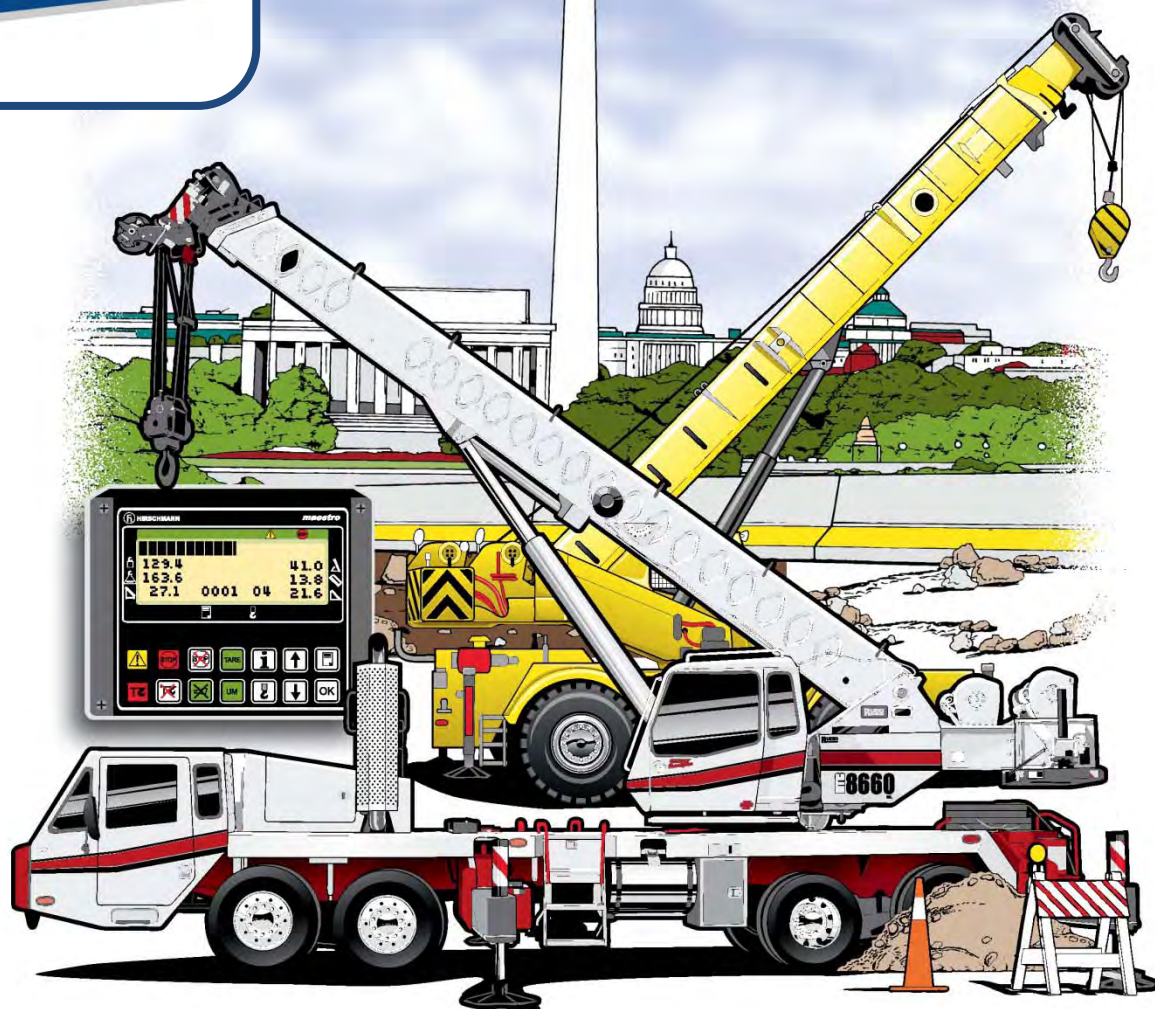




DS85/0002
Central unit / console



Operator's Manual

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MANUAL REVISIONS

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1 GENERAL INFORMATION

The PAT Load Moment Indicator¹ (LMI) has been designed to provide the crane operator with the essential information required to operate the machine within its design parameters.

Using different sensing devices, the Load Moment Indicator monitors various crane functions and provides the operator with a continuous reading of the crane's capacity. The readings continuously change as the crane moves through the motions needed to make the lift.

The LMI provides the operator with information regarding the length and angle of the boom, working radius, rated load and the total calculated weight being lifted by the crane.

If non permitted conditions are approached, the Load Moment Indicator will warn the operator by sounding an audible alarm, lighting a warning light and locking out those functions that may aggravate the crane's condition.

2 WARNINGS

The LMI is an operational aid that warns a crane operator of approaching overload conditions and of over hoist conditions that could cause damage to equipment and personnel.

The device is not, and shall not, be a substitute for good operator judgment, experience and use of accepted safe crane operating procedures.

The responsibility for the safe crane operation shall remain with the crane operator who shall ensure that all warnings and instructions supplied are fully understood and observed.

Prior to operating the crane, the operator must carefully and thoroughly read and understand the information in this manual to ensure that he knows the operation and limitations of indicator and crane.

Proper functioning depends upon proper daily inspection and observance of the operating instructions set forth in this manual. Refer to Section 6. *Pre-Operation Inspection and Calibration Verification* of this handbook.



The LMI can only work correctly, if all adjustments have been properly set. For correct adjustment, the operator has to answer thoroughly and correctly all questions asked during the setup procedure in accordance with the real rigging state of the crane. To prevent material damage and serious or even fatal accidents, the correct adjustment of the LMI has to be ensured before starting the crane operation.

¹ LOAD MOMENT: generally the product of a force and its moment arm; specifically, the product of the load and the load-radius. Used in the determination of the lifting capacity of a crane

3 SYSTEM DESCRIPTION

The PAT Load Moment Indicator consists of a central micro processor unit/operating console, length/angle sensor, pressure transducers, and anti-two block switches.

The system operates on the principle of reference/real comparison. The real value, resulting from the pressure measurement is compared with the reference data, stored in the central processor memory and evaluated in the micro processor. When limits are reached, an overload warning signal is generated at the operator's console. At the same time, the aggravating crane movements, such as hoist up, telescope out and boom down, will be stopped.

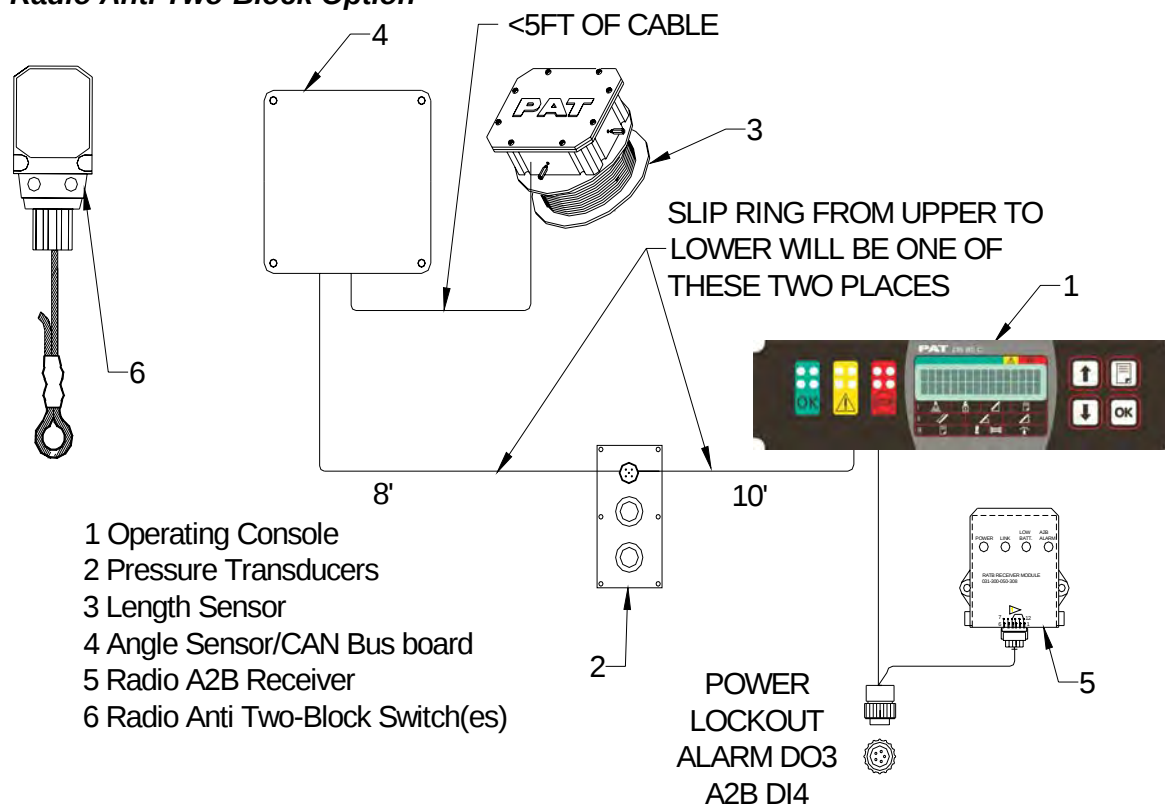
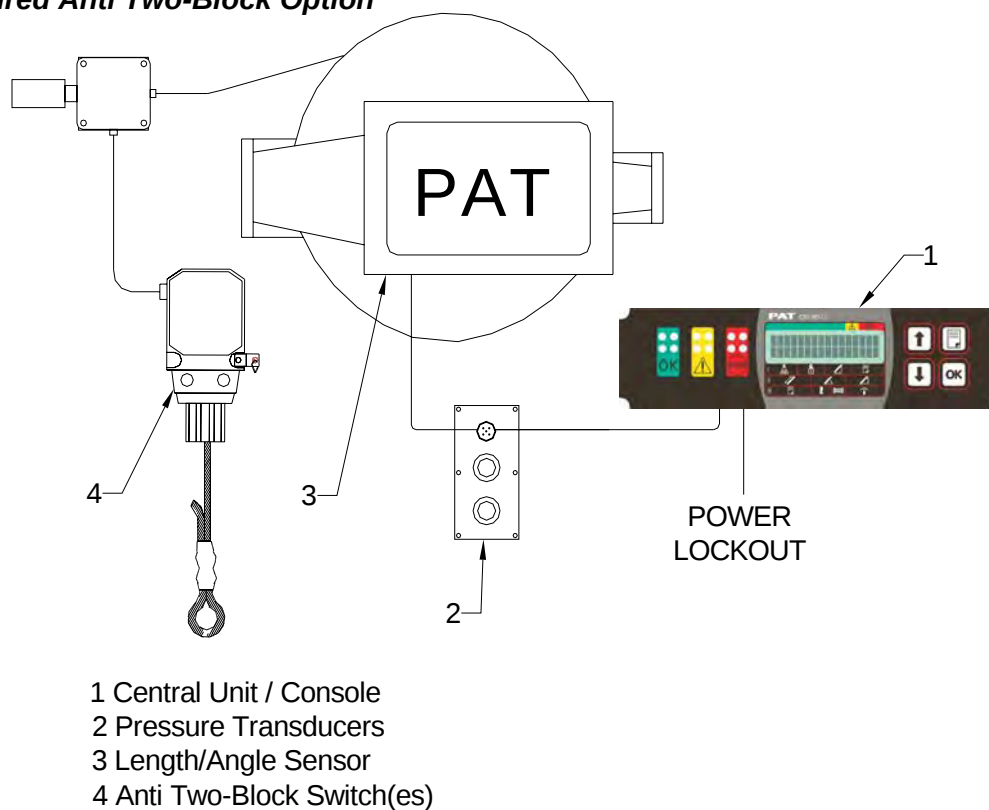
The fixed data regarding the crane, such as capacity charts, boom weights, centers of gravity and dimensions are stored in memory in the central processor unit. This data is the reference information used to calculate the operating conditions.

The of operating modes are selected by the operating mode key on the console by scrolling through the text messages defining the boom truck configuration.

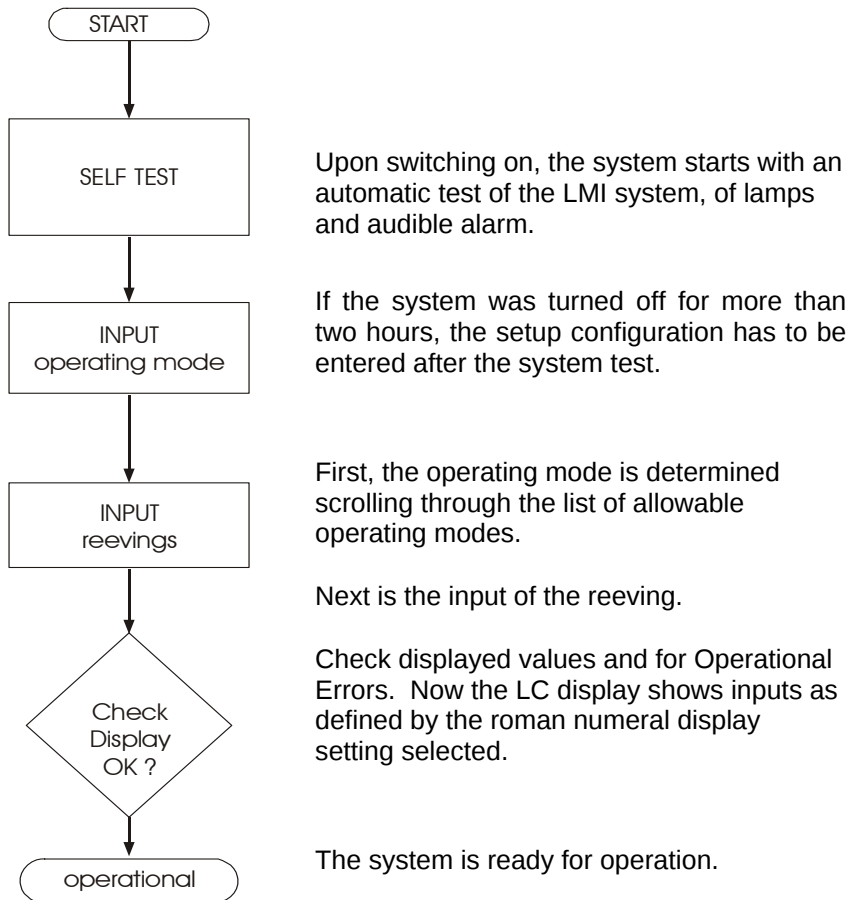
The crane load is measured by pressure transducers attached to the piston and rod side of the hoist cylinders.

Boom length and boom angle are transmitted by length/angle CAN bus node mounted on the side of the boom in the angle sensor box. The length sensor/cable reel is mounted inside the base which measures the boom length.

The PAT RATB works like our normal Anti-Two-Block. It alerts to an impending two-block condition. This alert can come in the form of an audible alarm and visual LED or with the optional function lockout if the crane is so equipped. The radio anti two block transmitter switch transmits a error condition when the switch closes or transmits an OK signal, no less than every two seconds to the receive. The transmitters send a unique serialized frequency on up to three separate channels to ensure accurate and consistent reception of data and to reduce the possibility of unnoticed failure. The transmitter is powered by 4 C batteries with an expected battery life of 1 year with normal usage. The receiver is mounted into a receiver box locate near the operating station. The receiver box provides the following indications: Power (status), LINK, Low Battery, and A2B. The receiver will work 10..32VDC and fused to 1 Amp.

Fig. 1: Components of the LMI system PAT DS 85**Radio Anti Two-Block Option****Hardwired Anti Two-Block Option**

System Function



3.1 OPERATING CONSOLE

The console has 3 functions:

- inputs by the crane operator (operating mode, reeving)
- input of geometry limit values and signalization of exceeded limit values
- display of important operating information and service data.

The operator's console is mounted by the operating station in the operator's field of vision. For a better identification of displays and operating elements, they are continuously backlit during operation.

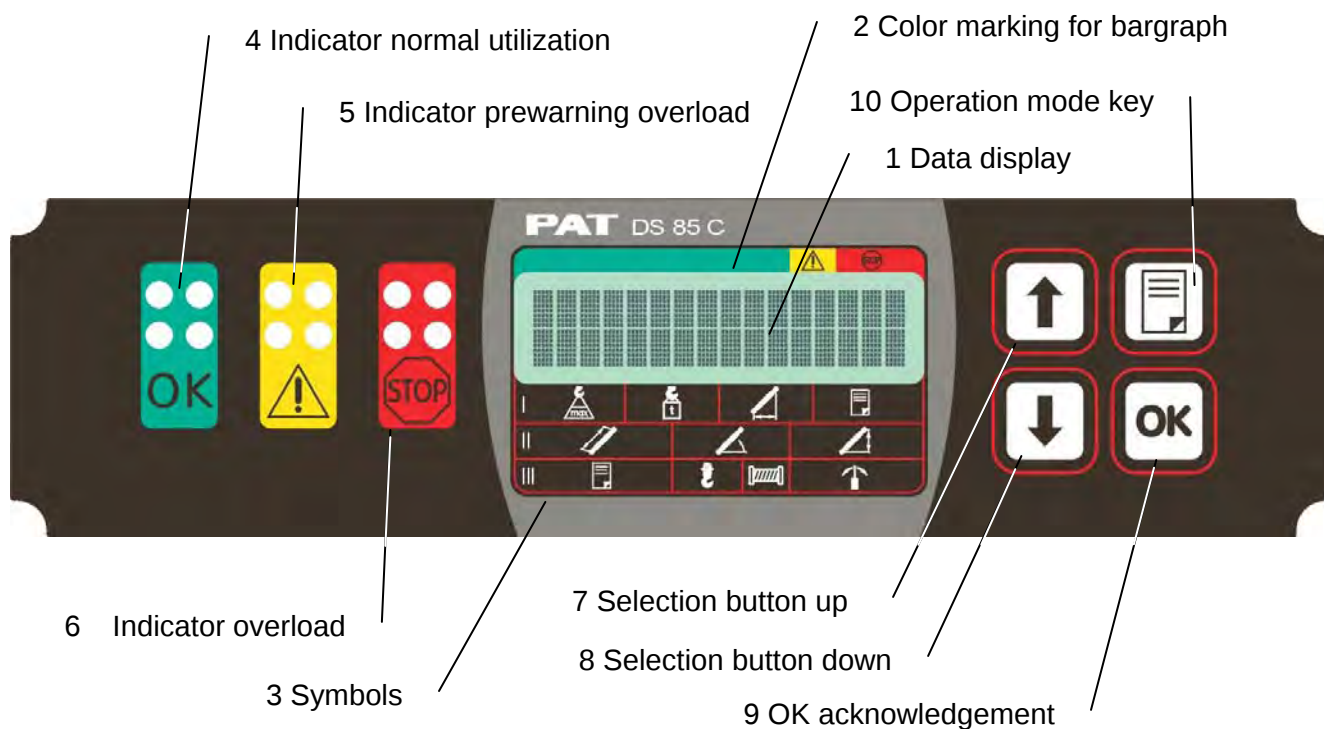
3.2 CONTROL IDENTIFICATION

This unit contains a display and different controls which are described as follows:

Legend to Fig 2:

- 1 Data display (backlit)
- 2 Color marking for bargraph (utilization)
- 3 Symbols
- 4 Indicator normal utilization
- 5 Indicator prewarning overload
- 6 Indicator overload
- 7 Selection button up
- 8 Selection button down
- 9 OK acknowledgement button
- 10 Operation mode key (reeving)

Fig. 2a: Operating Console



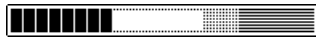
1 Data display



The *Data display* (1) is an illuminated LC display which shows several values.

The figure shows the display during normal operating, limit setting, error codes, and service information.

2 Utilization bar graph



This utilization bar graph display (2) indicates how much of the loader's rated capacity is being used. (utilization)

As the rated capacity of the loader changes as it is moved through its various motions, the utilization display will constantly change as well.

The bar graph is marked with different colors:

- green: and safe section (0%...90% of rated cap.)
- yellow: prewarning section (90%...100% of rated cap.)
- red: overload section (>100% of safe working load)

3 Symbols for display values



Symbols (3) below the display data are the designators for the values displayed above the marked areas.

The display level label (I or II, at the left) marks the level selected.

Display level selection is made by way of the selection buttons *up* (7) or *down* (8), respectively.

4 Normal utilization Indicator



This green lamp will light up when the load on the crane is below 90 % of the loader's rating capacity, indicating that the utilization is normal

5 Prewarning indicator



The yellow *prewarning light* (5) will light up when the load on the crane is over 90 % of the crane rating, indicating that an overload condition is approaching

IMPORTANT

Warns the operator to continue his crane operation with caution.

6 Overload indicator



The red *overload light* (4) warns the operator that a rated load condition has been reached.

7 up Selection button



This selection button selects display elements during the following functions:

- Selection of display level
- Selection of language
- Selection of operating mode (reeving)

8 down Selection button



This selection button selects display elements during the following functions:

- Selection of display level
- Selection of language
- Selection of operating mode (reeving)

9 OK Acknowledgement button



An acoustical alarm message can be acknowledged by activation of this selection button.

However, audible alarm message acknowledgement can be activated after 5 seconds alarm duration, at the earliest.

The acoustical alarm will sound upon the following events:

System test, overload condition, malfunction of the load moment indicator system, or after recognized operator errors.

10 Operating mode Selection button (Select Reeving)



The function Setup operating mode (reeving) is activated by this selection button.

The setup procedure is described in chapter 4.2.



WARNING

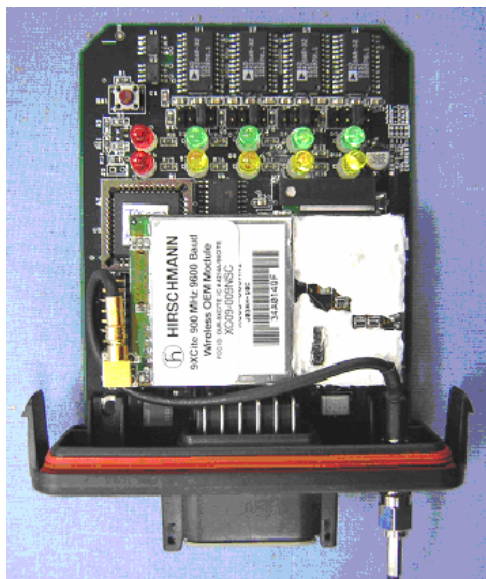
The correct setting of the Operating Mode is of utmost importance for the proper function of the system and the loader. Therefore, only operators who are thoroughly familiar with the load capacity charts and the use and operation of the system shall set the Operating Mode.

Failure to properly program the LMI with the correct operating mode code may result in property damage or serious bodily injury or death to personnel.

To assure the crane is properly programmed, verify that the operating mode code, shown at data display (1) and the load capacity chart match the lifting configuration of the crane.

3.3 RADIO ANTI-TWO BLOCK SYSTEM

3.3.1 Receiver



Radio Anti-Two-Block Receiver and Receiver Box

3.3.1.A LEDs:

1.The POWER LED (Green)	Shows that there is power to the system.
2.The LINK LED (Green)	Indicates the status of the communication link between the main hoist A2B transmitter and the receiver. Failure of the communication link will turn off the Green LED and turn off the output to the lockout relay.
3.The LOW BATTERY LED (Yellow)	Indicates that the battery of the main transmitter needs to be replaced.
4. The A2B LED (Red)	Indicates an impending two-block condition of the main hoist. The Red LED will light when the load-handling device has lifted the A2B weight. This LED will light simultaneously with the engaging of the lock out solenoids (if installed).

3.3.1.B ID button

The yellow ID button, located in the lower right-hand corner of the receiver board, is used to set the transmitter ID of the transmitter into the receiver.

3.4 TRANSMITTER / SWITCH

The transmitter and battery housing are made of a special plastic that resists impact and will not become brittle even in low temperatures.

Transmitter LED

The transmitter has an LED on the bottom for diagnostics. The LED should be on when in a two-block condition or when the weight is lifted. The LED will flash rapidly during a 2-block condition and will stop flashing after the switch is in a two-block condition for more than 15 seconds. The LED will flash randomly approximately every 2 seconds when the switch is transmitting. When in sleep mode, the LED will not flash.

3.4.1 Storage of the A2B transmitter for Travel

The weight should remove from the switch when traveling to extend battery life. The system is in permanent lockout and the system will not function until the chain is unhooked. To use the feature, attach any part of the chain into the hook. When it is desired to use the switch again, simply unhook the chain to allow the switch to close.

**WARNING**

The weight and chain must be hung from the switch and/or the chain must be unhooked before the crane is operated.



4 CONFIGURATION SETUP

The LMI setup procedure allows the operator to input the crane operating mode through the text displays and enter the reeving or parts of line used. The operator must correctly setup the Load Moment Indicator system when the crane operation configuration has been changed or after turning on the system powered.

4.1 SETUP OF OPERATING MODE (REEVING)



WARNING

The correct setting of the Operating Mode Code (Reeving) is of utmost importance for the proper function of the system and the crane. Therefore, only operators who are thoroughly familiar with the load capacity charts and the use and operation of the system shall set the Operating Code.

Failure to properly program the LMI with the correct operating mode code may result in property damage or serious bodily injury or death to personnel.

To assure the crane is properly programmed, verify that the operating mode code shown at data display (1) and the load capacity chart match the lifting configuration of the crane.

...at power up:

- System performs a system test and will display the software version in the DS85 system 7-10 seconds.
- The system will then display an operating mode scroll through the operating codes and select the mode matching the crane configuration then



Press .

- Reeving will be displayed, scroll up or down to display the correct parts of lines configured on the crane



Press .

- The system should then be ready to operate.

...during operation:

- To change the operating mode or reeving during



operation Press and complete the procedure described above in the at power up' column.

4.2 ADJUSTING THE TEXT MESSAGE LANGUAGE

Text messages can optionally be displayed in German, English, French or Italian. It is not necessary to repeat this language adjustment when starting the system as it will be stored until the next adjustment. The procedure is described as follows:



To start function press

The following language displays can be scrolled through:

ENGLISH
0
FRANCAIS
1
DEUTSCH
2
ESPANOL
3



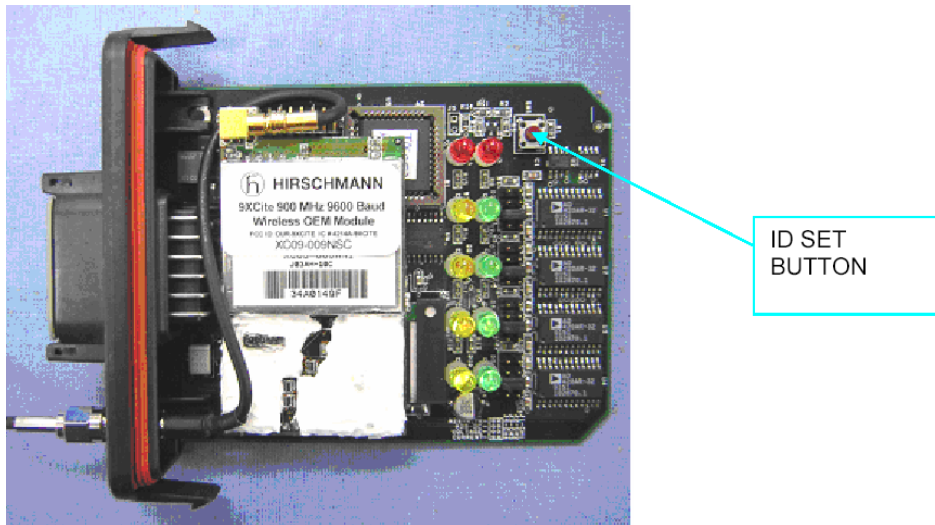
press to select the language shown on the screen.

Note: The language will only displayed if the manufacturer defines the operating mode verbiage.

4.3 SETUP/CALIBRATION OF THE RADIO ANTI-TWO BLOCK

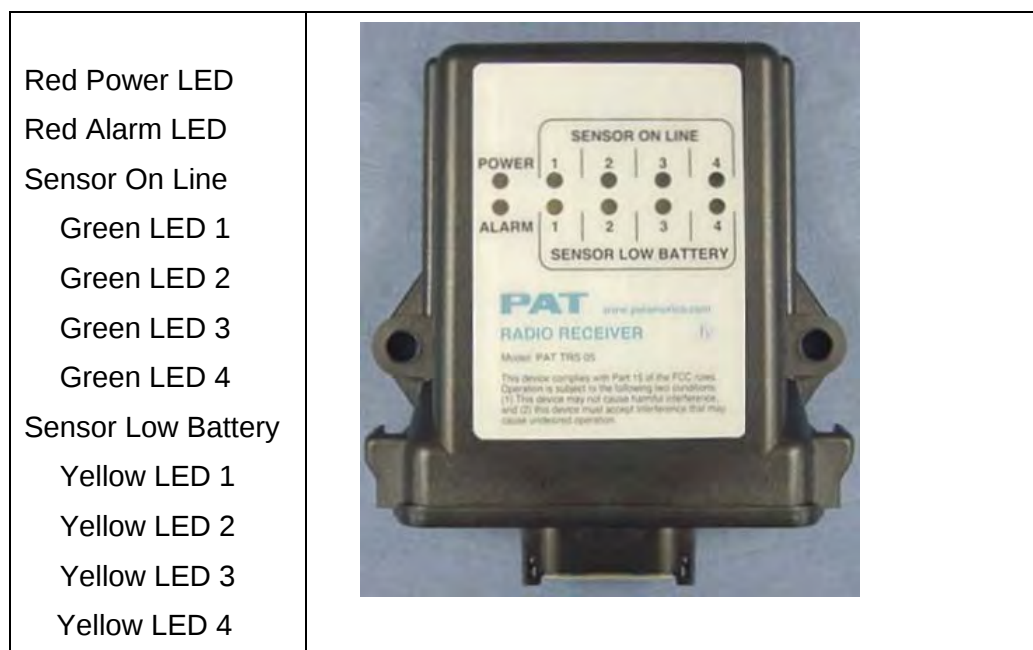
4.3.1 Setup Overview

The PAT RATB is easily configured to communicate with up to 2 transmitters. Simply by pressing and holding the yellow “ID” button for 7 seconds, the receiver can sense the transmitters being used and configure the receiver to listen to only those transmitters. There are no numbers, ID’s or codes to remember or write down.



The receiver module has the following functions:

- Visual indication of receiver power, radio links (sensor on line), sensors low battery, and alarm conditions.
- Installs/uninstalls a sensor
- Allows a zero point and output adjustment of a load sensor.



4.3.2 LEDs

Red Power LED	Power is applied to the circuit board.
Red alarm LED	An installed sensor is indicating an alarm, or communication as been lost to an installed sensor.
Green LED 1 ON	Sensor on channel #1 is installed and communicating correctly.
Green LED 1 FLASHING	Sensor #1 is not communicating correctly.
Green LED 1 OFF	No sensor is installed on channel #1.
Yellow LED 1 ON	Sensor #1 batteries are low and need replaced. Note that the sensor is still operating correctly.
Green LED 2 ON	Sensor #2 is installed and communicating correctly.
Green LED 2 FLASHING	Sensor #2 is not communicating correctly.
Green LED 2 OFF	No sensor is installed on channel #2.
Yellow LED 2 ON	Sensor #2 batteries are low and need replaced. Note that the sensor is still operating correctly.
Green LED 3 ON	Sensor #3 is installed and communicating correctly.
Green LED 3 FLASHING	Sensor #3 is not communicating correctly.
Green LED 3 OFF	No sensor is installed on channel #3.
Yellow LED 3 ON	Sensor #3 batteries are low and need replaced. Note that the sensor is still operating correctly.
Green LED 4 ON	Sensor #4 is installed and communicating correctly.
Green LED 4 FLASHING	Sensor #4 is not communicating correctly.
Green LED 4 OFF	No sensor is installed on channel #4.
Yellow LED 4 ON	Sensor #4 batteries are low and need replaced. Note that the sensor is still operating correctly.
Green Heartbeat LED	This will flash during normal operation. If it is a solid or off, the receiver has a software error or the board has a component failure.

4.3.3 Control Identification

Sensor #1 output jumper J4

Sensor #2 output jumper J3

Sensor #3 output jumper J2

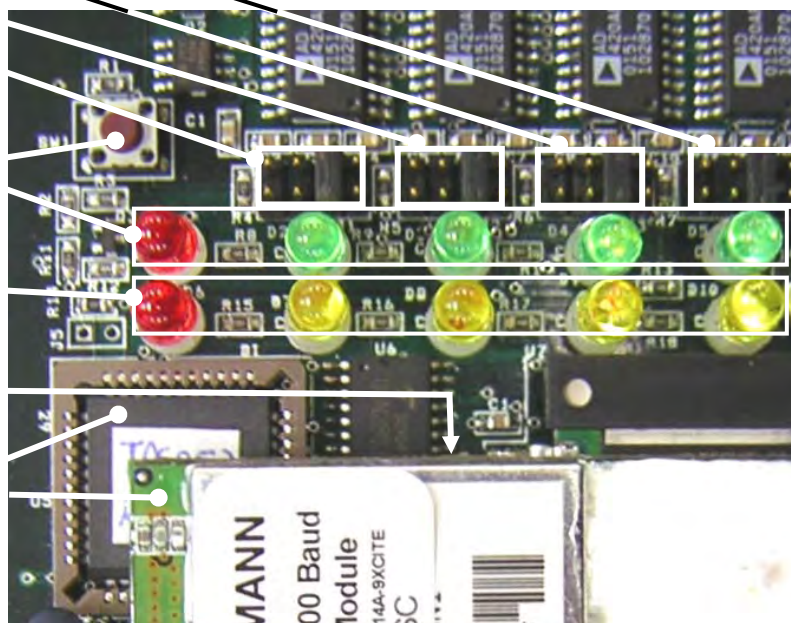
Sensor #4 output jumper J1

ID button
power (red), sensor link 1-4 left
to right (green)

LEDs
1-4 left to right (yellow)

LEDs Green Heartbeat LED
(located just under radio
module)

software chip
radio module 031-300-300-024



Heartbeat LED: When blinking, this small surface board mounted green LED indicates the system is operation properly.

ID button: The red ID button, located below the software chip on the receiver board, is used to setup the sensor transmitter to the receiver.

5 OPERATION

5.1 RECEIVER

Upon switching on crane ignition switch, the system starts with an automatic test of the receiver board, LEDs and electronic components. The red power LED should be on and the green LEDs that sensors have been linked to should also be on.

If an alarm condition exists investigate and clear the condition before operation and using the system.

During the normal operation of the system, the POWER and SENSOR ON LINE (if linked to a sensor) LEDs should be on.

POWER LED

The POWER LED shows that the receiver is getting power from the crane. The receiver is on any time the crane is operating and supplying power to the system.

SENSOR ON LINE LED

The SENSOR ON LINE LED indicates the status of communication of the transmitter(s). During normal operation of the system, the LED will be on. The LED will flash if communication or transmission between the sensor transmitter and the receiver is interrupted or lost. The system should not be operated if the SENSOR ON LINE LED is flashing. If the LED is off no sensor is linked to this channel.

LOW BATTERY LED

The low battery indicator (yellow LED) will light indicating that you have a limited time to operate before the sensor battery life ends. When a low battery condition occurs, the follow 2 conditions will exist:

1. The yellow LED will come on the TRS 05 for the sensor.
2. The signal for that sensor will cycle between input signal and max signal, which causes a system fault and alarm for 25 seconds. The intent is to warn the operator that something is not correct with the system. If the receiver is powered off/on and the low battery condition exists, the signal will again cycle for another 25 seconds.

When the battery level is to the point that it is too low to operate, the system will display a loss of communication and alarm. Use any off-the-shelf alkaline C-cells; Duracell, Eveready, etc. After replacing the transmitter batteries, the receiver should clear the low battery indication.

ALARM LED

This LED will light simultaneously with the engaging of the lock out solenoids (if installed).

Test the electronics

Cycle the power to the system, each LED on the receiver will light for 2 seconds when the system is powered. All of the indicator lights must come on or the system is not functioning properly. If any light does not function, do not use the system until it has been repaired.

Refer to receiver operating manual for pre-operational inspection.

If a green sensor on line LED starts to flash, this means a sensor is installed and the communication link has been lost. When communication has been lost to a load cell, the receiver will output the maximum voltage signal for the output sensor (9VDC).

If a low battery LED is on, replace the batteries in the linked transmitter, refer to [Battery Replacement](#).

The TRS 05 setup/calibration procedure allows the operator to input the type of sensors being used, and adjust the zero point and output adjustment of a load sensor. The operator must complete the setup procedure for each sensor.

6 SETUP A SENSOR/MENU OPTIONS



While the ID button is held or in the calibration process, the sensor outputs will not correctly indicate the status of other installed sensors. Correct operation will return when the menu is exited or calibration process is complete or system is powered off/on.

The sensor setup and calibration is completed with the one ID button, pressing it starts the menu and releasing the button selects the menu or action the operator want to complete. If an incorrect menu is activated or the button is released accidentally, simply cycle the power and start over.

6.1 INSTALL SENSOR / TRANSMITTER

Press and hold the ID button for 3-5 second the 1st green LEDs will begin blinking. If the button is held for 3-5 more seconds the 2nd LED will begin to blink, continue holding the button and the setup program will cycle through the 4 sensor channels. When the correct LED is blinking, channel to be installed, release the ID button, the receiver begins to search for a transmitter ID code. The green LED will become solid when the transmitter is linked.

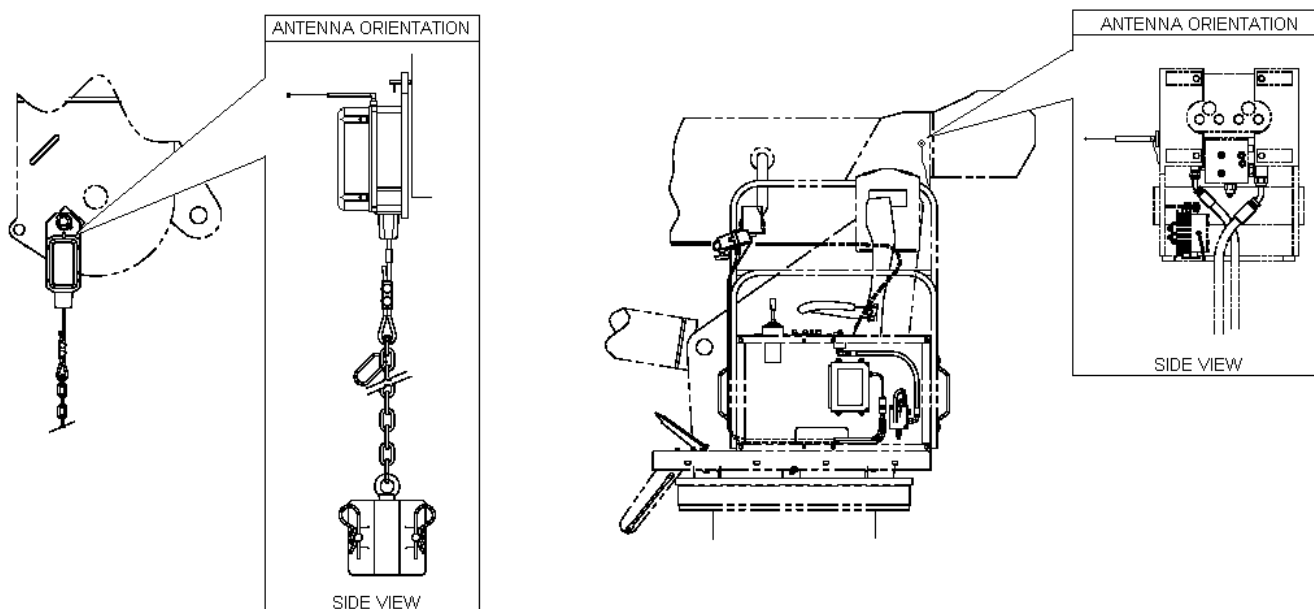
As the ID button is held and released at the blinking LED, the following actions will occur:
Green LED 1 Blinking: Search for / Install sensor 1. LED will turn solid when the sensor is found.

Green LED 2 Blinking: Search for / Install sensor 2. LED will turn solid when the sensor is found.

NOTE: A new sensor or transmitter maybe install over an existing link, when this occurs the previous link and code are removed from memory and the new one stored.

RADIO ATB ANTENNA INSTALLATION

Mount the antennas in identical positions (90° / perpendicular to the boom) and in a direct line between transmitter and receiver, ensuring that no obstructions will interfere with the transmission of the radio signal.



UNINSTALL SENSOR / TRANSMITTER

If a sensor is setup on the channel the LED will be on, press and hold the ID button (16-28 seconds) through the Install Sensor mode (blinking LEDs1-4) until the correct 1-4 LED is solid. When the correct LED is solid, channel to be uninstalled, release the ID button. The sensor for the selected channel/LED 1-4 will be uninstalled and the system will be in normal operating mode.

As the ID button is held (16-28 seconds) through the Install Sensor mode (blinking LEDs1-4) and released at the solid LED, the following actions will occur:

- Green LED 1 solid: Uninstall sensor 1.
- Green LED 2 solid: Uninstall sensor 2.
- Green LED 3 solid: Uninstall sensor 3.
- Green LED 4 solid: Uninstall sensor 4.

This is a basic overview table of the menu selections from the TRS 05. Press and hold ID button, release the button at the desired indication (or the number seconds) defined in the following table.

NOTE: If an incorrect menu is activated or the button is released accidentally, simply cycle the power and start over.

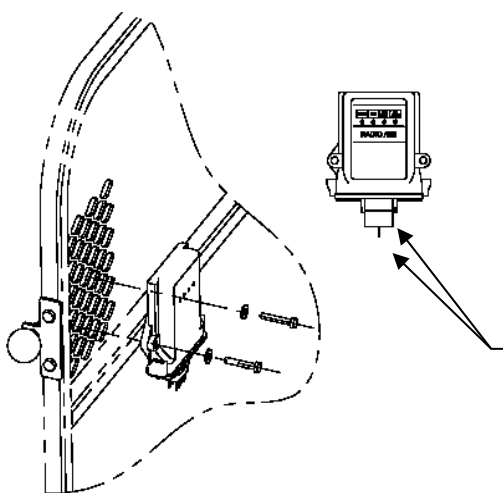
Menu Selection Release ID Button	Indication	Indication Starts (Sec)	Indication Ends (Sec)
Install/setup sensor on channel 1	blinking green LED 1	3	6
Install/setup sensor on channel 2	blinking green LED 2	6	9
Install/setup sensor on channel 3	blinking green LED 3	9	12
Install/setup sensor on channel 4	blinking green LED 4	12	15
Uninstall a sensor on channel 1	solid LED 1	16	19
Uninstall a sensor on channel 2	solid LED 2	19	22
Uninstall a sensor on channel 3	solid LED 3	22	25
Uninstall a sensor on channel 4	solid LED 4	25	28
Set all the analog outputs for voltage 0-5V	All 4 green LEDs blinking	29	32
Set all the analog outputs for 4..20ma	All 4 green LEDs solid	33	36
Set all the analog outputs for voltage 1-9V	All 4 yellow LEDs blinking	37	40
Set all the analog outputs for voltage 0-9V	All 4 yellow LEDs solid	40	43
Calibrate load/angle sensor on channel 1	blinking yellow & green LEDs 1	43	46
Calibrate load/angle sensor on channel 2	blinking yellow & green LEDs 2	46	49
Calibrate load/angle sensor on channel 3	blinking yellow & green LEDs 3	50	53
Calibrate load/angle sensor on channel 4	blinking yellow & green LEDs 4	53	56
Service information on channel 1	blinking yellow LED 1	56	59
Service information on channel 2	blinking yellow LED 2	59	63
Service information on channel 3	blinking yellow LED 3	63	66
Service information on channel 4	blinking yellow LED 4	67	70
Exit/No action	LEDs off no	71	

7 INSTALLATION

7.1 RECEIVER

The receiver module should be mounted so the operator can view the LEDs and setup the system for operation. The location of the receiver should be in direct line of site of the transmitter and blocked by as little metal as possible between the transmitter and receiver. However, in some cases the receiver has been installed surrounded by metal and worked well. The location needs to be tested before mounting the hardware. If the signal is lost, the box/receiver indicates a link error.

Securely attach the receiver onto a solid surface using the mounting holes.



Ensure both the 12 pin header and the Deutsch plug are firmly snapped and properly seated into the enclosure during installation.

** An initial "click" will be heard when the header is inserted into the enclosure. An additional "click" will indicate the header is seated properly in place.*

CORRECT



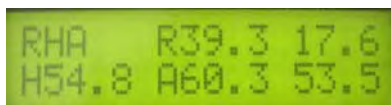
INCORRECT



7.2 LIMIT SETTING

The procedure is described as follows:

To start function press  + 



The display will define the existing limits set, press  or 

The following limits displays can be scrolled through:

ANGLE
RADIUS
TIP HEIGHT
EXIT

press  to select the limit marked at the upper left of the screen.

7.2.1 ANGLE

 SET MAX. ANGLE 

MOVE BOOM TO MAX. ANGLE DISPLAYED 

MAX. ANGLE ANGLE XX.X DEG 

ACCEPT MAX ANGLE XX.X DEG 

OR  EXIT 

 SET MIN. ANGLE 

MOVE BOOM TO MIN. ANGLE DISPLAYED 

MIN. ANGLE ANGLE XX.X DEG 

ACCEPT MIN. ANGLE XX.X DEG 

OR  EXIT 

 DELETE LIMIT 

 EXIT 

7.2.2 RADIUS

 SET MAX. RADIUS 

MOVE BOOM TO MAX. RADIUS DISPLAYED 

MAX. RADIUS XX.X FT. 

ACCEPT RADIUS XX.X FT. 

OR  EXIT 

 SET MIN. RADIUS 

MOVE BOOM TO MIN. RADIUS DISPLAYED 

MIN. RADIUS XX.X FT. 

ACCEPT RADIUS XX.X FT. 

OR  EXIT 

 DELETE LIMIT 

 EXIT 

7.2.3 TIP HEIGHT

 SET MAX. TIP HEIGHT 

MOVE BOOM TO MAX. TIP HEIGHT DISPLAYED 

MAX. TIP HEIGHT XX.X FT. 

ACCEPT TIP HEIGHT XX.X FT. 

OR  EXIT 

 DELETE LIMIT 

 EXIT 

EXIT

 EXIT 

8 PRE-OPERATION INSPECTION AND CALIBRATION VERIFICATION

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

8.1 MACHINES WITH ONLY A MAIN HOIST

Be sure the weight of the anti two-block switch is properly installed on the main hoist load line. With even parts of hoisting line, the weight shall be attached to the dead-end line. With odd parts of hoisting line, the weight shall be attached to the line of lowest speed.

If the boom extension is in the operating position and no load line is being used on main boom, to prevent injury or damage to equipment, the weight shall be removed from main boom switch. In that case the anti two-block switch has to be locked with the red Anti Two-Block Retainer, which is fixed with a red lanyard (not shown) at the anti two-block switch.



Failure to re-position the anti two-block switch weight will prevent the overhoist system from functioning properly. No weight shall be on the main hoist anti two-block switch when the boom extension is being used.

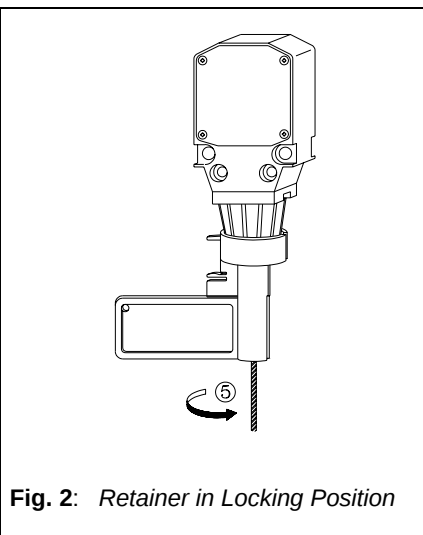
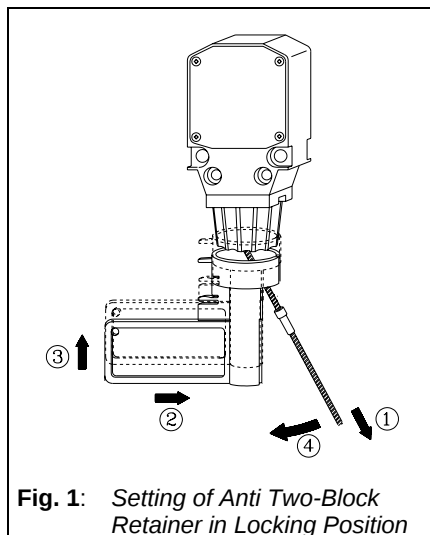
8.2 MACHINES WITH MAIN AND AUXILIARY HOISTS

If the crane works with boom extension and there are two switches. The weight attached to the main hoist anti two-block switch shall be removed. In that case the anti two-block switch has to be locked with the red Anti Two-Block Retainer, which is fixed with a red lanyard at the anti two-block switch (described in the following pages). Then the weight shall be reattached to the boom extension anti two-block switch.

8.3 INSTALLATION OF ANTI TWO-BLOCK RETAINER IN LOCKING POSITION

Procedure (see Fig. 1 and 2):

1. Pull the cable out of the switch and bend back parallel to the boom and hold (1).
2. Slide the retainer from left side with its slot over the cable between the crimped stop and the switch (2). Push it firmly straight onto the cable guide of the Anti Two-Block switch (3).

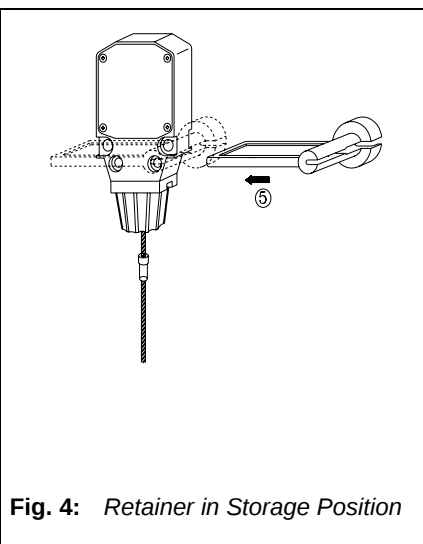
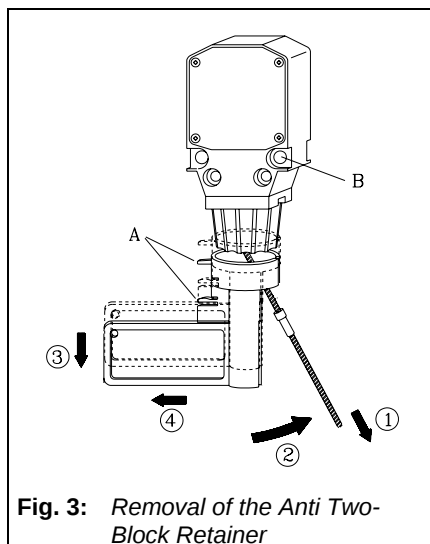


3. Straighten the cable completely into the slot and release the cable (4).
4. Turn the flag of the retainer for best visibility for the operator (5).

8.4 REMOVAL AND STORAGE OF THE ANTI TWO-BLOCK RETAINER

Procedure (see Fig. 3 and 4):

1. Pull the cable out of the switch (1) and bend back parallel to the boom and hold (2).
2. Move the retainer down (3) and then left (4) to remove it from the Anti Two-Block switch. Release the cable.
3. For storage slide the retainer from right side (5) over the Anti Two-Block switch until the clips (A) lock into the holes (B).



8.5 PRE-OPERATION INSPECTION AND CALIBRATION VERIFICATION

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

1. Check the electrical wiring connecting the various parts of the system for physical damage.
2. Check the anti two-block switches and weights for free movement.
3. Check the spring-loaded cable reel to be sure it is free to rotate, has tension and the cable is reeled properly.



The following tests shall be performed with care to prevent damage to the machine or injury to personnel. Proper functioning of the system requires successful completion of these tests before operating the machine.

If the light and audible alarm do not function as described and the crane movements are not stopped, the system is not working properly. The malfunction shall be corrected before operating the crane.

If the operator cannot see the load handling device approaching the boom nose, he shall have an assistant (signal person) watch the load handling device. The operator shall be prepared to stop the machine immediately should the LMI system not function properly as indicated by lighting the red warning light (4), sounding the audible alarm and locking the crane movements, hoist up, telescope out and boom down.

1. Check the anti two-block alarm light (4) and the audible alarm by performing one of the following tests:
 - a) By manually lifting the weight attached to the anti two-block switches. When the weight is lifted, the audible alarm should sound, the anti two-block alarm light (4) should light.
 - b) Slowly raise the main boom load handling device to create a potential two-block condition. When the load handling device lifts the weight, the audible alarm should sound, the anti two-block alarm light (4) should light and the motion of the load handling device should be stopped. Lower the load handling device slightly to eliminate this condition.
 - c) Slowly lower the boom to create a potential two-block condition. When the load handling device lifts the weight, the audible alarm should sound, the anti two-block alarm light (4) should light and the boom lowering function should be stopped. Lower the load handling device slightly to eliminate this condition.
 - d) Slowly extend (telescope) the boom to create a potential two-block condition. When the load handling device lifts the weight, the audible alarm should sound, the anti two-block alarm light (4) should light and the boom telescope out function should be stopped. Lower the load handling device slightly to eliminate this condition.
2. If the crane is equipped with a boom extension, repeat the test procedure for the boom extension anti two-block switch. Check that the display of the main boom length agrees with the actual boom length.
3. Check that the display of the main boom angle agrees with the actual boom angles.
4. Check that the display of the operating radius of the crane agrees with the actual radius.
5. Check the load display by lifting a load of known weight.

9 SERVICE AND MAINTENANCE

Daily maintenance of the load moment indicator consists of inspecting:

1. The electrical wiring connecting the various parts of the system.
If electrical wiring is damaged, it shall be replaced immediately.
2. If the insulation is worn on the length sensor cable or cable guides are damaged, these parts shall be replaced.
3. Check the anti two-block limit switches for freedom of movement.
4. The cable reel shall be under tension to operate properly.
5. Check the pressure transducers at the hoist cylinder(s) and the connecting hoses for oil leakage.
6. During battery replacement, use caution when opening the battery cover and transmitter to avoid damage to the gasket causing moisture ingress which could corrode the batteries and terminals. Inspect the gasket surface on the transmitter for nicks or other damages that may prevent the gasket from sealing. If it appears to be damaged, a replacement gasket should be installed.

Other than correcting the problems identified in the Malfunctions Table and replacing faulty mechanical parts and cables, no other repairs shall be performed by non expert personnel.

10 TROUBLESHOOTING

10.1 GENERAL

In case of a malfunction of the system, the display (1) will indicate a code that identifies the system malfunction.

The error codes listed in the Malfunction Table will identify various faults that can occur with the LMI. Following the Malfunction Table are pages which explain each fault and describe the action which shall be taken to correct the fault.

Faults within the electronic microprocessor shall be repaired by factory trained service personnel. When these faults occur, the competent service organization shall be contacted.

10.2 SERVICE SCREEN

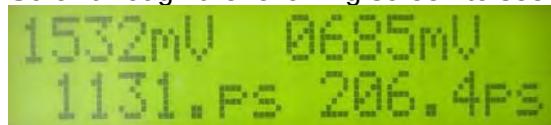
The procedure is described as follows:

To start function press  + 

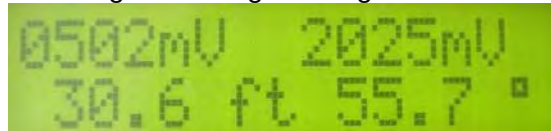


press  to select the limit marked at the upper left of the screen.

Scroll through the following screen to see piston and rod side voltages and pressures.



And length and angle voltages and measurements.



10.3 MALFUNCTION TABLE

Error Code	Error
E01	Fallen below the radius or above angle range
E02	Radius range exceeded or fallen below angle range
E03	Boom position is out of the permissible working area
E04	Operating mode not existing
E05	Prohibited length range

NOTE:

If there is any Error Code displayed on the console which is not listed in the Malfunctions Table you shall call the Local Distributor.

10.4 OPERATING ERRORS

Malfunctions in the system which are caused by range exceeding or operating errors by the crane operator himself are indicated on the display together with an explanation. These error codes are E01, E02, E03, E04, and E05 and they can normally be eliminated by the crane operator himself.

Error Code	Cause	Elimination
E01	Fallen below the minimum radius or above the angle given in the load capacity chart due to luffing up the boom too far.	Boom down to a radius or angle given in the load capacity chart.
E02	The maximum radius or minimum angle given in the load capacity chart was exceeded due to luffing down the boom too far.	Boom up to a radius or angle given in the load capacity chart.
E03	Boom position is out of the permissible working area (over front).	Move boom back to the permissible working area. See lifting diagram in the load capacity charts.
E04	Operating mode switch in the console incorrectly set.	Correctly set operating mode switch to the code assigned to the operating mode of the crane.
	Operating mode is not permissible with the actual crane configuration, boom position or area definition.	Be sure crane is set up according to proper operating configurations.
E05	Boom was telescoped too far or not far enough, you may only operate up to a certain maximum or minimum boom length or with load curves for boom extension where you have to telescope the main boom to a certain length.	Telescope boom to correct length, given in the load capacity chart.
	Length sensor adjustment changed i.e. length sensor cable slid off the length sensor drum.	For elimination refer to service manual.



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