Technical Training

Data Bus and LICCON Computer System

LIEBHERR Datenbus-Technik
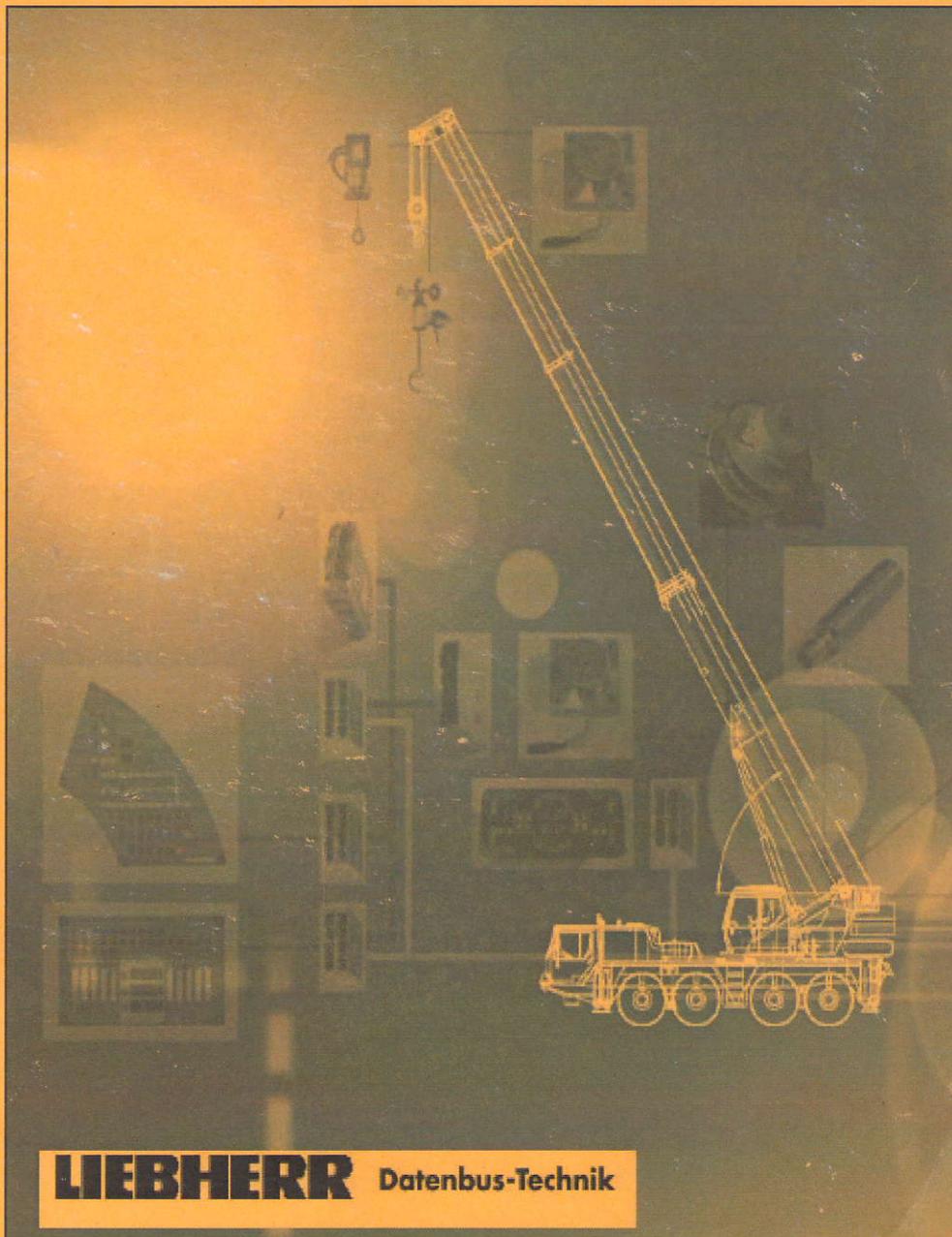
Release 06/2001

LIEBHERR

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Kundendienst-Schulung

LIEBHERR

The LICCON computer system for telescopic and lattice boom cranes.

A system with comprehensive informative, monitoring and control functions.

LIEBHERR

The better crane.

LICCON - Introduction:

Already in 1989, Liebherr developed an own, user-programmable crane control system to meet the high demands of a mobile crane:
LICCON = LIEBHERR Computed Controlling

The most essential demands on such a system were:

1. Insensivity towards environmental influences effecting construction machinery such as:
    - temperature (-40 ... 85°C),
    - vibrations, shock,
    - humidity, corrosive atmosphere,
    - dirt, dust,
    - electromagnetic and electrostatic influences,
    - failures in the supply voltage.

2. Minor variety of plug-in cards, thus:
    - less hardware,
    - improved maintenance and care,
    - invariably high quality standard due to larger number of pieces,
    - improved spare parts supply,
    - less administration costs,
    - more intensive and co-ordinated development and system test.

3. High standards in respect to safety such as:
    - consideration of the relevant, existing regulations,
    - possibility of multi-channel extension of the system without the need of additional components.

4. Cost-optimized co-ordination of the control system of the mobile crane and its hydraulic system:
    - the control and LMB (load moment limitation) must form a unity,
    - convenient setting and diagnostic facilities,
    - outstanding flexibility by user-programmability,
    - minor installation and cabling time.

5. The entire know-how of soft- and hardware must be developed by Liebherr.

LICCON application programs

The LICCON safe load indicator:

The LICCON safe load indicator (SLI).

The LICCON components:

1 Electronic basic unit
2 Display screen with keyboard
3 Pressure sensor
4 Length sensor (tele ram)
5 Angle sensor (base section)
6 Cable drum
7 Angle sensor (boom head)
8 Power pack
9 Microprocessor (central unit)
10 Hoist limit switch (main boom)
11 Hoist limit switch (swing-away jib)
12 Wind sensor
13 Limit switch: boom interlocked
14 Limit switch: superstructure locked
15 Sensor: Working area limitation (optional)
16 Supporting pressure sensor 4x (optional)
17 Key-operated switch
18 Crane control
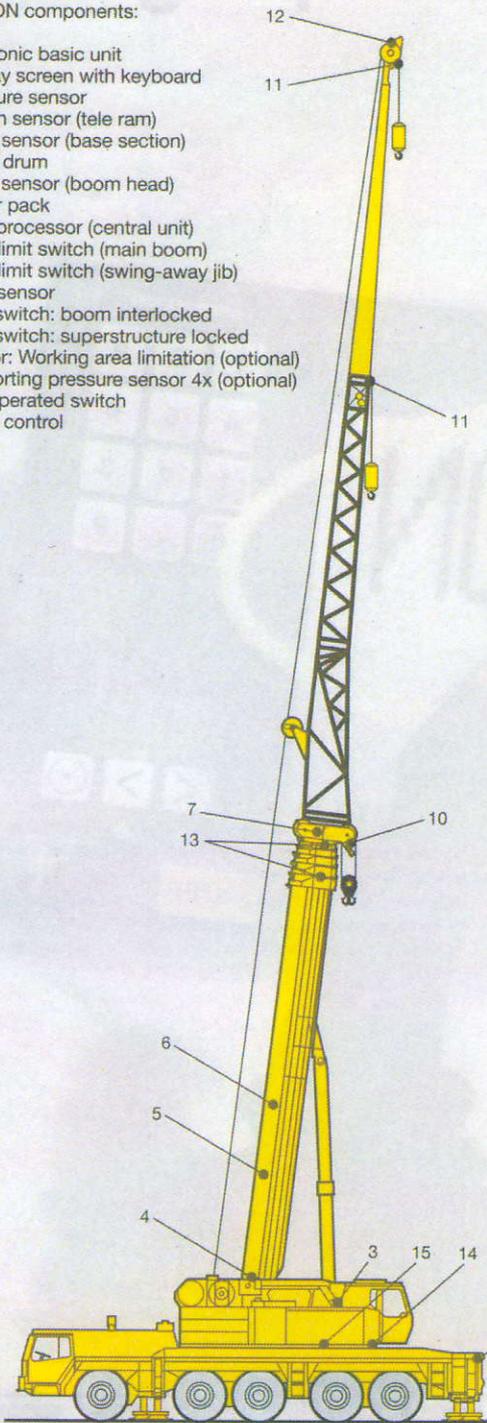
The LICCON safe load indicator (SLI) essentially differs from other SLIs on the market by the internal computing process. Liebherr developed a calculating method not only taking into account the deflection of given telescoping boom lengths but any deflection at any extended boom length. This method offers entirely new possibilities. Formerly, a telescopic crane could only handle the loads stipulated in the respective load charts. The safe load indicator developed by Liebherr allows the handling of the optimal load at any boom length. The system receives the measured data from the sensor inputs and its operating parameters by the "configuration program". The computer system informs the crane operator by means of the "operating picture" in respect to all parameters required for crane operation.

fig. 01-06

The LICCON configuration picture:

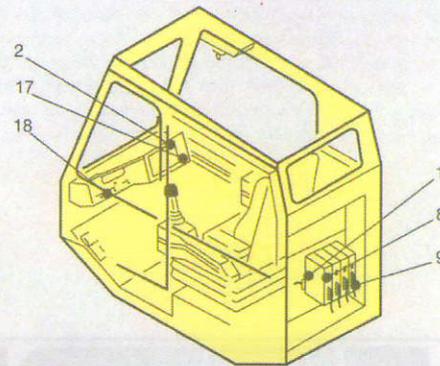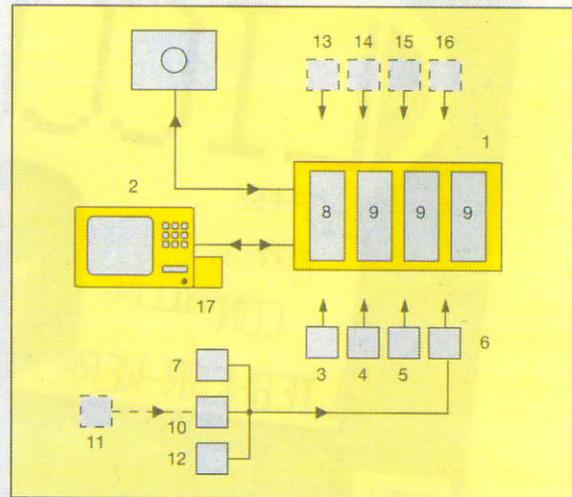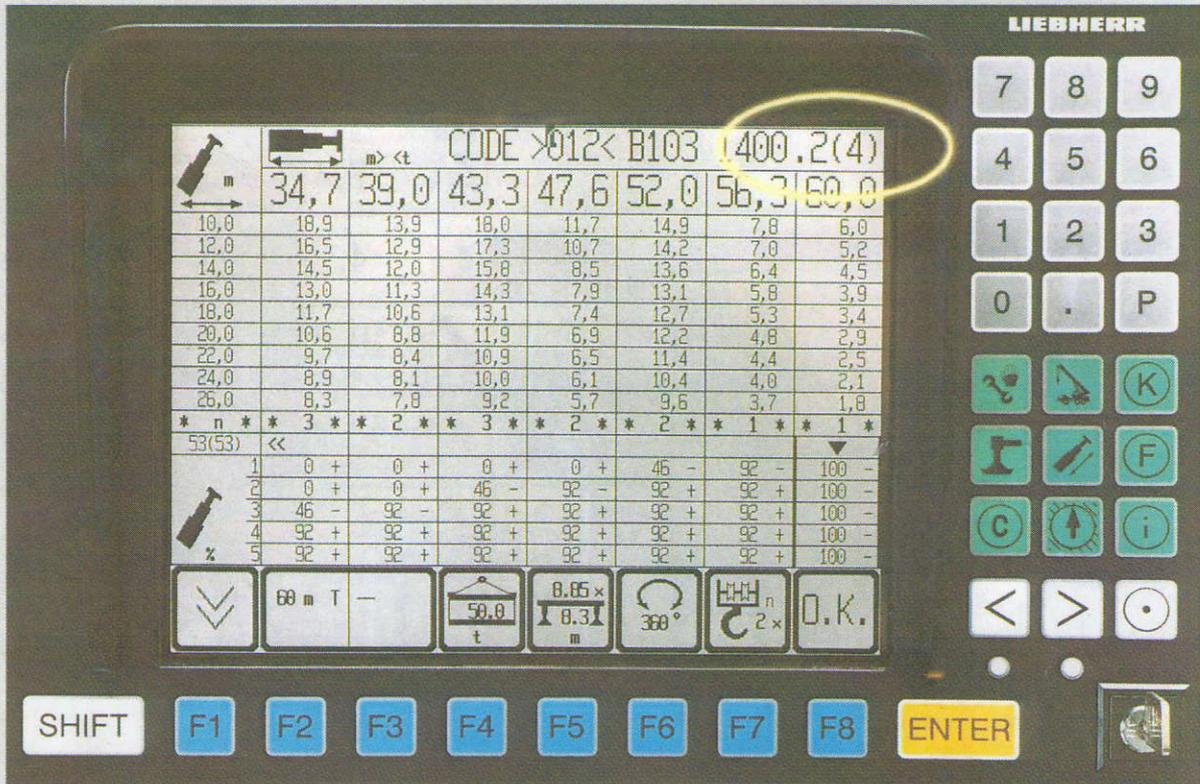# The LICCON configuration picture.

CODE >012< B103 1400.2(4)						
m						
34,7	39,0	43,3	47,6	52,0	56,3	60,0
10,0	18,9	13,9	18,0	11,7	14,9	7,8	6,0
12,0	16,5	12,9	17,3	10,7	14,2	7,0	5,2
14,0	14,5	12,0	15,8	8,5	13,6	6,4	4,5
16,0	13,0	11,3	14,3	7,9	13,1	5,8	3,9
18,0	11,7	10,6	13,1	7,4	12,7	5,3	3,4
20,0	10,6	8,8	11,9	6,9	12,2	4,8	2,9
22,0	9,7	8,4	10,9	6,5	11,4	4,4	2,5
24,0	8,9	8,1	10,0	6,1	10,4	4,0	2,1
26,0	8,3	7,8	9,2	5,7	9,6	3,7	1,8

| * n * | 3 | 2 | 3 | 2 | 2 | 1 | 1 |

53(53) <<

%							
1	0 +	0 +	0 +	0 +	45 -	92 -	100 -
2	0 +	0 +	46 -	92 -	92 -	92 +	100 -
3	46 -	92 -	92 +	92 +	92 +	92 +	100 -
4	92 +	92 +	92 +	92 +	92 +	92 +	100 -
5	92 +	92 +	92 +	92 +	92 +	92 +	100 -

60 m T — 50,0 t 0.05× / 0.31 m 360° n 2× O.K.

SHIFT | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | ENTER

By means of the LICCON configuration picture on the monitor, the crane operator transmits to the safe load indicator the desired configuration and thus receives the respective load charts. Comfortable interactive functions enable the setting of the desired crane configuration. The operating mode is preselected by means of function keys "F4" for the main boom and "F3" for the auxiliary jib. Function keys "F4" to "F6" set the configuration within the operating mode in respect to counterweight, supporting basis and operating area desired. An assigned code to each load chart selected according to this setting procedure also enables quick selection of a load chart. A load chart available according to the preselected operating mode and configuration is displayed on the monitor upon

pressing the key "ENTER". The "F7"-key allows to set the hoist rope reeving. A load chart comprising more than 9 columns is displayed on several pages. The safe load indicator adopts the new set values upon pressing the key "O.K" which results in the automatic display of the operating picture.

CODE >012< B103 1400.3(4)						
m						
52,0	52,0	56,3	60,0	17,5	21,8	26,1
28,0	9,5	8,9	8,9	7,7			
30,0	8,7	8,3	8,3	7,1			
32,0	8,1	7,7	7,6	6,6			
34,0	7,5	7,2	7,2	6,1			
36,0	6,9	6,8	6,6	5,7			
38,0	6,4	6,3	6,1	5,3			
40,0	5,9	6,0	5,7	4,9			
42,0	5,5	5,6	5,3	4,5			
44,0	5,0	5,2	4,9	4,2			

| * n * | 3 | 2 | 2 | 2 | 3 | 2 | 2 |

27(53) <<

%							
1	92 +	46 +	92 +	100 +	0 +	46 -	92 +
2	92 +	92 +	92 +	100 +	46 -	46 +	46 +
3	92 +	92 +	92 +	100 +	0 +	0 +	0 +
4	92 +	92 +	92 +	100 +	0 +	0 +	0 +
5	46 +	92 +	92 +	100 +	0 +	0 +	0 +

60 m T — 50,0 t 0.05× / 0.31 m 360° n 2× O.K.
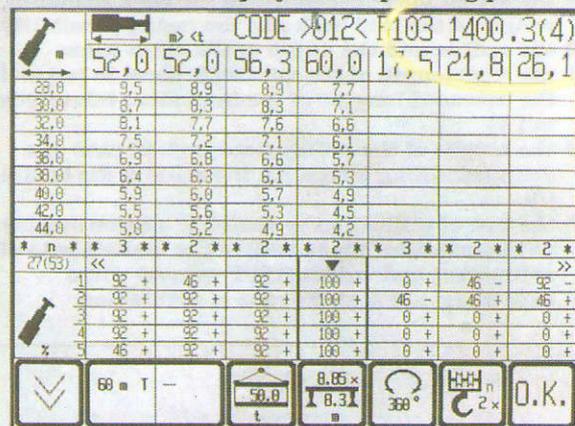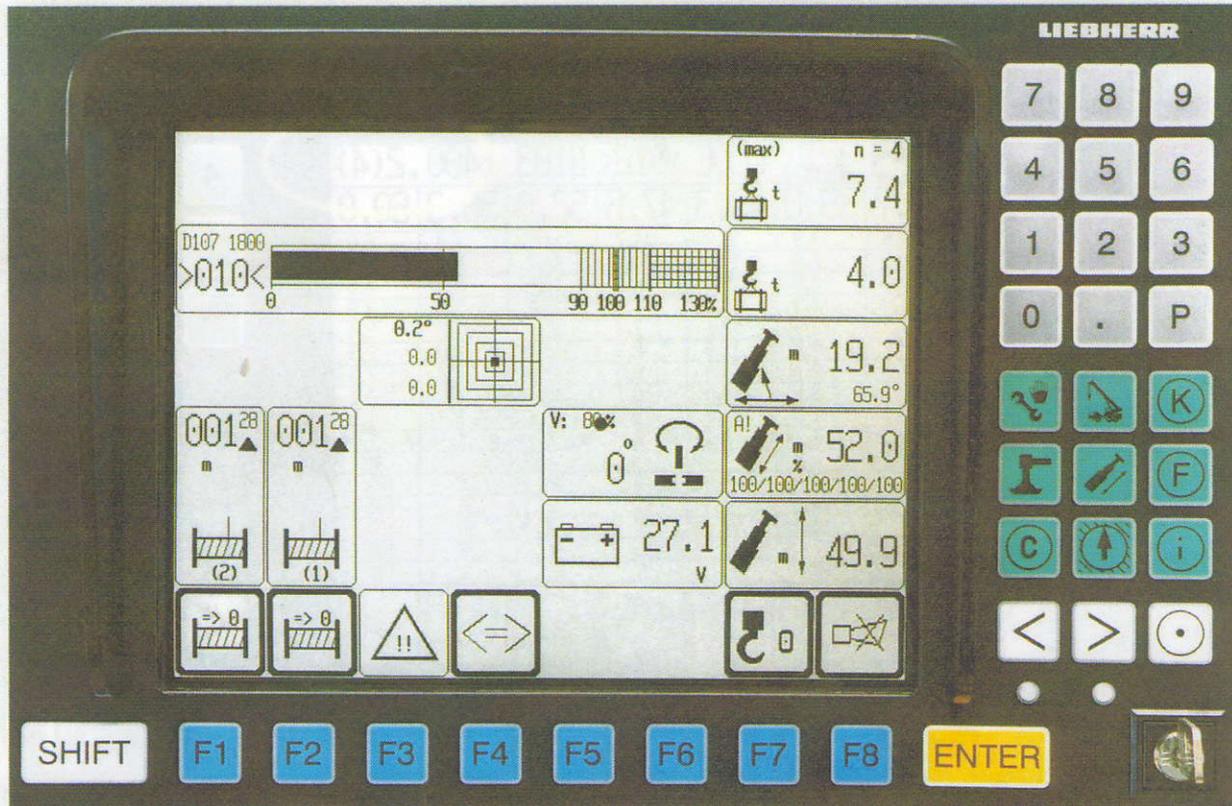
fig. 01-07

The LICCON operating picture:

The LICCON operating picture.

Graphic symbols in the LICCON operating picture display continuous information in respect to all essential data of the crane's geometry. Displayed are for instance:

- the maximum lifting capacity
- the actual load suspended on the hook including weight of the load hook and the taring possibility
- the radius and the angle of the main boom
- the total length of the telescopic boom in [m] and the extended lengths of the individual telescopes in [%]
- the height of the pulley head and, in case of a mounted luffing lattice jib, the angle of the lattice jib
- the rate of utilization by means of a baton display with a prewarning at 90 % of the crane's rate of utilization and with a STOP symbol when exceeding 100 % of the rate of utilization

- depending on the crane's equipment, the motion of winch 1 and, if existing, of winch 2 is displayed by flashing arrows; the actual hook path is continously displayed with the correct sign according to the zero point adjustable according to requirement
- the contact of the hoist limit switch results in the display of a flashing symbol

All displays for critical conditions are accompanied by an audible signal. Due to safety reasons, another program may only be selected upon the operator's acknowledgement of the warning signal by switching off the horn. Any subsequent critical condition will again be audible.

fig. 01-08

The additional displays:

The additional displays.
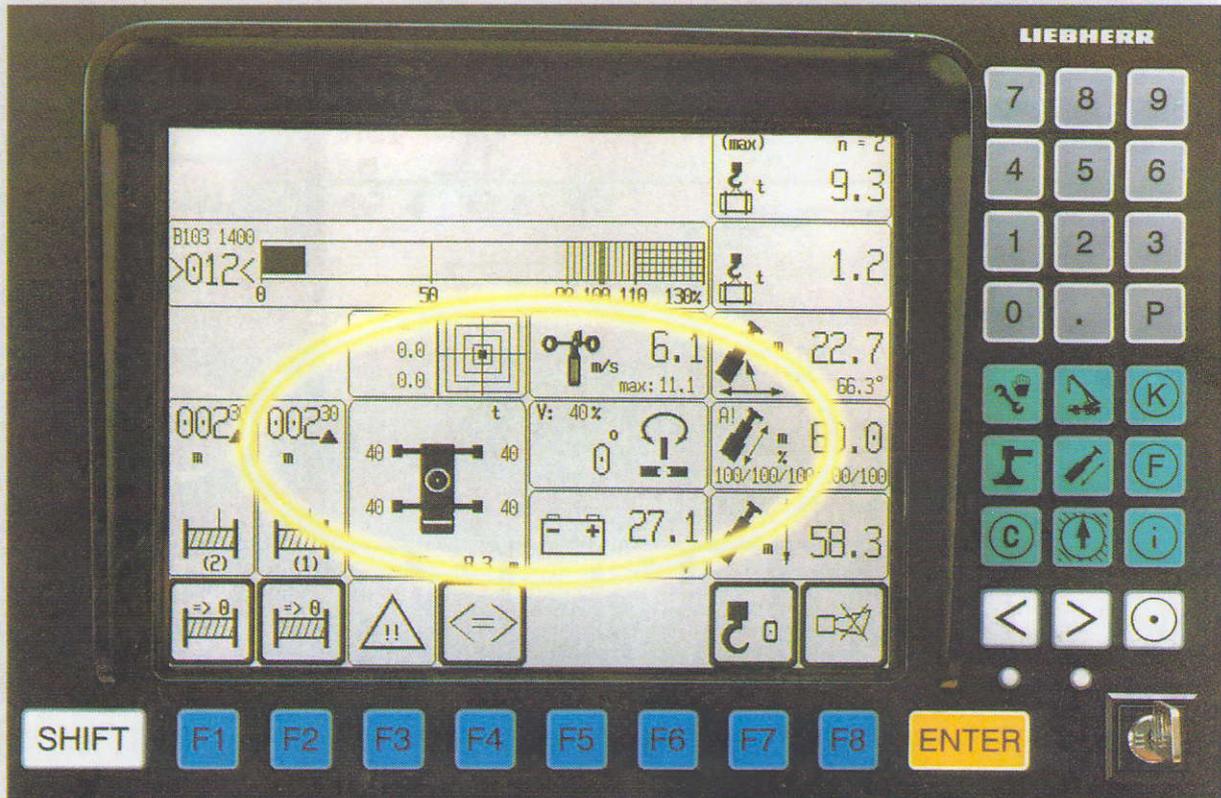
Depending on crane type and equipment, a series of other symbols can be displayed, either according to the requirement of the crane operator or automatically in case of a failure. The advantage of this feature is that the operating picture is not overcharged with information but that the operator always gets a warning signal in case of a failure. The following symbols are assigned to the monitoring function:

● indication of inclination
● wind sensor
● monitoring of supporting pressure
● interlocking of superstructure with horizontal slewing angle display and set slewing speed reduction
● tension of batteries

The overlay of these symbols is accompanied by an audible warning signal. The following symbols, of an informative character only and which do not signalize a failure, are displayed in another area of the operating picture:

● high-speed switched off
● LICCON safe load indicator bridged by means of the setting switch
● lower/upper limit angle of the load utilization attained
● fuel indication

The LICCON computer system displays system errors and application errors on the monitor. Application errors caused by operation or external influence, e.g. on the sensors, are displayed in the operating picture by ERROR with an error number.
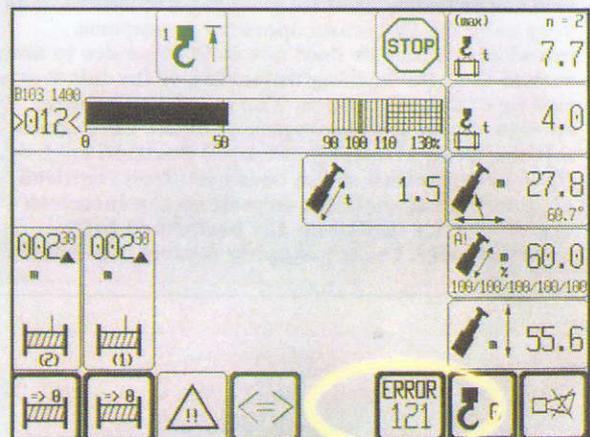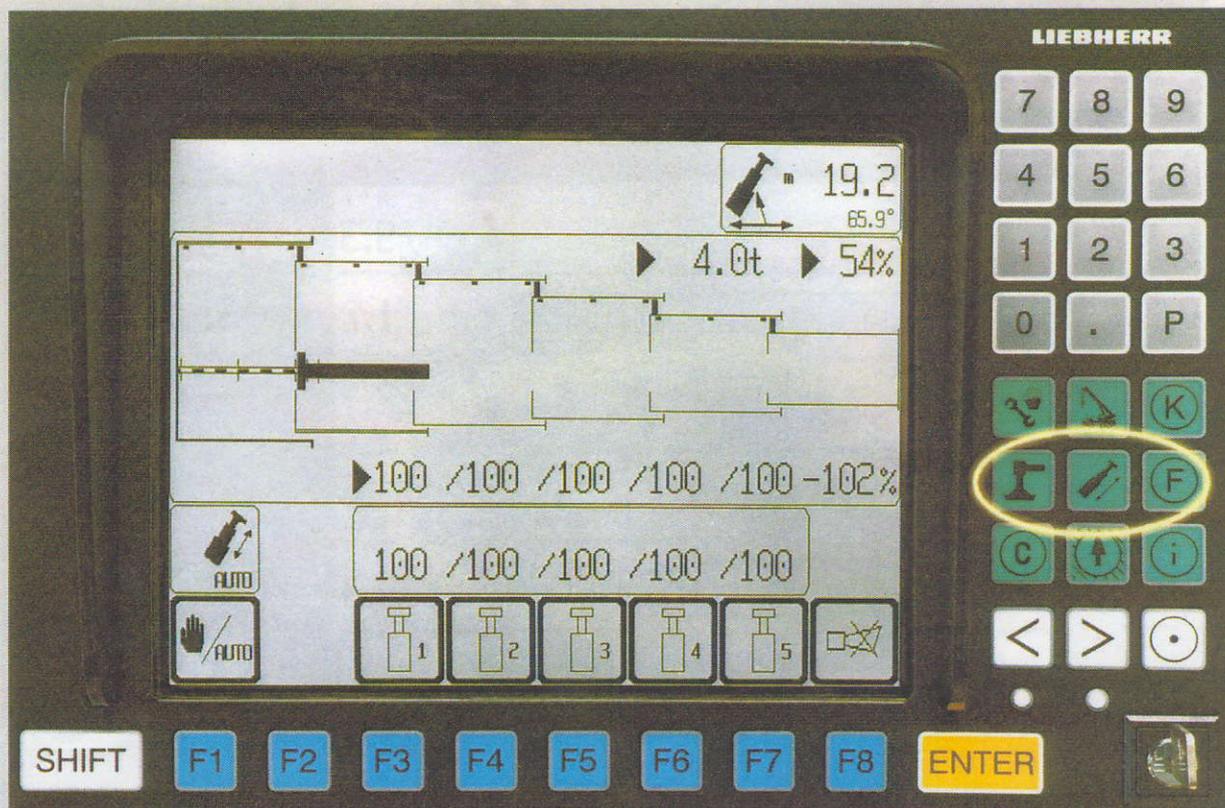

fig. 01-09

The LICCON telescoping picture:

The LICCON telescoping picture.

The LICCON telescoping picture is only available on mobile cranes with interlockable telescopic boom. It demonstrates the crane operator the interlocking condition of the telescopic boom by means of a dynamic full graphics display, the position of the individual telescopes to one another and the extended condition of the telescoping ram. Due to the automated telescoping procedure, it is very easy for the crane operator to perform telescoping since he does not need any more to take care of the interlocking/unlocking of the telescopic ram or of the telescopes. The computer system selects the operating sequence of the individual telescopes in attaining the final position desired. Upon preselection of the boom position required, all telescoping motions as well as the interlocking/unlocking functions are performed fully automatically. The telescoping control "Telematik"

enables manual as well as automatic telescoping. In the telescoping picture of the LTM 1160/2 for instance, the following display elements are represented:
- the stylised telescopic boom with base section and piston rod, the ram with interlocking device, and telescopes 1-5 with their interlocking points
- the function keys F3-F7 for selecting the position of telescopes 1-5
- the selected telescoping position of telescopes 1-5
- the actual telescoped condition of telescopes 1-5 and, divided by a hyphen, the condition of the telescoping ram
- the display symbols for the automatic and manual telescoping procedure
- the telescopable load

fig. 01-10

The system of supporting forces:

The system of supporting forces.
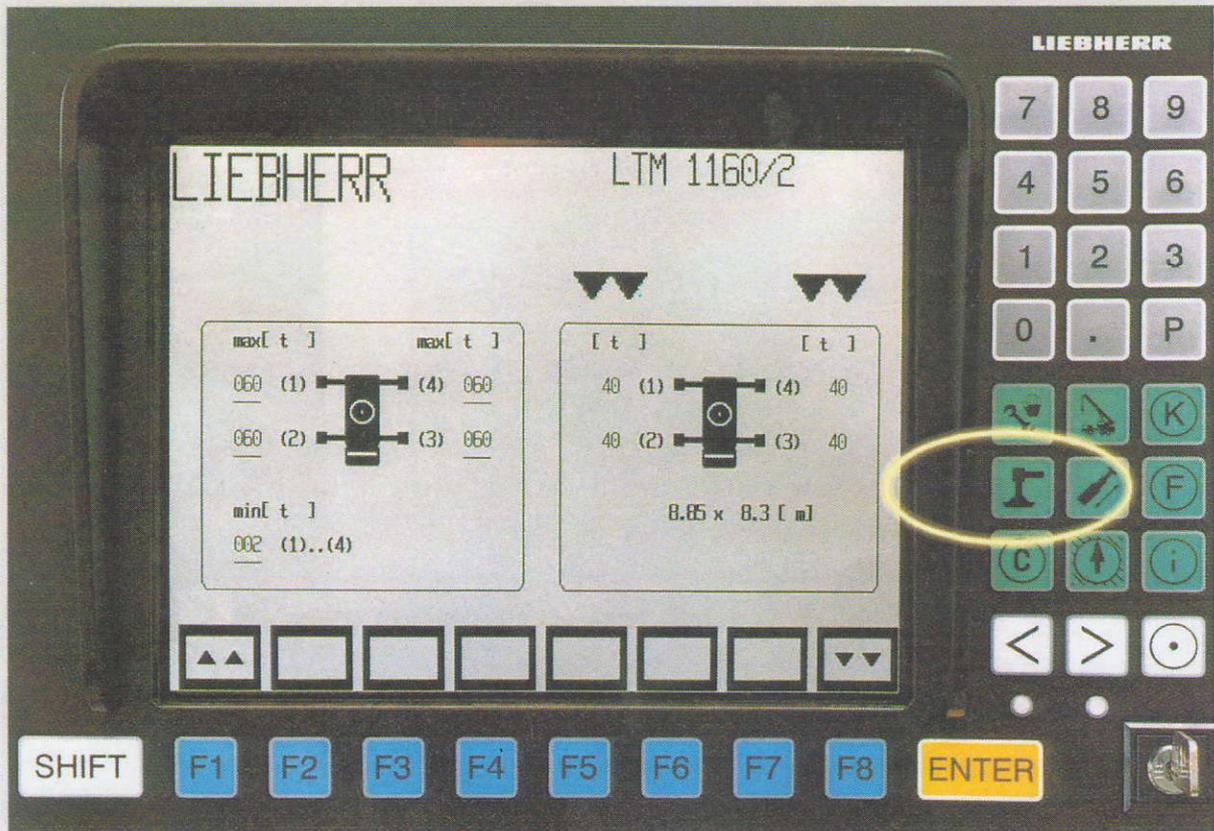
During operation, the monitoring system of supporting forces continuously determinates, by means of pressure sensors, the actual pressure on the 4 supporting rams and displays it as supporting force (t) for each ram. The supporting forces can be displayed on the request of the crane operator by operating function key "F3", or will be displayed automatically in the operating picture if a critical situation arises. The crane symbol in conjunction with the audible warning signal is issued if the maximum force has been attained or exceeded by one ram at least, or if the minimum force has been attained or dropped below the set limits. The exceeded or insufficient supporting force value is displayed by flashing figures in those cases. However, the crane motions will not be switched off when the minimum or maximum supporting forces have been attained. Due to the variable programmability of the limiting values, the monitoring system of the supporting forces can also be employed for prewarning by means of the program "modification of supporting force limiting values". Upon pressing program key "supporting force", at the right-hand side of the screen appears the DISPLAY window with the actual, really acting supporting forces, and at the left-hand side, the EDIT window with the maximum and minimum values programmed at the factory. Two double arrows point on the DISPLAY field, i.e. the program now operates in the "DISPLAY MODE". Upon pressing function key F1, both double arrows point on the EDIT window and the CURSOR appears on the maximum value of ram (1). The value indicated by the CURSOR can be modified by means of the numeric input panel. Any new value entered is checked in respect to its validity and, subsequently, either signalized as faulty or accepted directly by the LICCON system.

fig. 01-11

The working area limitation:

The working area limitation.
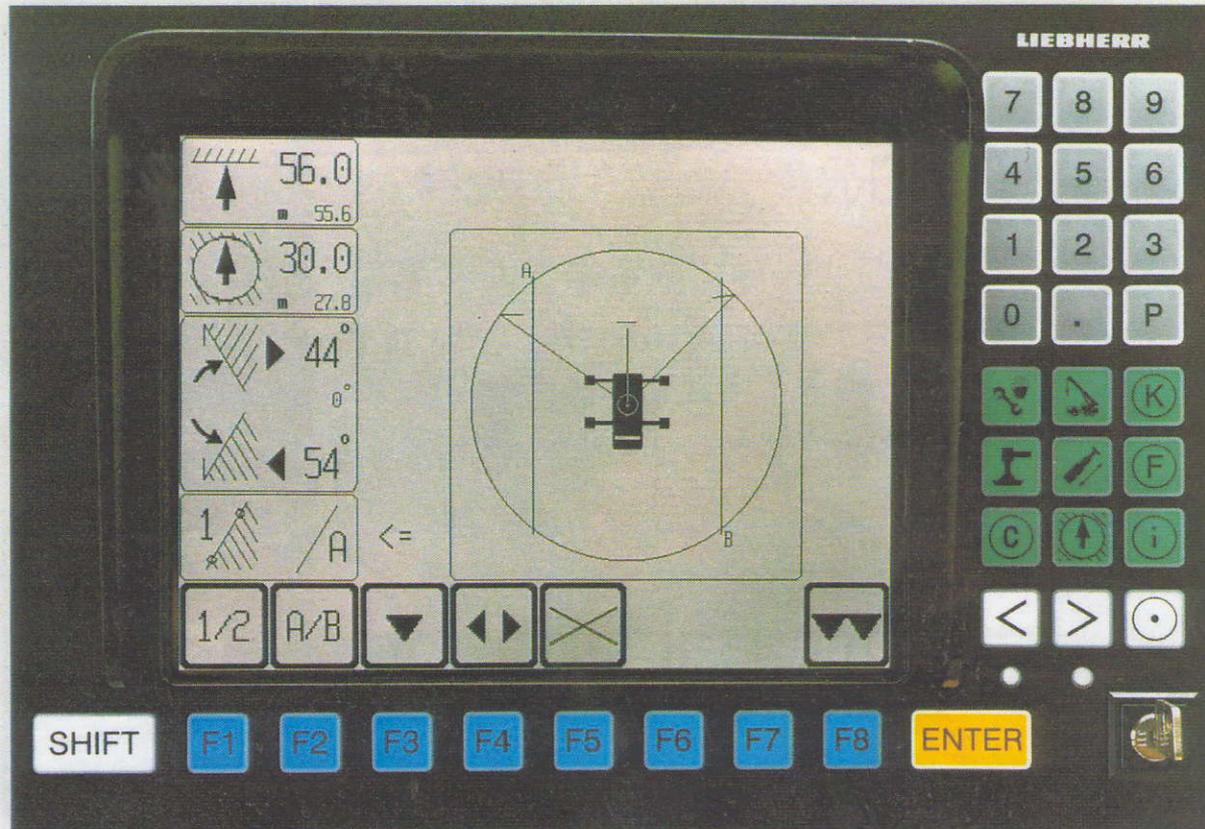
The LICCON working area limitation system for Liebherr mobile and crawler cranes contributes to the unburdening of the crane operator by controlling the working area limits, especially in situations where the handling of loads requires his full attention. Working areas may be restricted by buildings, bridges, roofs, high-voltage overhead lines, pipe lines or adjacent cranes. The automatic area limitation system can be programmed conveniently and its functions are easily understandable. Four different limitation functions are provided:

- The pulley head height limitation restricts the boom head pulley to a predetermined measure. The boom luffing and telescoping motions are cut off when the forbidden working areas are attained.
- The radius limitation prevents the load hook from exceeding a predetermined "maximum" radius. The boom lowering and telescoping motions are cut off when the forbidden working areas are attained.

- The slewing area limitation consists of a right side and left side angle limit which cannot be overrun during activated limitation.
- The edge limitation allows a working area limitation between two edges - A and B - which, however, should not intersect the slewing rim centre. The edge limitation enables slewing at 360° but it may be necessary to reduce the radius in certain cases.

By means of a simple but convenient editor program, the crane operator can enter the various area limits into the LICCON system and activate or inactivate them. Every limitation function can be activated individually but also in conjunction with others so that even a complex of working area limitations are programmable.

fig. 01-12

## The LICCON control parameter programm, test system, work planner:

The LICCON control parameter program.

The control parameter program allows preselection of the maximum slewing speed in steps of 10 % to 100 %. Thus, the operation of the control lever for the slewing motion results in an effect of different sensitivity. Moreover, the control parameter program enables the locking of a hoist winch with unreeved rope in order to prevent the formation of slack rope in case of unintentional operation of the respective control lever.
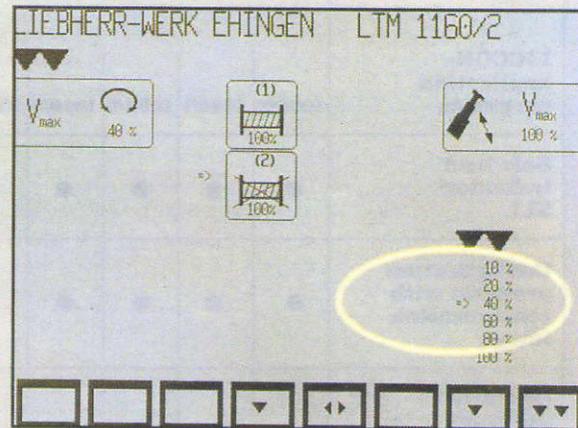
The LICCON test system.

The test system enables the servicing personnel of quickly locating any failure at the sensory system. Convenient interactive functions permit the inspection of any input and output of the entire system by different displays on the screen, even during crane operation. The display on the screen includes the assignment of the individual sensors to the system, their function as well as the respective terminals in the control cabinet. Thus servicing already starts at the display screen, trouble shooting becomes a matter of seconds. The state of development of the program modules and load charts can be represented on the display screen with the aid of the table of contents. Thus a continuous service of the crane is guaranteed by the manufacturer.
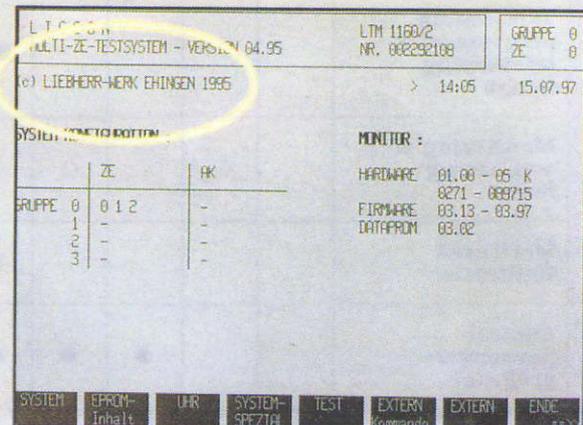
The LICCON work planner.

For more efficient planning of crane jobs, Liebherr offers its customers the LICCON work planner, i.e. a software program on diskettes for planning, simulation and documentation of crane applications on the display screen. The 2-D planner program allows the drawing of buildings, the writing of texts and implication of a scale model crane with all its working motions into a fictitious construction site. Moreover, the work planner provides for more transparency in the submission of offers, facilitates the briefing of crane operators and can be run on a Laptop calculator for field service.
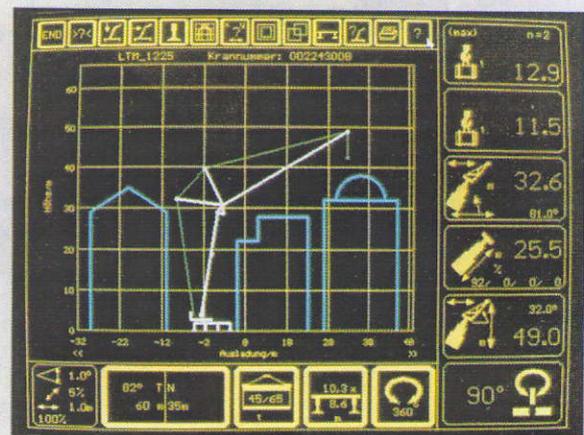
fig. 01-13

LICCON application programs - overview:

LICCON-application programs	LTM mobile cranes with the LICCON system												
	1030/2	1040/1	1050/1	1060/2	1080/1	1090/2	1120/1	1160/2	1225	1280	1300	1500	1800
Safe load indicator/ SLI	●	●	●	●	●	●	●	●	●	●	●	●	●
Configuration program with configuration image	●	●	●	●	●	●	●	●	●	●	●	●	●
Operation program with operating image	●	●	●	●	●	●	●	●	●	●	●	●	●
Telescoping program with telescoping image					●[1]	●[1]	●[1]	●[1]	●	●[1]	●	●[1]	●[2]
Monitoring of supporting forces				○	○	○	○	○	●	●	●	●	●
Work area limitation					○	○	○	○	○	○	●	○	●
Control-parameter-program			●	●	●	●	●	●	●[3]	●[3]	●	●[3]	●[3]
Test system	●	●	●	●	●	●	●	●	●	●	●	●	●
2D-work planner, incl. supporting pressure display [4]	●	●	●	●	●	●	●	●	●	●	●	●	●

● standard
○ option
[1] Telematik
[2] no „telescoping image" but %-indication for T1, T2, T3 on „operating image"
[3] luffing winch of jib with graded speed (%)
[4] crane data diskette standard equipment, basic program optional

fig. 01-14

LICCON application programs

- Work sheets -

_____

_____

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Technical Training

LICCON Computer System

The program "Configuration"

On the LICCON configuration picture, the crane operator enters the data for the selected configuration into the safe load indicator and receives the corresponding load charts on the monitor.

LIEBHERR

Keypad: 7 8 9 / 4 5 6 / 1 2 3 / 0 . P / (K) (F) (i) / (·) / ENTER

Screen display:

CODE >XXXXX BXXX YYZZ.5(6)

m> <t	41,3	22,7	30,1	33,9	37,6	41,3	45,0
3,0							
3,5							
4,0	12,5						
4,5	12,2						
5,0	12,0	10,6	12,5				
6,0	11,5	10,0	12,2	8,8			
7,0	11,0	9,5	11,9	7,0			
8,0	10,6	9,0	11,6	6,6	10,8		
9,0	10,3	7,3		6,3	10,5	5,7	
					10,2	5,4	
1	46-	0+	0+	0+	1*	1*	1*
2	46+	0+	46-	92-	0+	46-	92-
3	92+	92-	92+	92+	92+	92+	92+
4	92+	92+	92+	92+	92+	92+	92+
5	46+	46+	46+	46+	46+	46+	46+

29(96) << >>

F1 F2 F3 F4 F5 F6 F7 F8

O.K. — 35.0 t — 7.23× 17.0 m — 360° — 2×

SHIFT

Work Sheet

What is shown on the LICCON picture under the respective number?

Liebherr-Werk Ehingen GmbH

Kundendienst Schulung

[Numbered answer boxes 1–9]

Memorizing errors in OW mode:

From the operating picture at an error message:

- **F8**   press key „horn symbol" to de-activate the beep sound

- **F8**   press key to initiate the error message and error description of the error stack

From the operating picture without error message:

- **ⓘ**   press key to open the test system

- **F5**   press key „test and error", to change the key assignment in the test system

- **F5**   press key „error" to initiate the error determination

  The error stack of the HC11 processor of ZE0 is openened automatically.

Memorizing errors:

- **SHIFT** + **F5**   press keys simultaneously to activate the error storage

- **ENTER**   press key to start the error storage

Storage routine:

By this storage routine, all error stacks of the processors are processed and the error messages stored on the battery-backed RAM memory of the common memory card of the power pack.

This has the purpose, that the operator can store permanently an error condition or an error in a certain operating condition of the crane (date, time are also recorded). A replica of the momentary error condition is made.

The error messages are permanently stored, even when the ignition is switched off or the battery disconnected.

Up to 160 error messages can be stored. This fixed error memory will not be overwritten until the storage routine is restarted .

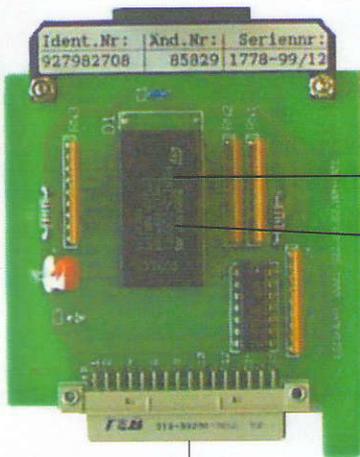Former errors will be deleted or overwritten in that case.

Storage routine: ZE0: HC11 - TMS - EAM 1 - 2 - 3 - 4 - 5 - 6, then

                ZE1: HC11 - TMS - EAM 1...... etc.

                until all ZEs have been processed. A bleep sound is emitted on completion.

                Subsequently, the error stack displays all errors which were stored in the error stacks at that moment.
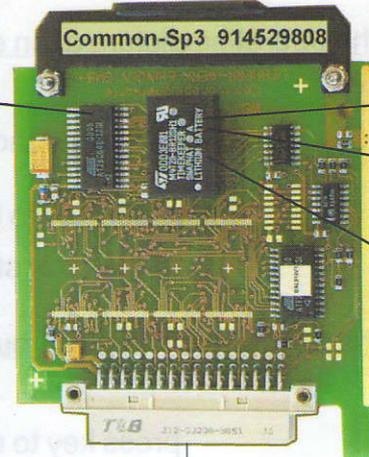
Common memory card 1:   _Common memory card 2:_   _Common memory card 3:_
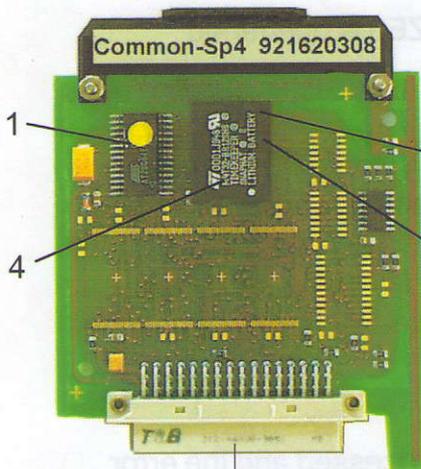

Plug-in stations 2-row   Plug-in stations 2-row   Plug-in stations 2-row

Common memory card 4:

Plug-in stations 3-row

1	EEPROM memory (8kB)
2	RAM memory (8kB) (max. 160 errors storable, battery-backed)
3	Common memory(clock, 2kB)
4	Lithium battery (3,6 V)

Common memory card in power pack (NT):

Power pack 1	Common memory fixed -mounted
Power pack 2	Common memory card 1, 2, 3 Plug-in stations 2-row Memory card 2 + 3 compatible
Power pack 3	Common memory card 4 Plug-in stations 3-row, substitutes power pack 1 +2

Crane types without transfer switch „UW-OW mode": LTM 1300/1, LTM 1500

Read out and memorising errors:

On crane types without transfer switch „UW- OW mode", error messages (active and inactive errors) can be memorized in carrier and crane mode.

OW and UW can be operated separately and simultaneously.
The UW LSB data bus (LSB2) is connected with the LICCON system and the data busses on the OW via the slewing pass-through. On large cranes (LTM 1300/1, LTM 1500 with two engines), a transfer switch „UW-OW mode" which interrupts the bus line is non-existent.
Thus, memorizing errors in the RAM memory in UW mode and OW mode is possible.
For that purpose, however, the OW engine must be started or the LICCON system activated.

Important indications:

- **On de-activation of the ignition, all error messages (active and inative errors) are deleted in the error stacks.**

Read out and memorizing errors on the UW:

It is recommandable to write down errors on a sheet of paper in carrier mode.

Remark: Read out of error memories of CAN control modules (engine, transmission ...)
       --> see further back

Read out and memorizing errors on the OW:

From the operating picture with error message:

- F8   press key „horn symbol" to de-activate the bleep sound
- F8   press key to initiate the error message and the error description of the error stack

From the operating picture without error message:

- (i)   press key to open the test system
- F5   press key „test and error" to change the key assignment in the test system
- F5   press key „error" to initiate the error determination
                       The error stack of the HC11processor of ZE0 is opened automatically.

- SHIFT + F5   press keys simultaneously to activate the error storage
- ENTER   press key to start the error storage
                       The memorizing routine processes the individual processors as on cranes with one engine.
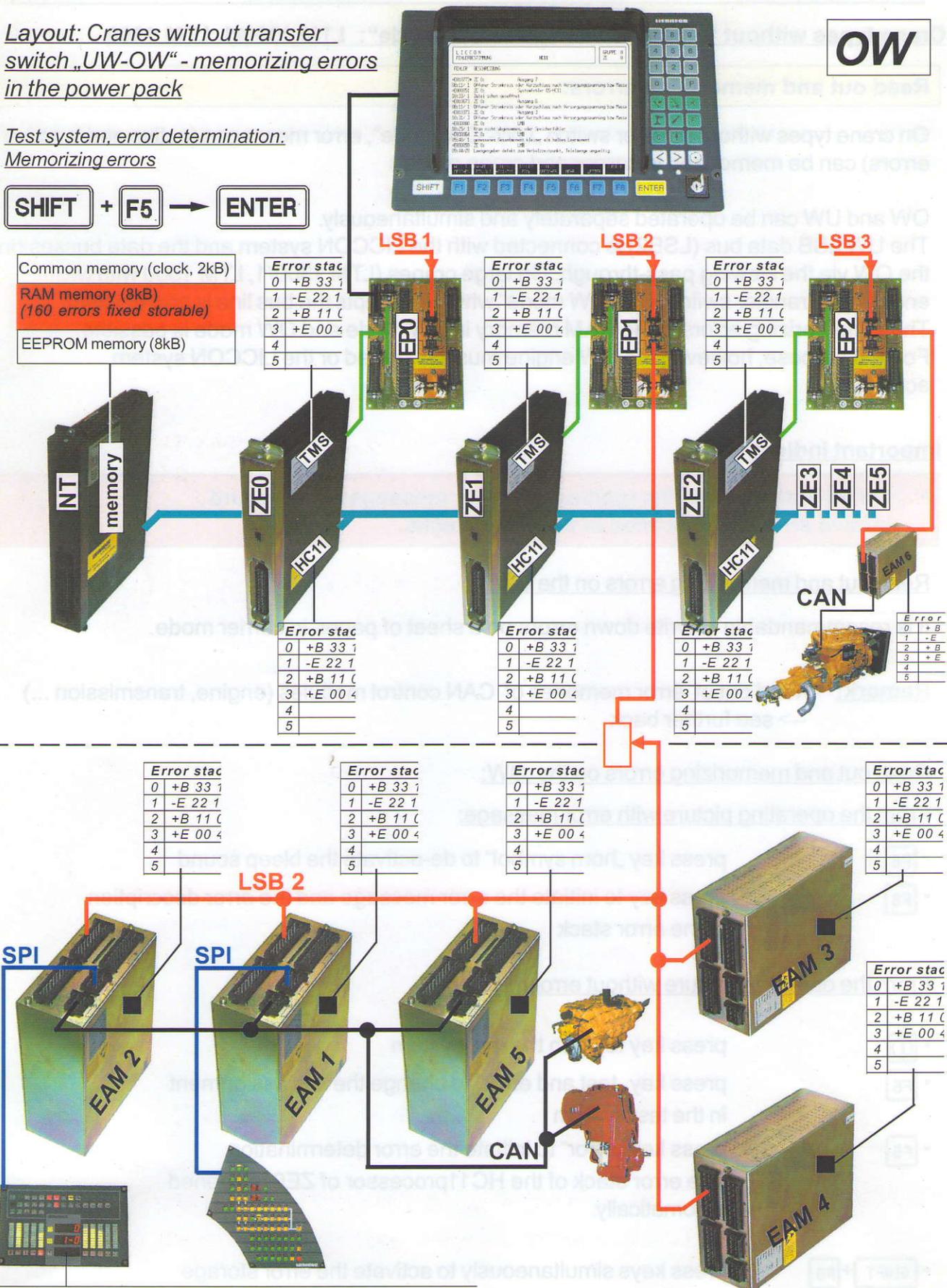
OW

Layout: Cranes without transfer switch „UW-OW" - memorizing errors in the power pack

Test system, error determination: Memorizing errors

$$\boxed{\text{SHIFT}} + \boxed{\text{F5}} \longrightarrow \boxed{\text{ENTER}}$$

Common memory (clock, 2kB)
RAM memory (8kB) *(160 errors fixed storable)*
EEPROM memory (8kB)

LSB 1   **LSB 2**   **LSB 3**

Error stac	
0	+B 33 1
1	-E 22 1
2	+B 11 (
3	+E 00 4
4	
5	

Error stac	
0	+B 33 1
1	-E 22 1
2	+B 11 (
3	+E 00 4
4	
5	

Error stac	
0	+B 33 1
1	-E 22 1
2	+B 11 (
3	+E 00 4
4	
5	

EP0   EP1   EP2

NT / memory

ZE0 / TMS / HC11   ZE1 / TMS / HC11   ZE2 / TMS / HC11   ZE3 ZE4 ZE5

CAN

EAM 6

Error	
0	+ B
1	- E
2	+ B
3	+ E
4	
5	

Error stac	
0	+B 33 1
1	-E 22 1
2	+B 11 (
3	+E 00 4
4	
5	

Error stac	
0	+B 33 1
1	-E 22 1
2	+B 11 (
3	+E 00 4
4	
5	

Error stac	
0	+B 33 1
1	-E 22 1
2	+B 11 (
3	+E 00 4
4	
5	

Error stac	
0	+B 33 1
1	-E 22 1
2	+B 11 (
3	+E 00 4
4	
5	

Error stac	
0	+B 33 1
1	-E 22 1
2	+B 11 (
3	+E 00 4
4	
5	

Error stac	
0	+B 33 1
1	-E 22 1
2	+B 11 (
3	+E 00 4
4	
5	

LSB 2

SPI   **SPI**

EAM 2   EAM 1   EAM 5

EAM 3

Error stac	
0	+B 33 1
1	-E 22 1
2	+B 11 (
3	+E 00 4
4	
5	

CAN

EAM 4

Display of active errors:

$$\boxed{i} \longrightarrow \boxed{\text{E. 00}} \quad \boxed{33 \ 47}$$

Display of inactive errors:

$$\boxed{i} + \boxed{\text{✋}} \longrightarrow \boxed{\text{-E. 00}} \quad \boxed{33 \ 47}$$

UW

LIEBHERR

Read out of the error memories of CAN modules:

Realized as from software version/crane:

fromMULI	Crane type
0	LTM 1100/2, LTM 1200/1, LTM 1055/1, LR 1600/1
4	LTM 1060/2
2	LTM 1300/1
7	LTM 1500
14	LTM 1080/1

CAN diagnosis:

E/A modules and CAN modules (control module, transmission, anti skid system, intarder) are interconnected by the CAN bus. The E/A module, responsible for the control of the connected CAN modules serves as interface (gateway) to the error memory of the CAN modules. The error diagnosis is realized via that interface.

Outline of the respective E/A modules (interfaces), see table 1 on the following page.

On the call-off of the error memory EAM1, the errors of the CAN modules on the UW are read out simultaneously. The error display can be skipped through or updated by key "more". The diagnostic of the engine control on the OW is performed via EAM6.

Inactive errors can also be displayed by means of function key "parameter ON" (F2) and are identified by " - ".

Calling off the CAN errors via the test system LICCON:

Selection test system --> „Test + Error" (F5) --> „Error" (F5) --> selection ZE0,1,2 --> „error EAMn" (F4).

Equally the E/A module errors with the CAN errors can be memorized by --> „Test + Error" (F5) --> „Error" (F5) --> Shift + F5 (Enter).

Remark: Repeat the procedure <u>twice</u> to enable the errors of the CAN bus users, chronologycally offset, to be displayed also.

### Calling off the inactive CAN errors on the UW:

Press keys [✋] + [i] for **approx. 4s** (until the error display is reset).
The system requires that period to read out all errors and to file them in the error memory..

Remark: Subsequently, read out inactive errors again by [✋] + [i] keys.

The read out errors are filed in the error memory of the respective EAM.

Outline of interfaces:
Circuit diagram extract LTM 1080/1
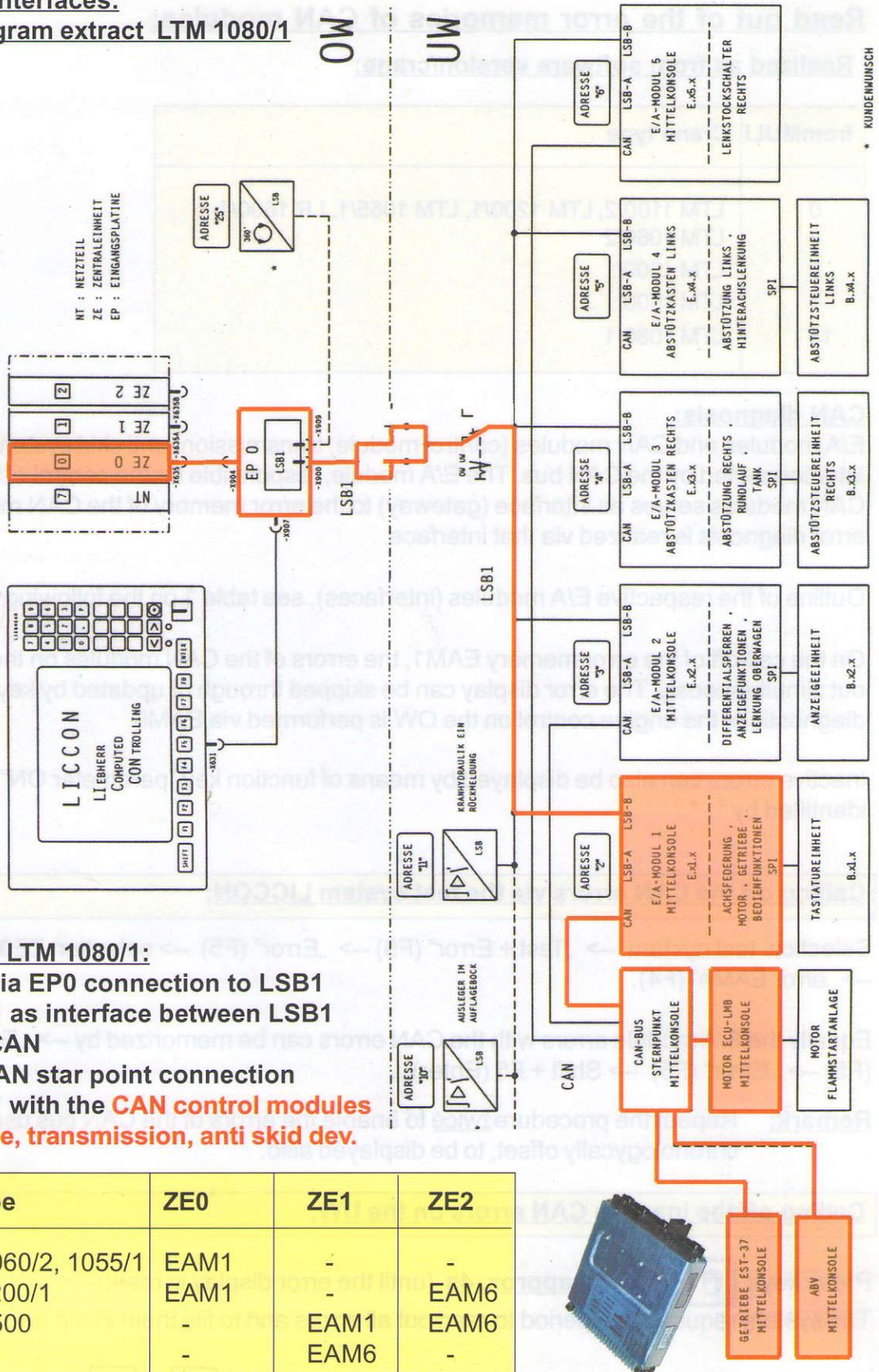
NT : NETZTEIL
ZE : ZENTRALEINHEIT
EP : EINGANGSPLATINE

Example - LTM 1080/1:
- **ZE0** via EP0 connection to LSB1
- **EAM1** as interface between LSB1 and CAN
- via CAN star point connection **EAM1** with the **CAN control modules engine, transmission, anti skid dev.**

Crane type	ZE0	ZE1	ZE2
1080/1, 1060/2, 1055/1	EAM1	-	-
1100/2, 1200/1	EAM1	-	EAM6
1300/1, 1500	-	EAM1	EAM6
LR 1600/1	-	EAM6	-

Table 1

EAM1 = E/A-Modul 1 (UW)
EAM6 = E/A-Modul 6 (OW)

Remark:

The error counter of the LICCON error display indicates only how often the error code CAN has been called off via the CAN. The 1st parameter of the error code/-text indicates the frequency of the error occurrence, provided that it is signalized by the respective control module called off . A frequency of 00h-FEh is valid, otherwise this indication has to be disregarded .

The E/A module, which backs up the ISO interface, is identified on the test picture
LSB --> EAM (Enter) --> INPUT/OUTPUT --> CAN configuration by
a "1" in the most significant bit (B31, left).

```
SPI          ID:  2 - E: 15 - S:  0 - T:  0 - X: 18 - A:  0
CAN - Soll 1000 0000 0000 0000 - 1001 1000 0000 1110
CAN - Ist  1000 0000 0000 0000 - 1001 1000 0000 1110
```

Important indications:

> - **On de-activation of the ignition, all error messages (active and inactive errors) are deleted in the error stacks.**
>   **Error messages in the CAN modules are not deleted by that action.**

Deletion of error memories of CAN modules via the test system LICCON:

The deletion of the error memory (F1) of the E/A module serving as diagnostic interface to the CAN (EAM1, EAM6) initiates automatically an additional deletion procedure of all CAN users.
After the deletion by pressing 2 times key "more", check the error memories again.

WARNING!
After manipulations on the cabling of the software downloads, errors develop partially in the CAN-modules (e.g. "EAM missing on CAN").
Therefore, after every software download or pull-off of connectors/sensors from a control module, **it is necessary** to perform a deleting procedure (as described above).

Deletion of error memories of CAN modules via test programs UW:

The error memories of the control modules engine, transmission, anti-skid device, intarder, connected to the CAN, can be deleted by test programs 46..49 on the UW.

Menue	Test routine
46	delete **engine error**
47	delete **transmission error**
48	delete **anti-skid dev. error**
49	delete **intarder error**

Procedure:
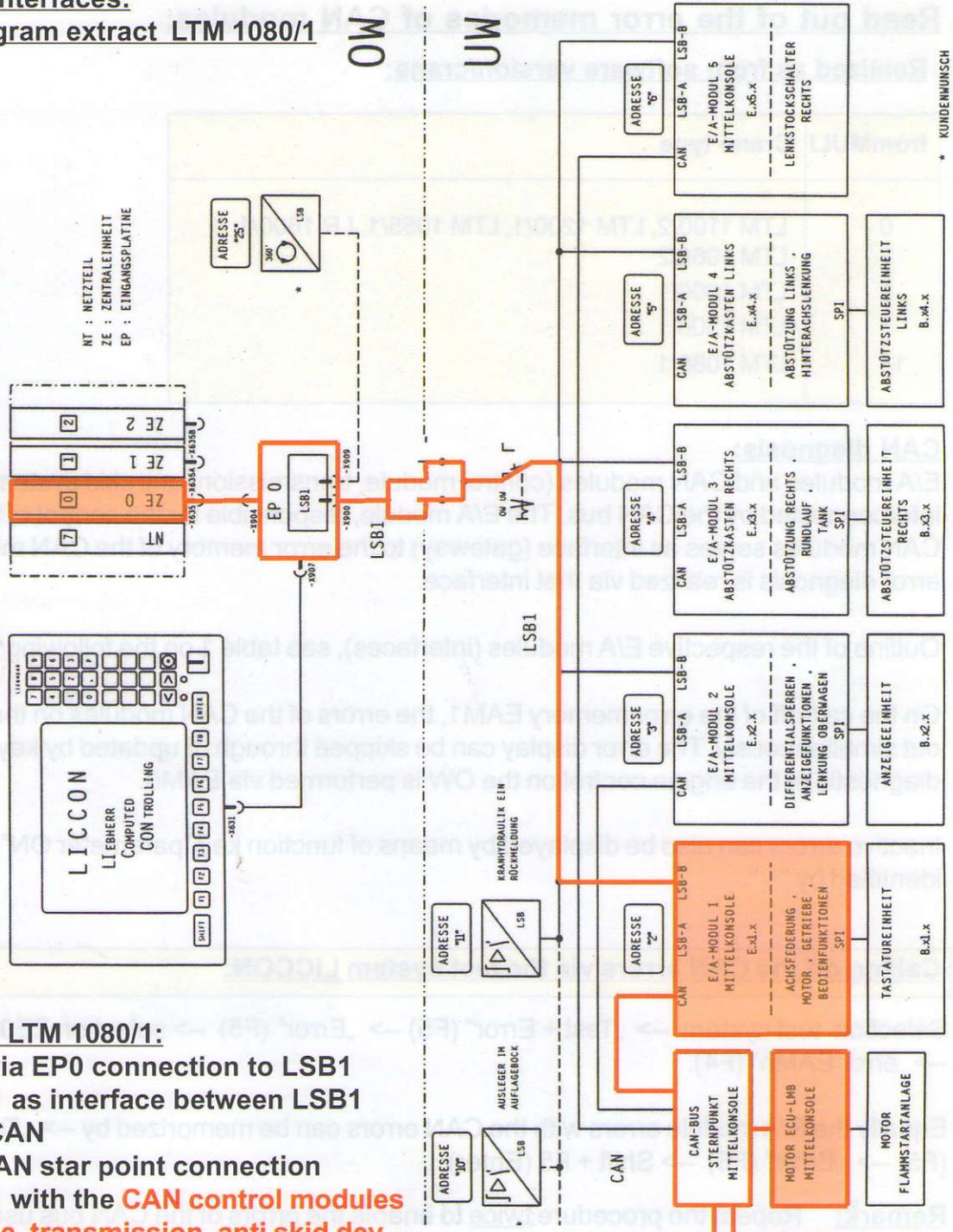Activate test program with

| HAND key + i key + P1 key + P2 key |

at stopped engine:

--> select test program (P1/P2)
--> activate program (Hand)
--> check-back information **70** = deletion performed
   (at check-back **55** = no answer from control module --> deletion not possible
   -->option: try several times or check voltage supply/fuses).

Outline of interfaces:
Circuit diagram extract LTM 1080/1

OW

UW

NT = NETZTEIL
ZE = ZENTRALEINHEIT
EP = EINGANGSPLATINE

ADRESSE "25"

360° LSB

ZE 2 — 2
ZE 1 — 1
ZE 0 — 0
NT — 7

EP 0   LSB1

LSB1

LSB1

L I C C O N
LIEBHERR
COMPUTED
CONTROLLING

SHIFT

ADRESSE "6"   CAN   LSB-A LSB-B   E/A-MODUL 5 MITTELKONSOLE   E.x5.x   LENKSTOCKSCHALTER RECHTS   * KUNDENWUNSCH

ADRESSE "5"   CAN   LSB-A LSB-B   E/A-MODUL 4 ABSTÜTZKASTEN LINKS   E.x4.x   ABSTÜTZUNG LINKS HINTERACHSLENKUNG   SPI   ABSTÜTZSTEUEREINHEIT LINKS   B.x4.x

ADRESSE "4"   CAN   LSB-A LSB-B   E/A-MODUL 3 ABSTÜTZKASTEN RECHTS   E.x3.x   ABSTÜTZUNG RECHTS RUNDLAUF TANK   SPI   ABSTÜTZSTEUEREINHEIT RECHTS   B.x3.x

ADRESSE "3"   CAN   LSB-A LSB-B   E/A-MODUL 2 MITTELKONSOLE   E.x2.x   DIFFERENTIALSPERREN ANZEIGEFUNKTIONEN LENKUNG OBERWAGEN   SPI   ANZEIGEEINHEIT   B.x2.x

ADRESSE "2"   CAN   LSB-A LSB-B   E/A-MODUL 1 MITTELKONSOLE   E.x1.x   ACHSFEDERUNG MOTOR · GETRIEBE BEDIENFUNKTIONEN   SPI   TASTATUREINHEIT   B.x1.x

ADRESSE "1"   LSB

KRANHYDRAULIK EIN RÜCKMELDUNG

AUSLEGER IM AUFLAGEBOCK

ADRESSE "0"   LSB

CAN-BUS STERNPUNKT MITTELKONSOLE

MOTOR ECU-LMB MITTELKONSOLE

MOTOR FLAMMSTARTANLAGE

GETRIEBE EST-37 MITTELKONSOLE

ABV MITTELKONSOLE

Example - LTM 1080/1:

- **ZE0** via EP0 connection to LSB1
- **EAM1** as interface between LSB1 and CAN
- via CAN star point connection **EAM1** with the **CAN control modules engine, transmission, anti skid dev.**

Crane type	ZE0	ZE1	ZE2
1080/1, 1060/2, 1055/1	EAM1	-	-
1100/2, 1200/1	EAM1	-	EAM6
1300/1, 1500	-	EAM1	EAM6
LR 1600/1	-	EAM6	-

EAM1 = E/A-Modul 1 (UW)
EAM6 = E/A-Modul 6 (OW)

Table 1

Summary: Memorizing errors

On cranes WITH
Transfer switch „UW-OW mode":
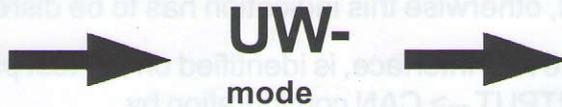
Keyboard unit	Display unit
active errors	
i	
inactive errors	
✋ + i	-E.003347

UW-mode

OW-mode

On LICCON screen:
test system,
error determination;

SHIFT + F5 → ENTER

On cranes WITHOUT
Transfer switch „UW-OW mode":

UW
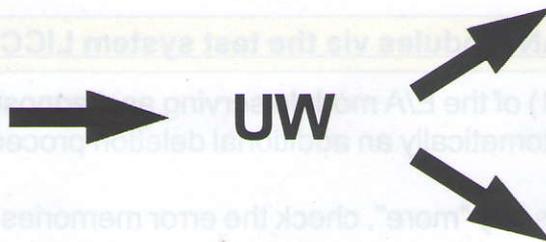
Im LICCON screen:
test system,
error determination;

SHIFT + F5 → ENTER

Keyboard unit	Display unit
active errors	
i	
inactive errors	
✋ + i	-E.003347

OW

On LICCON screen:
test system,
error determination;

SHIFT + F5 → ENTER

IMPORTANT: ALWAYS APPLICABLE:

Ignition OFF → **All error messages in the error stacks are being deleted !**

At pressing:
SHIFT + F5 → ENTER → **All memorized formererror messages in the RAM error memory are being overwritten and are deleted.**

Remote Diagnosis

Table of contents

1 Introduction
1.1 Scope of delivery
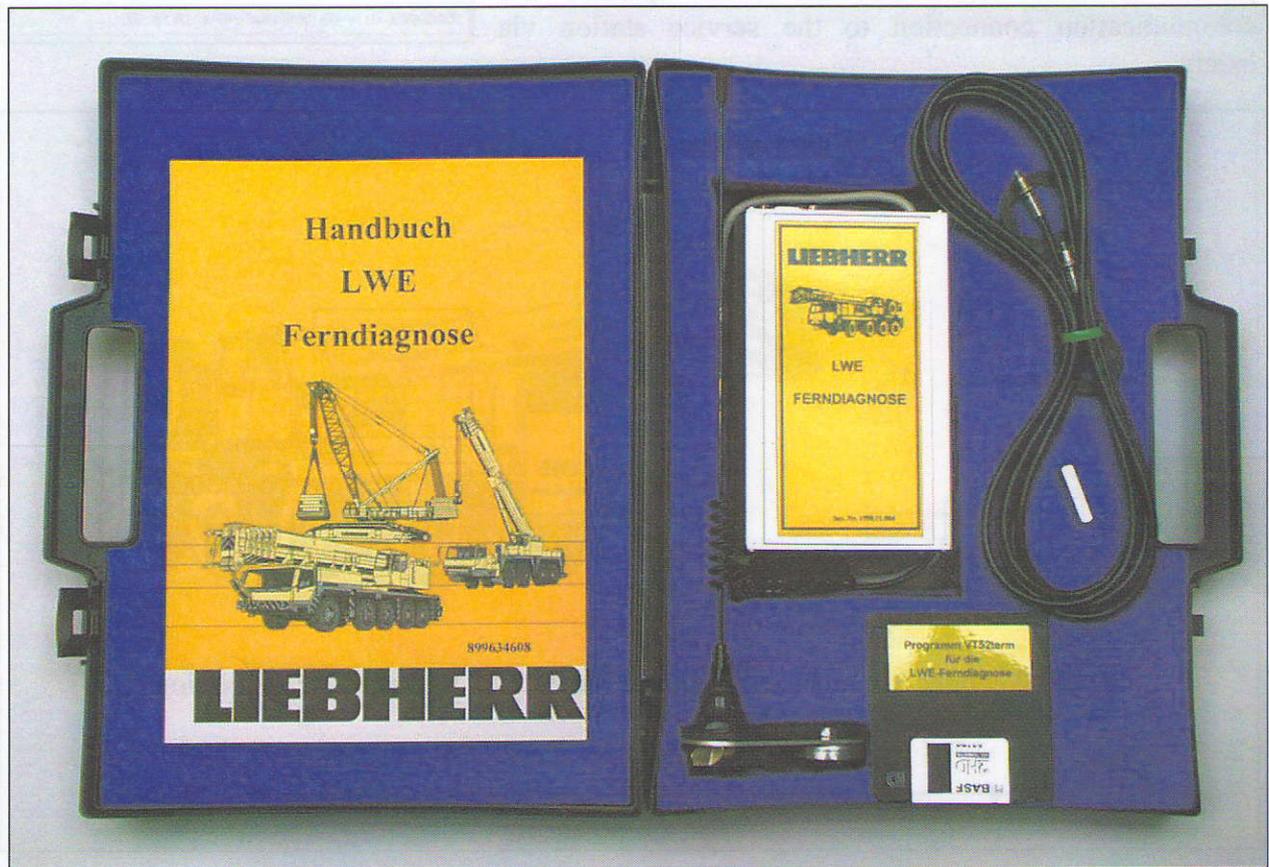
Case with   1 LWE remote diagnosis module with two connection cables
      1 Aerial
      1 Extension cable for aerial with coupling element
      1 Program VT52term
      1 Manual LWE remote diagnosis

1.2 What can be achieved with the LWE remote diagnosis?

The LWE remote diagnosis enables remote servicing of the crane in case of an error. This requires the crane operator to connect the LWE remote diagnosis module with the LICCON system of the crane. Subsequently he contacts a service station by a mobile phone (handy). The service station establishes a connection with the remote diagnosis module on the crane by means of a PC with modem and the corresponding software. This reads out the data from the LICCON system via the Multi-ZE test system and transmit them to the computer of the service station. Based on the transmitted data, the servicing personal can give the crane operator further instructions for a quick and efficient elimination of the error.

As long as the connection from the service station to the LWE remote diagnosis module exists, the LICCON monitor is in the remote diagnosis mode or external operation (see adjacent fig.). However, the crane operator can execute all crane functions, but without operating picture. It is essential that the crane operator has communication connection to the service station via handy.

A vocal connection must be established in parallel to the data transmission:

The LWE remote diagnosis is only practicable on cranes which are equipped with the LICCON safe load indicator and crane control (SPC).

In a case of error, the LWE remote diagnosis is only practicable if the Multi-ZE test system can be initiated by means of the LICCON.

In the LWE remote diagnosis, a GSM module is incorporated into which an SIM card must be installed. The SIM card must be cleared for the data transmission and the PIN inquiry mode be de-activated.