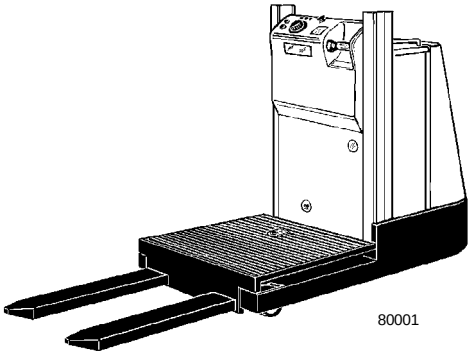
Workshop Manual EK10



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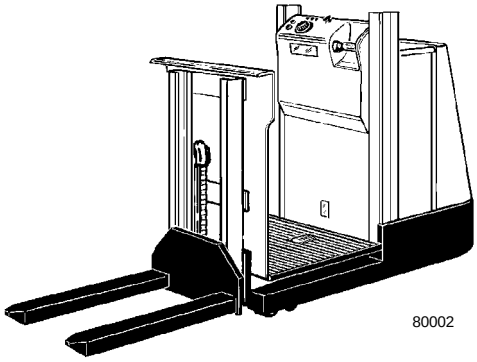

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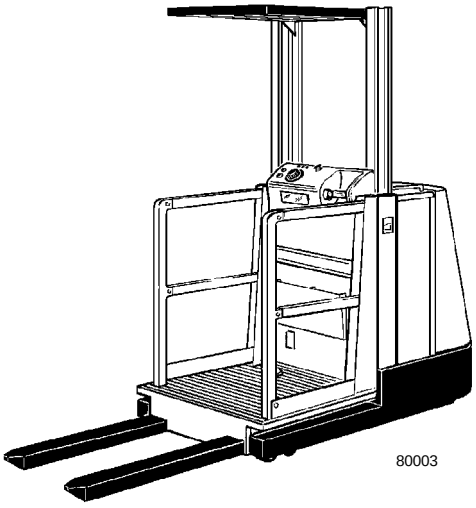

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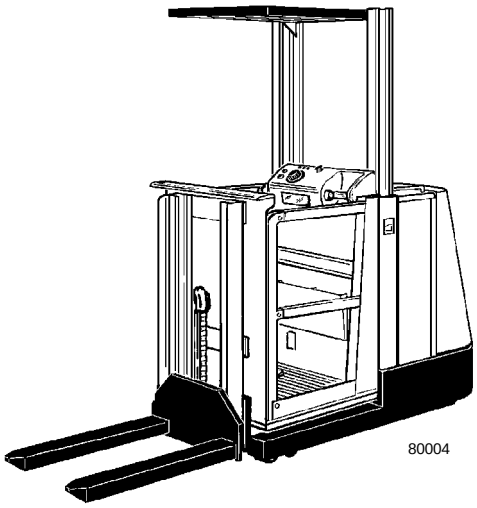

80004

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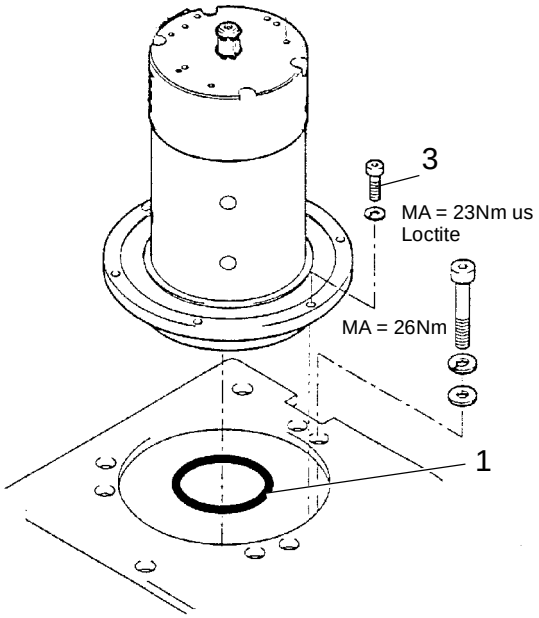
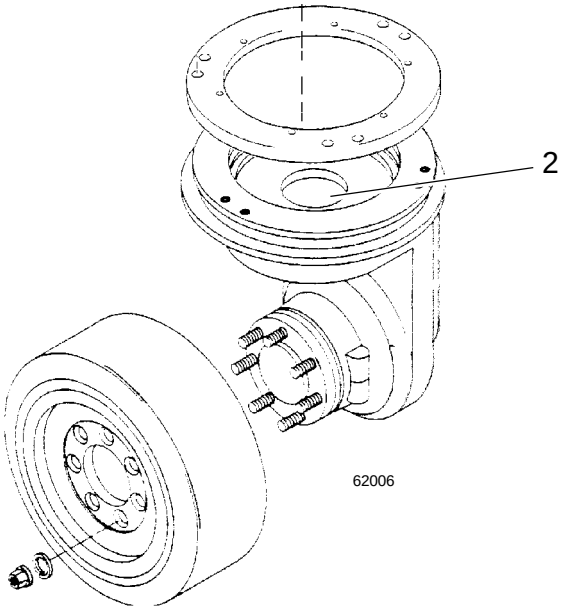
Installation

To install the travel motor, follow the instructions for removal in reverse order.
It can be installed without the use of any special tools.

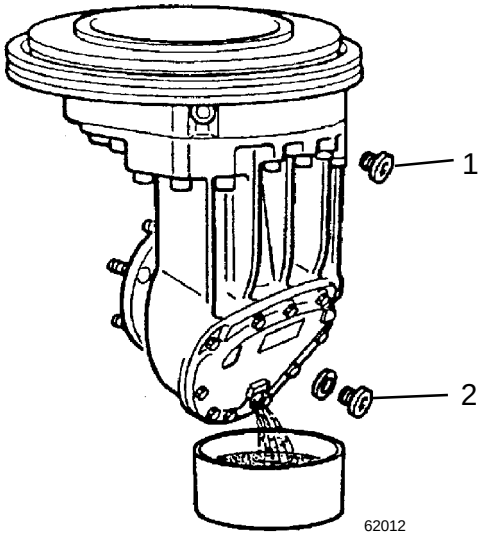
Note: Only use screws of the prescribed length, otherwise the four-point bearing may be damaged!

Remark: Screw in and tighten the 8 screws (3) diagonally in several passes.





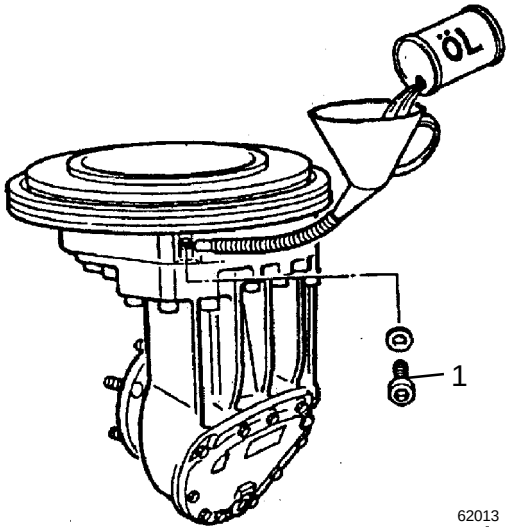
Oil change method



- Turn the steering anti-clockwise until the oil drainage screw is easily accessible (2).
- Position an oil catchment vessel with a volume of at least 2.5l under the oil drainage screw (3) of the gear.
- Unscrew the oil filler cap (2) with a hexagon socket screw key (size 6).
- Unscrew the oil drainage screw (3) with the hexagon socket screw key (size 6) and drain off the oil.

Caution: Risk of burning!

The oil temperature can reach up to 80°C when the vehicle is in operation.



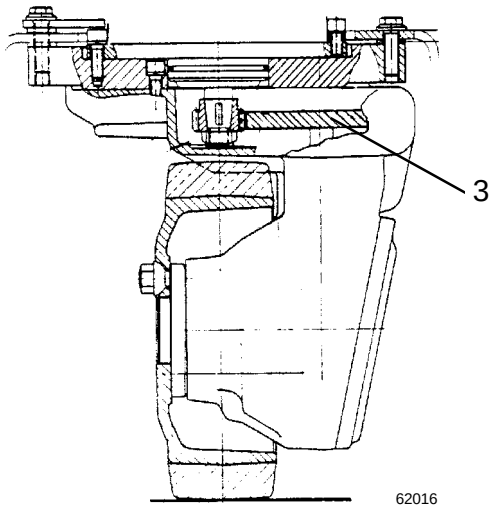
- Clean the magnet on the oil drainage screw (3) and screw it back in with a new sealing ring.

Note: Tightening torque for oil filler cap (1) and drainage screw (3) M_A= 22Nm.

- Fill with new gear oil up to the lower edge of the filler hole.

Remark: The gear oil can also be filled up or checked through the upper gear opening (travel motor removed.

The oi level is correct, when the spur wheel (5) is immersed in the oil by about 1/3 of its height.

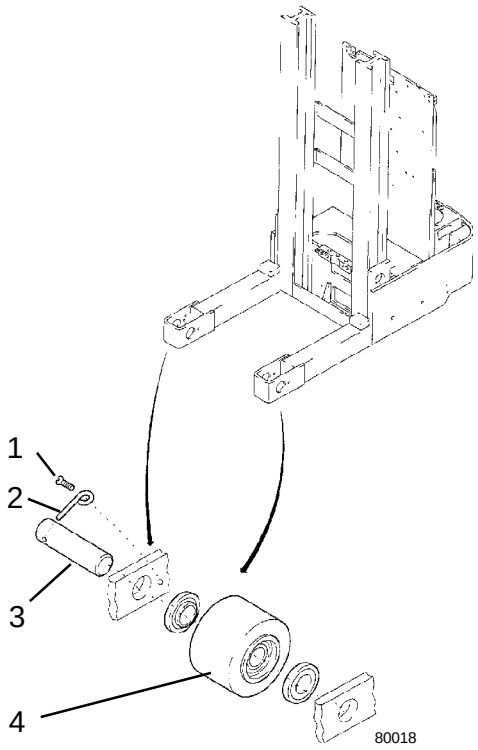


- Screw the oil filler cap (1) back in.

General

Dimensions when new: Ø 150 x 100mm
The idling wheels must be replaced when

- the surface is deeply pitted or out of round or is cracked
- the tyre diameter has decreased by 10% (minimum permissible tyre diameter 135mm).



Removal

- Bring the support carriage or cab to a lift height at which the idling rollers are easily accessible.
- Support the support carriage or cab safely from below to prevent it falling.
- Jack up the vehicle and support it safely from below.
- Unscrew the screw (1).
- Pull out the safety pin (2).
- Push out the bolts (3).
- Remove the idling wheel (4).

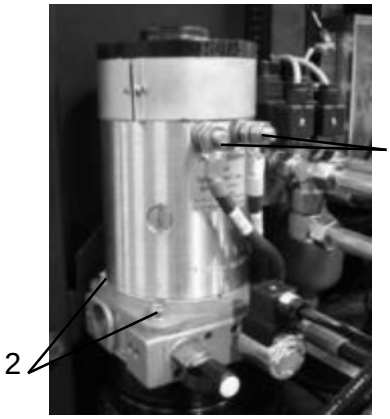
Remark: To reinstall the wheel, follow the instructions above in reverse order.

Pump unit

Removing the pump motor (HO, HM)

1. Pull out the battery plug .
2. Disconnect the connecting cable (1) at the motor (mark the cable).
3. Remove the 3 hexagon socket screws (2).
4. Carefully remove the motor.

To install the pump motor, follow the instructions above in reverse order, taking into account the following points:



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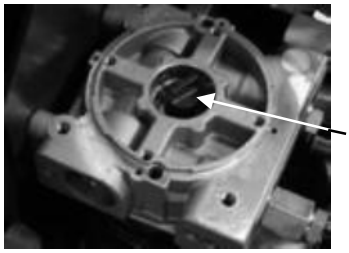
1. The connections must face towards the front.
2. The motor shaft (3) must be pushed correctly onto the cross coupling (4).



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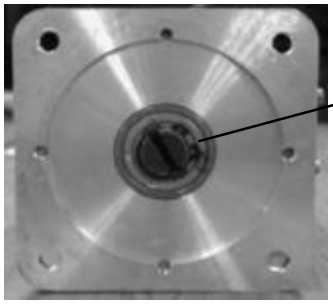

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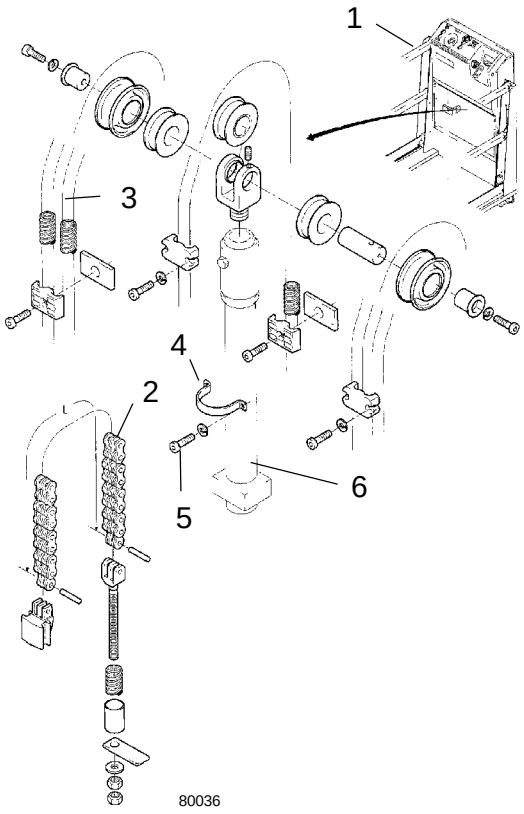
Main lift cylinder on HO/HM

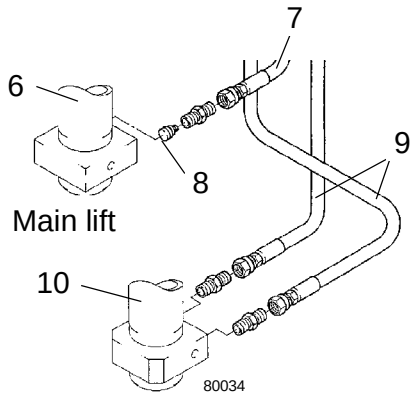
Removal

1. Remove the cab (1).
2. Remove the main lift chains (2).
3. Remove the trailing cable (3) from the guide rollers.
4. Lower the main lift cylinder (6).
5. Take off the (4) by removing the 2 cheese-head screws M10x12 (5).
6. Remove the main lift cylinder (6) from its seat on the chassis.
7. Unscrew the hydraulic hose (7), and seal the cylinder and hose.
8. To reinstall the cylinder, follow the removal instructions in reverse order.

Remark: On vehicles with an additional lift, the hydraulic hoses (9) must be removed from the additional lift cylinder (10). The hoses and cylinders must be sealed with sealing plugs.

Caution: The line break protection (8) is in the pressure connection of the main lift cylinder.





Additional lift

Pin assignment

X1:1 In 0V power supply for the Diagnosisplug of the steering controller.

X1:2 In Supply voltage for releasing the brake.
If no +24V power is applied to X1:2 the brake cannot be released. The ABÜ detects an error. There is a 4.7kΩresistor between 1+24V and X1:2 for the contact testing of the internal safety relay.

X1:3 Out 0V power for switching on the steering contactor 3K.
Is switched when the power supply for the steering controller is applied, setpoint and actual value are in the correct range and there are no internal errors.

X1:4 In Coding Input: 0V and X1:21 (0V): Coding, version with steering wheel (default setting is steering knob, small steering modification)

X1:5 In Travel speed
As long as impulses are received at this input, the steering remains 100% active, even if the deadman switch is released. Without impulses, the anti-walk function is activated when the deadman switch is removed.

X1:6 Out 0V power supply for setpoint and actual value potentiometer

X1:7 In Diagnosis lead for PC

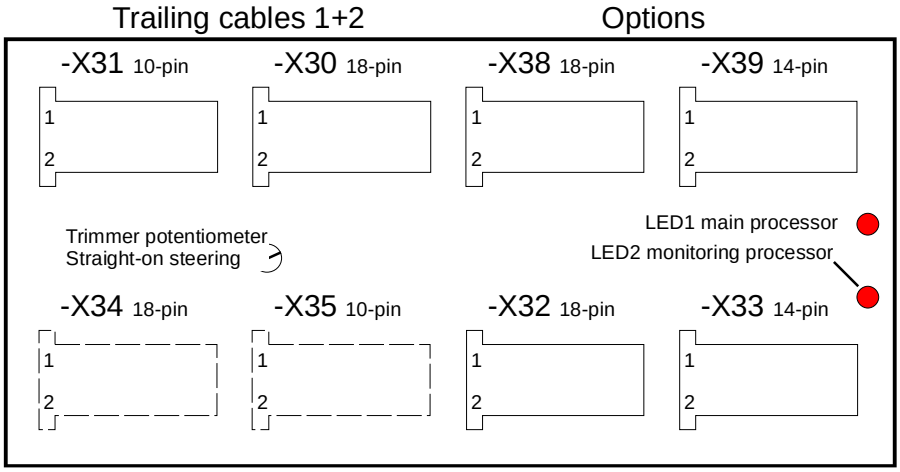
X1:8 Out Positive power supply for setpoint and actual value pot. approx. 9.3V.

X1:9 In Enable steering
As soon as there is a difference between the setpoint and actual value, the steering is activated, even without the enable steering signal. If the deadman switch is released without a setpoint/actual value difference (when the vehicle is at a standstill), the power to the steering amplifier is switched off. In this way, a continuous flow of power caused by twisting of the drive wheel can be prevented when the vehicle is at a standstill. Without a setpoint/actual value difference, the drive wheel can be moved out of the home position by up to 15° by external influences.

X1:10 In Steering actual value 3R10/2
If the voltage is not within a range of 6.5 - 2.5V, K1 and 3K1 drop out (cable breakage fuse).

X1:11Out Steering OK (0V)
If any of the following errors occur, the 0V signal is switched off:
1. Setpoint / actual value potentiometer faulty
2. Undervoltage for setpoint/actual value potentiometer
3. Contact test of internal safety relay negative
4. Internal error

Pin assignment

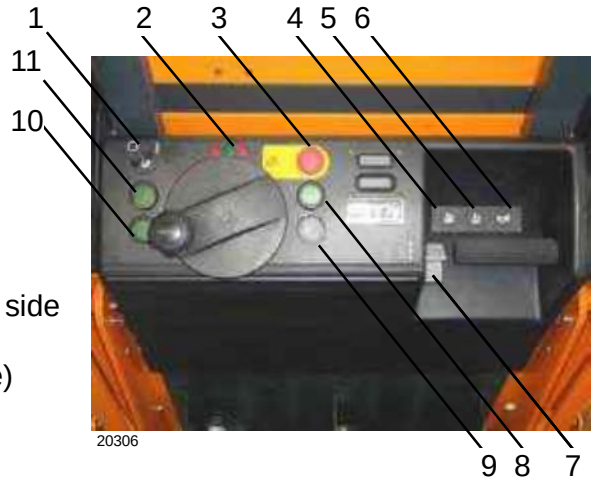


Trailing cables 1and 2

	-X31		-X30	
Pin	FZS1 function	FZS2 function	FZS1 function	FZS2 function
1	0V	0V	ABÜ enable	ABÜ enable
2	1+24V	1+24V	Deadman OUT	Deadman OUT
3	+24V	+24V	Travel DWS	Travel DWS
4	EMERGENCY-STOP 2	EMERGENCY-STOP 2	Travel LS	Travel LS
5	Pump contactor	Pump contactor	NO/HO operation	NO/HO operation
6	Lowering valve	Lowering valve	Travel setpoint	Travel setpoint
7	Main lift valve	Main lift valve	1.2 m switch, decel.	1.2 m switch, decel.
8	Additional lift valve	Additional lift valve	Setpoint steering 1	Setpoint steering 1
9	n.c. (not connected)	SIO RxD	Setpoint steering +	Setpoint steering +
10	n.c.	SIO TxD	Setpoint steering 2	Setpoint steering 2
11			Setpoint steering -	Setpoint steering -
12			Actual value steering 1	Actual value steering 1
13			n.c.	Aisle recognition
14			Deadman 2	EASS release
15			Chain switch LHS	Chain switch LHS
16			Chain switch RHS	Chain switch RHS
17			n.c.	Pedestrian mode OUT
18			n.c.	n.c.

Position of the operating elements

1 Key switch
2 Wheel position display/ Error code
3 EMERGENCY-STOP button
4 Lifting button
5 Lowering button
6 Horn button
7 Travel setpoint generator
8 Operating console switch-over button
9 2-handed operation, additional lift (with load side operating console)
Cabin light (with load side operating console)
10 2-handed operation, travel in aisle
11 Acknowledgement key



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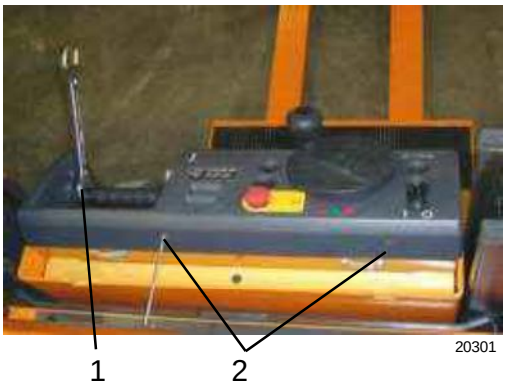
Removal

- Release the 2 screws (2), using a 4mm hexagon socket screw key.
- Remove the grip (1), using a 24mm open-ended spanner.
- Lift the operating console up and off.
- Disconnect the connection to the vehicle control system.



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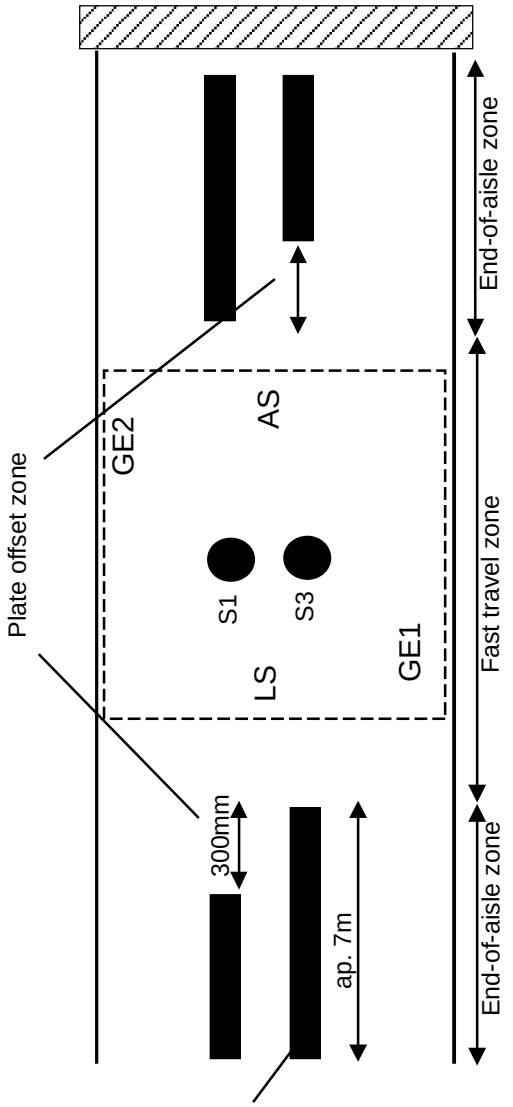
Installing

Follow the instructions for removal in the opposite order.
Lower the operating console parallel to the wall of the cab, and ensure that the plastic guides are correctly seated.

EASS Inductive

Monitoring

	Outside aisle	End-of-aisle zone	Plate offset zone	Fast travel zone
Plate offset > 300mm Towards end of aisle Towards middle of aisle			Error Error	
Travel switch forw. and reverse at same time		Error	Error	Error
Travel direction is not same as incremental encoder direction		Error	Error	Error
Only one aisle recognition active			Error	
Incremental encoder not plugged in Towards end of aisle Towards middle of aisle		vRED vRED	vmax vRED	vmax vmax
1 channel faulty	Error	Error	Error	Error
Channels reversed		Error	Error	Error



Remark: If an error occurs (LED F on the EASS module goes out), the vehicle is brought to a standstill. It can be driven at 2.5km/h by holding down the acknowledgement key.
If an error occurs while the acknowledgement key is pressed, the vehicle is stopped. It can be driven at 2.5 km/h by holding down the acknowledgement key.

General

The speed sensor is supplied with 12V by the brake monitoring board (ABÜ). At its outputs, it delivers voltages of approx. 1V or 11V, depending on its switching status.

The speed sensor uses two internal proximity switches to determine the speed of the drive motor. The speed sensor is monitored constantly by the ABÜ (brake monitoring board).

If an error occurs (e.g. if a channel is faulty), this is recognised by the ABÜ board and electromagnetic braking is initiated immediately.

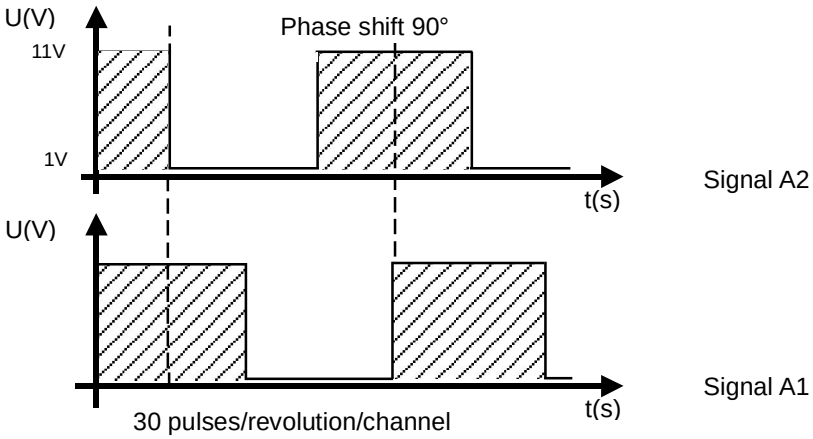
In the event of failure, the ABÜ board generates a flashing error code which is shown on the fault LED (see ABÜ/ Flashing error code).

10069

Terminals block connector X2

X2 : 1	pink	12V
X2 : 2	purple	Signal A1
X2 : 3	yellow	GND
X2 : 4	orange	Signal A2

Signal sequence



Assembly: The mounting distance between the counting wheel and the sensor should be between 1 and 2 mm.

Main current section - terminals

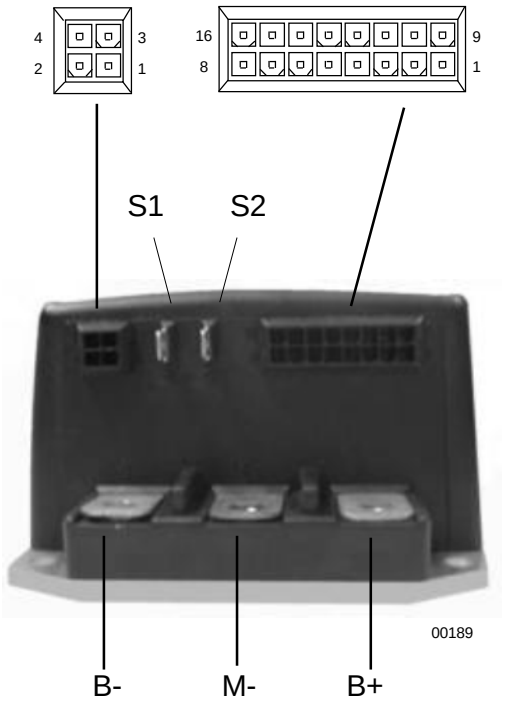
B+
is connected indirectly to the positive battery pole and directly with armature A1 of the motor via contactor 1K34.

B-
is connected to the negative battery pole.

M-
is connected to the armature A2 of the motor.

S1 / S2
is connected to shunt field F1 and F2 of the motor.

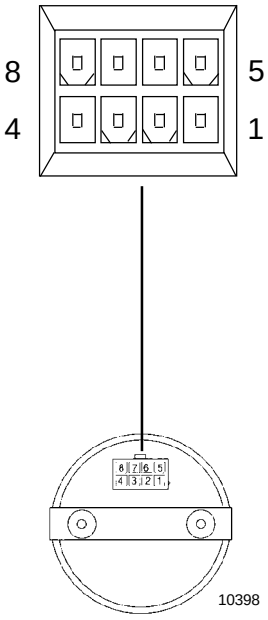
Remark: The travel direction of the vehicle depends on the polarity of S1 and S2.



Pin assignment

Operating voltage

Pin 5 = B+ (15V) min
Pin 8 = B - (0V)



Data input

Pin 6 = Data input

Other pin assignments

Pin 1 = not occupied
Pin 2 = not occupied
Pin 3 = not occupied
Pin 4 = not occupied
Pin 7 = not occupied

Basic data

Operating voltage	15V min
Operating temperature	-10°C to +70°C

List of parameters 2

No.	Display	Explanation	Range	Value
24	TAPER RATE	Change-over from braking to rolling	1 - 20	20
25	M1 MAX FWD SPEED	Maximum forward travel speed	0% - 100%	36
26	M2 MAX FWD SPEED		0% - 100%	100
27	M3 MAX FWD SPEED		0% - 100%	52
28	M4 MAX FWD SPEED		0% - 100%	100
29	M1 MAX REV SPEED	Maximum reverse travel speed	0% - 100%	36
30	M2 MAX REV SPEED		0% - 100%	100
31	M3 MAX REV SPEED		0% - 100%	52
32	M4 MAX REV SPEED		0% - 100%	100
33	CREEP SPEED	Speed that is set with the smallest throttle deflection	0% - 25%	5
34	THROTTLE TYPE	Throttle type	5kΩ-0 (1), 0-5V (2)	2
35	THROTTLE DEADBAND	Width of neutral position of throttle r	0% - 40%	25
36	THROTTLE MAX	Width of maximum setting of throttle	60% -100%	100
37	THROTTLE MAP	Throttle sensitivity at low speed	20% - 80%	40
38	FIELD MIN CURRENT	Smallest permissible field current, affects the maximum speed	1.6A - 10A	8.8
39	FIELD MAX CURRENT	Largest permissible field current, affects the maximum speed	Field Min - Rated	25
40	FIELD MAP START	Affects the armature current and consequently the torque with load on starting-up	25A - 300A	75
41	FIELD MAP	Affects the armature current and consequently the torque with load at v_{max}	0% - 100%	70
42	CURRENT RATIO	Factor of current increase in proportion to specification from throttle	1- 4	1

= adjustable parameters

List of error codes

Code	Designation	Description
43	THERMAL CUTBACK	Reduction due to excess temperature (120°C) or under temperature (-35°C) of the travel control
14	SRO	Start-up protection. Setpoint comes before travel dir. switch
23	HPD	Start-up protection. Setpoint comes before deadman
23	SERVICE TOTAL	1st "key switch" service counter has run down. Parameter 70
23	SERVICE TRAC	1st "Travel, lifting and lowering" service counter has run down. Parameter 71
23	TOTAL DISABLED	2nd "Emergency operation, key switch" has run down. Parameter 74
23	TRAC DISABLED	2nd "Emergency operation, lifting, lowering, travel" has run down. Parameter 75
13	M- SHORTED	Short-circuit at M output to B-
11	CURRENT SHUNT FAULT	Error at internal current sensor
33	FIELD OPEN	Motor field coil interrupted
32	MAIN CONTACTOR WELDED	Contact of 1K34 welded
42	OVERVOLTAGE	Battery voltage too high / emergency-stop pressed during travel or emergency-stop due to steering error
44	ANTI TIEDOWN	MODE input 1 active on switching-on
31	CONT COIL / FIELD SHORT	Contactor coil 1K34 has shorted
12	HW FAILSAFE	Internal error
41	LOW BATTERIE VOLTA-GE	Battery voltage too low
22	EMR REV WIRING	Internal error
34	MISSING CONTACTOR	Contactor coil 1K34 interrupted
21	THROTTLE WIPER HIGH	Throttle wiper error
44	MOTOR HOT	Motor temperature >160°C
44	MOTOR WARM	Motor temperature <90°C
20	BDI LOW	Battery discharge indicator registering less than 20% capacity
24	TROTTLE WIPER LOW	Travel potentiometer voltage(wiper) too low
21	TROTTLE WIPER HIGH	Travel potentiometer voltage(wiper) too high

Tester

Speed measurement

The current and the maximum speeds are shown in the "**Speed measurement**" window (1).
The speed is determined by the speed sensor, which is connected directly to the steering system.
To display the maximum speed, "**Reset maximum speed**" (2) must first be pressed, so that the relevant display field shows "0.0 km/h".
Clicking on "**Start measurement**" (3) starts the speed measurement, while "**Stop measurement**" (4) stops it. The highest speed measured in this period is shown in the "**Maximum speed**" display field (5).

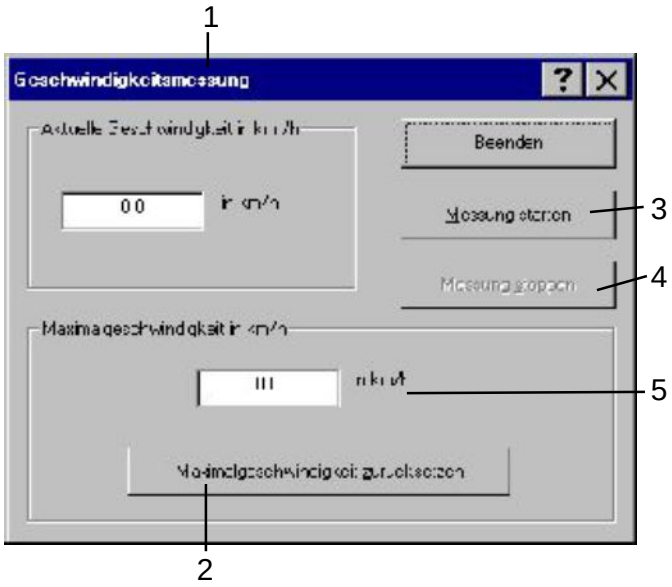


Table of errors

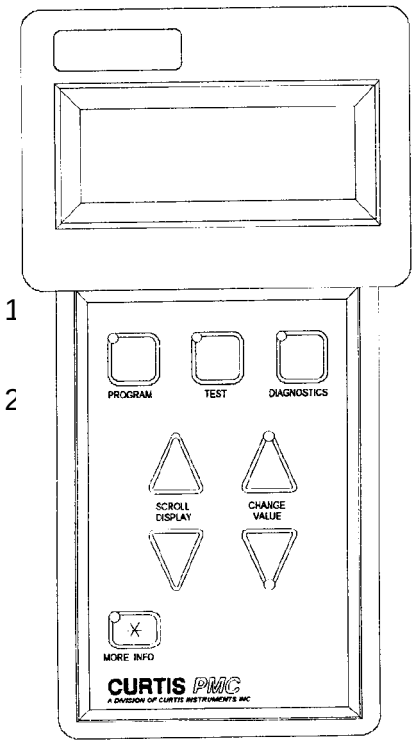
Error no.	Description	Cause	Rectification
39	Both setpoint potentiometers show implausible values.	• The voltages of the twin setpoint potentiometer at pins X1:19 and X1:20 do not match. • Loose contact. • Fault in potentiometer. • If error 35 is also displayed at the same time, please rectify this error first.	• Check potentiometer connections for faulty cables and/or plug-in connectors. • In the event of a short-circuit against 24V, the actual value potentiometer must also be replaced once the error has been rectified. • With the vehicle moving, steer very slowly from one steering end stop to the other. If the error always appears at the same steering position, this indicates that the potentiometer is faulty.
40	Both actual value potentiometers show implausible values.	• The voltages of the twin setpoint potentiometer at pins X1:10 and X1:22 do not match. • Loose contact. • Fault in potentiometer. • If error 35 is also displayed at the same time, please rectify this error first.	• Check potentiometer connections for faulty cables and/or plug-in connectors. • In the event of a short-circuit against 24V, the actual value potentiometer must also be replaced once the error has been rectified. • With the vehicle moving, steer very slowly from one steering end stop to the other. If the error always appears at the same steering position, this indicates that the potentiometer is faulty.

Setting parameters

PROGRAM menu

Press the "PROGRAM" button (1). The LED (2) in the top left-hand corner of the button lights up.
All the parameters are displayed with their values.
There are always 4 parameters shown on the display

■	TRAVEL STRBG	-> 250
	SLOW TRAVEL STRBG	250
	BRAKING STRBG	120
	SLOW BRAKING STRBG	120



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Displaying current errors

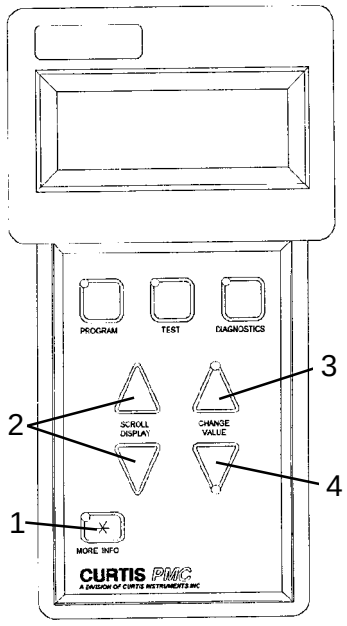
When the DIAGNOSTIC button (1) is pressed, all the errors that are currently registered are shwon on the display.

Error history

Pressing the DIAGNOSTIC (1) and MORE INFO (2) buttons at the same time takes you into the special diagnostic menu.

Here, a list of errors is displayed that have been detected by the control system since the last time the errors were deleted.

Each error is only displayed once.



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BELLY ERROR	Error on checking the belly switch
CONT. DRV. EX. CURR.	Current through contactor driver too high
DIR. CONT. STUCK	Contacts of the direction contactor are stuck
START-UP PROT. HPD	Start-up protection for travel switch triggered
FAILURE FUSE	Hardware failure fuse triggered
U BATT TOO LOW	Battery voltage too low (< 16V)
M SHORT-CIRCUIT	Short-circuit at M output to B-
CONTACTOR INTERRUPTION	Interruption of contactor control circuit
NO ERROR	Control has not detected an error
EXCESS VOLTAGE	Battery voltage too high
START-UP PROT. SRO	Start-up protection for
TEMPERATURE ERROR	Reduction due to excess or low temperature
TRAVEL SW. ERROR 1	Travel switch error, incorrect value
TRAVEL SW. ERROR 2	Travel switch error, interruption in cable

(see 'Travel control software)

Lifting chains

Checking the lifting chains for damage

- Twisted link pins

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- Loose link pins

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- Unacceptable external wear

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