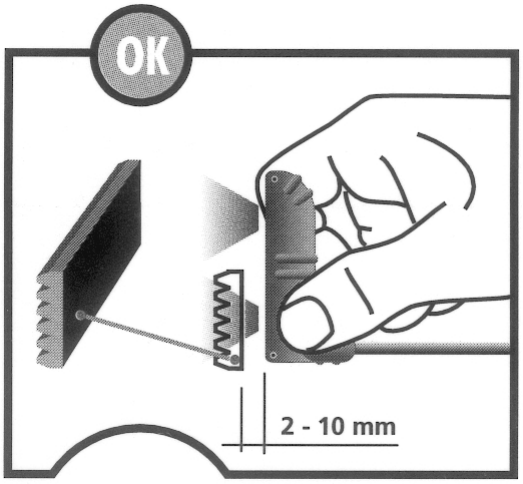
2 Press the left key to switch on the tension load tester.



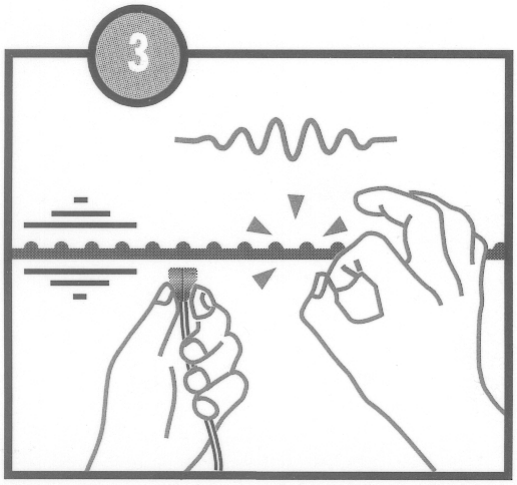
3 Take the sensor and hold the belt disc in the center.

4 The sensor consists of the two microphones.
Hold the microphone in front of the belt, the second must be free

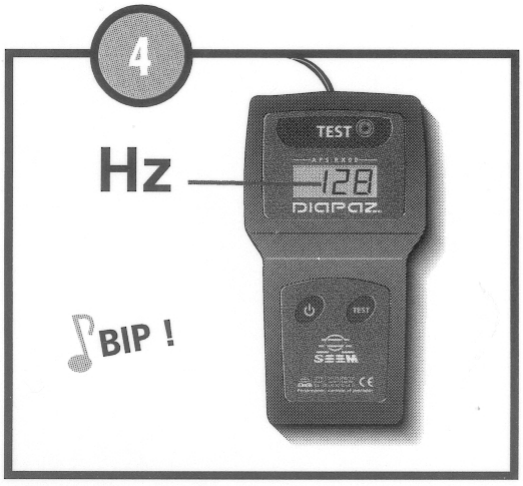
5 Maintain a distance from 2 to 10 mm !



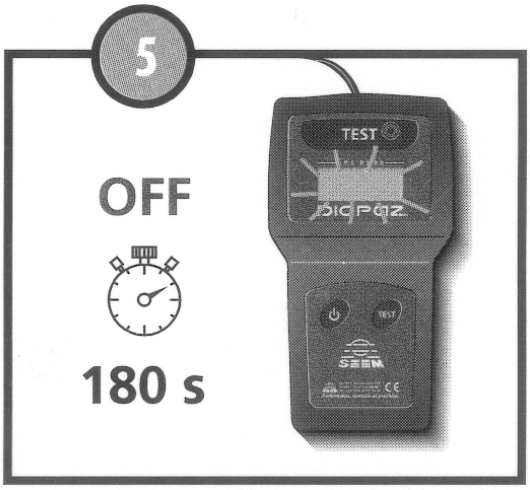
6 Use fingers to create oscillations in the belt.



7 Read frequency.
The frequency must be between 51 and 53 Hz . Otherwise the belt must be newly tightened.



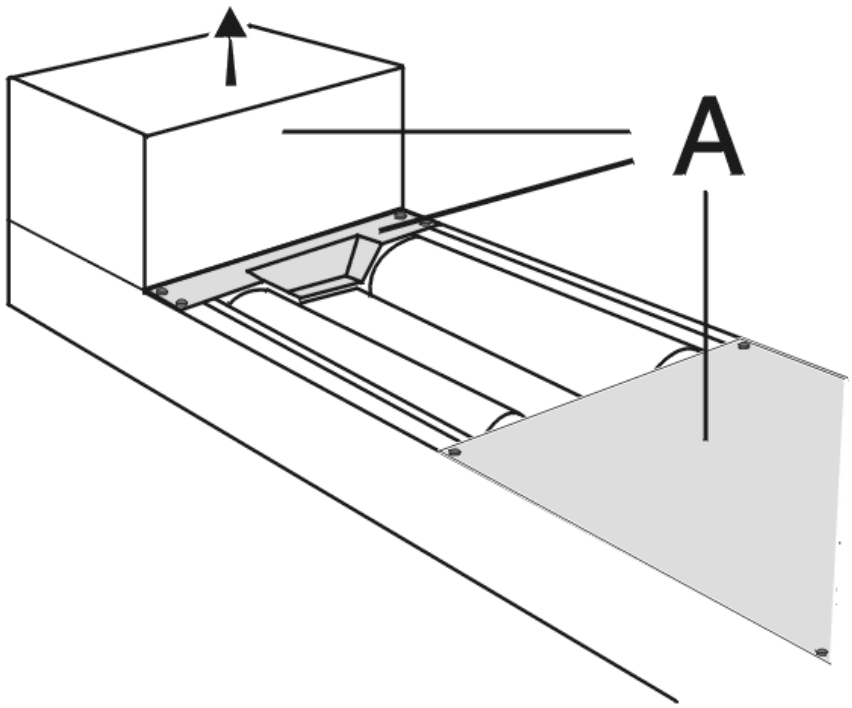
The tension load tester switches off automatically after 3 minutes.



8.1.3 Set the Tension of the Toothed Belt

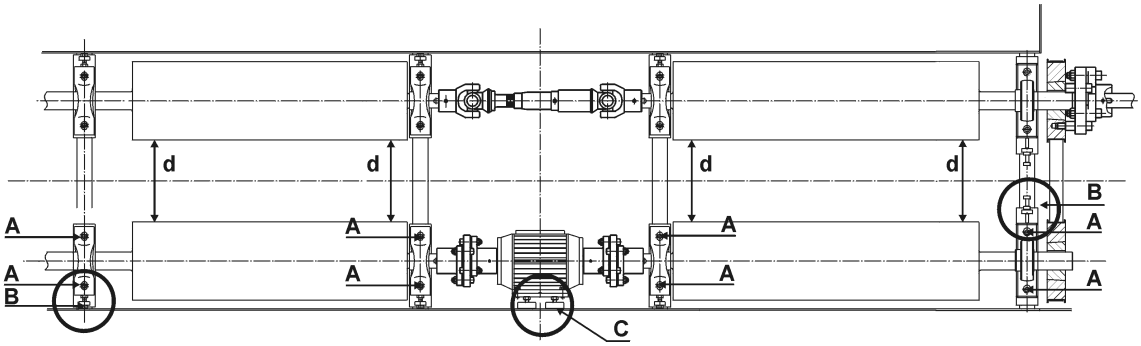
The removal of the ASM cover is easier if the lifting beam cover is slightly raised.

1 Remove the screws of the cover (A) and remove cover.



Removing the cover

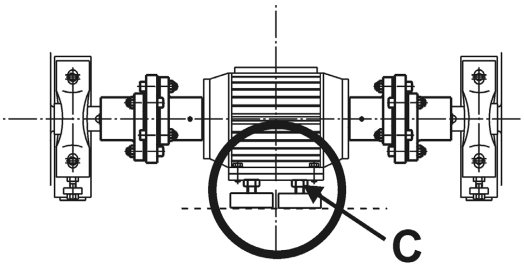
2 The rollers must have the same separation **d** overall (total deviation ± 1 mm)



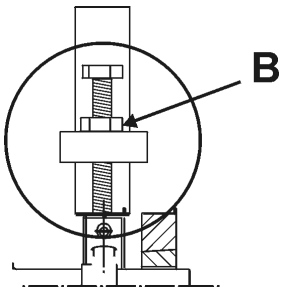
ASM-P/PLUS

3 Loosen all bearing screws **(A)** of the rollers on the drive on side.

4 If necessary, loosen the screws of the rubber buffer. **(C)**.

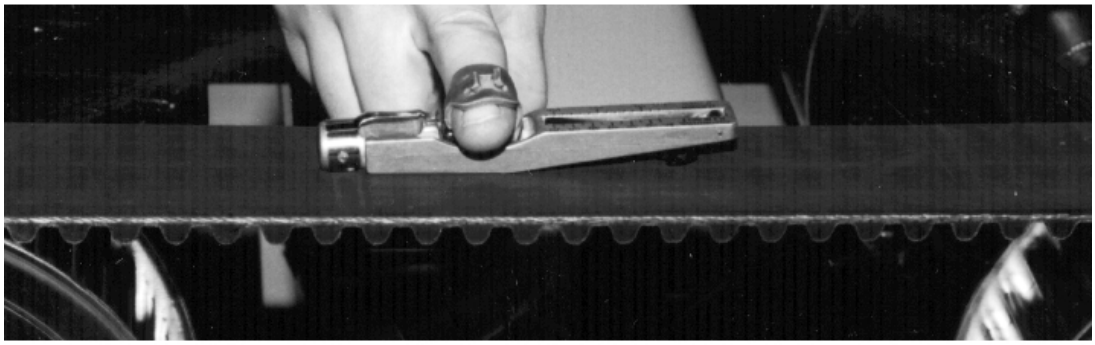


5 Set the belt tension with turnbuckle **(B)**



The tension of the toothed belt must not exceed 110 Nm or 53 Hz. Otherwise the internal motor is no longer able to drive the dynamometer (parasitic losses too high). The belt tension must be checked according to the operating instructions of the used 'Tension Load Tester'!

6 Test the tension of the toothed belt with tension load tester (Place the tension load tester centered on the toothed belt).



9-09

Mesure toothed belt tension

When using tension load tester SEEM, see paragraph 8.1.2.

7 Re-tighten the bearing screws after setting the proper tensioin.

Bearing screws	*Torque*
M16	160 Nm
M14	114 Nm

8 Measure the separation (d) of the rollers and if necessary set.

The distance between the left and right rollers must be the same at any given point.
If required adjust all bearings of the support roller to this distance.

9 Retighten the screws of the rubber buffer.

10 Reinstall the cover plates.

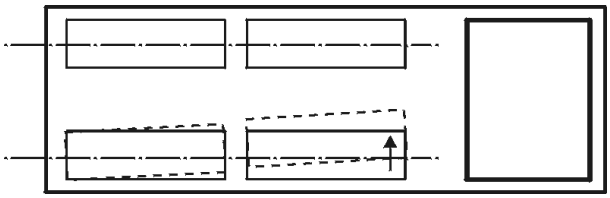
8.2 Toothed Belt Exchange

1 Remove the cover as described in previous paragraph.

2 Loosen the right and middle bearing screws **(A)** of the roller on the drive on side.

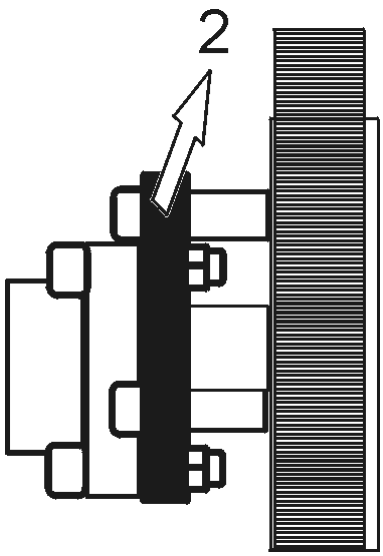
3 Loosen the turnbuckle completely.

4 Pull the rollers towards the front.



5 The roller is joined to the eddy-currrent brake on one side via the joint disc coupling. Dismount the joint disc of this coupling. Loosen the 6 screws **(1)** of the coupling flange and pull out the joint disc. **(2)**

Do not loosen the bearing screws of the front roller!



Coupling with Joint Disc

6 Remove the old toothed belt and place on the new one

7 Remount joint disc.

8 Tighten toothed belt as described in previous paragraph.
The axles of the front and rear rollers must run in a parallel relation ± 1 mm.

9 Retighten bearing screws and turnbuckle.

10 Reinstall the cover plates.

8.2.1 Toothed Belt Data

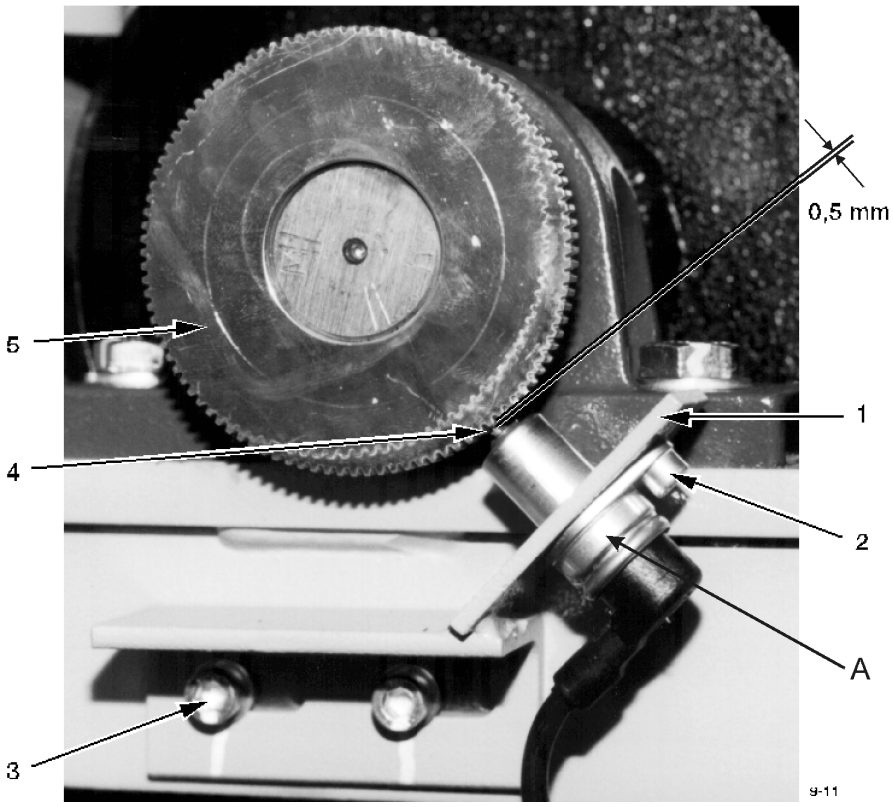
The following values are valid for the Poly Chain GT belt.

Roller set	ASM-P/PLUS
Belt type	14 M
Belt length	1568 mm
Width	37 mm
Number of teeth	112
Toothed belt tension load	51…53 Hz (SEEM) 100…110 Nm (Optibelt)

8.3 Impulse Sensor Exchange

The roller speed is sensed by an impulse sensor in connection with a toothed wheel.

Shows the installation position of the impulse sensor.



Impulse sensor

8.3.1 Impulse Sensor Removal

1 Remove necessary facings and covers (middle cover, cover of the lifting beam, left-side cover) .

2 Unscrew the impulse sensor (A) from the backet. The bracket itself must not be unscrewed.

3 Disconnect the impulse sensor cable.

8.3.2 Impulse Sensor Installation

1 Connect the new impulse sensor to the bracket (4).
Secure the screw (2) with Loctite .

2 Properly connect and attach the wiring of the impulse sensor.

The clearance between impulse sensor and tooth wheel of 0,5 $\pm 0,1$ mm must be accurately maintained!
Wrong clearance leads to erroneous or missing measurement results and/or damage to the impulse sensor!

3 Adjust the clearance between impulse sensor (2) and toothed wheel (5) by using a thickness gauge at the bracket.

4 Secure screws (3) with Loctite and retighten the screws.

5 Reinstall facings and coverings.

8.4 Strain Gauge Exchange

8.4.1 Strain Gauge Removal

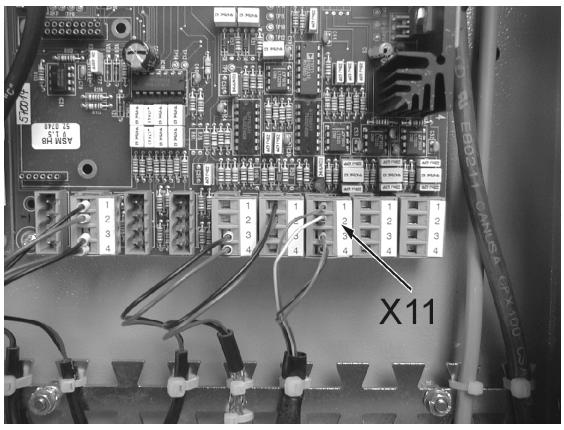
Before any work on or near the strain gauge is started, the power supply to the test stand must be disconnected!

1 Uncrew the fixing screws on the circuit box.

2 Electrically clamp the strain gauge cables in the circuit box.
Note down the colors of the cable wires.

Connector X11

Pin		Signal
1	———	+12V (red)
2	———	+ Input strain gauge (white)
3	———	- Input strain gauge (green)
4	———	GND (black)



3 Loosen the screw-type conduit fittings and pull out the cables.

4 Open up the circuit box.

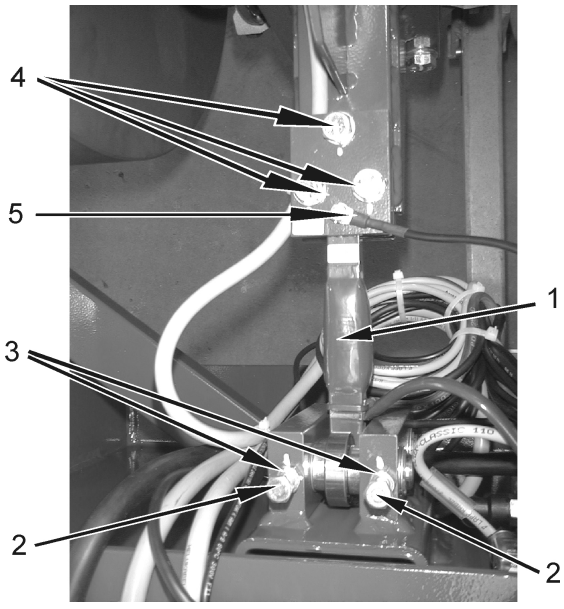
5 Loosen the lock nuts (3) .

6 Loosen the setting screws (2) .

7 Remove the fixing screws (4) of the strain gauge.

8 Unscrew the temperature sensor (5) .

9 Remove the strain gauge (1) .



Removal of the strain gauge

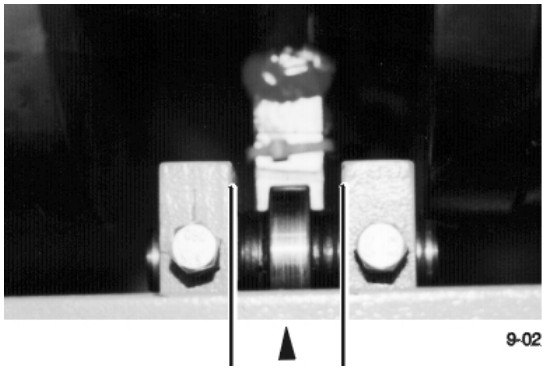
8.4.2 Strain Gauge Installation

The reinstallation of the strain gauge is accomplished by reversing the steps of the removal.

After the installation of a new strain gauge, it is necessary to recalibrate the test stand!

When installing the strain gauge pay attention to the following:

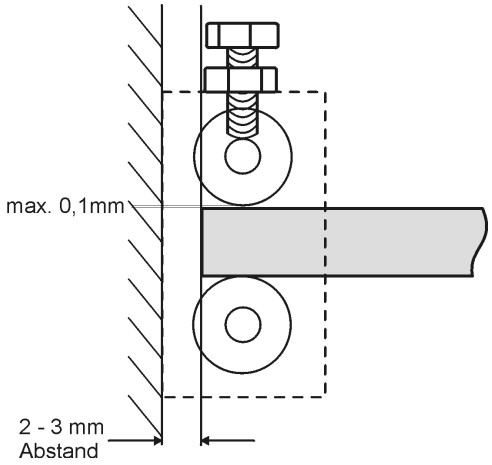
1 The strain gauge must be centered in the counter bearing.



Installation of the strain gauge

2 Set a play of 0,1 mm (Figure 8-13) between the strain gauge and the upper roller bearing by using the setting screws (2).

The front fixing screw (4) must have a quality of 10.0!



Strain gauge counter bearing

3 If the separation of 2 to 3 mm is not given, the strain gauge must be shortened with a cut-off grinder

4 Tighten fixed screws and secure with Loctite.

8.5 Exchanging the Tension Set

Installation instructions:

1 Clean the shaft end surface and all other fitted parts of dirt and grease.

2 Grease the tightening screws (threading pins).

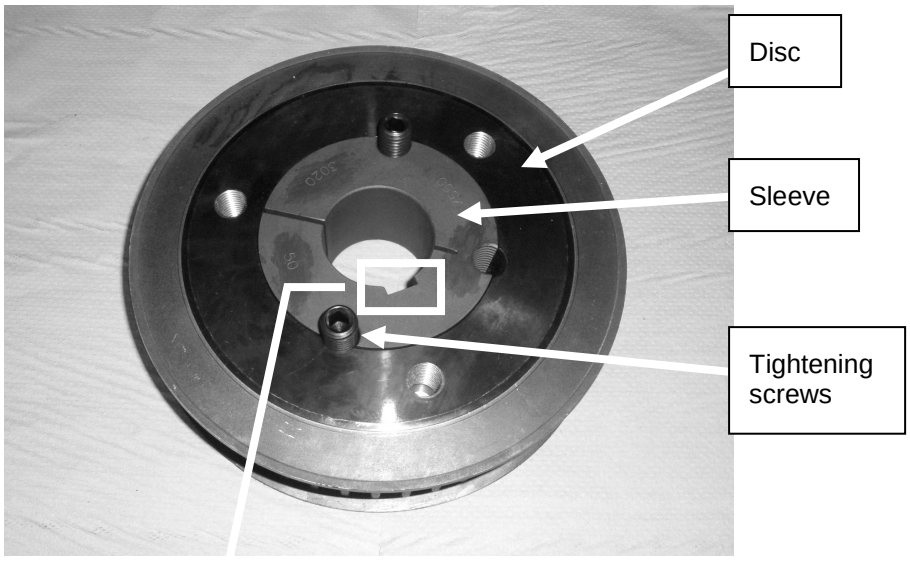
3 Fit the disc and sleeve into one another, line up drill holes and loosely screw in screws.

4 Push the disc and sleeve as unit onto the shaft, align and tighten the screws one after the other. Torque is 90 Nm with Model 3020 .

5 Hammer the sleeve deeper in using a suitable wooden piece. Tighten the screws again with a torque of 90 Nm. If necessary, repeat the procedure.

6 Pay attention that the sleeve clamps onto the shaft and then the disc pulled on slightly onto the sleeve.

7 If there is a slot at the shaft end, the slot in the sleeve must be lined up with the slot on the shaft end.



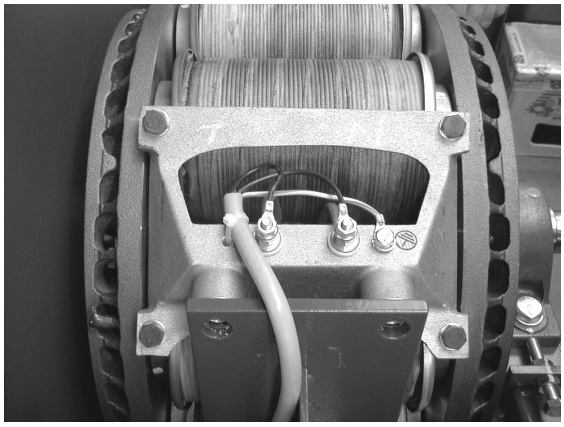
Installation **without** key!

8.6 Eddy-Current Brake Exchange

8.6.1 Removal of the Eddy Current Brake

Life Threatening!
Before any work on or near the eddy-current brake is started, the power supply to the test stand must be disconnected!

1 Disconnect the power supply to the test stand.



2 Remove the cover grids of the eddy-current brake and the lateral roller covers on the brake-side.

3 Open the eddy-current brake connection box, mark the connection line and clamp it electrically.

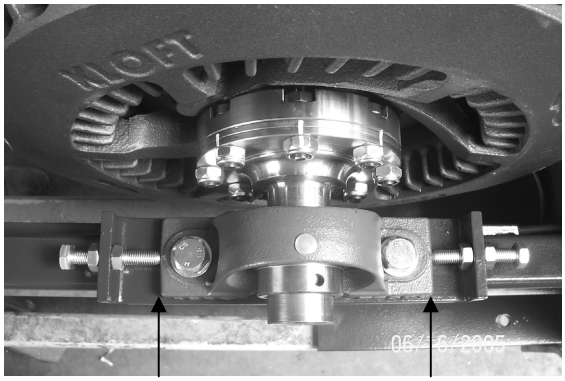
4 Unscrew the circuit box.

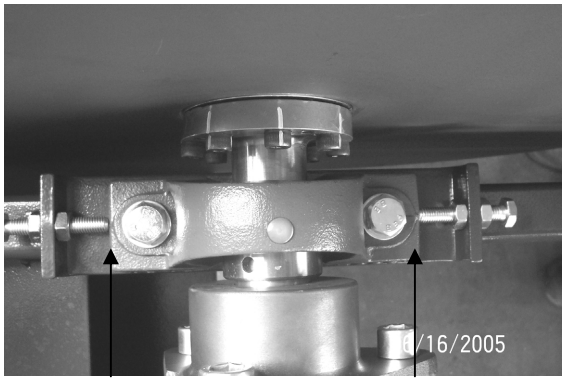
5 Remove the strain gauge

6 Remove temperature sensor. (see previous paragraph)

7 Remove the joint disc of the coupling. Loosen the 6 Screws **(1)** of the coupling flange and pull out the joint disc **(2)**

8 Mark the position of both brake bearings on the frame.

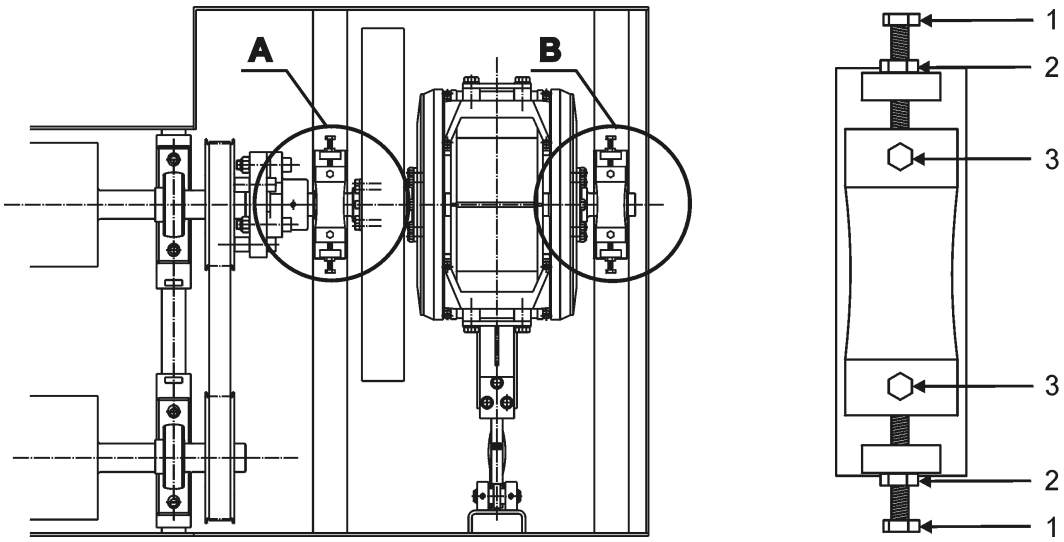




9 Loosen the lock nuts of the centering screws.

10 Loosen the centering screws (1) of both brake bearings.

11 Remove the screws (3) and discs of both brake bearing and remove the eddy current brakes.



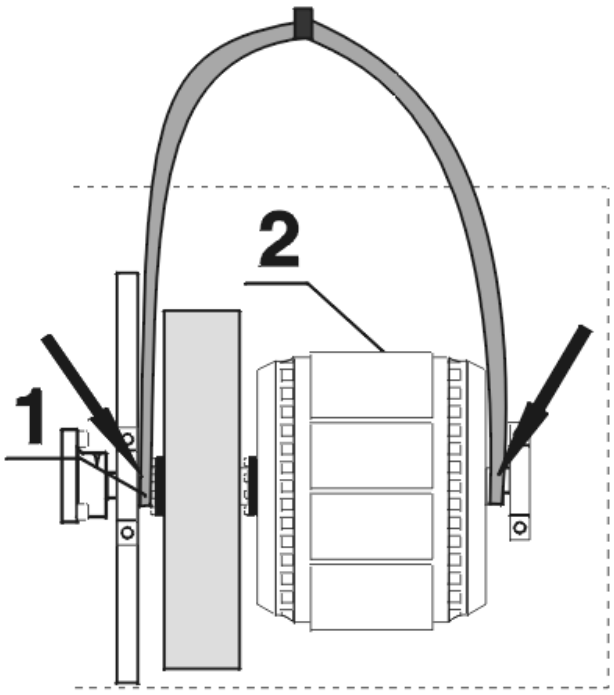
Brake bearing

The crane and the lifting strap must have sufficient strength to lift the weight of the eddy-current brake!

Ensure that the coils are not damaged when the eddy-current brake is being lifted out of its housing. Never attach the lifting strap to the coils of the eddy-current brake . Attach only to the center shaft.

12 Attach the lifting strap and the lifting device to the axle (1) of the eddy-current brake. (2).

13 Lift out the eddy-current brake.

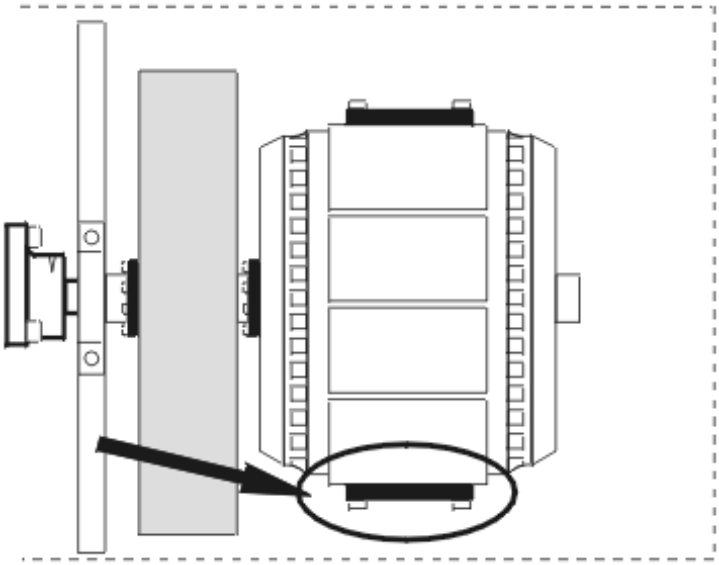


Lifting out the eddy-current brake

1 Axle

2 Eddy current brake

14 Disassemble strain gauge holder and re-assemble again on the new eddy-current brake.



Exchange of the strain gauge holder

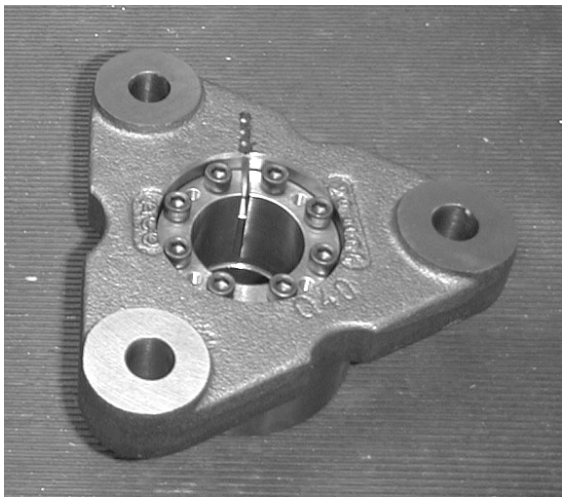
8.6.2 Installation of the Eddy-Current Brake

8.6.2.1 ASM Performance Plus

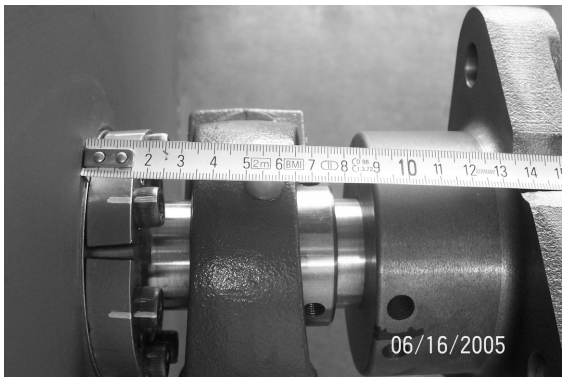
The crane and the lifting strap must have sufficient strength to lift the weight of the eddy-current brake!

Ensure that the coils are not damaged when the eddy-current brake is being lifted out of its housing. Never attach the lifting strap to the coils of the eddy-current brake . Attach only to the center shaft.

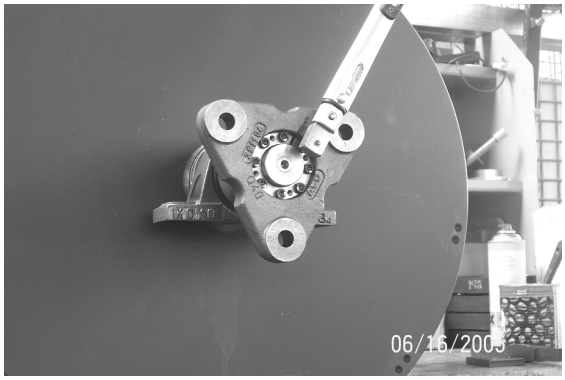
1 Clean the shaft end and clamping set with brake cleaner. Attach clutch.



2 Set the separation between clutch/flywhel to 90 mm.



3 Tighten clamping set with several rotations to 17 Nm (the screws should not move any longer).

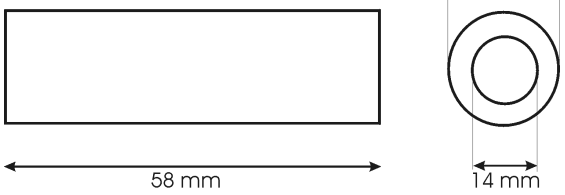


4 Attach the lifting strap and the lifting device to the axle of the eddy-current brake.

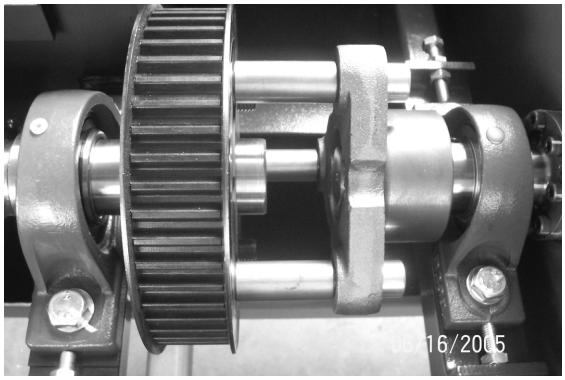
5 Lower the eddy-current brake into the test stand.

6 Align the eddy-current brake roughly with the markings for the brake bearings (on the frame).

7 Attach 3 mounting sleeves between coupling and pulley.

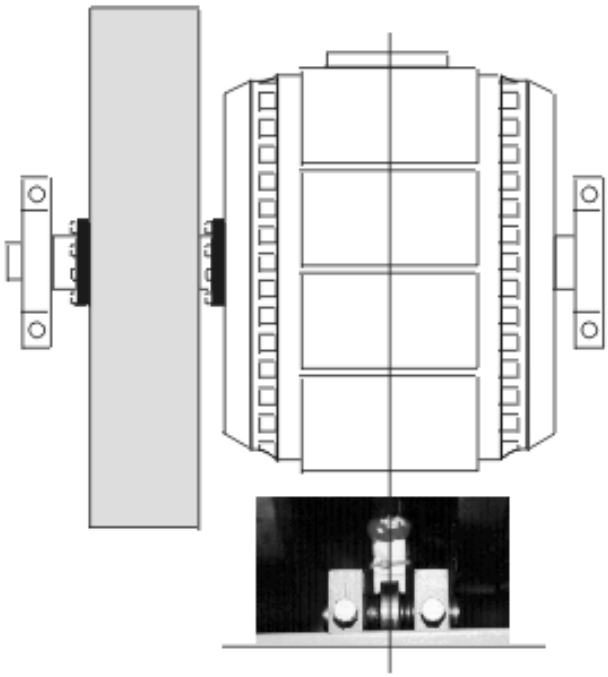


3 mounting sleeves



8 Rotate rollers 5 rotations and tighten pulley by hand.

Mount strain gauge centrally in the thrust bearing and then align the eddy current brake so that the center of the eddy current brake is lined up with the center of the strain gauge.



Positioning of the eddy current brake

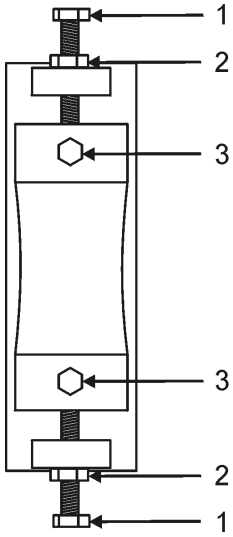
9 Place the screws and discs of both brake bearings and do not tighten

10 Slightly tighten the centering screws of both brake bearings.

11 Tighten the screws (3) of both brake bearings.

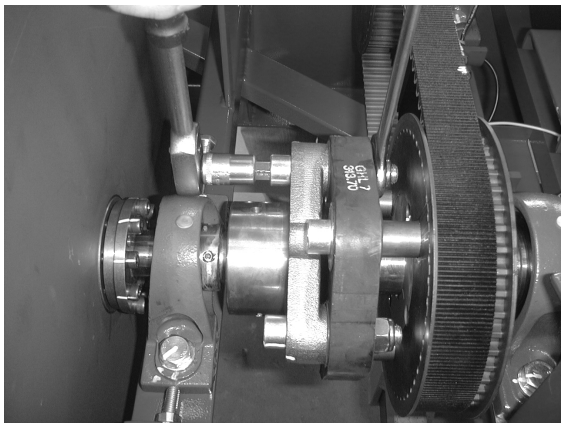
12 Tighten the centering screws of both brake bearings. (1)

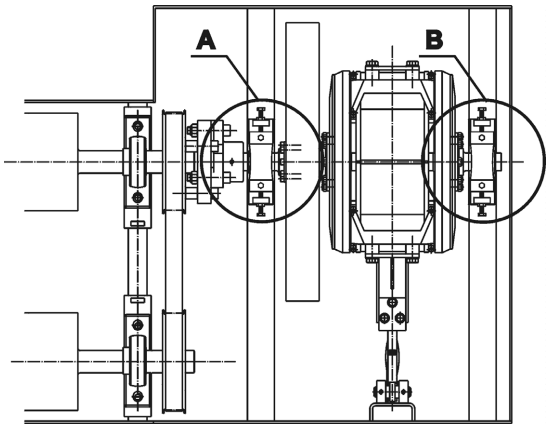
13 Tighten the lock nuts (2) of the centering screws.



14 The grub screw of the coupling flange must be drilled again. Drill about 3mm deep, clean the drill hole, glue the screw with Loctite 243 and screw in tightly.

15 Remove mounting sleeves, tighten pulley with 84 Nm and secure with Loctite.





Fixed and movable bearing

16 Use a drill to drill the grub screws of the fixed bearing (A) ∅ 8,5 ca. 3mm deep and clean the drill hole.

17 Secure the threaded pin with nut lock and tighten securely.

18 Drill the grub screws of the fixed bearings 3mm deep with a drill machine. (A) ∅ 8,5; clean the drill hole.

19 Put a nut lock on the threaded pin and screw in tightly. After screwing the threaded pin unscrew by a ¼ rotation (max. 1mm), so that the bearing can move freely.

20 Mount the temperature sensor. Pay attention to cable guide.

21 Install strain gauge (see paragraph *"Exchange of Strain Gauge"*).

22 Install a traction relief clamp to the connection line.

23 Connect the grounding wire and connection line of the eddy-current brake. Pay attention to cable identifications.

24 Mount circuit box.

25 Install the roller side covers. (brake side)

26 Connect the test stand to power supply.

8.6.2.2 Final Check

Make sure that cables or hoses do not rub on rotating parts!

1 Make sure that cables and hoses are correctly installed and positioned.

2 Conduct a trial run in Service-Program, Motor ON, Motor OFF . Pay attention to smooth running and untypical noises.

3 Do calibration.

4 Reset and store parasitic losses with Service-Program.

5 Test Load check with Service-Program.

6 Install cover grid.

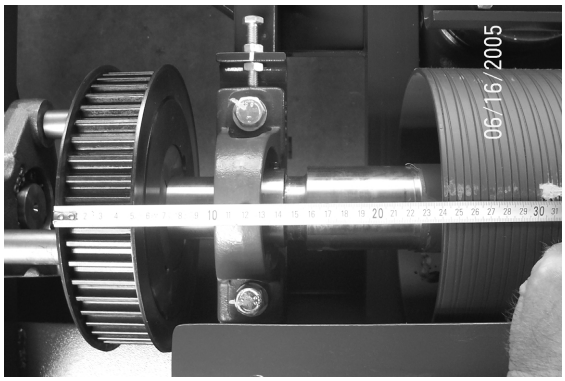
8.6.2.3 ASM Performance

The crane and the lifting strap must have sufficient strength to lift the weight of the eddy-current brake!

Ensure that the coils are not damaged when the eddy-current brake is being lifted out of its housing. Never attach the lifting strap to the coils of the eddy-current brake . Attach only to the center shaft.

1 Clean the shaft end and clamping set with brake cleaner. Attach clutch.

2 Set separation between pulley /outside edge brake roller to 238 mm.



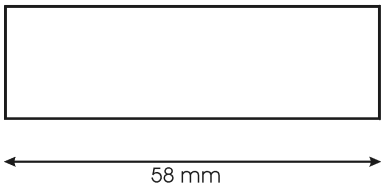
3 Tighten pulley with 84 Nm.

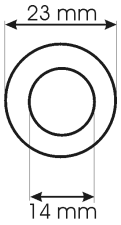
4 Attach the lifting strap and the lifting device to the axle of the eddy-current brake.

5 Lower the eddy-current brake into the test stand.

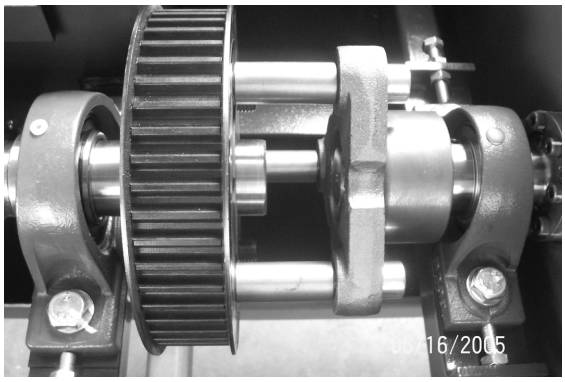
6 Align the eddy-current brake roughly with the markings for the brake bearings (on the frame). (Mount eddy current brake centrally in thrust bearing).

7 Attach 3 mounting sleeves between coupling and pulley.





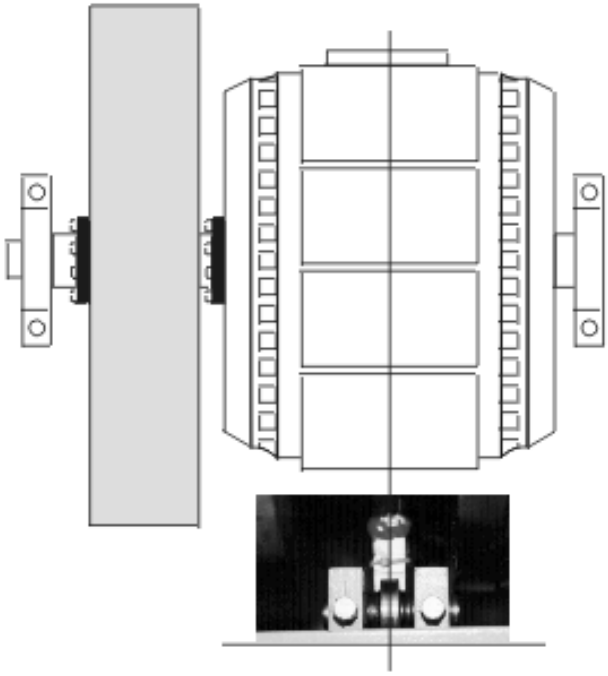
3 mounting sleeves



8 Die Madenschraube des Kupplungsflansches müssen nun wieder verbohrt werden. Dazu die Madenschraube ca. 3 mm tief verbohren, das Bohrloch säubern, die Madenschraube mit Loctite 243 einkleben und fest eindrehen.

9 Rotate rollers 5 rotations and tighten pulley by hand.

Mount strain gauge centrally in the thrust bearing and then align the eddy current brake so that the center of the eddy current brake is lined up with the center of the strain gauge.



Positioning of the eddy current brake

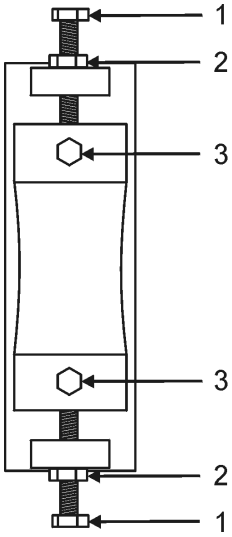
10 Place the screws and discs of both brake bearings and do not tighten.

11 Slightly tighten the centering screws of both brake bearings.

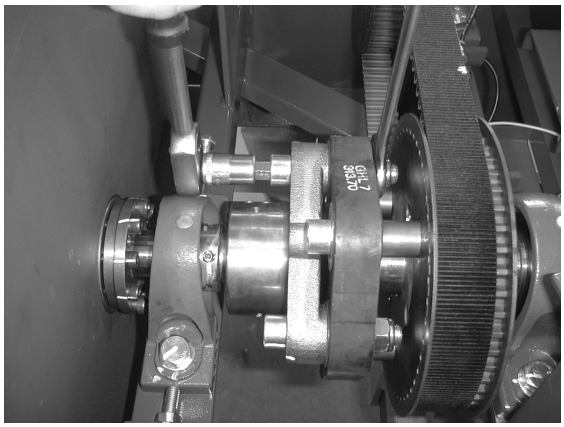
12 Tighten the screws (3) of both brake bearings.

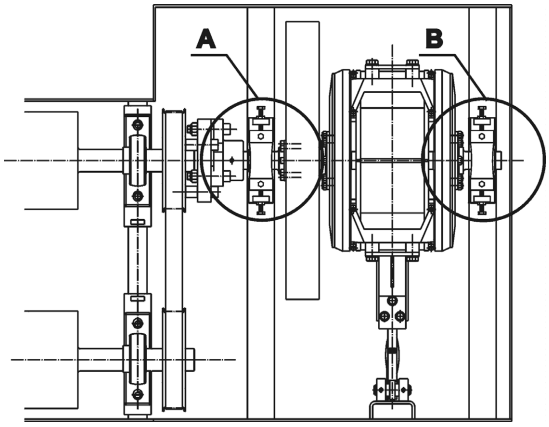
13 Tighten the centering screws of both brake bearings. (1)

14 Tighten the lock nuts (2) of the centering screws.



15 Remove mounting sleeves, tighten pulley with 84 Nm and secure with Loctite.





Fixed and movable bearing

16 Use a drill to drill the grub screws of the fixed bearing (A) ∅ 8,5 ca. 3mm deep and clean the drill hole.

17 Secure the threaded pin with nut lock and tighten securely.

18 Drill the grub screws of the fixed bearings 3mm deep with a drill machine. (A) ∅ 8,5; clean the drill hole.

19 Put a nut lock on the threaded pin and screw in tightly. After screwing the threaded pin unscrew by a ¼ rotation (max. 1mm), so that the bearing can move freely.

20 Mount the temperature sensor. Pay attention to cable guide.

21 Install strain gauge (see paragraph *"Exchange of Strain Gauge"*).

22 Install a traction relief clamp to the connection line.

23 Connect the grounding wire and connection line of the eddy-current brake. Pay attention to cable identifications.

24 Mount circuit box.

25 Install the roller side covers. (brake side)

26 Connect the test stand to power supply.

8.6.2.4 Final Check

Make sure that cables or hoses do not rub on rotating parts!

1 Make sure that cables and hoses are correctly installed and positioned.

2 Conduct a trial run in Service-Program, Motor ON, Motor OFF . Pay attention to smooth running and untypical noises.

3 Do calibration.

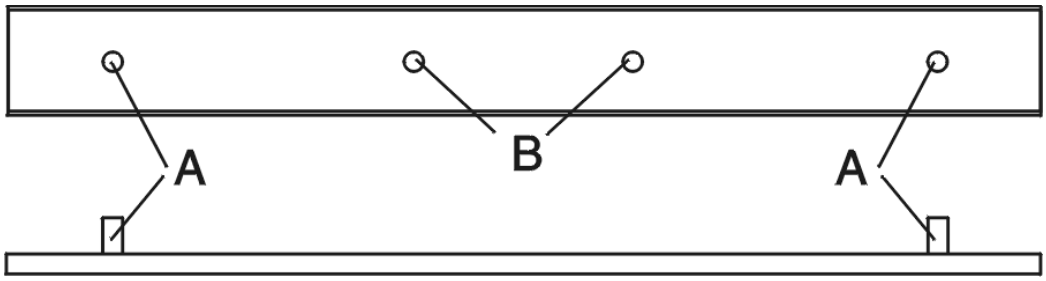
4 Reset and store parasitic losses with Service-Program.

5 Test Load check with Service-Program.

6 Install cover grid.

8.7 Working on the Lift Beam

8.7.1 Lift Beam Structure

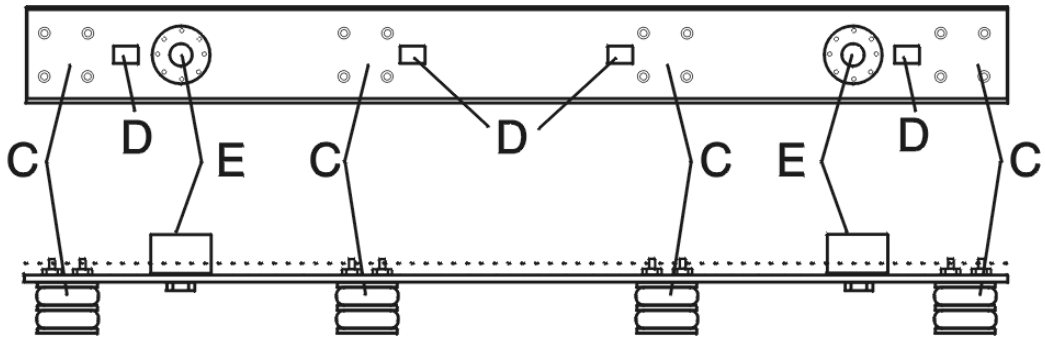


Cover of the lift beam: top- and side view

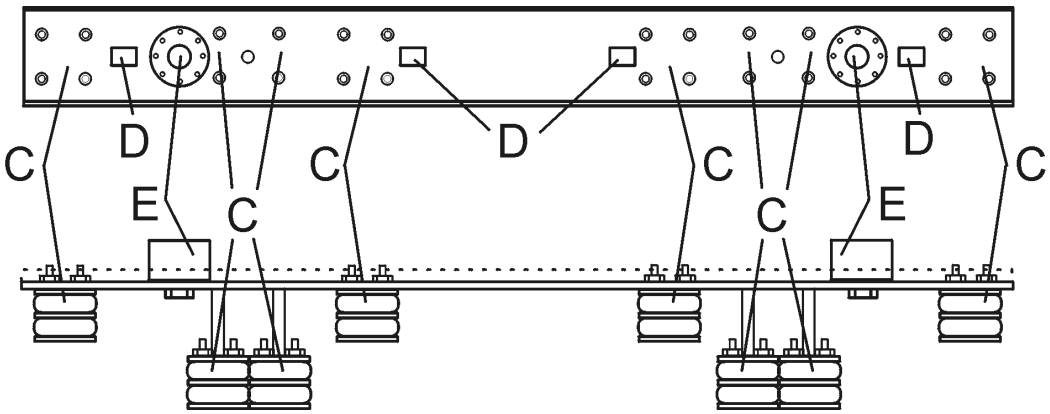
A Guide bolt for lift beam

B Guide sleeve for guide bolt

ASM Performance



ASM Performance Plus



Base unit of the lift beam: top view and side view

C air bellow and holding of the air bellow

D guide sleeve for guide bolt

E weighing cell of the scale

8.7.2 Weighing Cell Replacement

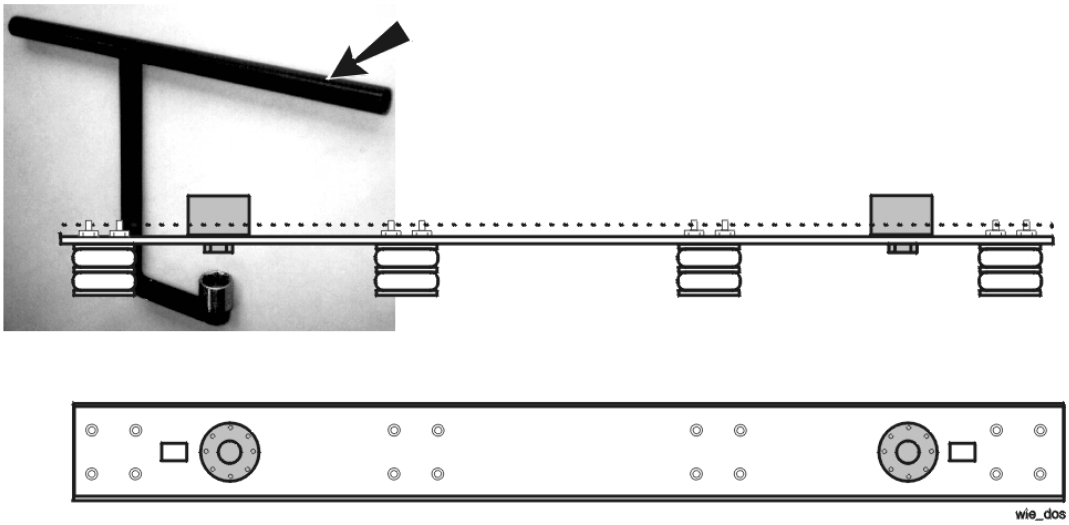
1 Loosen the four screws of the middle cover and remove the cover plate.

2 Remove the cover of the lift beam.

3 Disconnect the wiring of the weighing cell.

4 Loosen the screw with a special wrench and remove the old weighing cell.

5 Fasten the new weighing cell and connect it electrically.



Replacement of the weighing cell of the scale

Connector X9 (Connection scale right-hand)

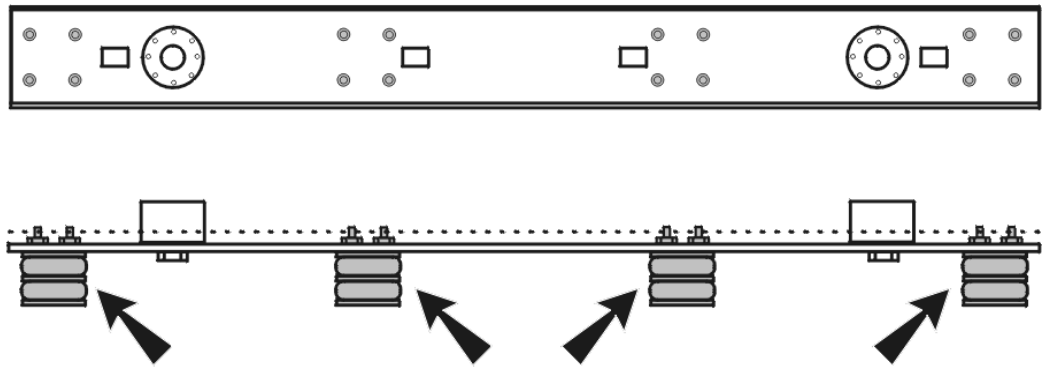
Pin		Signal
1	———	+12V
2	———	+ Input scale right
3	———	- Input scale right
4	———	GND

Connector X10 (Connection scale left-hand)

Pin		Signal
1	———	+12V
2	———	+ Input scale left
3	———	- Input scale left
4	———	GND

8.7.3 Air Bellow Replacement

If one of the lower air bellows is to be replaced the respective upper air bellow must also be removed.



Arrangement of the air bellows

8.7.3.1 Air Bellow Removal (ASM Performance)

1 Place the lifting beam in the lowest position.

2 Remove the middle- and side covers of the roller set.

3 Remove the cover from the lift beam.

4 Remove both brake shoes.

5 Reduce the operating pressure of the lift beam to 2 bar.

6 Raise the lift beam in the Service Program.

7 Place wooden chocks (approx 12 cm high) in the middle of the frame on both sides under the lift beam.

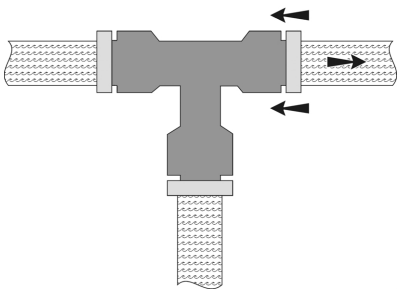
8 Lower the lift beam in the Service Program.

9 Switch off main switch.

10 Disconnect the impulse sensor (RPM sensor).

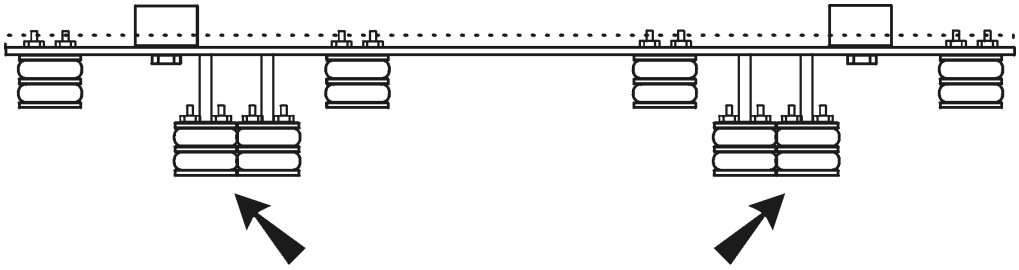
Danger!
Disconnect test stand from power supply!

11 Remove the air pressure hose from the air bellow to be replaced.
Press onto the blue ring and remove the air hose.



12 Remove the fixing screws of the air bellow to be replaced and remove the air bellow from below.

8.7.3.2 Removing a Lower Air Bellow (ASM Performance Plus)



1 Place the lifting beam in the lowest position.

2 Remove the middle- and side covers of the roller set.

3 Remove the cover from the lift beam..

4 Remove both brake shoes.

5 Reduce the operating pressure of the lift beam to 2 bar.

6 Raise the lift beam in the Service Program.

7 Place wooden chocks (approx 12 cm high) in the middle of the frame on both sides under the lift beam.

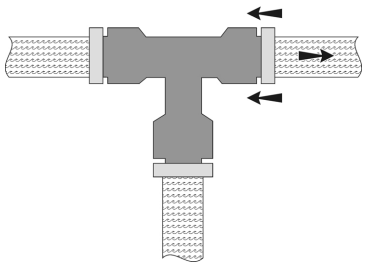
8 Lower the lift beam in the Service Program.

9 Switch off main switch.

10 Disconnect the impulse sensor (RPM sensor).

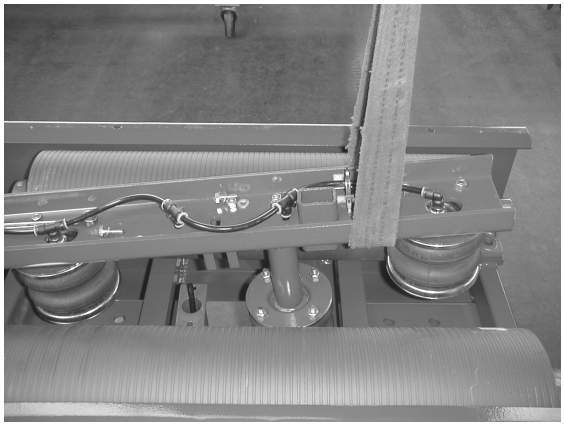
Danger!
Disconnect test stand from power supply!

11 Remove the air pressure hose from the air bellow to be replaced.
Press onto the blue ring and remove the air hose.



12 Attach the lifting strap to the lifting beam and pull up ca. 15 cm.

13 Remove the fixing screws of the air bellow to be replaced and remove the air bellow



8.7.3.3 Air Bellow Installation

The reinstallation of the new air bellow is accomplished by reversing the steps of the removal.

Adjust the lift beam pressure to operating pressure.

8.7.4 Adjustment of the Lifting Beam

1 Slightly loosen the nut (B) on the threaded rod of the brake lever.

2 Lift the lift beam with operating pressure.

When the lift beam is raised, the brake shoes (D) must touch the rollers evenly.
Make sure that the lift beam is not tilted when the brake shoes are attached to the rollers!

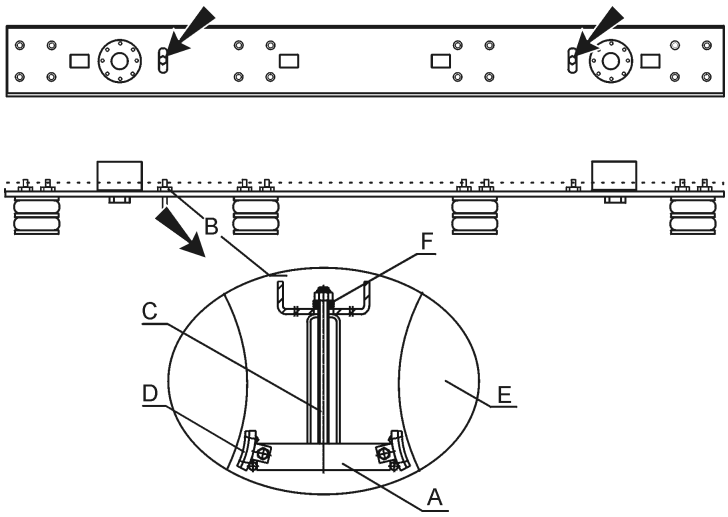
3 Adjust the lift beam by tightening the nut. The distance between the top edge of the roller and the top edge of the lift beam tube must be 45 mm on both sides without covers.

Setting of the lift beam

If the cover cannot be properly installed, although the lift beam is correctly adjusted, check
- the number of cup springs,
- the brake shoe installation,
- the brake lining wear and
- brake lever installation

8.7.5 Brake Shoe Replacement

In order to replace the brake shoes, the respective brake lever must be removed.



Brake shoe replacement

A	Brake leverl	C	Threaded rod	E	Roller
B	Nut	D	Brake shoe	F	cup springs

8.7.5.1 Brake Lever Removal

1 Remove the middle cover plate of the test stand.

2 Remove the cover of the lift beam.

3 Unscrew the self-locking nut (B) the metal plate and the cup springs.

4 Completely remove the brake lever.

5 Replace brake shoes (D).

8.7.5.2 Brake Lever Installation

1 Insert the brake lever.

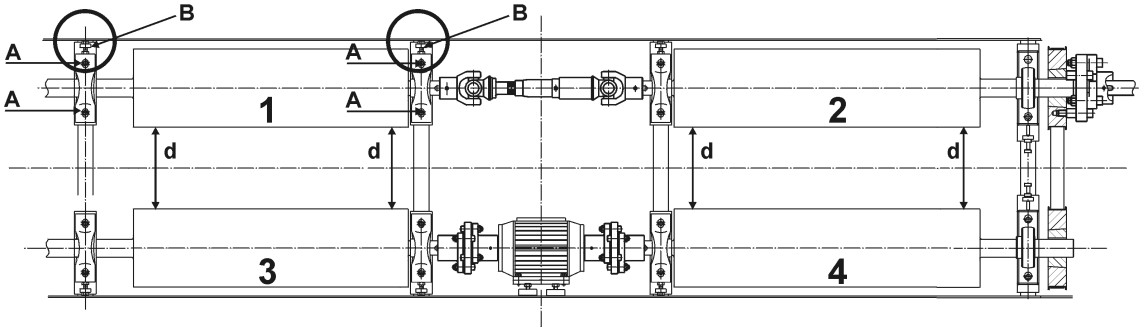
2 Shift the metal plate and the cup springs over the threaded rod and secure it with the nut (B).Only slightly tighten the nut.

3 Readjust the lift beam, as described in previous paragraph.

8.8 Exchange of the Roller Bearing

If two roller bearings opposite one another are simultaneously defective, only one after the other must be exchanged and adjusted!

8.8.1 Roller Bearing of Roller 1



ASM-P/PLUS

1 Remove necessary casing and covering (middle cover, side cover) .

2 Remove impulse sensor.

3 Loosen the bearing screws **(A)** of roller 1.

4 Remove roller 1.

5 Mark the position of the cardan shaft and remove it.

6 Replace defective roller bearing. (do not drill).

7 Re-install cardan shaft.

8 Position roller 1:
- set same distance **d** (total deviation ± 1 mm) between roller 1 and 3 .
- Adjust roller 1 to 3 exactly symmetric to alignment.

9 Tighten bearing screws **(A)** .

Bearing screws	*Torque*
M16	160 Nm
M14	114 Nm

10 Check position of roller 1 if necessary set using the adjustment screw **(B)**.

The roller separation (left and right-hand roller) must be the same at every position.
If necessary, all bearings of the support roller must be aligned to this distance.

11 Use a drill to drill the grub screws of the fixed bearing (A) ∅ 8,5 ca. 3mm deep and clean the drill hole.

12 Secure the threaded pin with nut lock and tighten securely.

13 Use a drill to drill the grub screws of the movable bearing (A) ∅ 8,5 ca. 3mm deep and clean the drill hole.

14 Secure the threaded pin with nut lock and tighten securely

15 Install impulse sensor

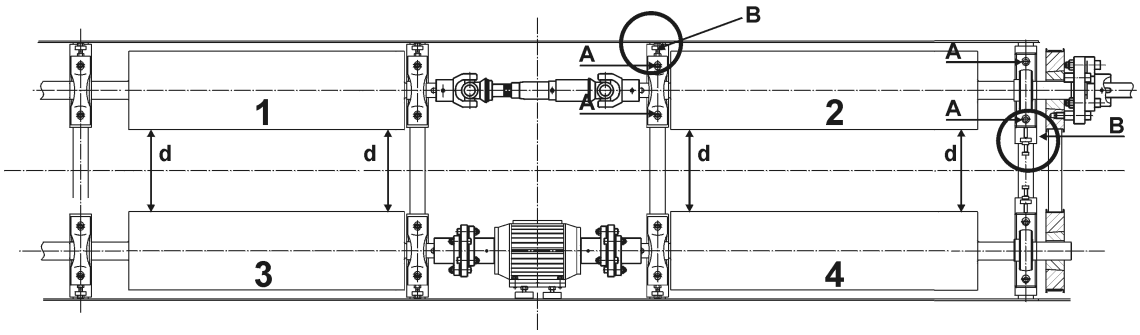
16 Check and set, if necessary, distance between impulse sensor and toothed wheel ($0{,}5^{\pm 0{,}1}$ mm) .

17 Mount covers properly.

18 Set parasitic losses and store with service program.

19 Test Load check with service program.

8.8.2 Roller Bearing of Roller 2



ASM-P/PLUS

1 Remove necessary casings and coverings (middle cover, side cover) .

2 Loosen the adjustment screw on the side of the eddy current brake **(B)**.

3 Pull roller 2 to the inside.

4 Remove toothed belt.

5 Remove the clutch flexible disc.

6 Loosen the bearing screws **(A)** of roller 2 .

7 Remove roller 2 .

8 Mark the position of the cardan shaft and remove.

9 Replace defective roller bearing (do not drill).

10 Re-install cardan shaft.

11 Position Roller 2 :
- set same distance **d** (total deviation ± 1 mm) between roller 2 and 4 .
- Adjust roller 1 to 3 exactly symmetric to alignment.

12 Place toothed belt and tension it.
The axles of the front and rear rollers must run absolutely parallel ± 1 mm.

13 Tighten bearing screws **(A)** .

Bearing screws	*Torque*
M16	160 Nm
M14	114 Nm

14 Check the position of roller 2 and if necessry set with the adjustment screw **(B)**.

The roller separation (left and right-hand roller) must be the same at every position.
If necessary, all bearings of the support roller must be aligned to this distance.

15 Use a drill to drill the grub screws of the fixed bearing (A) ∅ 8,5 ca. 3mm deep and clean the drill hole.

16 Secure the threaded pin with nut lock and tighten securely.

17 Use a drill to drill the grub screws of the movable bearing (A) ∅ 8,5 ca. 3mm deep and clean the drill hole.

14 Secure the threaded pin with nut lock and tighten securely

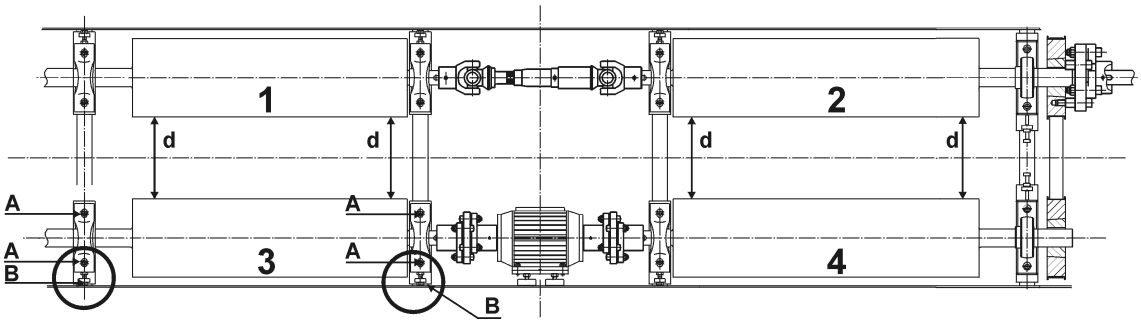
19 Re-install the flexible disc of the clutch and if necessary use mounting sleeves

20 Mount covering properly.

21 Set parasitic losses and store with service program.

22 Test Load check with service program.

8.8.3 Roller Bearing of Roller 3



ASM-P/PLUS

1 Remove necessary casings and coverings (middle cover, side cover) .

2 Measure with a caliper gauge and note down the distance of both motor clutches.

3 Mark the position of the clutch flange.

4 Remove the attachment screws of the clutch flange.

5 Loosen the bearing screws **(A)** of roller 3 .

6 Remove roller 3 .

7 Replace defective roller bearing (do not drill).

8 Position Roller 3 :
- set same distance **d** (total deviation ± 1 mm) between roller 1 and 3 .
- Adjust roller 1 to 3 exactly symmetric to alignment.

9 Tighten bearing screws **(A)** .

Bearing screws	*Torque*
M16	160 Nm
M14	114 Nm

10 Check the position of roller 3 and if necessry set with the adjustment screw **(B)**.

The roller separation (left and right-hand roller) must be the same at every position.
If necessary, all bearings of the support roller must be aligned to this distance.

11 Attach fixing screw of the clutch flange and tighten slightly.

12 Bring the clutch to the previously marked distance

13 Rotate the rollers several rotations.

14 Align the motor clutch with a rubber hammer.

15 Tighten attachment screws.

16 Use a drill to drill the grub screws of the fixed bearing (A) ∅ 8,5 ca. 3mm deep and clean the drill hole.

17 Secure the threaded pin with nut lock and tighten securely.

18 Use a drill to drill the grub screws of the movable bearing (A) ∅ 8,5 ca. 3mm deep and clean the drill hole.

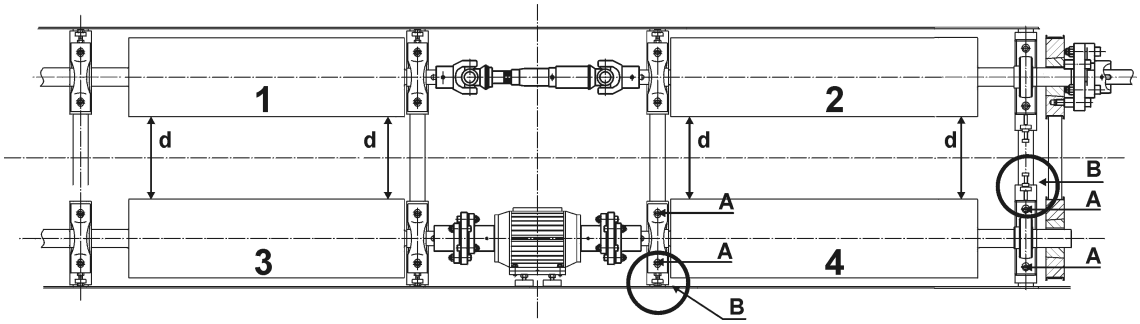
19 Secure the threaded pin with nut lock and tighten securely

20 Mount covering properly.

21 Set parasitic losses and store with service program.

22 Test Load check with service program.

8.8.4 Roller Bearing of Roller 4



ASM-P/PLUS

1 Remove necessary casings and coverings (middle cover, side cover) .

2 Measure with a caliper gauge and note down the distance of both motor clutches.

3 Mark the position of the clutch flange.

4 Remove the attachment screws of the clutch flange.

5 Loosen the adjustment screw on the side of the eddy current brakes **(B)**.

6 Pull roller 2 to the inside.

7 Remove toothed belt.

8 Loosen the bearing screws (A) of roller 4 .

9 Remove roller 4 .

10 Replace defective roller bearing (do not drill).

11 Put in toothed belt.

12 Position roller 4 :
- set same distance **d** (total deviation ± 1 mm) between roller 2 and 4 .
- Adjust roller 2 to 4 exactly symmetric to alignment.

13 Tension toothed belt.

14 Check alignment of belt disc.

15 Tighten bearing screws (A).

Bearing screws	*Torque*
M16	160 Nm
M14	114 Nm

16 Check the position of roller 2 and if necessry set with the adjustment screw **(B)**.

The roller separation (left and right-hand roller) must be the same at every position.
If necessary, all bearings of the support roller must be aligned to this distance.

17 Attach fixing screw of the clutch flange and tighten slightly.

18 Bring the clutch to the previously marked distance

19 Rotate the rollers several rotations.

20 Tighten attachment screws.

21 Use a drill to drill the grub screws of the fixed bearing (A) ∅ 8,5 ca. 3mm deep and clean the drill hole.

22 Secure the threaded pin with nut lock and tighten securely.

23 Use a drill to drill the grub screws of the movable bearing (A) ∅ 8,5 ca. 3mm deep and clean the drill hole.

24 Secure the threaded pin with nut lock and tighten securely

25 Mount covering properly.

26 Set parasitic losses and store with service program.

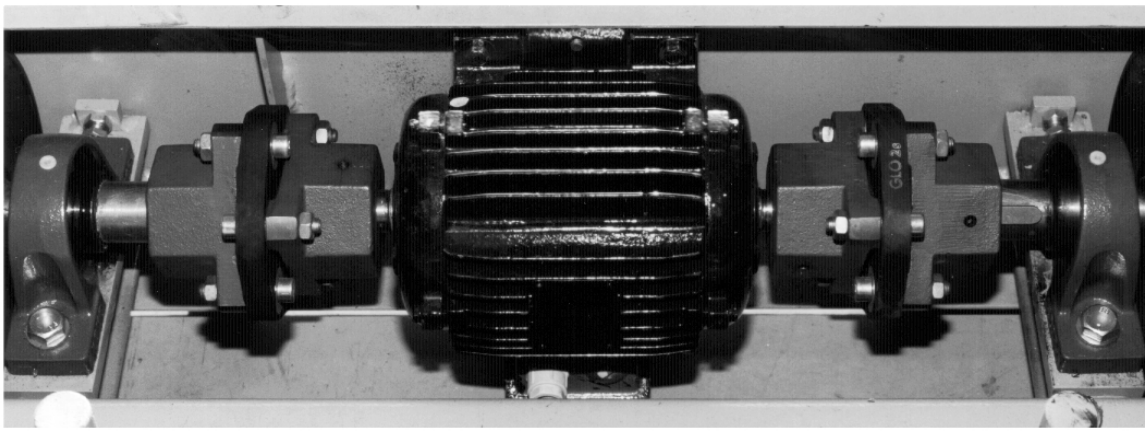
27 Test Load check with service program.

8.9 Exchange of the Brake Bearing

See paragraph *"Exchange of the Eddy Current Brake"*.

8.10 Three-Phase Motor Exchange

The rollers of the ASM test stand are driven by a three-phase motor which is connected to the rollers via a shaft plate coupling. The motor is fastened with two screws to prevent twisting.



Three phase motor

8.10.1 Three-Phase Motor Removal

1 Remove the middle cover plate of the roller set.

2 Release the rubber buffers of the motor support.
The motor must freely suspend in the axles.

3 Loosen the upper screws of the motor circuit box.

4 Raise the lift beam in the Service-Program.

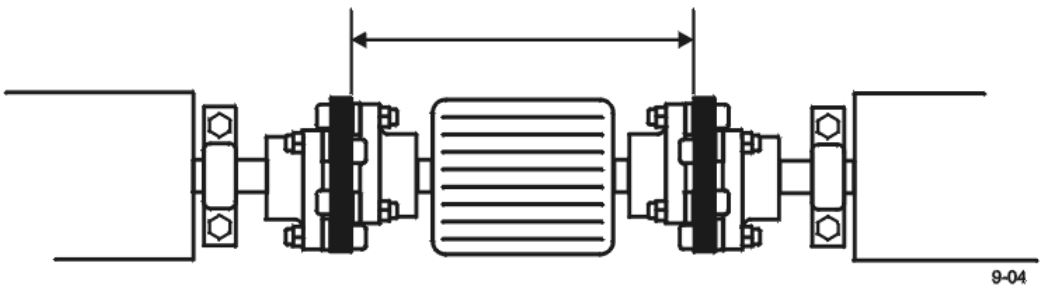
5 Loosen the lower screws of the motor circuit box.

6 Lower the lift beam in the Service-Program.

7 Disconnect the test stand from power supply.

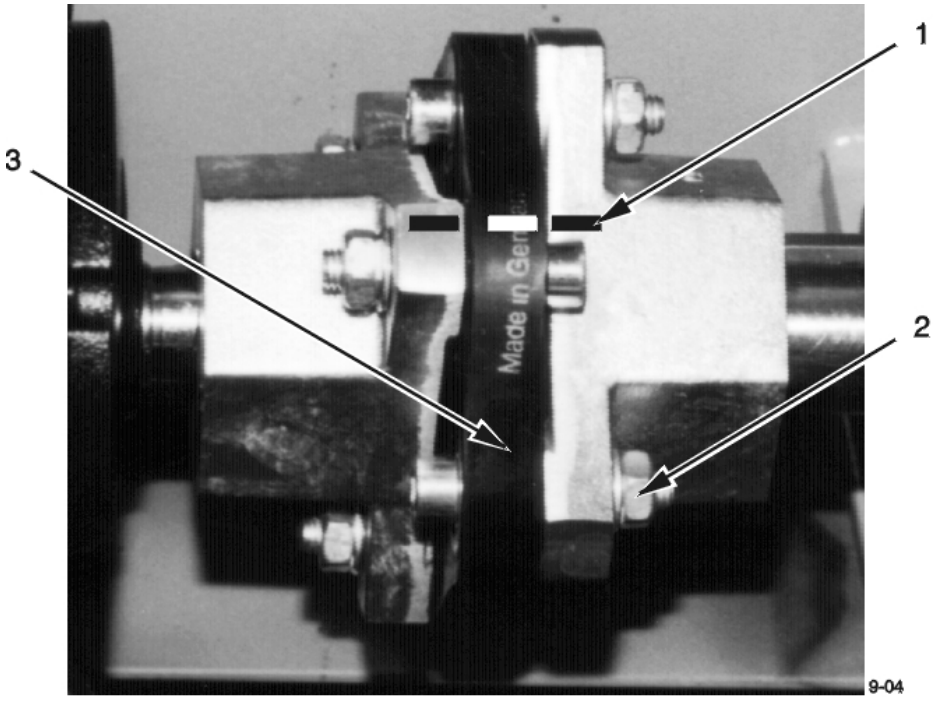
8 Remove the cover of the motor circuit box and electrically clamp the motor cables and thermo protection cables.

9 Measure the distance between the two couplings and note it down.



Distance measurement

10 Mark the position of the coupling flanges (1) with a text marker.



Marking the couplings

11 Remove 5 fixing screws (2) on each coupling flange.

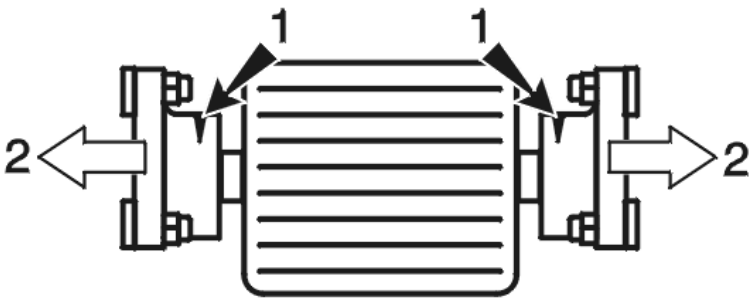
12 Lift the motor with a lifting band and/or a lifting device to release the couplings.

13 Remove the last two fixing screws from the couplings.

14 Pull out the shaft plates (3) and lift out the motor.

15 Loosen the headless screws (1) of the coupling flanges of the old motor.

16 Remove the coupling flanges (2) from the shaft by using a detaching device.



Coupling flange removal

8.10.2 Three-Phase Motor Installation

1 Slide the couplings onto the shafts of the new motor.

2 Install the motor to the test stand frame.

For the adjustment of the correct clearance special 18 mm spacers can be used instead of shaft plates.

3 Insert spacers or shaft plates (3).

4 Slightly tighten all fixing screws (2) of the coupling flanges.
Pay attention to the markings (1).

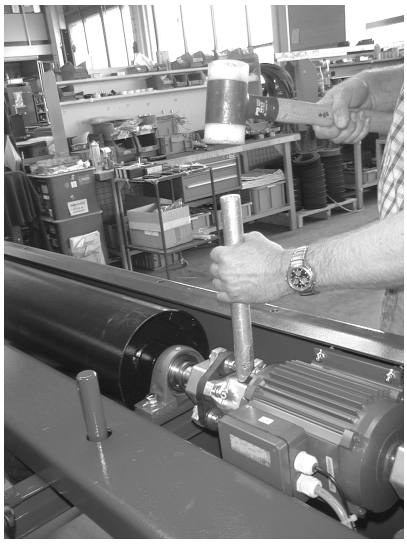
5 Align the couplings to the clearance marked before.
This is not necessary if spacers were used.

6 Retain the coupling flanges with the motor shafts, clean the drilling holes and glue the headless screws (1) with Loctite 243.

In case spacers were used to set the correct clearance, the spacers must now be replaced by shaft plates.

7 Rotate the rollers several rotations.

8 Fasten the optical leveling instrument with the magnet holder to the test stand frame. Adjust the measuring peak to the highest point of the right side of the motor housing.



9 Turn rollers by several rotations and determine the highest position.

10 Align the right motor coupling by using a rubber hammer.

11 Repeat step 9 and 10 until the deviation is 0.3 mm or less.

12 Tighten the fixing screws of the right coupling.

13 Fasten the optical leveling instrument with the magnet holder to the test stand frame. Adjust the measuring peak to the highest point of the left side of the motor housing.

14 Turn rollers by several rotations and determine the highest position.

15 Align the left motor coupling by using a rubber hammer.

16 Repeat step 14 and 15 until the deviation is 0,3 mm or less.

17 Tighten the fixing screws of the left coupling.

18 Remove the optical measuring device.

19 Install the motor cables and the cables of the thermo-protection.
Pay attention to the rubber grommets.

20 Connect the test stand to power supply.

21 Tighten the upper screws of the motor circuit box.

22 Raise the lift beam in the Service-Program.

23 Tighten the lower screws of the motor circuit box.

24 Lower the lift beam in the Service-Program.

25 Fasten the rubber buffers of the motor support.
Slightly tighten the screws and lock them.

8.10.2.1 Final Check

Make sure that cables or hoses do not rub rotating parts!

1 Make sure that cables and hoses are correctly installed and positioned.

2 Conduct a test run in the Service-Program. Carry out Motor ON, Motor OFF.
Pay attention to untypical noises and check on truth of rotation.

3 Do calibration.

4 Re-determine and store parasitic losses in the Service-Program.

5 Conduct a "Load Check" with the Service-Program.

6 Install middle cover plate of the roller set.

9 List of Variables

- EEPROM variables: 0…199
- RAM variables: 200…

9.1 EEPROM Variables

№	Description	Default	Limits
0	Software version	126	1…65535
1	Brake roller diameter [0.1 mm] (2173)	2173	10...20000
2	Support roller diameter [0.1 mm] (2173)	2173	10...20000
3	Pulses per revolution (brake roller) (100)	100	1...5000
4	Pulses per revolution (support roller) (100)	100	1...5000
5	Nominal torque [N] (3000)	6001	100...20000
6	Base inertia [kg] (907)	907	10...5000
7	Rotating vehicle inertia [kg] (60)	60	0...1000
8	Type of acceleration filter (1) 0 = filter with critical damping 1 = Bessel filter 2 = Butterworth filter 3 = Chebyshev filter with 0.5 db ripple	1	0...3
9	Degree of acceleration filter (1) 0 = filter disabled 1 = first degree 2 = second degree	1	0...2
10	Limit frequency of acceleration filter [0.01 Hz] (300)	900	1...2500
11	Type of torque filter (1) 0 = filter with critical damping 1 = Bessel filter 2 = Butterworth filter 3 = Chebyshev filter with 0.5 db ripple	1	0...3
12	Degree of torque filter (2) 0 = filter disabled 1 = first degree 2 = second degree	2	0...2
13	Limit frequency of torque filter [0.01 Hz] (30)	30	1...2500
14	Time for lifting bar up [s] (10)	10	1...200
15	Time for lifting bar down [s] (10)	10	1...200
16	Nominal dyno speed [0.1 km/h] (1600)	2000	500...3000
17	P-share of torque regulator [0.01] (125)	250	0...65000
18	I-share of torque regulator [ms] (400)	200	1...65000
19	D-share of torque regulator [10 µs] (2000)	2000	0...65000
20	T-share of torque regulator [10 µs] (2000)	2000	0...65000
21	P-share of speed regulator [0.01] (2000)	2000	0...65000
22	I-share of speed regulator [ms] (100)	100	1...65000
23	D-share of speed regulator [10 µs] (0)	0	0...65000
24	T-share of speed regulator [10 µs] (0)	0	0...65000
25	Prebrake range of speed regulator [0.1 km/h] (60)	60	0...5000

№	Description	Default	Limits
26	P-share of road load regulator [0.01] (80)	160	0...65000
27	I-share of road load regulator [ms] (500)	250	1...65000
28	D-share of road load regulator [10 µs] (0)	0	0...65000
29	T-share of road load regulator [10 µs] (0)	0	0...65000
30	Torque regulator release [0.1 km/h] (50)	50	0...500
31	Speed regulator release [0.1 km/h] (50)	50	0...500
32	Road load regulator release [0.1 km/h] (5)	5	0...500
33	Reference speed of road loads [0.1 km/h] (805)	805	100...3000
34	Maximum control of the eddy-current brake [%] (100)	40	0...100
35	Clock frequency of the pulse-width modulator [Hz] (1250)	1250	375, 1250, 5000
36	Torque calibration factor (forward) [digit] (1600)	1886	1...2048
37	Relative belt compensation [0.1 %] (1000)	1000	0...32000
38	Torque calibration factor (reverse) [digit] (1600)	1886	1...2048
39	Size of the acceleration buffer (2)	2	1...10
40	Type of acceleration filter (display) (1) 0 = filter with critical damping 1 = Bessel filter 2 = Butterworth filter 3 = Chebyshev filter with 0.5 db ripple	1	0...3
41	Degree of acceleration filter (display) (2) 0 = filter disabled 1 = first degree 2 = second degree	2	0...2
42	Limit frequency of acceleration filter (display) [0.01 Hz] (200)	200	1...2500
43	Minimum limit of I-share of torque regulator (0)	0	0...32000
44	Maximum limit of I-share of torque regulator (2000)	2000	0...32000
45	Minimum limit of I-share of speed regulator (1000)	1000	0...32000
46	Maximum limit of I-share of speed regulator (2000)	2000	0...32000
47	Temperature monitoring of eddy-current brake [°C] (120)	120	0...200
48	Prebrake hysteresis of speed regulator [0.1 km/h] (20)	20	0...100
49	Inertia for 'Augmented Braking' [kg] (500)	500	0...5000
50	EEPROM reset (42330)	42330	0...65535
51	Coefficient A_p of parasitic losses [0.01 kW] (0) *	1	0...32000
52	Coefficient B_p of parasitic losses [0.01 kW] (0) *	2	0...32000
53	Coefficient C_p of parasitic losses [0.01 kW] (0) *	0	0...32000
54	Type of motor control (2) 1 = motor slip 2 = time ramp	2	1, 2
55	Maximum range for auto-offset adjustment [N] (100)	100	0...3000
56	Maximum temperature of roller bearings [°C] (100)	100	0...200
57	Maximum temperature of cooling unit [°C] (500) 0 = no monitoring 100…1023 = monitoring active	500	
58	Zero point of scale 1 (0)	0	0...32000
59	Amplification factor of scale 1 (3483)	3483	0...32000
60	Zero point of scale 2 (0)	0	0...32000
61	Amplification factor of scale 2 (3483)	3483	0...32000
62	Rotary field frequency for generator monitoring [0.01 Hz] (1000)	1000	0...5000
63	Window for amplification adjustment [digit] (10)	10	1...254

№	Description	Default	Limits
64	Window for offset adjustment [digit] (2)	2	1...254
65	Absolute belt compensation [0.1 N] (200)	200	–9999...9999
66	Maximum rotary field frequency [0.01 Hz] (7500)	7500	0...32000
67	Motor slip [0.01 Hz] (100)	100	0...32000
68	Amplitude offset (100)	100	0...32000
69	Phase sequence 0 = right 1 = left	0	0, 1
70	Dyno speed [0.1 km/h] (500)	500	0...3000
71	Speed correction factor for constant load regulator (700)	700	0...32000
72	Offset for constant load regulator [0.01 kW] (0)	0	0...32000
73	PWM frequency for maximum voltage [0.01 Hz] (5250)	5250	0...32000
74	I^2t limit for motor temperature monitoring [0.01 A^2s] (1350)	9999	0...65000
75	Speed correction faktor for variable load regulator (700)	700	0...32000
76	Assumed current for motor cooling [0.1 A] (30)	30	0...32000
77	Ramp time up to 10 km/h [s] (5)	5	0...32000
78	Ramp time up to 20 km/h [s] (30)	30	0...32000
79	Ramp time up to 30 km/h [s] (45)	45	0...32000
80	Ramp time up to 40 km/h [s] (60)	60	0...32000
81	Ramp time up to 50 km/h [s] (80)	80	0...32000
82	Calibration factor for roller bearing temperature [0.1 %] (1150)	1150	0...32000
83	AD converter value at 0 °C (roller bearings) [AD digit] (290)	290	0...1023
84	Temperature compensation of parasitic losses [0.01 %/10 °C] (1350)	1350	–32000... 32000
85	Temperature at determination of parasitic losses [°C] (20)	25	0...32000
86	Variable load offset [0.1 hp] (20)	20	
87	Auto-offset adjustment for scale 0 = no auto-offset adjustment, but weight at v = 0 km/h 1 = auto-offset adjustment + weight at v = 0 km/h 2 = auto-offset adjustment + weight = 0 at v = 0 km/h	1	0, 1, 2
88	Calibration weight for torque [0.1 N] (18000)	18000	0...65535
89	Temperature at torque adjustment (°C) (34)	18	0...32000
90	Potentiometer zero point (127)	64	0...255
91	Potentiometer amplification (127)	255	0...255
92	Start speed ISE [0.1 km/h] (80)	80	0...9999
93	Stop speed ISE [0.1 km/h] (966)	966	0...9999
94	Maximum line current [0.1 A] (300)	300	0...1000
95	Calibration factor for torque sensor temperature [0.1 %] (1100)	1100	0...32000
96	AD converter value at 0 °C (torque sensor) [AD digit] (290)	290	0...1023
97	Temperature compensation of torque [0.01 %/10 °C] (30)	30	–32000...32000
98	Dyno losses at 15 mph [0.01 kW] *	29	0...1000
99	Dyno losses at 25 mph [0.01 kW] *	63	0...1000
100	Correction factor for reverse calibration	1000	1…30000

*) The values of these variables are automatically written in once the 'Parasitic Loss Determination' has been done.

9.1.1 Read-Only Variables

№	Description	Default	Limits
187	Operational minute counter (value * 10000)	4	0...65535
188		99999	
189		99999	
190	EEPROM reset for variables 180…199 when the value of variable 190 is not 42330	42330	0...65535
191	Power limit value to determine a dyno overload [kW]	333	0…32000
192	Speed limit value to determine a dyno overload [km/h]	200	0…32000
193	Torque limit value to determine a test stand overload [N]	6000	0…32000
194	Determination of duration of power overload [s]	0	0…32000
195		99999	
196	Determination of duration of speed overload [s]	0	0…32000
197		99999	
198	Determination of duration of torque overload [s]	0	0…32000
199		99999	

9.2 RAM Variables

№	Description	Unit
200	Target value for speed regulator [0.1 mph]	mph
201	Target value for torque regulator [0.1 lbf]	lbf
202	Vehicle inertia for road load regulator	lb
203	Cv for drive simulation regulator	hp
204	Bv for drive simulation regulator	hp
205	Av for drive simulation regulator	hp
206	Control for brake test	%
207	Start speed for stop watch 1	mph
208	Stop speed for stop watch 1	mph
209	Brake roller speed	mph
210	Acceleration	mph/s
211	Power	hp
212	A_t for tire-roll losses	hp
213	B_t for tire-roll losses	hp
214	C_t for tire-roll losses	hp
215	Support roller speed v	mph
216	Weight, right scale	lb
217	Weight, left scale	lb
218	ISE (Inertia Simulation Error)	%
219	Performance test flag	
220	Torque minus losses (A_v, B_v, C_v)	lbf
221	Torque plus losses (A_v, B_v, C_v)	lbf
222	Temperature of strain gauge	F
223	Line current	A
224	Temperature of bearings	F
225	Distance	mi
226	not assigned	
227	Sto time of stop watch 1	s
228	Power target value for ASM regulator	hp
229	Tire/roller losses for ASM regulator	hp
230	Speed reference for ASM regulator	mph
231	Torque	lbf
232	Speed for intermediate test	mph
233	Stop watch 1 intermediate time	s
234	Start speed for stop watch 2	mph
235	Stop speed for stop watch 2	mph
236	Stop watch 2	s
237	Enable loss compensation [0/1]	
238	Total weight	lb
239	Compensated A_p of parasitic losses	hp
240	Compensated B_p of parasitic losses	hp
241	Compensated C_p of parasitic losses	hp
242	Compensated parasitic losses for ASM 5015	hp
243	Compensated parasitic losses for ASM 2525	hp

№	Description	Unit
244	Measuring direction (0 = normal, 1 = reverse)	
245	I^2t for temperature switch-off [0.01]	A^2s