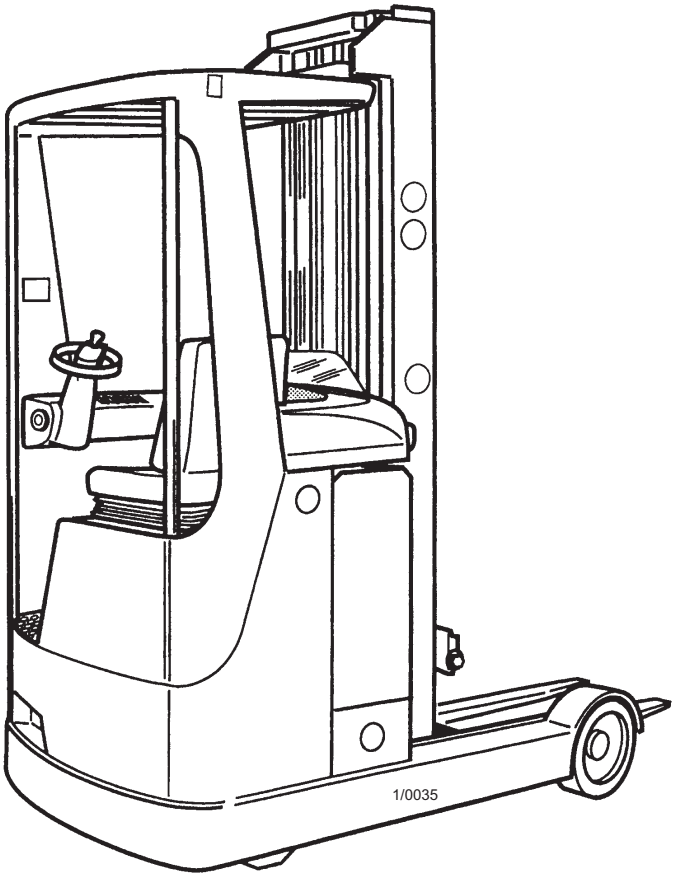
Workshop Manual FM Type 447

To get the
Table of Assemblies
click here

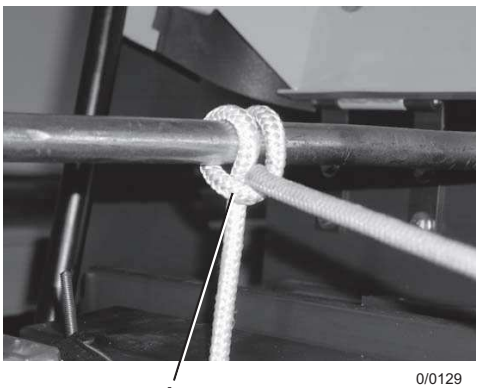


First issued:	05/01	Workshop Manual	**FM Type 447**	Id. no. 8 054 226
Last revision:	06/03			

Contents

Removing the drive motor

- Attach the rope to the fork prongs of a fork-lift truck or to a crowbar with a mast hitch knot (1) (see sheet no. A 13).



0/0129

Note: Never work without these special tools! A considerable amount of force is required to release the seal between the motor and the gear!

Raise the drive motor vertically, taking care not to let it tilt, otherwise there is a risk that the drive pinion and the gear may be damaged!

- Hold tight to the free end of the rope. Apply the crowbar to the vehicle chassis and lift out the drive motor.

  If you are working with a fork-lift truck, the rope must be highly tensioned. Use slight jerking movements at the drive motor to release the motor from the gear and then lift it out.

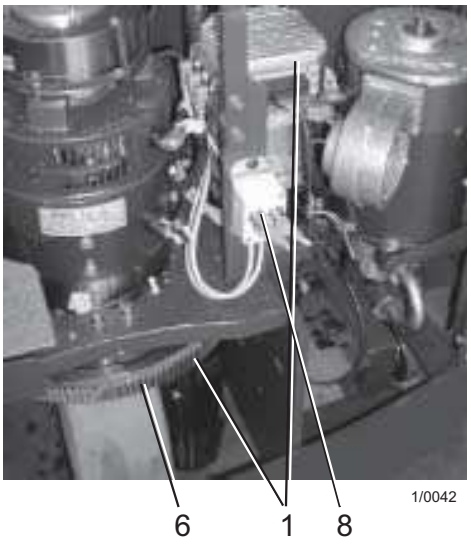
Remark: If the drive motor is lifted out with a rope that stretches, you must not try to lift the drive motor out with a fork-lift truck alone. If this is attempted, there is a severe jolt when the motor is separated from the gear and there is a risk that the drive motor and the vehicle may be damaged. There is also a potential risk of injury to people.

General

The steering (1) is a fully electrical 180° toothed gear steering system (for the 360° steering option, please see B23 ff.) made up of the following components:

- Steering unit with gear (2)
- Drive unit (3) with actual value potentiometer (4)
- Setpoint potentiometer (5)

The steering system is practically maintenance free. Only the toothed gear (7) and the toothed gear ring (6) must be lubricated with all-purpose grease as part of the quarterly maintenance plan.



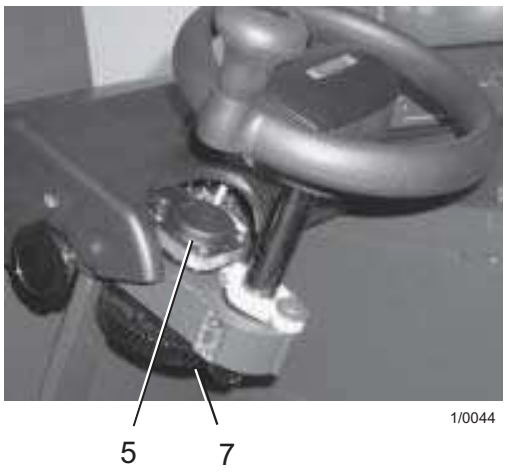
1/0042

Technical data for the steering unit (180°-version)

Id. no. (until 06/01)	:	8 424 045 / 8 426 351 AT
Id. no. (from 07/01)	:	8 425 916 / 8 426 559 AT
Model	:	SL 062-Z1
Motor version	:	Carbon-brush free DC-motor with permanent magnet and flange-mounted cyclo gear (i= 59)
Voltage	:	48V
Speed	:	2400 rpm
Output	:	500W
Protection cass	:	IP54
Insulation class	:	F
Steering speed	:	ca. 72°/s -> ca. 2.5s/180° (the value depends on the vehicle)

1/0043

Remark 1: If the steering is used when the vehicle is at a standstill, the degree of wear on the drive wheel is increased. For this reason, avoid excessive steering when the vehicle is at a standstill!



1/0044

Remark 2: In the 1st version of the vehicle, the setpoint and actual value potentiometers are still connected via an external DC/DC converter. This converts the unstabilised 16V supply for the steering unit into a stabilised 12V supply for the potentiometer. This converter is integrated in the steering unit in the 2nd version (from 07/01 see Id. no. above).

Setpoint potentiometer

Id. no. W8 408 841

General

The setpoint potentiometer (1) is used to define the required steering direction.
It can be accessed by removing the two plastic shell covers (4 screws).

The potentiometer is connected to the steering wheel (3) by the transmission (2) (transmission ratio steering wheel : potentiometer = 4 : 1).

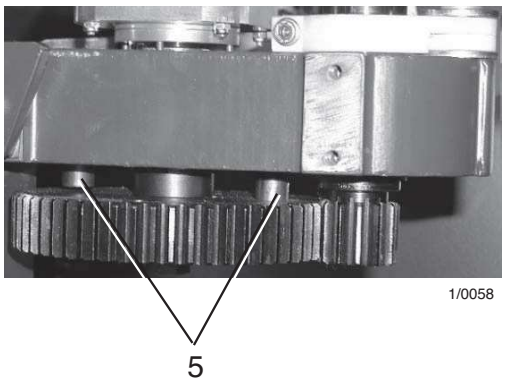
The two plastic sliding surfaces (4) are used to adjust the steering force (principle of friction, see sheet no. B17).

Because the system is a 180° steering system, the maximum turning angle of the steering wheel is limited mechanically by the two tensioning points (5).

The potentiometer itself has a 2-channel design, i.e. it generates 2 setpoint signals with a phase offset of 90°(main/control potentiometer). Both the setpoint signals are evaluated by the steering logic and compared to one another (redundant safety).

Remark: If the setpoint potentiometer is faulty, the error message "FE83" appears on the display (see sheet no. B8).
This potentiometer is identical to the acual value potentiometer.

1/0044



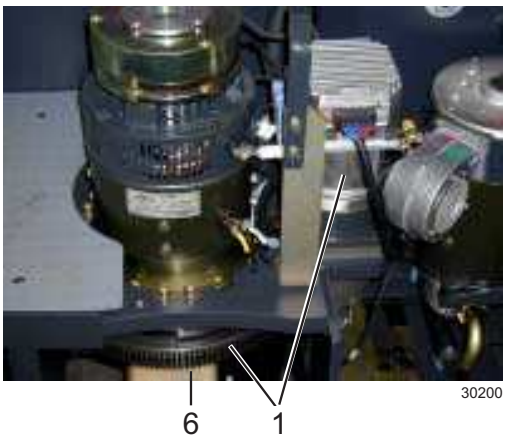
1/0058

360° steering

General

Vehicles built in 04/2003 or later can be fitted with the 360° steering option (1). It is made up of the following components:

- Steering unit with gear i=59 (2)
- Drive unit (3) with "2-channel" actual value potentiometer (4)
- Setpoint potentiometer (5)



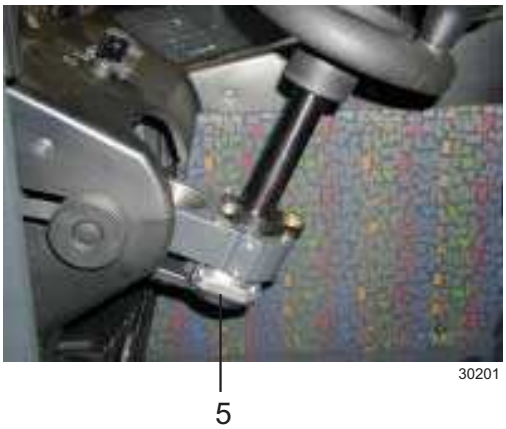
The steering system is practically maintenance-free. Only the gear ring (6) must be lubricated with all-purpose grease as part of the quarterly maintenance plan.

Technical data for the steering unit (360° version)

Id. no.	:	8 428 574
Model	:	SL 062-Z1
Motor version	:	Carbon brushless DC motor with permanent magnet and flange-mounted cyclo gear (i=59)
Voltage	:	48V
Speed	:	2400 rpm
Output	:	500W
Protection class	:	IP54
Insulation class	:	F
Steering speed	:	ca. 72°/s -> ca. 5s/360° (value depends on vehicle)

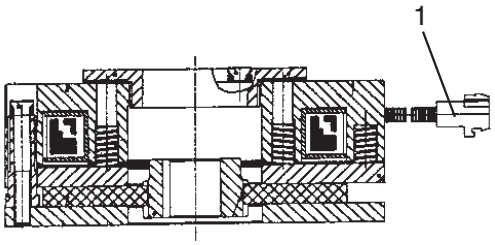
Remark 1: If the steering is used when the vehicle is at a standstill, the degree of wear on the drive wheel is increased. For this reason, avoid excessive steering when the vehicle is at a standstill!

Remark 2: This steering unit can only be used for the 360° steering option. From 10/2003, a steering unit will be available that supports both the 180° and 360° functions (Id. no.: W8 428 575)!
In this version, the cyclo gear transmission is i=71 (see nameplate (7))!



Electro-magnetic parking brake

Removal



1/0171

Remark: When the brake unit is removed, the travel drive is unbraked. For this reason, secure the vehicle before removal, to prevent it from rolling away.

- Disconnect the electrical connection (1, connector X1) at the brake.
- Release the 3 hexagon socket screws (2) M8X22.
- Remove the complete brake unit.

1/0173

To install the brake unit, follow the instructions above in reverse order; tightening torque for the screws (2) : 23Nm.

Remark: Once the electromagnetic brake has been installed, the brake clearance must be checked and adjusted without fail (see sheet no. C6), and a function test must be carried out on the brakes. The brake deceleration moment must also be checked (see sheet no. C21).

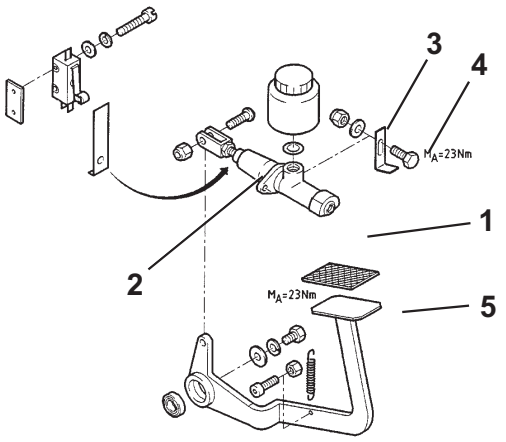
Generator/hydraulic/mechanical service brake

Adjusting the brake pedal

The brake pedal must be adjusted when:

- The main brake cylinder (1) has been replaced,
- The piston rod clearance ("snifter clearance") (2) is not correct,
- Components in the brake pedal assembly have been replaced.

Note: Since an optimum braking effect cannot be achieved during adjusting work on the brake pedal, the vehicle must be secured to prevent it from rolling away.



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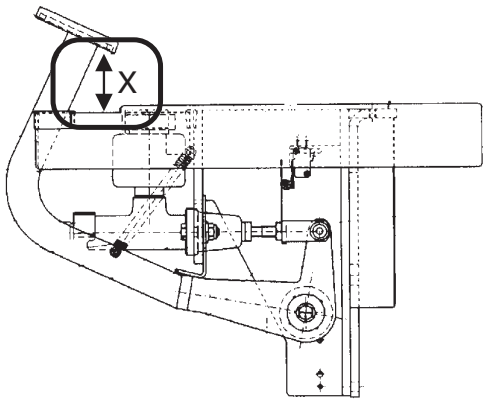
- Slightly loosen the nut (3) of the stopper for the brake pedal movement distance.

- Move the stopper (4) along the slot until there is a measurement X of approx. 62 mm at the brake, between the lower edge of the pedal and the mounting plate of the accelerator pedal. The meauurement must be taken without the rubber pedal cover (5).



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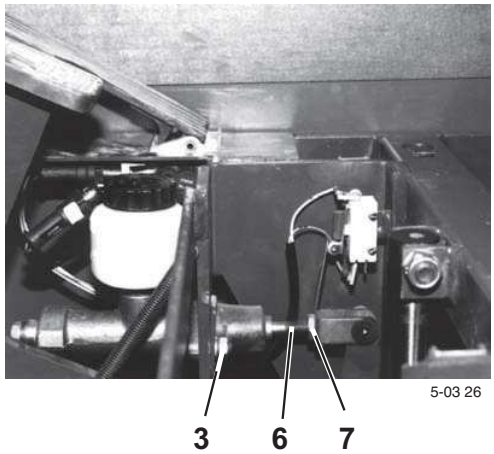
- Tighten the nut (3).

- Loosen the nut (7) and turn the threaded rod (6) so that there is a clearance of 1 mm between the piston and piston rod of the main brake cylinder. Tighten the nut again.
  This "snifter clearance" is not visible, since the protective cap covers the end of the piston rod. It can, however, be felt easily, by pressing the brake pedal slowly downwards by hand out of its home position. When the piston rod has moved a distance of 1 mm, you should feel a slight resistance which is caused by the piston rod and the piston coming into contact with each other.



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Contents

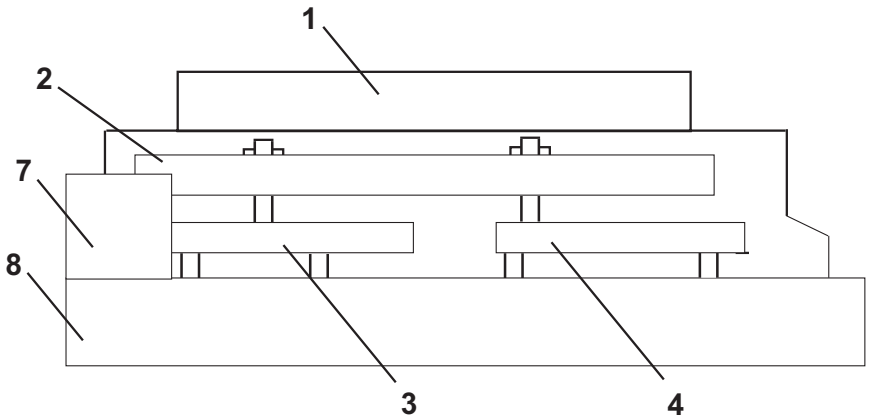
Sheet no.

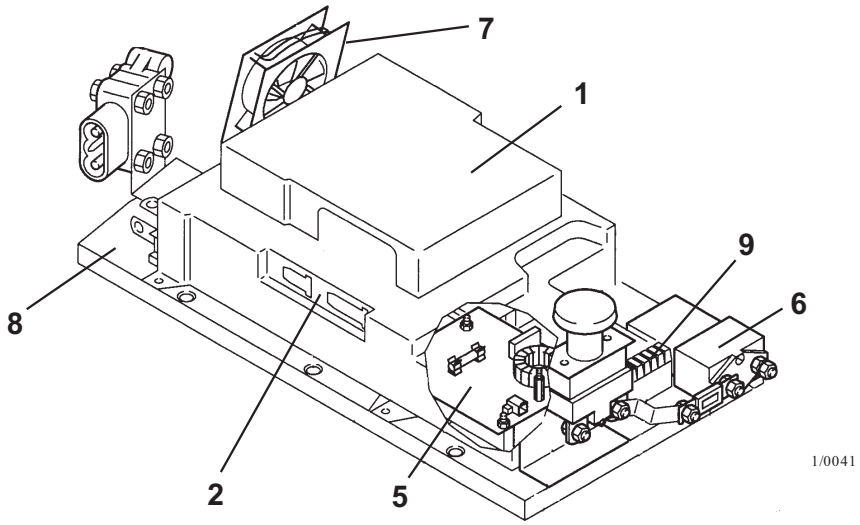
Travel and pump controller (FPS)

Guide to components

The FPS is made up of the following components:

(1)	Load handling controls module (LAS-module)	Id. no. W8 409 734
(2)	Logic board, FPS	
(3)	Amplifier, drive motor	Id. no. W8 409 671 (AT, incl. LAS-module)
(4)	Amplifier, pump motor	W8 427 032 (AT, without LAS-mod.)
(5)	DC/DC converter	Id. no. W8 409 595 (see sheet no. M16)
(6)	Main contactor	Id. no. W8 406 797 (see sheet no. M9)
(7)	Fan	Id. no. W8 409 666
(8)	Heat sink	
(9)	Control current fuse	(see sheet no. M13)
(10)	Main current fuse	(see sheet no. M13)

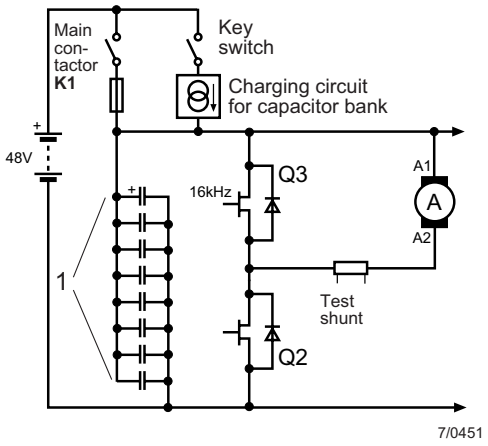




Travel and pump controller

Functional principle of the main current circuit for generator braking

On generator braking, the field is initially fully excited (approx. 34A). This causes an increase in the voltage at the armature of the drive motor during the braking process.

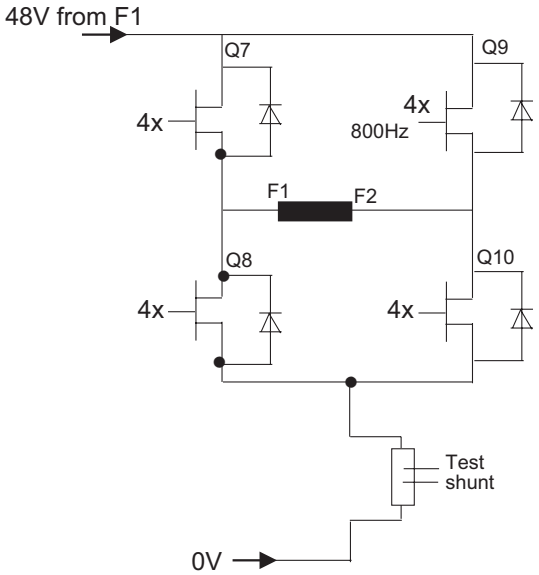


U_{Motor} is higher than U_{Batt} and current flows from A1 back to the battery via the MOSFETs Q2 and main contactor K1.

The maximum current is limited by the timing of the MOSFETs (parameters can be set).

If U_{Motor} is smaller than U_{Batt}, so the current is regulated as it flows through the MOSFETs Q3.

This process continues until the motor comes to a standstill.



Generator braking is initiated:

- When the accelerator pedal is released ("Release Braking" parameter)
- When the brake pedal is depressed lightly ("Pedal Braking" parameter)
- When the travel direction is changed when the accelerator pedal is pressed = reversing ("Invers Braking" parameter)
- When the deadman switch is released ("Release Braking" parameter)
- When the vehicle is at a standstill and begins to roll away during the monitoring phase (roll-away monitoring, parameters cannot be set).

Remark: For futher details on the parameters, see sheet no. V48

Travel and pump controller

Description of error codes

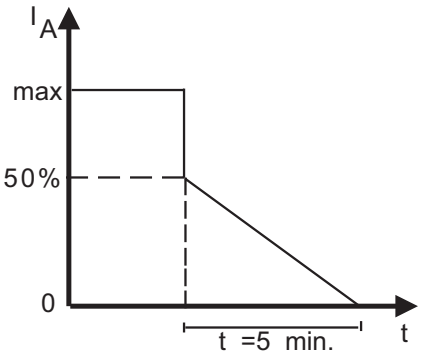
Main contactor closed (FE19, see V57)

The capacitors are discharged again briefly (by selection of the MOSFETs in the field circuit) immediately after switching on at the key switch, in order to test the status of the contactor contacts.
If they are not discharged, the main contactor is already closed when the key switch is switched to ON.

Remark: This error can also occur if there is something wrong in the field current circuit.

Coil short-circuit (FE19, see V57)

After the main contactor closes, it is clocked (PWM).
If a current that is too high is detected flowing over the contactor, this is identified as a short-circuit (see sheet no. M9).



Drive motor temperature (FE20, see V58)

Excess temperature in e drive motor from 140°C.
The maximum armature curent is briefly reduced to half and is set to zero after 5 minutes.
The field is held at the nominal value.
As soon as the temperature switch closes again, the monitoring is stopped.
The braking current is maintained.
The cut-out process can be reset with the key switch. It is then possible to drive again for 5 minutes more.

Drive motor carbon brushes (FE 21, see V58)

This message is issued when the carbon brushes in the drive motor are worn.
It has no effect on the system.

Load handling controls module (LAS)

Control of the hydraulics

General

There is either a joystick (1) plus max. 3 additional buttons or four individual levers (2) plus max. 2 additional buttons fitted on the vehicle for the hydraulic movements.

The following functions can be carried out:

-	Main lift	lifting/lowering	(Lever 1 / Joystick axis 1)
-	Reaching	LS/DS	(Lever 2 / Joystick axis 2)
-	Tilting	LS/DS	(Lever 3 / Joystick rocker)
-	Trans. reach	R/L	(Lever 4 / Joystick rocker + button (3))
-	Add. hydr.1	R/L	(Lever 4+add. button/joystick rocker+add. button (4))
-	Add. hydr.2	R/L	(Lever 4+add. button/joystick rocker+add. button (see M5))

Remark: For joystick axis 1, see Fig. 1
For joystick axis 2, see Fig. 2
For details on joystick, please see shett no. M99
For position of additional buttons, please see sheet no. M5

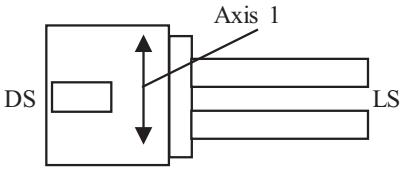


Fig. 1

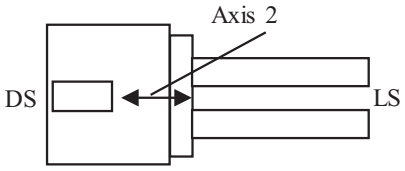
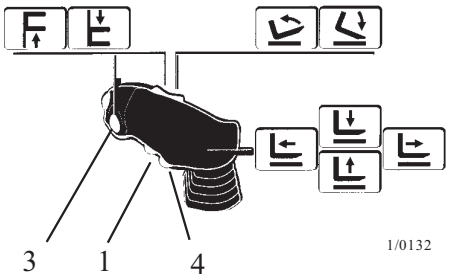
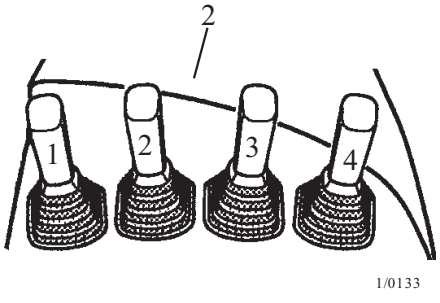


Fig. 2





The setpoint generators used are double potentiometers (bi-directional). Every function input of the LAS module, e.g. lifting/lowering the main lift, is therefore made up of two analogue inputs which are monitored internally.
The input signals are evaluated by the LAS module and sent on to the relevant valves or the FPS.
In order for the individual functions to be executed correctly, the axes must be parameterised and the potentiometers read in (see "Commissioning the hydraulics", sheet no. V13 ff.).
All axes can be selected simultaneously with each other except the axes of the additional hydraulics. These can only be moved individually.

Load handling controls module (LAS)

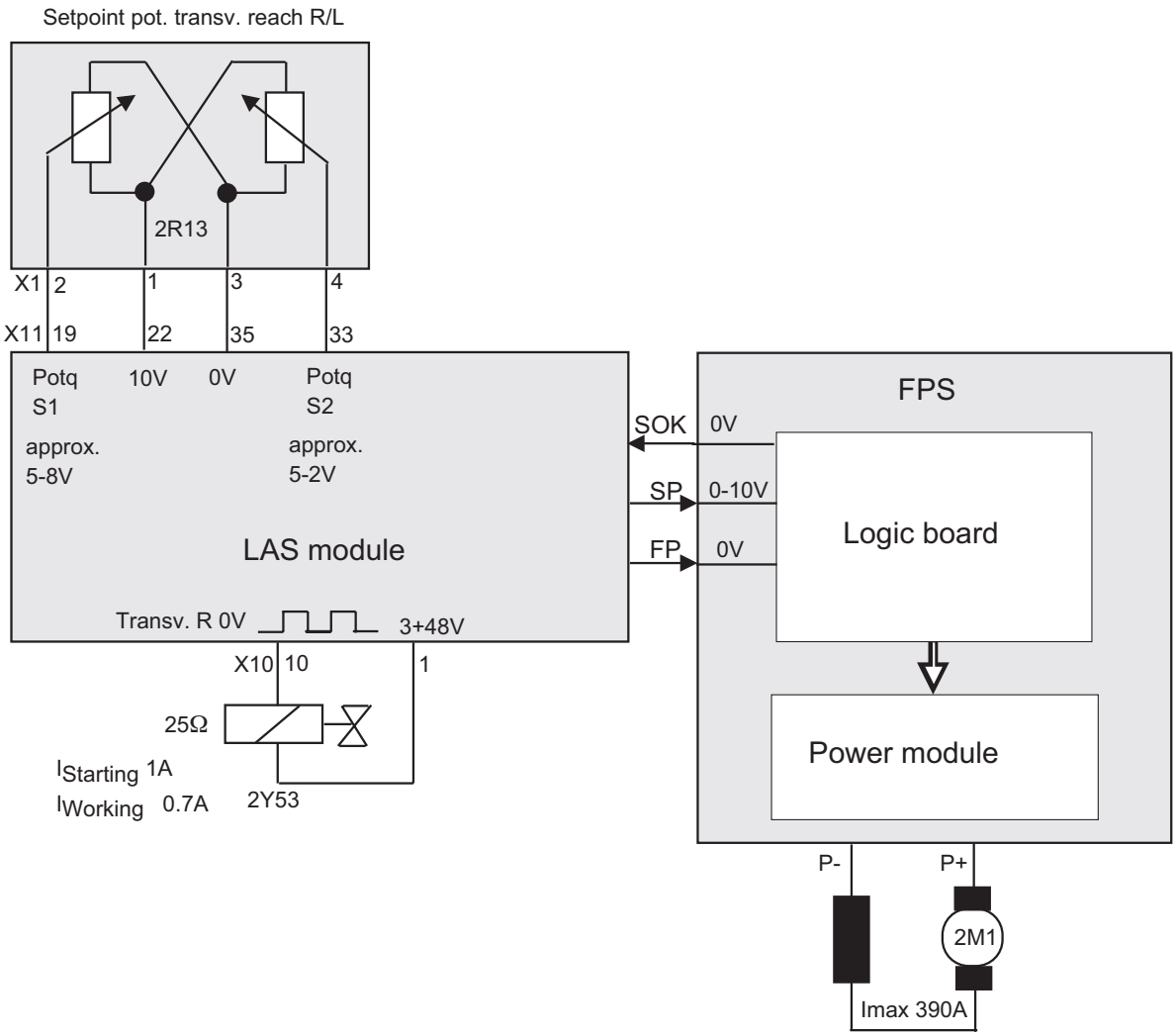
Control signals for transverse reach RIGHT with 4-lever system

For prerequisites, see table on sheet no. M35

Other signals:

SOK =	Control OK signal from the FPS (0V active)	X20:13 ribbon cable
SP =	Pump motor setpoint (0-10V)	X20:09 ribbon cable
FP =	Pump motor enable signal (0V active)	X20:10 ribbon cable
PotqS1 =	Setpoint potentiometer 1 approx. 5-8V	X11:19 LAS module
PotqS2 =	Setpoint potentiometer 2 approx. 5-2V	X11:33 LAS module

Remark: The combined voltages of setpoint potentiometers PotqS1 and PotqS2 should be approx. 10V, otherwise the error monitoring system responds with the relevant "FE" error code (FE 53, see sheet no. V29).
The SP output (LAS module to logic board) depends on the parameter set for the "Pump transverse reach" signal (see sheet no. V20).



Load handling controls module (LAS)

General vehicle options

In addition to the hydraulic options (see sheet no. M55), there are also other general vehicle optionsin the LAS module that can be configured using a notebook (see sheet no. V17).

These general vehicle options are:

1. Warning light

A 24V signal is supplied at output X10.31 as soon as the vehicle is driven or the main lift is lowered. Since the output can only be loaded with a max. of 0.5A, a relay must be inserted here.
If this option is not activated, the output is switched on permanently during travel and the lowering main lift function (use of an all-round light).
If the option is activated, the output is clocked with 2.5Hz (use of a flashing light).

2. Height display

When this is used in combination with a height measuring system (see sheet no. M105), the current lifting hegiht is shown on the display in mm.

3. DS/LS travel

A 24V signal is supplied at output X10.17 when the vehicle is driven actively (pulses from the drive motor speed sensor, accelerator pedal and deadman switch actuated). Since the output can only be loaded with a max. of 0.5A, a relay must be inserted here.
This means that a signal transducer (horn or similar) can be selected in dependence on the travel direction.

DS = drive side, LS = load side

Load handling controls module (LAS)

Safety monitoring

Description of error codes

Valves for lifting/lowering active without having been selected (FE70, see sheet no. V29)

The LAS module detects between terminals X10.4/X10.2 (switching valve for lifting) or X10.5/X10.2 (proportional valve for lowering) that the valves are being driven (internal current measuring circuit detects that current is flowing), although the axis has not been selected at the potentiometer.
There is an internal error in the LAS module (current measuring circuit faulty, switching transistor faulty).
Both safety relays K1 and K2 are switched off by the ÜWA-CPU. No vehicle functions other than the steering can be used.
The LAS module must be replaced.

Valves for DS/LS reaching active without having been selected (FE71, see sheet no. V29)

The LAS module detects between terminals X10.7/X10.13 (proportional valve for DS reaching) or X10.6/X10.13 (proportional valve for LS reaching) that the valves are being driven (internal current measuring circuit detects that current is flowing), although the axis has not been selected at the potentiometer.
There is an internal error in the LAS module (current measuring circuit faulty, switching transistor faulty).
Both safety relays K1 and K2 are switched off by the ÜWA-CPU. No vehicle functions other than the steering can be used.
The LAS module must be replaced.

Valves for DS/LS tilting active without having been selected (FE72, see sheet no. V29)

The LAS module detects between terminals X10.1/X10.9 (switching valve for DS tilting) or X10.1/X10.8 (switching valve for LS tilting) that the valves are being driven (internal current measuring circuit detects that current is flowing), although the axis has not been selected at the potentiometer.
There is an internal error in the LAS module (current measuring circuit faulty, switching transistor faulty).
Both safety relays K1 and K2 are switched off by the ÜWA-CPU. No vehicle functions other than the steering can be used.
The LAS module must be replaced.

Load handling controls module (LAS)

Software versions

Version CPU	Version ÜWA	File	Comment
1.00	1.00	Project 100.hex	- Series launch 10/2000
1.01	1.00	Project 101.hex	- Problems / lifting height indicator resolved 10/2000
1.23	1.00	LASdc123.hex	- EEPROM checksum introduced
			- Drive motor speed sensor activated
			- Switching output for travel direction DS/LS introduced
			- Warning light function developed (switching/flashing output)
			- Lowering function improved (ramp parameters added)
			- Potentiometer monitoring on switching on (zero setting)
			- Steering active, monitoring activated
			- On switching on FE55 if commissioning not OK
			- Monitoring of the potentiometers (joystick/4-lever) improved
			- New standard parameter set (series 1)
			- New error messages FE 54, 91, 99 (see V29) 01/2001
1.23	1.01	LASdc123.hex	- Error in additional hydr. 2 with 4-lever function resolved 04/2001
1.35	1.01	LASdc135.hex	- Error in hour meter resolved
			- Diagnosis now also possible without display/steering connected
			- FE88 activated (see sheet no. V29)
			- FE94 activated (see sheet no. V29)
			- FE97 activated (see sheet no. V29)
			- FE99 activated (see sheet no. V29)
			- LS/DS travel option is moved to output X10:17
			- Potentiometer monitoring improved 05/2001
2.01	1.01	LASdc201.hex	- Teaching-in routine for hydraulics potentiometer optimised
			- FE87 (flutter error) FE83 allocated
			- Servicemaster V2.02 is needed 03/2002
2.07	1.01	LASdc207.hex	- New parameter for "Lifting pump min." (please see V85)
			- New parameter for "Lifting ramp" (please see V85)
			- Static travel direction output at X10.18, DWS = 24V
			- Display FE50-53 resets itself if OK
			- Function of reach and lowering lock improved 09/2002

Remark: All updates of the LAS module after version 1.23 need at least software version 2.10 in the steering. If steering software versions lower than 2.10 are installed, the error message FE88 is shown sporadically on the display (no data transmission along the CAN bus from the steering to the LAS module). In this case, the steering must be changed to V2.10.

Display

Onboard diagnosis

Menu 4_

The vehicle type is displayed under menu point 40. This means the same as the activated parameter set type (from LAS module V2.01).

Fig. 1: Display of menu point 40, Vehicle type FM 14

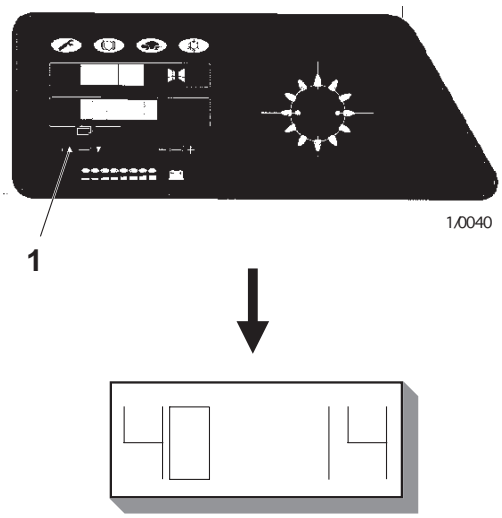


Fig. 1

Remark: The values shown here are only examples. They may vary from one vehicle to another.
In versions earlier than LAS module V2.01, this menu point does not have a function, i.e. there are no vehicle-specific parameter sets stored in the LAS module.

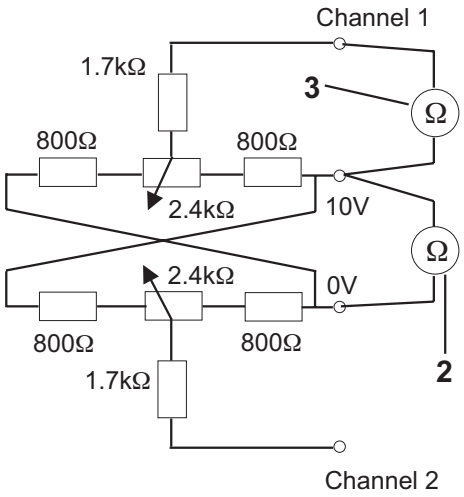
To quit menu point 40, press the left-hand key (1) for about 2 seconds.

To quit menu point 4_, press the left-hand key (1) for about 2 seconds.

Joystick

Potentiometer structure

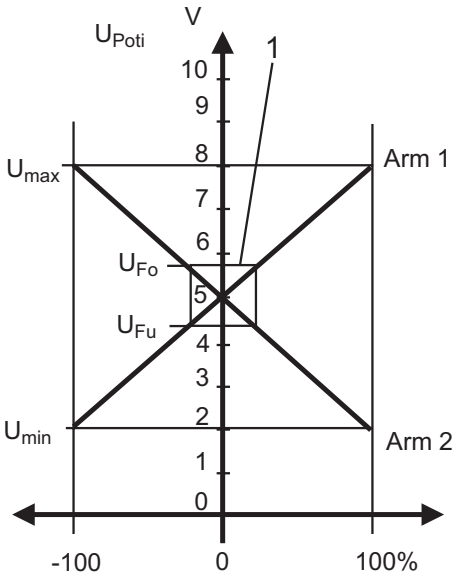
The actual potentiometer has 2.4 kW, there are 2 resistors connected in series, each with 800W, and there is another resistor with 1.7 kW in the potentiometer arm lead.
This means that when the joystick is in the home position, there is a signal of approx. 5V at each of the two channels 1+2.
When the joystick is "pulled". the signal at channel 1 rises to approx. 8V and at the same time channel 2 "drops" to approx 2V.
When the joystick is "pushed", exactly the opposite happens.
A movement of the joystick is not detected until the signal leaves the "zero range" (1) (see sheet no. M53).
Monitoring of the potentiometer signals in the LAS module is based on the fact that when both arm signals are added together, they should always produce approx. 10V. If this addition result is no longer within the permitted range of 8.5-10.9V, this is recognised as an error.



Resistance measurement

When a measurement is taken between the terminals (2), the result is a value of approx. 2 kW.
When a measurement is taken between the terminals (3), the result is a value of approx. 3.2 kW when the joystick is in the home position.
The value then rises to approx. 3.6 kW or falls to 2.5 kW, depending on the direction in whcih the joystick is moved.

Remark: The joystick can also be tested with the Servicemaster Software under "Diagnosis of analogue values for hydraulics" (see sheet no. V30).

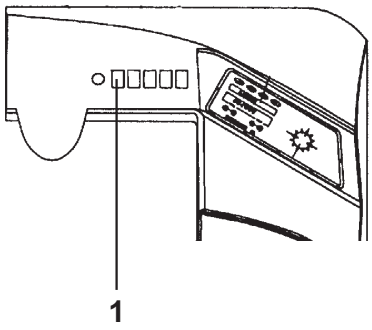


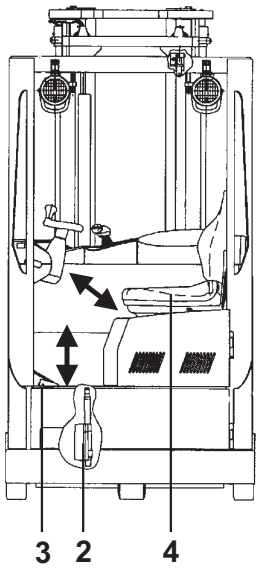
Joystick movement

U_{Fo} = Voltage, upper limit of range
U_{Fu} = Voltage, lower limit of range

Seat adjustment

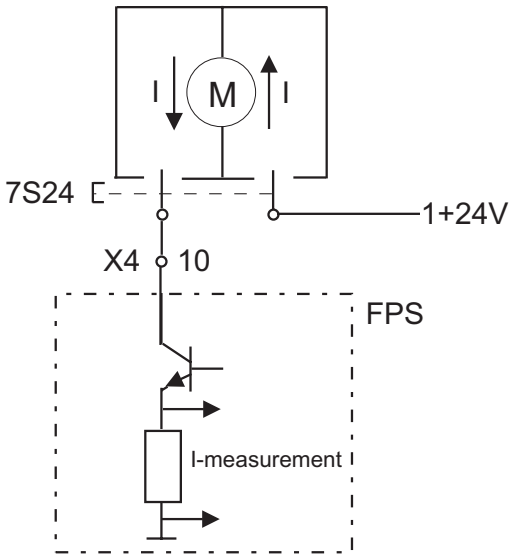
The electrical seat adjustment is activated with button 7S24 (1).
With this feature, the motor (2) and the seat adjustment machanism make the footplate (3) move vertically and the seat (4) move diagonally up and down at the same time.
This means that the optimum working position can be set for each driver.
The servomotor is set permanently to 24V.
The 0V signal is connected via the FPS.
As long as the motor current is I < 10A, the transistor is switched and the motor drives the seat adjusting mechanism.
If the motor current exceeds 10A for more than 10ms, the transistor is switched off and the motor comes to a standstill.
This occurs at the top and bottom mechanical end positions of the system.
The up and down movement is achieved by changing the poles of the servomotor with button 7S24.





Remark: The seat adjustment is available as an optional extra.
The motor is maintenance-free and can only be replaced as a complete unit.

Note: The upper and lower fastening screws of the seat adjusting motor (2) should not be fully tightened. They are simply used as "screw-fit push-in bolts". The play they provide evens out mechanical tolerances.
Tightening the screws fully causes premature failure of the motor.



Chassis valve block

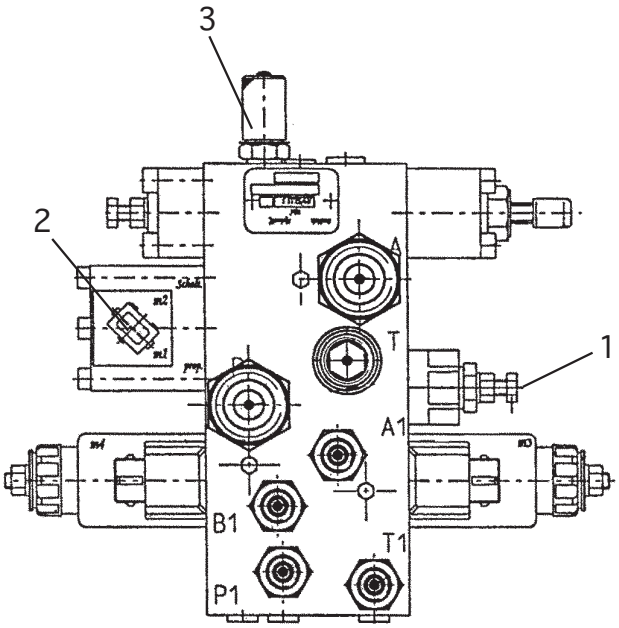
Adjusting work

After the valve block has been replaced, various adjusting jobs must be carried out.
The pump and tank must also be flushed out.
This is also necessary after the pump has been replaced.

Flushing out the pump and tank

- Unscrew the pressure relief valve (1) fully (0 bar setting).
- Pull out the valve connector for lifting/lowering (2).
- Select lifting for 30 secs.

Remark: "FE 60" appears on the display because the LAS-module has detected a line breakage to the valve for lifting/lowering.

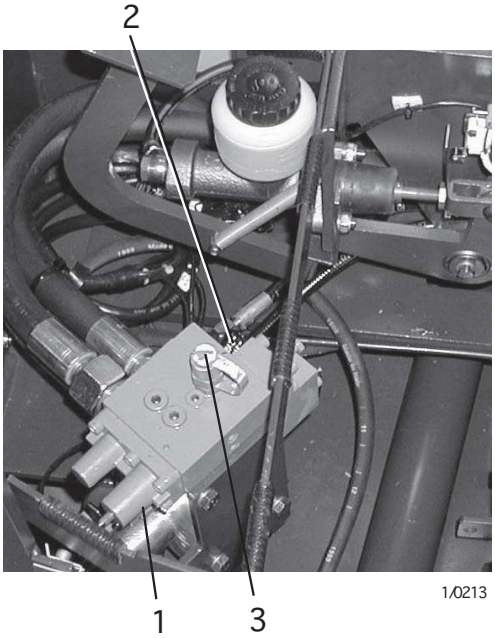


1/0211

- The oil can now circulate without pressure and is cleaned by the runback filter.
- Reconnect the valve connector.
- Adjust the pressure relief valve.

Pressure relief valve (1)

- Connect a manometer to the test connection (3).
- Pick up the rated load.
- Measure the pressure required to lift the rated load (= operating pressure) and if necessary increase the pressure by turning the screw (1) to the right.
- Add 10% to the measured operating pressure, e.g. measured operating pressure = 180 bar + 10% (18 bar) = 198 bar.
- Move the lifting device to the mechanical end stop (max. pressure builds up) and set the pressure (in this example to 200 bar).
- Finally, check that the pressure relief valve definitely remains closed during the transition from the free lift to the main lift, through the brief pressure peak that occurs here (noise emission, brief loss of speed at mast transition point); if necessary, lower the max. pressure slightly.



1/0213

Line break protection

Id. no.: see table on N21

General

The line break protection (LBS, 1+2) prevents uncontrolled, accelerated movement by a loaded hydraulic consumer (i.e. a drop), if the hydraulic back pressure is lost in the event that a pressurized lead or connection breaks.

Remark: Two different types of LBS are used. LBS1 is adjustable and LBS 2 is not adjustable.

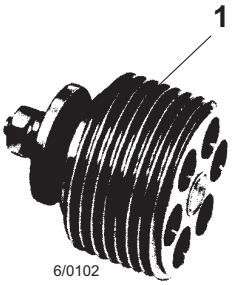
The line break protection is screwed directly into the pressure oil inlet and outlet of the hydraulic consumer that is to be protected (see also plan of hydraulic system, Id. no. W8 392 628).

The valves used are plate valves. Their valve screw is lifted from the valve seat by a spring when they are in the home position, leaving the flow-through cross section free.

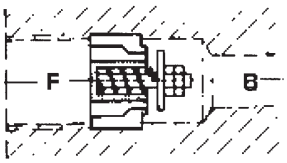
The flow resistance and blockage effect at the valve screw in the direction of flow B --> F (operating or initiating direction) have less force during normal operation than the counterforce of the spring. The valve remains open.

If the flow current increases in the event of an emergency due to the driving load, the force of the flow becomes greater than the force of the spring, and the valve closes immediately.

Remark: In order to remove the LBS 1 from the lifting cylinder, you must use the special tool with Id. no. W8 044 065 (3).
LBS 2 can be removed with a normal hexagon socket screw key.



6/0102

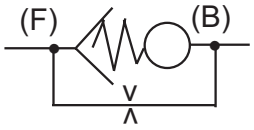


6/0103

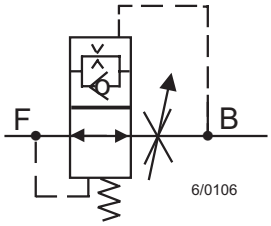
1/0202

Symbolic drawing

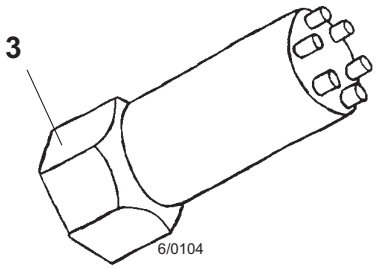
simplified



detailed



6/0106



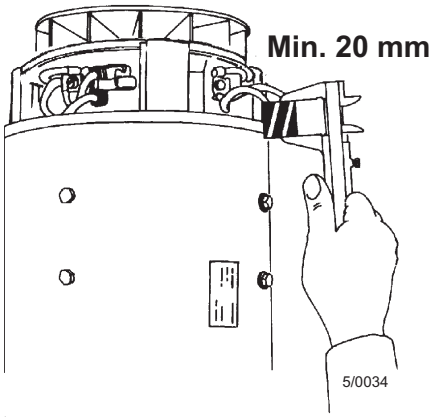
6/0104

Pump unit

Replacing the carbon brushes

Id. no. W8 409 243

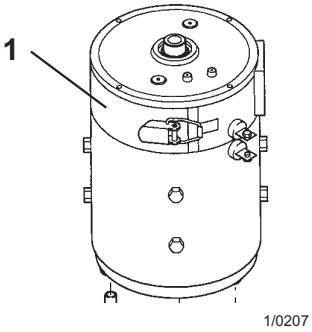
The carbon brushes must be replaced when a residual length of **20 mm** has been reached, which is equivalent to wear of approx. 50 %. They must also be replaced when the carbon brush monitor has responded (see sheet no. N26)



Length of a new carbon brush: 40 mm
The entire set of carbon brushes must always be replaced (4 brushes)

Removal

- Pull out the battery plug.
- Make the pump unit accessible (see sheet no. N23).
- Remove the side covers at the left so that the mounting opening for changing the carbon brushes is accessible.
- Remove the tensioning belt (1) from the pump motor.



- Lift the brush spring (2) and pull the carbon out at the connecting lead (3).
- Disconnect the connecting lead (4)
- Clean out the commutator space (blow out).

Note: The carbon dust is hazardous to the health. Always wear a protective mask!

- Insert the new carbon brushes.

Remark: The motor should not be run at full power directly after the brushes have been replaced. The carbons run in relatively quickly under a low load.

Contents

Sheet no.

Software updates

Servicemaster

Commissioning the steering

Adjusting the flutter

The two signals from the setpoint potentiometer are monitored against each other. The difference between them (ΔR1-R2 = ΔU1-U2) is theoretically constant and should not exceed a range of +/- 0.3 V (see sheet no. B14).

Exception:
If the "control potentiometer" runs through its "Zero point" (7° range) this monitor is inactivated, because a range of +/- 0.3V is always exceeded here (see sheet no. B14).

If a flutter that is too large is detected, the steering switches off and "FE 87" is displayed.
It is possible that this flutter may have to be stopped, because of the potentiometer tolerances. If this does not help, the setpoint potentiometer must be replaced!

Procedure:

- In "Inbetriebnahme-Lenkung" (see sheet no. V8, Fig. 1), click on the Weitere Einstellungen button (1).
- Turn the steering wheel slowly from end stop to end stop, observing the "Lenkrad Gleichlauf" display (2) as you do so.
- The point at which the display changes to red is the point at which the permissible flutter is exceeded. If this occurs in an area in which the control potentiometer is within the dead range (7° range), this should be ignored. For help in identifying this: it is when a change is made from the "S1<S2" range (3) to the "S1>S2" range (4) and vice versa.
  The range that is not currently active has a grey background.
- If the display changes to red outside the dead range, the flutter is too high and must be adjusted. To do so, observe the value of the fluctuation (5) at which the display changes to red. This value may be positive or negative (you can see this from sign in front of the number).

Fig. 1 1/0088

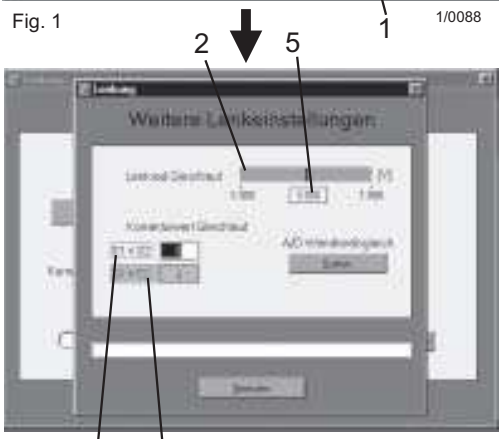


Fig. 2 1/0094

Servicemaster

Commissioning the hydraulics

Commissioning with standard parameter set (Initial commissioning)

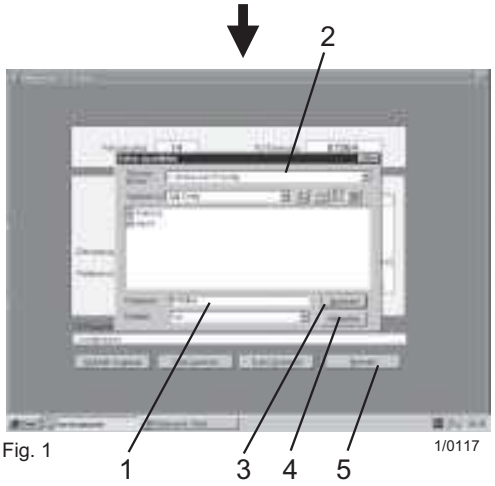


Fig. 1 1/0117

- Enter a name for the file you want to save in the "Dateiname" field (1), e.g. the vehicle ID. (see sheet no. V16, "FZ-Kennung"). The specified directory (2) for storing files is "c:\FmService\Config", but this can be changed if required.
- Save the complete data for the LAS-module on the computer with the Speichern button (3). The Abbrechen button (4) can be used to abort the process without saving the data.
- The Beenden button (5) can be used here and in the following masks to close the Servicemaster software.

Recommended values for initial commissioning

The values listed below are for optimum adjustment of the individual hydraulic axes. The speed specifications refer to a **"Test with rated load"!**

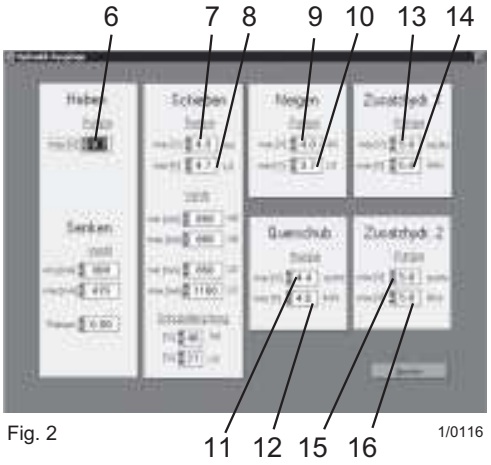


Fig. 2 1/0116

- **Setpoints for pump speeds**

Lifting	(6)	10.0V	max. speed (100% pump speed)
Reach DWS	(7)	4.6V	approx. 10.5 cm/s
Reach LS	(8)	4.9V	approx. 10.5 cm/s
Tilting DWS	(9)	4.0V	approx. 3.0 sec.
Tilting LS	(10)	3.7V	approx. 3.0 sec
Transv. shift r.	(11)	4.5V	approx. 4.4 cm/s
Transv. shift l.	(12)	4.4V	approx. 4.4 cm/s
Add. hydr.1 r.	(13)	5.0V	depends on attachment
Add. hydr.1 l.	(14)	5.0V	depends on attachment
Add. hydr.2 r.	(15)	5.0V	depends on attachment
Add. hydr.2 l.	(16)	5.0V	depends on attachment

DWS = Drive wheel side LS = Load side r. = right l. = left

Remark: On vehicles with pre-pressure valves for reach (see sheet no. N19), the parameters for "Reach DWS" and "Reach LS" must be increased by approx. 1.0V.

List of errors, continued

Error	Cause: LAS	Cause: FPS	Cause: Steering	ERR. No.	Class / remark
Steering supply voltage faulty, Battery excess/undervoltage			X	80	2
Steering power unit excess current			X	81	2
Steering power unit excess temperature			X	82	2
Steering setpoint generator wire breakage, short circuit or *error in flutter (from LAS module V2.01)*			X	83	2
Steering actual value generator wire breakage, short circuit or *internal speed sensor faulty (from LAS module V2.01)*			X	84	2
Steering motor model error			X	85	2
Steering motor position controller error			X	86	2
Steering internal error			X	87	2
Steering CAN Bus error			X	88	2
Steering g EEPROM error, incorrect checksum			X	89	2
CPU error, LAS internal	X(Ü-CPU)			90	2
EEPROM parameter set is incorrect, calculated checksum does not match stored checksum	X(S-CPU)			91	2 from LAS 1.23
Communication error CAN Bus, LAS cannot send any more data, display and steering are not responding	X(S-CPU)			95	2
Communication error CAN Bus between LAS steering a) LAS has not received a data change for more than 200ms b) CAN - wire breakage to steering	X(S-CPU)			98	2
Electr. steering does not send "Steering active" when vehicle moves	X(S-CPU)			99	2 ab LAS 1.23
Communication error CAN Bus (see FE95)	X(S-CPU)			97	2 ab LAS 1.35
Steering torque too low when vehicle travelling	X(S-CPU)			94	2 ab LAS 1.35

Remark: For a detailed description of the LAS errors, see sheet no. MXX.
For a detailed description of the steering errors, see sheet no. B8.

WinPulsE

Reading data out of the FPS (Receive from RAM)

Before adjustments can be made, the data must be read out of the FPS.

- In the menu bar, click on "Function" and then "Parameters" (1).
- In the window that then opens, click on the Receive from RAM button(2).
- The parameters are read out of the FPS. This takes about 25 secs.
- The parameters are then available (3).
- To close the active window, click on the Close (4) button.

Remark: Once the data has been read out of the FPS, the parameters and configuration can be changed. It is also possible to store the complete data set (see sheet no. V40, 41). If there is no User_Comment (5) in the "Parameter change" window, the data is from the FPS. If there is a comment, the data is from a vehicle file that has previously been opened by the computer.

Fig. 1 1/0149

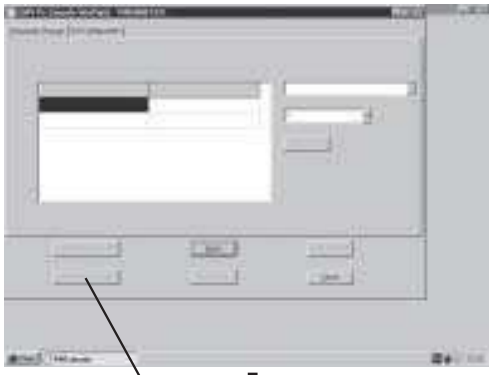


Fig. 2 1/0150

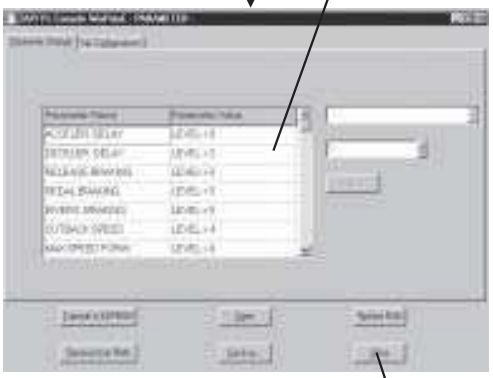


Fig. 3 1/0151

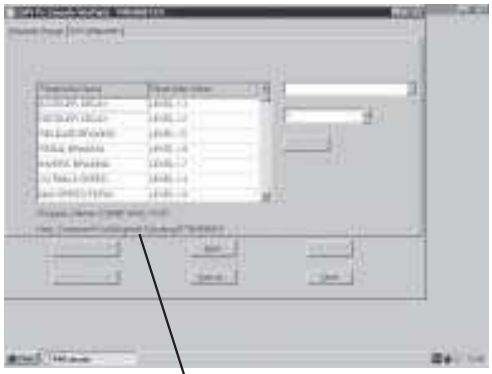


Fig. 4 1/0152

WinPulsE

Changing the configuration (Set Configuration)

Changing the configuration

Before the configuration can be changed, a connection must be made (see sheet no. V38). The data must be read out of the FPS (see sheet no. V39) or a vehicle file must be opened (see sheet no. V42).

Procedure for "Data from the FPS":

- In the menu bar, click on "Function" and then "Parameter" (1).
- The -Parameter- window (2) opens.
- In the -Parameter- window, click on "Set Configuration" (3). The input window opens (4).
- Select the Receive from RAM button (5), and the data is read out of the FPS.

Remark: This process is only necessary if no data has yet been read out of the FPS or if no vehicle file has yet been opened.

- In the selection window (6), click on the "Hour Counter" parameter (7).

Remark: The selected parameter is displayed in the selection window with its name and the option that is currently set (8), and is active for alteration.

- The arrow key (9) can be used to display the options that can be set (10) and to change them:

  - Keyon: Hour counter counts when key switch ON
  - Running: Hour counter only counts when a motor is driven by the FPS
  - Running and Lowering : The hour counter counts when the motors are driven or the main lift lowering function is active

Fig. 1 1/0149

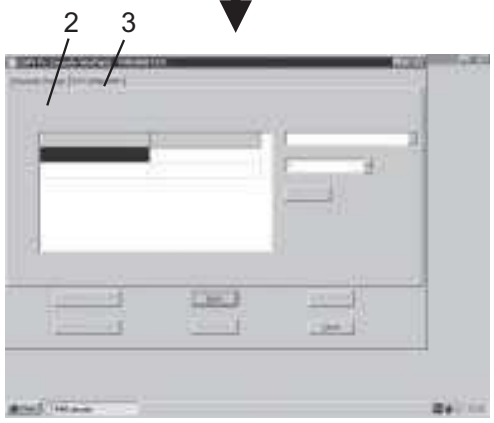


Fig. 2 1/0150

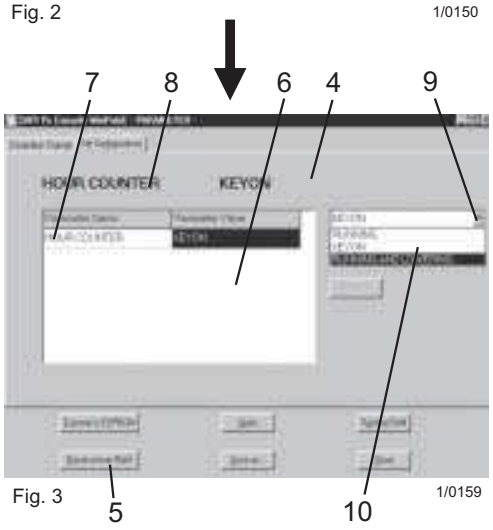


Fig. 3 1/0159

WinPulsE

Changing the hour counter (Set Hour Counter)

The operating hours that are shown on the display can be modified here. However, the "internal operating hours" of the FPS cannot be changed!

- In the menu bar, click on "Function" and then "Set Hour Counter" (1).
- The -Set Hour Counter- window opens (2).
- The current operating hour is shown on the input window (3).
- The operating hours can be changed with the selection fields (4).

OR

- Double click with the mouse in the input window (3). The background to the displayed value turns blue and the required number of hours can be entered on the keyboard.
- Use the Acquire button (5) to reset the original value again.

Remark: A Save operation (6) cannot be carried out prior to this.

- The value that has been entered can be stored in the FPS with Save (6). The newly set value can be seen on the display immediately.
- The Close button (7) closes the active window.

Remark: No "Transmit to EEPROM" is necessary, since the data is changed directly in the FPS.

Fig. 1 1/0149

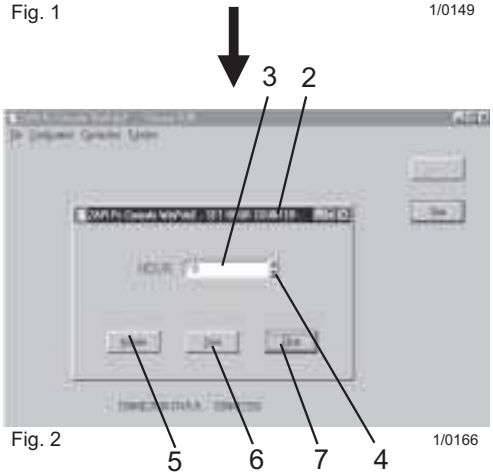
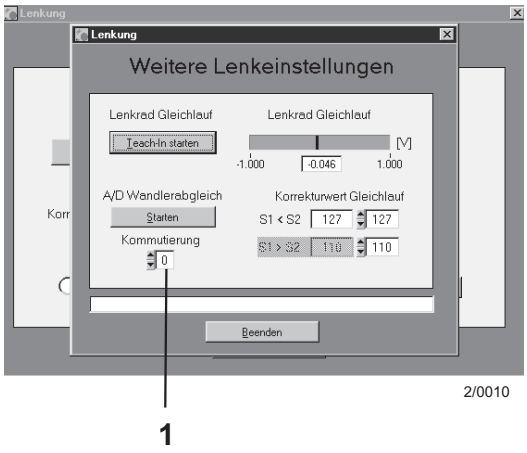


Fig. 2 1/0166

Software updates

Servicemaster V2.02

Correcting the steering speed



If the steering speed to the left/right is different, the "Commutation" parameter (1) can be used to adjust it. The default setting is "0", or the value that was set in the factory is displayed. It can be altered within a range of +/-2. The value must be changed positively or negatively, according to where the difference in speed lies.

Remark: The parameter change is not adopted in the steering until the vehicle is switched off and then on again!
Only steering systems built from 11/2001 onwards (V4.12) are adjusted specifically with regard to the steering speed!

Note: The "Commutation" parameter may only be adjusted if the steering speed is extremely different on the two sides, since a change in the value can cause a considerable loss of torque!!

Teaching-in routine for hydraulics potentiometer

In principle, the teaching-in process for the joystick and single-lever potentiometer is unchanged (see sheet no. V14).
However, additional potentiometer data is now read in during the present routine (in the background, not apparent to the operator).
This improves the error monitoring (messages FE50-54 appeared sporadically in the past) and the zero setting monitoring (previously sporadic slight lowering of the main lift of its own accord).

Remark: The improved teaching-in routine requires an LAS module version 2.01.
An LAS module version 2.01 also requires a Servicemaster Version 2.02.
If these requirements are not met, the additional teaching-in data cannot be transmitted.

Software updates

Servicemaster V2.05

Teaching-in the 360° steering

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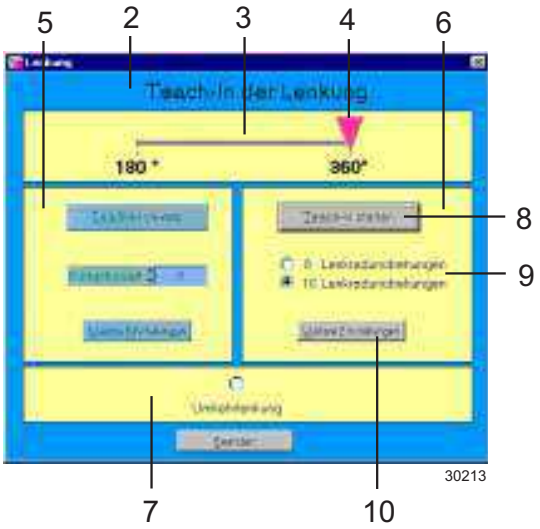
You can access teaching-in of the steering (1) through "Commissioning - Steering" (2).
The "Selection field 180° / 360°" (3) shows the current configuration of the steering, i.e. when the steering is logged into, first the current configuration of the steering is read out (180° or 360°), and the sliding regulator (4) positioned accordingly.
Then either the "Teaching-in 180° (5)" or "Teaching-in 360° (6)" area is automatically inactive (in the example, the 180° area is inactive).
The 180° or 360° configuration can be changed by moving the sliding regulator (4), but is not activated until the key switch is switched off and then on again.

Remark: At the moment there are only 2 separate steering units. One for the 180° version (see B3) and one for the 360° version (see B23).

Note: **A 180° version must not be configured as a 360° version and vice versa!!**



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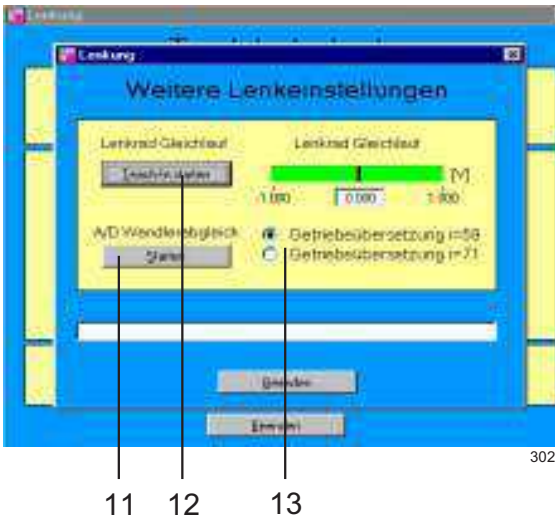
From 10/2003, there will be a unit available that can operate both versions.

The teaching-in process for the 180° version of the steering (5) is almost identical to the previous teaching-in process (please see V97).

The "Reverse steering" selection field (7) for configuring a reverse steering system is for both types of steering.

Teaching-in of the 360° steering is started with the Teach-In starten button (8) (please see V88).

The parameter 8 or 10 turns of the steering wheel (9, please see V91) are used to define how many turns of the steering wheel (setpoint potentiometer) are needed to make a complete turn of the drive wheel (360°).
The Weitere Einstellungen button (10) can be used to enter the menu for the other steering settings.



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- A/D converter calibration (11, please see V92)
- Teaching-in the flutter (12, please see V93)
- Setting the gear transmission ratio (13, see V96)