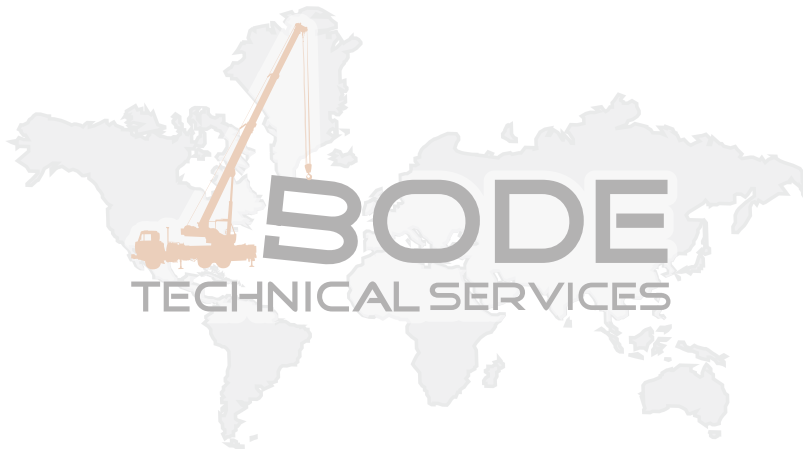


Operators Manual for:

LMS - Model AC 401

HRLAP-LOAD Indicator System



PAT-KRUEGER Corporation, Inc.

980 Industrial Court

Rockford, IL 61111-7512



INDEX

FOREWORD	1
INTRODUCTION	2
WARRANTY	3
OPERATION AND FUNCTION	4
Actual Load	4
Crane Information	5
Radius	5
Length	5
Angle	5
PUSH BUTTONS AND SELECTOR SWITCHES	5
Boom Angle Limit	5
Load Limit and Preset	6
Tare	6
Part of Line (POL) Selector Switch	7
Boom Configuration Selector Switch	7
R-L-A Selector Switch	7
Horn/A-2-B Button	7
By-pass Key Switch	7
Scan Length	7
Audible Alarm	8
SYSTEM OPERATION	8
Set-Up	8
Physical Check	9
Normal Operating Conditions	9
Two-Block During Operation	9
PREVENTIVE MAINTENANCE	10
Daily Inspection	10
Semi-Annual Inspection	11
Annual Inspection	11
ERROR CODES	12



FOREWORD

The purpose of this handbook is to provide the operator with information on the proper operation of the KRÜGER - LMS SERIES family of Indicating Systems.

The LMS SERIES family of Indicating Systems are designed to provide an audible and visual warning of an IMMINENT TWO-BLOCK condition with digital indication of LOAD ON THE HOOK, LOAD RADIUS, MAIN BOOM LENGTH and MAIN BOOM ANGLE. The LMS SERIES family of Indicating Systems can actuate an optional crane function shut off system.

These system are available in various combinations of data display. This manual covers all combinations currently available. Use only that portion of this manual which applies to your specific system.

WARNING

DO NOT CONSIDER THIS SYSTEM A SUBSTITUTE FOR GOOD JUDGEMENT, EXPERIENCE AND ACCEPTED SAFE CRANE OPERATIONAL PRACTICES.

THE CONTENTS OF THE LMS SERIES OPERATORS HANDBOOK AND THE CRANE MANUFACTURERS HANDBOOKS SHOULD BE READ AND THOROUGHLY UNDERSTOOD BEFORE ATTEMPTING TO OPERATE THE CRANE.

NOTE

This system utilizes a series of electrical and mechanical components and cannot be 100% fail safe.

This system should only be serviced by qualified individuals, either PAT-KRUEGER Corporation, Inc. service technicians or those who have received special training from Krüger GmbH or their authorized representatives.

To avoid damage and loss of warranty consideration, we recommend repair only be attempted by individuals with a strong electrical/electronic background.

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INTRODUCTION

The Krüger LMS SERIES family of Indicating Systems incorporate state-of-the-art design to provide components for integration into operating systems for most specific crane applications.

The compact display panel provides easy to read LCD displays, clear function identification and easy to operate controls. The display panel is connected to the junction box with a 26 pin corrosion proof quick disconnect coupling and cable.

The complete microprocessor based electronic is contained on a plug-in PC board, which allows ease of set-up and service. Using microprocessor techniques, special customer requests are programmed into the software without changing the hardware. Adjustments for specific crane parameters are made with a plug-in hand held terminal.

The LMS SERIES indicator covered by this publication provides indication of TWO-BLOCK, RADIUS, LENGTH, ANGLE, ANGLE PRESET and LOAD ON THE HOOK.

SPECIFICATIONS

Power Supply:	12VDC (24VDC) \pm 20%
Current Draw:	150 mA w/o warning lights and sensors (max. 500mA)
Working Temperature:	-22°F to 160°F (-30°C to + 70°C)
Relative Humidity:	95%/40°C
Enclosure:	IP65.
Display:	One or two 6 digit illuminated LCD with 1/2" characters
Accuracy of Display:	
Length indication:	\pm 2% of actual length, 0.5 ft. increments
Angle:	-2° to 0° of actual angle, 0.5° increments
Radius:	-0% to + 10% of actual radius, 0.5 ft. increments
Load:	-0% to +10% in increments best suited to the load display

FEATURES

Load Pre-warning:	90% of act. load
Load Warning:	100% of act. load
Angle Preset:	Both high and low boom angle adjustable from 0-90°
Sensor Circuit Monitoring:	All wiring for the sensors is monitored for open and short circuits



WARRANTY

THERE ARE NO WARRANTIES EXPRESS OR IMPLIED, MADE BY EITHER THE DISTRIBUTOR OR THE MANUFACTURER ON NEW KRÜGER EQUIPMENT, EXCEPT THE MANUFACTURER'S WARRANTY AGAINST DEFECTS IN MATERIAL AND WORKMANSHIP SET OUT BELOW.

NEW EQUIPMENT WARRANTY

The manufacturer warrants each new product made by the manufacturer to be free from defects in material and workmanship. At its option, all obligation and liability under this warranty is limited to free of charge replacement, repair or reconditioning, at its factory, of any part proven defective under normal use and service within twelve (12) months from the date of delivery. The system or component must be on record with the manufacturer as being delivered by the distributor. If the system or component is not on record as being delivered by the distributor, the warranty period will commence on the date of shipment from the factory. This warranty shall not include any transportation, customs or other charges or the cost of installation or any liability for the cost of installation or any other liability for direct, indirect or consequential damage or delay resulting from the defect. The manufacturer is not responsible for, and makes no warranties in connection with, the installation or servicing, use or operation of the product. Any repair, alteration or adjustment of the product or any substitution of parts without the express written consent of the manufacturer shall void this warranty. This warranty covers only the products of KRÜGER including products replaced, repaired or reconditioned by KRÜGER. The products of other manufacturers are covered only by such warranties as are made by their manufacturers.

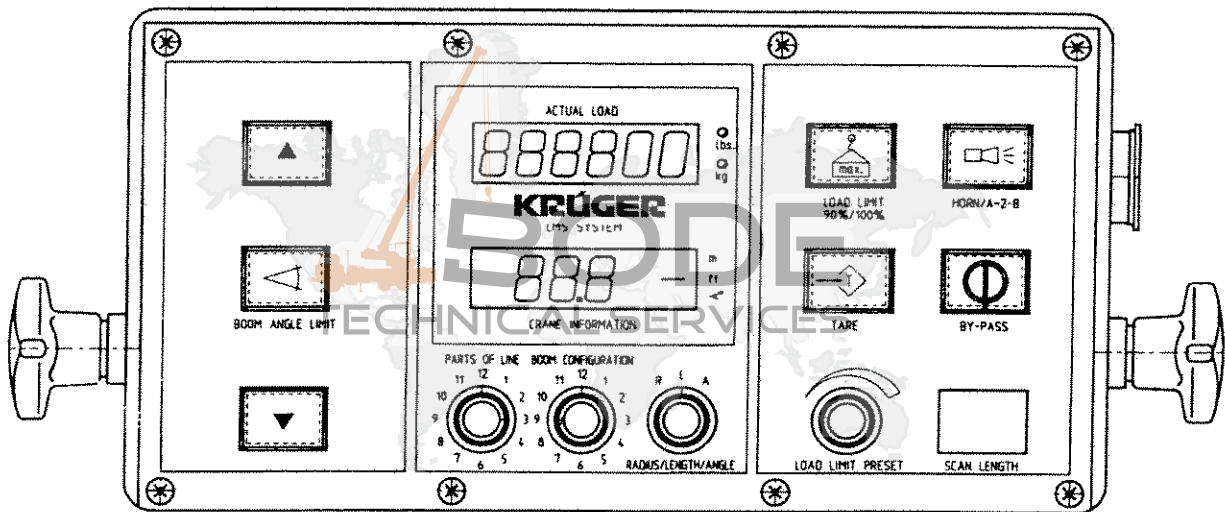
THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND OF THE OBLIGATIONS OR LIABILITY ON THE PART OF THE MANUFACTURER, AND KRÜGER NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR IT ANY OTHER LIABILITY IN CONNECTION WITH SUCH EQUIPMENT!

OPERATION AND FUNCTION

This section of the manual will provide the operator with information on the location and operation of the displays, push buttons, lights and selector switches of the LMS SERIES family of Indicating Systems.

The LMS SERIES family of Indicating Systems are designed to provide an audible and visual warning of an IMMEDIATE TWO-BLOCK condition; with digital indication of LOAD ON THE HOOK, LOAD RADIUS, MAIN BOOM LENGTH and MAIN BOOM ANGLE. The LMS SERIES family of Indicating Systems can actuate an optional crane function shut off system.

These systems are available in various combinations of data display. This manual covers all combinations currently available by describing the HRLAP-LOAD features and operation.



LCD DISPLAY

The two displays located in the center of the panel provide the operator with crane status.

ACTUAL LOAD

Load on the hook is displayed in the top LCD readout. The actual load on the main load line or the auxiliary load line, as selected with the BOOM CONFIGURATION selector switch, is displayed in either lbs. or kg.. The 6 digit display in increments from 10 to 100 lbs./kg. automatically switches to the increment of best resolution. An LED indicates that the indication is either kilogram (kg) or pounds (lbs.).

If no load sensor is installed for the selected boom configuration, the load display will indicate "0".

CRANE INFORMATION

The bottom display is used to display radius, length or angle indication which has been selected with the R-L-A selector switch.

RADIUS

The load radius for the main boom load radius is displayed in increments of 0.5 feet or 0.5 meter. When the boom configuration selector is in an attachment configuration, the radius displayed is for the attachment. A cursor - in the display window indicates either Feet or meter indication.

LENGTH

The actual length of the main boom only is displayed in increments of 0.5 feet or 0.5 meter for hydraulic machines. On lattice boom cranes the boom length selected with the scan feature is displayed. A cursor - in the display window indicates either Feet or meter indication.

ANGLE

The Angle of the main boom is displayed in 0.5 degree increments. A cursor - in the LCD display window is shown at the symbol < when the angle is displayed.

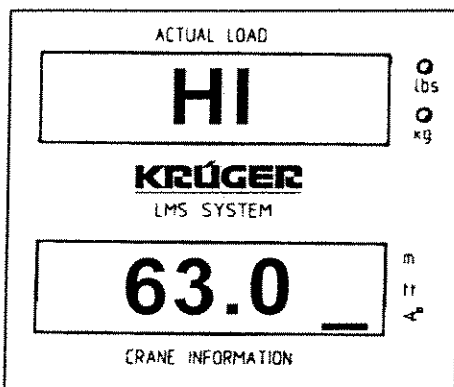
PUSH BUTTONS AND SELECTOR SWITCHES

BOOM ANGLE LIMIT

The series of three (3) buttons is used to set the high and low boom angle limits of operation and provide visual warning that a preset limit has been exceeded.

The two BLUE angle preset buttons are used to perform the following functions:

1. Recall and display the existing preset values
To display an existing value push either the UP or DOWN button. If the UP button is pushed the LCD display will change to:



The angle will be displayed for approximately 5 seconds, then return to the data displayed previously.

2. Change the existing stored values.

To change existing values proceed as follows: Push either the UP or DOWN BLUE button to display the currently stored angle preset value. To increase the stored value push the UP button.





To decrease the stored value push the DOWN button.

The display will return to the previous data after 5 seconds from the last change.

NOTE

Angle preset values can be displayed or changed with the R-L-A selector switch in any of the positions.

3. To reset the system after an error code is displayed.
Correct the condition indicated by the error code, then simultaneously push BOTH BLUE buttons. The system will display the crane information indicated by the selector switches. Holding the buttons too long will cause the system to display CHANNEL DATA. To eliminate this display PUSH and HOLD the RED HORN BUTTON, then PUSH the BLUE DOWN BUTTON. This will create a system reset.

The RED warning light “BOOM ANGLE LIMIT” and the audible alarm come on when the actual angle values exceed the preset values.

LOAD LIMIT AND PRESET

With the LOAD LIMIT PRESET any desired value for a load limit can be set. To display the load preset, push the RED LOAD LIMIT button. After releasing the LOAD LIMIT push button, the actual load will be displayed.

Until the LOAD LIMIT push button is pushed again, the previously set load limit value remains unchanged, even if someone unintentionally turns the LOAD LIMIT PRESET knob or the ignition is turned off.

To set a load limit value push the LOAD LIMIT button and hold down while rotating the LOAD LIMIT PRESET knob until the desired value is shown in the ACTUAL LOAD display.

The LOAD LIMIT push button is also a warning light, which gives an intermittent visual signal at 90% of the preset load limit value and a permanent visual signal at 100% of the preset load limit value.

TARE

To zero out unwanted loads, such as hook blocks, slings, etc., press the GREEN TARE button. The ACTUAL LOAD display will show zero (0). When the TARE button is pushed the button is lit, which gives a visual indication that the tare feature is being utilized.

When pushed again the TARE button light goes off and the load display shows the actual load.

NOTE

Maximum tare range is 100%. The load limit preset value is not affected by the tare feature.



PART OF LINE (POL) SELECTOR SWITCH

This selector switch must be positioned to agree with the actual parts of line reeved on the hookblock. The displayed load indication is directly affected by the position of the selector switch. Twelve positions can be selected either for odd POL (1;2;3;4...) or for even POL (2;4;6;8...). The load display will display nothing for POL selections not used on the 12 position selector.

BOOM CONFIGURATION SELECTOR SWITCH

This selector switches between the various boom configurations, which have been programmed. A decal on the panel housing advises the operator of the machine configurations that have been programmed. A maximum of 12 different configurations can be programmed.

If an unprogrammed position is selected ERROR CODE :01 will be displayed. To correct select another position on the Boom Configuration Selector Switch.

R-L-A SELECTOR SWITCH

The selector switch RLA, switches the displayed values in the "Crane Information" LCD readout, from radius (R) to length (L) and angle (A) respectively.

HORN/A-2-B BUTTON

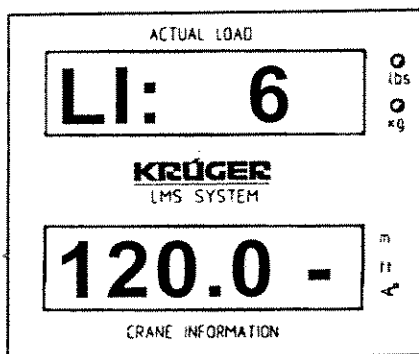
If the A-2-B circuit is deactivated (open) the warning light "Horn/A-2-B" comes on and the shut off relay (in the junction box) is utilized to stop specific crane functions, if the machine is equipped with an optional crane function shut off system. The shut off function can be by-passed using the momentary "By Pass" key switch in the panel. If the A-2-B switch is activated and the "By Pass" key switch is used, the A-2-B warning light will remain on until the pending 2-Block condition ceases.

BY-PASS KEY SWITCH

The optional crane function shut off can be by-passed using the momentary "By Pass" key switch in the panel.

SCAN LENGTH

This feature is only provided for systems installed on lattice boom cranes. The operator must select the main boom length that is installed on the crane. To use this feature, rotate the R-L-A selector switch to the length (L) position. Press and release the SCAN LENGTH button. The LCD display will change to:



The top display is a length index table. The lower display indicates the programed main boom length associated with the index.

To change the boom length press and release the UP or DOWN arrow button, used to change the boom angle pre-set, until the desired boom length is displayed in the lower display.

The display will return to the previous data 5 seconds after the last change is made.



AUDIBLE ALARM

Integrated into the panel is an electronic beeper which is activated by:

1. Open A-2-B circuit
2. If the preset Hi Lo angle limits are reached
3. The preset load limit value is reached

The audible alarm can be silenced by pushing the button Horn/A-2-B. The audible alarm will automatically be reactivated for all three functions after leaving the limited values for angle, load preset or pending two-block condition.

Selector Kg/Lbs. and m/ft.

The selector switch to display the readout in metric or U.S. values is inside the panel housing. Switching the selector also changes the cursor position for both LCD displays to appropriate values.

SYSTEM OPERATION

SET UP

This section will provided a step by step sequence of start up and operation of the LMS SERIES of Indicating Systems.

1. Install jumper cable or dummy plug in the appropriate receptacles at the boom tip and attachment(s) for the machine configuration being used.

The dummy plug is only used if the machine is equipped with two (2) winches and two (2) or more A-2-B switches.

Install the dummy plug only if a single A-2-B switch is being employed, with this type machine configuration.

2. Install counterweight(s) on A-2-B switches to be checked.

CAUTION

THE LENGTH OF THE CHAIN IS IN ACCORDANCE WITH HOOK SPEED AND SENSITIVITY OF THE OPTIONAL SHUT OFF SYSTEM AND SHOULD NOT BE SHORTENED OR A POSSIBLE TWO-BLOCK CONDITION COULD RESULT PRIOR TO ACTUAL FUNCTION SHUT OFF.

NOTE

With even parts of hoist line, the counterweight should be attached to the dead end line.



With odd parts of hoist line, the counterweight should be attached to the slowest speed line.

3. Start the crane according to the crane manufacturer instructions.
4. At start up the LMS SERIES Indicating System automatically begins a system self test. During this cycle the RED Boom Angle Limit, Load Limit, Horn/A-2-B and GREEN Tare lights are lit momentarily and the audible alarm beeps briefly.
5. Check the High and Low Boom Angle preset values stored in the system by depressing either the UP or DOWN buttons. Follow instructions in the previous section to reset the stored values, if a change is required.
6. Check the LOAD LIMIT value stored in the system. Follow instructions in the previous section to reset the stored values, if a change is required.

PHYSICAL CHECK

This portion of the check out must be performed with extreme care and can be by passed if the crane operator is sure that the shut off system is operational.

7. With the boom at a low angle, lift the A-2-B counterweight by hand to simulate a two-block condition. The following should occur:
 - * RED "HORN/A-2-B" light is ON.
 - * Audible alarm sounds. Push "HORN/A-2-B" button to shut off horn.
 - * If so equipped, the optional shut off system is deactivated and the following functions are inoperative:
 - * Hoist up both main and auxiliary
 - * Boom lowering
 - * Telescope out (Hydraulic Machine Only)

Begin Safe operation of the crane. PROCEED WITH APPROPRIATE CARE.

NORMAL OPERATING CONDITIONS

During normal crane operation the Operating Panel will

- * Have the RED "Horn/A-2-B" light OFF
- * Have the audible alarm SILENT
- * If so equipped, the Crane Function Shut Off System is activated and all crane functions are operational.

TWO-BLOCK DURING OPERATION

When a two-block condition occurs during operation the panel will display the following:

- * The RED "Horn/A-2-B" light is ON
- * The audible alarm SOUNDS. It can be silenced by pushing the RED "Horn/A-2-B" button.



- * If so equipped, the Crane Function Shut Off System is deactivated and the following crane functions are inoperative:
 - * Hoist up both main and auxiliary
 - * Boom lowering
 - * Telescope out (Hydraulic Machine Only)

TO CORRECT:

Lower the load, Raise the boom or Retract the boom. Use the crane function which best suits the immediate situation and job site conditions.

When the two-block condition has been corrected:

- * The RED "Horn/A-2-B" light is "OFF"
- * The audible alarm is silent
- * The horn is reset, if it had been silenced previously.

Return to normal crane operation. PROCEED WITH APPROPRIATE CARE.

PREVENTIVE MAINTENANCE

The LMS SERIES Indicating System uses electronic, electrical and mechanical components. The system should only be serviced by PAT-KRUEGER Corporation, Inc. Service Technicians or those who have received special training from Krüger GmbH or their authorized representatives.

The operator retains the responsibility for inspection of the system components. To insure that no external damage will affect proper system operation inspections should include:

DAILY INSPECTION

1. Inspect all anti-2-block switches for free movement of the lever arm that supports the counterweight.
2. Counterweights should be free of obstructions in the operating position and installed on all switches where a load line is being used for a lift.
3. Insure that the anti-2-block portion of the system is properly wired at the boom nose.
 - A. Install JUMPER CABLE from auxiliary attachment to the boom nose receptacle, if used.
 - B. Install DUMMY PLUG in the boom nose receptacle, if the machine is equipped with two (2) winches and NO auxiliary attachment is being used.
4. Check for proper connection of the Anti-Two-Block cable at the clamping block at the boom head.
5. Closely inspect the cable between the Anti-Two-Block switch at the boom head and the cable reel on the boom base section for cuts and/or abrasions.



6. Check anti-2-block operation. Individually lift each counterweight. The RED - HORN/A-2-B light on the control panel should be lit and the audible alarm should sound. If equipped with an optional Crane Function Shut Off System, this system should be deactivated.
7. Report all damage to your supervisor for appropriate action

SEMI-ANNUAL INSPECTION

In addition to the requirements of the DAILY INSPECTION the LOAD INDICATING portion of the system should be tested.

Load Indicating system testing should be performed by a Service Technician of PAT-KRUEGER Corporation, Inc. or someone who has received special training by Krüger GmbH or their authorized representatives.

1. All functions of the System will be inspected for continued compliance with manufacturer operational specifications.
2. Load tests of a minimum two (2) separate capacity chart ratings shall be performed.
3. Calibrate to meet Current SAE Specifications, if necessary
 - J375 Apr85 Radius-of-Load or boom angle indicating system
 - J376 Apr85 Load indicating devices in lifting crane service
 - J1180 Oct80 Telescopic boom length indicating system
 - J1305 Jun87 Two-block warning and limit system

ANNUAL INSPECTION

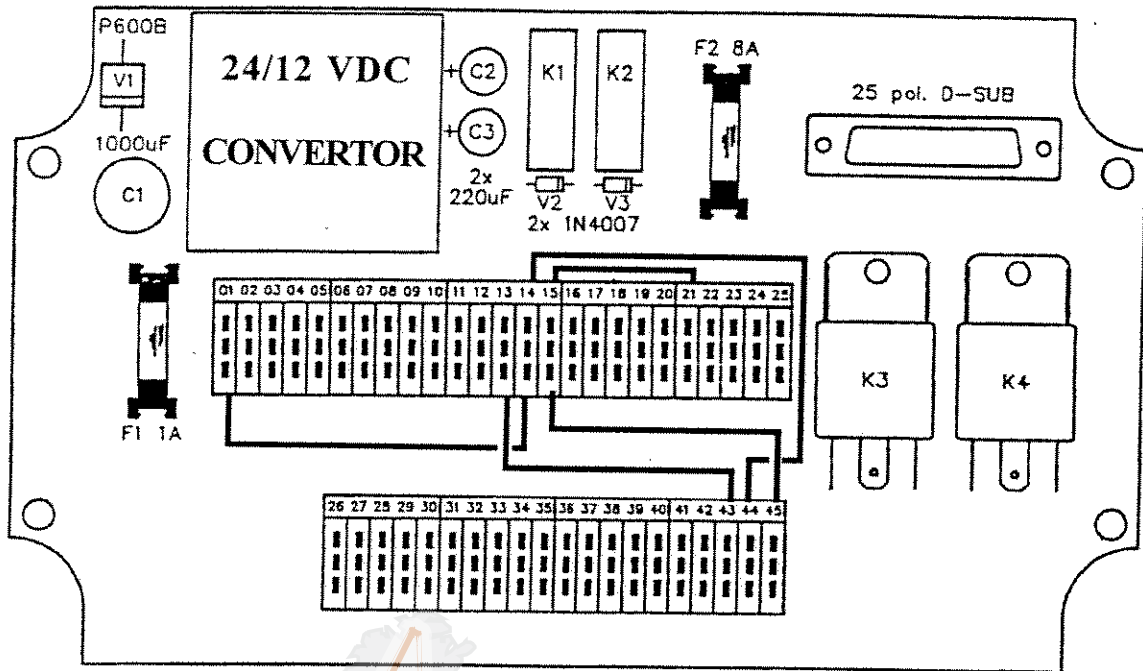
Certification by an authorized Testing Company shall include calibration verification, as required by applicable laws.



ERROR CODES

The following error codes may appear on the display panel. When calling for assistance please advise the error code that appears on the panel.

<u>CODE NO.</u>	<u>DESCRIPTION</u>
01	POSITION ON SELECTOR NOT PROGRAMMED
60	ADC FAULT
61	LOAD SENSOR OUTPUT MAIN TO LOW
62	LOAD SENSOR OUTPUT MAIN TO HIGH
63	LENGTH SENSOR OUTPUT TO LOW
64	LENGTH SENSOR OUTPUT TO HIGH
65	ANGLE SENSOR OUTPUT MAIN TO LOW
66	ANGLE SENSOR OUTPUT MAIN TO HIGH
67	LOAD SENSOR OUTPUT AUX TO LOW
68	LOAD SENSOR OUTPUT AUX TO HIGH
71	ANGLE SENSOR OUTPUT JIB TO LOW
72	ANGLE SENSOR OUTPUT JIB TO HIGH
79	ANALOG GROUND
80	EPROM CHACKSUM ERROR
90	MICROPROCESSOR FAULT
93	CONVERSION FACTOR
94	ILLEGAL INTERRUPT - VECTOR
95	TIMER OVERFLOW
96	EEPROM FAULT
97	TIMER FAULT
98	RAM ADDRESS ERROR
99	RAM DATA ERROR



JUNCTION BOX - PC BOARD

This picture of the junction box PC board is shown here to indicate to the installer and operator the location of the internal jumpers installed prior to shipment. **DO NOT REMOVE** these jumpers without authorization from PAT-KRUEGER Corporation, Inc.

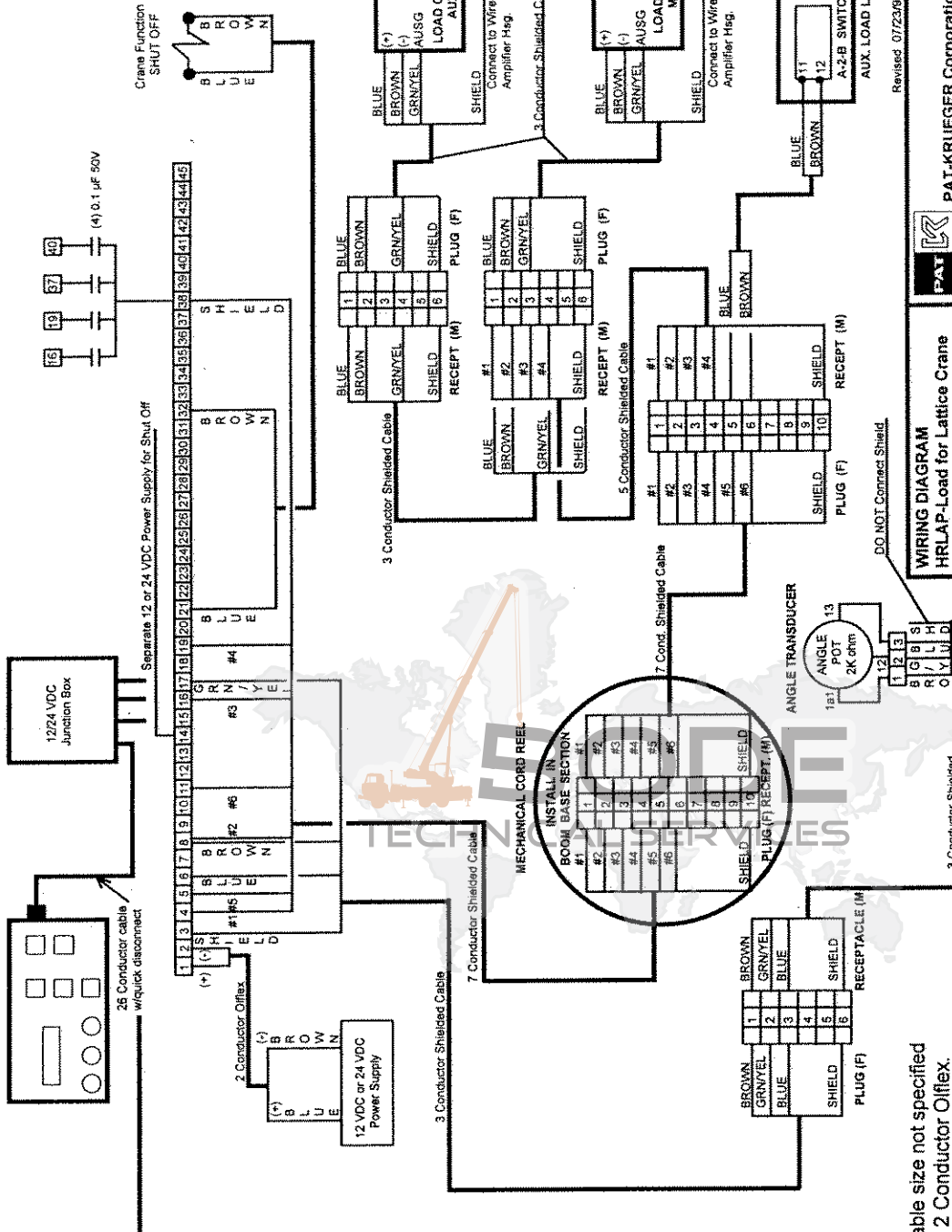
NOTE

Any change to these jumpers may affect the proper operation of the optional Crane Function Shut Off System.

The lower terminal strip is shown out of position for purposes of illustration.

The K3 and K4 relays are not installed in each junction box. They are used with an optional Positive Ground Crane Function Shut Off system or where the optional Crane Function Shut Off system requires an amperage greater than 8 Ampere to operate properly.

1	12/24 VDC Input
2	White + Brown + Green
3	0 VDC
4	Green or Clear (Shield)
5	+12 V Fused
6	+12 V Fused
7	+5 V
8	0 V (Analog)
9	0 V (Analog)
10	Red/Blue - Brown/Blue
11	Red/Blue
12	White/Green
13	White/Green
14	Yellow/Brown
15	Black
16	Lead Cell Main
17	Angle Signal
18	Length Signal
19	Load Cell Aux.
20	White/Pink
21	White/Gray
22	White/Yellow
23	White/Yellow
24	Brown/Green
25	Gray/Brown
26	0 VDC
27	0 VDC
28	0 VDC
29	0 VDC
30	0 VDC
31	0 VDC
32	0 VDC
33	0 VDC
34	0 VDC
35	0 VDC
36	0 VDC
37	0 VDC
38	0 VDC
39	+12 V Fused
40	0 V (Analog)
41	0 V (Analog)
42	0 V (Analog)
43	0 V (Analog)
44	0 V (Analog)
45	0 V (Analog)



NOTE: If cable size not specified
use 2 Conductor Olflex.

WIRING DIAGRAM
HRLAP-Load for Lattice Crane
J.G.

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PAT-KRUEGER Corporation, Inc.
980 Industrial Ct. Rockford, IL 61111-7512

