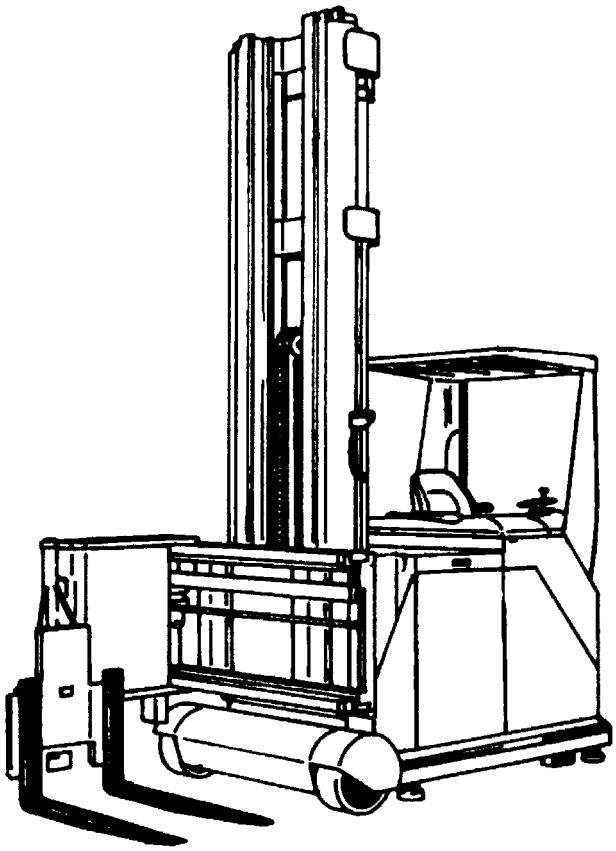
Workshop Manual GX13

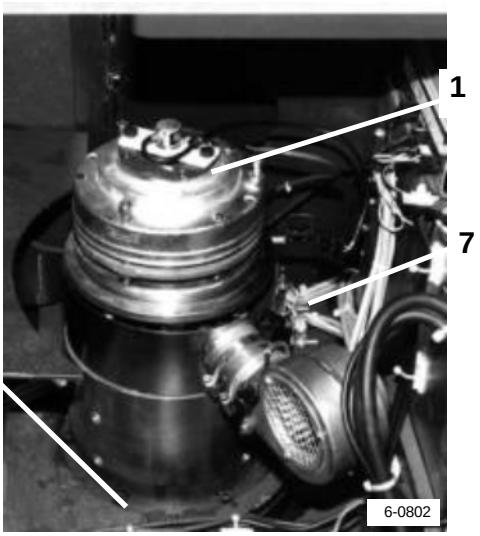


First Issue: 4/96 **Last Revision:** 8/98		**Workshop Manual**	**GX13**	**Id. no. 8 054 131**

Removing the travel motor

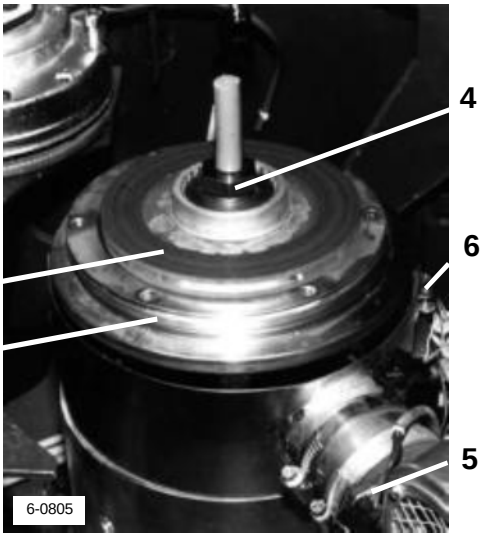
Caution: After the travel motor has been removed, the vehicle is no longer braked. For this reason, the vehicle must be secured against rolling away.

1. Move the driver's seat back electrically.
2. Pull out the battery plug.
3. Remove the electromagnetic spring-loaded brake (1) (see sheet no. C 21) and the rotor (2).
4. Remove the flange (3).
5. Unscrew the shaft journal (4) and remove the disc.
6. Disconnect the block plug (5) for the travel motor fan.
7. Open the tensioning belt (6) and remove with the travel motor fan.
8. Mark the travel motor connecting cables (7) and disconnect and isolate them.



Note: The travel motor connecting cables must be isolated because the battery will later be reconnected for further stages of the process.

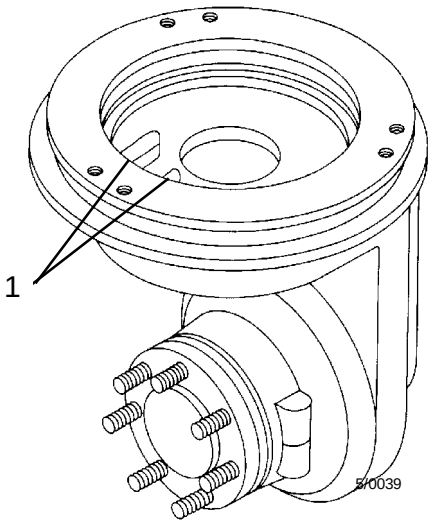
9. Unscrew and remove the 6 hexagon socket screws (8). A hexagon socket screw key bent at a right angle should be used for this purpose.



Continued on sheet no. A6

Travel motor, maintenance
(contd.)

Visual inspection, exchanging damaged parts:



- Straighten or exchange dented sealing tapes (Id. no. W8 405 826).

- Check fan impellers for damage. Damaged fans (imbalance, reduced output) must be exchanged (Id. no. W8 415 994 (48 V)).

- Clean the ventilation channels at the gear box (1). To do so, remove the travel motor and clean the channels using a vacuum cleaner (do not clean them with compressed air). Soiling reduces the air circulation, leading to increased temperatures in the motor and to possible destruction.

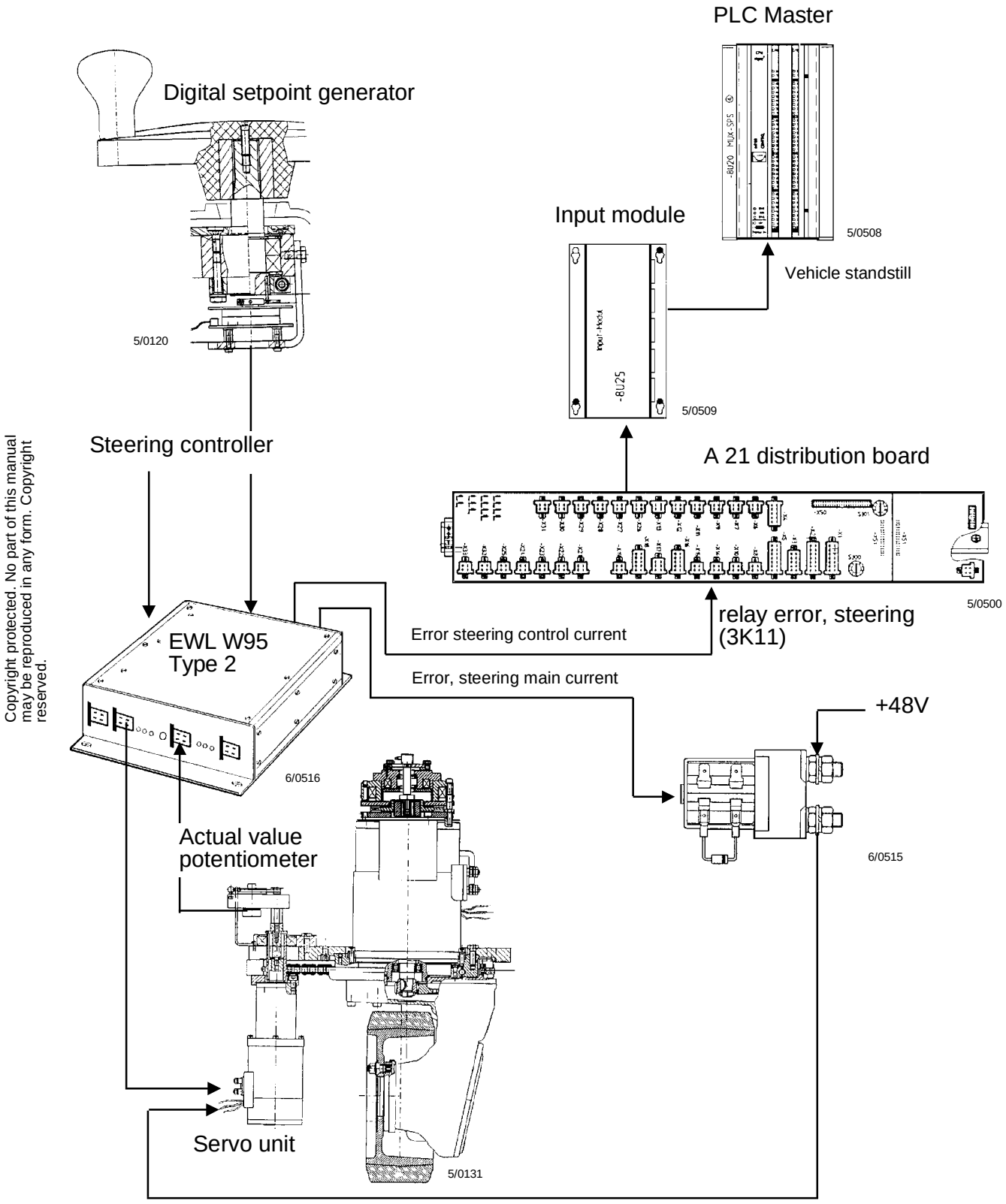
- Check field and armature windings for signs of overloading (overheating): dark coloration, brittle or burned insulation, unsoldered commutators.
  Motors bearing this kind of damage must be exchanged without delay.

- If you discover oil or grease in the motor (usually an oil paste, oil vapour mixed with dust and carbon abrasions), investigate the cause immediately and remedy. The motor must be cleaned extremely thoroughly.

Remark:

Rapid carbon brush or commutator wear is generally due to the effect of oil.
The oil/grease burns in the brush sparks, leaving a sharp-edged oil ash which has an abrasive efect.
This can tend to lead to inadmissibly high levels of carbon brush wear before the scheduled maintenance dates.

Principle of the manual steering



Steering controller EWL W 95, type 2

Continued

2. Potentiometer (2) can be used for fine adjustment during mechanical presetting of the actual value potentiometer.

Procedure

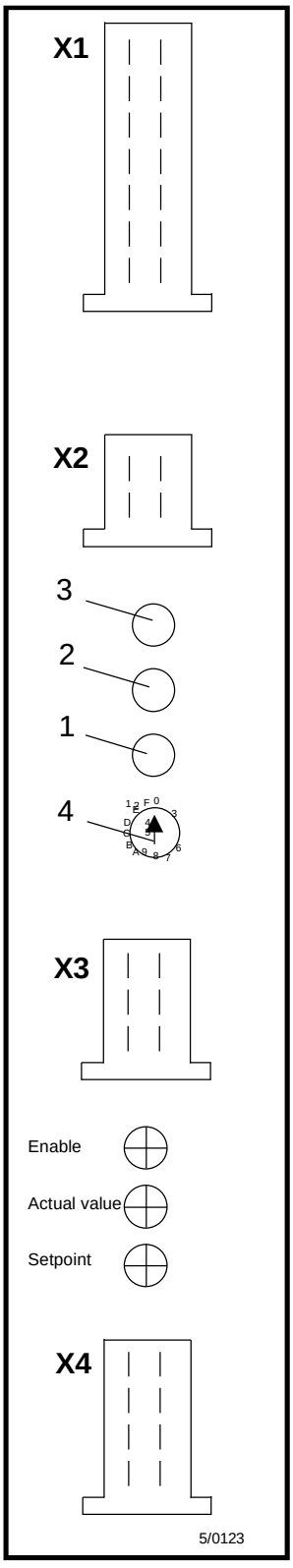
- Turn the setpoint generator until input E10.3 channel 5 is illuminated in the PLC (actual value, straight-on).
- Switch the rail switch (light scanner). This forces the controller into straight-on mode.
- Turn potentiometer (2) until the drive is straight.

3. Potentiometer (3) can be used for fine adjustment when readjusting the 90° steering angle (clockwise rotation to decrease the steering angle).
   Turn this potentiometer until a steering angle of 90° is achieved to the left and right.

Caution: Do not turn too far. The drive must not knock against the mechanical stop.

4. If the steering angle is too small, potentiometer (1) must be turned (anti-clockwise).

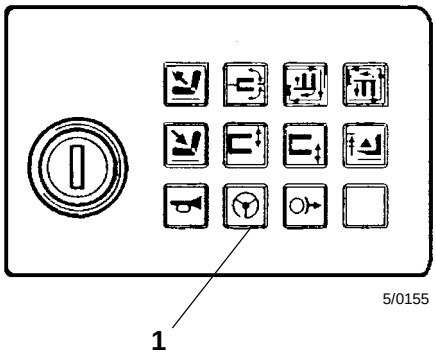
5. Turn the service switch (4) back to its normal position Ø.



LR80

Operating mode

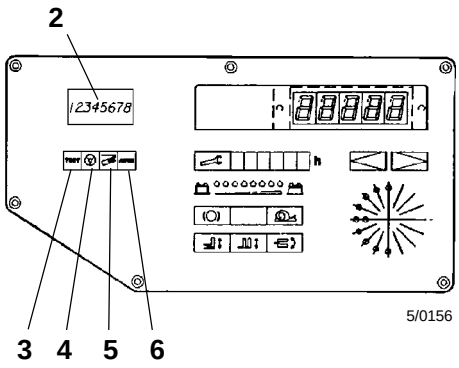
Manual steering:
Once the self-test is completed, the indicator light goes off (3).
The displays (4 and 5) flash alternately (speed limit 2.5 km/h, wire search). If the vehicle is to be driven away from the induction loop, button (1) must be pressed once. Display (4) lights up and the maximum speed V_{max} can be reached.



Steering with the inductive control system:
Travel with the inductive control system takes place in three stages.

a) Wire search mode
When the scan switch (1) is pressed, the "Wire search" function is activated, and indicator lights (5 and 6) flash alternately.
The closer an areial comes to the guide wire, the shorter these intervals become. When an aerial is positioned directly above the guide wire, the interval changes to a continuous signal.

b) Preparatory aisle-travel mode
Once the guide wire has been detected by an aerial, the system switches automatically into preparatory aisle travel, i.e. when the manual steering is automatically disconnected, the control unit continues steering at a reduced speed of travel until the vehicle is correctly aligned, ready to enter the aisle. This operating mode is indicated by a flashing indicator light (6).



LR 80

Central processing unit

DC/DC converter Id. no. W8 007 390

The DC/DC converter (1) generates a voltage of 5 V and 12 V. Both voltages can be adjusted.

Before it can be adjusted, the converter must be removed from the central processing unit. To do so, unscrew the front panel and remove.

The trimming potentiometer for the 5 V voltage (2) is on the converter motherboard.

Adjustments can be made with a 0.5 x 2.8 x 100 screwdriver, which is pushed into a hole with a cover (ADJ 5 V) (2).

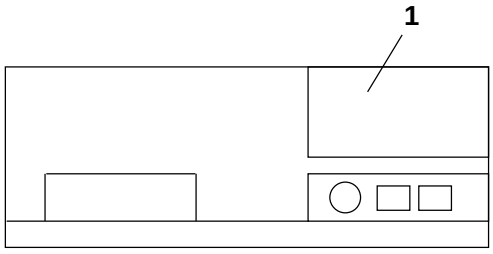
The trimming potentiometer for the 12 V voltage (3) is on the right-hand side when viewed from the pin side.

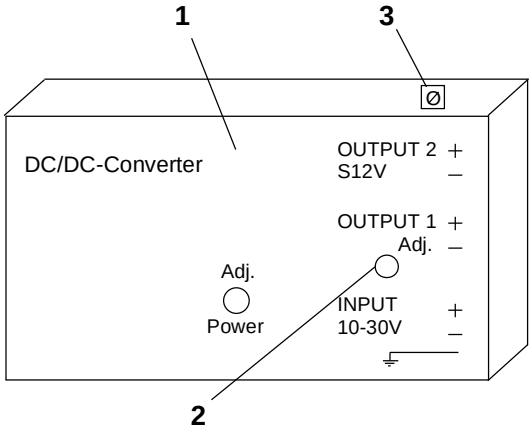
The following applies for both voltages:

Clockwise rotation: voltage increases

Anti-clockwise rotation: voltage decreases

Voltage range:	5 V	min:	3.6 V
		max:	5.8 V
	12 V	min:	9.6 V
		max:	14.7 V





LR 80

Commissioning

Adjusting the wheel of the potentiometer

- Test 03 - (Set mode switch to 3)

Caution: Beforehand the offset potentiometer must be set to ± 00 (see B42).

Using the **Manual** potentiometer, set the guided wheel exactly to "forward travel", set the **Wheel** potentiometer so that the display indicates:

WHEEL = 800. Then fix

Remark: The position of the hand wheel (set-point value) is of no significance for the synchronization of the actual value and drive mechanism.

Testing the controller (controller setting, dynamics)

- Test 04 - Set operating mode switch to 4.

- Turn steering potentiometer to the centre position.
  When the turning carriage meets a mechanical stop, check the wheel potentiometer setting. If in order, check the connections of the proportional valve. If the steering movement is too slow or too fast, set the optimum angle speed using the angle control amplifier potentiometer.

- Turn the steering potentiometer to the left and right against the steering stop. If the maximum angle stop on the right or left is not correct, the stops can be adjusted using the potentiometer. (See from B90)

LR 80

Error signal:
*** Service display unit data transmission fault ***

Test of data transmission to the service display unit
In this test, the transmission of data to the service display unit is performance tested.
(If undefined symbols appear in the service display unit, the unit or the cable can be defective.)

What to do when this error signal appears:
If this fault occurs, the cable connection to the service display unit must be checked.
- If defective, exchange the cable
- Using the test service display unit at X3 central unit, test whether it functions with the test service display unlt. If so, exchange the service display unit at the truck.

Error signal
*** 12 V voltage too high ***
*** 12 V voltage too low ***

Test of 12 V voltage (min. max. value testing)
In this test, the voltage is tested for a minimum and maximum value. (The voltage value must lie within this range).

What to do when this error signal appears:
If this fault occurs, check the 12 volt output voltage of the DC/DC converter. Exchange the power supply unit in the central unit.

Error signal
*** 5 V voltage too high ***
*** 5 V voltage too low ***

Test of the 5 V voltage (min. max value testing)
In this test, the voltage is tested for a minimum and a maximum value. (The voltage value must lie within this range).

What to do when this error signal appears:
If this fault occurs, check the 5 V output voltage of the power supply unit.
Exchange the DC/DC converter in the central unit.

LR 80

Changing the parameters (German software)

Configuration continued

Position the cusor on the **S** of **S**ICH (= Save)

EXE
the display then reads

SICH A | MODE

the display then reads

SICH C

enter your personal code, e.g.

L | R | EXE

The setup program is now stored and can be called again at any time.

Continued on sheet no. B 95

LR 80

Continued

Setting the LR 80 with a PSION

Maximum steering angle limit to the right

Aim: To determine the maximum steering angle without the drive hitting against the mechanical stop.

Example:

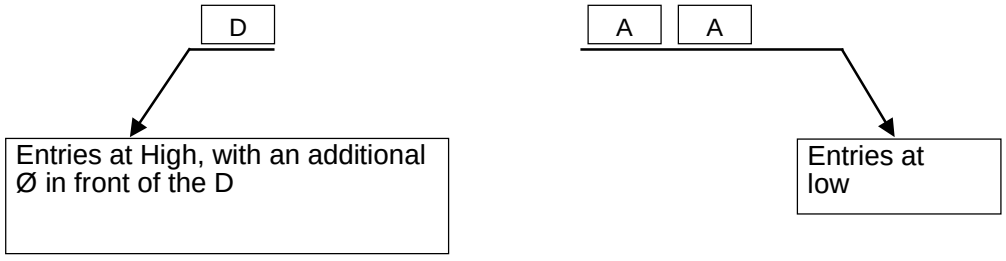
PSION entry

[S] [shift] and [D] [A] [A] [EXE] = maximum steering angle to the right

PSION reads: S DAA SEND
Display reads: SANZ DAA

Note: When the EXE command is given, the drive rotates. Ensure that the service switch is set to position "A" (see sheet no. B 10). The example value given above (DAA) should not be selected too high, otherwise the drive wll hit the mechanical stop. The value must be raised step by step, so that the drive stops approx. 20 mm before the mechanical stop.

When the correct value has been determined, e.g. D A A (make a note of it), this is later written in under an addresss (see sheet no. B110) as follows:



PSION entry

[S] [shift] and [8] [Ø] [Ø] [EXE] = centre

PSION reads: S 8ØØ SEND
Display reads: SANZ 8ØØ

Caution: The drive turns back into the central position.

Continued on sheet no. B 103

LR 80

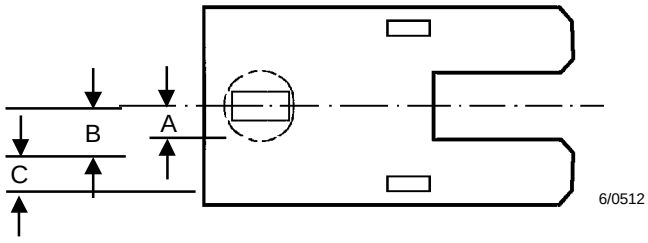
Continued

Setting the LR 80 with a PSION

Optimising the parameters

Address	Designation	Value
	Emergency-off parameters	
XE 59	Max. error for lateral deviation Preparatory aisle steering (1 aerial has identified induction loop)	4 Ø (guide value) must be determined
XE 5A	Max. error for lateral deviation Aisle steering (dimension "B")	2 Ø (guide value) must be determined
XE 5B	Max. error for lateral deviation, Aisle steering take-over dependent on value at XE5A (XE5B must be smaller than XE5A)	15 (guide value) must be determined
XE 5D	Additional deviation in reverse travel at front aerial	ØB (guide value) must be determined

Explanation of emergency-off parameters:
The purpose of these parameters is to monitor the lateral deviation. They can be adjusted separately for the individual steering modes.



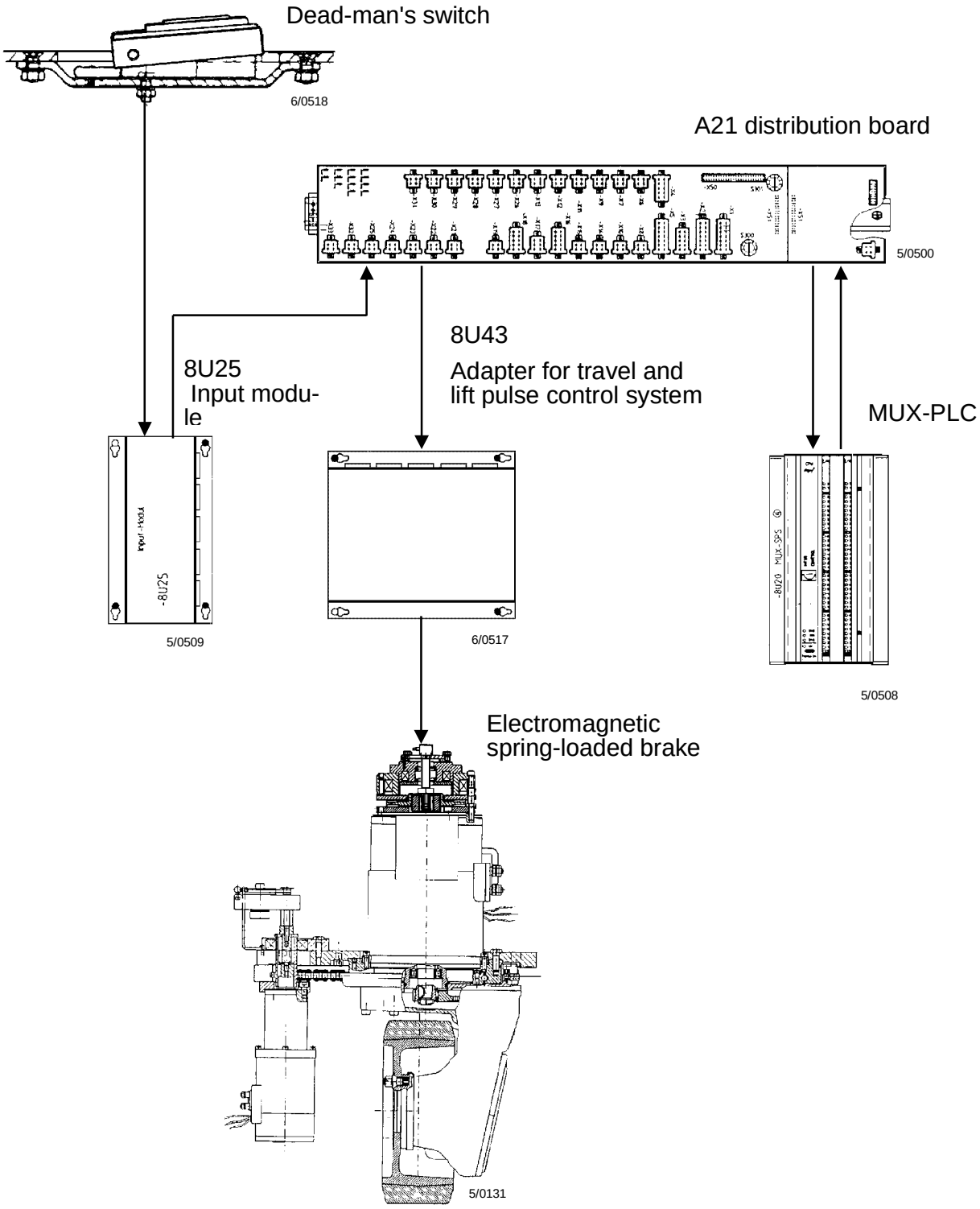
A = max. deviation at aisle take-over = XE 5B

B= max. deviation for emergency-off during forwards travel = XE 5A

C= Additional deviation for emergency-off during reverse travel = XE 5D

A minimal deviation is quite possible, depending on the position of the given values, so that an optimum parameter setting can be achieved.

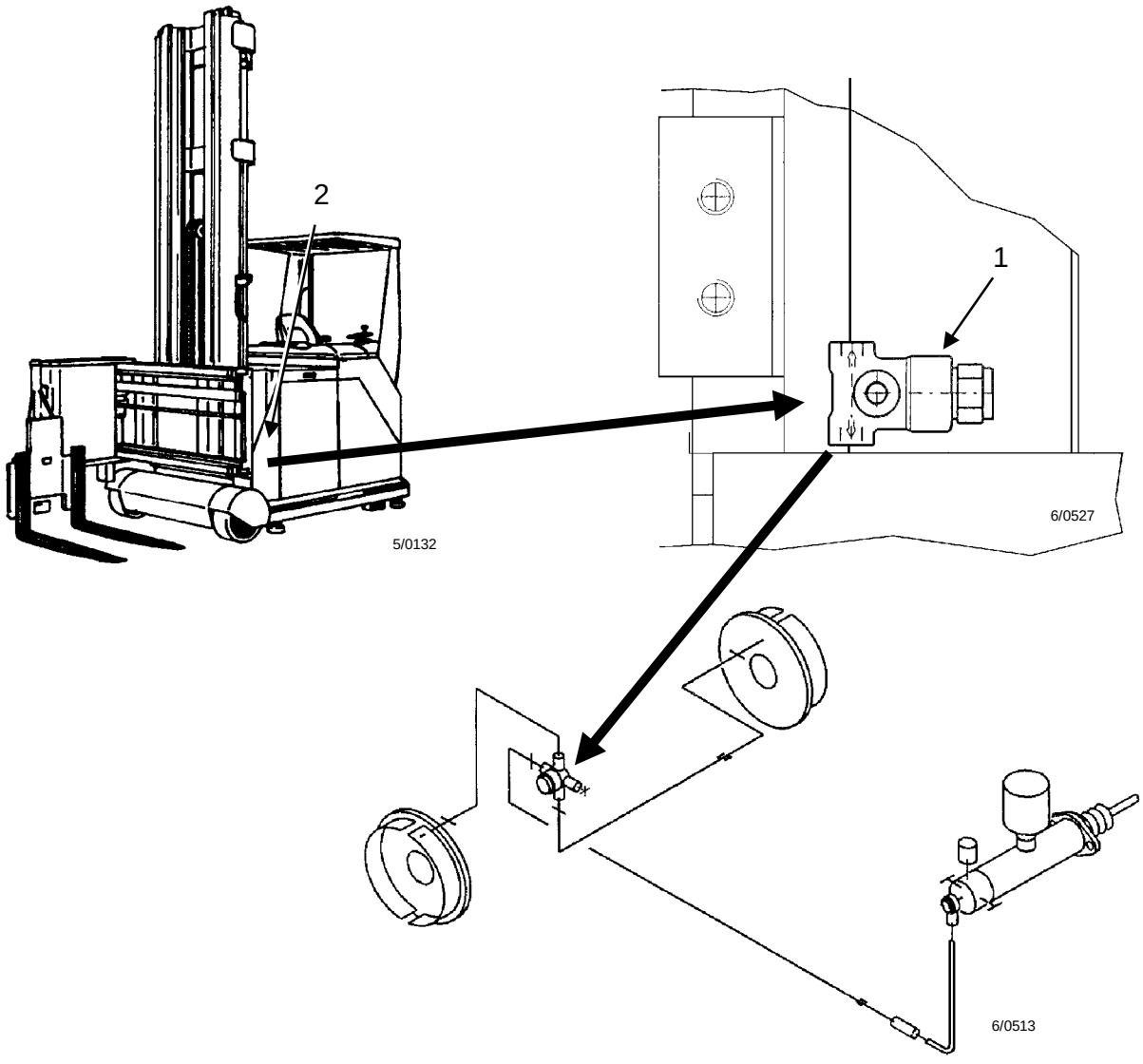
Plan of electromagnetic spring-loaded brake



Brake pressure reducer
Id. no. W8 410 525

The brake pressure reducer (1) is set to 40 bar and its purpose is to prevent the pressure which builds up in the brake system rising above 40 bar. As a result, the braking force is never exceeded. No adjustments may be made to the brake pressure reducer.

The brake pressure reducer can be accessed by removing the cover (2).



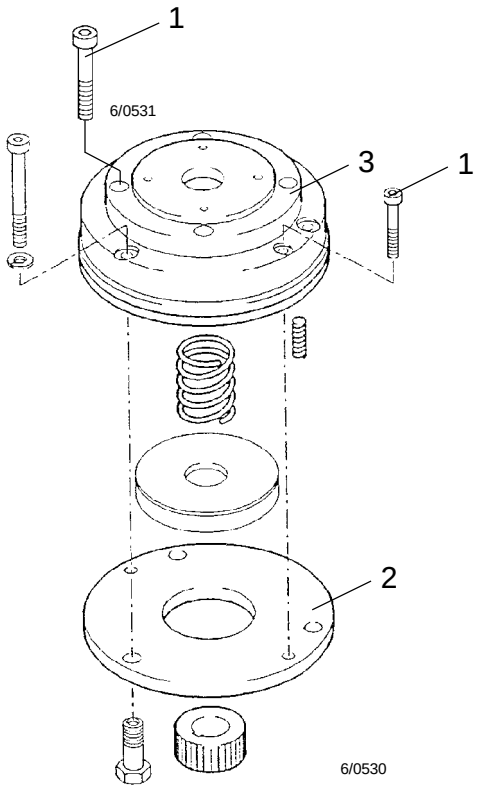
Electromagnetic spring-loaded brake

Releasing the brakes mechanically

The brakes must be released mechanically:

1. if one of the brake coils or one of the components essential for releasing the brakes is faulty, and the vehicle must be brought out of aisle mode quickly.

2. if the vehicle chassis has to be pushed during commissioning.
   For this purpose, screw in the two hexagon socket screws M 6 x 50 (1) as far as they go. This pulls the brake base-plate (2) tightly against the body of the magnet (3) and the brake disc is released.



Triplex mast

Location of proximity switches and block connectors on triplex mast

Id. no. W8 405 321 (proximity switch)

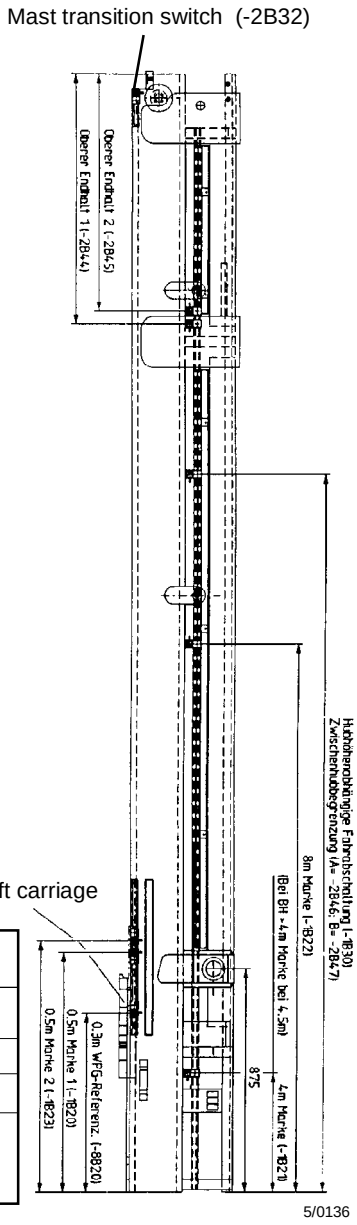
Remark: For information on testing the proximity switches see M 54.

The proximity switches on the mast are polled constantly, to ascertain whether a function has been selected, i.e. if they are dampened, functions such as creep speed or upper end stop are not activated (except at mast transition).

The function is not activated until the proximity switch is **no longer** dampened.

For safety reasons, all the proximity switches are double (redundant).

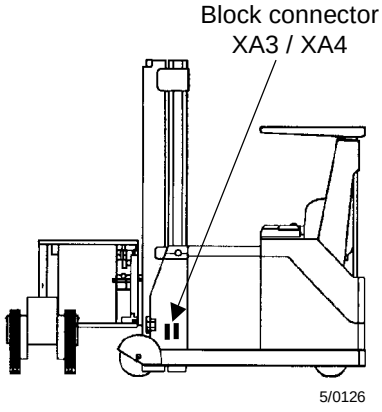
Remark: Proximity switch 2B32 is not polled continuously.



BASIC APPLIANCE									
h3 > 8m	X	X	X	X	X	X	X	X	X
h3 < 8m	X	X	X	X			X	X	X
Remark	-1B20	-1B23	-1B21	-1B24	-1B22	-1B25	-2B44	-2B45	-2B32
	0.5m Switch 1	0.5m Switch 2	4m Switch 1	4m Switch 2	8m Switch 1	8m Switch 2	upper Endstop1	upper Endstop 2	Lift speed. red

Lowering damping, simultaneous

OPTIONS				
Lift-top travel cut-out				X
Height ref. WPG/WHA			X	
Intermed. lift A.B	X	X		
Intermediate lift A	X			
Remark	-2B46	-2B47	-8B20	-1B30
	Intermed. lift A	Intermed. list B	Reference, lifting	Lift cut-out



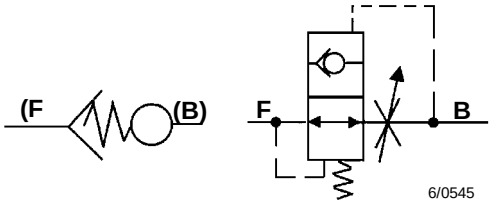
Cylinders

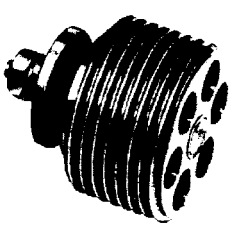
Line break protection, type LB-3C...

Id. Nr. see Tabel

Symbolic diagram

Simplified Detailed





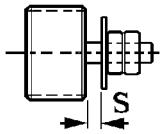
General

The line break protection prevents an uncontrollable accelerated movement of a loaded hydraulic device (crash) should hydraulic back pressure be lost due to breakage of the pressurized line or line connection. It must be screwed directly on or in the pressure oil input of the hydraulic device. The type LB is a disc valve whose valve screw in the idle state is raised by a spring from the valve seat, so maintaining a flowthrough cross-section of varying width. The force of the flow resistance and damming effect at the valve screw in the flow direction B --> F (working or release direction) under normal conditions are not as high as the counterforce of the spring, and so the valve remains open.

If, in case of emergency the flow volume increases due to the higher driving force, the flow forces overcome the spring force and the valve shuts instantaneously .

Remark: A special tool (1), Id. no. W8 044 065 is needed to remove the line break protection from the lift cylinder.

Continued on sheet no. F16



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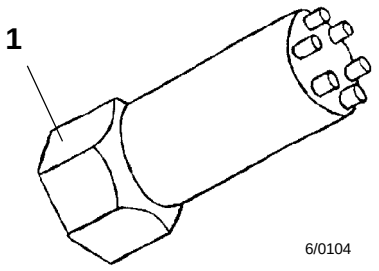


The basics of multiplex technology

Multiplex = multiple operation

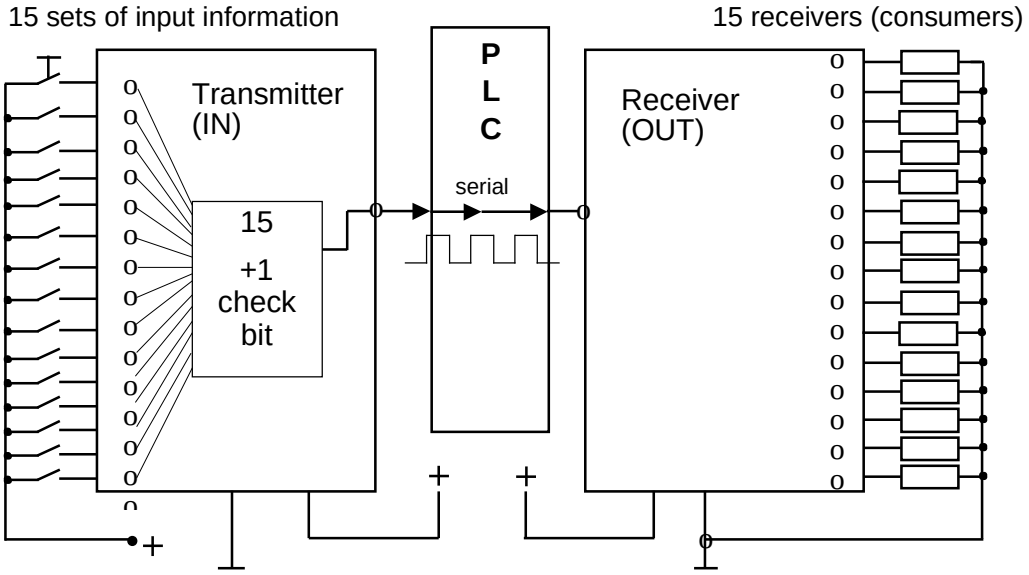
The aim of a multiplex system is to use a single wire lead for multiple functions and also to transmit several switching statuses.

For this purpose, a transmitter is required at the input side which polls 15 switch positions and sends this information in series to the MUX-PLC via the transfer line (15 switch positions and 1 check bit).

At the other end of the MUX-PLC is a receiver which redistributes the data as it arrives in small amounts, and in this way controls 15 consumers.

Reasons for using multiplex technology:

1. The more lines there are in a system, the more expensive it becomes.
2. Wire breakages often occur at critical points, i.e. susceptibility to faults is minimised in multiplex systems (fewer connections = fewer error sources).
3. Errors are easy to identify and locate.
4. The system is "simple" to extend.



Modules

Board A21 (versions 1 and 2)

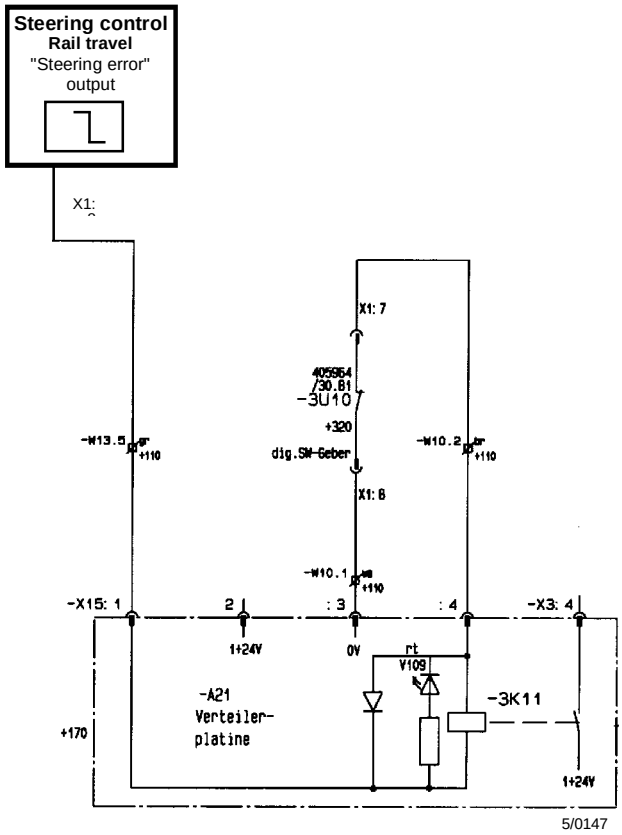
Steering error relay 3K11

Functional characteristics

The "steering error" switching output is a HIGH signal for standard steering (rail travel), but a LOW signal with the LR80 (inductive steering).

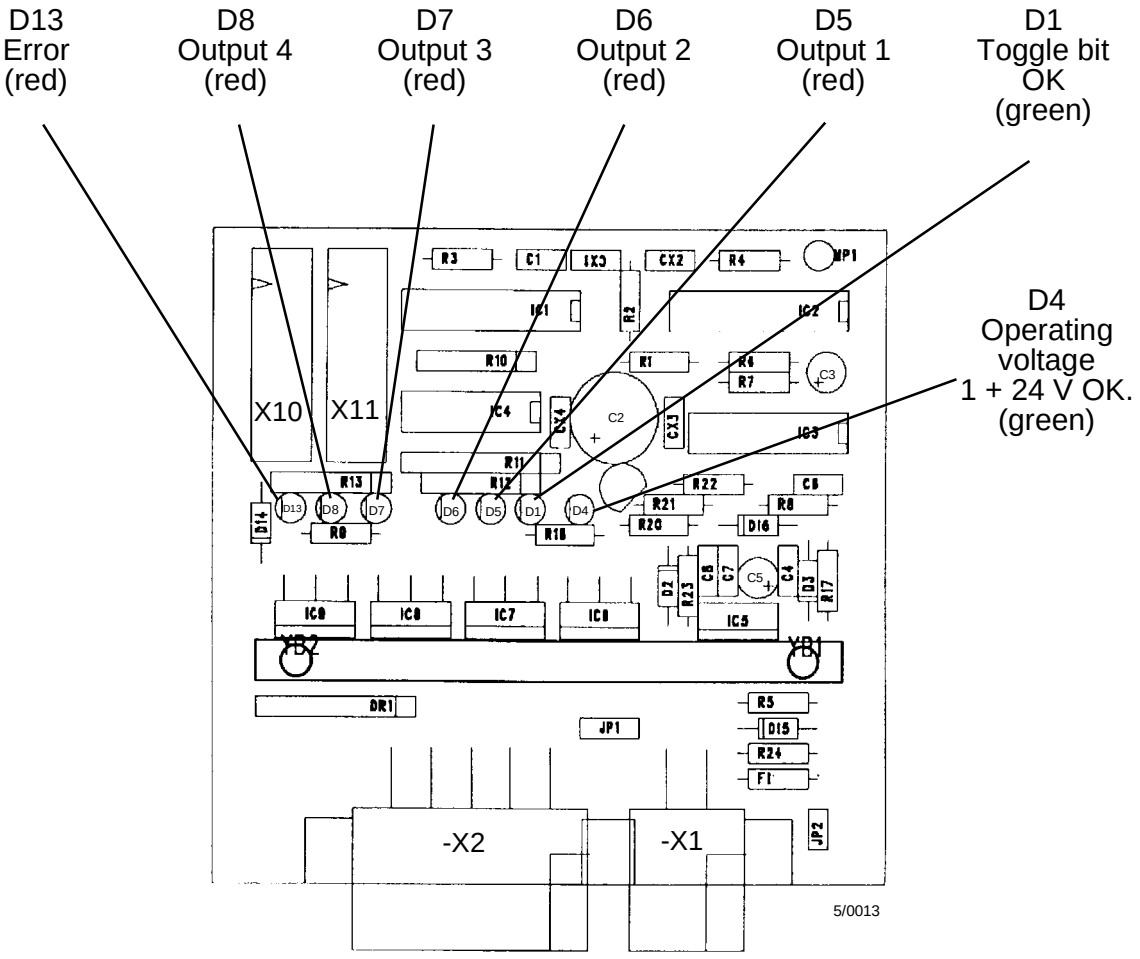
When the steering system is free of faults, there are 24 V at this output during standard steering, but 0 V during inductive steering. If an error occurs, the potential of the output is switched over.

So that the A21 board can be used for both types of steering, the relay 3K11 is used with rewiring.



Modules

Decoder



Modules

For vehicles from 9/98 see sheet no. M154

8U43 Analogue output, travel/ lift control system

Display LEDs

There are three green display LEDs on the 8U43:

LED 3:	12 V voltage OK	(1)
LED 12:	K100 operative	(2)
LED 209:	K200 operative	(3)

Test points

MP1	1 + 24 V	(4)
MP2	2 + 24 V	(5)
MP3	12 V	(6)
MP4	5 V	(7)
MP5	0 V	(8)
MP6	Pump setpoint	(9)

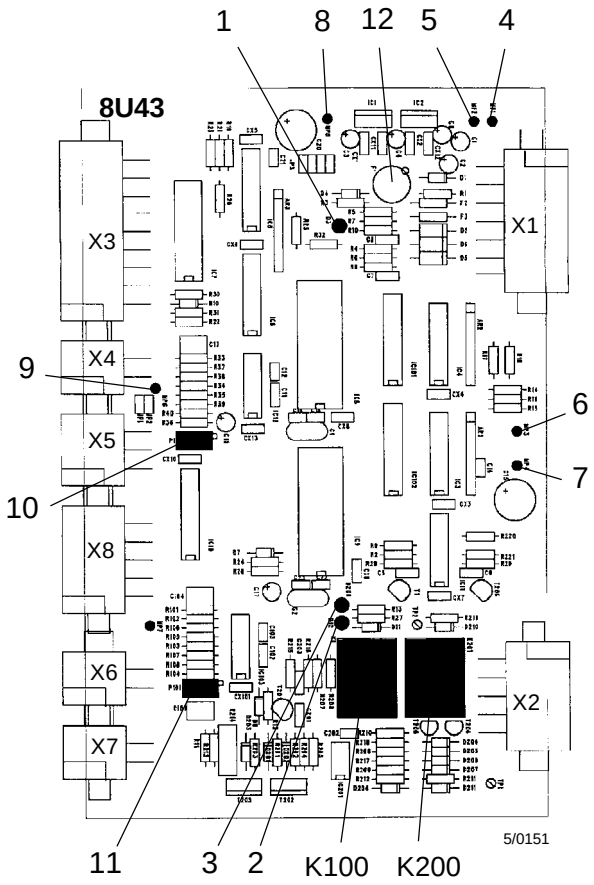
Fuse:	F1 (12)	250 mA

Potentiometer setting

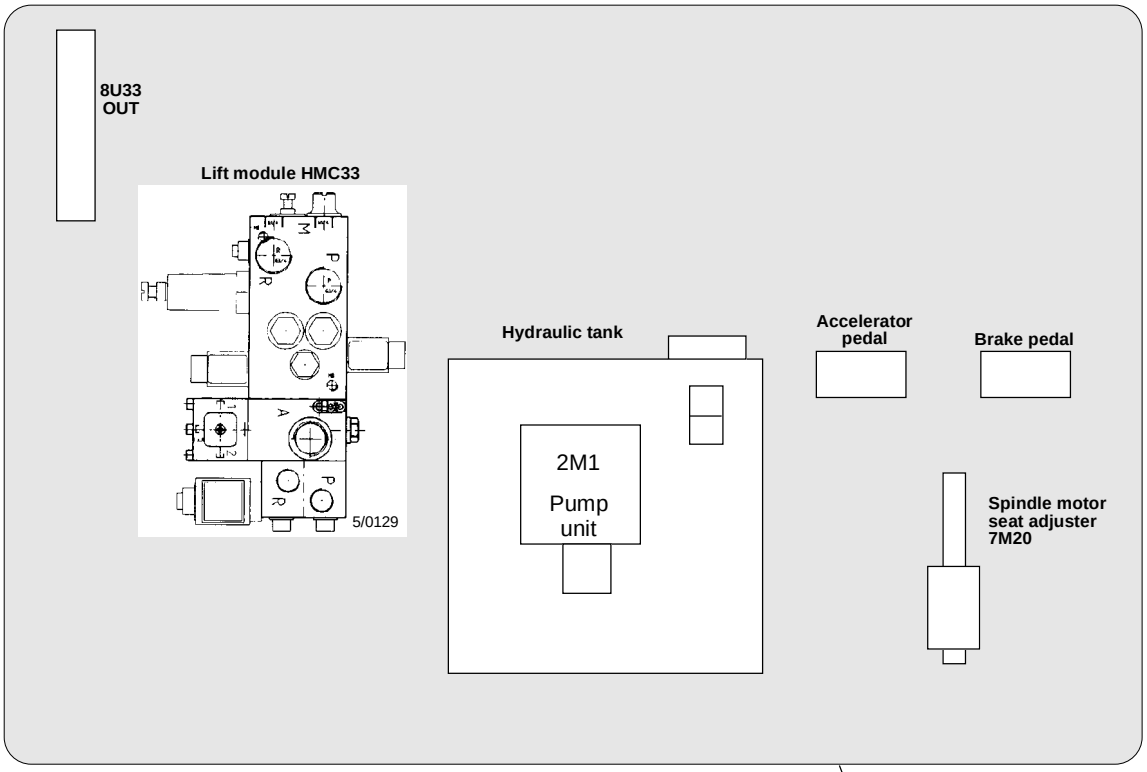
There are two potentiometers on the 8U43:

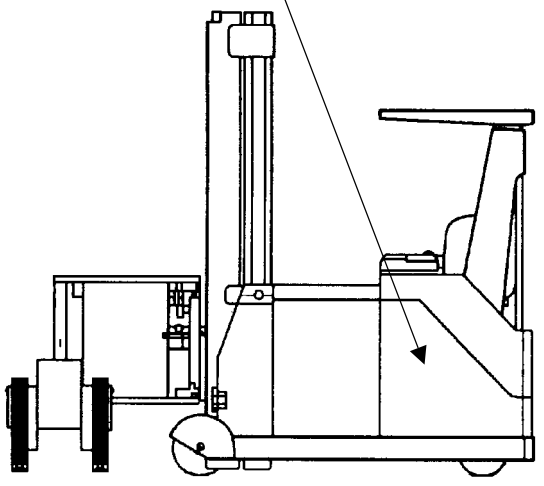
P1	(Pump setpoint)	(10)
P101	(is not used)	(11)

P1: Voltage measurement between MP6 and MP5
Hydraulic lever in zero position: 2V
Hydraulic lever full deflection: approx. 9V



Location of the components in the assembly compartment (right)





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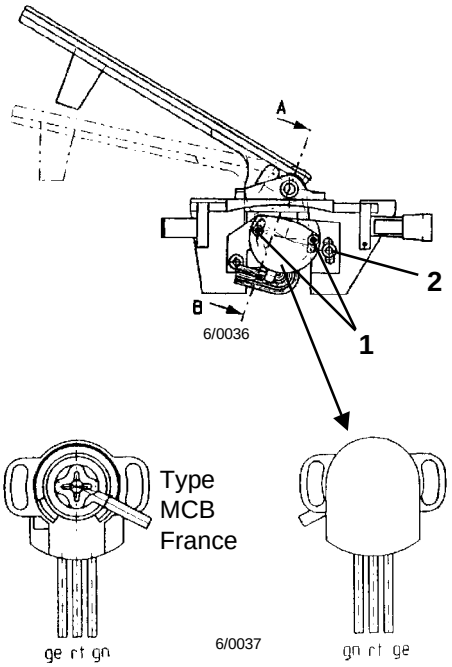
Continued

Travel transducer

For vehicles from 9/98 see sheet no. M163

In the event that the setpoint is not within the given range (see sheet no. M 58) or the potentiometer has been replaced, adjust the potentiometer as follows:

1. Set the idle position (approx. 7 V) of the pedal with the two longitudinal holes (1).
2. Set the maximum value (approx. 12 V) with the pedal fully depressed, using the longitudinal hole (2) if necessary .
3. Secure the screws with locking compound.



Remark: The wiper of the potentiometer is held in the "normal position" by an internal spring. When the potentiometer is installed, this wiper is already tensioned. When removing, ensure that the tension on the wiper is not relieved suddenly, otherwise the potentiometer may be damaged.

Continued

Changing parameters with the PSION manual programming unit

Use [↓] [→] to move to the L of LADE (LOAD)

[EXE]

You will now see:

LADE C:

if "LADE A:" appears, press [MODE] once

Enter file name, in this case:

[F] [M] [EXE]

You will now see:

ENDE ABBRUCH BEAR SICH LADE

Move the cursor to the E of ENDE (END)

[EXE]

You will now see:

SENDEN EMPFANG STELLEN ERFASSE

Use [↓] to move to the T of TERM

[EXE]

The PSION display is now empty with the cursor blinking in the bottom left-hand corner.
This means the PSION is configured and ready for

programming / parameter alterations!

Remark: You **must** make this connection to X5 **before** the vehicle is switched on with the key-operated switch.

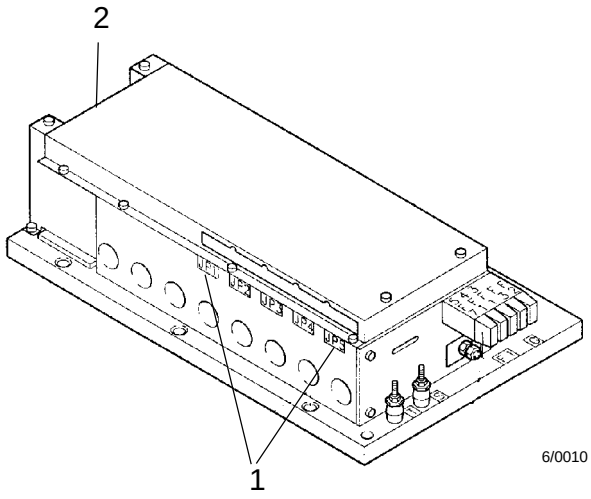
If you wish to quit the programming mode: press [ON].

Combined travel and lift pulse control system TRSC 900 W

Id. no. W8 405 544

General

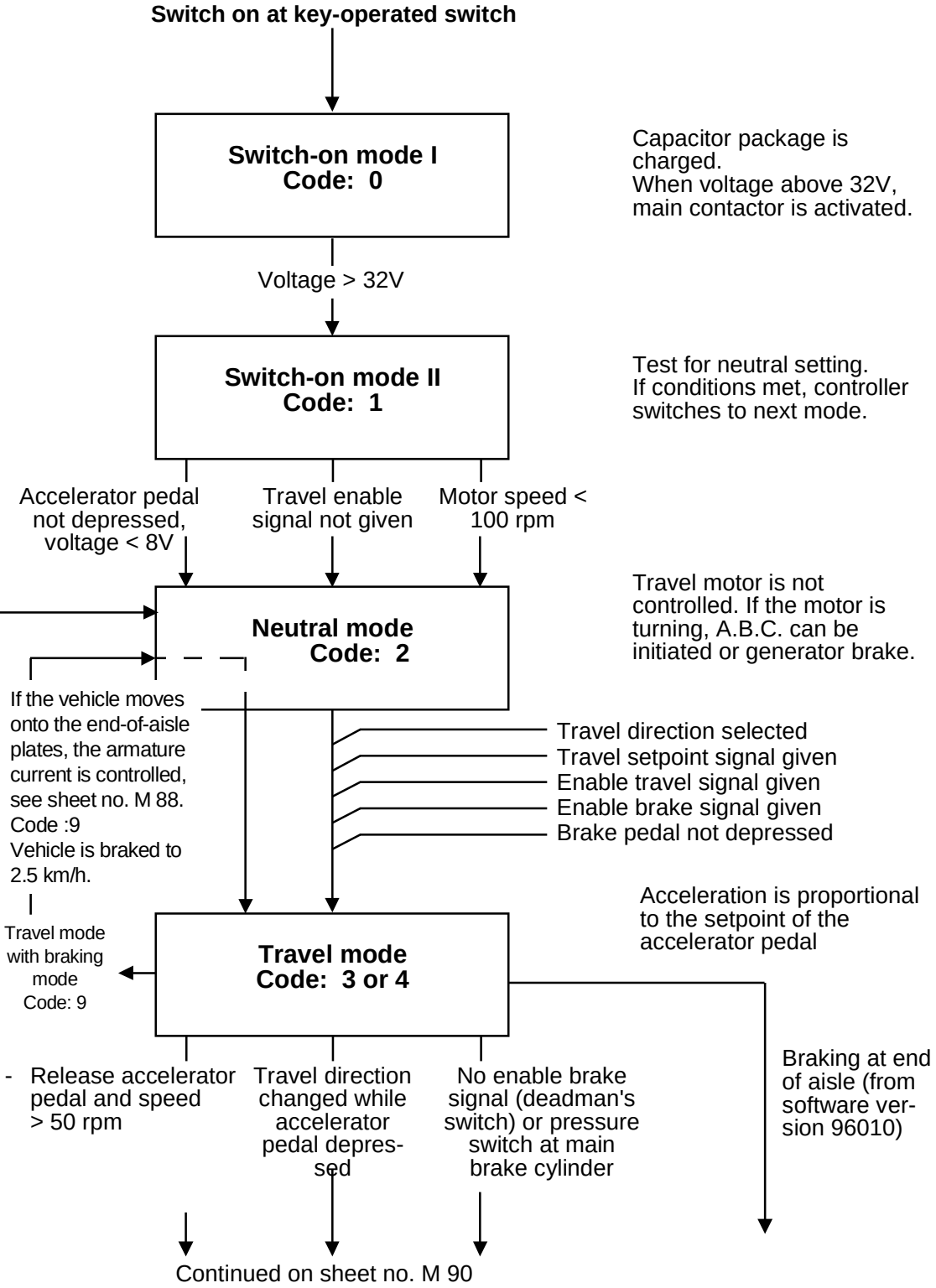
The ABB control system contains an independent travel and lift pulse control system. The two systems have separate microcontrollers which are responsible for the control and monitoring functions.
The travel controller circuit board is the board with connectors X1 - X5 (1).
The travel controller circuit board only has one connector X9 (2).
The main current circuits which control the motors operate on the principle of pulse-width modulation with15.7 KHz.
Control is continuous and effected with MOSFET transistors.
The travel motor is a separately excited shunt motor and the hydraulics motor is a series-wound motor.
Also integrated in the unit is an operating hours counter, which only counts when the MUX-SPS sends an enable message via the 8U43 (analogue output, travel/lift control system) to the control system.
An integrated battery discharge indicator shows the battery capacity.
Both these sets of data are sent by serial data transmission to the display 8U31 and evaluated. Operating and error information is also sent via the serial interface to the display unit.



Combined travel and lift pulse control system TRSC 900W
Travel and generator braking

Continued: **Travel controller operating modes**

Flow chart of operating modes



Combined travel and lift pulse control system TRSC 900W

Operating hours counter and battery discharge indicator

The operating hours counter and the battery discharge indicator are integrated in the control system and cannot be replaced individually.

The operating hours are counted as soon as the travel or pump motor is activated or a 0V signal reaches output X9.11 (the hour counter also works while the mast is lowered).

The operating hours are counted in tenths of an hour.They can be modified using the PSION manual programming unit (see sheet no. M 106).

The battery discharge indicator circuit determines the battery capacity from the voltage level of the integrated capacitor package (see sheet no. M83).

The information about operating hours and battery capacity is sent to the display 8U31 by serial data transmission (see sheet no. M30) and displayed there.

Combined travel and lift pulse control system TRSC 900W

Continued
Setting parameters and diagnosis options

Saving parameters

If you press the [Y] key, the display shows (in sequence):

Parameters saved!

```
PARAMS SAVED !!!
S:  SYSTEM SETUP
O:  OPERATION
```

To change back to the parameter settings (SYSTEM SETUP), press [S] .
To change to operating/diagnosis mode, press [O] (main contactor becomes operative; all functions are possible again).

2. Operation (Betriebs-/Diagnosemode)

When the [O] key is pressed, the main contactor becomes operative and all functions can be initiated again. Error mesage 03 is no longer displayed on the console.

The PSION now displays numerical and letter codes. The numbers represent the operating mode of the travel controller (see sheet no. M87) and the letters represent an error code (see sheet no. M94).

Remark: The main contactor cannot operate until the integrated capacitor package is charged to at least 32 V
(see also sheet no. M83).

Procedure for setting the length of the end-of-aisle plates and installation

Once the length of the end-of-aisle plates has been calculated (see below), the plates can be either glued to the floor or fastened in place with nail dowels. It is, however, preferable to glue the plates in place and then also fasten them with nail dowels. This ensures that the plates remain firmly in position on the floor.

Glue type: Id no. W8 050 452
Nail dowel: Id no. W8 411 548

Continued on sheet no. M129

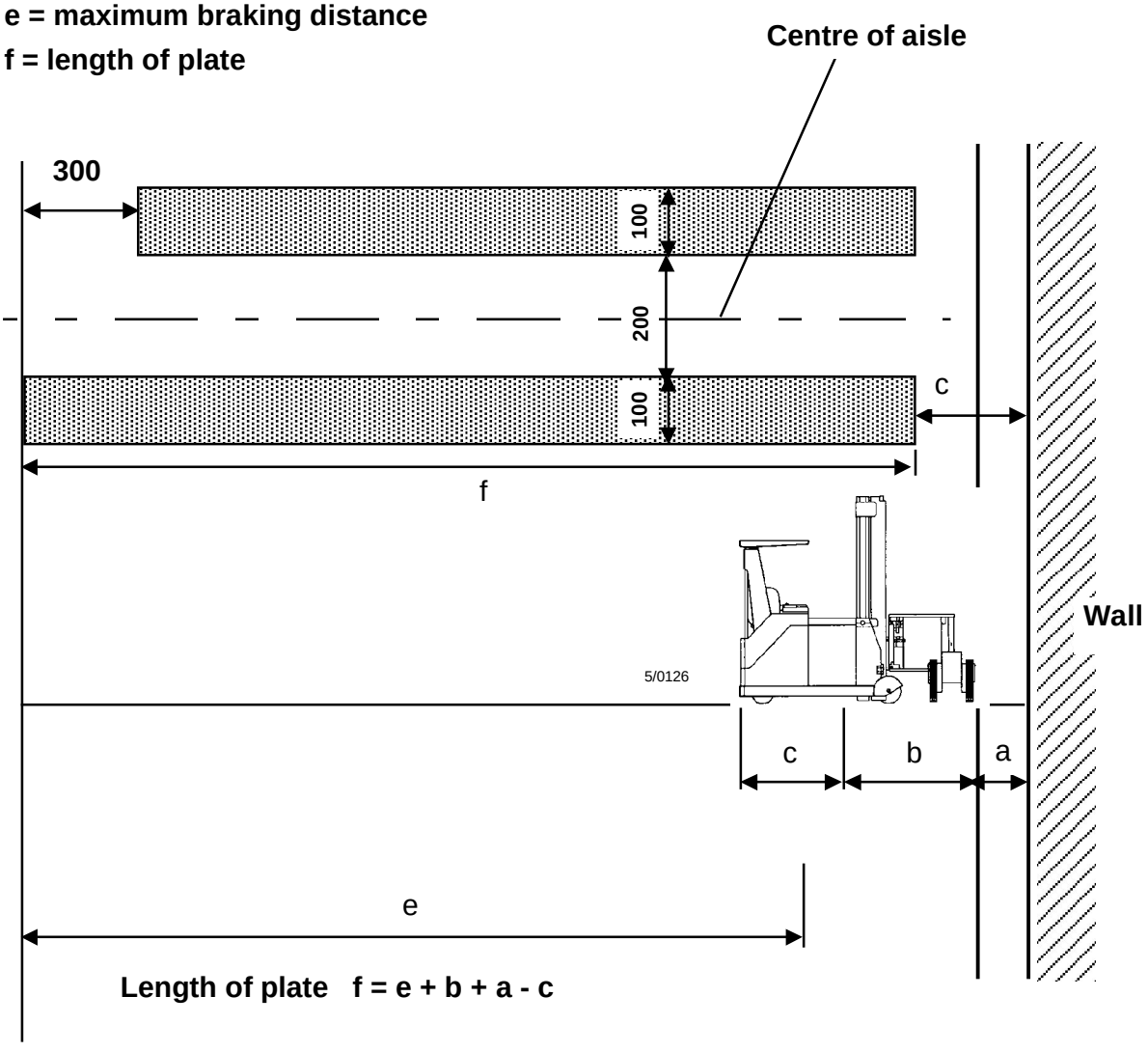
a = Safe clearance 1 m

b = Centre of the sensor to the rearmost point of the vehicle

c = Centre of the sensor to the foremost point of the vehicle

e = maximum braking distance

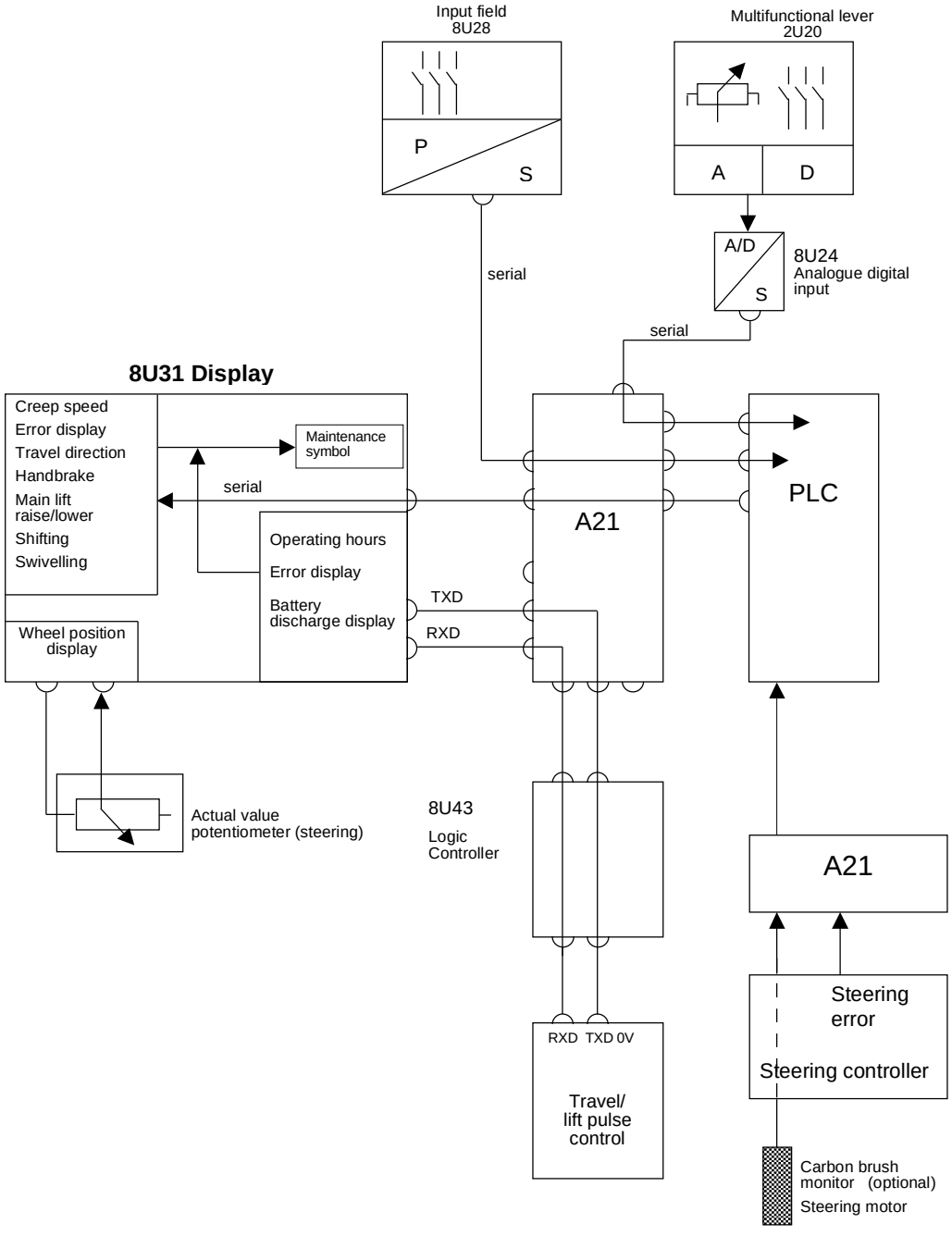
f = length of plate



Modules

Display board 8U31

Block diagram (Informants for visual messages on the display)

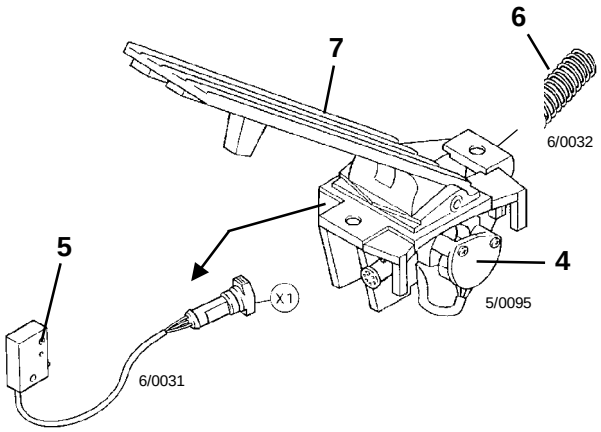


Travel transducer

Id. no. W8 415 984 (complete)

When the pedal is depressed, the travel transducer generates the travel setpoint, which is sent directly to the travel control system. Releasing the pedal also initiates a generator braking process.
The basic components of the travel transducer are:

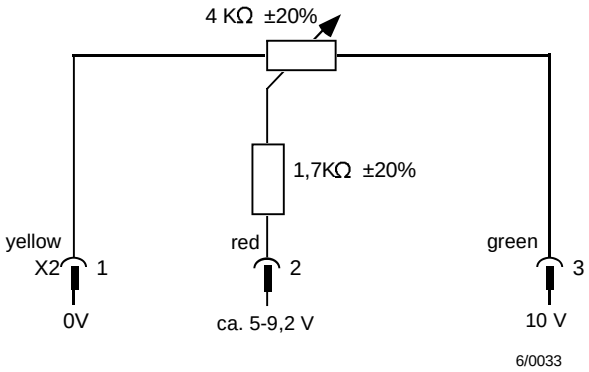
- Potentiometer for setpoint generation (4),
- Microswitch (Id. no. W8 405 571) for home position control (5),
- Pedal return spring (6), Id. no. W8 416 801,
- Actuator pedal (7).



When the travel transducer is inactive, the setpoint is approx. 5 V and the affixed microswitch is not switched. If the pedal is depressed slightly, the switch switches a 24 volt signal via the 3K11 to enable travel at the travel and pump control system.

When the pedal is depressed as far as it will go, the setpoint is approx. 9,2 V.

Potentiometer assembly



Measured values

Potentiometer installed and adjusted (resistance values vary according to the tolerance levels):

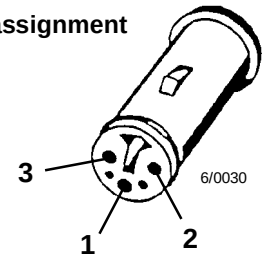
Terminal X2	Resistance level
1 - 3	3.75 KΩ
1 - 2	3.59 KΩ - 5.16 KΩ
2 - 3	3.52 KΩ - 1.96 KΩ

Potentiometer removed:

Terminal X2	Resistance level
1 - 3	3.75 KΩ
1 - 2	1.61 KΩ - 5.35 KΩ
2 - 3	5.35 KΩ - 1.61 KΩ

Permissible temperature range: -40°C to +125°C

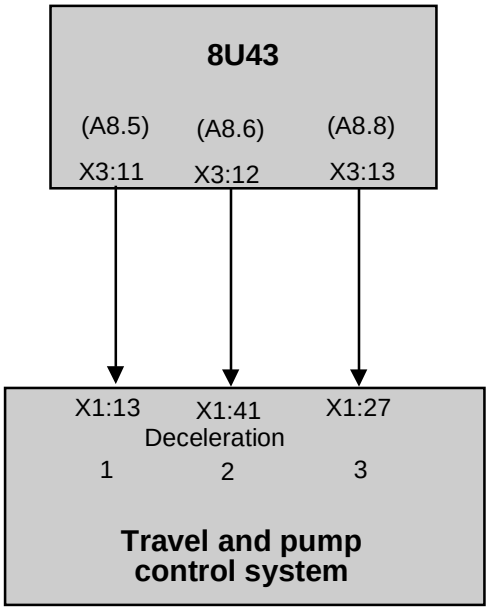
Pin assignment



Continued on sheet no. M 59

Continued
Travel and pump control system

Deceleration 1, 2 and 3



Irrespective of the height-related speed limitation there are situations which call for **deceleration**:
- Automatic braking at end of aisle,
- Fork not in the vehicle contour,
- End of rail travel and 0.5m switch actuated,

or braking to a **standstill**:

- Aisle travel selected but not yet acknowledged,
- Absolute stop.

The PLC sets the relevant output for deceleration via module 8U43 as appropriate for the situation. The speeds for deceleration are set in the travel and pump control system.

Deceleration 1: 0 km/h
Deceleration 2: 2.5 km/h
Deceleration 3: 1 km/h

Typical adjustment values for deceleration

	min. value	typical value	max. value	Address
Deceleration 1	0 km/h	0 km/h	2.5 km/h	VRED1
Deceleration 2	2 km/h	2.5 km/h	3 km/h	VRED2
Deceleration 3	0 km/h	1 km/h	2.0km/h	VRED3

These types of deceleration actuate a defined braking torque until the vehicle reaches the required speed.
The signal logic is designed to be resistant to cable breakage, i.e in the event of cable breakage, the relevant deceleration type is active.
If no deceleration type is selected, 24V are applied to all 3 inputs.

Continued

PSION - preparation for programming the FPS

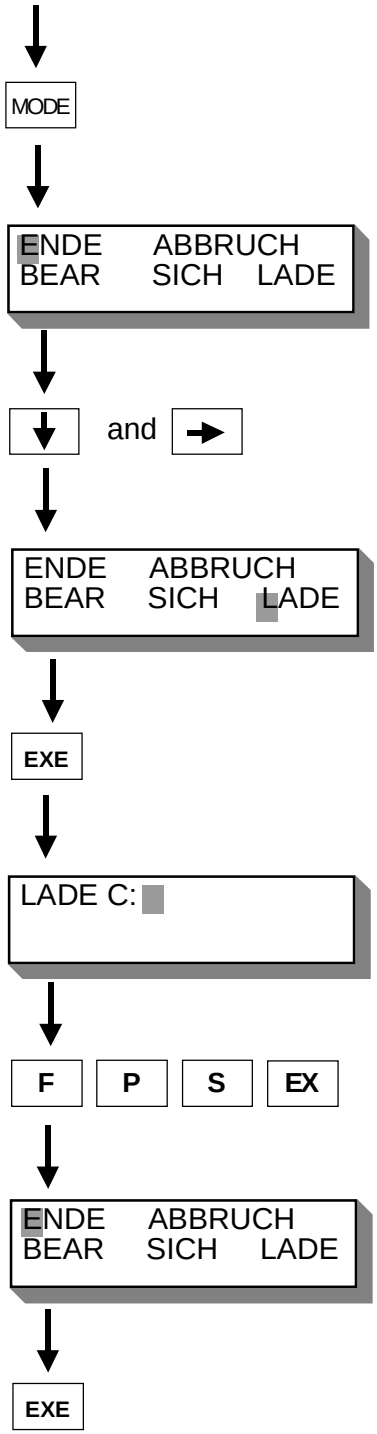
Adjust the interface parameters (see the section entitled "**PSION - programming the FPS**", M176)

Call the "**LADE**" menu:

Remark: If "**SICH A:**" appears, press the **MODE** - key once.

Enter a file name (see the section entitled "**PSION - programming the FPS**", M176):

Confirm the end.



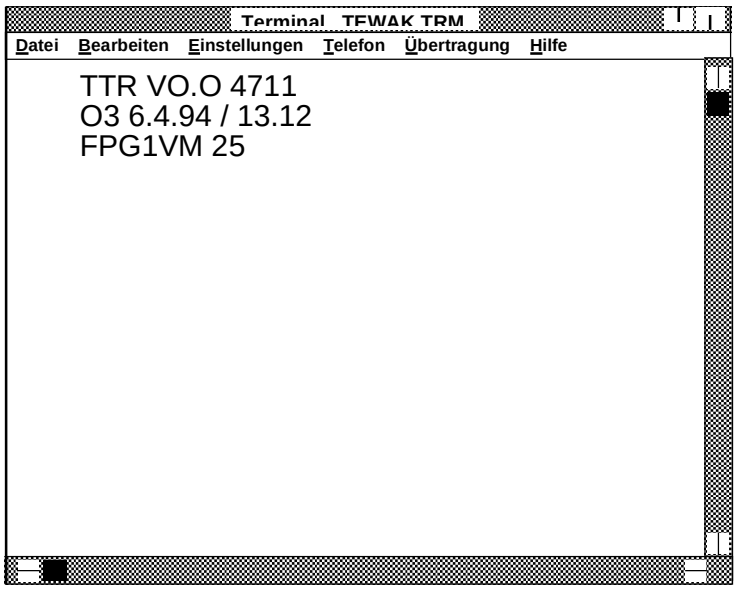
Notebook (MS DOS) - programming /setting parameters in the FPS

Reading out travel parameters FPG1VM

Enter parameter FPG1VM.

F P G 1 V M ↵

The parameter for travel profile v = 2.5km/h is set to 25.



Changing parameter FPG1VM

Enter a new parameter value (e.g. 20).

/ (Shift "7")

F P G 1 V M =

2 0

Continue

Notebook (WIN95) - programming the FPS

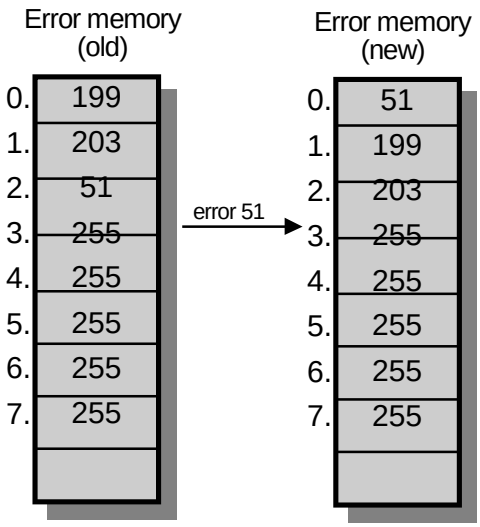
Overview of the parameter settings for the terminal program:

- Bits per second	:	2400
- Data bits	:	8
- Parity	:	none
- Stop bits	:	1
- Protocol	:	none
- Reception buffer	:	high
- Transmission buffer	:	high
- Emulation	:	automatic identification
- Assignment of the function, arrow and control keys	:	terminal
- Connect via	:	direct connection via COM1
- Use FIFO buffer	:	active
- On reception, add line feed at line end	:	active

Continued

Travel and pump control system

Error memory



All errors in the configuration table are stored in the error memories in the order in which they occur. The error memories store the last 8 errors. The error stored under position 0 (ERR-0) is the most recent error and that at position 7 (ERR-7) is the oldest. Each error is only entered once in the list. If an error which has already been entered occurs again, it is written in position 0 and the old entry is deleted. In an error-free status, the error memory contains the no. 255.

This memory can be read out with the PSION or notebook.

Enter: **E** **R** **R** **O** **EXE**

Output:

E R R - O = 2 0 3

Error 203: carbon brush error in travel motor, emergency operation

Deleting the error memory

If you wish to delete the 8 stored errors, proceed as follows:

Enter: **E** **C** **L** **=** **1** **EXE**

The content of the memory is deleted.

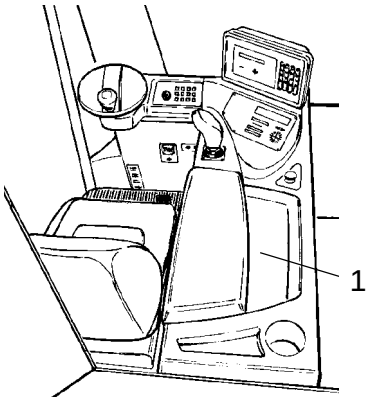
Enter: **E** **C** **L** **=** **O** **EXE**

The value 255 is now entered in the error list under all 8 memory entries ("255" means no error has occurred).

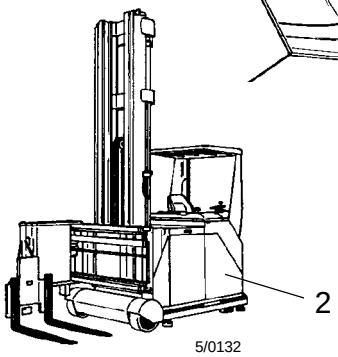
Pump motor

Removing the pump unit

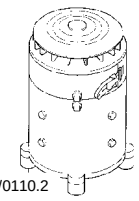
1. Pull out the battery plug.
2. Remove covers (1) and (2).
3. Remove the fan impeller cover (3).
4. Remove the fan impeller (4).
5. Mark the motor connections (5) and disconnect them.
6. Draw out the hydraulic fluid with a pump, Id. no. W8 412 061 (see sheet no. N25).
7. Spread out absorbent cloths underneath the pump unit.
8. Remove the angled flange socket (6) complete with the hydraulic hose.
9. Unscrew the hydraulic hose (7).



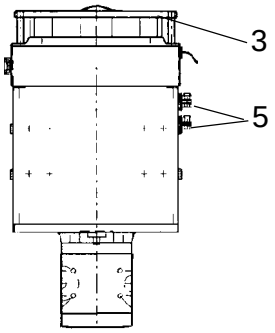
6/0586



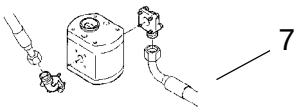
5/0132



6/0110.2



6/0584



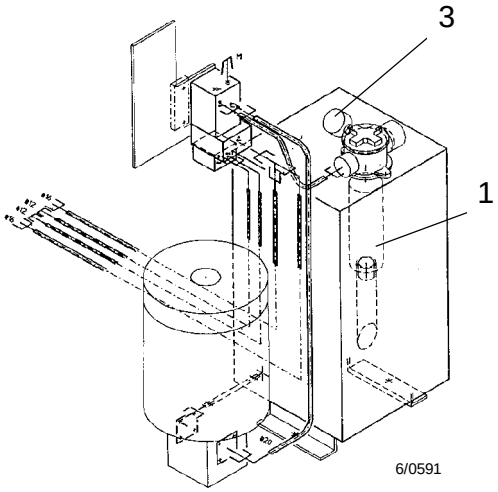
6/0110.1

Runback filter with manometer

Id. no. W8 412 848

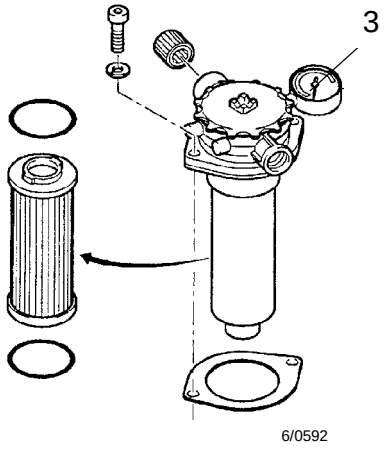
General

The runback filter (1) serves the purpose of filtering the oil that runs back into the tank through the filter cartridge (2). This ensures that the useable life of the hydraulic oil is kept to a maximum. The frequency with which the filter cartridge needs changing depends on how much the vehicle is used.
A manometer (3) is fitted to the runback-filter housing.
The manometer (3, green/red area) indicates the banking-up pressure in the filter caused by the oil flowing back as the mast is lowered.



The more soiled the filter cartridge becomes, the more the pressure rises in the manometer (can be seen best during a lowering movement).

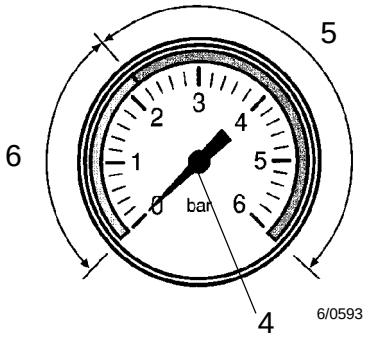
The filter cartridge must be replaced when the pointer (4) enters the red area (5) of the manometer during a lowering movement.
As long as the pointer remains in the green area (6), the filter cartridge does not need replacing.



Remark:

1) The hydraulic oil must be at operating temperature (warmed up) for checking the condition of the filter on the manometer display. If the oil is cold, the reading may be inaccurate.

2) If the hydraulic filter is not replaced when it is soiled, the hydrualic oil flows back into the tank unfiltered through a bypass valve.



Continued

Pipe unions / hose unions

Mounting the sealing taper union

Unions with sealing tapers are used when hydraulic hoses are connected at the HMC-33 lift module (see sheet no. N10) and at the SWR directional valve block (see sheet no. N17).
As the structure of the union is different (O-ring seal), different mounting regulations apply in this case:

- Oil the O-ring seal.
- Insert the sealing taper in the cone of the union spigot.
- Close the union nut manually and tighten using the torque specified in the table below:

Pipe connection	Tightening torque in Nm
6 - L	20
8 - L	30
10 - L	40
12 - L	45
15 - L	60
18 - L	90
22 - L	120
28 - L	140
6 - S	25
8 - S	40
10 - S	50
12 - S	60
14 - S	75
16 - S	80
20 - S	120
25 - S	170

Remark: The designation of the pipe connection size (e.g. 6L, 12s) is embossed in the face side of the union.

L = Standard union pipe
S = Heavy-duty pipe union
12 = Outside diameter of pipe

Continued on sheet no. N35

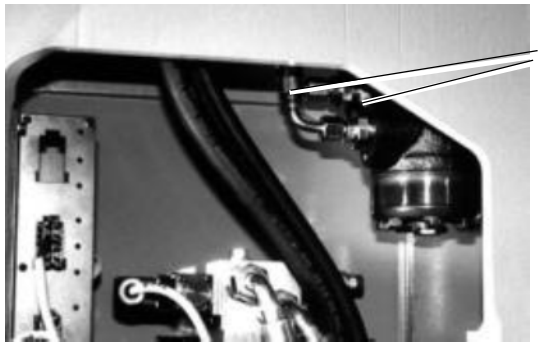
Swivel shift fork

Removing the swivel shift fork

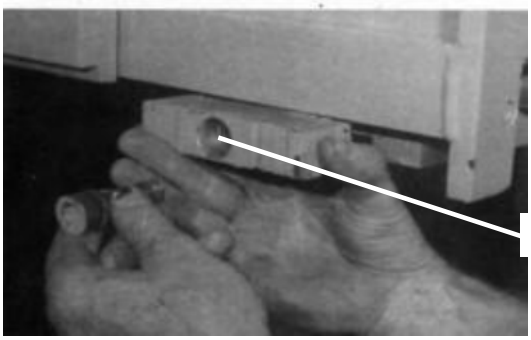
10. Release the hydraulic connections at the hydraulic motor (1) and wrap absorbent cloths round them.

11. Remove the stop buffer (2).

12. Push the swivel shift fork to the left and out of the toothed racks.



6-0116



6-0134

To **mount** the swivel shift foks, follow the instructions above in reverse order.

Remark: For instructions on how to adjust the rollers, see sheet no. T6

Seat adjuster

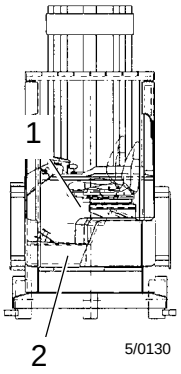
Removing the spindle motor (8)

1. Remove the covers (1, 2 + 3).
2. Raise the seat slightly with the adjuster.
3. Support the floor plate securely from below (4).
4. Remove the connection cable (5).

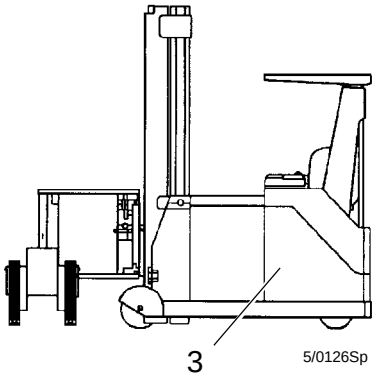
Remark: Because the spindle motor connection cable is particlarly long (standard length) we recommend that you cut the connecting cable in the middle. When the new spindle motor is then installed, professional insulated cable lugs can then be attached. The two cut cable ends can then be reconnected.

5. Remove the 2 screws (6/7).
6. Remove the spindle motor.

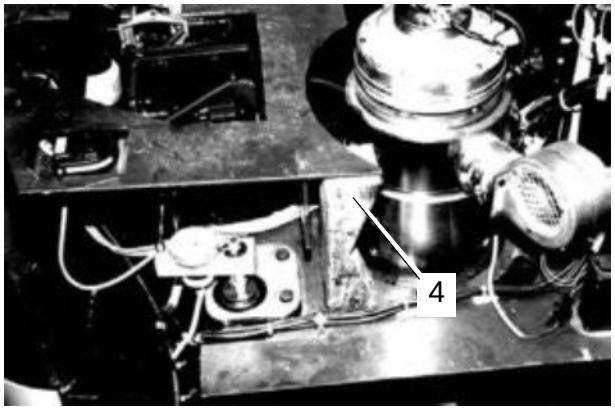
To replace the spindle motor, follow the instructions above in reverse order. During installation, also note the instructions on sheet no. U 10).



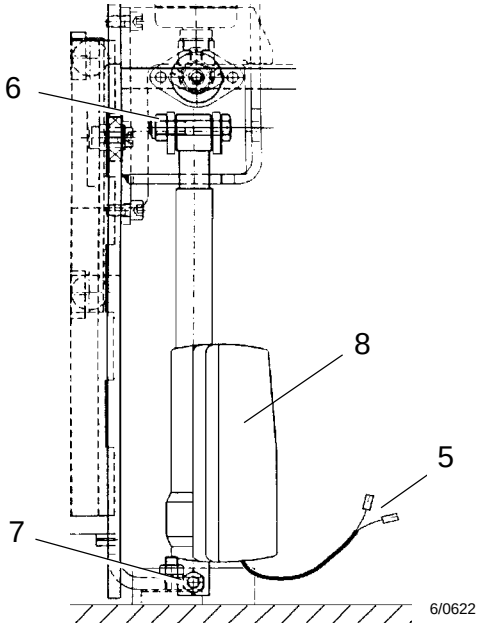
5/0130



5/0126Sp



6-0115



6/0622

PLC input operands

The channel can be selected with S300 (see M7).
*As of appr. 1/97, switch height has been changed to 6000 mm

Conn-ector	LED	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Parallel & counter inputs
	16	Toggle bit	Toggle bit	Toggle bit	Toggle bit	Toggle bit	Toggle bit	Toggle bit	Toggle bit	E9.8 Geber-5
X5:6 X5:5 +	15	E2.7 Fachabt.L.	E4.7	E6.7 4000mm-2	E7.7 Heb=Li	E11.7	E12.7	EW2.1	E8.7	E9.7 Not-Aus
X5:4 X5:3 +	14	E2.6 Fachabt.R.	E4.6	E6.6 8000mm-2 *6000mm-2	E7.6 Schub	E11.6 Battkontr	E12.6 Hubg.Red	EW2.1	E8.6	E9.6 SE.PA-i.O.
X5:2 X5:1 +	13	E2.5 Sch.Mitte	E4.5	E6.5 ZwhubbgrB	E7.5 Dreh	E11.5 Totmann	E12.5 Gabel.Zykl	EW2.1	E8.5	E9.5 Ges.Geb 4
X4:8 X4:7 +	12	E2.4 Red.A.Re	E4.4 Zus.Mit.R	E6.4 Fahrabs.1	E7.4 Senk=Re	E11.4 Auto.LR80	E12.4 Auto.Ein	EW2.1	E8.4	E9.4 Ges.Geb 3
X4:6 X4:5 +	11	E2.3 Red.A.Li	E4.3 Zus.Mit.L	E6.3 Zwhubbgr.A	E7.3 Rück.	E11.3 Redz.LR80	E12.3 Achse.Z	EW2.1	E8.3 Opt. E8.3	E9.3 Ges.Absol
X4:4 X4:3 +	10	E2.2 Freihub-2	E4.2 Zus.End.R	E6.2 500mm-2	E7.2 Vor	E11.2 Schiene2	E12.2 Achse.Y	EW2.1	E8.2 Gab.Ver.R	E9.2 Ges.Geb.2
X4:2 X4:1 +	9	E2.1 Lastsens	E4.1 Zus.End.L	E6.1 500mm-1	E7.1	E11.1 Schiene1	E12.1 Up-Down	EW2.1	E8.1 Gab.Ver.L	E9.1 Ges.Geb.1
X3:8 X3:7 +	8	E1.8 Ra.Dre.Re.	E3.8	E5.8	EW1.2 Soll.Hub	E10.8 8U43 i.O.	EW1.3 Sollw.WPG	EW1.4	M128 Sy.Dre.R	M120 F-Richt 1=vor, 0=rück
X3:6 X3:5 +	7	E1.7 Ra.Dre.Li.	E3.7	E5.7 Freihub-1	EW1.2 Soll.Hub	E10.7 Fußbrems	EW1.3 Soll.WPG	EW1.4	M127 Sy.Dre.L	EW2.4 Inkrem.
X3:4 X3:3 +	6	E1.6 E.Dre.Re.	E3.6	E5.6	EW1.2 Soll.Hub	E10.6 Gabel i.O	EW1.3 Soll.WPG	EW1.4	M126 Vor.Sy.Dr	EW2.4 Inkrem.
X3:2 X3:1 +	5	E1.5 E.Dre.Li.	E3.5	E5.5	EW1.2 Soll.Hub	E10.5 Stell i.O	EW1.3 Soll.WPG	EW1.4	M125 ZW.H.EntA	EW2.4 Inkrem.
X2:8 X2:7 +	4	E1.4 Ra.Sch.Re.	E3.4	E5.4 O.Enh-2	EW1.1	E10.4	EW1.3 Soll.WPG	EW1.4	M124 H-A.LR80	EW2.4 Inkrem.
X2:6 X2:5 +	3	E1.3 Ra.Sch.Li.	E3.3	E5.3 O.Enh-1	EW1.1	E10.3 Gerad.Ist	EW1.3 Soll.WPG	EW1.4	M123 Ges.Entr	EW2.4 Inkrem.
X2:4 X2:3 +	2	E1.2 E.Schi.Re.	E3.2	E5.2 4000mm-1	EW1.1	E10.2 Geradeaus	EW1.3 Soll.WPG	EW1.4	M122 SitzSenk	EW2.4 Inkrem.
X2:2 X2:1 +	1	E1.1 E.Schi.Li.	E3.1	E5.1 8000mm-1 *6000mm-1	EW1.1	E10.1 Lenk-O.K.	EW1.3 Soll.WPG	EW1.4	M121 SitzHeb	EW2.4 Inkrem.
		Attach-ment 8U21	**Attach-ment 8U22**	**Mast 8U23**	**Operat. desk 8U24**	**Chassis 8U25**	**WPG distrib. 8U26**	**not used**	**Operat. desk 8U28**	

Changing the parameters

What to do if data is lost during a battery change or if the battery discharges

When the battery is changed or in the event that the battery becomes discharged, the appliance will be left without a power supply for a certain amount of time.

As a result:

1. The programmed calendar and time are lost. The result of this is that the data will be incorrect on the EPSON printer printouts, which is likely to cause confusion.

2. It is no longer possible to run the WAPST program. The PLC parameters cannot be accessed unless the WAPST cue is displayed.

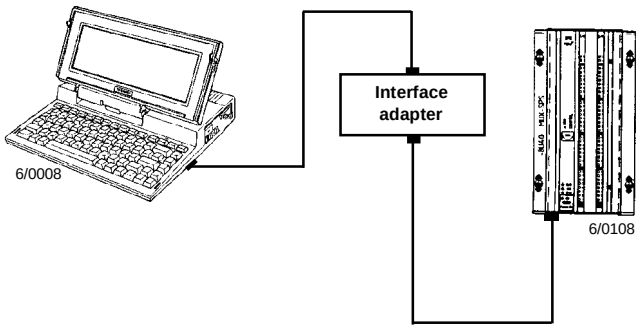
In order to avoid this kind of confusion, these features can be set up again and updated. This procedure is optional for the data and time, but it is essential to reinsert the WAPST cue. For instructions, please refer to sheet no. V 15.

Changing parameters in the PLC with a Notebook

Parameter modifications and troubleshoting can be carried out with either the PSION manual programming unit or with a Notebook. Information about how to use a Notebook for this work is provided on the following pages.

For this work you will need a Notebook, an interface adapter, Id. no. W8 406 464, and an PLC MUX installation diskette, Id. no. W8 406 810.

- Connect the notebook to the PLC via the interface adapter.
- Start the vehicle.
- Switch on the notebook.



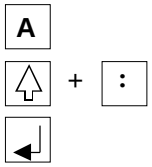
You will now see:

```
HIMEM testet den erweiterten Speicher...beendet.


SystemSoft Socket Services 2.1 Vadem Version 1.05 (2188-08)
Copyright 1993-1994 SystemSoft Corporation. All Rights Reserved

SystemSoft Card Services 2.1 Version 2.06 (2036-09)
Copyright 1993-1994 SystemSoft Corporation. All Rights Reserved.

SystemSoft Plug-N-Play Card Services Allocation Utility Version 3.01 (2137-13)
Copyright 1993-1994 SystemSoft Corporation. All Rights Reserved.

SystemSoft CardID Version 1.03 (2082-12)
Copyright 1993-1994 SystemSoft Corporation. All Rights Reserved.
SystemSoft CS APM Version 1.03
Copyright 1993-1994 SystemSoft Corp. All Rights Reserved
Maustreiber - Version 6.44       Standard-Version
Copyright (C) 1984, 1994  Logitech S.A. Alle Rechte vorbehalten.

Lese die Initialisierungsdatei MOUSEDRV.INI...
Suche eine Maus...
 PS/2-Maus gefunden.
Angeschlossen an EGA/VGA.
Maustreiber installiert.
C:\>
```

6/0290

- Insert the PLC MUX diskette in drive A of the Notebook

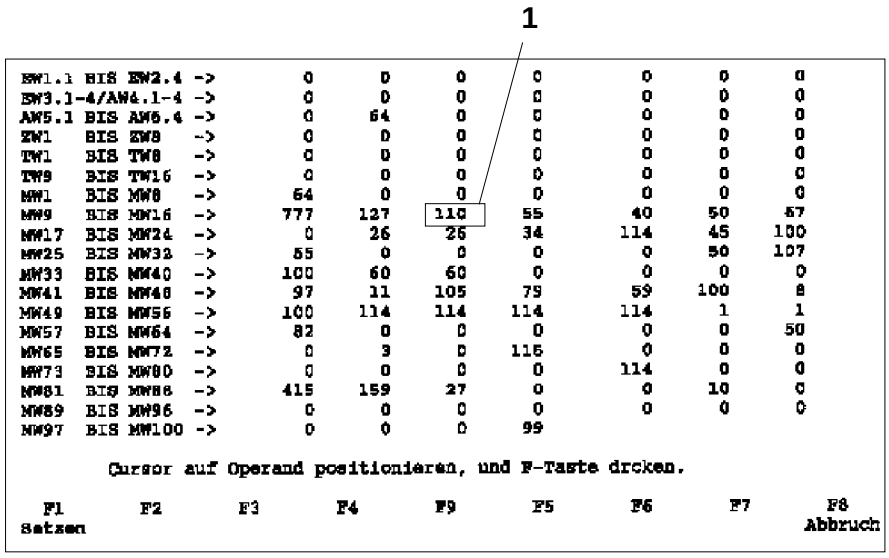
Enter:



Continued

Changing parameters in the PLC with a Notebook

You will now see:



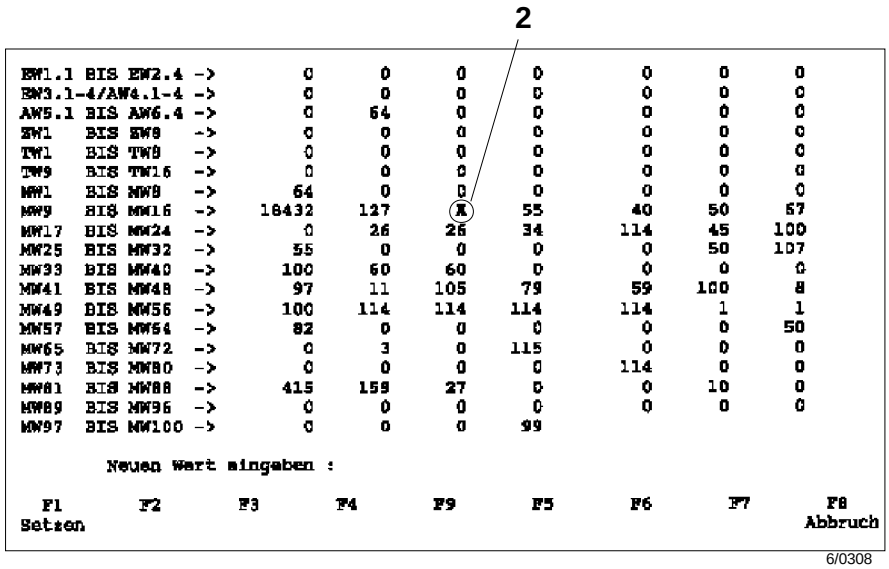
6/0307

- Move the cursor onto the marker word (MW) you wish to change and press

F1

Example: No. 1 is MW11.
The value of MW11 is constant 110.

You will now see:



6/0308

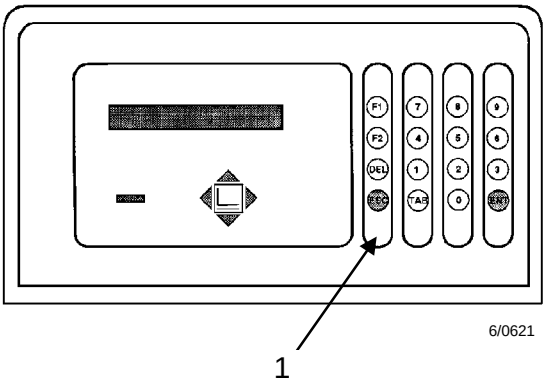
Enter: **1** **2** **2** ↵

Example

The position of the cursor is indicated with an X (no. 2).

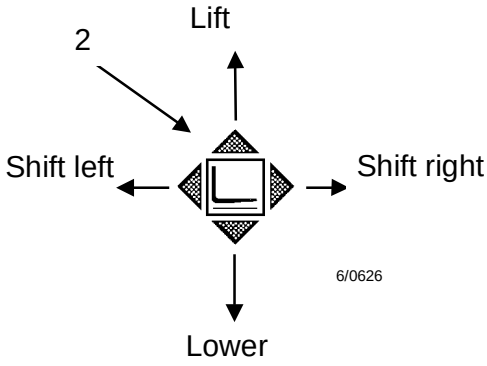
WPG 7

Operating principle



In programming mode, the lift heights of the various shelf levels in the aisle racks are allocated shelf numbers, usually in consecutive order. The lift heights are stored in a semiconductor memory as setpoints.

If a shelf number is then selected on the keypad (1) and the multifunctional lever actuated, the proportional valve is triggered and the load carriage moves. The electronic system in the WPG now begins a continuous comparison of the actual value for the fork position and the desired setpoint.

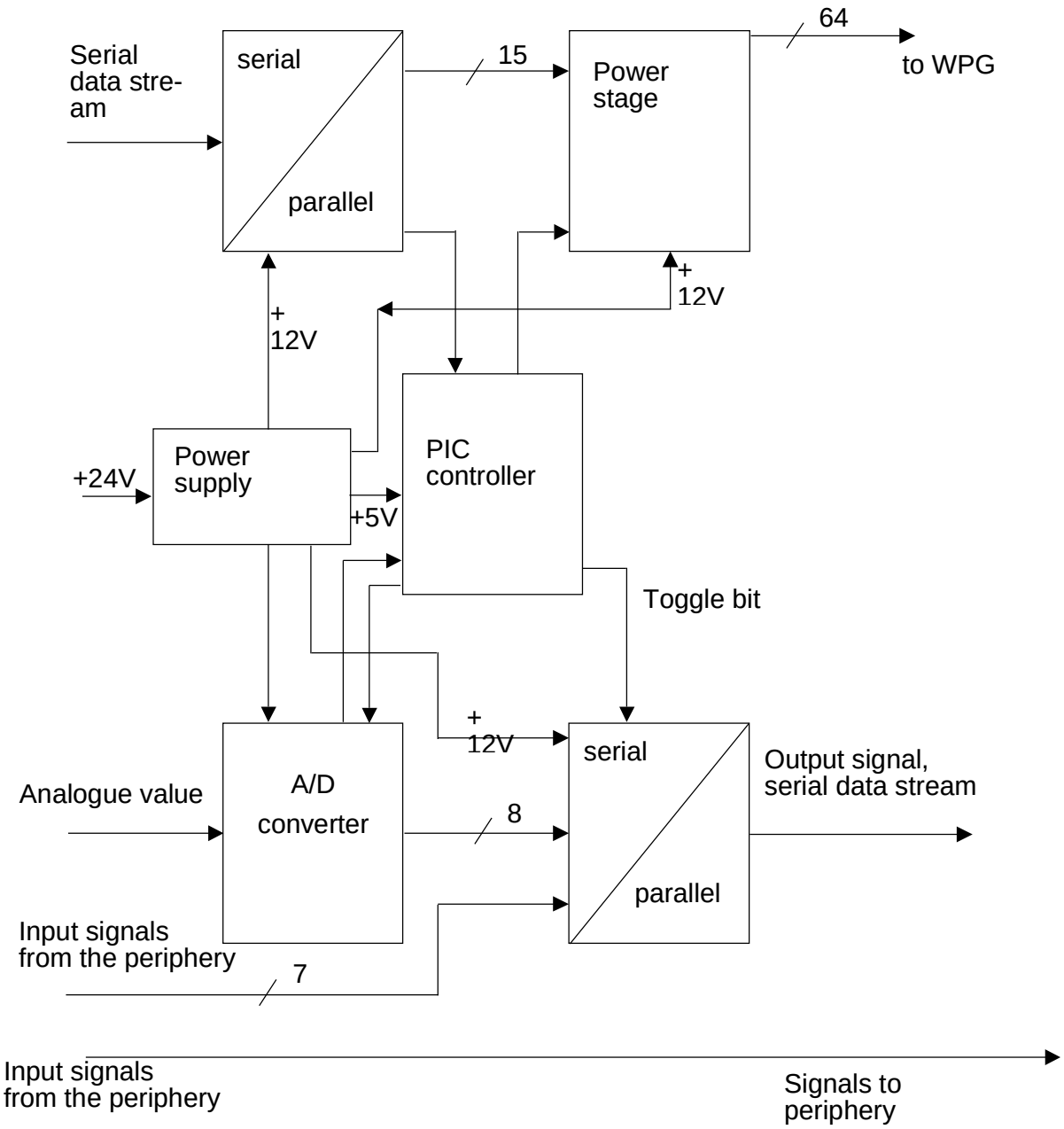


Shortly before the set lift height is reached, the oil flow is throttled and then stopped. The operator is informed of this by an acoustic signal. The lift is now switched off.

Every directional movement which is to be carried out is shown on the display (2). The fork is now at the correct shelf level. The swivel shift fork or telescopic fork can now be moved out to remove a pallet from the shelf or to insert one. A distance measurement is also made here with a second pulse generator. (Fork cycle option) the horizontal control works on the same principle as the vertical control.

WPG 7

Block diagram



WPG 7

Programming mode (see also adjusting chart on sheet no. W 34)

If the "programming mode" menu point is selected from the menu, the programming mode can be called by entering the correct code.

The red LED (in the front panel) lights up and the WPG 7 prompts the user to carry out a reference run.

Once the reference run has been successfully completed, the appliance automatically enters the next menu level down. You can now select either **Vertikal** (Vertical), **Funktionstasten** (Function keys), or **Ausschub** (Extend).

* **Vertikal (Vertical)**

The following points are available in the menu under the **Vertikal (Vertical)** option:

- PROG. MAX LEVEL
- PROG. HEIGHT
- HEIGHT DISPLAY
- STAND. FREE LIFT
- INDIVID. FREELIFT
- ZONES LIMITS
- FULL FREE LIFT
- SLOPE LIFT CHANG.

If you wish to select one of these points, use the **ENT** key. Changes can be made to the displayed values with the **DEL** key.

The first time the **DEL** key is pressed, the cursor begins to flash and the value displayed can be overwritten. If the **DEL** key is pressed again, the entire contents of the output field are deleted, and the cursor is positioned at the start of the input field.

Continued on sheet no. W16

WPG 7

Description of the menus and how to use them

Parameters for destination targeting

The parameters for targeting are only effective in direct proximity to the target point, in other words, when the control system for the proportional valve has lowered its ramp and the axle has not yet stopped at its destination.

The following parameters are available:

Pos.accura

Target speed

Motion read

Gain

Integrat. step

The meanings of these parameters are explained in the description of the parameters.

There may be several reasons for an axle not reaching its destination, for example:

- The axle rocks to and fro at its destination

  → either the **Gain** is too high or the **Valve offset** too large

- When the axle stops, it is not within the positioning accuracy range

  → **Target speed** is too high or **Motion read** is too low

- The axle moves to its target too slowly

  → **Integrated step** too small

WPG 7

Detailed description of errors

Error message	Cause of error	Solution
Division by 0	Division by zero has taken place, Hardware error	Parameters invalic. If this error message appears once, replace the program and/or T-CPU
Interrupt	Hardware error, incorrect interrupt vector	If this error message appears, several times, replace the program and/or T-CPU
Interrupt 8259	Hardware error, incorrect interrupt vector	If this error message appears, several times, replace the program and/or T-CPU
Shaft not OK Y	Signal flow	Check the axle-OK signal
	The fork is not in its home position during travel	Check fork position
Drag distance Y wrong direction	Main lift does not move or moves in the WPG 7 and up/down direction signal	Check the analogue signal from
Pin pointing Y	Main lift does not reach its destination due to incorrect parameter programming, mechanical jamming or soiling in the hydraulic system	Check the parameter settings, ensure the main lift runs easily and check the hydraulic system to ensure it is correctly adjusted and that there is no soiling or leakage.
Command not possible Y	current controller status or reference marker Drive command entered is not possible in the is not set.	Conduct a reference run
Initialisation error Y	Error during controller initialisation for main lift caused by invalid parameter for main lift	Check the parameter setting
Correction value Y	Acceptance of the actual value at the reference point for the main lift gives too great a correction value.	Check the reference point switch, check the position sensing system
Axle not ok Z	(Axle not OK Z). Signal flow	Check the axle-OK signal
Drag distance Z	The fork does not move or moves in the wrong direction	Check the analogue signal and up/down direction signal
Destination targeting Z	Fork does not reach its destination due to incorrect parameter programming, mechanical jamming or soiling in the hydraulic system	Check the parameter settings, ensure the fork runs easily and check the hydraulic system to ensure it is correctly adjusted and that there is no soiling or leakage.
Command not possible Z	Drive command entered is not possible in the current controller status or reference marker is not set.	Conduct a reference run
Initialisation error Z	Error during controller initialisation for fork caused by invalid parameter for shift function	Check the parameter setting
Correction value Z	Acceptance of the actual value at the ref. pt. for the fork gives too great a correction value	Check the reference point switch, check the position sensing system

Stromflußdarstellung

The following display appears:

INTER CONTROL MUX-Master Progr.-Gert Version 1.5D Serien-Nummer 330001

Datum/Index	Name	Projekt	Firma	Teile-Nr.
26.06.96	Mustermann	GX13 Ablauf	Muster	GX13 B00
61292C02	18:03 Uhr	Musterfabrik	Foerdertechn	61292C02

F1 Programmieren / Editor
F2 Baustein - Menue
F3 Ausdruck - Menue
F4 SPS Online Funktionen - Menue

F7 Kopf editieren und CPU konfigurieren
F8 Projekt waehlen, Formatieren, Kopieren - Menue

F1	F2	F3	F4	F9	F5	F6	F7	F8
Editor	Baustein	Ausdruck	Online	DOS			K Edit	P-Menue

Enter: F4

The following display appears:

INTER CONTROL MUX-Master Progr.-Gert Version 1.5D Serien-Nummer 330001

Datum/Index	Name	Projekt	Firma	Teile-Nr.
26.06.96	Mustermann	GX13 Ablauf	Muster	GX13 B00
61292C02	18:03 Uhr	Musterfabrik	Foerdertechn	61292C02

F1 Compilieren - Laden - Starten
F2 Stromfluss-Darstellung
F3 SPS - Monitor
F4 SPS Betriebsstatus Anzeige

F5 SPS Variablenzustandsanzeige

F8 Hauptmenue

F1	F2	F3	F4	F9	F5	F6	F7	F8
Compiler	Stromfl.	Monitor	Status		Zustand			Menue

Enter: F2

Display: Line number? The relevant line number (address) is taken from the Querverweisliste (see sheet Z6.5).

Enter: 5, 1, 4, ↵ Example

PLC output operands

Truth table, reverse travel - V_{max}

Shown with S 301

Remark: Only for vehicles until combined travel and lift pulse control system software-version 96010.

	LED	CHANN. 1	CHANN. 2	CHANN. 3	CHANN. 4	CHANN. 5	CHANN. 6	CHANN. 7	CHANN. 8
	16	Toggle bit	Toggle bit	Toggle bit	Toggle bit	Toggle bit	Toggle bit	Toggle bit	Toggle bit
Output Operand	**15**								
Output Operand	**14**				**A4.6** Operating hrs.				
Output Operand	**13**				**A4.5** Enable brake				
Output Operand	**12**								
Output Operand	**11**								
Output Operand	**10**								
Output Operand	**9**								

Output Operand	**8**								
Output Operand	**7**				**A8.7** Magnetic brake				
Output Operand	**6**				**A8.6** Speed 2				
Output Operand	**5**				**A8.5** Speed 1				
Output Operand	**4**			**A7.4** Flash	**A8.4** Speed 0				
Output Operand	**3**								
Output Operand	**2**				**A8.2** Reverse				
Output Operand	**1**								
		Display **8U31**	**Attach-ment** **8U32**	**Chassis Valves** **8U33**	**Lift and travel pulse control** **8U43**				

PLC output operands

Truth table, reverse travel - V6.5 km/h

Shown with S 301

Remark: Only for vehicles from combined travel and lift pulse control system software-version 96010 on.

	LED	CHANN. 1	CHANN. 2	CHANN. 3	CHANN. 4	CHANN. 5	CHANN. 6	CHANN. 7	CHANN. 8
	16	Toggle bit	Toggle bit	Toggle bit	Toggle bit	Toggle bit	Toggle bit	Toggle bit	Toggle bit
Output Operand	**15**								
Output Operand	**14**				**A4.6** Operating hrs.				
Output Operand	**13**				**A4.5** handbrake				
Output Operand	**12**								
Output Operand	**11**				**A4.3** Steering lock				
Output Operand	**10**								
Output Operand	**9**								
Output Operand	**8**								
Output Operand	**7**				**A8.7** Magnetic brake				
Output Operand	**6**								
Output Operand	**5**								
Output Operand	**4**			**A7.4** Flash	**A8.4** Speed 1				
Output Operand	**3**								
Output Operand	**2**				**A8.2** Reverse				
Output Operand	**1**								
		Display **8U31**	**Attach-ment** **8U32**	**Chassis Valves** **8U33**	**Lift and travel pulse control** **8U43**				