

iSCOUT

expert compact

Graphics console



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Operator's Manual

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1. GENERAL INFORMATION

The purpose of the **iFLEX5** load moment limitation and control system with **iSCOUT expert compact console** (hereafter referred to as LMI) is to provide the crane operator with important information necessary for the operation of the crane within the areas of operation specified by the manufacturer. The LMI uses a variety of different sensors to monitor different crane functions and communicates the crane performance data to the crane operator on a continuous basis. This data changes constantly in connection with the crane movements.

If the crane nears its safe load limit, the system will warn the crane operator by means of both acoustic and optical signals. In addition, as soon as the crane reaches an unauthorized operating status, all crane movements will be switched off that would increase the load moment on the crane.

The PAT **iFLEX5** system uses a graphics operator interface, the functionality of which is determined by the crane manufacturer. The selection of the programmed functions is considerably simplified by the use of symbols.

The load moment limitation and control system based on the PAT **iFLEX5** is made up of main components that are connected via a CAN bus.

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2. IMPORTANT NOTES

The LMI is an operating aid that warns the crane operator of imminent overloading or of the approach of the hook block, hook ball, or load to the boom head, in order to avoid possible property damage or injury to personnel.

The device is not, nor is it intended to be, a substitute for good operator judgment and/or experience, nor does it remove the need for utilizing only recognized safe procedures during crane operations.

**CAUTION**

The crane operator continues to bear ultimate responsibility for safe operation of the crane. He must ensure that he fully understands and follows the displayed notes and instructions in their entirety.

Before beginning crane operations, the crane operator must carefully read and understand the entire manual in order to ensure that he is aware of the operation and limitations of both the LMI and the crane itself.

Proper functioning is dependent upon proper daily inspection and observation of the operating instructions set forth in the manual.

**WARNING**

The LMI is not able to provide aid to the crane operator unless it has been properly adjusted and unless the correct load capacity chart and the correct operating code have been entered for the respective rigging configuration. The accuracy of the LMI settings must be guaranteed before beginning crane work in order to avoid damage to property and severe or even fatal injuries to personnel.

**WARNING**

This system can be equipped with an external key-operated switch located in the crane operator's cab. This key-operated switch overrides control lever function switch-off by the LMI or by the hoist limit switch system. This switch may only be used during emergency situations, and even then only by authorized personnel. Failure to observe these instructions could result in damage to property and severe or even fatal injuries to personnel.

**WARNING**

The LMI cannot perform correctly unless it has been properly adjusted. The prerequisite for this is making conscientious and correct entries during the set-up procedure, in accordance with the actual configuration of the crane. The accuracy of the LMI settings must be ensured before beginning crane work in order to avoid damage to property and severe or even fatal injuries to personnel.

3. SYSTEM DESCRIPTION

The PAT load moment limitation and control system consist of an **iFLEX5** central unit, an **iSCOUT expert compact** CAN console and various sensors for collection the measured values.

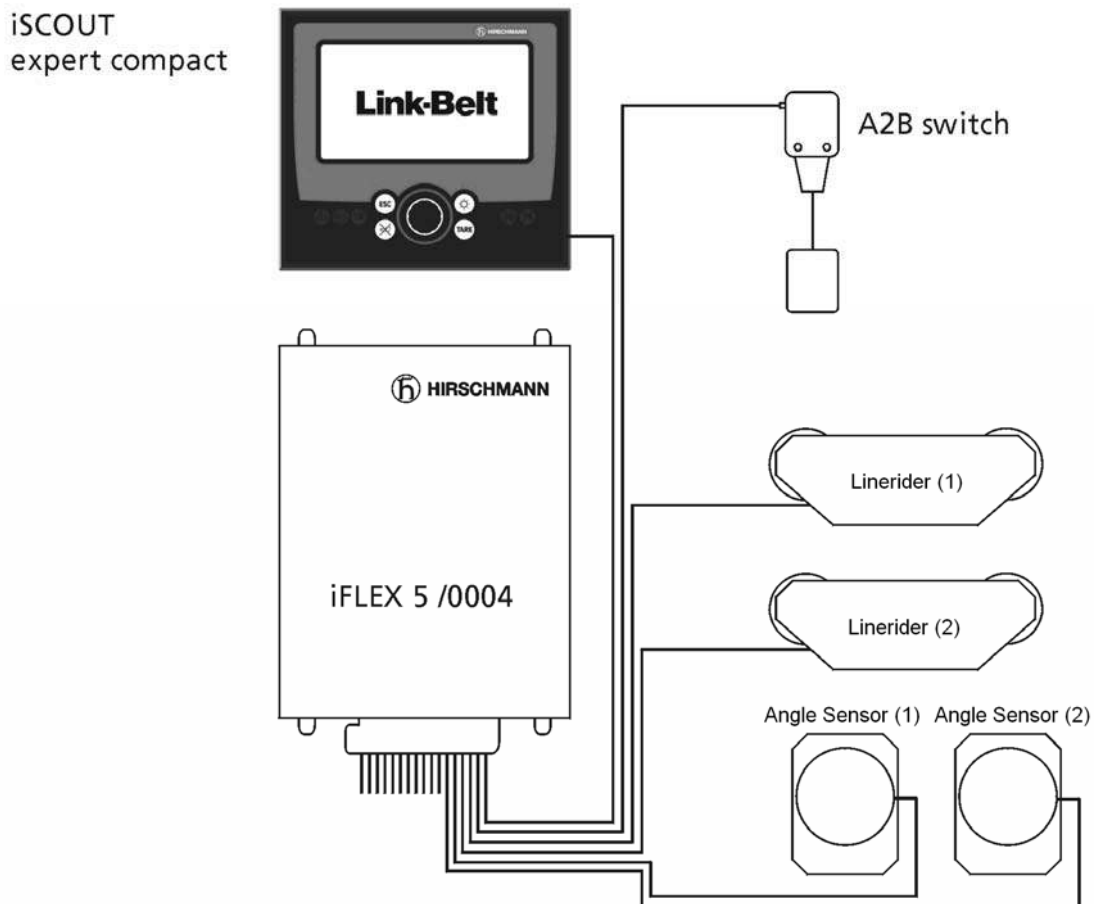


Fig. 1: Components of the LMI system with **iFLEX5**

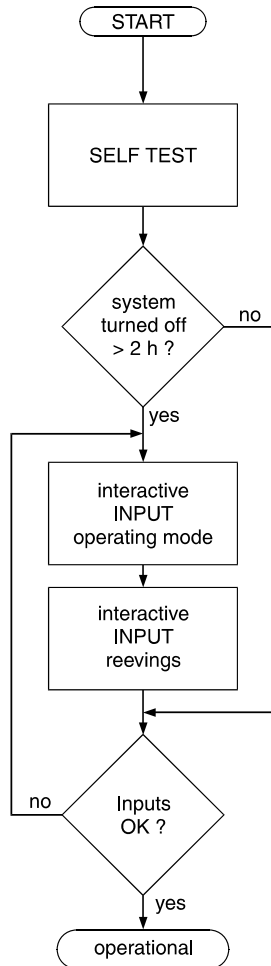
The system operates on the principle of reference/real comparison. The actual value is compared with the calculated reference values and evaluated by the system. An overload warning signal is triggered on the display and operating console once limit values are reached. All crane movements that increase the load moment are switched off at the same time.

The crane-specific data specified by the manufacturer, such as load capacity charts, boom weights, centers of gravity and dimensions, are stored in the central data memory. This data is the reference information used to calculate the operating conditions.

The boom angle is registered by means of an angle sensor that is mounted on the boom. The crane load is determined indirectly with the aid of force and angle sensors.

System Description

3.1 SYSTEM FUNCTION



Upon switching on, the system starts with an automatic test of the LMI system, of lamps and audible alarm. During the test, the LC (liquid crystal) display shows the start screen.

If the system was turned off for more than the maximum time, the setup configuration must be entered after the system test. (⇒ chapter 4)

First, the operating mode is determined by a step-by-step review of the rigging states.

Next, input of the reevings.

Now the LC display shows all inputs and awaits acknowledgment or cancelling.

Upon acknowledgment of the inputs the system is ready for operation. In the event of a disruption, a corresponding error code "E##" will appear on the Data display (1). (> refer to error code table)

3.2 OPERATOR'S CONSOLE

The console has several functions:

- Entries into the LMI system made by the crane operator (mode of operation, number of reevings, etc.)
- Important data and information displays during crane operation
- Input of geometry limit values and cut-off if exceeding limits
- Call-up and display of system information for operator and service personnel

The operating console is located in the operator's cab in plain view of the crane operator. All displays have background illumination for enhanced ease of recognition. The console contains various operating elements as well as a multifunction LC display, all of which are described in detail in Chapter 3.3.

The background illumination of the operating elements and the LC display is manually adjustable in accordance with present light levels.

3.3 Displays and operating elements

Figure 1 shows the display and operating elements of the iSCOUT **expert compact** console. The numbers in this illustration correspond to the numbers of the following functional characteristics for each element:

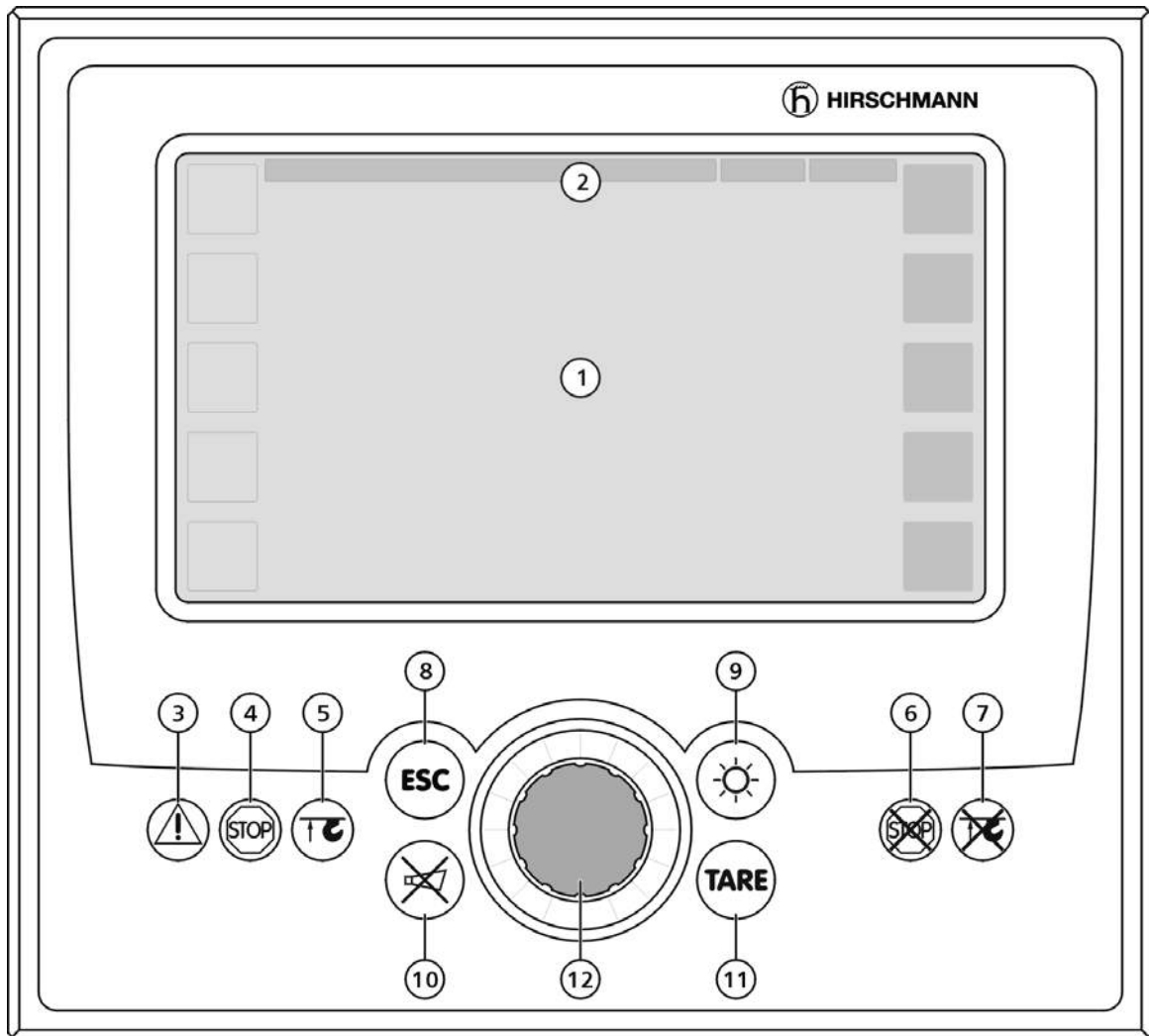


Fig. 2

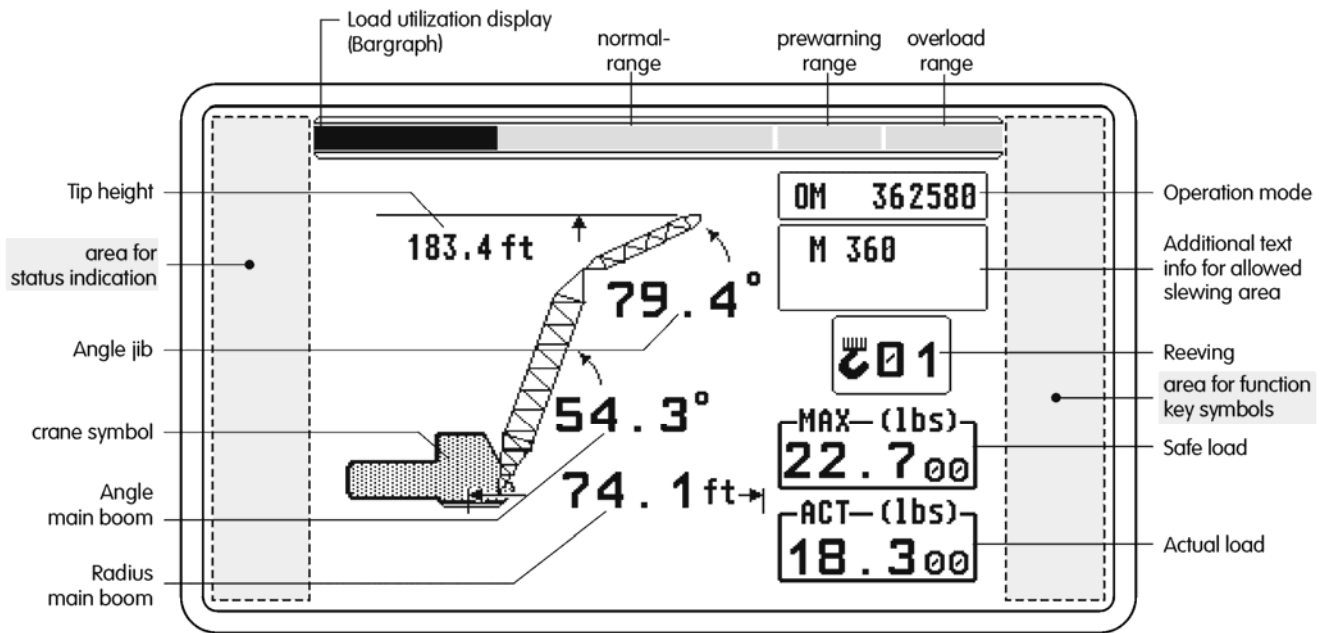
- | | | | |
|---|---------------------------------------|----|---|
| 1 | Data display | 7 | "Hoist limit override" warning light |
| 2 | Utilization display field (bar graph) | 8 | "ESC" pushbutton (to main menu) |
| 3 | Prewarning lamp (load moment) | 9 | "Settings > Brightness" pushbutton |
| 4 | Overload warning light (load moment) | 10 | "Alarm off" pushbutton |
| 5 | "Hoist limit" warning light (A2B) | 11 | "TARE" pushbutton |
| 6 | "LMI override" warning light | 12 | Rotary selection wheel with push button |

System Description

(1) Data display

The *Data display* (1) is a 6.5" LC color graphics display with background illumination which shows required data such as load values, geometry and crane data, symbols, etc., depending on the respective operating status.

Normal LMI display: (Illustration in black/white)



Other display examples:

Set-up Menu (mode of operation) Standard LMI screen Limits Menu

INFO Menu (CAN Node 2) Service Menu (Bus Information) Brightness Setting Menu

The **INFO Menu (CAN Node 2)** displays a table with the following data:

AI		AI	
0	34 2610.	4	38 3859.
1	35 3164.	5	39 816.0
2	36 1109.	6	40 4.0
3	37 935.0	7	41 79.0

A detailed description of the symbols and displays can be found both in the individual chapters and in the Appendix to this manual.

System Description

(2) Utilization display (bar graph)


The *Utilization display (bar graph)* indicates how much of the permitted load (nominal moment) is currently being utilized. The load display also undergoes constant alteration because the nominal moment changes continuously during lifting operation.

The bar graph is filled with various colors:

- green: "safe" range (0...90% of the nominal moment)
- yellow: "pre-warning" range (90...100% of the nominal moment)
- red: "overload range" (>100% of the nominal moment)

(3) "Load moment prewarning" light


This yellow prewarning light comes up when the load on the crane amounts to 90% - 100% of the respective nominal carrying load, which indicates that an overload situation is immediately pending.



For the crane operator, this means that the crane work can continue only with the greatest amount of caution.

(4) "Overload" warning light


This red *Overload warning light* indicates to the crane operator that an overload condition has occurred. It lights up when the crane load has reached 100% of maximum load carrying capacity permitted for the current operating status. The acoustic alarm sounds. The load-moment-increasing crane movements are switched off at the same time.

System Description

(5) "Hoist limit" warning light



This red warning light lights up when the hoist limit switch contacts open, i.e. when a hoist limit situation has occurred. The acoustic alarm sounds and load-moment-increasing crane movements are switched off at the same time.

NOTE

A hoist limit situation occurs when the hook block comes into contact with the boom head. The danger exists in such situations that the hoist rope will break, causing the load to fall. A hoist limit situation could arise from the load being pulled against the boom head or from the boom being extended or lowered without the hoist rope being spooled off the drum(s).

(6) "Load limit device (LMI) override" warning light



This red warning light lights up when the switch-off function of the LMI system has been manually overridden.

(7) "Hoist limit switch override" warning light



This red warning light lights up when the switch-off function of the hoist limit switch has been manually overridden.

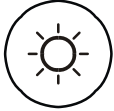
(8) "ESC (Escape)" key



Push button for returning to the normal LMI display

System Description

(9) "Brightness setting" pushbutton



The brightness and thus the legibility of the data display and the buttons can be adjusted at any time with this pushbutton.

(10) "Buzzer off" key



The acoustic alarm can be suppressed by pressing this pushbutton, although not before the alarm has sounded a minimum of 5 s. The alarm will sound again after approximately 10 s if the cause of it being triggered is still present.

The acoustic alarm sounds in the following situations:

System test, overload condition, imminence of a hoist limit situation (when the hoist limit switch function is registered by the LMI system), disruption of the LMI system, or presence of operating errors recognized by the system.

(11) "TARE" key



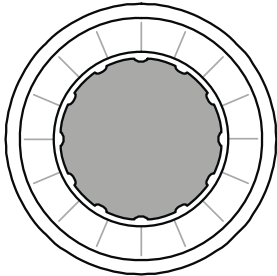
The "TARE" key is for the purpose of outputting the net load on the *Actual load display*. The net load is the current load minus the load hoisting equipment and the hook block. The "TARE" pushbutton must be pressed **before** the hoisting process is initiated.

After the button is actuated, the Current Load display is set to zero (tared). After the load has been raised, the Current Load display will then show the net load (payload). As soon as the working radius (by angle or radius modification) is modified, the display shows again the current load and the taring function is completed.

Note: The current load includes the hook block, the hoist rope and all of the load lifting tackle. The net load is the current load on the hook without load lifting tackle. Display errors can be caused by the effects of environmental influences such as wind on the boom or the load.

System Description

(12) Rotary selection wheel with pushbutton



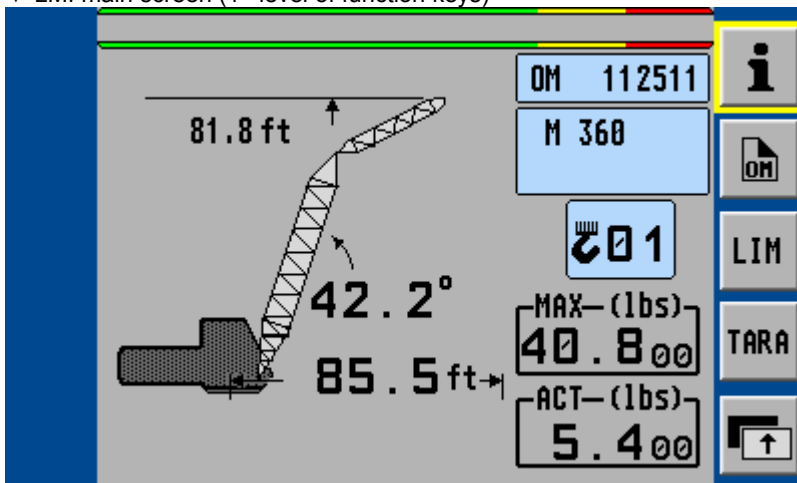
This central rotary selection wheel is used to navigate within the menu structure.

At first **select** the desired soft key symbol .

By **pressing** the button of the rotary wheel the marked function is carried out.



▼ LMI main screen (1st level of function keys)



< show info screens

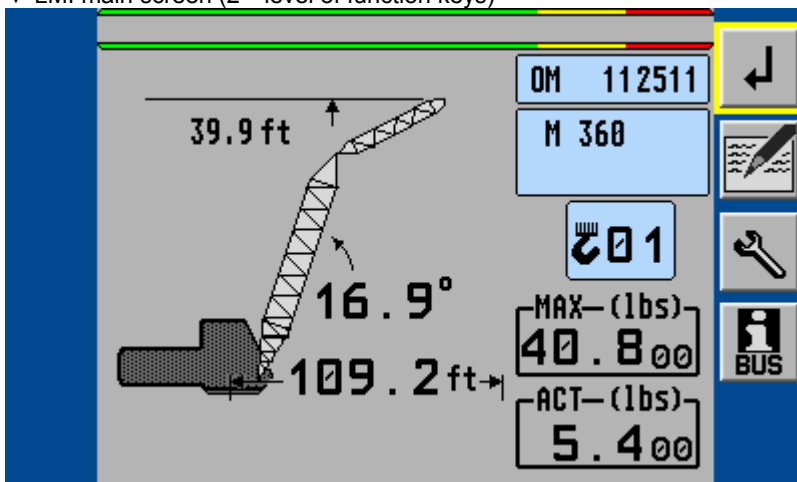
< start operation mode setup

< set geometrical limits

< start TARE function

< switch to 2nd level of function keys

▼ LMI main screen (2nd level of function keys)



< back to the previous menu

< show LMI value screen

< show service menu (code required)

< show CAN-bus menu

3.4. Description of the status symbols



Symbol for LMI error (in connection with fault code)



Symbol for bus error



Hoist limit switch has come into action (A2B)



Back-up battery for console RAM memory is low.
 Ask field service to replace lithium battery 3V on printed circuit board.



Back-up battery for iFLEX5 RAM memory is low.
 Ask field service to replace lithium battery 3V on printed circuit board.



Symbol **radius limitation**

- continuously visible:
radius limitation active
- blinking:
range limits exceeded
(⇒ see chapter 4.3.1)



Symbol **height limitation**:

- continuously visible:
height limitation active
- blinking:
height limit exceeded
(⇒ see chapter 4.3.2)



Symbol **boom angle limitation**:

- continuously visible:
boom angle limitation active
- blinking:
angle limits exceeded
(⇒ see chapter 4.3.3)



Symbol **slewing angle limitation**:

- continuously visible:
slewing angle limitation active
- blinking:
slewing angle limits exceeded
(⇒ see chapter 4.3.4.1)



Symbol **work area definition**:

- continuously visible:
work area definition active
- blinking:
work area limits exceeded
(⇒ see chapter 4.3.4.2)

Programming

4. Configuration SETUP

It is necessary to setup the system by entering the respective mode of configuration every time the crane structure is modified.



The SLI cannot perform correctly unless it has been properly adjusted. The prerequisite for this is making conscientious and correct entries during the setup procedure, in accordance with the actual configuration of the crane. The accuracy of the SLI settings must be ensured before beginning crane work in order to avoid damage to property and severe or even fatal injuries to personnel.

The correct setting is of utmost importance for the proper functioning of the system and the crane.

Therefore, only operators who are thoroughly familiar with the crane and the operation of the system should execute this configuration procedure.

The setup procedure is cancelled any time by pressing key (8) "ESC". The system, however, is only ready for operation, if the procedure has been **completed** and the inputs have been **confirmed**.

During the programming procedure the Load Moment Prewarning Light (3) and the Load Moment Limit Light (4) will light up and the crane movements will be interrupted.

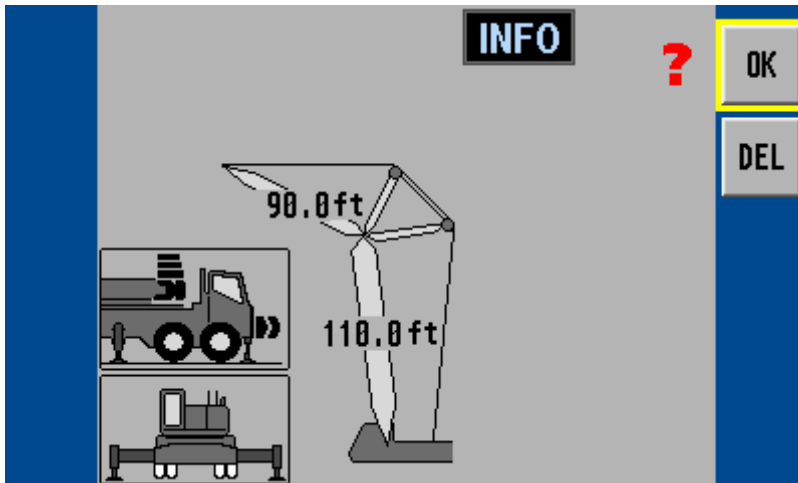
If the system is turned off all adjustments remain stored. When turning the system on again these adjustments can be acknowledged by merely pressing the "OK" key in the confirmation screens (provided that the crane configuration has not been modified)

Programming

• **Confirmation screens:**

In this menu screens, the operator is prompted to confirm the previous made entries if crane configuration has not been modified since last turning off the system.

Check the displayed values before confirming them!

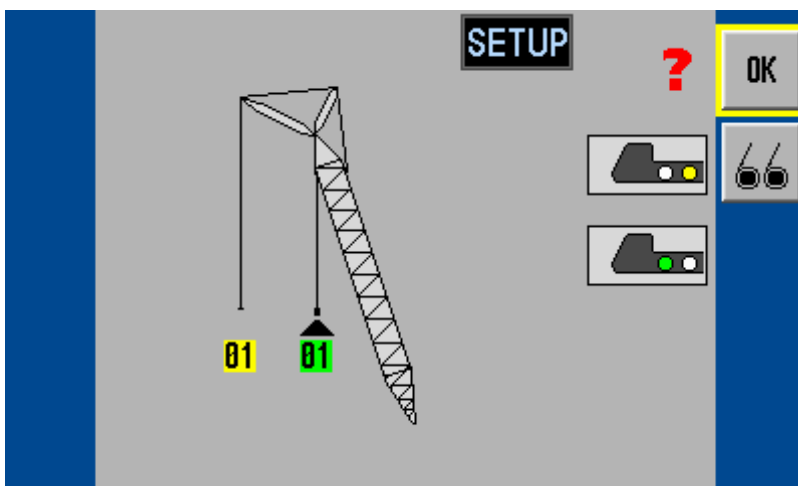


< OK, if all entries are correct

< DELETE entries, renew setup

< Quick change hoist selection

If "OK" was selected the next menu appears:



< OK, if all entries are correct

< Renew pickpoint and reeving selection

The procedure is completed after this confirmation, and the crane menu is displayed.

Programming

4.1 Interactive operating mode setup

It is necessary to setup the system by entering the respective mode of operation every time the crane structure is modified.

The system will temporarily interrupt the movements of the crane during the programming procedure.




The correct setting is of utmost importance for the proper functioning of the system and the crane. Therefore, only operators who are thoroughly familiar with the crane and the operation of the system should execute the setting of the system according to the operating configuration of the crane.

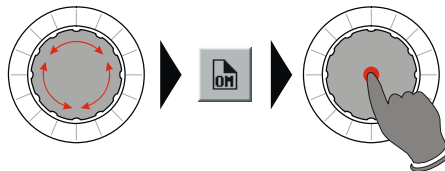
The LMI programming procedure consists of the following steps (interactive operation):

- setting the boom type configuration
- specify jib / selecting the pick point
- setting the outrigger configuration
- setting the counterweight configuration
- setting the hoist
- setting the reevings
- confirmation of the programming procedure

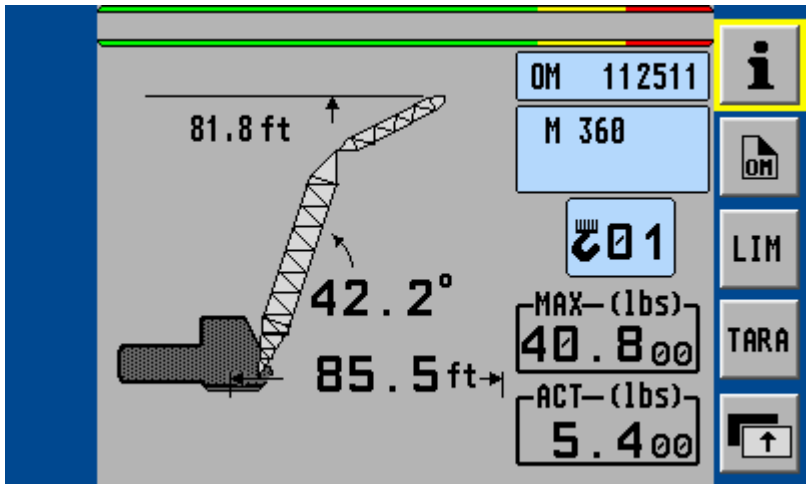
For easy operation, the computer guides the operator through the procedure step by step.

Calling up the function:

Select the soft function key  and actuate the rotary wheel button (from the LMI screen)



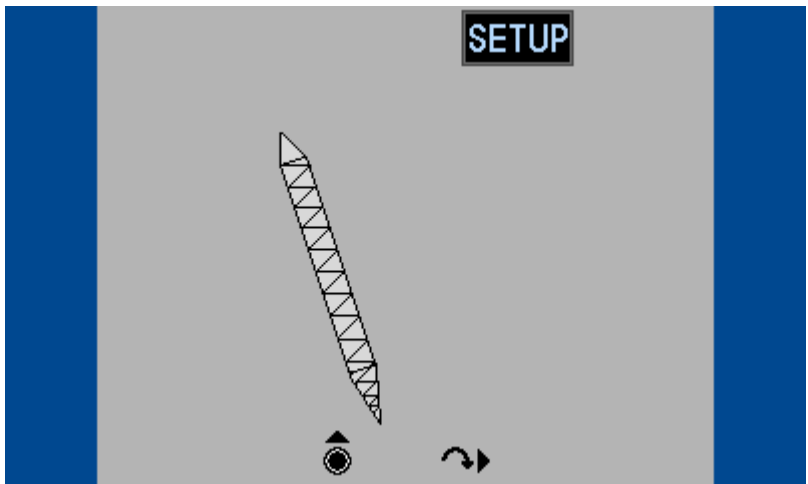
Programming



< Start operation mode setup

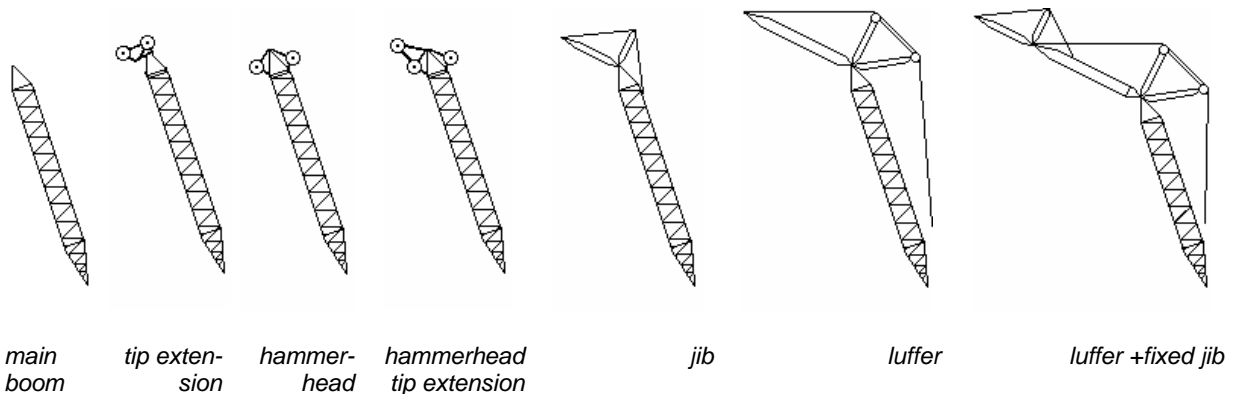
The following illustrations define the symbols appearing on the display during the setup procedure. Not all symbols will be shown, depending on the crane type and the answers to the questions.

• **Setting boom type configuration**



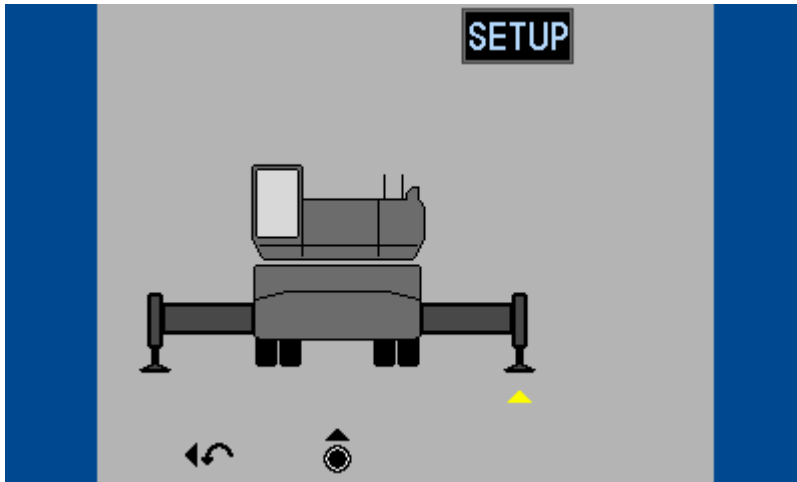
If "DEL " was selected:

select boom type with the rotary wheel and click wheel to confirm



Programming

- **Setting outrigger type**



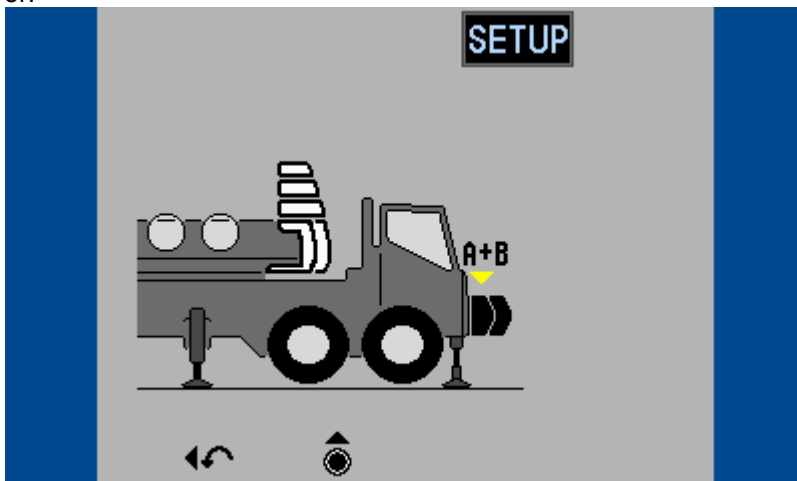
select base with the rotary wheel and click wheel to confirm

- **Setting counterweight configuration**



select counterweight with the rotary wheel and click wheel to confirm

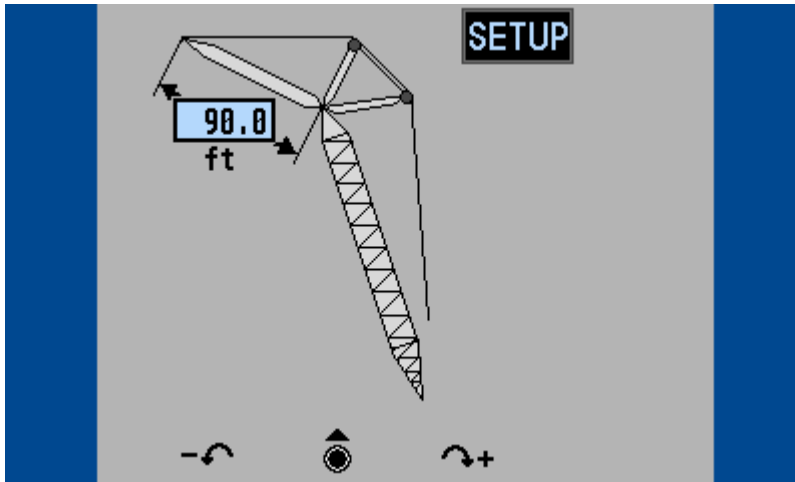
or:



select counterweight with the rotary wheel and click wheel to confirm

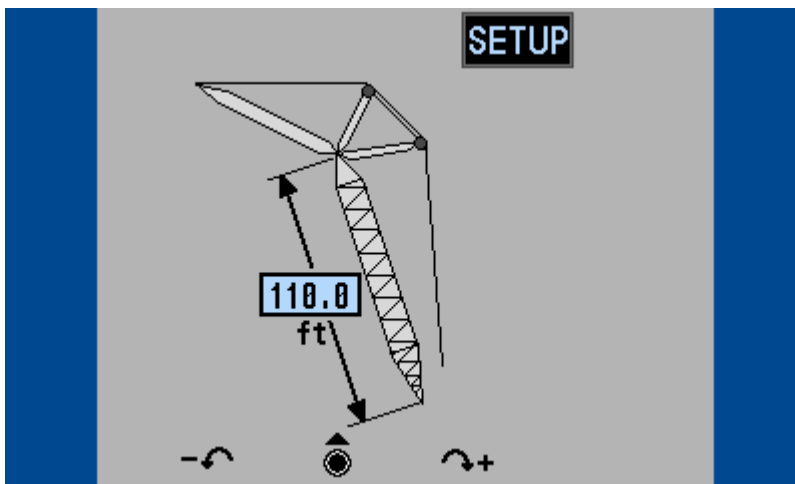
Programming

- Specify boom / Setting the hoist configuration and reevings (example luffer)



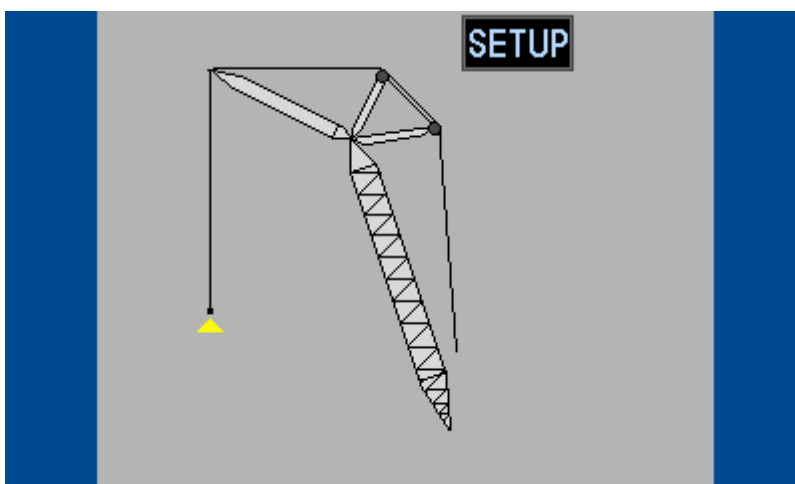
Luffing Jib length selection:

select luffer length with the rotary wheel and click wheel to confirm



Luffing Boom length selection:

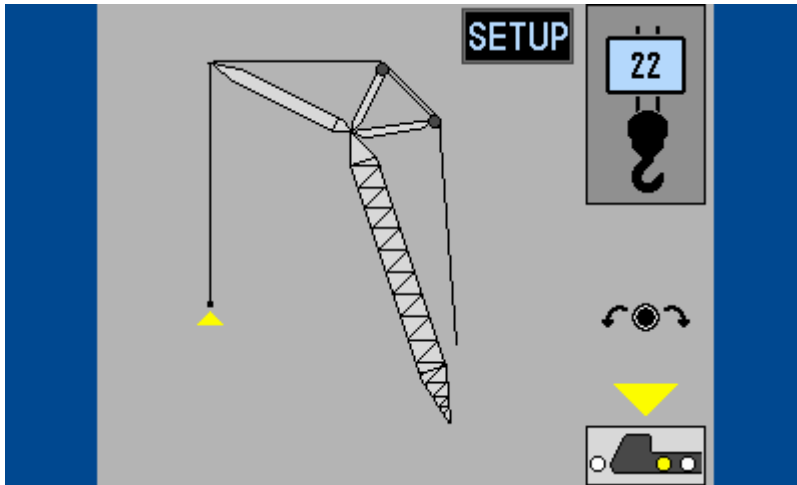
select luffer length with the rotary wheel and click wheel to confirm



select first pick point to configure:

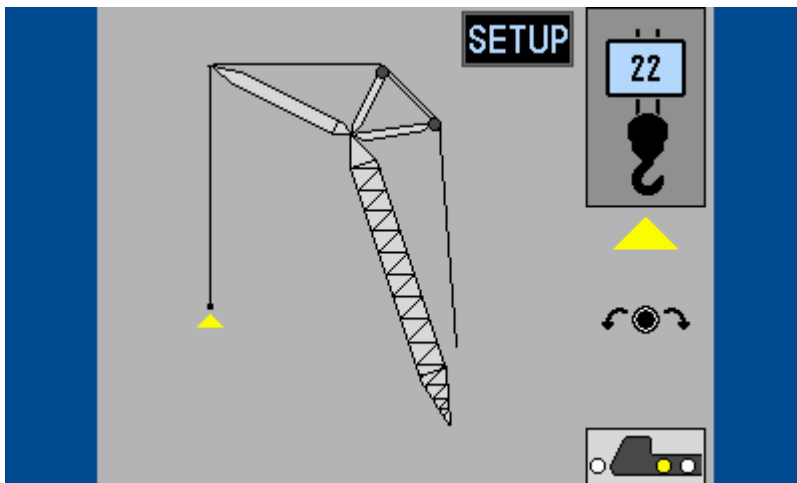
select pick point with the rotary wheel and click wheel to confirm

Programming



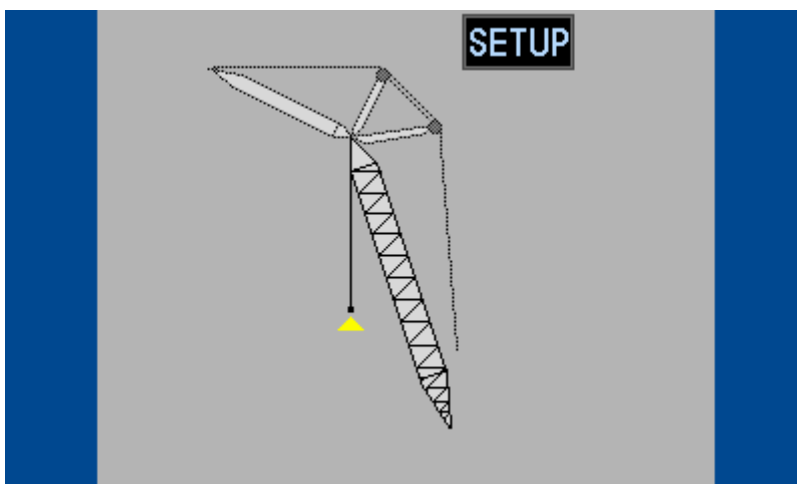
Select hoist for first pick point:

select hoist with the rotary wheel and click wheel to confirm



Select reeving for first pick point:

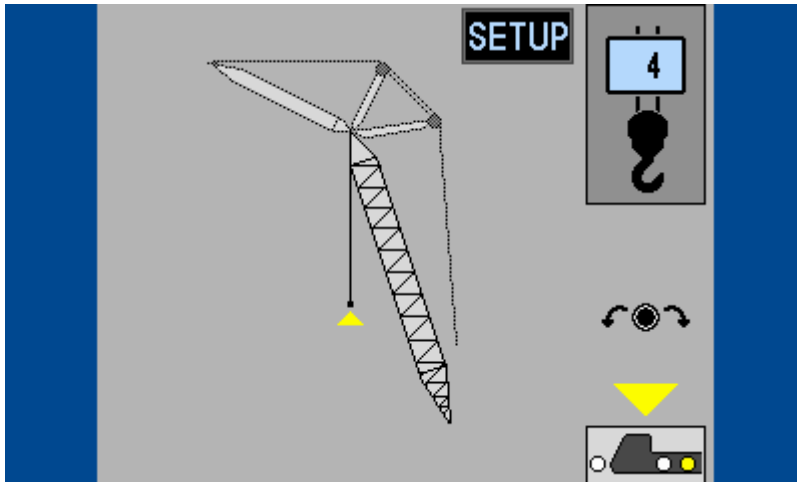
select number of reeving with the rotary wheel and click to confirm



select second pick point to configure:

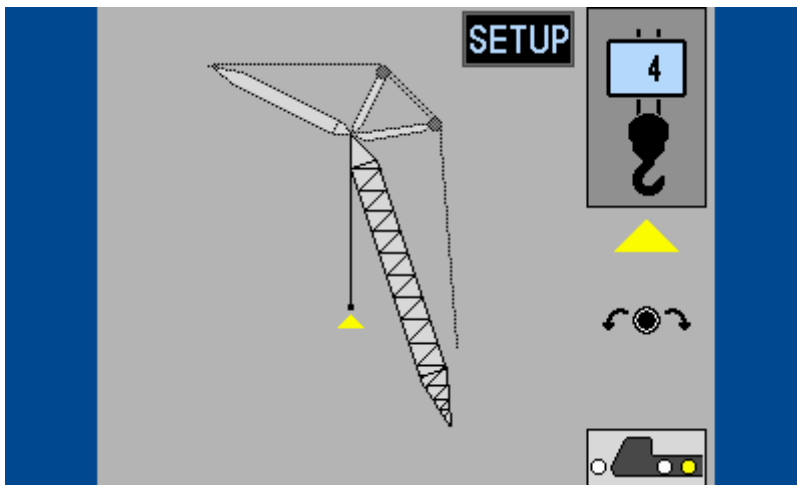
select pick point with the rotary wheel and click wheel to confirm

Programming



Select hoist for second pick point:

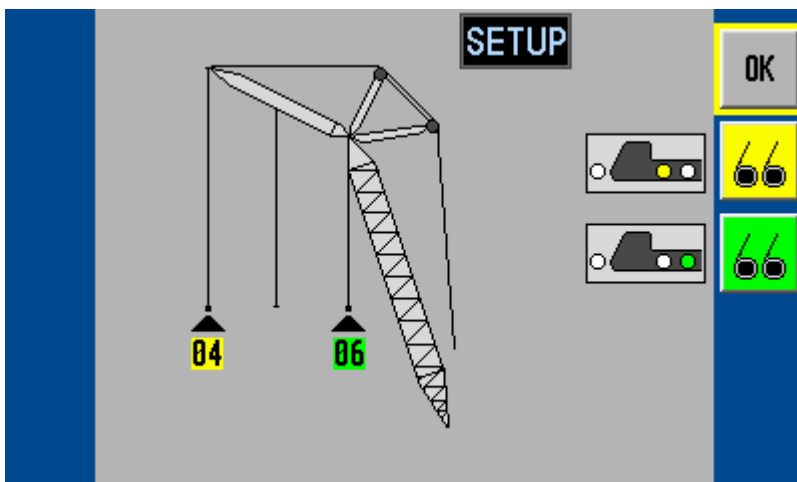
select hoist with the rotary wheel and click wheel to confirm



Select reeving for second pick point:

select number of reevings with the rotary wheel and click to confirm

- **Select hoist in use (example luffer)**



< OK, to confirm
the crane menu is displayed

< mark first pick point to use
(as defined above)

< use second pick point to use
(as defined above)


active pick point is marked with a flashing symbol

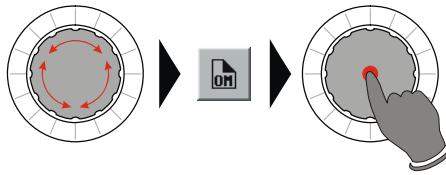
Programming

4.2 Quick hoist in use selection

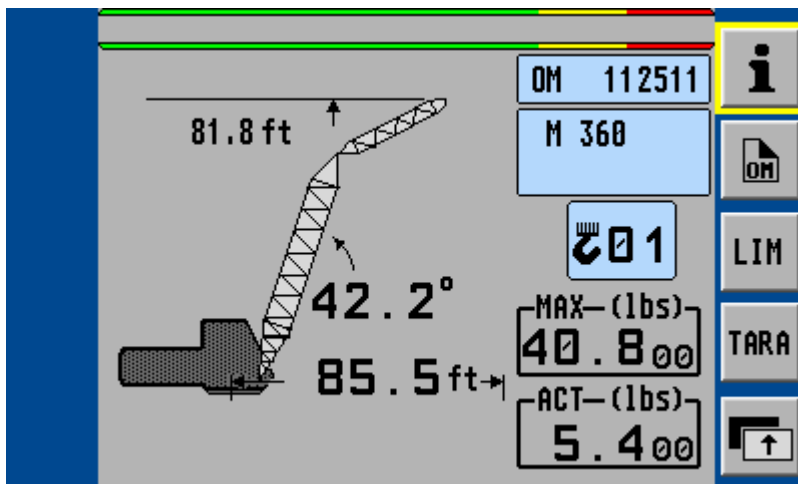
If, during the crane operation, the crane is switched over from front to rear hoist, the LMI system has to be adjusted to this modification. This modification can be entered without having to go through the whole LMI setup procedure again:

Calling up the function:

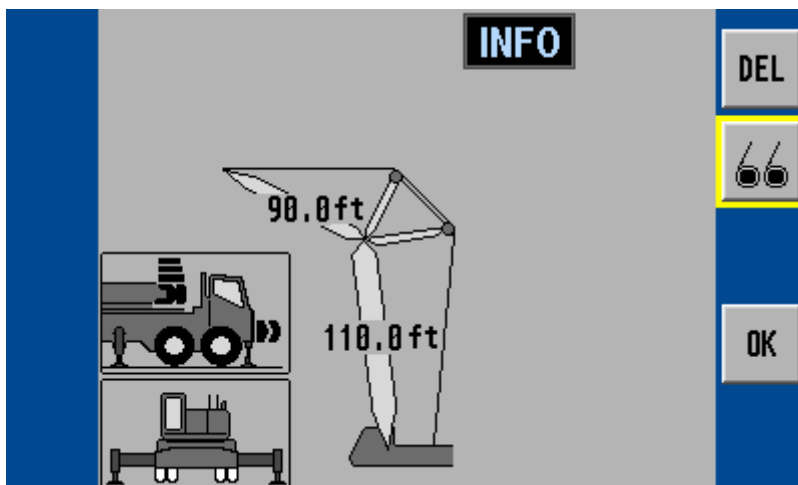
By selecting the the soft function key  and actuating the rotary wheel button (from the LMI screen)



Start of configuration setup menu:



< Start operation mode setup

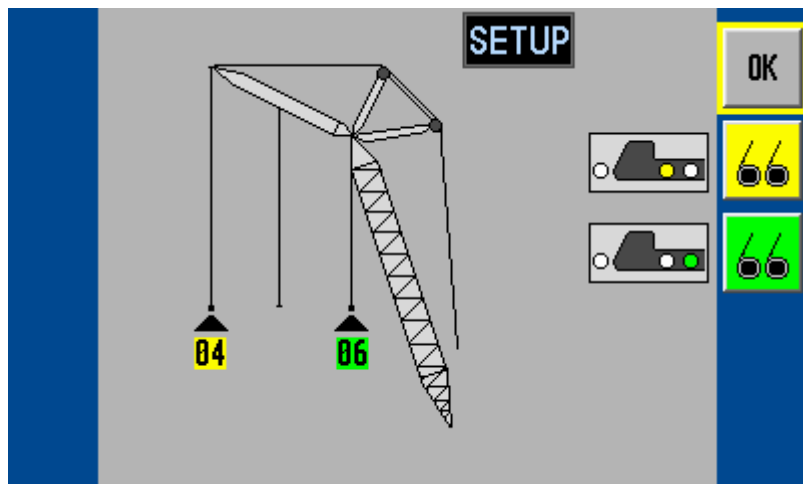


DELETE entries, renew setup

< Quick change hoist

OK, if all entries are correct

Programming



< **OK, to confirm**
the crane menu is displayed

< mark first pick point to use
(as defined above)

< use second pick point to use
(as defined above)

active pick point is marked with a
flashing symbol

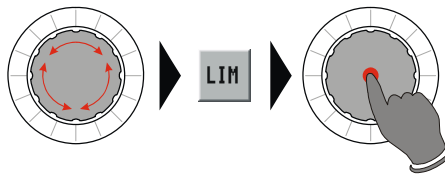
Programming

4.3 Programming geometrical limits

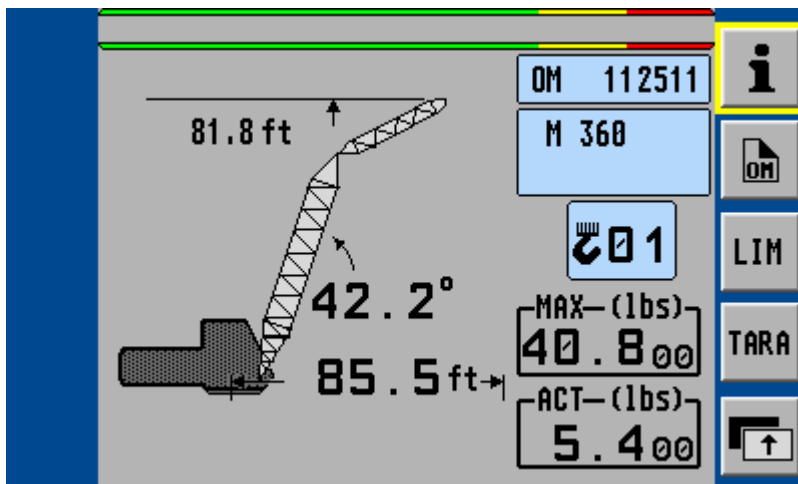
The LMI system comprises programmed limit entries for the operating range of the crane. Programming is facilitated by interactive step-by-step guidance.

- The functions can be used individually or combined. Symbols will mark active limitations.
- If a programmed limit is exceeded, the system shuts off the crane function and triggers a visual indication (blinking symbol) and an acoustical signal.

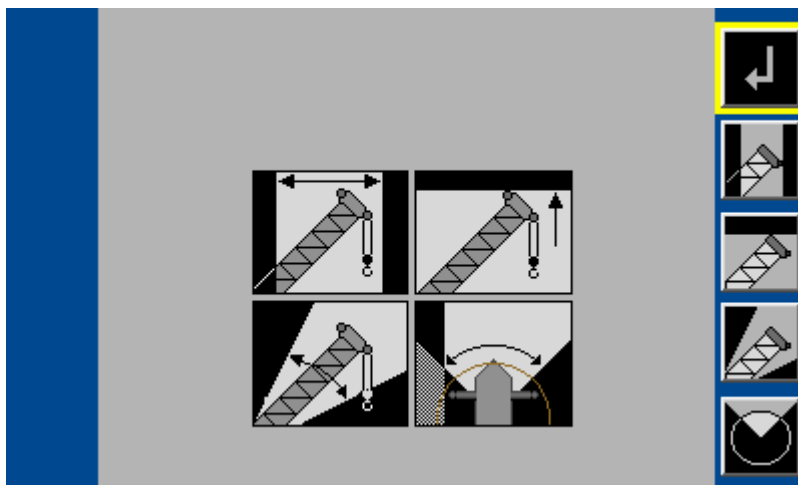
Calling up the function:



Start of limits setup menu:



< Start limits menu



back to normal LMI working screen

edit radius limit chapter:
> 4.3.1

edit height limit > 4.3.2

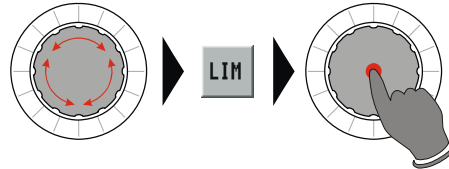
edit main boom angle limit > 4.3.3

edit slewing angle limit / virtual wall > 4.3.4

Programming

4.3.1 Radius Limitation

Programmable function to limit the minimum and/or the maximum boom radius



Calling up the function:

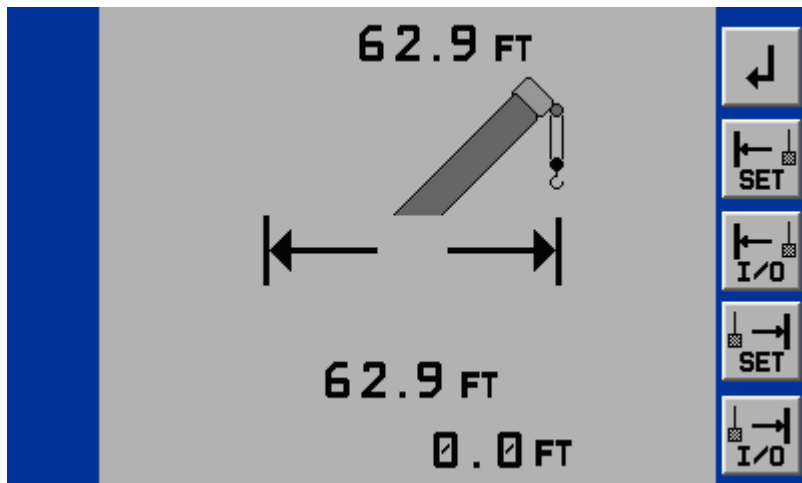
- back to normal LMI working screen
- edit radius limit**
- edit tip height limit
- edit main boom angle limit
- edit slewing angle limit / virtual wall

Example: Programming of the minimum radius limit. Programming of the maximum radius limit is comparable.

- back to limits main menu
- store actual boom position as minimum radius limit**
- switch minimum radius limit on/off
- store actual boom position as maximum radius limit
- switch maximum radius limit on/off

>>






Programming



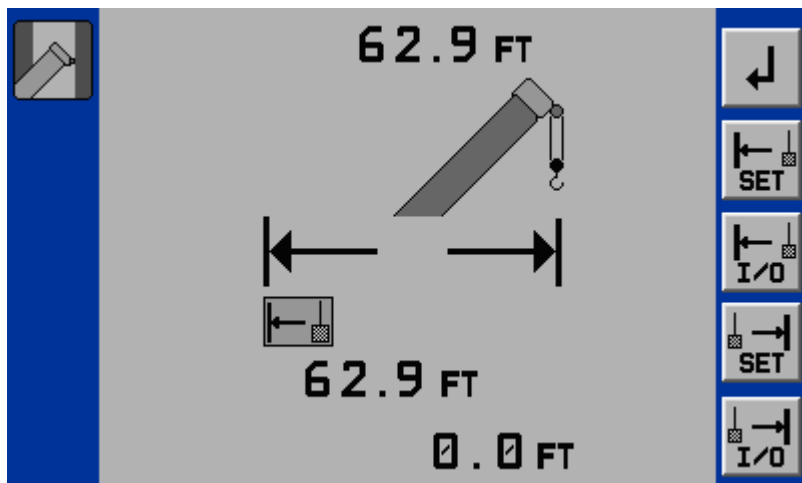
62.9 FT

62.9 FT

0.0 FT

-  back to limits main menu
-  store actual boom position as minimum radius limit
-  switch minimum radius limit on/off**
-  store actual boom position as maximum radius limit
-  switch maximum radius limit on/off






After limitation is switched on, the limit value and the respective status symbol appears. The symbol will blink, if one limit value is reached or exceeded:



62.9 FT

62.9 FT

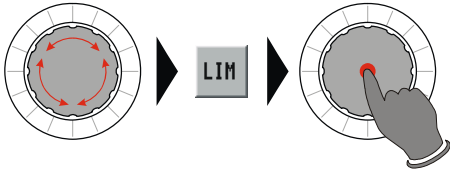
0.0 FT

-  back to limits main menu
-  store actual boom position as minimum radius limit
-  switch minimum radius limit on/off
-  store actual boom position as maximum radius limit
-  switch maximum radius limit on/off

Programming

4.3.2 Tip Height Limitation

Programmable function for the limitation of the tip height



Calling up the function:

- back to normal LMI working screen
- edit radius limit
- edit tip height limit**
- edit main boom angle limit
- edit slewing angle limit / virtual wall

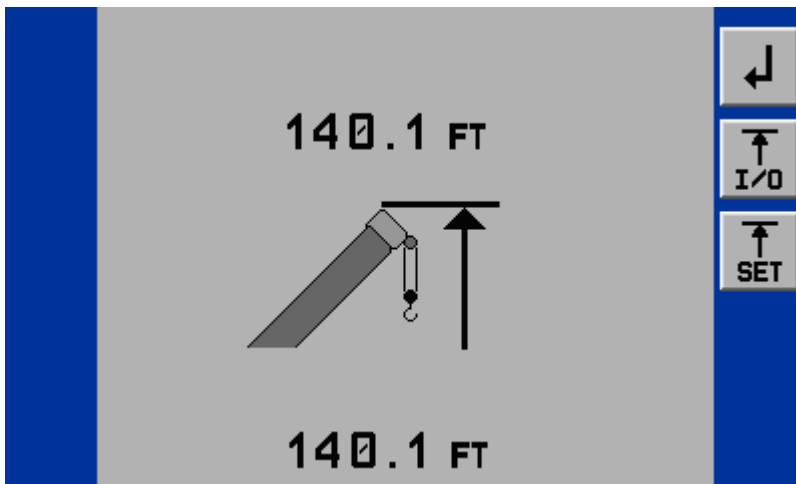
0 . 0 FT

140.1 FT

- back to limits main menu
- switch left limit on/off
- store actual boom tip height as maximum height limit**

>>

Programming

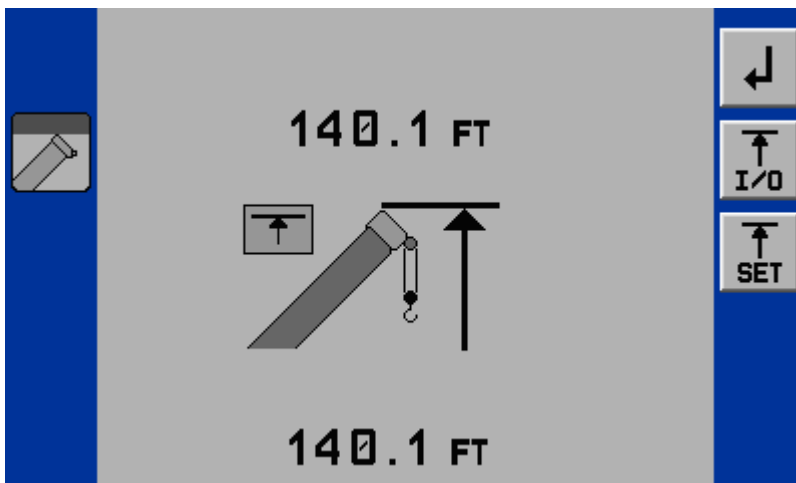


back to limits main menu

switch height limit on/off

store actual boom tip height as maximum height limit

After limitation is switched on, the limit value and the respective status symbol appears. The symbol will blink, if one limit value is reached or exceeded:



back to limits main menu

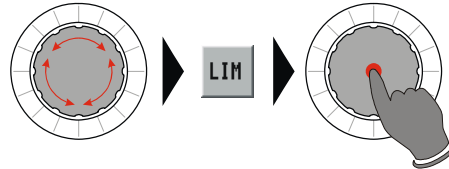
Switch height limit on/off

store actual boom tip height as maximum height limit

Programming

4.3.3 Boom Angle Limitation

Programmable function to limit the minimum and/or the maximum boom angle.



Calling up the function:

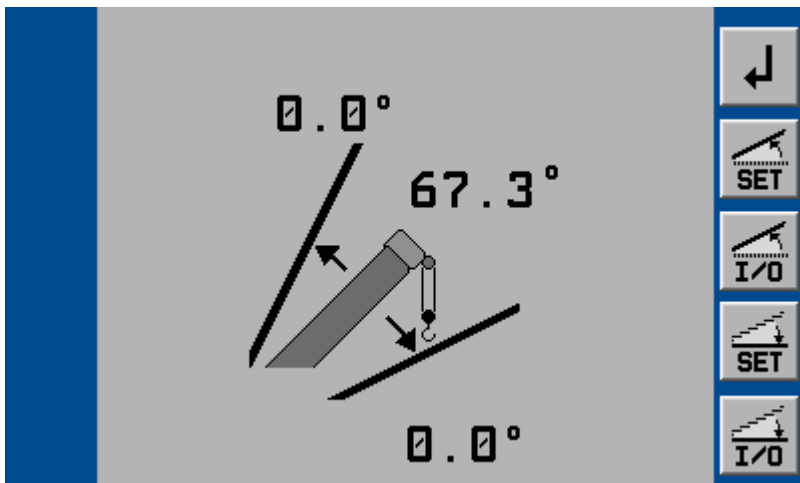
- back to normal LMI working screen
- edit radius limit
- edit tip height limit
- edit main boom angle limit**
- edit slewing angle limit / virtual wall






Example: Programming of the minimum boom angle limit. Programming of the maximum boom angle limit is comparable.

- back to limits main menu
- store actual boom position as maximum boom angle limit
- switch maximum angle limit on/off
- store actual boom position as minimum boom angle limit**
- switch minimum angle limit on/off

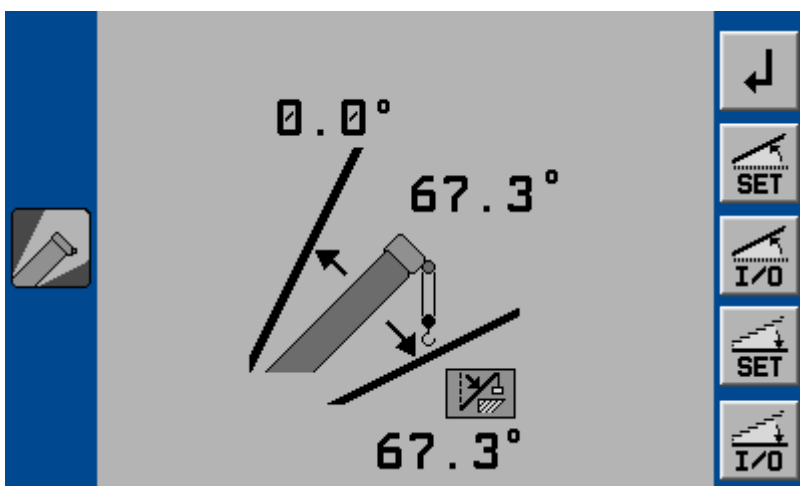
Note: The 0.0° value displayed indicates a maximum and/or minimum limit has not been programmed.






Programming



-  back to limits main menu
-  store actual boom position as maximum boom angle limit
-  switch maximum angle limit on/off
-  store actual boom position as minimum boom angle limit
-  **switch minimum angle limit on/off**

After limitation is switched on, the limit value and the respective status symbol appears. The symbol will blink, if one limit value is reached or exceeded.



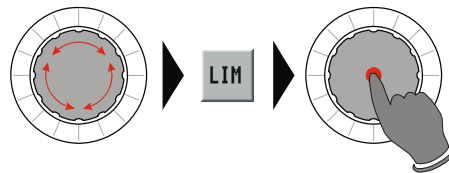
-  **back to limits main menu**
-  store actual boom position as maximum boom angle limit
-  switch maximum angle limit on/off
-  store actual boom position as minimum boom angle limit
-  switch minimum angle limit on/off

Programming

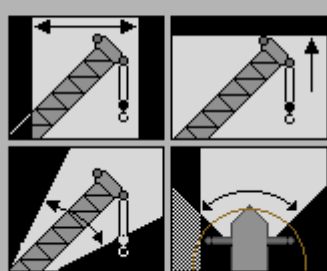

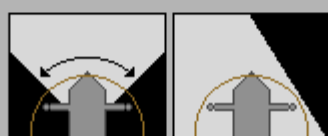

4.3.4 Slewing Angle Limitation / Virtual Wall Definition (if equipped)

4.3.4.1 Slewing Angle Limitation

Programmable function for the limitation of the left and/or right slewing angle.



Calling up the function:

		<p>back to normal LMI working screen</p> <p>edit radius limit</p> <p>edit tip height limit</p> <p>edit main boom angle limit</p> <p>edit slewing angle limit / virtual wall</p>
		<p>back to limits main menu</p> <p>edit slewing angle limit</p> <p>edit virtual walls</p>

>>

Programming

Example: Programming of the left slewing angle limit.
Programming of the right slewing angle limit is comparable.

back to limits main menu

store actual boom position as left slewing angle limit

switch left limit on/off

store actual boom position as right slewing angle limit

switch right limit on/off

back to limits main menu

store actual boom position as left slewing angle limit

switch left limit on/off

store actual boom position as right slewing angle limit

switch right limit on/off

When limitation is switched on, the limit value and the respective status symbol appears. The symbol will blink, if one limit value is reached or exceeded.

back to limits main menu

store actual boom position as left slewing angle limit

switch left limit on/off

store actual boom position as right slewing angle limit

switch right limit on/off

Programming

4.3.4.2 Working Area Limitation - Virtual Wall (if equipped)

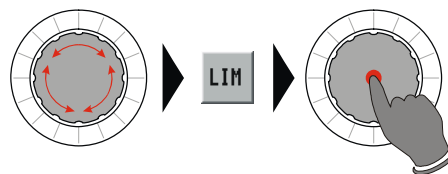
Programmable function for the limitation of the working area by up to 5 virtual walls.

The work area definition system helps the operator to define the crane's working area. This is done by creating vertical wall(s) that can represent obstacles (i.e. buildings, towers, poles, etc.) in the crane's working range. The wall(s) are set by defining points with the boom tip along the outer limits of the operator's work area, see setup procedure below. Because these walls are defined by the operator and are not "actual real" walls, we refer to them as "virtual" walls. When setting the walls, always keep a safe working distance to any obstacles. Never work outside a safe working area as outlined by common practice, standards, and manuals. A virtual wall is set by defining two points.

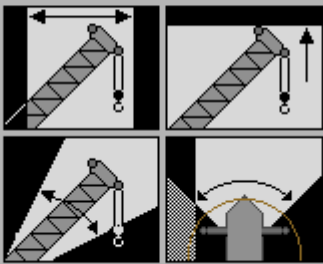





To prevent inaccuracies when defining the two points for the virtual wall, use the following two rules:

1. The two points should be the same distance from the obstacle.
2. Set the two points at the maximum distance apart, which can be safely reached by the boom tip.

The operator can setup up to 5 virtual walls, the first wall is defined by a straight line between two set points. The second through fifth walls are created by one new point and the previously selected point. After the walls have been set, the system alerts the operator when the boom approaches them. This is done both visual and audible. Similarly, the "virtual wall" symbol in the main screen blinks.

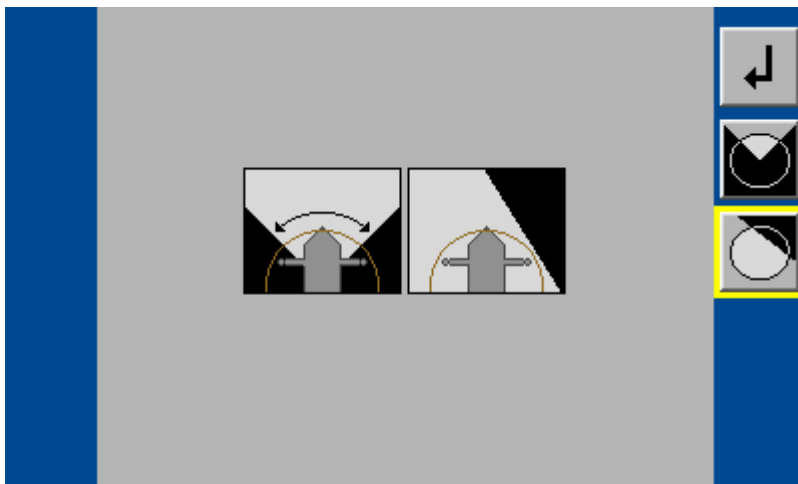


Calling up the function:

		back to normal LMI working screen
		edit radius limit
		edit tip height limit
		edit main boom angle limit
		edit slewing angle limit / virtual wall

>>

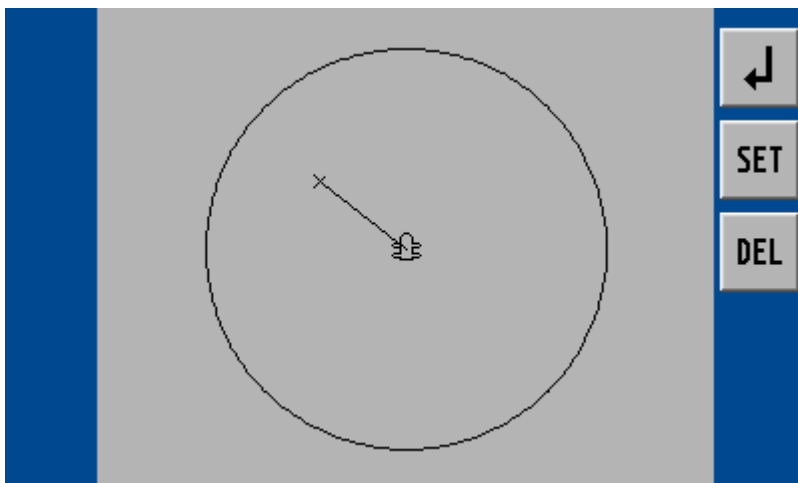
Programming



back to limits main menu

edit slewing angle limit

edit virtual walls



back to previous menu

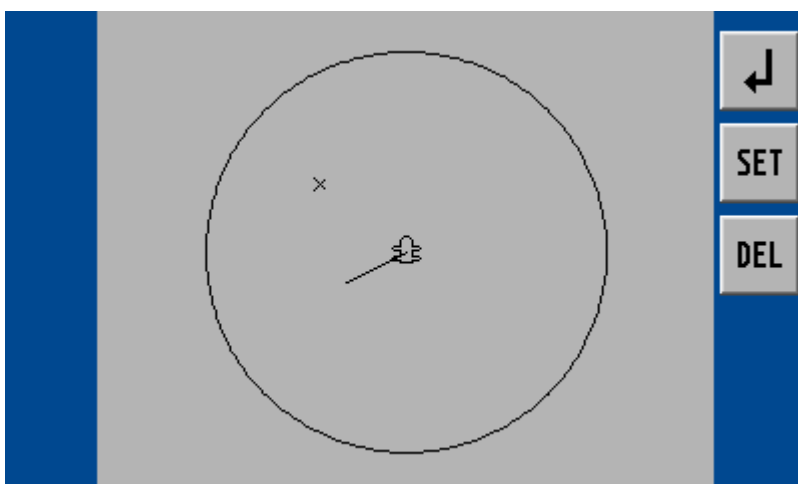
SET

set a point in the working area to start a wall

having pressed SET, the point is marked by " X"

DEL

delete existing walls



back to previous menu

SET

move the boom tip to another point
set the second point in the working area to create a wall

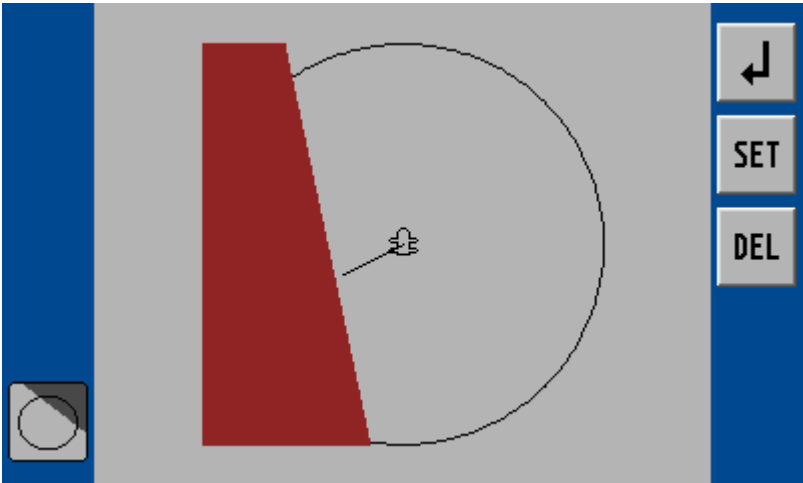
DEL

delete existing walls

When second point of the virtual wall is set, the wall is displayed and the respective status symbol appears. The symbol will blink, if the virtual wall is reached or exceeded.

>>

Programming

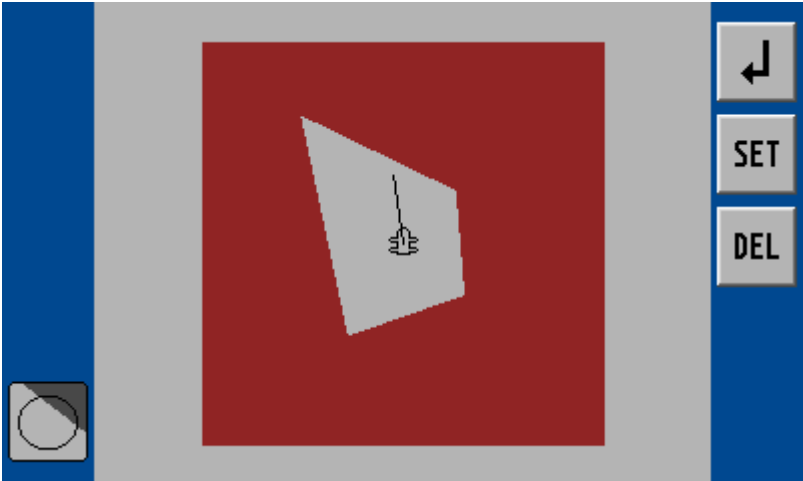


back to main limit menu

allows for further walls to be added (up to 5 virtual walls)

delete all existing walls

Example with 4 virtual walls:



back to main limit menu

allows for further walls to be added (up to 5 virtual walls)

delete all existing walls

Inspection checks before going into operation

5. PRE-OPERATIONAL INSPECTION

Prior to operating the crane, the following electrical connections must be checked to ensure that the LMI system is properly connected for the crane configuration.

- **Cranes with only a main hoist**

If the crane works only with the boom and without boom extension or lattice extension, no additional connections are necessary. It must however be ensured that the lifting limit switch weight is correctly mounted on the main boom hoist rope. With even numbers of rope lines, the lifting limit switch weight shall be attached to the "dead end" of the hoist rope. With odd numbers of rope lines, the lifting limit switch weight shall be attached to the rope line with the lowest operating speed.

If the crane works with a main boom extension or top section, the connecting cable must be mounted between the distributor socket on the lattice extension and the distributor socket on the main boom. The weight of the hoist limit switch of the main boom must be disconnected and mounted on the hoist limit switch of the extension or of the jib.



Failure to reposition the hoist limit switch weight will prevent the hoist limit switch system from functioning properly. No weight shall be mounted on the hoist limit switch of the main boom when working with the extension/top section.

- **Machines with Main and Auxiliary Hoists**

If the main boom extension or the top section is not used, then the bridging plug must be plugged into the distributor socket on the main boom and the lifting limit switch weight must be mounted on the main boom.

If the crane works with a main boom extension and/or with a lattice extension, then the connecting cable must be mounted between the distributor socket on the extension or on the top section and the distributor socket on the main boom. In addition, weights must be fitted to both the hoist limit switch of the main boom and the extension or the top section.

If the boom extension or the lattice extension are in working position and if the main boom is not equipped with a hoist rope, then the weight of the hoist limit switch on the main boom must be removed in order to prevent endangerment to personnel or damage to the equipment.

After the electrical connections have been checked to ensure that the system is properly connected for the respective crane configuration, the following checks must be made:

1. Check the electrical wiring connecting the various parts of the system for physical damage.
2. Check the hoist limit switches and hoist limit weights for free movement.
3. Inspection of the spring cable drum for smooth running, initial drum tension and correct winding of the cable.
4. Inspection of the mechanical and electrical installation of power measurement sockets on the lattice extensions (if present).

Inspection checks before going into operation

 **WARNING**

The following tests must be performed with care in order to avoid damage to the crane or injury to personnel. Proper functioning of the LMI system requires successful completion of these tests before commencing work. If the operator cannot see the hook block approaching the head machinery, he must assign this task to an assistant (slinger). The crane operator must be prepared to stop the crane at once in the event that the LMI system is not working correctly, i.e. when the red warning lights fail to light up, the acoustic alarm does not sound and the crane movements such as raising, extending and luffing are not switched off.

Check the *Hoist limit switch warning light* and the acoustic alarm as follows:

1. Manually raise the weight fitted on the hoist limit switch. As soon as the weight is raised, the acoustic alarm should sound and the *hoist limit switch warning light* should light up.

 **WARNING**

If the warning light and the audible alarm do not function as described and the crane movements are not switched off, then the system is not working properly. The malfunction must be corrected before commencing work.

5. If the crane is equipped with a main boom extension or with a lattice extension, then the inspection procedure must be repeated for the hoist limit switch of the extension/top section.
6. Check that the display of the main boom length agrees with the actual boom length.
7. Check that the display of the main boom angle agrees with the actual boom angle.
8. Check that the display of the operating radius of the crane agrees with the actual radius.
9. Check the load display by lifting a load of known weight. The accuracy of the load display must be within the tolerance range.

Inspection checks before going into operation

5.1 OPERATION

The LMI is operational once it has been adjusted properly. The crane operator must for that reason be familiar with all of the operating elements of the LMI and must make the correct entries before the crane begins work. The proper function of the system shall be checked by lifting a load of known weight and comparing the load to the information displayed on the LMI.

Rated loads include the weight of the hook block, slings, and auxiliary load handling devices. This combined weight must be subtracted from the values contained in the load capacity chart in order to determine the net load to be raised.



WARNING

If any of the displays reflect a deviation between displayed and actual values an authorized PAT service representative shall be called for repair of the system or re-verification of the crane's LMI calibration.

Contact: www.hirschmann-usa.com



WARNING

Any structural modifications or changes to the crane shall require re-verification of the crane's LMI calibration.

6. SERVICE AND MAINTENANCE

Daily maintenance of the load moment limitation system consists of inspecting:

1. The electrical wiring connecting the various parts of the system.
If a cable is damaged, then it must be replaced immediately.
2. The insulation of the length indicator rope and/or hoist limit switch cable and of the cable guides. If the insulation or the cable guides are damaged, then these parts should be replaced immediately.
3. Checking the hoist limit switches for ease of movement.



Personnel who are not specially trained may correct only those malfunctions listed in the Malfunction Table, but they are not permitted to replace any defective mechanical or electrical parts or cables.

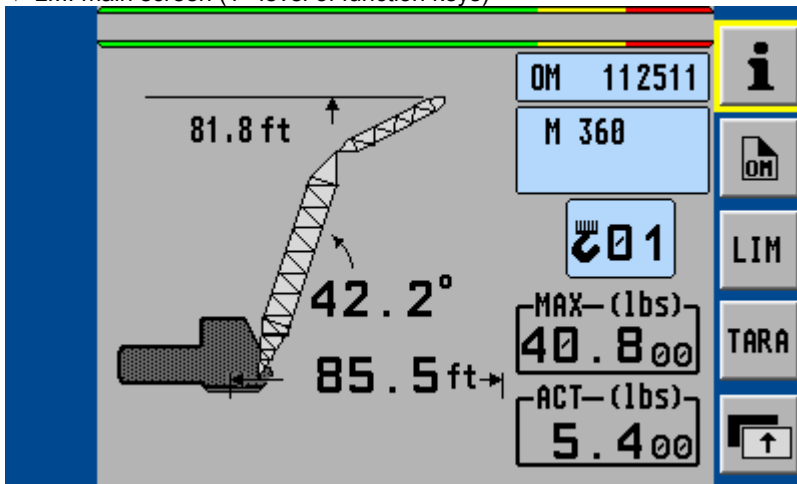
6.1 Info / Service Menus

The system contains different menus in which system information are displayed.

In addition, adjustments can also be made in several Service Menus that have an effect on system behavior. Access to these menus is protected by an access code.

The system will temporarily interrupt the functions of the crane during the call-up procedure. In addition, the warning lights (3), (4) and (5) will light up.

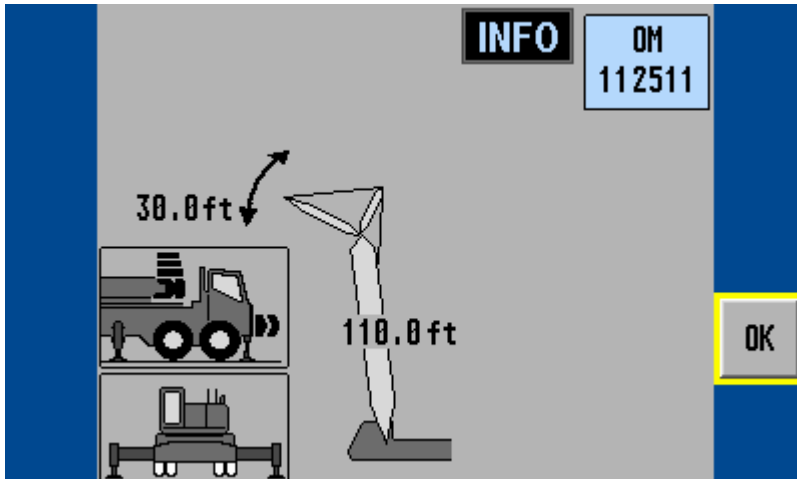
▼ LMI main screen (1st level of function keys)



< to Info screen LMI

< switch to 2nd level

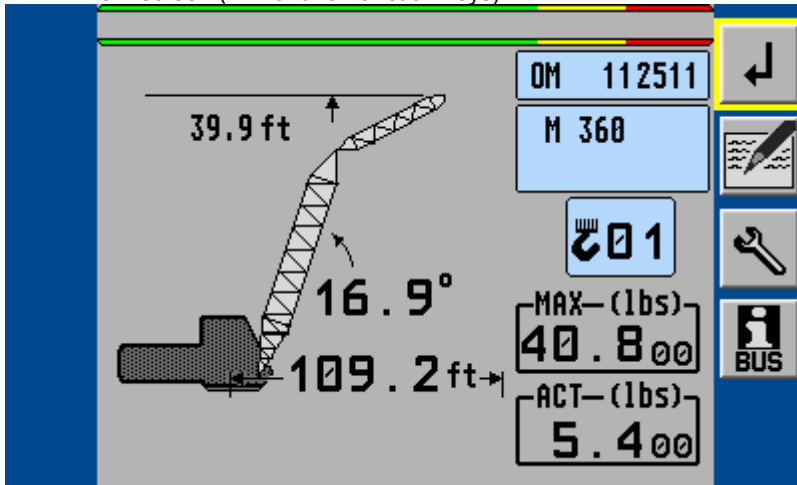
▼ Info screen LMI



< return to main menu

Service and Maintenance

▼ LMI main screen (2nd level of function keys)



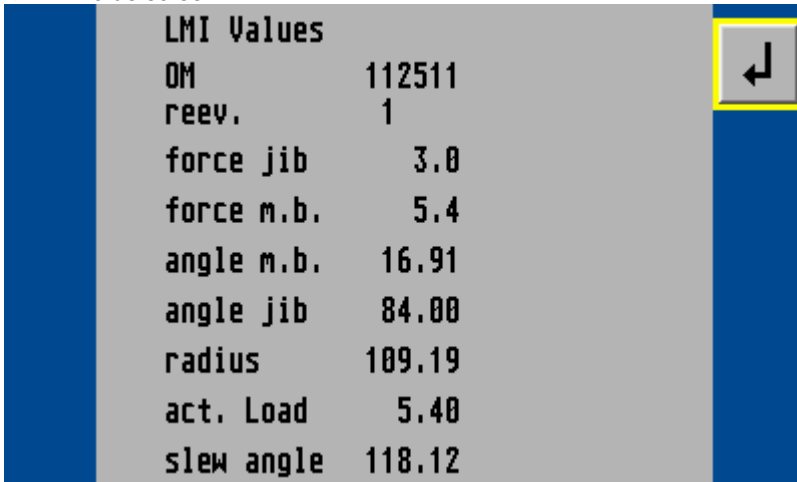
< back to previous menu

< to LMI value screen

< to service menus

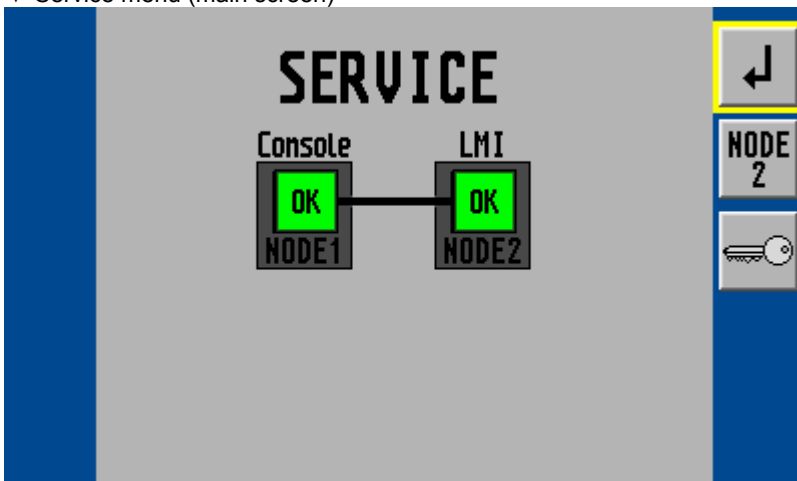
< to CAN-bus menu

▼ LMI value screen



< back to previous menu

▼ Service menu (main screen)



< back to previous menu

< to System Info node 2 (iFLEX5 central unit)

< to calibration menu (access code required)

Service and Maintenance

▼ System Info node 2 (digital inputs)

DI		DI		DI	
0	49	6	55	12	61
1	50	7	56	13	62
2	51	8	57	14	63
3	52	9	58	15	64
4	53	10	59		
5	54	11	60		



< back to previous menu



< to info screen digital outputs



< to info screen analog inputs

▼ System Info node 2 (digital outputs)

NODE2

DO		DO		DO	
0	02	6	08	12	18
1	03	7	09	13	19
2	04	8	14	14	20
3	05	9	15	15	21
4	06	10	16		
5	07	11	17		



< back to previous menu



< to info screen digital inputs



< to info screen analog inputs

▼ System Info node 2 (analog inputs)

NODE2

AI		AI	
0	34 2610.	4	38 3059.
1	35 3164.	5	39 816.0
2	36 1109.	6	40 4.0
3	37 935.0	7	41 79.0



< back to previous menu



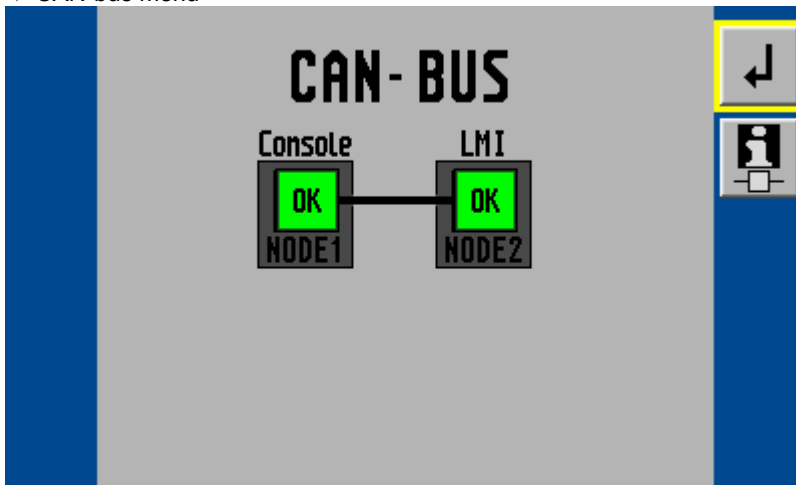
< to info screen digital inputs



< to info screen digital outputs

Service and Maintenance

▼ CAN-bus menu



< back to previous menu

< to CAN symbol legend

▼ CAN symbol legend




< back to previous menu



Troubleshooting

7. TROUBLESHOOTING

7.1 General

In the event of a malfunction or an operating error recognized by the system, codes will be displayed in the status field of the *Data display* (1) which specify the reason for the malfunction:

Error in the LMI system: 

Error in the control system:  or 

The error codes listed in the following Malfunction Table will identify various faults which can occur with this system. Malfunctions in the LMI System which were caused by exceeding the prescribed ranges or by operating errors on the part of the crane operator can normally be corrected by the crane operator himself. Errors in the microprocessor system **may only** be corrected by factory-trained Customer Service personnel.

Contact Hirschmann Customer Service or local dealer if this occurs.

Internet Support:

www.hirschmann-usa.com > *ELECTRONIC CONTROL SYSTEMS* > *Service & Support*

Troubleshooting

7.2 LMI System Malfunction Table (LMLG V 1.x)

Fault code	Error	Cause	Elimination
E01	Lowered below radius range or angle range exceeded	<ul style="list-style-type: none"> Fallen below the minimum radius or gone past the maximum angle specified in the respective load chart due to raising the boom too far 	<ul style="list-style-type: none"> Lower the boom to a radius or angle specified in the load chart.
E02	Radius range exceeded or lowered below angle range	<ul style="list-style-type: none"> Gone past the maximum radius or lowered below the minimum angle specified in the respective load chart due to lowering the boom too far 	<ul style="list-style-type: none"> Raise the boom to a radius or angle specified in the load chart.
E04	Operating mode not acknowledged or non permitted slewing zone	<ul style="list-style-type: none"> A non existing operating mode has been selected 	<ul style="list-style-type: none"> Set the correct operating mode for the operating state in question
		<ul style="list-style-type: none"> The boom is in a non-permitted slewing zone 	<ul style="list-style-type: none"> Slew the boom to a permitted area.
		<ul style="list-style-type: none"> The selected operating mode is not available in the Flash-EPROM or blocked 	<ul style="list-style-type: none"> Check the Data software in the Flash-EPROM
E05	Main boom length not available	<ul style="list-style-type: none"> A non existing main boom length has been selected 	<ul style="list-style-type: none"> Set the correct main boom length for the operating state in question
		<ul style="list-style-type: none"> The selected main boom length is not available in the Flash-EPROM or blocked 	<ul style="list-style-type: none"> Check the Data software in the Flash-EPROM
E06	Radius range exceeded or lowered below angle range with luffing jib operation	<ul style="list-style-type: none"> Maximum radius as specified in the load chart exceeded or lowered below minimum angle due to lowering the luffing jib too far 	<ul style="list-style-type: none"> Raise the jib to a radius or angle specified in the load chart.
E07	Overload relays check	<ul style="list-style-type: none"> Relays = overload active and CU input 20 = on Relays = no overload and CU input 20 = off 	<ul style="list-style-type: none"> Check cable to overload relays and CU input 20 Check relays Check CU input 20
E14	Below lower limit value in measuring channel "force main boom right"	<ul style="list-style-type: none"> Cable between the central unit and the force transducer defective or loose. Water inside the plug of the transducer Force transducer defective 	<ul style="list-style-type: none"> Check cable as well as plugs, replace, if need be Replace force transducer
		<ul style="list-style-type: none"> Electronic component in the measuring channel is defective. 	<ul style="list-style-type: none"> Replace sensor unit
E15	Below lower limit value in measuring channel "angle main boom"	<ul style="list-style-type: none"> Cable between the central unit and the angle sensor defective or loose. Water inside the plug of the angle sensor Angle potentiometer defective 	<ul style="list-style-type: none"> Check cable as well as plugs, replace, if need be. Replace angle sensor
		<ul style="list-style-type: none"> Electronic component in the measuring channel defective. 	<ul style="list-style-type: none"> Replace sensor unit
E16	Below lower limit value in measuring channel "angle luffing jib"	<ul style="list-style-type: none"> Refer to E15 	<ul style="list-style-type: none"> Refer to E15
E17	Below lower limit value in measuring channel "force luffing jib left"	<ul style="list-style-type: none"> Refer to E14 	<ul style="list-style-type: none"> Refer to E14

Troubleshooting

Fault code	Error	Cause	Elimination
E1A	Below lower limit value in measuring channel "slewing angle 1".	• Cable between the central unit and the slewing angle sensor defective or loose. Water inside the plug of the angle sensor	• Check cable as well as plugs, replace, if need be.
		• Slewing angle potentiometer is defective	• Replace slewing angle sensor
		• Electronic component in the measuring channel defective	• Replace sensor unit
E1B	Below lower limit value in measuring channel "slewing angle 2"	• Refer to E1A	• Refer to E1A
E1C	Below lower limit value in measuring channel "angle main boom tip" (if avail.)	• Refer to E15	• Refer to E15
E1E	Below lower limit value in measuring channel "force derricking system"	• Refer to E14	• Refer to E14
E1F	Below lower limit value in measuring channel "SL mast angle" (if avail.)	• Refer to E15	• Refer to E15
E24	Upper limit value in measuring channel "force main boom left" has been exceeded.	• Refer to E14	• Refer to E14
E25	Upper limit value in measuring channel "main boom angle" has been exceeded.	• Refer to E15	• Refer to E15
E26	Upper limit value in measuring channel "luffing jib angle" has been exceeded.	• Refer to E15	• Refer to E15
E27	Upper limit value in measuring channel "force luffing jib left" has been exceeded.	• Refer to E14	• Refer to E14
E2A	Upper limit value in measuring channel "slewing angle 1" has been exceeded	• Refer to E1A	• Refer to E1A
E2B	Upper limit value in measuring channel "slewing angle 2" has been exceeded	• Refer to E1A	• Refer to E1A
E2C	Upper limit value in measuring channel "main boom tip angle" has been exceeded (if avail.)	• Refer to E15	• Refer to E15

Troubleshooting

Fault code	Error	Cause	Elimination
E2E	Upper limit value in measuring channel "force derricking system" has been exceeded.	<ul style="list-style-type: none"> Refer to E14 	<ul style="list-style-type: none"> Refer to E14
E2F	Upper limit value in measuring channel "SL mast angle" has been exceeded.	<ul style="list-style-type: none"> Refer to E14 	<ul style="list-style-type: none"> Refer to E14
E37	Error in the logical program flow	<ul style="list-style-type: none"> System program file is defective Flash-EPROM defective 	<ul style="list-style-type: none"> Upload valid system software Replace central unit
E38	System program and crane data file do not match.	<ul style="list-style-type: none"> The system program in the LMI does not match to the programming in the crane data file 	<ul style="list-style-type: none"> Upload valid system program file or the valid crane data file
E39	System program and load chart file do not match	<ul style="list-style-type: none"> The system program in the LMI and the programming in the load chart file do not match. 	<ul style="list-style-type: none"> Upload valid system program file or the valid load chart file
E3A	crane data file and load chart file do not match	<ul style="list-style-type: none"> Crane type in dat file and load chart file is different 	<ul style="list-style-type: none"> Change dat file and/or load chart file
E43	Error in the write/read memory, (RAM)	<ul style="list-style-type: none"> Write/read memory (RAM) or central unit defective. 	<ul style="list-style-type: none"> Replace central unit
E51	Error in the crane data file	<ul style="list-style-type: none"> No valid data in the crane data file. Flash-EPROM defective 	<ul style="list-style-type: none"> Upload valid crane data file Replace central unit
E52	Error in load chart file.	<ul style="list-style-type: none"> No valid data in the load chart file Flash-EPROM defective 	<ul style="list-style-type: none"> Upload valid load chart file Replace central unit
E56	Error in crane data file.	<ul style="list-style-type: none"> No valid data in the crane data file during calibration. Flash-EPROM defective 	<ul style="list-style-type: none"> Restore or upload valid crane data file Replace central unit
E57	Error in serial crane data file.	<ul style="list-style-type: none"> Calibration data file does not contain valid data. Flash-EPROM defective 	<ul style="list-style-type: none"> Upload calibration data file Replace central unit
E60	The number of the selected File base and the programmed value are not identical	<ul style="list-style-type: none"> No valid data in the load chart file 	<ul style="list-style-type: none"> Upload valid load chart file
		<ul style="list-style-type: none"> Base number not programmed 	<ul style="list-style-type: none"> Program the correct base number (1 for base 1, 2 for base 2)
		<ul style="list-style-type: none"> Load chart file programmed wrong 	<ul style="list-style-type: none"> Check base programming in the load chart file.
E61	Error in the CAN bus data transfer for all CAN units	<ul style="list-style-type: none"> CAN Bus cable between the central unit and the sensor unit defective or not connected. 	<ul style="list-style-type: none"> Check the connection between the central unit and the sensor units
		<ul style="list-style-type: none"> Can bus port in the central unit defective 	<ul style="list-style-type: none"> Replace the central unit
		<ul style="list-style-type: none"> Short circuit in a CAN Bus cable 	<ul style="list-style-type: none"> Replace Can Bus cable
E80	Error in the slewing angle measurement	<ul style="list-style-type: none"> The difference between the average of the slewing angle and one of the wipers of the slewing potentiometer is out of the tolerance 	<ul style="list-style-type: none"> Check the slewing potentiometer adjustment Replace slewing angle sensor

Troubleshooting

Fault code	Error	Cause	Elimination
E81	Too large difference of the boom angles at tip and base boom (if avail.)	<ul style="list-style-type: none"> The angle as to the horizontal on the boom head exceeds the main boom angle by more than 5 degrees. 	<ul style="list-style-type: none"> Check angle sensor on the boom head. Check angle sensor on the base boom.
E82	Too large difference of the luffing jib angles at tip and base jib.	<ul style="list-style-type: none"> The angle as to the horizontal on the jib head exceeds the luffing jib angle by more than 5 degrees. 	<ul style="list-style-type: none"> Check angle sensor on the jib head. Check angle sensor on the jib base.
E83	Maximum force in the main boom pendants exceeded	<ul style="list-style-type: none"> The force actuating on the main boom pendants has exceeded the programmed value 	<ul style="list-style-type: none"> Reduce force acting on the main boom pendants.
E84	Wrong rigging condition.	<ul style="list-style-type: none"> The selected rigging condition is not contained in the crane data file. 	<ul style="list-style-type: none"> Select another rigging condition Check the programming in the crane data file.
E85	Error in the radius determination	<ul style="list-style-type: none"> The computed radius is too small (negative deflection) 	<ul style="list-style-type: none"> Check the programming in the crane data file.
E88	Faulty main boom position during luffing jib operation	<ul style="list-style-type: none"> During luffing jib operation the main boom is not in the prescribed angle range Angle measurement of main boom defective. 	<ul style="list-style-type: none"> Luff boom to the permitted range Check angle measurement of the main boom.
E89	Faulty positioning of the jib during operation with fixed angle to the main boom or to a luffing jib	<ul style="list-style-type: none"> During operation with fixed jib to the main boom, the jib is not in the permitted angle range Angle measurement of the jib defective 	<ul style="list-style-type: none"> Luff the auxiliary jib to the permitted range Verify angle measurement of the auxiliary jib.
E98	LMI watchdog activated	<ul style="list-style-type: none"> LMI processing time limit exceeded 	<ul style="list-style-type: none"> Reset system Connect PC terminal and watch error messages
EAB	Short circuit in the A2B switch circuit	<ul style="list-style-type: none"> Short circuit in the A2B switch Short circuit in the cable to the A2B switch 	<ul style="list-style-type: none"> Replace A2B switch Replace cable to the A2B switch
EAC	A2B switch circuit disconnected	<ul style="list-style-type: none"> Disconnected cable in the A2B switch Disconnected cable to the A2B switch 	<ul style="list-style-type: none"> Connect or replace cable in the A2B switch Connect or replace cable to the A2B switch
EAD	No valid A2B switch status	<ul style="list-style-type: none"> Sensor wrong function CAN bus delay 	<ul style="list-style-type: none"> Replace A2B switch Replace cable to the A2B switch

Troubleshooting

Fault code	Error	Cause	Elimination
EB1	Below lower limit value in measuring channel "rope length on the winch"	<ul style="list-style-type: none"> No rope on the winch (* only EB1) No sensor for winch measuring available rope length not calibrated wrong rope/winch parameters in data-programming counter input not define in configuration counter input defective 	<ul style="list-style-type: none"> calibrate rope length mount sensor or turn off this function in the data-programming calibrate rope length, layer check parameter in the data-programming change I/O configuration change lflex
EB2	Upper limit value in measuring channel "rope length on the winch" has been exceeded.	<ul style="list-style-type: none"> Rope completely rolled up on winch (* only EB2) Refer to EB1 	<ul style="list-style-type: none"> calibrate rope length Refer to EB1
EB3	Upper limit value in measuring channel "hook height" has been exceeded.	<ul style="list-style-type: none"> No rope length between front sheave and hook Refer to EB1 	<ul style="list-style-type: none"> Refer to EB1
EDD	Battery empty	<ul style="list-style-type: none"> Battery check detected a low voltage of the battery 	<ul style="list-style-type: none"> change and setup battery Temporary: Press alarm off button to work without data-logger
EFD	LMI Watchdog extra time	<ul style="list-style-type: none"> Function requires more than 0.5 seconds to activate, e.g. write flash PROM 	<ul style="list-style-type: none"> Message is deactivated automatically after processing

Note:

If a fault message is displayed that is not included in the present list, then please contact your local Hirschmann Customer Service. > www.hirschmann-usa.com <

Appendix: Menu overview calibration menus

▼ Start screen

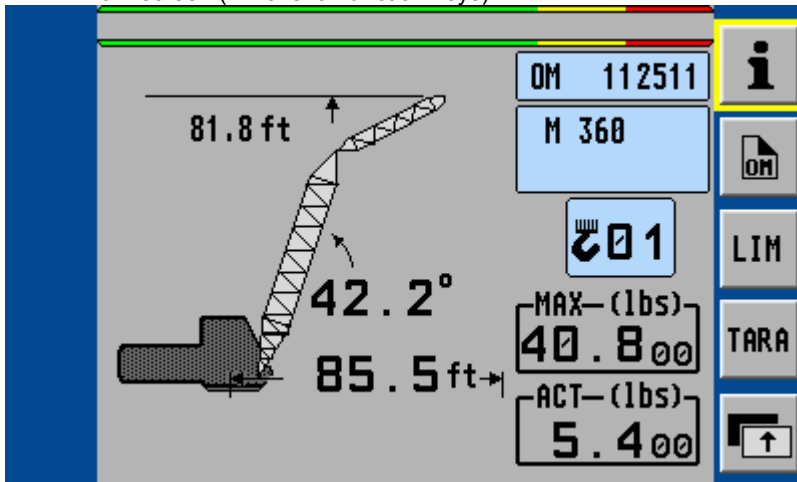


SYSTEM START SCREEN

No function keys available.

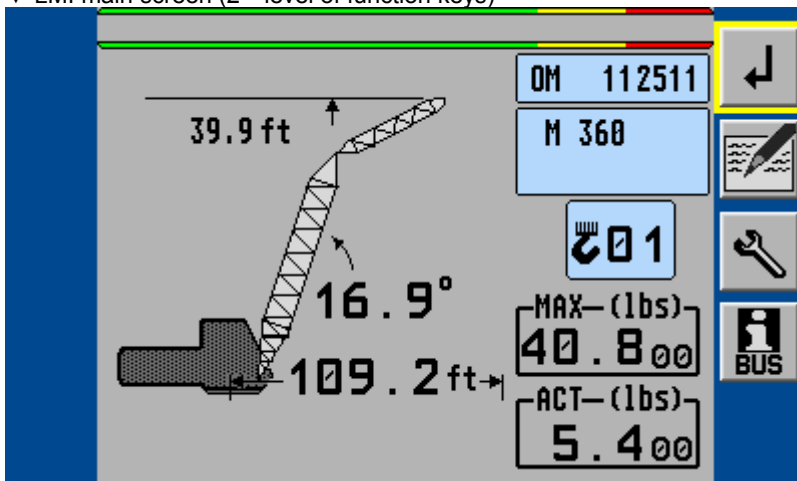
Screen automatically changes after completion of the system test.

▼ LMI main screen (1st level of function keys)



switch to 2nd level of function keys

▼ LMI main screen (2nd level of function keys)

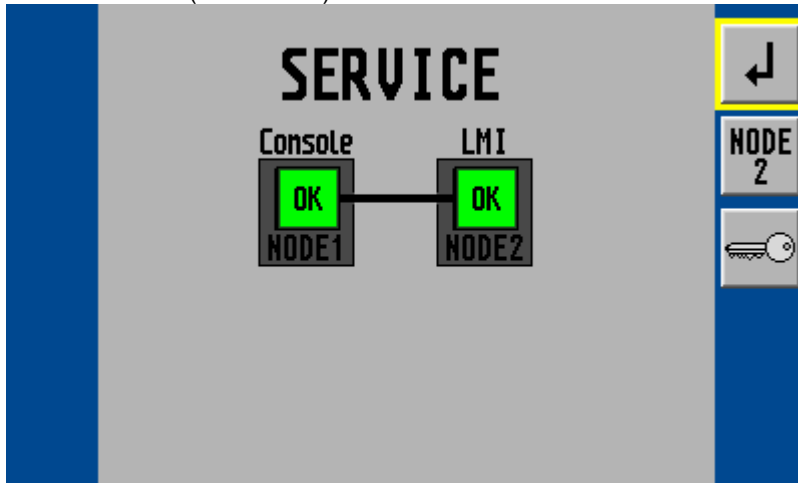


back to the previous menu

to service menu

Appendix: Menu overview calibration menus

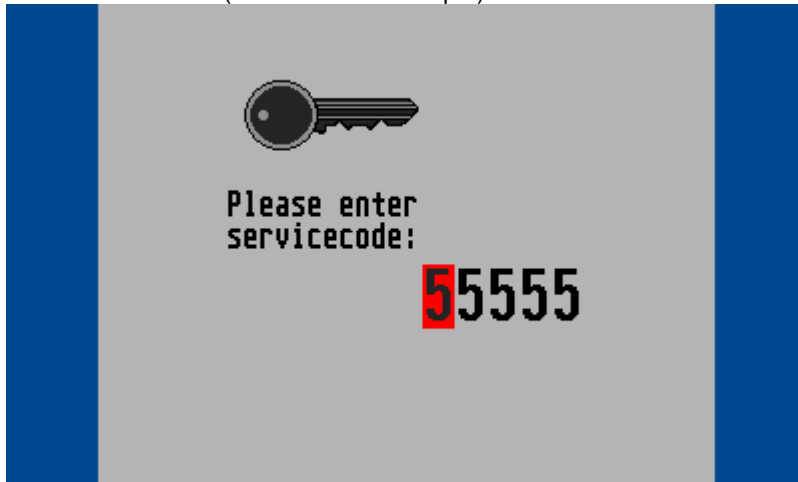
▼ Service menu (start screen)



back to the previous menu

to calibration menus
(access code input)

▼ Calibration menu (start access code input)



For access to the calibration menus it is necessary to input a matching 5-digit code.

Use the rotary selection wheel to input a numeral, and then push the wheel button to select the next digit.

If input is complete the confirmation screen appears:

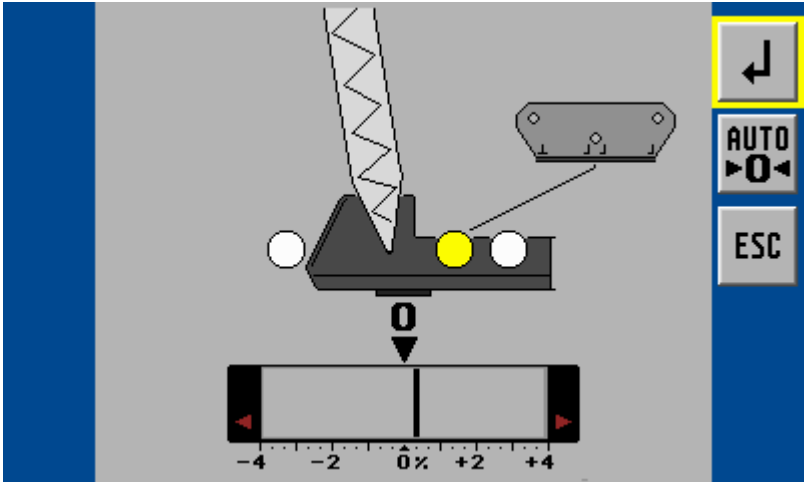
▼ input service code (confirmation screen)



OK, confirm selected code

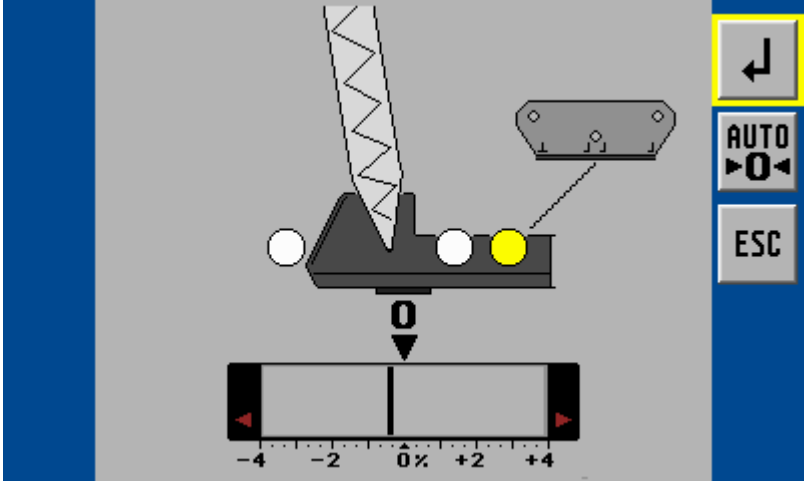
▼ zero-setting force 1

Appendix: Menu overview calibration menus



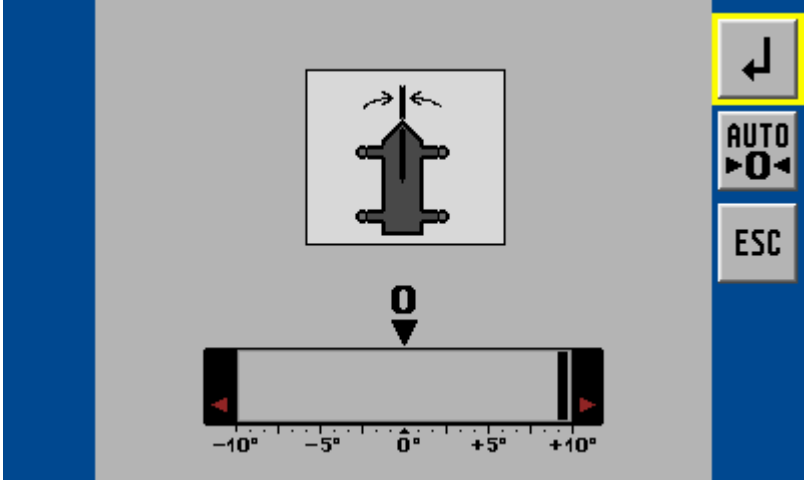
- to next calibration step
- zero-setting force 1 (SKM)
- abort calibration step

▼ zero-setting force 2



- to next calibration step
- zero-setting force 2 (SKM)
- abort calibration step

▼ zero-setting slewing angle sensor



- to next calibration step
- zero-setting slewing angle (DWG)
- abort calibration step

Appendix: Important notes for crane operators and crane operating companies

INSTRUCTIONS 1 Shut-off values for boom cranes with variable load ratings depending on variable working radius

The crane shut-off values are determined by us based on the load charts and design drawings specified by the crane manufacturer.

These theoretical shut-off values must be checked by means of tests on the crane with weighed test loads for all modes and at least with the following rig arrangements, depending on the crane design.

- **Cranes with fixed boom length in operation:**
Smallest, medium and largest radius for shortest, medium and longest boom length, as well as shortest, medium and longest jibs for these boom lengths.

INSTRUCTIONS 2 Important notes for the crane operator

The LMI is an operating aid to warn the crane operator of an imminent overload or of the hook block approaching the boom head, in order to avoid possible damage to property or personal injury.

This system cannot be, and is not intended to be, a substitute for good judgement or experience on the part of the crane operator, or for the application of recognized, safe working methods when using cranes. The crane operator is not released from his obligation to operate the crane safely. He must ensure that he fully understands and follows the notes and instructions displayed. Before beginning work with the crane, the crane operator must carefully read and understand the entire Manual to ensure that he is aware of the operation of the LMI and the crane. Proper functioning depends on due daily inspection of the system and compliance with the operating instructions listed in this Manual.

The system can only offer the crane operator help if the LMI is correctly adjusted, and the correct load chart and the correct operating code have been entered for the particular rig arrangement. To avoid damage to property and serious or even fatal injuries to persons, it is essential to ensure that the LMI is correctly adjusted before beginning crane work.



This system can be equipped with a key-operated switch which is located in the microprocessor central unit. This key-operated switch overrides the LMI's shut-off feature. The switch may only be actuated in emergencies by authorized personnel. Non-compliance with these instructions may lead to damage to property and serious or even fatal injuries to persons.

Appendix: Important notes for crane operators and crane operating companies

INSTRUCTIONS 3 Notes on Electromagnetic Compatibility (EMC) in electronic systems taking account of the effect of electromagnetic fields

Electromagnetic fields are having an increasing effect on electronic systems and may lead to malfunctions; to avoid these, we have listed preventive measures in the following, according to the latest state of technology:

1. The preventive measures proceed primarily from the basic idea that the electronic circuits should be shielded from irradiated high frequencies by a closed, low-resistance protective shield against high-frequency interference.
 - All components are equipped with metallic outer housings with grounding option;
 - only cables with a braided screen are used. The screen must generously cover all connectors and must be of high conductivity;
 - coupling of the crane earth and the electronics earth in one single point of the system only.
2. The general precautions listed under Section 1 cannot assure complete protection against electromagnetic fields in all cases, however, since the size and type of effect depend on local conditions.

Examples of such influencing factors are:

- particularly unfavourable arrangement of the aerials in relation to the system,
- very high transmission power,
- consistent compliance with measures of Section 1 not possible due to local conditions,
- long cables,
- coupling of interference into the supply leads.

In unfavourable conditions, one has no choice but to take experimental measures on site, in addition to the preventive measures, while taking account of the principles mentioned in Section 1, for example:

- fitting filters or short-circuiting the interference frequencies using capacitors;
- establishing or separating earth connections;
- using a guarded shield system.

Appendix: Important notes for crane operators and crane operating companies

INSTRUCTIONS 4 Notes on industrial safety when repairing display and control consoles

Caution: Liquid crystal displays contain liquid chemical substances in the display. Particular caution and care are therefore necessary:

- when operating equipment containing liquid crystal displays
- during storage and transport (risk of breakage !)
- when disposing of unusable or excess liquid crystal displays

Possible sources of danger are chemical effects in the event of skin contact with broken liquid crystal displays. In the event of contact, wash the affected skin areas thoroughly with soap. Be particularly careful with open wounds !

INSTRUCTIONS 5 Installation instructions for display and control consoles without closed metallic housing

To avoid radio interference, high-frequency devices and equipment coming under general approval requirements published by the Federal Minister for Post and Telecommunications in his Official Gazette No. 163/1984 as Decree No. 1045/1984 and No. 1046/1984 must comply with the limit values and conditions laid down there.

For display and control consoles without closed metallic housing (dashboard installation version), the conductor screen must therefore be mounted on the dashboard directly in front of the console by means of a bare cable clip.

Revision History

Version	Date	Modifications	Name
Rev. A	2008-03-04	First Issue for Link-Belt 278 LMI with iFLEX5 System	rk
Rev. B	2008-04-22	Revise Manual to meet LinkBelt's recommendations	Sc
Rev. C	2008-08-18	Description for battery symbols added. Description for confirmation screens added.	rk