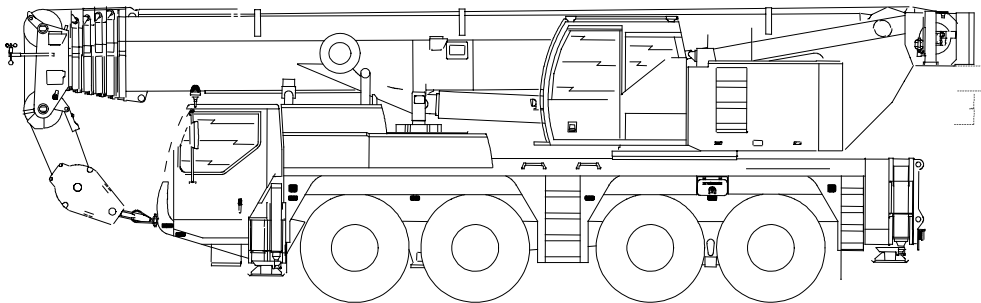


LIEBHERR

Test program (Chassis)

LTM 1090/3



History

Release:	Date:	Name:	Description:	
x	11.08.03	Stocker	Document:	Test program - CH LTM 1090/3 Version 0000
			Reason for change:	new - Test program - active rear axle steering new Test 30: Special diagrams on support box Test 31: Manual steering in test mode Test 32: Angle sensor zeroizing Test 33: Function test - centering circuit Test 34: Function test - blocking and centering valve Test 72: Active rear axle steering hydraulics modified - System faults can now be displayed test program - Test 04 extended: Lights test with sliding spar illumination - At start of test program (engine ON), not all outputs will be limit switched (light)
			Introduction from device no.:	From 1st device
x	24.10.03	Stocker	Document:	Test program - CH LTM 1090/3 Version 0000
			Reason for change:	- Test program - heating servomotors interface new cab fitted Test 13: Servomotors (ventilation flaps and heating) Test 14: Installation position of servomotors (ventilation flaps and heating)
			Introduction from device no.:	From new cab interface
			Document:	
			Reason for change:	
			Introduction from device no.:	

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Overview

1 Test program overview

For test	Test sequence	Engine
A1	Support control unit right/left: Data transfer (RC-modules)	OFF
A2	Support control unit right/left: Pilot lamps	OFF
A3	Support control unit right/left: Keys	OFF
01	Keypad unit: 7-segment display / buzzer / function displays	OFF
02	Keypad unit: Keys	OFF
03	Keypad unit: Inputs	OFF
04	Keypad unit: Lights test	OFF
05	Keypad unit: Test outputs statically	OFF
06	Keypad unit: Special functions	OFF
07	Keypad unit: Data transfer (RC-modules)	OFF
08	Keypad unit: Measure indicatorpower	OFF
09	Display unit: Pilot lamps / bar diagrams / 7-segment displays	OFF
10	Display unit: Inputs	OFF
11	Display unit: Output	OFF
12	Display unit: Data transfer (RC-modules)	OFF
13	Servomotors (ventilation flaps and heating)	OFF
14	Installation position of servomotors (ventilation flaps and heating)	OFF
30	Active rear axle steering - special diagrams on support box left/right	ON
31	Active rear axle steering - manual steering in test mode	ON
32	Active rear axle steering - angle sensor zeroizing	ON
33	Active rear axle steering - centering circuit function test	ON
34	Active rear axle steering - blocking and centering valve function test	ON
40	Engine braking flap	ON
41	Ventilation flap (customer request)	ON
43	Hydrostatic fan drive	ON
44	Hydrostatic fan drive (automatic)	ON
46	Engine - clear error code memory	OFF
47	Transmission - clear error code memory	OFF
48	ABS - clear error code memory	OFF
49	Intarder - clear error code memory	OFF
60	AAS sensors (customer request)	OFF
61	ABS valves (customer request)	OFF
62	ASR diff. valve (customer request)	OFF
63	Wheel speed display (ABS)	ON
70	Axle spring mounting function and axle spring mounting hydraulics	ON
71	Hydraulics - support	ON
72	Hydraulics - active rear axle steering	ON
73	Hydraulics - front axle steering	ON

Chart: Test program overview

[History](#)

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[Brief description](#)

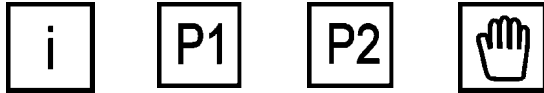
General

2 Test program description

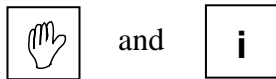
This test program tests the **hardware** of the **keypad unit**, **display unit**, **support control unit right** and **support control unit left** and all **functions** and **hydraulics** in the chassis. The test program can be started in **engine ON** or **engine OFF** mode.

2.1 Activating the test program in “Engine ON” or “Engine OFF” mode

To activate the test program, press the following 4 keys on the keypad unit: (see - [keypad unit](#))



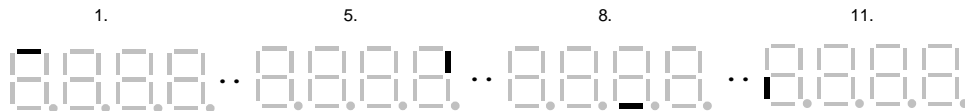
In “Engine OFF” mode, the test program can also be started on the support control unit; the following 2 keys must be pressed simultaneously for 2 seconds.



The test program in “Engine ON” mode can only be started on the **keypad unit**.

Display on the display unit when the test program is activated:

On the display unit (see [display unit](#)), “Test program activated” will be displayed in the following way on 7-segment displays H162..H165 (error displays) (running light).



"Test program activated" in ENGINE ON mode

Throughout the test program, **system faults** will be displayed on flashing pilot lamp H153. If system faults occur, these can be called up using the i-key. When the i-key is pressed, however, the current test will stop, or the test status will revert to the 1st test.

The 7-segment displays H162 .. H165 (running light) will therefore fade temporarily for operating faults, system faults and for individual tests.


"Test program activated" in ENGINE OFF mode


Throughout the test program, neither **system faults** nor **operating faults** will be displayed. The 7-segment displays H162 .. H165 (running light) will only fade temporarily for individual tests.

General


2.2 Switching between the individual tests

Use keys P1 and P2 on the keypad unit to select individual tests.

 P1 Current test count down (decremental)

 P2 Current test count up (incremental)

2.3 Starting and stopping individual tests

 Start selected test

 i 1 x: Stop selected test
2 x: Back to 1st test

2.4 Menu navigation

Selection of individual tests is carried out by using the keypad unit to navigate the menu. The two 7-segment displays H66 and H67 on the keypad unit (H66 upper left and H67 upper right) indicate which test is to be carried out or has been selected. At the start of the test program, Test = 01 is displayed and keys P1 or P2 can be used to switch between the individual test modes, with key P1 decrementing and key P2 incrementing the test mode. Use the Hand key to start the test displayed on H66 and H67. The two 7-segment displays H68 (lower left) and H69 (lower right) on the keypad unit will display, if applicable, a error code after each test. The current test is terminated by using the i-key, which returns the user to the main menu. If the i-key is pressed on the main menu, the user is taken to Test 01 in the main menu.

2.5 Test display

The test which is currently running is displayed on the two 7-segment displays H66 and H67 (upper left and upper right) on the keypad unit. If the key is pressed, the two decimal points on H66 and H67 will illuminate. With an automatic test procedure, the two 7-segment displays will start to flash at approx. 1 Hz (1 x per sec.) once the test is completed. The display will also start to flash (without decimal points) and the buzzer will sound if a test which provides no status signal is selected on I/O module 2 (e.g. no connection via LSB).

General

2.6 General information

Certain criteria must be fulfilled in order to carry out a test procedure:

- Connection from I/O module to currently assigned participant (keypad unit, display unit, support control units, ..)
- Intact LSB bus connection
- Correct power supply for individual components (I/O module, keypad unit, display unit, support control units, ..)

Activating the test program in "Engine OFF" mode

When the test program is activated in "Engine OFF" mode on the keypad unit, the **"application"** on each I/O module for 'normal' crane operations will be **shut down**. This is mandatory so that no crane 'movements' can occur when operating keys on the keypad unit or the support control units during individual test procedures.

If the **test program on the keypad unit is activated**, the various tests can be carried out on the keypad unit and display unit. The test program on the right and left support control units will be in stand-by mode here. Stand-by mode will be indicated by LED 1° and LED 5° flashing on both support control units (LED 1° and LED 5° flash simultaneously at 2 Hz (2 x per sec.)), the remaining displays on the support control unit will be unlit. Key illumination is always activated.

Activating the test program in "Engine ON" mode

When the test program is activated in "Engine ON" mode on the keypad unit, the application on each I/O module for 'normal' crane operations will be **maintained**. The test programs run parallel to the application.

2.7 Stopping the test program in ENGINE ON or ENGINE OFF mode

The test program is terminated using **Ignition OFF**.

Reversion to "normal" crane operating mode is only possible if the ignition is switched off beforehand.

Support control unit

3 All test programs

3.1 Test programs on the support control unit

Support control unit, right

1. Data transfer between I/O module and support control unit right
2. 7-segment displays, display t (tons) klbs (kilo pounds) and LEDs
3. Keys

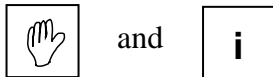
Support control unit, left

1. Data transfer between I/O module and support control unit left
2. 7-segment displays, display t (tons) klbs (kilo pounds) and LEDs
3. Keys

If the **test program on the right support control unit is activated**, the test program for the left support control unit will be in stand-by mode. Stand-by mode will be indicated by both LEDs flashing (LED 1° and LED 5° flash simultaneously 2x per second) (see [Support control unit](#)).

If the **test program on the left support control unit is activated**, the test program for the right support control unit will be in stand-by mode. Stand-by mode will be indicated by both LEDs flashing (LED 1° and LED 5° flash simultaneously 2x per second).

Starting a test program:



Press keys simultaneously for 2 seconds.

The following 3 tests will be run:

1. Data transfer between I/O module and support control unit:
2. Pilot lamp test:
3. Key test:

The test program can be restarted both during and at the end of the test.

Support control unit

Test A1

3.1.1 Data transfer between I/O module and support control unit

Test sequence:

During normal operations, data transfer speed between the I/O module and the support control unit runs at 50 kbaud (50000 bit/s.). To test the RC-modules for MOSI (Master Out Slave In) and CK (Clock), the transfer rate will be higher for this test (100 kbaud). If a fault occurs here, this means that the RC-modules are outside their tolerance. This test only runs for a fixed time (5 sec.). Afterwards, the original baud rate will be set and the pilot lamp test started automatically.

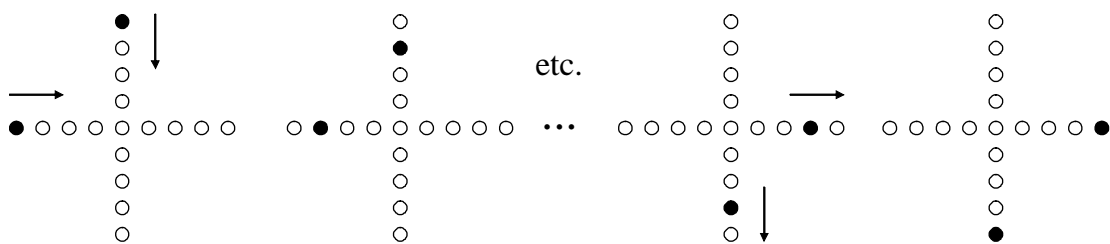
Test A2

3.1.2 Pilot lamp test

Test sequence:

All pilot lamps (7 sec. displays, LEDs and displays t (tons) and klbs (kilo pounds)) will be tested. The green LED will be tested indirectly during “normal crane operation”.

All pilot lamps are switched off at the start of the test. All indicator lamps will be switched on in turn from upper left (UL) to lower left (LL) and from upper right (UR) to lower right (LR), beginning with ‘t’ (tons), then ‘klbs’ (kilo pounds), then the triple 7-segment displays. The individual 7-segment displays will be counted up from right to left and from 0..9 and when 9 has been reached, an 8 with a decimal point will be displayed. When the final 8 with decimal point LR has been displayed, all LEDs on the electrical tiltmeter display will be switched on continuously.



After this, all LEDs (tiltmeter display) and also LED 1° and LED 5° switch on. All pilot lamps are switched on for approx. 4 seconds. After these 4 seconds have elapsed, all pilot lamps switch off except for LED 1° and LED 5°, which indicate that the key test is activated.

Support control unit

Test A3

3.1.3 Key test

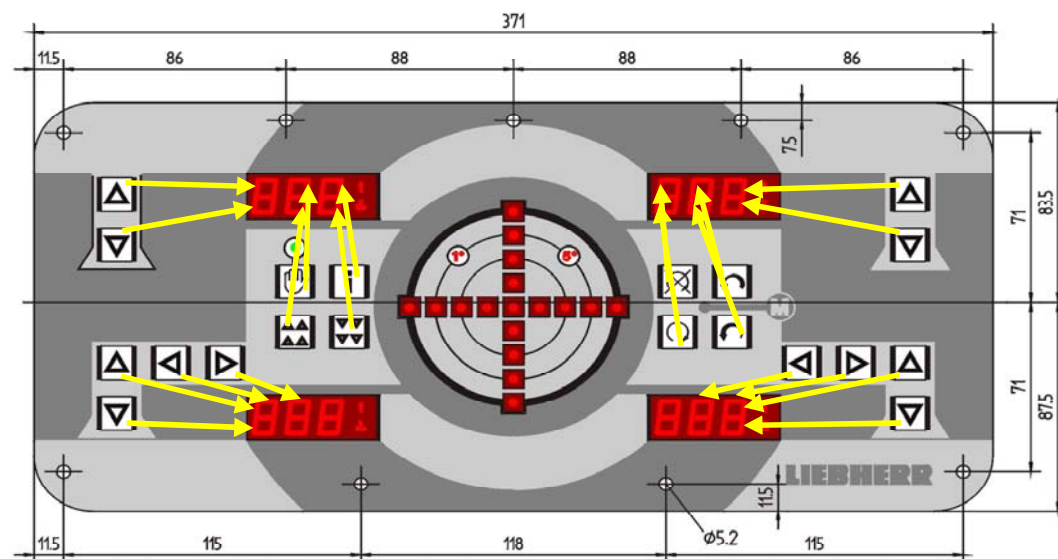
Test sequence:

The functionality of the individual keys on the support control unit will be indicated on the 7-segment displays 7-seg. UL, 7-seg. LL, 7-seg. UR, 7-seg. LR on the support control unit. For this, a key will be assigned to each segment of the 7-segment display. Once the test is running, the keys on the support control unit can be pressed in any sequence.

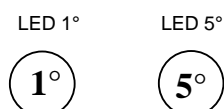
To guarantee the function of the keys, the release key (Hand key) must be pressed.

All segments of the 7-segment display in question are switched off at the start of the test. If a key is pressed and then released within 3 seconds, the segment belonging to it will be switched on and will remain on.

Assignment of keys to the segments:



The two LEDs (1° and 5°)



are switched on throughout the key test.

Support control unit

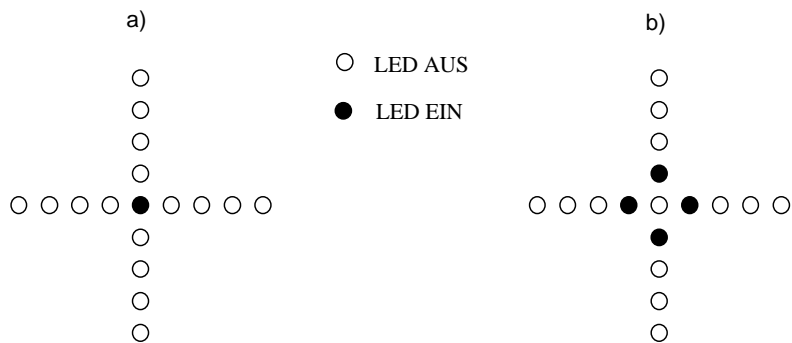
Test A3

Error code:

If a fault occurs during the **data transfer test**, e.g.:

- a) Test could not be started (BUS connection I/O module and support control unit not functioning properly) or
- b) brief removal of the SPI plug on the support control unit during the RC-module test, this will be displayed on the electrical tiltmeter in the following way.

If there is no fault, all LEDs are OFF.



No error code will be shown for the **pilot lamp test**, since only a visual check is carried out.

Key test:

"Key stuck" status will be shown as an operating fault or system fault and the release key on the support control unit will be locked.

Test 01

3.2 Function displays, buzzer and 7-segment display on the keypad unit (Test 01)

Test sequence:

At the start of the test, all function displays and 7-segment displays are switched off. The automatic test sequence for the 7-segment displays, the buzzer and the function displays will then start. The process for the individual test sequences is as follows:

7-segment displays test:

At the start of the test, all 7-segment displays are switched off. The displays now start to count up respectively (in the sequence upper left (H66), upper right (H67), lower left (H68), lower right (H69)) from 0..9. When 9 is displayed, all segments of the relevant 7-segment displays will be switched on (numeral 8 with a decimal point). When this test is completed, the two upper 7-segment displays (H66 and H67) will display the current test (test currently running) (see - [keypad](#) unit).

Buzzer test:

At the end of the 7-segment display test, the buzzer will be switched on for a brief period, indicating that the 7-segment display test is over and also that the function display test is starting.

Function displays test:

One function display after the other will be switched on (from upper left to lower right, H1..H65). This takes place over a time interval of approximately 150 milliseconds.

When the entire test is completed, all function displays will remain on and 7-segment displays H68 and H69 will display the numeral 8 with a decimal point. The current test will flash on 7-segment displays H66 and H67 to show that the automatic test sequence is over. Pressing the i-key returns the user to the main menu. All function displays and 7-segment displays will switch off, with the exception of: the parking light and rotating beacon function displays. These two function displays are switched on or off manually.

Error code:

No error code will be shown for this test, since only a visual / acoustic check is carried out.

Test 02

3.3 Keys on the keypad unit (Test 02)

Test sequence:

At the start of this test, all function displays are switched off; the special functions auxiliary heating, parking light, rotating beacon and hazard warning lights should also be switched off. The test sequence is from S1..S65, (upper left..lower right or R key to Hazard warning light key).

The function display above the R key will start to flash at approx. 8 Hz (8 x per sec.). This key must now be pressed briefly and then released within a fixed time period (3 seconds) (Check for rising and falling pulse). If the functionality of this key is correct (can be pressed and key does not stick), the function display will be switched on above the relevant key and the next function display will start to flash. If the key is not pressed during the delay, the function display will switch off and change to the next key. If this key sticks (key shows continual ON signal) or is pressed for too long, the function display above this key will start to flash at approximately 1 Hz (1 x per sec.). The keys i, P1 and P2 are not tested during this sequence. These keys are, however, checked indirectly via the menu navigation.

The special function keys auxiliary heating (S43), parking light (S57), rotating beacon (S64) and hazard warning lights (S65) must be briefly pressed twice within the 3 seconds, since each key is reset in a bistable trigger circuit.

Keys whose function displays flash at approx. 1 Hz (1 x per sec.) have either been pressed too long or are sticking (key shows continual ON signal). If the function display above a key does not illuminate, this indicates that the key in question has either not been pressed or is defective. The test will run once. At the end of the test sequence, the status display will flash and an appropriate error code will be displayed. If the i-key is used to change to the main menu, all function displays and the 7-segment displays for the error code display will switch off.

Exception: the parking light and rotating beacon function displays. These two function displays are switched on or off manually.

Error code:

Error code 70: All keys are functioning.

Error code 01: At least one key is defective or has been operated incorrectly.

See chart "[Error code - hardware components LIEBHERR CH](#)".

Test 03

3.4 Keypad unit inputs (Test 03)

Test sequence:

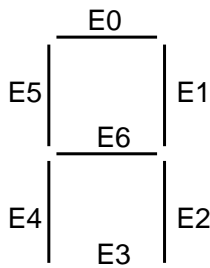
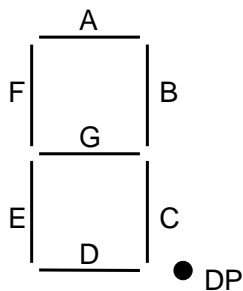
This test displays the status of the inputs E0..E6 on the lower left 7-segment display (H68). For this test, an input will be assigned to each segment of the 7-segment display. The input stages of the keypad unit can now be individually tested by setting and resetting the input signals. If a segment illuminates, this indicates that the relevant input is ACTIVE.

Segment:	Input:	Function:
A	E0	Auxiliary heating - ON status signal *
B	E1	Auxiliary heating - tracking fan *
C	E2	Auxiliary heating - thermostat *
D	E3	Auxiliary heating - timer switch *
E	E4	Air-conditioning system - thermostat/pressure switch *
F	E5	Horn
G	E6	Blocked
DP	---	---

Chart: Assignment of segment / input and function * Customer request

Segment description

Assignment of inputs



This test runs as long as the i-key is pressed. After the i-key has been pressed, the program returns to the main menu.

Error code:

No error code will be shown for this test, since only a visual check is carried out.

Test 04

3.5 Vehicle lights test (Test 04)

Test sequence:

This test connects the outputs (A26, A24, A29, A27, A22, A30, A28, A25 and A13 (A13 cyclic), and A24 again, see chart below) to the keypad unit in a distinct sequence and at defined time intervals. Time intervals are dependent on the type of crane.

The number of the output currently set will be displayed on the 7-segment displays H68 and H69.

Step:	Output:	Function:
1	A26	Fog lamps ON *
2	A24	beam headlight or low-beam headlight and/or ¹⁾ high-beam headlight
3	A29	Indicator left ON
4	A27	Rear fog light ON
5	A22	Reversing light ON
6	A30	Indicator right ON
7	A28	Rotating beacon ON
8	A25	Parking light and all lighting devices ON Sliding spar illumination (cyclic)
9	---	3s buzzer, operate steering-column switch left
10	A24	beam headlight or low-beam headlight and/or ¹⁾ high-beam headlight

Chart: Lights test

* Customer request

- 1) see circuit diagram: "Low-beam headlight and high-beam headlight" or "Low-beam headlight or high-beam headlight"
- 2) Output A24 connects the low-beam headlight or the low-beam headlight and/or the high-beam headlight; this is dependent on the switch position on the steering-column switch left. In Step 9, the approx. 3s buzzer on the keypad unit indicates that the steering column switch left must be pressed. This ensures that in Step 2 or Step 9, the low-beam headlight and/or the high-beam headlight is switched on dependent on the steering-column switch.

Note on brake light:

In this test, only the *keypad unit outputs* will be connected. The brake light will be connected instantaneously from the I/O module (see circuit diagram) and can therefore not be explicitly connected with this test.

Trick:

The brake light can also be tested by stopping the test program with Ignition OFF, depressing the operating brake and simultaneously restarting the test program. In this arrangement, the brake light is continuously switched on during "Test program ON with ENGINE OFF". The brake light is switched off via Ignition OFF.

Error code:

No error code will be shown for this test, since only a visual check is carried out.

Test 05

3.6 Outputs on the keypad unit (Test 05)

Test sequence:

This test only sets those outputs which do not have any safety-related consumers connected to them. The outputs which would be said to be safety-related are A15 (axle floating 1) and A16 (axle floating 2), which cannot simply be set and reset, or a dangerous situation could result. Also, output A23 (Horn) cannot be set since this output is controlled directly via the input (E5).

By pressing the Hand key and the P1 key or the Hand key and the P2 key, the output currently set will be reset and the newly selected output set. Key P1 counts down and key P2 counts up the selection. The number of the currently set output will be displayed on 7-segment displays H68 (lower left) and H69 (lower right). With transistor outputs, key P1 can be used to call up the output state (error code). The code (see chart) will then be displayed on 7-segment displays H68 and H69 for the duration of operation. If key P1 is pressed during a relay output, '--' will be displayed as the output state, since it is not possible to call up status during a relay output. It is possible to use key P2 to reset the output that has just been set for the duration of operation. If the last output (A30) is set and the Hand key and P2 pressed, the first output (A0) will be set again. If the first output (A0) is set and the Hand key and P1 pressed, the last output (A30) will be set again.

The test can be stopped at any time using the i-key. All outputs will then be reset and the program changes to the main menu.

Relay outputs:

These outputs cannot be tested for functionality using software; the outputs can only be connected for a specific amount of time and then checked by the operator (acoustic or visual check).

Transistor outputs:

These outputs can be tested using software under certain conditions, since these transistors have a diagnostic connection (Status). This additional information can be used in connection with the transistor's input signal (Input) and the output level to derive information on the output state of the transistor (see chart).

Test 05

Transistor output states:

Activation	Status	Output	Estimation BUK202/203 Outputs: A11, A12, A14, A15 ¹⁾ , A17, A18, A19	Estimation BSP450 Outputs: A0, A1, A2, A3, A4, A5, A6, A7,	Error code
0	0	0	Overheating	---	C2
		1	Short circuit to supply	Short circuit to supply, exposed line	
0	1	0	Normal OFF	Normal OFF	C3
		1	Short circuit to supply	---	
1	0	0	Short circuit to earth, overheat	Short circuit to earth, overheat	C4
		1	exposed line, load current too small, short circuit to supply	---	
1	1	0	Under/overvoltage	---	C5
		1	Normal ON	Normal ON	

Chart: Output state of transistors dependent on the activation of the transistor, the status and the output (output or status signal will not be collected using software)

If consumers with a low load are connected at the transistor outputs (BUK202, BUK203, BSP450), it is possible that the code 'C4' will be shown when the output state (error code) is called up with an activated output (**example: Auxiliary heating - output A11**).

This is due to the fact that the transistors are only able to identify that a current is flowing at a specific current threshold and can only provide an appropriate status signal at this point. The current thresholds are shown in the following chart:

Transistor current threshold values:

Current thresholds	BSP450 (1A)	BUK203 (2A)	BUK202 (8A)
Minimum current threshold [mA]	15	30	150
Typical current threshold [mA]	22.V	90 ¹⁾	450
Maximum current threshold [mA]	30	150	750

Chart: Transistor current threshold values

¹⁾ i.e., at a load current of less than 90 mA (on the outputs A11, A12, A14, A15 ²⁾, A17, A18, A19 and A16 ²⁾ on keypad unit A, the test program will show the code 'C4' (load current too small) for a set output and connected consumer.

²⁾ previously not set or called up.

Test 05

Description of the outputs on the keypad unit:

No. of output	Transistor/ relay output	Function of connected consumer (optional)	Type of consumer
A0	BSP 450	Recirculated air	Engine - servodrive
A1	BSP 450	Fresh air	Engine - servodrive
A2	BSP 450	Air - windscreen	Engine - servodrive
A3	BSP 450	Air - footwell	Engine - servodrive
A4	BSP 450	Auxiliary engine heater *	Engine - servodrive
A5	BSP 450	Cab heating	Engine - servodrive
A6	BSP 450	see circuit diagram assignment	
A7	BSP 450	see circuit diagram assignment	
A8	Bosch relay	Fan speed 1	Engine - fan
A9	Bosch relay	Fan speed 2	Engine - fan
A10	Bosch relay	Fan speed 3	Engine - fan
A11	BUK 203	Auxiliary heating *	Control-unit - auxiliary heating
A12	BUK 203	Air conditioning/clutch compressor *	Solenoid valve
A13	Bosch relay	Sliding spar illumination	Headlights left / right
A14	BUK 203	Air-conditioning - solenoid valve *	Solenoid valve
A15	BUK 203	Axle floating 1 *	Solenoid valve
A16	BUK 203 ²⁾ , BSP 450 ³⁾	Axle floating 2 *	Solenoid valve
A17	BUK 202	Mirror heating	Resistors
A18	BUK 202	Heating - driver's seat *	Resistors
A19	BUK 202	Heating - passenger's seat *	Resistors
A20	BSP 450	Auxiliary heating/valve engine/cab	Solenoid valve
A21	Bosch relay	Headlight washer system *	Engine (windscreen wiper)
A22	Bosch relay	Reversing lights	Headlights/Horn - backwards
A23 ¹⁾	Bosch relay	Horn	Horn
A24	Bosch relay	Lamp	Headlights left / right
A25	Bosch relay	Parking light	Side lamps,...
A26	Bosch relay	Fog lamps *	Headlights
A27	Bosch relay	Rear fog lamp	Rear lights
A28	Bosch relay	Rotating beacon	Rotating beacons
A29	Bosch relay	Indicator left	Indicator lights

Chart: Description of the individual outputs on the keypad unit

¹⁾ this output is activated direct from input E5

²⁾ Keypad unit A

³⁾ Keypad unit B

Error code:

C2, C3, C4, C5: The error code for the output test only provides information on the output state of the transistors.

See chart “[Error code - hardware components LIEBHERR CH](#)”.

Test 06

3.7 Special functions on the keypad unit (Test 06)

1. Internal OR gate of the keypad unit:

At the start of this test, the **parking light**, **rotating beacon**, **auxiliary heating** and **hazard warning light** functions, and the **inputs E1 (auxiliary heating - tracking fan)** and **E3 (auxiliary heating - timer switch)** must not be activated. As with the inputs test (Test 03), the status of inputs E1 and E3 will be displayed on 7-segment display H68).

The test program must now be exited via Ignition Off; the ignition will remain switched off. The special functions **parking light**, **rotating beacon**, **auxiliary heating** and **hazard warning lights** will now switch on and off individually one after the other. If one or more special functions is switched on, I/O modules 1 and 2 and the display unit will be supplied with power. If one of the inputs E1 or E3 are active, I/O modules 1 and 2 and the display unit will also be supplied with power. If all special functions and (if possible) inputs E1 and E3 have been tested via the keypad unit's OR gate, the test program (Test 06) must be restarted.

2. Internal locking of the keypad unit:

When testing locking, neither special functions nor the inputs E1 or E3 may be active. Locking may now be switched on by pressing the N-key. The locking status will be displayed on the function display above this key (locking ON --> function display ON, locking OFF--> function displays OFF). The locking status will, however, only be shown when the ignition is switched on. The ignition can now be switched off. I/O modules 1 and 2 and the display unit must now continue to be supplied with power. **This test is only completed when the test program (Test 06) is restarted and the N-key is pressed twice** (locking will thereby be switched off again).

3. Internal EOR gate of the keypad unit:

At the start of this test, the **parking light and rotating beacon** functions must be switched off. The parking light (A25) will now be switched on using key S57. Key P1 can be used to activate the EOR for the duration of the operation, which will switch off the parking light. Rotating beacon (A28) will be activated using key S64. By using key P2, the rotating beacon can be switched off via the EOR. If the parking light and rotating beacon functions are switched off using the S57/S64 keys, the outputs can also be activated using keys P1 and P2 for the duration of the operation.

The user can return to the main menu at any time by pressing the i-key.

Error code:

No error code will be shown for this test, since only a visual check is carried out.

Test 07

3.8 Data transfer between I/O module and keypad unit (Test 07)

Test sequence:

In normal operation, data transfer between the I/O module and the keypad unit runs at 50 kbaud. To test the RC-modules for MOSI (Master Out Slave In) and CK (Clock), the transfer rate will be higher for this test (100 kbaud). If a fault occurs here, this means that the RC-modules are outside their tolerance. This test only runs for a fixed time (5 sec.). The original baud rate will subsequently be reset and a error code produced. The i-key can be used both after and during the test to return to the main menu.

Error code:

06, 70: The error code 06 will be displayed on the keypad unit's 7-segment displays H68 and H69 in the event of defective RC-modules. If no fault is present, error code 70 will be displayed.

See chart "[Error code - hardware components LIEBHERR CH](#)".

Test 08

3.9 Measuring indicator power on the keypad unit (Test 08)

Test sequence:

The keypad unit has a measuring device which is able to measure the current indicator power. Once the test has been activated, the R-key can be used to set the flash relay for the left indicator (A29) and the D-key used to set the flash relay for the right indicator (A30). The function displays above the two keys indicate whether the assigned output is set (function display ON signifies that the output is connected). The number of attached (functioning) indicator lamps will be displayed on 7-segment display H69 (lower right). If a 7 is displayed, however, this could indicate that either 7 or more indicator lamps are activated.

Caution: If additional indicator lights (5W) are fitted on the crane, the left and right indicator power must be tested separately.

Error code:

No error code is displayed for this test.

Test 09

3.10 Pilot lamps, 7-segment displays, bar diagrams on the display unit (Test 09)

Test sequence:

At the beginning of the test, all pilot lamps (with the exception of those controlled directly via inputs), bar diagrams and 7-segment displays are switched off. All pilot lamps (exception as above) will now be switched on one after the other, beginning at H102 (upper left). After this, those which are activated directly via the inputs will be switched on via the lamp test (with the exception of the charge indicator lamp, which cannot be operated using software). The individual 7-segment displays will then count up from 0..9 and when the 9 is displayed all segments of the relevant 7-segment displays will be switched on (numeral 8 with a decimal point). The bar diagrams will subsequently switch on segment by segment, beginning at bar diagram H166 (left). The pilot lamps, bar diagrams and the 7-segment displays will be switched off 5 seconds after the end of the test, so that the display unit does not heat to an unacceptable degree (see [display unit](#)). The i-key on the keypad unit can be used to return to the main menu at any time.

Error code:

No error code will be shown for this test, since only a visual check is carried out.

Test 10

3.11 Display unit inputs (Test 10)

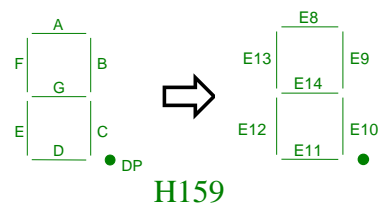
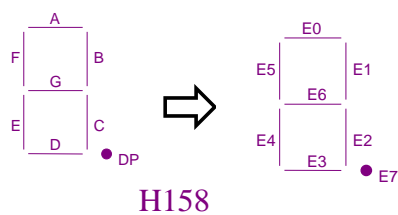
Test sequence:

The status of the individual inputs is displayed on the display unit's 7-segment displays (middle row, left) and (middle row, second from left). For this test, an input will be assigned to each segment of the 7-segment displays. Each input stage on the display unit can now be tested individually. If a segment illuminates, this signifies that there is an active signal on the relevant input. Inputs E3..E6 must be activated at 0 V and inputs E0..E2 and E7..E14 activated at +24 V, so that each input is identified as being ACTIVE.

This test runs until the i-key is pressed. After the i-key has been pressed, the program returns to the main menu.

7-segment display:	Segment:	Input:	Function:
middle row left (H158)	A	E0	Lamp
middle row left (H158)	B	E1	High-beam headlight
middle row left (H158)	C	E2	Auxiliary heating - ON status signal
middle row left (H158)	D	E3	see circuit diagram assignment
middle row left (H158)	E	E4	see circuit diagram assignment
middle row left (H158)	F	E5	see circuit diagram assignment
middle row left (H158)	G	E6	see circuit diagram assignment
middle row left (H158)	DP	E7	see circuit diagram assignment
middle row second from left (H159)	A	E8	Crane turn signal switch left
middle row second from left (H159)	B	E9	Crane turn signal switch right
middle row second from left (H159)	C	E10	see circuit diagram assignment
middle row second from left (H159)	D	E11	see circuit diagram assignment
middle row second from left (H159)	E	E12	see circuit diagram assignment
middle row second from left (H159)	F	E13	see circuit diagram assignment
middle row second from left (H159)	G	E14	Input D+
middle row second from left (H159)	DP	--	--

Chart: Assignment of segments Inputs



Error code:

No error code will be shown for this test, since only a visual check is carried out.

Test 11

3.12 Display unit output (Test 11)

Test sequence:

Output A0 cannot be set using software. A0 is set if there is sufficient power at input E14 (D+). Information on the output state can be derived according to the chart using the status signal of the BUK 202 transistor (see Keypad unit output test). This error code will be directly shown on the keypad unit's 7-segment displays H68 and H69.

This test can be stopped at any time by pressing the i-key.

Error code:

C3 : During the test, the message C3 must appear, since no D+- signal (engine ON) is active during the test program.

See chart "[Error code - hardware components LIEBHERR CH](#)".

Test 12

3.13 Data transfer between I/O module and display unit (Test 12)

Test sequence:

In normal operation, data transfer between the I/O module and the display unit runs at 50 kbaud. To test the RC-modules for MOSI (Master Out Slave In) and CK (Clock), the transfer rate will be higher for this test (100 kbaud). If a fault occurs here, this means that the RC-modules are outside their tolerance. This test only runs for a fixed time (5 sec.). The original baud rate will subsequently be reset and a error code produced. The i-key can be used both after and during the test to return to the main menu.

Error code:

07, 70: In the event of defective RC-modules, error code 07 will be displayed on the keypad unit's 7-segment displays H68 and H69. If no fault is present, error code 70 will be displayed.

See chart "[Error code - hardware components LIEBHERR CH](#)".

Test 13

3.14 Heating servomotors (Test 13)

This test checks

- a) **the activation**, and the
- b) **function of the servomotors** for the chassis heating.

Caution: "New cab" interface: Heating water circuit is now controlled by means of 2 solenoid valves.

a1) up to "new cab" interface

Throughout the entire test, the keypad unit's transistor outputs **A0**, **A1** (activation servodrive recirculated/fresh air), **A2**, **A3** (activation servodrive footwell/windscreen) **A4** and **A5** (activation servodrive water circuit) will be diagnosed for overloading, exposed line and short circuit to earth.

a2) from "new cab" interface

Throughout the entire test, the keypad unit's transistor outputs **A0**, **A1** (activation servodrive recirculated/fresh air), **A2**, **A3** (activation servodrive footwell/windscreen) will be diagnosed for overloading, exposed line and short circuit to earth. The transistor outputs **A4** and **A5** (activation valves water circuit) will only be diagnosed for overloading.

If there is an error with outputs A0 .. A5, the test program will be terminated and an error message will be displayed on the keypad unit's lower 7-segment displays (see error code below).

b) The function of the servomotors will be established by means of the fault group signal (FGS) (diagnostic outputs on the servomotors summarized). In the event of a fault, the diagnostic output of each servomotor provides a +24V signal while the software generates a system fault.

Functionality of the servodrives:

- Since any fault diagnosis on the servodrives is shown on the display unit as a fault group signal, it is necessary to test each servodrive separately in case of defect (appearance of system faults).
- The servodrives switch off independently at their *zero setting* (no power consumption) (e.g. recirculated air / fresh air: activations A0 = 0 V and A1 = 0V). The servodrive does not provide a diagnostic signal at the zero setting (servomotor switched off).
 - The servomotors do not therefore provide a diagnostic signal if all servomotors are switched off. The system fault will also not be shown.
- If there is a defect on a servodrive (e.g. incorrect angle, ventilation flap stuck..), the diagnostic signal will be set (FGS). The servodrive now attempts with each maximum activation to reach 4 x its angle.

Test 13

This test should be carried out

1. after installation of the servomotors (initial installation or replacement),
2. in case of a defect on the servomotors (system fault generated) and
3. during a function check of the servomotors (dispatch)

Test sequence:

At the start of the test, the servodrives will be brought to the *zero setting*.

At the zero setting, the ventilation flaps are set to 100% fresh air and 100% windscreen, the heating is set to level 3 (max.) (up to "new cab" interface) (all servomotors will be switched off). After this, all servodrives are brought to their maximum limit stop (A0..A5 activated) (from "new cab" interface A0 .. A3). This will test whether at least 1 servomotor is generating a fault signal (by diagnosis). If this is not the case, the test program will stop and the number 70 will show on the keypad unit's lower 7-seg. display as long as outputs A0..A5 do not also report any error.

In the event that at least 1 servomotor displays a fault (by diagnosis), the servodrives will be checked one after the other.

The duration of the complete test is between approx. 3 minutes (no fault) and 4 minutes (servomotor fault).

The recirculated air/fresh air and windscreen/footwell display units on the keypad unit flash throughout the test.

At the end of the test, more detailed information on the error code will also be provided on these function displays.

Error code:

See chart "[Error code - hardware components LIEBHERR CH](#)".

Test 14

3.15 Position of installation of servomotors (Test 14)

This test sets the position of installation of the servomotors for the heating in the chassis. The drive shaft of the servomotors can rotate around a maximum angle of 240°. The delivery status of the servomotor is not, therefore, always guaranteed if the servomotor is supplied with power when in “uninstalled status”.

At installation, if it is not possible to guarantee the delivery status (position of installation) of the motor shaft, the servomotor should be placed in its position of installation.

Important:

The servomotor to be adjusted must not be obstructed (no load on servomotor).

To start the test:

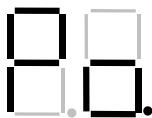
Throughout the entire test, the keypad unit's transistor outputs **A0**, **A1** (activation servodrive recirculated/fresh air), **A2**, **A3** (activation servodrive footwell/windscreen) **A4** and **A5** (activation servodrive water circuit) will be diagnosed for overloading, exposed line and short circuit to earth. If there is an error with outputs A0 .. A5, the test program will be terminated and an error message will be displayed on the keypad unit's lower 7-segment displays (see error code below).

Test sequence:

The heating (warm/cold), recirculated air/fresh air and windscreen/footwell display units on the keypad unit flash throughout the test.

1. The servodrive is brought to its maximum position. The drive shaft will now run to the right and left limit stop up to four times and then to the maximum position.
2. Position 0 of the servomotor will be activated.
3. The position of installation of the servomotor will be activated. The drive shaft will again run to the right and left limit stop up to four times and then to the position of installation.

Automatic adjustment takes approximately 4 minutes. The test is completed when a beeper sounds on the keypad unit for approx. 1 second and the legend Po. (position reached) is displayed on the keypad unit's lower 7-segment display .



The test may only be stopped by pressing "i-key" or "ignition OFF" if the servomotor is flange-mounted on the ventilation flap or the water valve.

Error code:

See chart “[Error code - hardware components LIEBHERR CH](#)”.

Test 30

3.16 Active rear axle steering, special diagrams on support control units right/left (Test 30)

General:

This function is used to **display** all relevant inputs, outputs and variables (angular values of each axle ..) of the active rear axle steering.

Start conditions:

- Transmission in “Neutral“
- Speed < 0.2 km/h

To activate the test:

At the start of the test, the support control units right/left will show the current test, the test index and the value of the current index (see “Overview of inputs, outputs and variables“).

The individual indices can be selected using the support control unit's “Hand“ and “i“ keys.

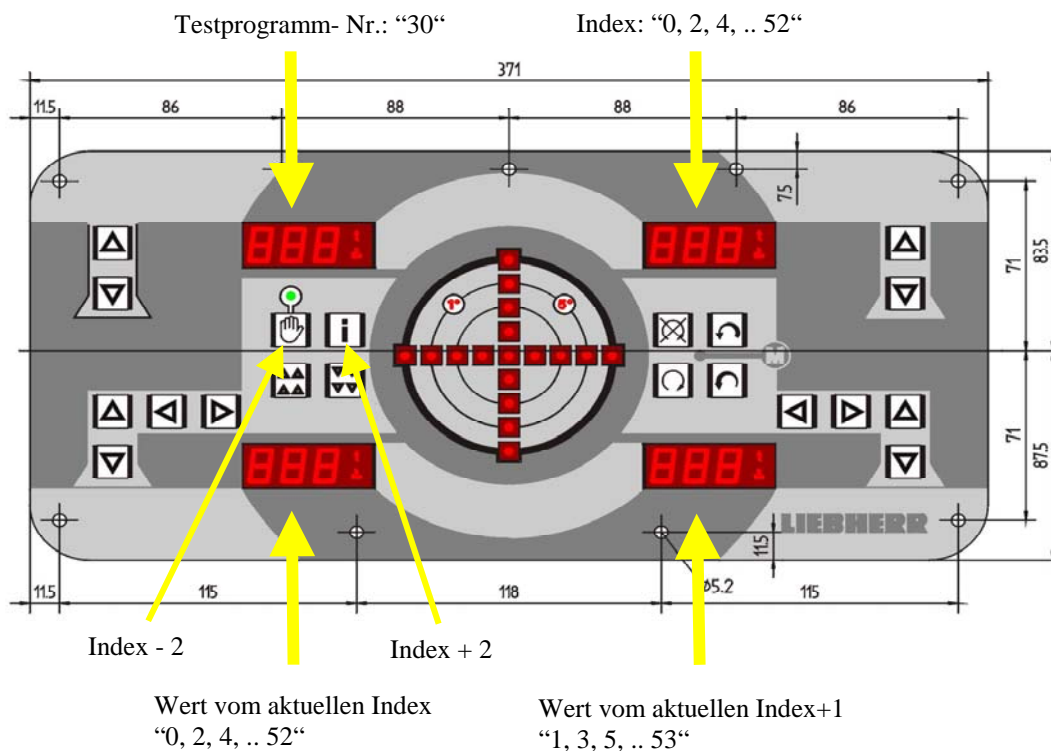


To count down the index



To count up the index

Display on support control units right/left:



Test 30

Overview of inputs, outputs and variables

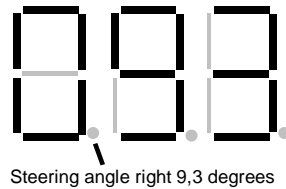
Test Index	Variables, inputs and outputs	
	Support control unit, left	Support control unit, right
0	Angular value - angle sensor 1 (FA)	Angular value - angle sensor 1 (FA)
1	unassigned	unassigned
2	Angular value - angle sensor 2 (SA1)	Angular value - angle sensor 2 (SA1)
3	Angular value - angle sensor 3 (SA2)	Angular value - angle sensor 3 (SA2)
4	unassigned (optional)	unassigned (optional)
5	unassigned (optional)	unassigned (optional)
6	Angular value - FA "Channel 1"	Digital value - FA "Channel 1"
7	Angular value - FA "Channel 2"	Digital value - FA "Channel 2"
8	Angular value - SA1 "Channel 1"	Digital value - SA1 "Channel 1"
9	Angular value - SA1 "Channel 2"	Digital value - SA1 "Channel 2"
10	Angular value - SA2 "Channel 1"	Digital value - SA2 "Channel 1"
11	Angular value - SA2 "Channel 2"	Digital value - SA2 "Channel 2"
12	unassigned (optional)	unassigned (optional)
13	unassigned (optional)	unassigned (optional)
14	unassigned (optional)	unassigned (optional)
15	unassigned (optional)	unassigned (optional)
16	Setpoint value - regulator (SA1)	Setpoint value - regulator (SA1)
17	Setpoint value - regulator (SA2)	Setpoint value - regulator (SA2)
18	unassigned (optional)	unassigned (optional)
19	unassigned (optional)	unassigned (optional)
20	Setpoint value - actuator (SA1)	Setpoint value - actuator (SA1)
21	Setpoint value - actuator (SA2)	Setpoint value - actuator (SA2)
22	unassigned (optional)	unassigned (optional)
23	unassigned (optional)	unassigned (optional)
24	Output - locking valve	Output - locking valve
25	unassigned (optional)	unassigned (optional)
26	Output - centering valve	Output - centering valve
27	Output - emergency supply centering circuit	unassigned
28	EPIA measure	EPIA measure
29	Operating mode - steering NOMINAL	Operating mode - steering NOMINAL
30	Operating mode - steering preselected	Operating mode - steering preselected
31	Operating mode - steering active	Operating mode - steering active
32	Engine speed ACTUAL	Engine speed ACTUAL
33	Driving speed ACTUAL	Driving speed ACTUAL
34	Input - pressure switch centering circuit I/O module4	Input - pressure switch centering circuit I/O module3
35	Input - flow switch power-steering pump	Input - flow switch centering circuit
36	Input - flow switch steering pump	unassigned
37	Counter status - valve diagnostics	Counter status - valve diagnostics
38	Gradient angular value FA "Channel 1" (max)	Gradient angular value FA "Channel 1" (current)
39	Gradient angular value FA "Channel 2" (max)	Gradient angular value FA "Channel 2" (current)
40	Gradient angular value SA1 "Channel 1" (max)	Gradient angular value SA1 "Channel 1" (current)
41	Gradient angular value SA1 "Channel 2" (max)	Gradient angular value SA1 "Channel 2" (current)
42	Gradient angular value SA2 "Channel 1" (max)	Gradient angular value SA2 "Channel 1" (current)
43	Gradient angular value SA2 "Channel 2" (max)	Gradient angular value SA2 "Channel 2" (current)
44	unassigned (optional)	unassigned (optional)
45	unassigned (optional)	unassigned (optional)
46	unassigned (optional)	unassigned (optional)
47	unassigned (optional)	unassigned (optional)
48	Plausibility angular value FA "Channel 1/2" (max)	Plausibility angular value FA "Channel 1/2" (current)
49	unassigned	unassigned
50	Plausibility angular value SA1 "Channel 1/2" (max)	Plausibility angular value SA1 "Channel 1/2" (current)
51	Plausibility angular value SA2 "Channel 1/2" (max)	Plausibility angular value SA2 "Channel 1/2" (current)
52	unassigned (optional)	unassigned (optional)
53	unassigned (optional)	unassigned (optional)

Chart: Assignment of segments Inputs

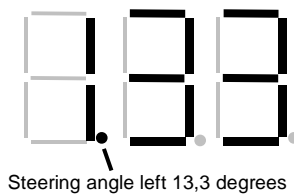
Test 30

Angular values display in 1/10 degree:

Example:



Example 2:



Details on the indices:

Index 0 .. 5:

Real (mean) angular values of each axle, both channels. For the real angular value, dependent on the axles and steering effort left or right, an additional steering geometry factor is calculated in.

Index 6 .. 15:

Support control unit, left:

Angular value of each angle sensor channel excluding steering geometry factor.

Support control unit, right:

Digital value of each angle sensor channel excluding steering geometry factor.

Index 16 .. 23:

Nominal values of regulator and actuator.

Index 24 .. 27:

Output signals of each I/O module (left side I/O module 4 and right side I/O module 3).
Display: 000: Output not connected, 001 Output connected.

Index 28:

EPIA safety measure: (Error Possibility and Influence Analysis)

0: no fault,

1: Centering or locking, dependent on drive status.

Test 30

Index 29 .. 33:

Operating modes, engine speed and driving speed.

Index 34 .. 36:

Input signals of each I/O module 3 and 4.

Display: "000", input signal not present.

Display: "001", input signal present.

Flow switch:

Display "000", no flow, flow switch not connected.

Pressure switch:

left: I/O module 4, display "001", pressure is present.

right: I/O module 3, display "000", pressure is present.

Index 37:

Counter status - valve diagnosis (see Test 34).

Index 38 .. 53:

Gradient (angle alteration of one channel) and plausibility (angle comparison of channel 1 to channel 2) of each of the angle sensor channels.

Support control unit, left:

Maximum value of each of the angle sensor channels. Maximum value display only starts after appropriate channel is selected.

Support control unit, right:

Current value of each of the angle sensor channels.

Error code:

No error code will be shown for this test, since only a visual check is carried out.

Test 31

3.17 Active rear axle steering, manual steering in test mode (Test 31)

General:

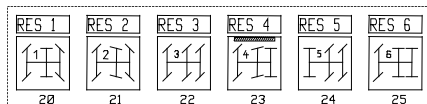
No safety measures are employed during manual steering. This corresponds to independent steering mode (operating mode 5) excluding safety measures (locking or centering). This is of use when starting, since air is still present in the hydraulic leads and this results in LECs (Liebherr Error Code)+ Measure.

Start conditions:

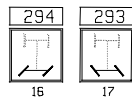
- Transmission in “Neutral“
- Speed < 0.2 km/h

Only the current test will be displayed on the right/left support control units when starting.

The function displays for the active rear axle steering (operating mode 1 ..6) will be switched on and off one after the other on the keypad unit (running light). No specific operating mode is guaranteed while the running light is activated.



The manual steering right/left keys can be used to steer as with manual steering (operating mode 5).



Once the test has begun and the hydraulic lines have filled with oil and no LEC is active, the test program must be stopped using “Ignition OFF“, so that a specific operating mode can be produced again.

Error code:

No additional error code is displayed for this test.

Test 32

3.18 Active rear axle steering, angle sensor zeroizing (Test 32)

General:

This function is designed to "zeroize" the angle sensor of each axle of the "active rear axle steering". On the front axle (always the first axle), as well as on each steering axle, the angle sensor is located on the right-hand side of the vehicle in the steering knuckle. These angle sensors must be "zeroized" (first "zero setting"), using the following test procedure to ensure that the crane will be able to travel straight ahead surely.

When "zeroizing" the angle sensor, measured value deviations (measured value - chain from sensor signal to measured value conversion in the I/O module, which differs from crane to crane) can occur. In order to eliminate these deviations, the angle sensor must be "zeroized" again (second "zero setting"). The second "zero setting" takes place in "non-centered status", after the respective axles have been corrected (see test sequence).

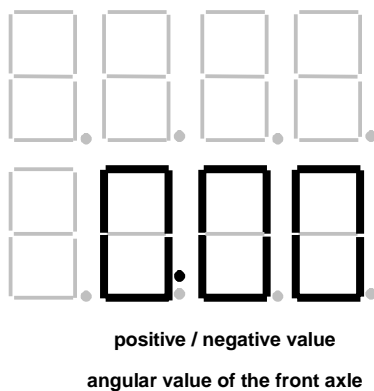
Start conditions:

- Transmission in "Neutral"
- Speed < 0.2 km/h
- Drive program 5 (DP5, manual steering)

To activate the test:

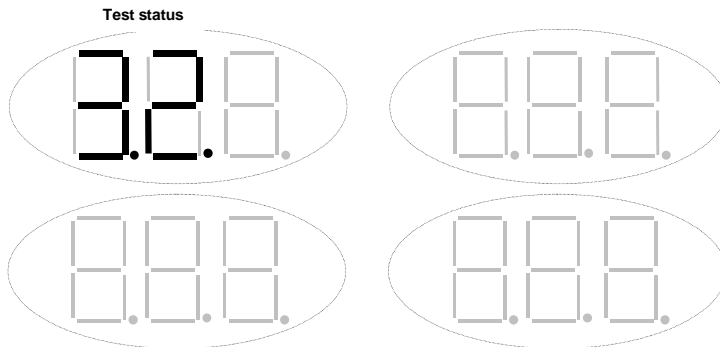
The current angular value of the *front axle* will be shown on the display unit when starting the test.

The current angular value of the *front axle* will be displayed on the display unit in the cab:



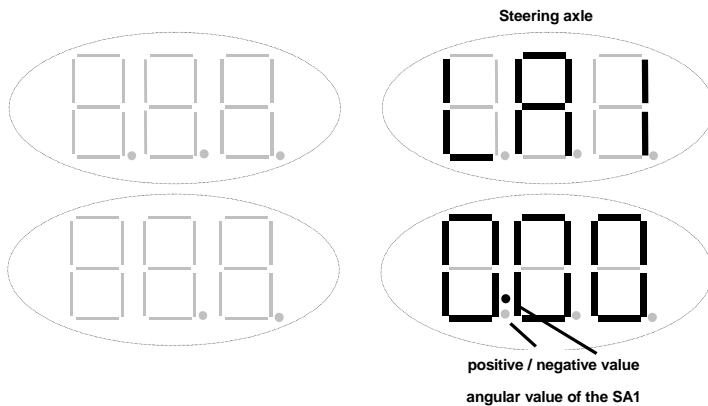
Test 32

Displays on support control units right/left in non-centered status:

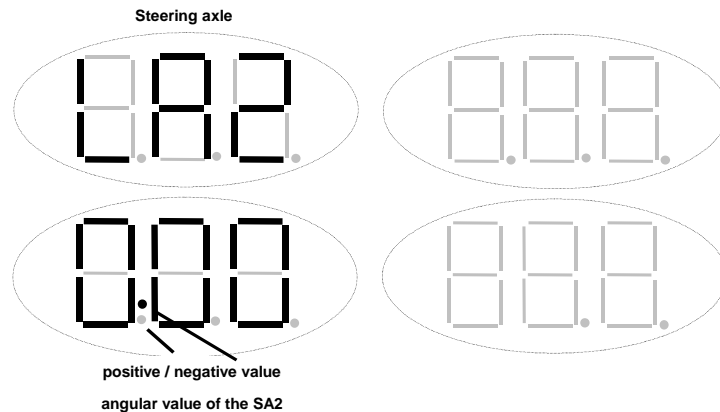


The angular value of the steering axles will only be displayed on the support control units if the axles have been centered. When centering the steering axles, a check will first be made to establish whether all angular values of the steering axle lie within the $> -3^\circ \dots < 3^\circ$ range, in order to prevent dangerous conditions for personnel. If this is the case, these axles will be centered. If an axle is not within this range, the axles will have to be steered to 0° (manual steering using drive program 5). If all axles are within the $> -3^\circ \dots < 3^\circ$ range, centering will take place automatically.

The current angular value of SA1 will be displayed on the right support control unit:



The current angular value of SA2 will be displayed on the left support control unit:



Test 32

"Zeroizing" the angle sensor for the first time:

Front axle:

Setting the angle sensor to zero must take place when the front axle has been positioned straight ahead or after the track alignment has been adjusted (see below "Setting the sensor to zero").

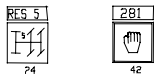
SA1 and SA2:

Setting the angle sensor to zero must take place when the axles are in centered status after the steering axles have been positioned straight ahead or after the track alignment has been adjusted (see below "Setting the sensor to zero").

The current angular value can be read off the display unit in the cab as well as on the support control units. If the display value is not 0° (display: 000 or 0.00), the angle sensor will have to be "zeroized" a second time (correct measuring faults).

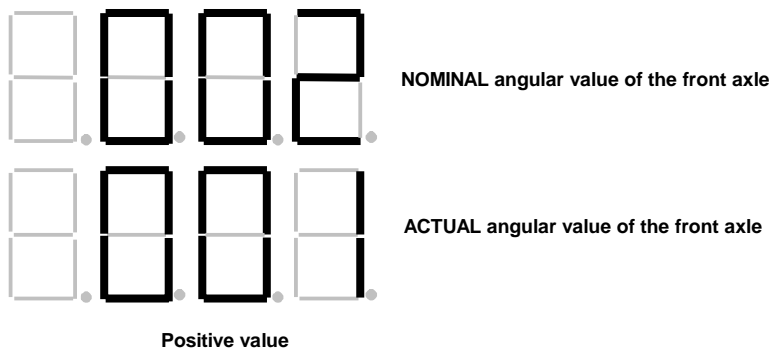
"Zeroizing" the angle sensor for the second time:

In order to start the second "zeroizing" procedure, the **Hand key** and the **DP 5-key** must be pressed simultaneously.



The NOMINAL angular values will also now be shown on the respective displays. This will also cancel the centering of the steering axles.

ACTUAL and NOMINAL angular value of the front axle:



Test 32

Front axle:

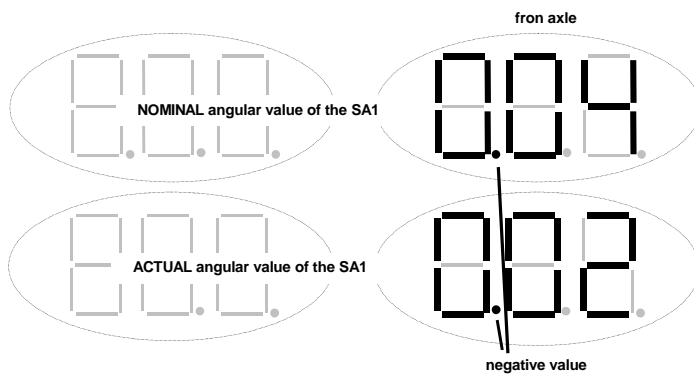
Before the second “zeroizing“, the angular value of the front axle must be corrected (ACTUAL- NOMINAL).

Use the steering wheel to change the ACTUAL value to the displayed NOMINAL value. The front axle's angle sensor must now be “zeroized“ for the second time.

When driving straight ahead, the angular value of the front axle must now be 0°.

ACTUAL and NOMINAL angular value of the steering axes:

Example:Steering axle 1 (SA1)



Steering axes:

Before the second “zeroizing“, the angular value of the steering axes must be corrected (ACTUAL- NOMINAL). Use the Hand and i-keys to change the ACTUAL value to the displayed NOMINAL value.

i-key on the right support control unit: SA1

Hand key on the left support control unit: SA2

Only one key is responsible for steering wheel movements right and left.

If the NOMINAL angular value is greater than the ACTUAL angular value, the axle will be moved to the right. If the NOMINAL angular value is smaller than the ACTUAL angular value, the axle will be moved to the left.

The steering axes' angle sensor must now be “zeroized“ for the second time.

The angular value on the steering axes in centered status must now be 0° (start test again, start centering and read off angular values).

Note:

With sensor zeroes, an incorrect signal can be briefly displayed from the sensor signal. This brief signal will be identified by the active steering system and results in a safety measure. This safety measure stops the test program. Restart the test program after pressing Ignition OFF.

Test 32

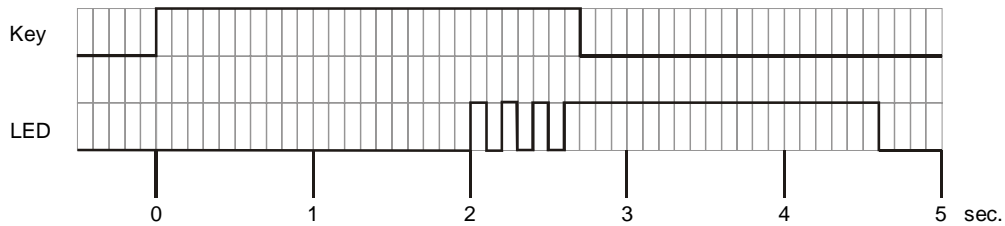
Setting the sensor to zero:

Zeroizing the sensor:

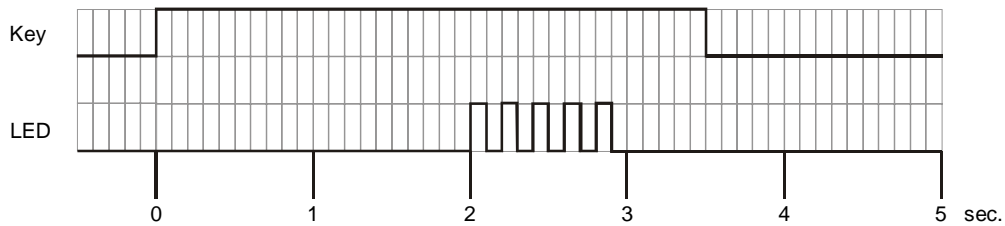
The key must be pressed for exactly 2-3 seconds to set the sensor to zero.

After 2 seconds, the LEDs will flash at approx. 10Hz . The key must then be released within 1 second to zeroize. Confirmation of zeroizing is shown on each channel by one yellow LED (channel A) and one green LED (channel illuminating for 2 seconds.

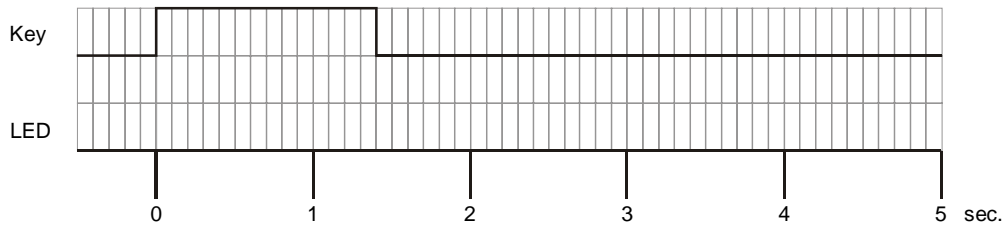
Key pressed OK, zeroizing will take place



Key pressed too long, no zeroizing will take place



Key not pressed long enough, no zeroizing will take place



Addition

This concludes sensor zeroizing.

If an angle sensor or I/O module3 or I/O module4 is exchanged, this process must be repeated (track and centering cylinders are also adjusted).

Error code:

No error code is displayed for this test.

Test 33

3.19 Active rear axle steering, centering circuit function test (Test 33)

General:

This function checks the function of the following components in the hydraulic centering circuit:

- Valve emergency supply centering,

Activation of valve emergency supply centering in normal operations:

No safety measure started and speed < 5 km/h:

- with Engine ON activation valve emergency supply approx. 1 second
- cyclic activation valve emergency supply approx. 0.5 second, if control deviation of a steering axle is > 0.5°:

Safety measure started and speed > 3 km/h:

- with centering active activation valve emergency supply 20 seconds

- Pressure switch 180 bar and
- output signals (centering valves and locking valve)

Start conditions:

- Transmission in “Neutral“
- Speed < 0.2 km/h
- Drive program 5 (DP5, manual steering)

To activate the test:

Only the current test will be displayed on the right support control unit when starting the test. The current test, pressure sensor input signals and centering valves' and locking valves' output signals will be displayed on the left support control unit.

Test 33

The “Hand“ and “i“ keys can be used to connect the individual valves:



Valve emergency supply centering



Centering valve

The valve emergency supply centering is connected by pressing the Hand key on the support control unit. After a specific period of time (dependent on the residual pressure in the centering circuit, size of the bubble memory and temperature), the pressure must build up to maximum pressure (press and hold the Hand key). The centering circuit pressure switch connects here at 180 bar. The input signals must be monitored on the left support control unit display (signal alteration from No pressure to Pressure present). This pressure will drop back after a specific period of time (Hand key not pressed). The pressure drop is dependent on leakage (signal alteration from Pressure present to No pressure).

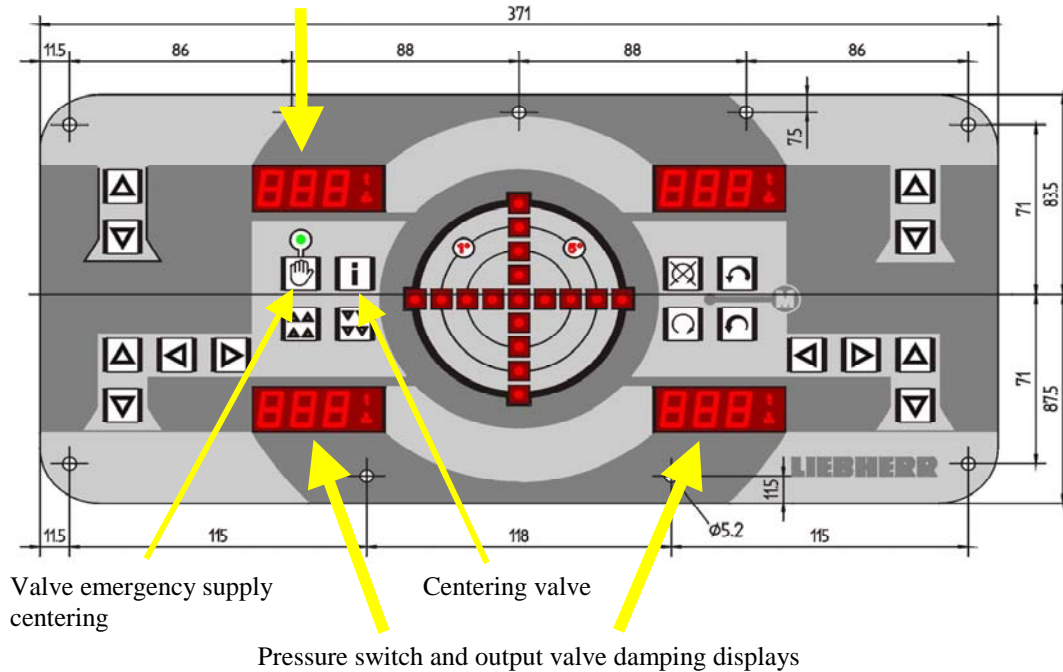
The pressure in the centering circuit also drops when centering; this is why the i-key can be used to activate centering. When centering the steering axles, a check will first be made to establish whether the angular values of the steering axle lie within the $> -3^\circ \dots < 3^\circ$ range, in order to prevent dangerous conditions for personnel. If this is the case, these axles will be centered. If an axle is not within this range, the i-key must be firmly pressed for 5 seconds, after which centering will also take place.

The Hand key can also be pressed simultaneously when centering (constant pressure build-up when centering) to ensure safe centering.

Test 33

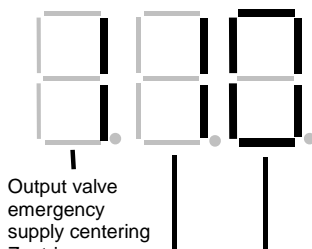
Displays on support control units right/left:

Test programm- Nr.: "33"

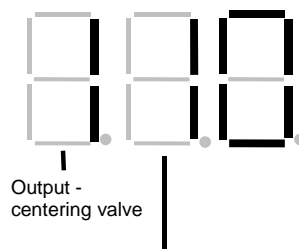


Pressure switch and output valve damping displays:

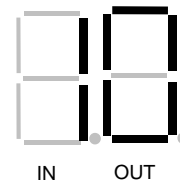
Display, lower left:



Display, lower right:



Example:



Input signal
pressure switch
180 bar
I/O- Modul 4
(IN = Pressure
present)

Input signal
pressure switch
180 bar
I/O- Modul 3
(OUT = Pressure
present)

Error code:

No error code is displayed for this test.

Test 34

3.20 Active rear axle steering, locking and centering valve function test (Test 34)

General:

With "active rear axle steering", hydraulic valves which come into use in the event of a fault or from a specific speed are installed. The centering valve only activates in the event of a fault. If the centering valve is activated (zero current status), each axle will be brought separately to 0° displacement. The locking valve activates in the event of a fault and for max. V steering. From max. V steering, the axles will be adjusted to 0°, the locking valve will also activate (zero current) and the axles in question will be hydraulically locked. When locked, the axles can only be steered to 0° (the maximum angle is now the current angle).

Centering valve: Changeover valve to activate / release the steering cylinder

Locking valve: Valve for opening the check valve on the centering cylinder

Function description

These valves are only activated in the event of a fault (exception is the locking valve from V steering max.). It must be ensured that these valves also switch safely and "mechanically". The centering valve must not be activated to check function while driving, since this affects driving quality. The locking valve will be activated while driving (max. V steering) but the steering angle is already 0°. It is therefore not possible to carry out any function checks. The valves will not be checked for functionality while driving, but instead will be checked cyclically after Ignition ON or by calling up a test program (description provided later). A check will be made to see whether the valve in question is "falling off" mechanically to ensure that it switches to a safe status in the event of a fault.

Starting conditions with Engine START (without test program):

The function check takes place with Engine ON and under the following starting conditions:

- Transmission in Neutral
- No fault present in "active rear axle steering" (angle sensor, ..)
- Speed < 0.2 km/h
- **Driving program on "Road driving"**
- Operating mode CH
- **Axle spring mounting "spring-mounted"**

After Engine ON, the conditions referred to above will be checked. If all preconditions are fulfilled, the "COUNTER_VALVE DIAGNOSTICS" counter will count down by 1. If these preconditions have occurred 10 x (COUNTER_VALVE DIAGNOSTICS = 0), the centering or locking valve will be tested dependent on wheel position.

"COUNTER_VALVE DIAGNOSTICS" counter value: 10 .. 0

Test 34

Starting conditions for test program 34:

- Transmission in "Neutral"
- V speed < 0.2 km/h
- Drive program 5 (DP5, manual steering)

The axles must not be spring-mounted here.

To activate the test:

- No fault present in "active rear axle steering" (angle sensor, ..)
- Operating mode CH

The test program will start when the **Hand key** and the **DP 5-key** are pressed simultaneously.



This will set the "COUNTER_VALVE DIAGNOSTICS" counter to "0". The counter will reach the value 10 if the test has run through completely, otherwise it will remain at "0".

Function check of valves dependent on wheel positions

Either the centering or the locking valve will be tested dependent on wheel positions. When testing the centering valve, it is important to ensure that the axles are actively steered to 0°. This will ensure that no personnel are put at risk during the function check.

With a wheel position < 3° (left or right locking) of all axles with centering cylinder, the respective centering valve (zero current) will be tested. The steering cylinders will thus be isolated (zero pressure) and "active" steering to the right will take place simultaneously (time specified). An error code will be shown if an angle alteration > 4° is identified.

With a wheel position >= 3° (left or right locking) of an axle with centering cylinder, the locking valve (zero current) will be tested. The check valves on the centering cylinder will be closed and "active" steering away from 0° will take place simultaneously (time specified). A error code will be shown if an angle alteration of > 4° is identified.

A **beeper** will sound for **10 seconds** on the keypad unit during the test. If no LEC (see below) appears after the 10 seconds, it is certain that the valves (dependent on the angle position at the start: centering valves at < 3° and locking valve >= 3°) are switching safely and "mechanically".

The test must be carried out with the wheel position at >= 3° and < 3° (see description given above).

Error code:

LECs are displayed for this test.

Test 40 and 41

3.21 Engine overspeed protection (Test 40 and 41)

Test 40 (braking flap)

Test 41 (ventilation flap)

Purpose:

The routines to activate the engine braking flap or the ventilation flap (customer request) in case of overspeeding serve to test the diesel engine's overspeed protection. The two tests set the upper limit speed for the activation of the speed protection function down to approx. 75% of the parameterized maximum speed.

Visualisation of the test is carried out via the two “dual 7-segment displays” on the control unit.

The tests **remain active** until they are stopped by pressing the **i-key**; this will reset the limit speeds.

After activating one of the two tests, the **accelerator pedal** must be **fully depressed**. After exceeding the limit speed, the **braking flap** or the **ventilation flap** must **respond**.

CAUTION!

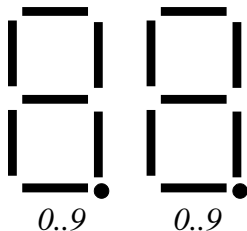
After operating the ventilation flap, the engine will be strongly "compressed", which could result in the engine shutting down*. Once the ventilation flap has shut, the engine should be switched off using "Ignition OFF" due to heavy carbon build-up. This test may only be carried out for a very brief period of time.

Error code:

See chart “[Main code/sub code test routines LIEBHERR CH](#)”.

lower display (H69):

Main code Sub code



*from Muli 2, an Engine Stop Signal will be specified via CAN. The engine will shut down.

Test 43 and 44

3.22 Hydrostatic fan drive (Test 43 and 44)

Test 43 (manual)

Test 44 (automatic)

Purpose:

The test routines are used to check a hydrostatic fan drive. Test program 43 adjusts the selected speed in 10% -increments from 0..100%, program 44 will run through automatically and increase the speed in 10% increments every 5 seconds from 0..100%.

Controlling function using the cab control unit:

The function can only be activated if the engine is identified as being ON

Activation takes place via test routines 43 and 44.

Visualisation of the test is carried out via the two dual 7segment displays on the control unit. The increase in speed will be indicated on the control unit by a short buzzer sound.

CAUTION!

Since fan control is switched off when the test program is active, the engine or gears could overheat. If this happens, an extended warning buzzer will sound on the keypad unit.

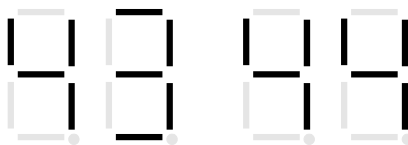
Test 43 remains active until it is **stopped** using the **i-key**. Temperature-dependent control will only be reactivated at this stage. Use keys **P1** or **P2** to increase fan speed.

Test 44 stops itself, but the fan remains set at 100% until the **i-key is pressed**. Temperature-dependent control will be reactivated at this stage.

upper display:

Absolute values

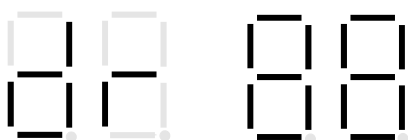
cyclical



lower display:

Speed "sp"

Speed in % (0..99 (100))



Test 46, 47, 48 and 49

3.23 Clearing the error code memory for ECU, TCU, AAS and intarder (Test 46, 47, 48 and 49)

Test 46 (engine)

Test 47 (transmission)

Test 48 (AAS)

Test 49 (intarder)

Purpose:

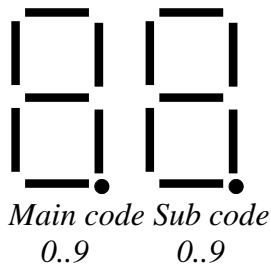
This function is used to clear inactive errors in the error memories of the ECU, TCU, AAS or intarder control units. These inactive errors occur in production if the peripherals of the individual control units were not fully connected at that stage.

The error code memory of the control units should be cleared before shipping the devices.

Error code:

See chart “[Main code/sub code test routines LIEBHERR CH](#)“.

lower display (H69):



Test 60, 61 and 62

Function check of AAS (customer request):

The test routines described below are used to check the AAS (automatic antilock system) to determine that electrical cabling and pneumatic brake line connections are correct.

Wire breakage, sensor faults, actuator faults:

There is no need to test the sensors or actuators for their electrical limit values since the electronics are already designed to carry out this procedure for "normal operation" and any faults will be reported and displayed as error codes.

AAS warning lamp:

The AAS warning lamp is checked in the cab's display unit when the lights test is carried out after the ignition has been turned on. The lamp's operation will be triggered if CAN shows an error with a value of 1..2 on the AAS or if the *sensor-memory-bit* is set. The lamp flashes at 1 Hz if the CAN connection between the vehicle electronics (I/O module 2) and the ABS/ASR control unit is faulty. A system fault will also be displayed for the I/O module in this case. Once a sensor fault has been identified, the lamp will remain on until all sensors have been identified as OK again and the vehicle is moving at approximately 20 km/h.

Clearing the error code memory:

This function should be carried out at the end of all tests. For a description, see the previous chapter "Clearing error code memory"

Checking ASR engine control:

This function check can be carried out without a test program. It is used to check the **engine control** during ASR operation. For this, the vehicle must be supported in such a way that no wheel has contact with the ground (Caution: axle spring-mounting should be *locked*). Now operate the parking brake, switch into drive direction D and depress the accelerator slowly. When doing this, the engine must be noticeably throttled back (observe engine speed) if a speed differential between the right and left or front and back wheels occurs on the driven axles. Cross-country speed + longitudinal lock + transverse locks can now be engaged in order to check whether the ASR is out of order from the non-occurrence of differential speeds on the wheels. In this case, no engine control may take place.

Note:

1. the longitudinal and transverse locks must be switched off when checking the ASR.
2. automatic control must be deactivated if the longitudinal and transverse locks are switched on.

Test 60

3.24 Testing the assignment of the AAS sensors (Test 60)

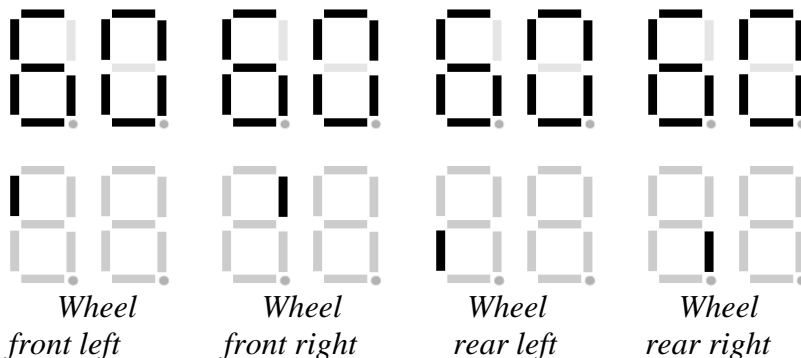
This routine identifies whether the front left, front right, rear left and rear right speed sensors are correctly connected. The outer segments on the 7-segment display, lower left, correspond to the 4 sensed wheels in the direction of travel. The segment for the wheel to be moved flashes until the AAS control unit reports a movement of the wheel. The reported **wheel speeds** of one axle will be compared.

When a **wheel speed** on the wheel being tested of **> 1.3 km/h** has been identified and a simultaneous wheel speed of **< 0.6 km/h** on the opposite wheel has been identified, the sensor will be identified as **OK**, a **buzzer** will sound **briefly** on the keypad unit and the **clearance lights**, the **parking light** and the two **turn signals** will be switched on. Conversely, if the opposite wheel is revolving more quickly than the wheel to be tested, the test will be terminated and the error code (54) will be displayed. In this case, either the test has not been carried out properly, or there is a wiring fault.

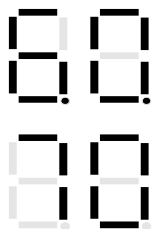
If a **fault** is detected during the test, the test routine will be stopped, an **error** in compliance with the *main code/sub code* description given above will be displayed and an **extended buzzer** will sound.

When the test identifies that the current sensor is operating correctly, it will automatically switch over to the next wheel. The wheel selected can be switched forward or back by pressing the **P1** or **P2** key. The test can be terminated prematurely by pressing the **i**-key.

Display while the test is running:



All four wheels tested successfully:



Error code:

See chart “[Main code/sub code test routines LIEBHERR CH](#)”.

Test 61

3.25 Testing the assignment of the AAS valves, pulse program (Test 61)

This routine identifies whether the front left, front right, rear left and rear right AAS control valves are correctly connected.

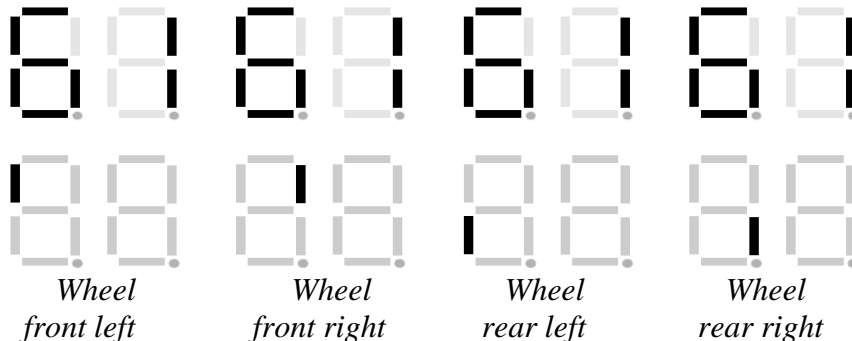
The outer segments on the 7-segment display, lower left, correspond to the 4 sensed wheels in the direction of travel. The segment for the wheel to be tested flashes. During the test (with brake fully depressed), the **brake pressure rate** of the four channels should be observed **as described**.

The current test stage will be displayed on the right-hand 7-segment display:

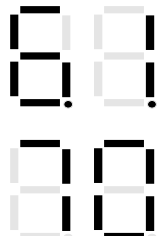
1. full brake pressure
2. reduced brake pressure
3. no brake pressure
4. reduced brake pressure
5. full brake pressure
6. Delay, buzzer, on to next wheel, stage 1

While the test is running, it will automatically switch over to the next wheel at the end of the test sequence and a **brief buzzing tone** will sound. The wheel selected can be switched forward or back by pressing the **P1** or **P2** key. By pressing the **i**-key, the test can be terminated prematurely.

Display while the test is running:



Test successfully concluded:

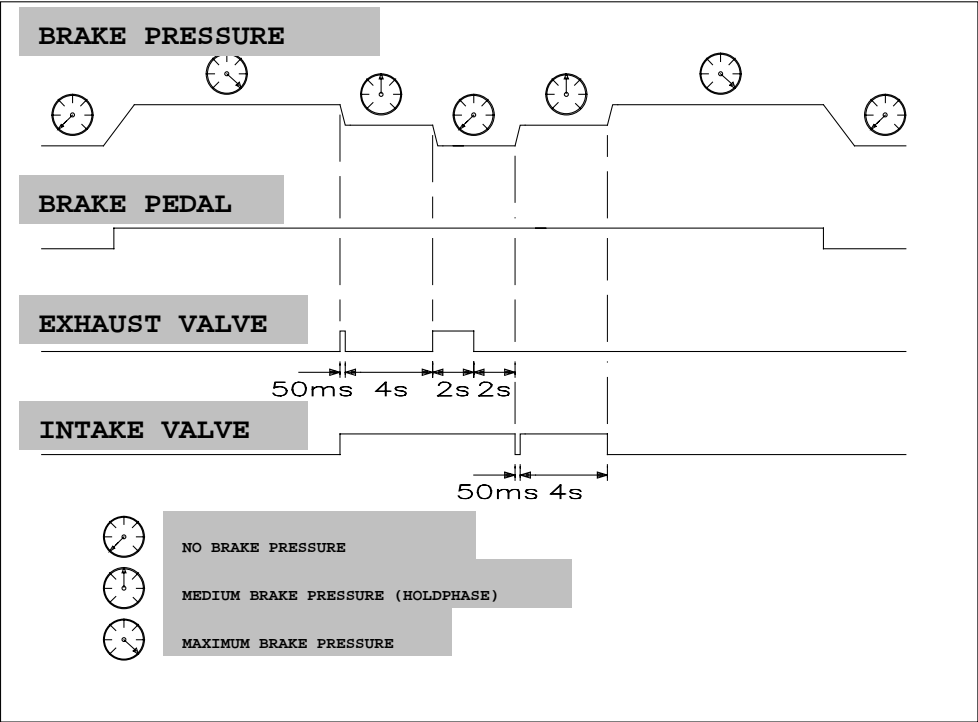


Error code:

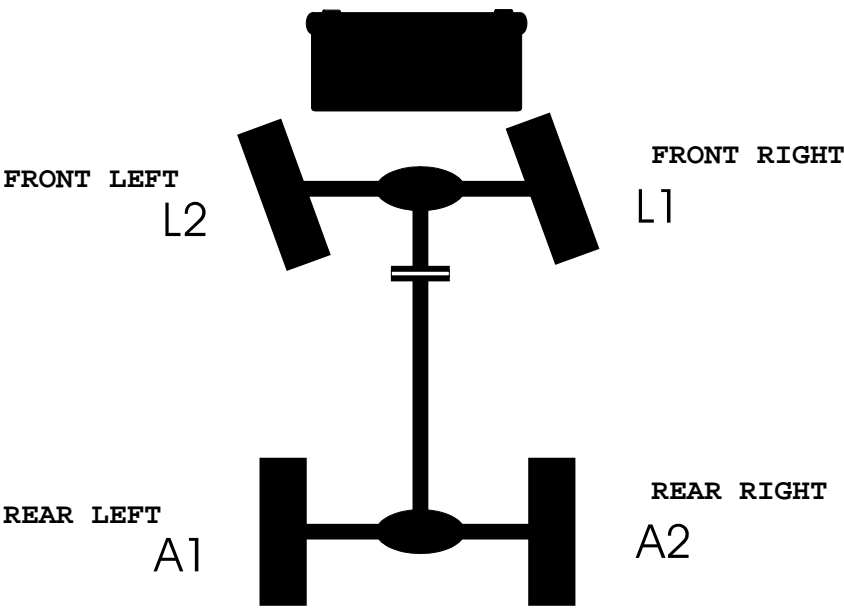
See chart “[Main code/sub code test routines LIEBHERR CH](#)”.

Test 60 and 61

Pressure rate during pulse program:



Description of the wheels:

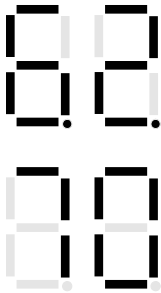


Test 62

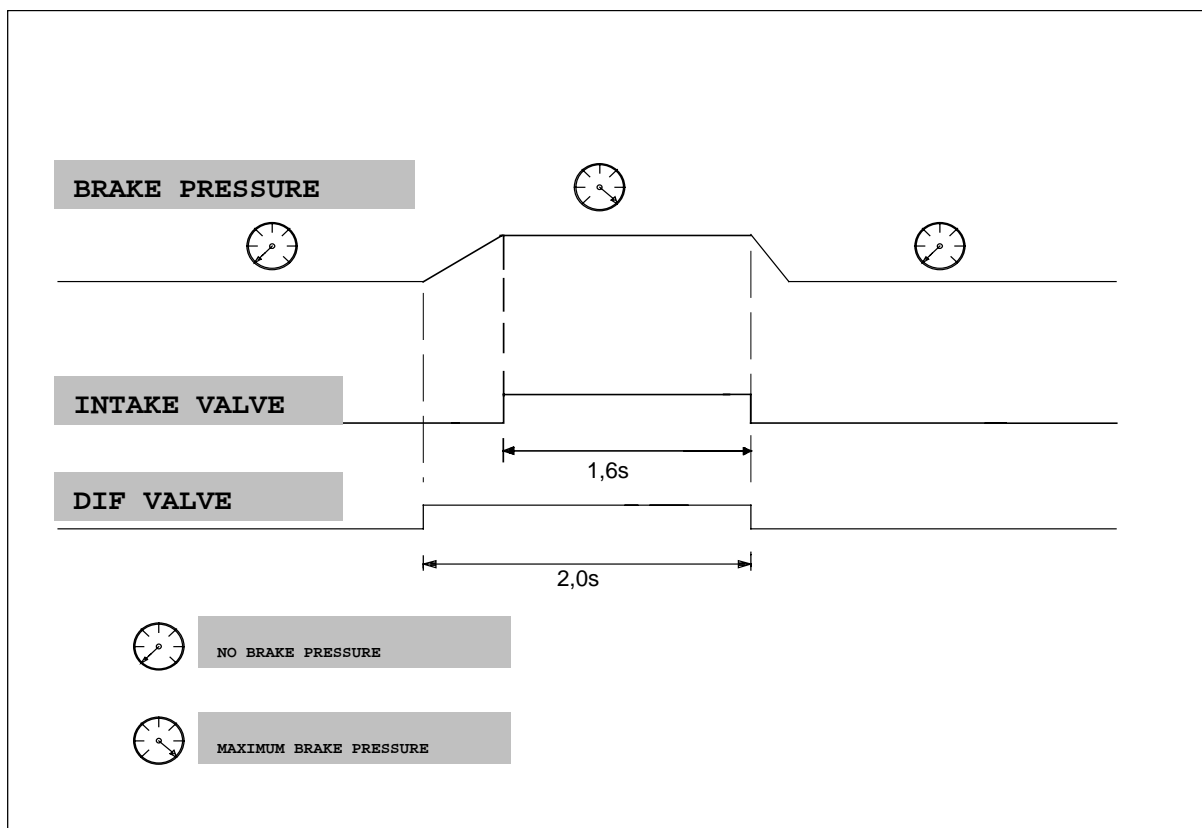
3.26 Checking the function of the ASR-DIF valve (Test 62)

This routine identifies whether the ASR-DIF valve is functioning.

Test successfully concluded:



After the routine has started, the pressure in the brake circuit of the driven axle will be controlled for approx. 0.5 seconds and then maintained for about 5 seconds. The **pressure rate** must be observed and should be displayed as follows:



Error code:

See chart “[Main code/sub code test routines LIEBHERR CH](#)”.

Test 63

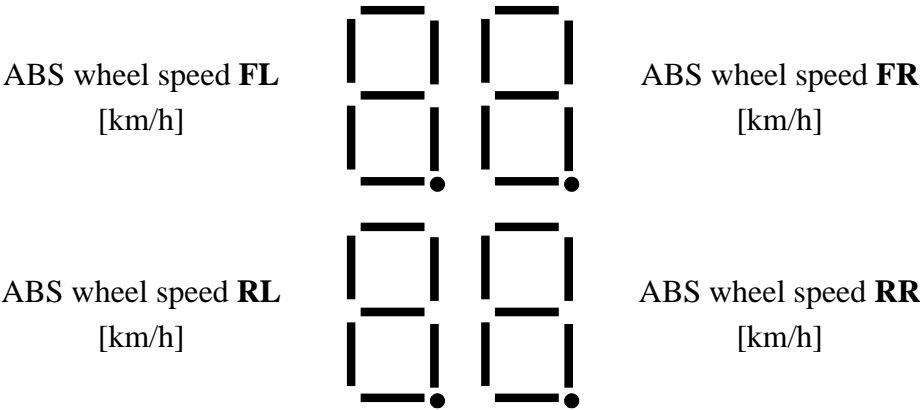
3.27 Wheel speed of the ABS speed sensors (Test 63)

Display shows the current calculated wheel speed of the ABS speed sensors (see also special diagrams in upper structure).

When the test is activated, the current calculated wheel speed of the four sensed wheels is called up and displayed on the keypad unit's 7-segment displays from 0..9 km/h (rounded).

In the event of strong deviation (approx. 2 km/h), check one of the sensors' magnet wheels.

Display on the keypad unit:



Error code:

No error code will be shown for this test, since only a visual check is carried out.

Test 70

3.28 Function and hydraulics of axle spring-mounting (Test 70)

General:

This test checks the status reports A1 and A2, the activation of the valves (up and down) front left (FL), rear left (RL), front right (FR) and rear right (RR) (*Axle spring-mounting function*) and the axle spring-mounting hydraulics (*Axle spring-mounting hydraulics*) (see circuit diagrams CH).

The pressure sensor adaptation must be connected so that the hydraulics of the vehicle (CH) can be tested (see [Pressure sensor connections](#) and [Connection plug centre console](#)).

Start conditions:

- Transmission in “**Neutral**”
- Axles “**spring-mounted**”

To activate the test:

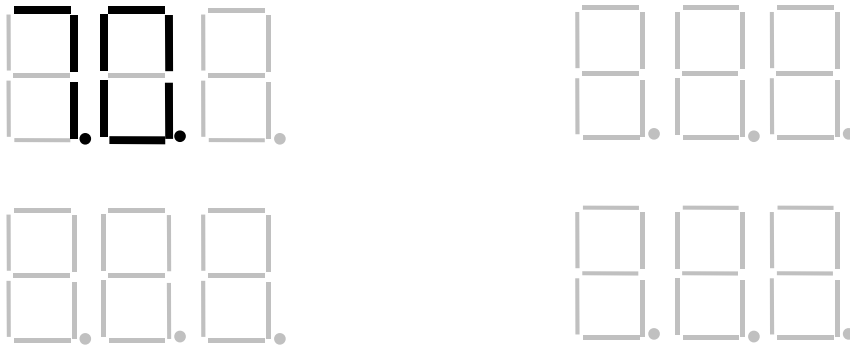
The test is activated using the Hand key on the keypad unit. If all starting preconditions are fulfilled, engine speed will be automatically set to 1000 rpm \pm 100 rpm (engine speed display H154..H157 on the display unit).

The axle spring-mounting's **current pressure** will be shown on the display unit (in bar) on 7-segment displays H162..H165 (error display) (see [Pressure values](#)).

The **specified pressure** will also be shown on the display unit's 7-segment displays H158..H161 (transmission display).

Test 70

The 7-segment displays 7-seg. UR, 7-seg. LR, 7-seg. LL and optionally the supporting force display will also be switched off on the support control units. The 7-segment display 7-seg. UL shows the current test (70).



If at least one of the starting conditions is not fulfilled, this test will not start. Error code 57 will appear on the keypad unit's 7-segment displays H68 and H69.

Termination criteria:

The "**Axle spring-mounting functions and hydraulics**" test program will be terminated if one of the starting conditions referred to above is no longer fulfilled. Error code 57 also shows on the keypad unit at termination. The test program can only be restarted by pressing the i-key.

The test program will also be terminated if the engine speed has exceeded the maximum speed of 1100 rpm for longer than 4 seconds or has dropped below the minimum speed of 900 rpm.

The test program can be terminated at any time using the i-key. When the i-key is pressed, engine speed is automatically set to idle.

The "**Axle spring-mounting functions and hydraulics**" test program will start when the **Hand key** and the **Level key** are pressed at the same time; both keys must be pressed and held. The test sequence will be **interrupted (not terminated)** if one of the keys is no longer being pressed. If both keys (Hand key and Level key) are pressed after an interruption, the test program will restart at the point at which it was interrupted.

The **Level key** does not start automatic level control; it is only used for the duration of the current test sequence. The **Level key** has no function if not used in conjunction with the Hand key.

Error code:

See chart "[Main code/sub code test routines LIEBHERR CH](#)".

Test 70

Axle spring-mounting status reports:

Front left (FL), rear left (RL), front right (FR), rear right (RR)

Axle spring-mounting:	FL		RL		FR		RR	
Status reports:	A1:	A2:	A1:	A2:	A1:	A2:	A1:	A2:
Vehicle raised:	0	0	0	0	0	0	0	0
Vehicle at Level:	0	1	0	1	0	1	0	1
Fault:	1	0	1	0	1	0	1	0
Vehicle lowered:	1	1	1	1	1	1	1	1

Chart: Axle spring-mounting status reports

Test sequence:

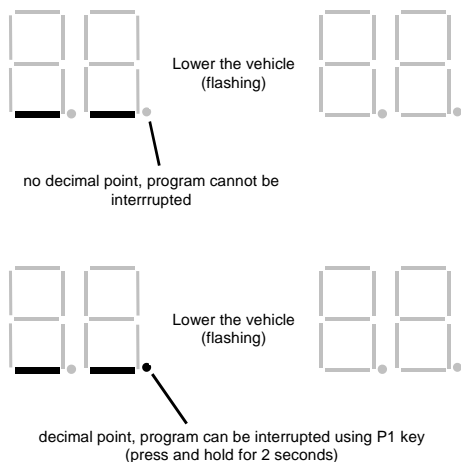
1. Checking status reports A1 and A2 FL, RL, FR and RR with vehicle lowered

Lowering the vehicle:

The vehicle will lower automatically and the status reports will be checked after a specific period of time (dependent on crane type). The vehicle will automatically be raised after the check.

The sequence "Lower_vehicle" will be displayed as follows on the keypad unit's 7-segment displays H68 and H69:

Lowering can be interrupted by pressing the P1 key (press and hold for 2 seconds) if the decimal point is also shown on the 7-seg. display. The sensor scan will now follow immediately.

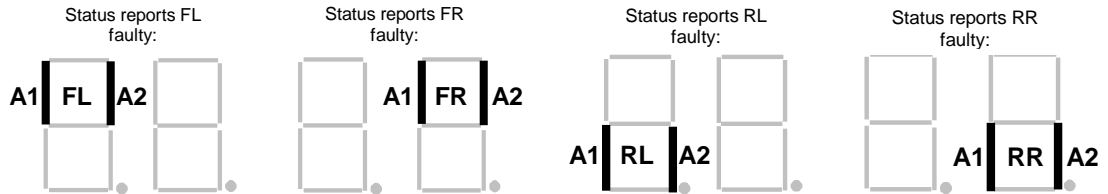


Test 70

Checking status reports A1 and A2 FL, RL, FR and RR

Status reports faulty:

The test program will be interrupted if at least one status report is faulty. The faulty status report will be displayed on H68 and H69 on the keypad unit.



Different combinations of the faulty status reports can also be displayed on 7-segment displays H68 and H69.

Examples:



→ Checking status reports or valve activation and repeating the test.

No faults in status reports:

If no faults are shown in status reports when the vehicle is lowered, a buzzer will sound for approx. 3 seconds on the keypad unit and error code 70 (status reports OK in lowered status) will be displayed on 7-segment displays H68 and H69. The vehicle will then be raised automatically.

Test 70

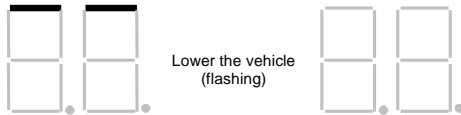
2. Checking status reports A1 and A2 FL, RL, FR and RR with vehicle raised

Raising the vehicle:

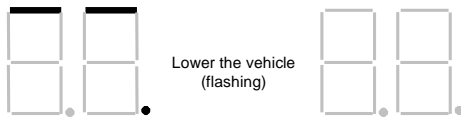
as for "Lowering the vehicle":

The sequence "Raise_vehicle" will be displayed as follows on the keypad unit's 7-segment displays H68 and H69:

Raising can be interrupted by pressing the P1 key (press and hold for 2 seconds) if the decimal point is also shown on the 7-seg. display. The sensor scan will now follow immediately.



no decimal point, program cannot be interrupted



decimal point, program can be interrupted using P1 key (press and hold for 2 seconds)

Checking status reports A1 and A2 FL, RL, FR and RR Status reports faulty:

The test program will be interrupted if one of the status reports is faulty. The faulty status report will be displayed as for "Lower the vehicle" on H68 and H69.

→ Checking status reports or valve activation and repeating the test.

No faults in status reports:

If no faults are shown in status reports when the vehicle is raised, a buzzer will sound for approx. 3 seconds on the keypad unit and error code 70 (status reports OK in raised status) will be displayed on 7-segment displays H68 and H69. The hydraulic pressure of the axle spring-mounting will now be checked while the vehicle is raised.

Test 70

3. **Checking the hydraulic pressure of the axle spring-mounting:**
A **buzzer** will sound **6x** for approx. **6 seconds** on the keypad unit and the hydraulic connection (P1, P2, P3 or P4) of the axle spring-mounting will be displayed on 7-segment displays H68 and H69. The user will then be requested to read the **pressure indicator on the display unit** and the vehicle will then automatically be moved to Level.

Display on the keypad unit:

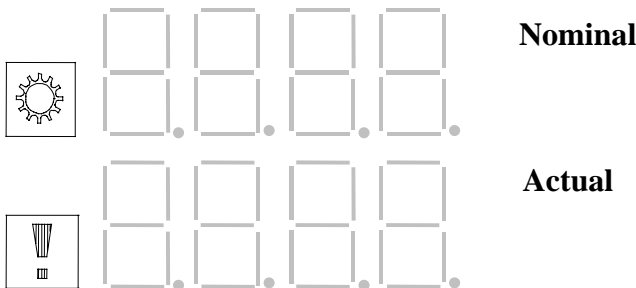
Example: P2: Hydraulic pressure of axle spring-mounting on P2 connection



Pressure indicator on display unit

The specified pressure will be shown on 7-segment displays H158..H161 (transmission display).

The current pressure (in bar) will be shown on 7-segment displays H162..H165 (error display).

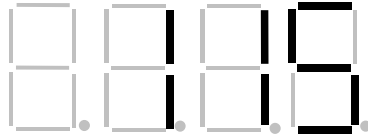


Test 70

Example: (pressure readings given here are not practice oriented)

Specified pressure:

115 bar \pm 5 bar (transmission display)



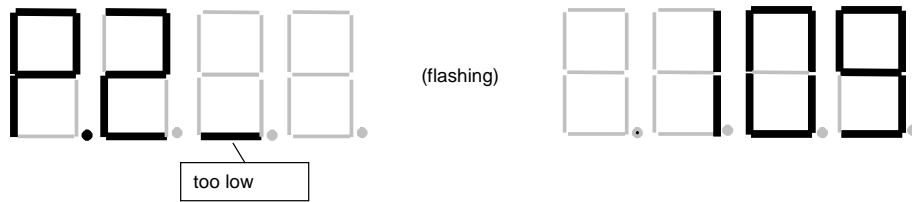
Current pressure:

Example 1: Pressure indicator: 109 bar (too low)

Example 2: Pressure indicator: 121 bar (too high)

Example 3: Pressure indicator: 110 bar..120 bar (within tolerance range)

Example 1: Axle spring-mounting hydraulic pressure too low (error display):



Example 2: Axle spring-mounting hydraulic pressure too high (error display):



Example 3: Axle spring-mounting hydraulic pressure within tolerance range:

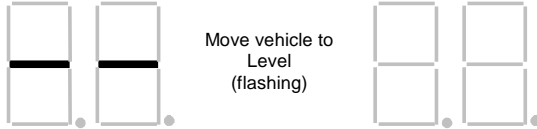
(error display):



Test 70

4. Moving the vehicle automatically to Level:

The following will flash on the keypad unit's 7-segment displays H68 and H69:



The vehicle will now be automatically moved to Level. The time required to do this is dependent on crane type.

Level achieved:

If Level is achieved within this time, the status reports A1 and A2 FL, RL, FR and RR are OK. Error code 70 (status reports A1 and A2 FL, FR, RL and RR OK) will be displayed on H68 and H69. It is now certain that the axle spring-mounting status reports are not faulty. It is, however, possible, that status reports FL and FR and/or RL and RR could be switched and that the activation of the valves could also be switched. For this reason, the valves (fill and drain) will be supplied individually.

If only the status reports or the valve activation are switched, Level would not have been achieved (see "Level not achieved").

The valves will now be activated in the following sequence:

1. Fill front left,
2. Drain front left,
3. Fill front right,
4. Drain front right,
5. Fill rear left,
6. Drain rear left,
7. Fill rear right,
8. Drain rear right

Time of activation is dependent on crane type.

The operator must observe whether the valves FL, FR, RL and RR are correctly supplied. If all valves are supplied correctly in accordance with the sequence given above, "**Axle spring-mounting function**" is OK. The "**Axle spring-mounting functions and hydraulics**" test program is therefore concluded.

Test program concluded at "Level achieved":

Test 70 on H66 and H67 flashes and error code 70 appears on H68 and H69.

Error code:

See chart "[Main code/sub code test routines LIEBHERR CH](#)".

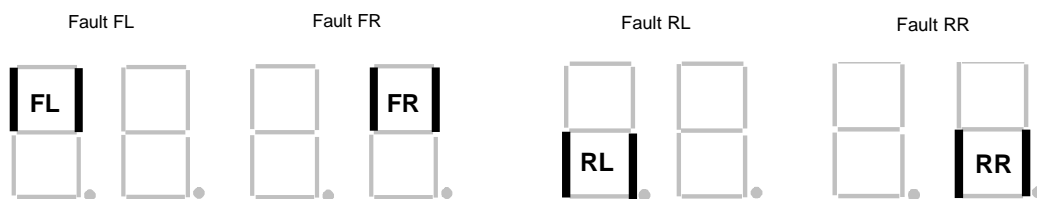
Test 70

Level not achieved:

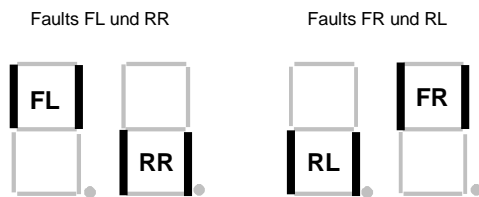
If Level is **not** achieved within this time, the following causes of fault must be considered:

1. Status reports A1 and A2 (at Level) or valve activation (fill, drain) FL, RL, FR or RR are faulty.
2. Status reports FL and FR and/or RL and RR are switched.

A **buzzer** will sound on the keypad unit for approx. **3 seconds** and the causes of fault referred to above will be displayed as follows on 7-segment displays H68 and H69.



Different combinations of the faulty status reports can also be displayed on 7-segment displays H68 and H69.



- Remedy:**
1. Vehicle will once again be lowered automatically (specified status)
 2. Check status reports FL and FR and/or RL and RR to see whether they are switched.
 3. Monitor valve activation (fill, drain) FL, RL, FR and RR individually.

Test 70

Lowering the vehicle again:

The vehicle will be fully lowered again to ensure that the axles have a specified status. The time required to lower the vehicle is dependent on crane type. When the vehicle is lowered, status reports FL and FR and/or RL and RR will now be monitored to check whether they are switched.

Checking status reports FL and FR and/or RL and RR to see whether they are switched:

Procedure:

1. Raise axle FR, time taken to raise FR is dependent on crane type
2. Monitor status reports FR and FL
3. Lower axle FR, time taken to lower FR is dependent on crane type
4. Raise axle RR, time taken to raise RR is dependent on crane type
5. Monitor status reports RR and RL
6. Lower axle RR, time taken to lower RR is dependent on crane type

If the system identifies that status reports FL and FR and/or RL and RR are switched, this will be displayed at “End of test program“ on 7-segment displays H68 and H69.

After axle RR has been lowered, all valves (fill, drain) FL, RL, FR and RR will be individually supplied:

Monitoring valve activation (fill, drain) FL, RL, FR and RR individually:

Time of activation is dependent on crane type.

The valves will now be activated in the following sequence:

1. Fill front left
2. Drain front left
3. Fill front right,
4. Drain front right
5. Fill rear left
6. Drain rear left
7. Fill rear right
8. Drain rear right

The operator must observe whether the valves FL, FR, RL and RR are correctly supplied. Valve activation will have to be checked if the sequence given above is not adhered to.

→ Check valve activation and repeat the test.

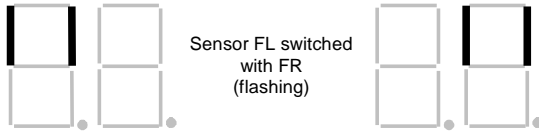
The test program is concluded when axle RR is lowered.

Test 70

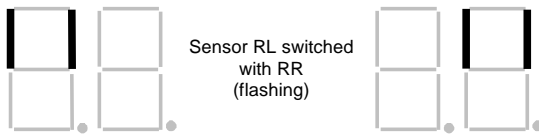
Test program concluded at "Level not achieved":

If the system has identified that status reports FL and FR and/or RL and RR are switched, this will be indicated on 7-segment displays H68 and H69.

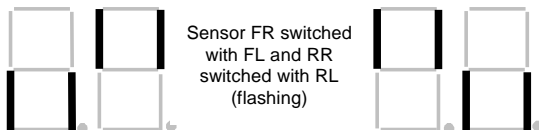
Sensor FL switched with FR:



Sensor RL switched with RR:



Sensors FL and FR switched and RL and RR switched:



If status reports FL and FR and/or RL and RR are not switched, causes of fault will be shown as for "Level not achieved" on 7-segment displays H68 and H69 and Test 70 flashes on H66 and H67.

Test 71

3.29 Support hydraulics (Test 71)

General:

This test checks the hydraulics of the support (*Support hydraulics*). The following pressures will be checked and displayed on the support control units right and left (see [Pressure values](#)).

Pressure indicator on support control unit right:

- SUPPORT_UP_FR
- SUPPORT_DOWN_FR
- SLIDING SPAR IN_FR
- SLIDING SPAR OUT_FR

- SUPPORT_UP_RR
- SUPPORT_DOWN_RR
- SLIDING SPAR IN_RR
- SLIDING SPAR OUT_RR

Pressure indicator on support control unit left:

- SUPPORT_UP_FL
- SUPPORT_DOWN_FL
- SLIDING SPAR IN_FL
- SLIDING SPAR OUT_FL

- SUPPORT_UP_RL
- SUPPORT_DOWN_RL
- SLIDING SPAR IN_RL
- SLIDING SPAR OUT_RL

The pressure sensor adaptation must be connected so that the hydraulics of the vehicle (CH) can be tested (see [Pressure sensor connections](#) and [Connection plug centre console](#)).

Starting conditions:

- Transmission in “Neutral“

To start the test:

The test is started using the Hand key on the keypad unit. If all starting preconditions are fulfilled, engine speed will be automatically set to 1000 rpm \pm 100 rpm (engine speed display H154..H157 on the display unit).

Test 71

The current pressure (in bar) and the specified pressure will be displayed on the respective support control unit.

If at least one of the starting conditions is not fulfilled, this test will not start. Error code 57 will appear on the keypad unit's 7-segment displays H68 and H69.

Error code:

See chart "[Main code/sub code test routines LIEBHERR CH](#)".

Termination criteria:

The test program will be terminated if one of the starting conditions referred to above is no longer fulfilled. Error code 57 also shows on the keypad unit at termination. The test program can only be restarted by pressing the i-key on the keypad unit.

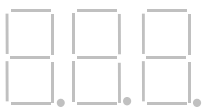
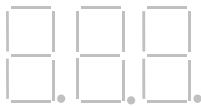
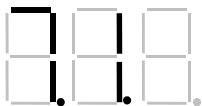
The test program will also be terminated if the engine speed has exceeded the maximum speed of 1100 rpm for longer than 4 seconds or has dropped below the minimum speed of 900 rpm.

The test program can be terminated at any time using the i-key. When the i-key is pressed, engine speed is automatically set to idle.

The "Support hydraulics" test is operated on the support control units right and left.

Test display and current pressure display with support UP/DOWN and sliding spar IN/OUT:

The 7-segment displays 7-seg. UR, 7-seg. LR, 7-seg. LL and optionally the supporting force display will also be switched off on the support control units. The 7-segment display 7-seg. UL shows the current test (71).



Test 71

Test sequence:

Pressure indicator on the support control units:

The current pressure and the specified pressure of "Support UP/DOWN and sliding spar IN/OUT" is displayed on support control units right and left.

The current pressure is only displayed on the support control units when the appropriate key is pressed.

On support control units with a release key (Hand key), the release key (Hand key) may have to be pressed to ensure the function of the other keys.

Pressure indicator on support control unit right:

Sliding spar IN/OUT RR and support UP/DOWN RR:

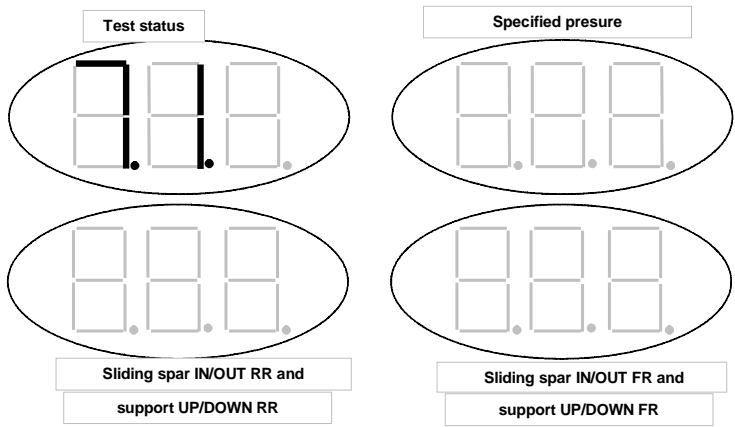
7-seg. LL

Sliding spar IN/OUT FR and support UP/DOWN FR:

7-seg. LR

Specified pressure:

7-seg. UR



Pressure indicator on support control unit left:

Sliding spar IN/OUT FL and support UP/DOWN FL:

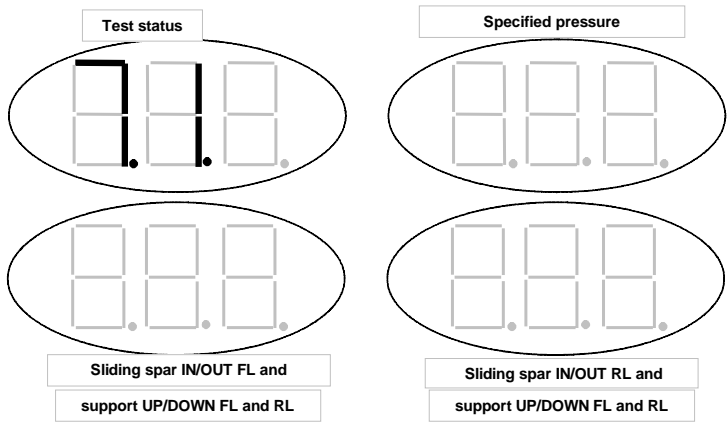
7-seg. LL

Sliding spar IN/OUT RL and support UP/DOWN RL:

7-seg. LR

Specified pressure:

7-seg. UR



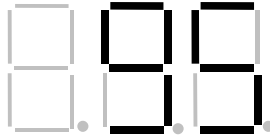
Test 71

Examples: (pressure readings given here are not practice oriented)

1. - Sliding spar OUT FR:

Specified pressure:

95 bar \pm 5 bar Pressure indicator 7-seg. UR



Current pressure:

Example 1: Pressure indicator 7-seg. LR: 89 bar (too low)

Example 2: Pressure indicator 7-seg. LR: 101 bar (too high)

Example 3: Pressure indicator 7-seg. LR: 90 bar .. 100 bar (within tolerance range)

Example 1: **Hydraulic pressure sliding spar OUT FR too low (display LR):**



Example 2: **Hydraulic pressure sliding spar OUT FR too high (display LR):**



Example 3: **Hydraulic pressure sliding spar OUT FR within tolerance range (display LR):**



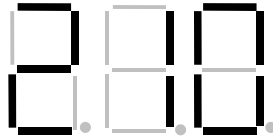
Test 71

2. Sliding spar IN RR:

Specified pressure:

210 bar \pm 5 bar

Pressure indicator 7-seg. UR:



Current pressure:

Example 1: Pressure indicator 7-seg. LL: 204 bar (too low)

Example 2: Pressure indicator 7-seg. LL: 216 bar (too high)

Example 3: Pressure indicator 7-seg. LL: 205 bar .. 215 bar ..
(within tolerance range)

Example 1: **Hydraulic pressure sliding spar IN RR too low (display LL):**



Example 2: **Hydraulic pressure sliding spar IN RR too high (display LL):**



Example 3: **Hydraulic pressure sliding spar IN RR within tolerance range**
(display LL):



Test 72

3.30 Active rear axle steering hydraulics (Test 72)

General:

This test checks the hydraulics of the active rear axle steering (*Active rear axle steering hydraulics*) (see [Pressure values](#)).

The pressure sensor adaptation must be connected so that the hydraulics of the vehicle (CH) can be tested (see [Pressure sensor connections](#) and [Connection plug centre console](#)).

Start conditions:

- Transmission in “Neutral“
- Drive program 5 (DP5, manual steering)

To start the test:

The test is started using the Hand key on the keypad unit. If all starting preconditions are fulfilled, engine speed will be automatically set to 1000 rpm \pm 100 rpm (engine speed display H154..H157 on the display unit).

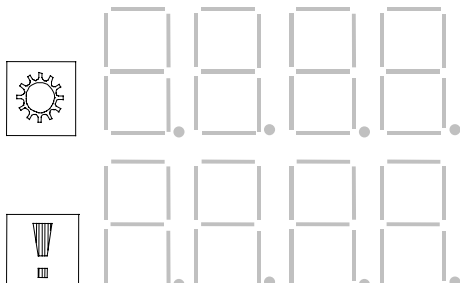
If at least one of the starting conditions is not fulfilled, this test will not start. Error code 57 will appear on the keypad unit's 7-segment displays H68 and H69.

Pressure indicator on display unit:

A total of 4 pressures will be displayed on the display unit, RAS fan standby, RAS fan return, RAS P and RAS LS. Only 2 pressures can be displayed simultaneously. For this reason, each time the Hand key is pressed, the system will switch between the pressure indicators **RAS fan standby/return** and **RAS P/LS**.



Test program started:



“RAS fan standby“

“RAS fan return“

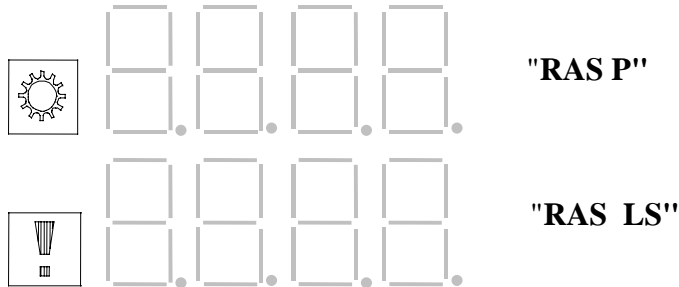
Test 72

At the start, the SPECIFIED pressure **RAS fan standby** (connection P5) will first be shown on 7-segment displays H158..H161 (transmission display) and the SPECIFIED pressure **RAS fan return** (connection P6) will be shown simultaneously on 7-segment displays H162..H165 (error display). Shortly after this, the current pressure **RAS fan standby** will be shown on the transmission display and the current pressure **RAS fan return** will be shown on the error display.

Pressing the Hand key:

The SPECIFIED pressure **RAS P** (connection P7) will be shown on the error display and simultaneously the SPECIFIED pressure **RAS LS** (connection P8) will be shown on the transmission display. Shortly after this, the current pressure **RAS P** will be shown on the transmission display and the current pressure **RAS LS** will be shown on the error display.

After pressing the Hand key:



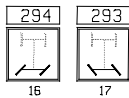
The 7-segment displays 7-seg. UR, 7-seg. LR, 7-seg. LL and optionally the supporting force display will also be switched off on the support control units. The 7-segment display 7-seg. UL shows the current test (72).



Test 72

Automatic locking:

At the start of the test program, the locking valve will automatically be switched to zero current. The axles are now locked and can therefore only be steered to 0°. The manual steering right/left keys must now be used to steer away from 0° now (against lock), so that the pressure (**RAS P**) can build up. The ACTUAL value must then be compared with the NOMINAL value.



Termination criteria:

The "Active rear axle steering hydraulics" test program will be terminated if one of the starting conditions referred to above is no longer fulfilled. Error code 57 also shows on the keypad unit at termination. The test program can only be restarted by pressing the i-key.

The test program will also be terminated if the engine speed has exceeded the maximum speed of 1100 rpm for longer than 4 seconds or has dropped below the minimum speed of 900 rpm.

The test program can be terminated at any time using the i-key. When the i-key is pressed, engine speed is automatically set to idle.

Locking of the axles affected will automatically be removed when the test program is terminated.

Error code:

See chart "[Main code/sub code test routines LIEBHERR CH](#)".

Test 73

3.31 Front axle steering hydraulics (Test 73)

General:

This test checks the hydraulics of the front axle steering (*Front axle steering hydraulics*) (see [Pressure values](#)).

The pressure sensor adaptation must be connected so that the hydraulics of the vehicle (CH) can be tested (see [Pressure sensor connections](#) and [Connection plug centre console](#)).

Starting conditions:

- Transmission in “**Neutral**“
- “Lock axles“ and “Support vehicle“ (not mandatory)

To start the test:

The test is started using the Hand key on the keypad unit. If all starting preconditions are fulfilled, engine speed will be automatically set to 1000 rpm \pm 100 rpm (engine speed display H154..H157 on the display unit).

If at least one of the starting conditions is not fulfilled, this test will not start. Error code 57 will appear on the keypad unit's 7-segment displays H68 and H69.

Termination criteria:

The "Front axle steering hydraulics" test program will be terminated if one of the starting conditions referred to above is no longer fulfilled. Error code 57 also shows on the keypad unit at termination. The test program can only be restarted by pressing the i-key.

The test program will also be terminated if the engine speed has exceeded the maximum speed of 1100 rpm for longer than 4 seconds or has dropped below the minimum speed of 900 rpm.

The test program can be terminated at any time using the i-key. When the i-key is pressed, engine speed is automatically set to idle.

Error code:

See chart “[Main code/sub code test routines LIEBHERR CH](#)“.

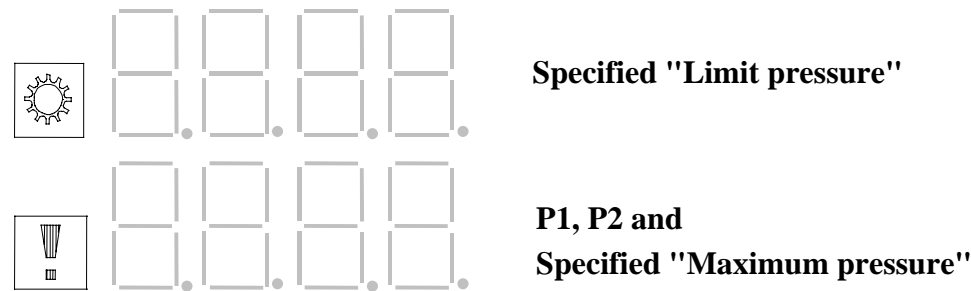
Test 73

Pressure indicator on display unit:

The **current pressure** (in bar) of the front axle steering will be shown on 7-segment displays H162..H165 (error display) and on 7-segment displays H158..H161 (transmission display) on the display unit.

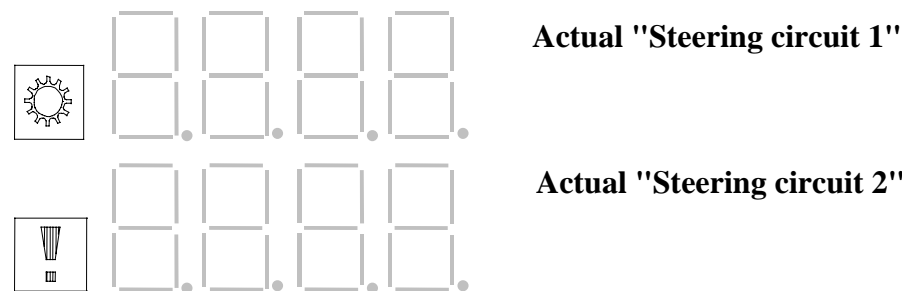
The **specified pressure** will also be displayed on these two displays for a short time after the start of the program (approx. 3 seconds) and will then be overwritten by the current pressure.

Test program started:



At the start, P1 (Pump1) will be displayed on 7-segment displays H162..H165 (error display) and the SPECIFIED “limit pressure “ of P1 will simultaneously be displayed on 7-segment displays H158..H161 (transmission display). Shortly afterwards, the SPECIFIED "maximum pressure" of P1 will be shown on the error display. This process repeats itself analogous to Pump 2.

Shortly after the start:

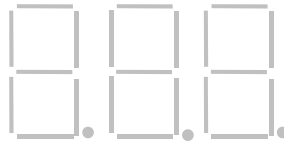
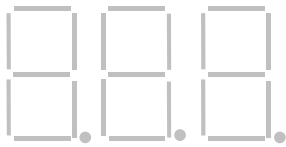
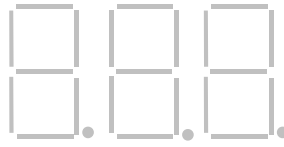
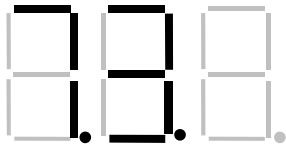


Test 73

7-segment displays 7-seg. UR,

7-seg. LR, 7-seg. LL and optionally the supporting force display will also be switched off on the support control units.

The 7-segment display 7-seg. UL shows the current test (73).



Test 73

Examples: (pressure readings given here are not practice oriented)

1. Maximum pressure

115 bar ± 5 bar (transmission display and error display, test program started)

Current pressure:

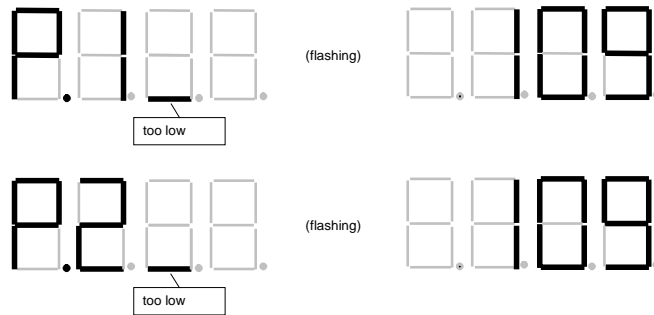
(transmission display and error display, shortly after the start)

Example 1: Pressure indicator: 109 bar (too low)

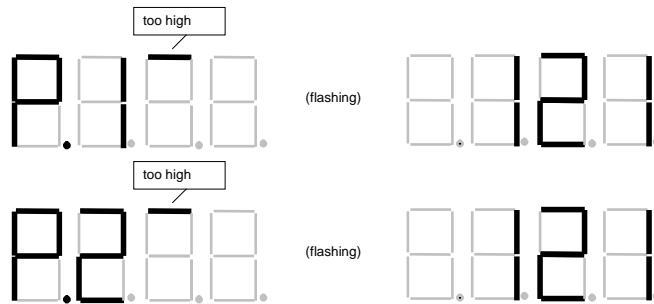
Example 2: Pressure indicator: 121 bar (too high)

Example 3: Pressure indicator: 110 bar..120 bar (within tolerance range)

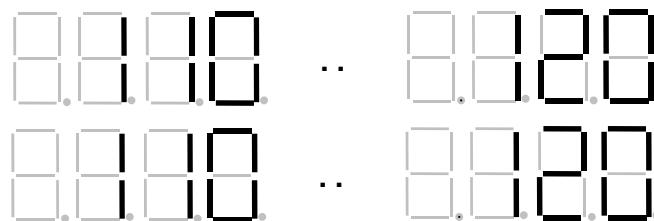
Example 1: Maximum pressure of front axle steering too low:



Example 2: Maximum pressure of front axle steering too high:



Example 3: Maximum pressure of front axle steering within tolerance range:



Test 73

2. Limit pressure

50 bar \pm 10 bar (transmission display and error display, test program started)

Current pressure:

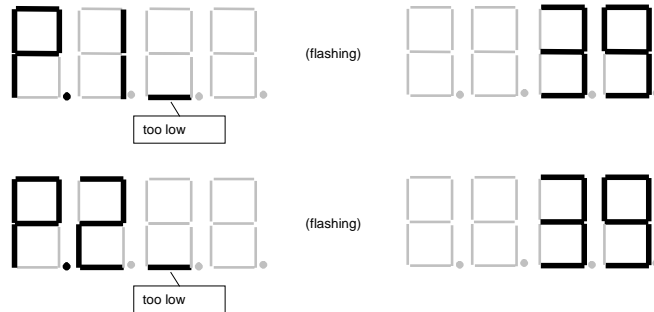
(transmission display and error display, shortly after the start)

Example 1: Pressure indicator: 39 bar (too low)

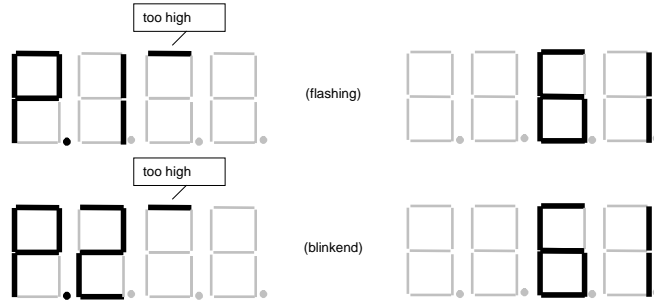
Example 2: Pressure indicator: 61 bar (too high)

Example 3: Pressure indicator: 40 bar..60 bar (within tolerance range)

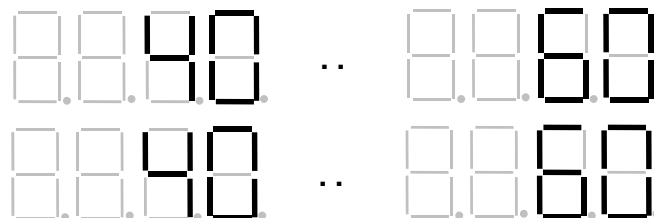
Example 1: Limit pressure of front axle steering too low:



Example 2: Limit pressure of front axle steering too high:



Example 3: Limit pressure of front axle steering within tolerance range:

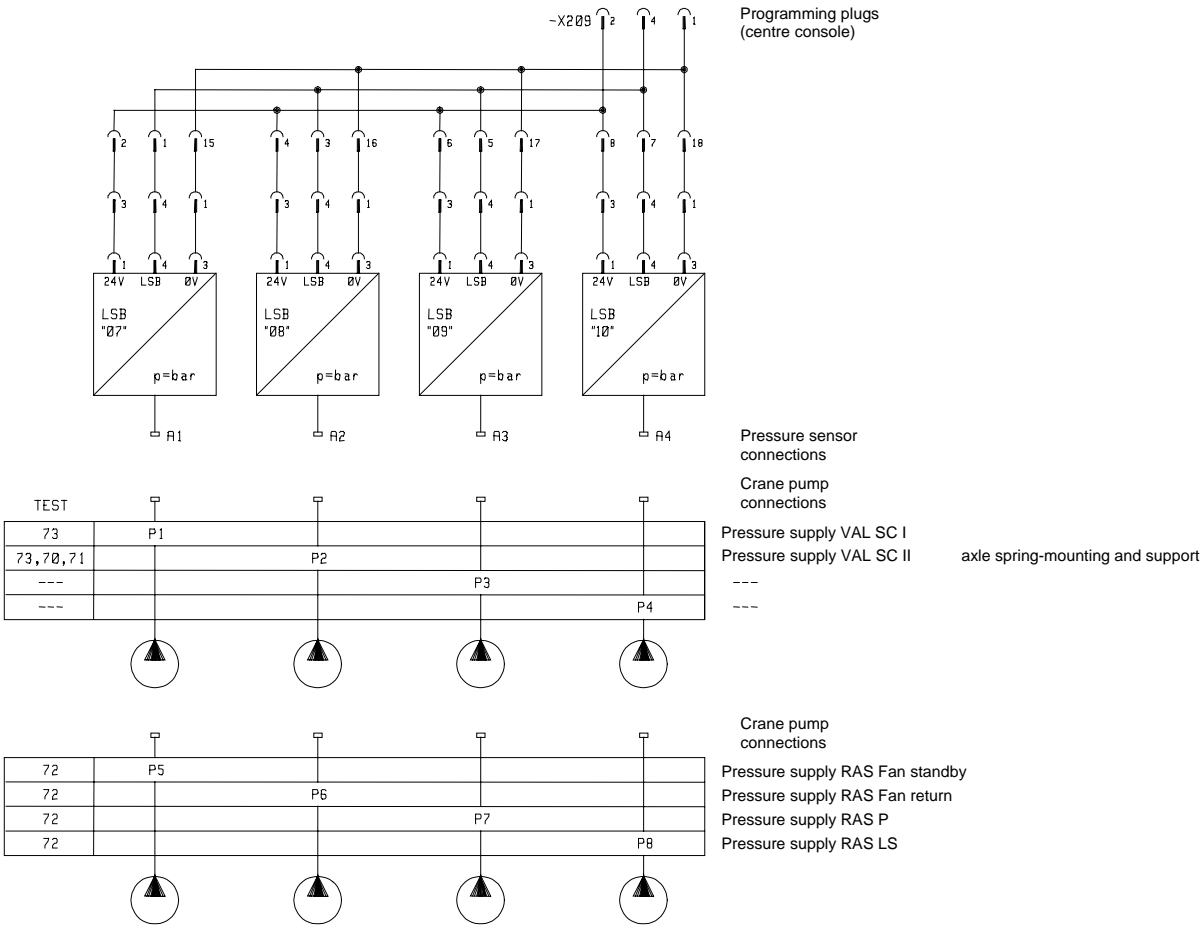


Test 70, 71, 72 and 73

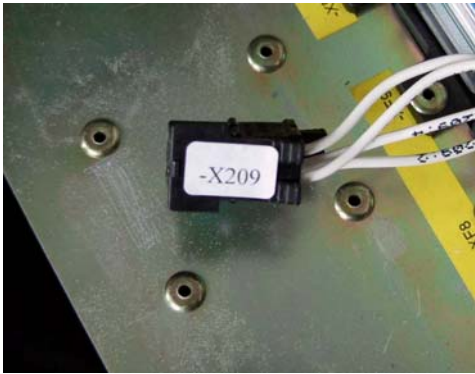
4 Hydraulics tests supplement

4.1 Connection plug centre console

LSB pressure sensor adaptation



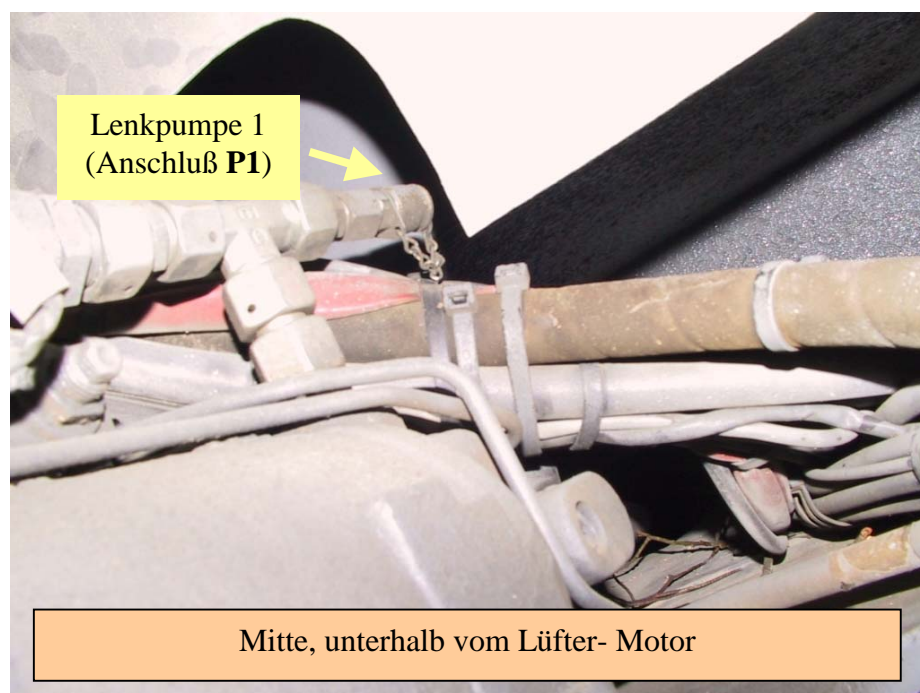
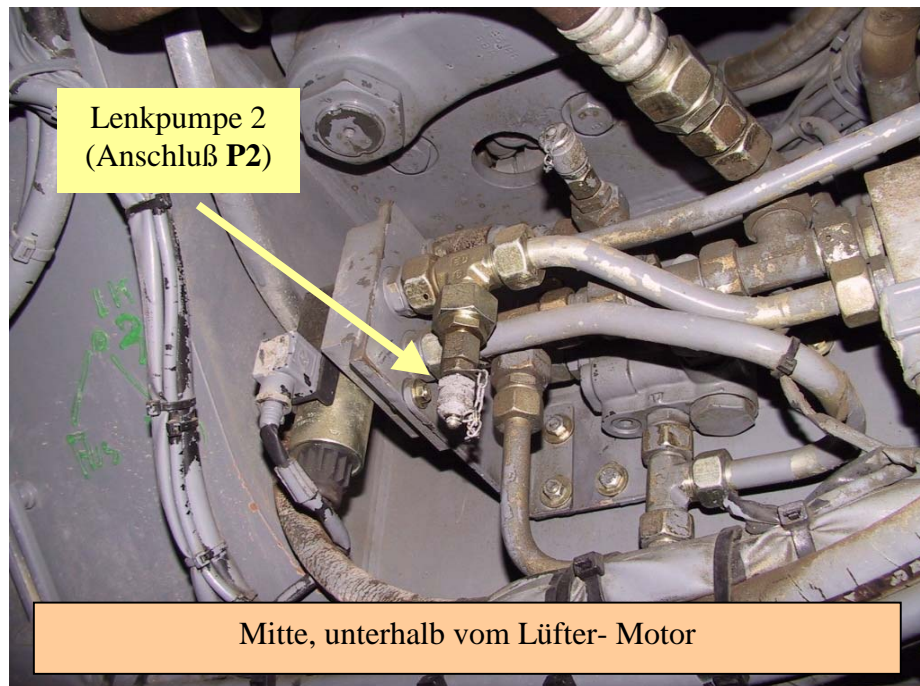
Plug -X209 centre console:



Test 70, 71 and 73

4.2 Pressure sensor connections (diagrams)

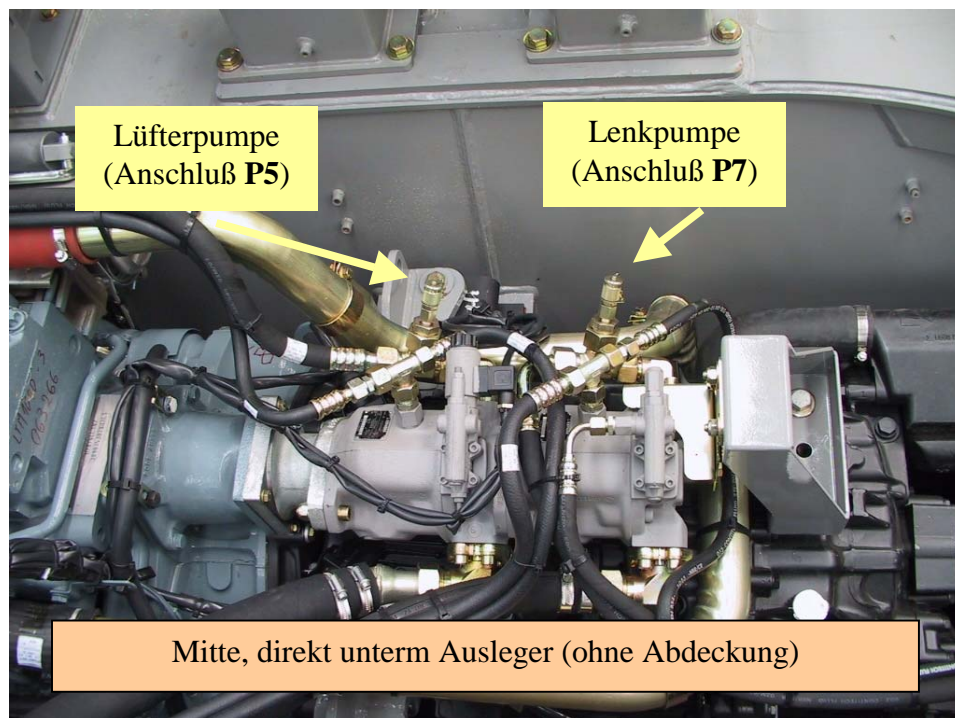
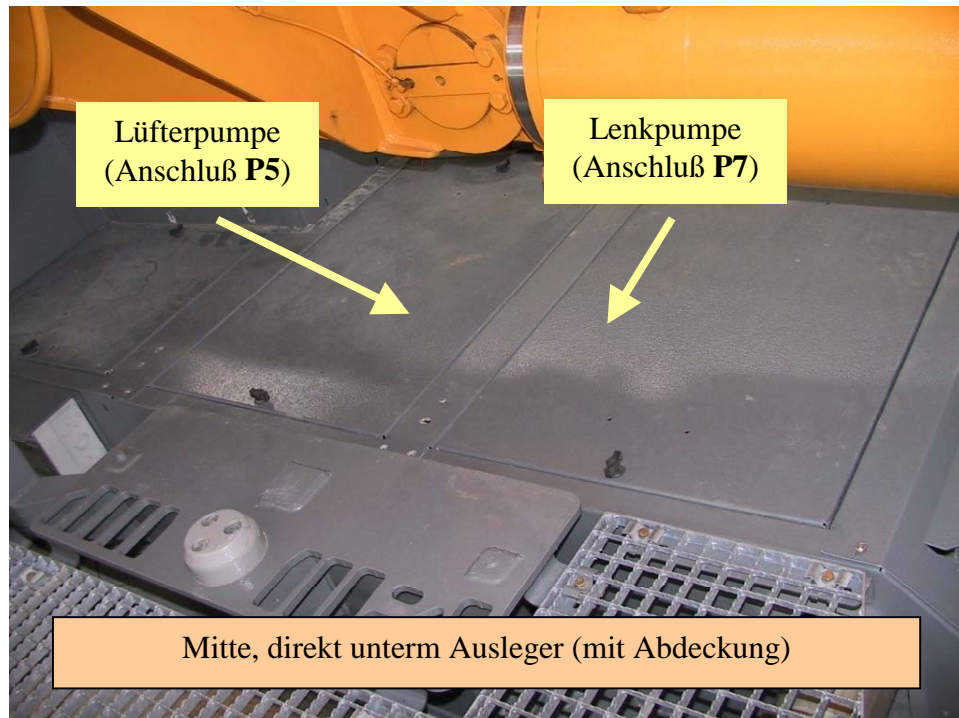
Front axle steering (Test 73) on P1 and P2
Axle spring-mounting (Test 70) and
Support (Test 71) on P2



Test 72

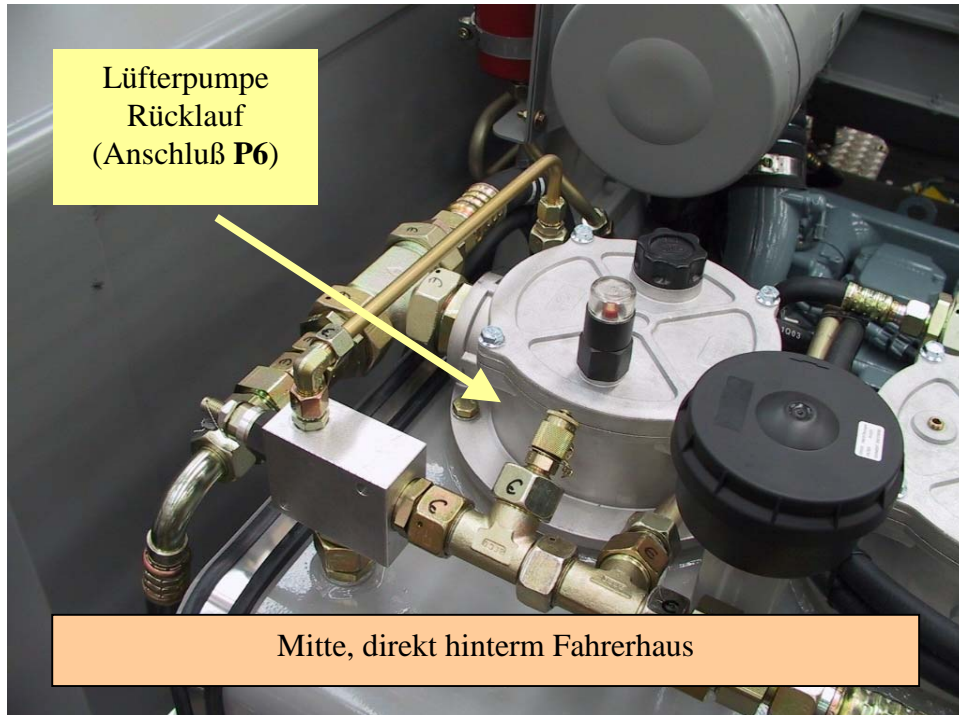
Active rear axle steering (Test 72) on P5, P6, P7 and P8

Pump fan standby on P5 and
Pump rear axle steering on P7

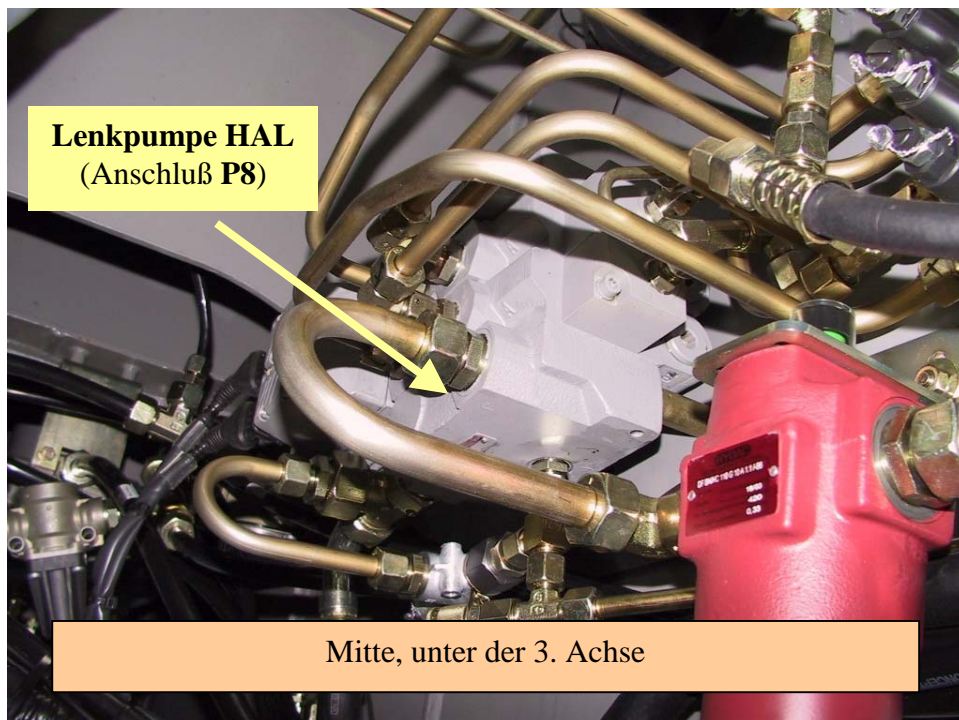


Test 72

Fan return (preload centering circuit) on P6



LS rear axle steering on P8



Test 70, 71, 72 and 73

4.3 Pressure values

Function, at speed: 1000 rpm	Pressure on pump [bar]	Pressure directly at measuring point [bar]	Test
Axle spring-mounting.	P2		70
Axle spring-mounting maximum	220		
Axle spring-mounting at top	210	--	
Axle spring-mounting minimum	200		
Support:	P2		71
Support cylinder IN maximum	220		
Support cylinder IN FL, FR, RL and RR	210	--	
Support cylinder IN minimum	200		
Support cylinder OUT maximum	220		
Support cylinder OUT FL, FR, RL and RR	210	--	
Support cylinder OUT minimum	200		
Sliding spar IN maximum	220		
Sliding spar IN FL, FR, RL and RR	210	--	
Sliding spar IN minimum	200		
- Sliding spar OUT FR maximum	95		
Sliding spar OUT FR	87	50	
Sliding spar OUT FR minimum	80		
Sliding spar OUT RR maximum	100		
Sliding spar OUT RR	90	50	
Sliding spar OUT RR minimum	80		
Sliding spar OUT FL maximum	95		
Sliding spar OUT FL	87	50	
Sliding spar OUT FL minimum	80		
Sliding spar OUT RL maximum	100		
Sliding spar OUT RL	90	50	
Sliding spar OUT RL minimum	80		
Active rear axle steering:	P5 / P6 / P7 / P8		72
Fan (standby)	35	P5	--
Fan (return)	10	P6	--
Pump LS (idle speed, no steering)	0	P8	--
Pump LS (steering on lock)	155	P8	--
Pump P (idle speed, no steering)	22	P7	--
Pump P (steering on lock)	165	P7	--
Front axle steering:	P1/ P2		73
FAS limiting pressure maximum	90		
FAS limiting pressure left and right	70	--	
FAS limiting pressure minimum	50		
FAS maximum pressure maximum	--		
FAS maximum pressure left / right	150	--	
FAS maximum pressure minimum	--		

Chart: Pressure values Hydraulics tests

Error codes

5 Error codes

5.1 Main code/sub code test routines LIEBHERR CH

Main code:

Value	Significance
1	Function activated
4	Activation of function impeded
5	Function interrupted / faulty
7	Function executed

Chart: Main code

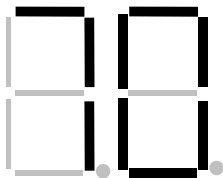
Sub code:

Value	Significance
0	O.K.
1	Control unit response faulty
2	Engine identified as OFF
3	Engine identified as ON
4	Sensor / actor identified as faulty or outside of tolerance range or incorrect assignment / installation
5	No response from control unit
6	Function not available / no customer request
7	Test conditions not within prescribed range

Chart: Sub code

Display on 7-segment display - keypad unit:

lower display:



Main code Sub code
0..9 0..9

Example: 70: 7: Function executed
0: O.K.

Error codes

5.2 Error code - hardware components LIEBHERR CH

Error code	Description	
--	Appears when status of a relay output called up during keypad unit output test	
70	No fault	
1	Key(s) on keypad unit defective	
6	RC-modules - keypad unit outside of tolerance	
7	RC-modules - display unit outside of tolerance	
15	Servodrive water circuit faulty (FGS). Warm/cold function displays on the keypad unit on static.	
16	Servodrive - recirculated/fresh air faulty (FGS) - recirculated/fresh air function displays on the keypad unit on static.	
17	Servodrive - footwell/windscreen faulty (FGS) - footwell/windscreen function displays on the keypad unit on static.	
18	Permanent signal from FGS on the display unit - warm/cold function displays, recirculated/fresh air and footwell/windscreen on the keypad unit on static.	
19	Data transmission fault of E/A1 and E/A2 (FGS) - warm/cold function displays, recirculated/fresh air and footwell/windscreen on the keypad unit on static.	
20	Output A0 on keypad unit: exposed line, short circuit to earth or VCC	
21	Output A1 on keypad unit: exposed line, short circuit to earth or VCC	
22	Output A2 on keypad unit: exposed line, short circuit to earth or VCC	
23	Output A3 on keypad unit: exposed line, short circuit to earth or VCC	
24	Output A4 on keypad unit: exposed line, short circuit to earth or VCC	
25	Output A5 on keypad unit: exposed line, short circuit to earth or VCC	
26	Outputs A0 and A1 on keypad unit: exposed line, short circuit to earth or VCC (line interruption connection servodrive recirculated/fresh air)	
27	Outputs A2 and A3 on keypad unit: exposed line, short circuit to earth or VCC (line interruption connection servodrive windscreen/footwell)	
28	Outputs A4 and A5 on keypad unit: exposed line, short circuit to earth or VCC (line interruption connection servodrive water circuit)	
	Keypad unit outputs: A11, A12, A14, A17, A18, A18, A19 Display unit output: A0	Keypad unit outputs: A0, A1, A2, A3, A4, A5, A6, A7, A20
C2	Overheat or short circuit to supply	Short circuit to supply or exposed line
C3	Operating status OFF or short circuit to supply	Operating status OFF
C4	Short circuit to earth, overheat, exposed line, load current too low or short circuit to supply	Short circuit to earth or overheat
C5	Operating status ON or under/overvoltage	Operating status ON

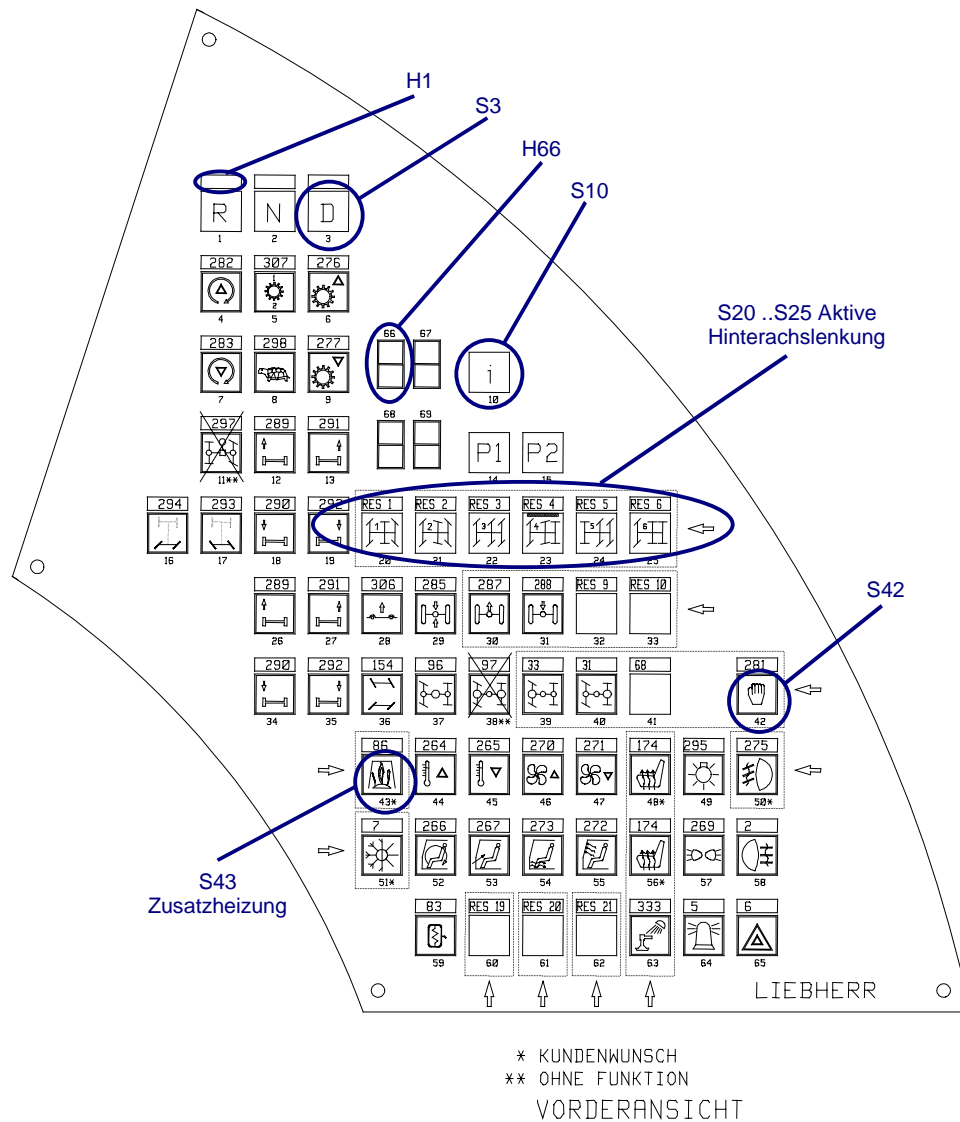
Chart: Error code - hardware components

FGS = Fault Group Signal

Diagrams

6 Diagrams

6.1 Diagram - keypad unit



Description of keys, function displays and 7-segment displays

S1..S65: Keys starting upper left (R-key = S1) to lower right (hazard warning light key = S65)

H1..H65: Function displays above the keys starting upper left (function display above R-key = H1) to lower right (function display above the hazard warning light key = H65)

H66: 7-segment display upper left

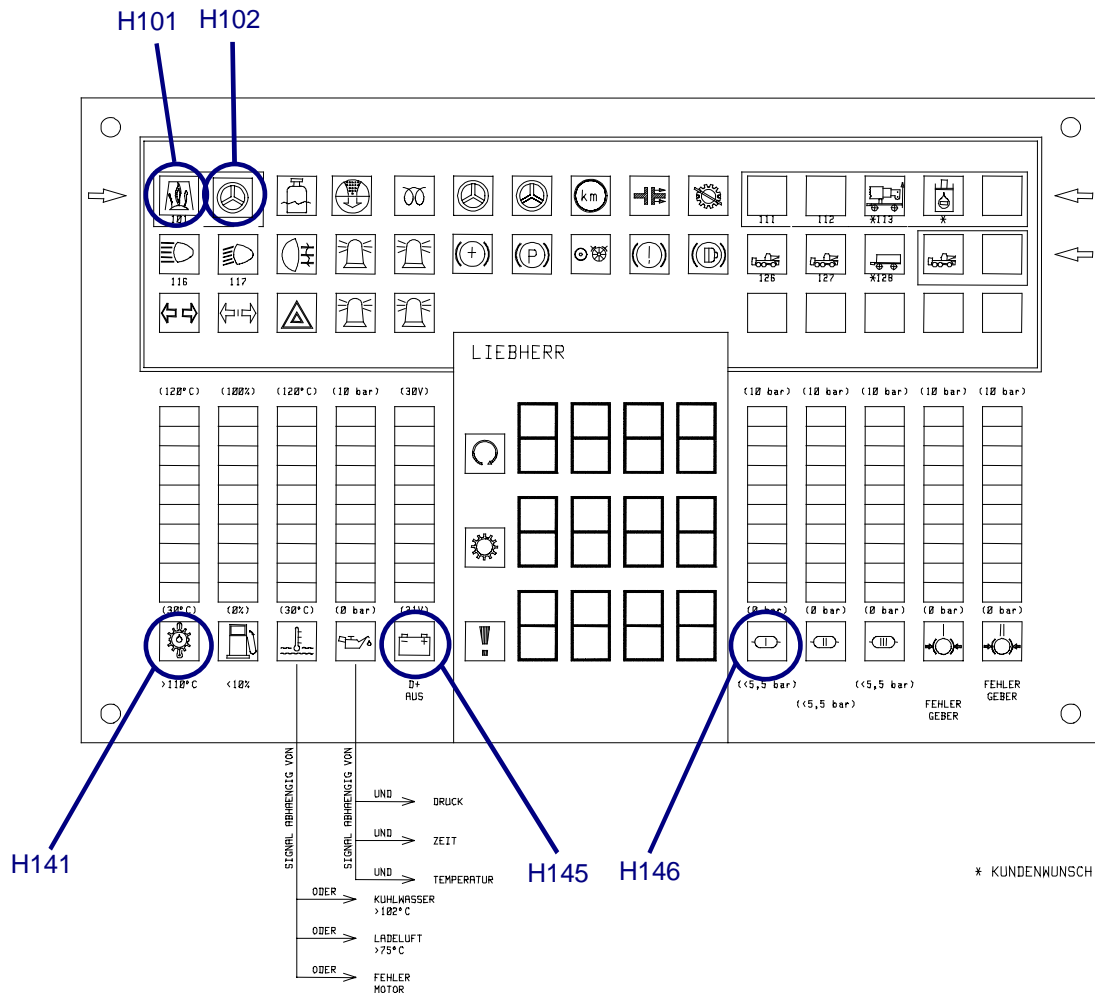
H67: 7-segment display upper right

H68: 7-segment display lower left

H69: 7-segment display lower right

Diagrams

6.2 Diagram - display unit



Description of pilot lamps, bar diagrams and 7-segment displays

H101..H153: Pilot lamps starting upper left (auxiliary heating =H101) to lower right (CAUTION pilot lamp = H153)

H154..H165: 7-segment displays starting upper row left (H154) to lower row right (H165)

H166..H175: Bar diagrams starting left (analogue display transmission oil temperature =H166)

to bar diagram right (analogue display brake pressure 2 = H175)

Brief description

7 Brief description of test program

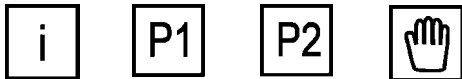
Preconditions for starting

Before the test program can be started, the following preconditions must be fulfilled:

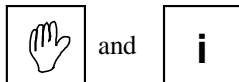
- Operating type chassis
- Ignition ON

Activating the test program

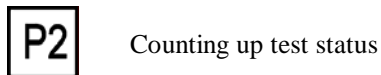
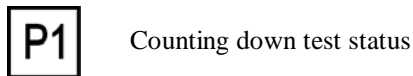
On the keypad unit:



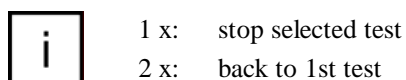
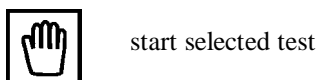
On the support control units, with “Engine OFF“:



Switching between the individual tests



Starting and stopping individual tests



Stopping the test program

The test program is terminated using Ignition OFF.

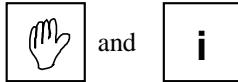
Brief description

Test of support control unit

Tests on the support control units

Support control unit right or left

To start the test:



Press keys simultaneously for 2 seconds

The following 3 tests will be run:

- Data transfer between I/O module and support control unit

With this test, data transmission will take place at a higher transmission rate (100 kBaud) than is usual (50 kBaud). If a fault occurs here, this means that the RC-modules are outside their tolerance.

Error code:

The error code will be displayed on the support control units on the electrical tiltmeter display.

- Pilot lamp test

All pilot lamps (7-seg. displays, LEDs and displays t (tons) and klbs (kilo pounds)) will be tested.

Error code:

No error code will be shown for this test, since only a visual check is carried out.

- Key test

The functionality of the individual keys on the support control unit right will be indicated on the 7-segment displays 7-seg. UL, 7-seg. LL, 7-seg. UR, 7-seg. LR on the support control unit right. For this, a key will be assigned to each segment of the 7-segment display. Once the test is running, the keys on the support control unit right can be pressed in any sequence.

Error code:

“Key stuck“ status will be shown as an operating fault or system fault and the release key on the support control unit will be locked.

Brief description

Test 01

Test of 7-segment display on keypad unit

Test of buzzer on keypad unit

Test of function displays on keypad unit

Error code:

No error code will be shown for this test, since only a visual / acoustic check is carried out.

Test 02

Testing the keys on the keypad unit

The function display above the R key will start to flash at approx. 8 Hz (8 x per sec.). This key and the following keys must now be pressed briefly and then released within a specified time.

Error code:

Error code 70: All keys are functioning.

Error code 01: At least one key is defective or has been operated incorrectly.

See chart "[Error code - hardware components LIEBHERR CH](#)".

Test 03

Testing the inputs on the keypad unit

This test displays the status of the inputs E0..E6 on the lower left 7-segment display of the keypad unit. For this test, an input will be assigned to each segment of the 7-segment display. The input stages of the keypad unit can now be individually tested by setting and resetting the input signals. If a segment illuminates, this indicates that the relevant input is ACTIVE.

Error code:

No error code will be shown for this test, since only a visual check is carried out.

Brief description

Test 04

Lights test

This test switches outputs on the keypad unit in a specified sequence and at specific time intervals. Time intervals are dependent on the type of crane.

Step:	Output:	Function:
1	A26	Fog lamps ON *
2	A24	Low-beam headlight or low-beam headlight and/or ¹⁾ high-beam headlight ON2)
3	A29	Indicator left ON
4	A27	Rear fog light ON
5	A22	Reversing light ON
6	A30	Indicator right ON
7	A28	Rotating beacon ON
8	A25	Parking light and all lighting devices ON Sliding spar illumination (cyclic)
9	---	3s buzzer, operate steering-column switch left
10	A24	Low-beam headlight or low-beam headlight and/or ¹⁾ high-beam headlight ON2)

Error code:

No error code will be shown for this test, since only a visual check is carried out.

Test 05

Testing the outputs on the keypad unit

This test only sets those outputs which do not have any safety-related consumers connected to them.

By pressing the Hand key and the P1 key or the Hand key and the P2 key, the output currently set will be reset and the newly selected output set. Key P1 counts down and key P2 counts up the selection. The number of the currently set output will be displayed on 7-segment displays H68 (lower left) and H69 (lower right).

Diagnosis of the outputs on the keypad unit

With transistor outputs, key P1 can be used to call up the output state (error code). The code will then be displayed on the keypad unit's 7-segment displays H68 and H69 for the duration of operation. If key P1 is pressed during a relay output, '--' will be displayed as the output state, since it is not possible to call up status during a relay output.

Error code:

C2, C3, C4, C5: The error code for the output test only provides information on the output state of the transistors.

See chart "[Error code - hardware components LIEBHERR CH](#)".

Brief description

Test 06

Test of internal OR gate on keypad unit:

(rotating beacon, parking light, hazard warning indicators and auxiliary heating)

The test program must now be exited via Ignition Off; the ignition will remain switched off. The special functions **parking light, rotating beacon, auxiliary heating** and **hazard warning lights** will now switch on and off individually one after the other. If one or more special functions is switched on, I/O modules 1 and 2 and the display unit will be supplied with power.

Test of internal locking of keypad unit:

Locking may be switched on by pressing the N-key. The ignition can now be switched off. I/O modules 1 and 2 and the display unit must now continue to be supplied with power. This test is only completed when the test program (Test 06) is restarted and the N-key is pressed twice (locking will thereby be switched off again).

Internal EOR gate of the keypad unit:

At the start of this test, the parking light and rotating beacon functions must be switched off. The parking light will now switch on. Key P1 can be used to activate the EOR for the duration of the operation, which will switch off the parking light. Rotating beacons (A28) also activate. By using key P2, the rotating beacon can be switched off via the EOR. If the parking light and rotating beacon functions are switched off using the S57/S64 keys, the outputs can also be activated using keys P1 and P2 for the duration of the operation.

Error code:

No error code will be shown for this test, since only a visual check is carried out.

Test 07

Data transfer between I/O module and keypad unit

With this test, data transmission will take place at a higher transmission rate (100 kBaud) (usually 50 kBaud). If a fault occurs here, this means that the RC-modules are outside their tolerance.

Error code:

06, 00: In the event of defective RC-modules, error code 06 will be displayed on the keypad unit's 7-segment displays H68 and H69. If no fault is present, error code 70 will be displayed.

See chart "[Error code - hardware components LIEBHERR CH](#)".

Brief description

Test 08

Measuring the indicator power on the keypad unit

The left and right turn signals can be switched on statically using the R-key and the D-key. The number of attached (functioning) indicator lamps will be displayed on 7-segment display H69 (lower right).

If additional indicator lights (5W) are fitted on the crane, the left and right indicator light power must be tested separately.

Error code:

No error code will be shown for this test, since only a visual check is carried out.

Test 09

- Test of pilot lamp / 7-segment displays / bar diagrams on the display unit
- Test of 7-segment displays on the display unit
- Test of bar diagrams on the display unit

Error code:

No error code will be shown for this test, since only a visual check is carried out.

Test 10

Test of inputs on the display unit

The status of the individual inputs is displayed on the display unit's 7-segment displays (middle row, left) and (middle row, second from left). For this test, an input will be assigned to each segment of the 7-segment displays. Each input stage on the display unit can now be tested individually. If a segment illuminates, this signifies that there is an active signal on the relevant input. Inputs E3..E6 must be activated at 0 V and inputs E0..E2 and E7..E14 activated at +24 V, so that each input is identified as being ACTIVE.

Error code:

No error code will be shown for this test, since only a visual check is carried out.

Brief description

Test 11

Testing the output on the display unit

A0 is set if there is sufficient power at input E14 (D+).

Error code:

C3 : During the test, the message C3 must appear, since no D+- signal (engine ON) is active during the test program.

See chart "[Error code - hardware components LIEBHERR CH](#)".

Test 12

Data transfer between I/O module and display unit

With this test, data transmission will take place at a higher transmission rate (100 kBaud) (usually 50 kBaud). If a fault occurs here, this means that the RC-modules are outside their tolerance.

Error code:

07, 70: In the event of defective RC-modules, error code 07 will be displayed on the keypad unit's 7-segment displays H68 and H69. If no fault is present, error code 70 will be displayed.

See chart "[Error code - hardware components LIEBHERR CH](#)".

Test 13

Heating servomotors

This test diagnoses outputs **A0..A5** on the keypad unit for overloading, exposed lines and short circuit to earth.

The function of the servomotors will be established by means of the fault group signal (FGS) (diagnostic outputs on the servomotors summarized). In the event of a fault, the diagnostic output of each servomotor provides a +24V signal while the software generates a system fault.

Error code:

See chart "[Error code - hardware components LIEBHERR CH](#)".

Brief description

Test 14

Position of installation of servomotors

This test sets the **position of installation of the servomotors** for the heating in the chassis. The drive shaft of the servomotors can rotate around a maximum angle of 240°. The delivery status of the servomotor is not, therefore, always guaranteed if the servomotor is supplied with power when in “uninstalled status”.

Error code:

See chart “[Error code - hardware components LIEBHERR CH](#)”.

Test 30

Active rear axle steering - special diagrams on support box right/left

This function is used to **display** all relevant inputs, outputs and variables (angular values of each axle ..) of the active rear axle steering.

Start conditions:

- Transmission in “Neutral”
- Speed < 0.2 km/h

Error code:

No error code will be shown for this test, since only a visual check is carried out.

Test 31

Active rear axle steering - manual steering in test mode

No safety measures are employed during manual steering. This corresponds to independent steering mode (operating mode 5) excluding safety measures (locking or centering). This is of use when starting, since air is still present in the hydraulic leads and this results in LECs (**Liebherr Error Code**)+ Measure.

Start conditions:

- Transmission in “Neutral”
- Speed < 0.2 km/h

Error code:

No additional error code is displayed for this test.

Brief description

Test 32

Active rear axle steering - angle sensor zeroizing

This function is designed to "zeroize" the angle sensor of each axle of the "active rear axle steering". On the front axle (always the first axle), as well as on each steering axle, the angle sensor is located on the right-hand side of the vehicle in the steering knuckle. These angle sensors must be "zeroized" (first "zero setting"), using the following test procedure to ensure that the crane will be able to travel straight ahead surely.

When "zeroizing" the angle sensor, measured value deviations (measured value - chain from sensor signal to measured value conversion in the I/O module, which differs from crane to crane) can occur. In order to eliminate these deviations, the angle sensor must be "zeroized" again (second "zero setting"). The second "zero setting" takes place in "non-centered status", after the respective axles have been corrected (see test sequence).

Start conditions:

- Transmission in "Neutral"
- Speed < 0.2 km/h
- Drive program 5 (DP5, manual steering)

Error code:

No error code is displayed for this test.

Test 33

Active rear axle steering - centering circuit function test

This function checks the function of the following components in the hydraulic centering circuit:

- Valve emergency supply centering,
- Pressure switch 180 bar and
- output signals (centering valves and locking valve)

Start conditions:

- Transmission in "Neutral"
- Speed < 0.2 km/h
- Drive program 5 (DP5, manual steering)

Error code:

No error code is displayed for this test.

Brief description

Test 34

Active rear axle steering - blocking and centering valve function test

With “active rear axle steering”, hydraulic valves which come into use in the event of a fault or from a specific speed are installed. The centering valve only activates in the event of a fault. If the centering valve is activated (zero current status), each axle will be brought separately to 0° displacement. The locking valve activates in the event of a fault and for max. V steering. From max. V steering, the axles will be adjusted to 0°, the locking valve will also activate (zero current) and the axles in question will be hydraulically locked. When locked, the axles can only be steered to 0° (the maximum angle is now the current angle).

Centering valve: Changeover valve to activate / release the steering cylinder

Locking valve: Valve for opening the check valve on the centering cylinder

Starting conditions for test program 34:

- Transmission in “Neutral“
- Speed < 0.2 km/h
- Drive program 5 (DP5, manual steering)

Error code:

LECs are displayed for this test.

Brief description

Test 40 and 41

Engine braking flap overspeed protection (40)

Ventilation flap overspeed protection (41)

The routines to activate the engine braking flap or the ventilation flap (customer request) in case of overspeeding serve to test the diesel engine's overspeed protection. The two tests set the upper limit speed for the activation of the speed protection function down to approx. 75% of the parameterized maximum speed.

Error code:

See chart "[Main code/sub code test routines LIEBHERR CH](#)".

Test 43 and 44

Checking a hydrostatic fan drive (43) (manual)

Checking a hydrostatic fan drive (44) (automatic)

Test program 43 adjusts the selected speed in 10% -increments from 0..100%, program 44 will run through automatically and increase the speed in 10% increments every 5 seconds from 0..100%.

The function can only be activated if the engine is identified as being ON.

Test 43 remains active until it is **stopped** using the **i-key**. Temperature-dependent control will only be reactivated at this stage. Use keys **P1** or **P2** to increase fan speed.

Test 44 stops itself, but the fan remains set at 100% until the **i-key is pressed**. Temperature-dependent control will be reactivated at this stage.

Error code:

See chart "[Main code/sub code test routines LIEBHERR CH](#)".

Brief description

Test 46, 47, 48 and 49

Clearing the error code memory - ECU (46) (engine)

Clearing the error code memory - TCU (47) (transmission)

Clearing the error code memory - AAS (48) (AAS)

Clearing the error code memory - intarder (49) (intarder)

This function is used to clear inactive errors in the error memories of the ECU, TCU, AAS and intarder control units. These inactive errors occur in production if the peripherals of the individual control units were not fully connected at that stage.

Error code:

See chart “[Main code/sub code test routines LIEBHERR CH](#)“.

Test 60

Checking the assignment of AAS sensors

This routine identifies whether the front left, front right, rear left and rear right speed sensors are correctly connected. The outer segments on the 7-segment display, lower left, correspond to the 4 sensored wheels in the direction of travel. The segment for the wheel to be moved flashes until the AAS control unit reports a movement of the wheel. The reported **wheel speeds** of one axle will be compared.

When a **wheel speed** on the wheel being tested of **> 1.3 km/h** has been identified and a simultaneous wheel speed of **< 0.6 km/h** on the opposite wheel has been identified, the sensor will be identified as **OK**, a **buzzer** will sound **briefly** on the keypad unit and the **clearance lights**, the **parking light** and the two **turn signals** will be switched on. Conversely, if the opposite wheel is revolving more quickly than the wheel to be tested, the test will be terminated and the error code (54) will be displayed. In this case, either the test has not been carried out properly, or there is a wiring fault.

If a **fault** is detected during the test, the test routine will be stopped, an **error** in compliance with the *main code/sub code* description will be displayed and an **extended buzzer** will sound.

When the test identifies that the current sensor is operating correctly, it will automatically switch over to the next wheel. The wheel selected can be switched forward or back by pressing the **P1** or **P2** key. The test can be terminated prematurely by pressing the **i**-key.

Error code:

See chart “[Main code/sub code test routines LIEBHERR CH](#)“.

Brief description

Test 61

Testing the assignment of the AAS valves, pulse program

This routine identifies whether the front left, front right, rear left and rear right AAS control valves are correctly connected.

The outer segments on the 7-segment display, lower left, correspond to the 4 sensed wheels in the direction of travel. The segment for the wheel to be tested flashes. During the test (with brake fully depressed), the **brake pressure rate** of the four channels should be observed **as described**.

The current test stage will be displayed on the right-hand 7-segment display:

1. full brake pressure
2. reduced brake pressure
3. no brake pressure
4. reduced brake pressure
5. full brake pressure
6. Delay, buzzer, on to next wheel, stage 1

While the test is running, it will automatically switch over to the next wheel at the end of the test sequence and a **brief buzzing tone** will sound. The wheel selected can be switched forward or back by pressing the **P1** or **P2** key. The test can be terminated prematurely by pressing the **i**-key.

Error code:

See chart "[Main code/sub code test routines LIEBHERR CH](#)".

Test 62

Checking the function of the ASR-DIF valve

This routine identifies whether the ASR-DIF valve is functioning.

After the routine has started, the pressure in the brake circuit of the driven axle will be controlled for approx. 0.5 seconds and then maintained for about 5 seconds.

Error code:

See chart "[Main code/sub code test routines LIEBHERR CH](#)".

Brief description

Test 63

Wheel speed of ABS speed sensors

This routine calculates the wheel speed of the ABS speed sensors (see also special diagrams in upper structure).

Error code:

No error code will be shown for this test, since only a visual check is carried out.

Test 70

Testing the function and hydraulics of the axle spring-mounting

This test checks the status reports A1 and A2, the activation of the valves (up and down) front left, rear left, front right and rear right (Axle spring-mounting function) and the axle spring-mounting hydraulics (Axle spring-mounting hydraulics).

The pressure sensor adaptation must be connected so that the hydraulics of the vehicle (CH) can be tested (see [Pressure sensor connections](#) and [Connection plug centre console](#)).

Start conditions:

- Transmission in “Neutral“
- Axles “spring-mounted”

The **current pressure** and the **specified pressure** (in bar) of the axle spring-mounting will be displayed on the display unit (see [Pressure values](#)).

To start the test:

Press the **Hand key** and the **Level key** simultaneously; both keys must remain pressed down.

Test sequence:

1. The vehicle will be lowered automatically (status reports will be checked)
2. The vehicle will be raised automatically (status reports will be checked)
3. Test hydraulic pressure
4. The vehicle will now be automatically moved to Level
5. All valves for UP and DOWN will be activated systematically
6. Test concludes

Error code:

See chart “[Main code/sub code test routines LIEBHERR CH](#)“.

Brief description

Test 71

Testing the hydraulics of the support

This test checks the hydraulics of the support (Support hydraulics). All pressures will be checked and displayed on the support control units right and left (see [Pressure values](#)).

The pressure sensor adaptation must be connected so that the hydraulics of the vehicle (CH) can be tested (see [Pressure sensor connections](#) and [Connection plug centre console](#)).

Start conditions:

- Transmission in “**Neutral**”

When the key is pressed, the **current pressure** and the **specified pressure** (in bar) of the support will be shown on the support control units.

Error code:

See chart “[Main code/sub code test routines LIEBHERR CH](#)”.

Test 72

Hydraulics - active rear axle steering

This test checks the hydraulics of the rear axle steering (*Rear axle steering hydraulics*) (see [Pressure values](#)).

The pressure sensor adaptation must be connected so that the hydraulics of the vehicle (CH) can be tested (see [Pressure sensor connections](#) and [Connection plug centre console](#)).

Start conditions:

- Transmission in “**Neutral**”
- Drive program 5 (DP5, manual steering)

The **current pressure** and the **specified pressure** (in bar) of the rear axle steering will be displayed on the display unit.

Error code:

See chart “[Main code/sub code test routines LIEBHERR CH](#)”.

Brief description

Test 73

Testing the hydraulics of the front axle steering

This test checks the hydraulics of the front axle steering (Front axle steering hydraulics) (see [Pressure values](#)).

The pressure sensor adaptation must be connected so that the hydraulics of the vehicle (CH) can be tested (see [Pressure sensor connections](#) and [Connection plug centre console](#)).

Start conditions:

- Transmission in “**Neutral**”
- “Lock axles” and “Support vehicle” (not mandatory)

The **current pressure** and the **specified pressure** (in bar) of the front axle steering will be displayed on the display unit.

Error code:

See chart “[Main code/sub code test routines LIEBHERR CH](#)”.