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OPERATORS MANUAL  
FOR  
MARK 3E/1 - MODEL AE 201  
VERSION 1.0

LOAD MOMENT INDICATOR  
FOR  
HYDRAULIC OPERATED CRANES

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## FOREWORD

The purpose of this manual is to provide the operator with information on start-up, operation and preventative maintenance of the KRÜGER Mark 3E/1 Load Moment Indicator System.

This system was designed to aid the operator in recognizing conditions where structural failure or loss of stability of the crane might result.

The KRÜGER Mark 3E/1 Load Moment System will sense and alert the operator to imminent overload and/or two-block conditions. The Mark 3E/1 System can actuate an optional crane function shut-off system.

### WARNING

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

THE CONTENTS OF THE KRÜGER MARK 3E/1 OPERATORS HANDBOOK AND THE CRANE MANUFACTURERS HANDBOOKS SHOULD BE READ AND THOROUGHLY UNDERSTOOD BEFORE ATTEMPTING TO OPERATE THE CRANE.

CERTAIN PROGRAMMING STEPS MAY BE NECESSARY BEFORE EACH LIFT. IF INCORRECTLY PROGRAMED, THE SYSTEM WILL NOT SENSE AND ALERT THE OPERATOR TO AN IMMINENT OVERLOAD CONDITION.

### NOTE

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

This system should only be serviced by qualified individuals, either the Service Technicians of Krüger Germany or those who have received special training and authorization from Krüger Germany.

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

## INTRODUCTION

The KRÜGER Mark 3E/1 Load Moment Indicator System is an electronic/mechanical sensing system designed to indicate the approach to maximum rated lifting capacity of the crane and/or an imminent two-block condition.

When properly installed in conjunction with a crane function shut off system, the Mark 3E/1 Load Moment Indicator System prevents crane overload conditions from occurring and/or the hook block of the crane from coming into contact with the sheaves in the boom head.

The system consists of the following components:

- Display Panel
- Electronic Processor with shut off relays
- Spring-Operated Cable Reel with Angle and Length Sensors
- One or more Load Sensors - Hydraulic Pressure, Load Cell or Tensiometer
- Area Definition Sensors
- Anti-Two-Block Switch with Counterweight

By programming the unit, with information requested during the start up sequence, the system monitors and displays:

- Load Moment
- Actual Load on the Hook
- Boom Angle
- Boom Length
- Boom Radius
- Maximum Load allowed for Crane Configuration
- Service Information

The system continually monitors output from the force and configuration sensors. It integrates the programmed inputs from the display panel switches, force sensors and configuration sensors and compares the summary of this information to the manufacturers capacity charts, which are stored in the central processor.

The resulting data is displayed for the operator. If an overload and/or imminent two-block condition is determined, the operator is warned with an audible and visual alarm. If the machine incorporates a crane function shut off system, the crane functions are disabled until the overload or imminent two-block condition is corrected.

## WARRANTY

**THERE ARE NO WARRANTIES EXPRESS OR IMPLIED, MADE BY EITHER THE MANUFACTURER OR THE DISTRIBUTOR 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 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 !**

## SYSTEM COMPONENTS

This section will identify and describe each component used in the KRÜGER Mark 3E/1 Load Moment Indicator System.

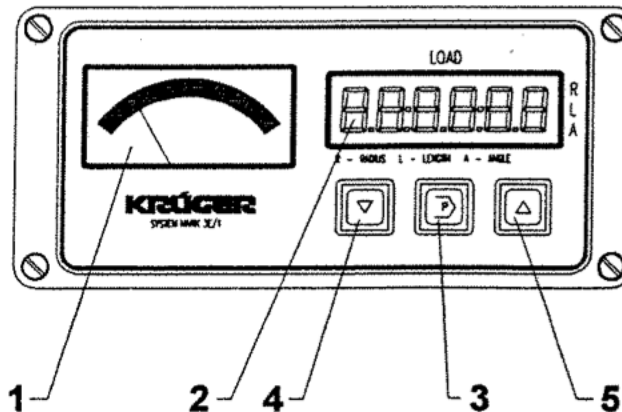
### CAUTION

READ THIS SECTION CAREFULLY TO ENSURE THAT PROPER PROGRAMMING WILL BE ACCOMPLISHED DURING THE START UP PROCEDURE.

### CONTROL PANEL

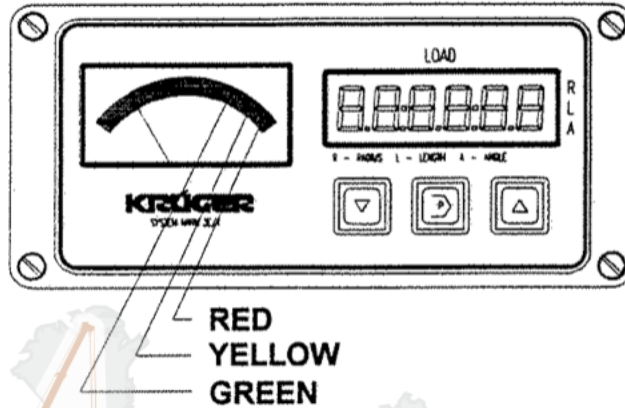
This unit is located in the operators cab. It consists of

- 1: Load Moment Meter
- 2: LC-Display of Crane Information
- 3: "PROGRAM" Button
- 4: "SELECT" Button
- 5: "MAX. LOAD" Button



### 1. Load Moment Meter

The cranes actual loading as a percentage of permissible load for the current crane configuration capacity chart is displayed on an analog scale.



#### GREEN = SAFE WORKING AREA

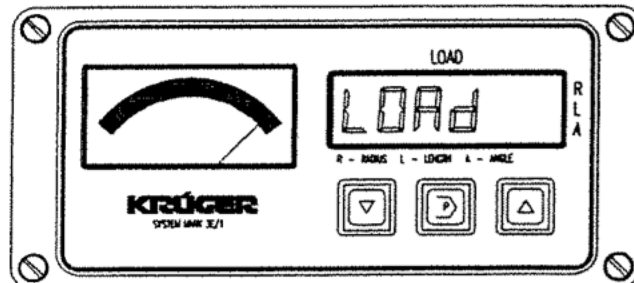
The actual load moment; consisting of the actual hook load, attachments, main boom weight and dynamic forces, is less than 90% (or a value dictated by local Codes) of the capacity chart load.

#### YELLOW = CAUTION


The actual load is approaching the capacity chart load


#### RED = MAXIMUM LOAD MOMENT CONDITION

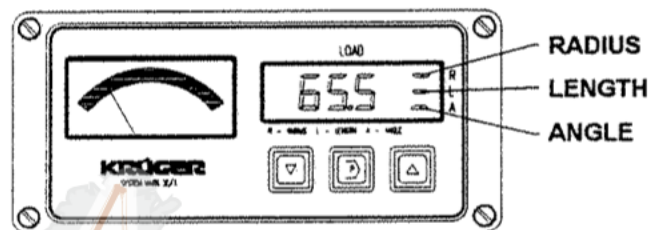
The actual load is equal to or greater than the capacity chart load or more than 100% (or a value dictated by local Codes). Simultaneously the horn is activated and the flashing LC-Display will show:



## 2. LC-Display of Crane Information

The display shows set-up information and operator instructions, which the operator responds to during the START UP procedure. After finishing the START UP procedure; the actual load is displayed continuously. By pushing the "SELECT" Button  the display will also show boom radius, boom length and boom angle information. The information shown is indicated by a bar on the right of the display.

By pushing the "MAX. LOAD" Button  the flashing display will show the maximum load.



### NOTE

The decal on the top of the panel, e.g.

#### SYSTEM MARK 3E/1 VERSION 1.0

This LMI will display all values in FEET & LBS.

alerts the operator to the units of measure displayed, i.e. metric (t or kg and m) or US (pounds and feet)

**Actual Load:** The actual load on the hook, including other boom attachments, hook block(s), slings and the load. No bar on the display.

**Maximum Load:** The capacity chart load for the current conditions as programmed for the specific machine.

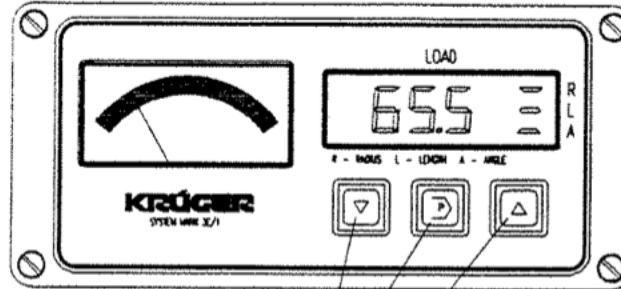
**Radius:** The actual radius as measured from the center of rotation to the center of the load (Bar on the display in the upper position indicating "R").

**Length:** The actual main boom length from the boom pivot pin to the head sheaves (Bar on the display in the center position indicating "L").

**Angle:** The actual angle of the boom base section, to the horizontal (Bar on the display in the lower position indicating "A").

If a failure of the system should occur or operating conditions exceed the programmed values, the display will provide basic information to assist in troubleshooting and/or correction of an operational problem.





- "SELECT" Button
- "PROGRAM" Button
- "MAX. LOAD" Button

**3. "PROGRAM" Button**



This button is used to confirm selections made by the crane operator to changes in machine configuration, part of line and winch selection.

**4. "SELECT" Button**



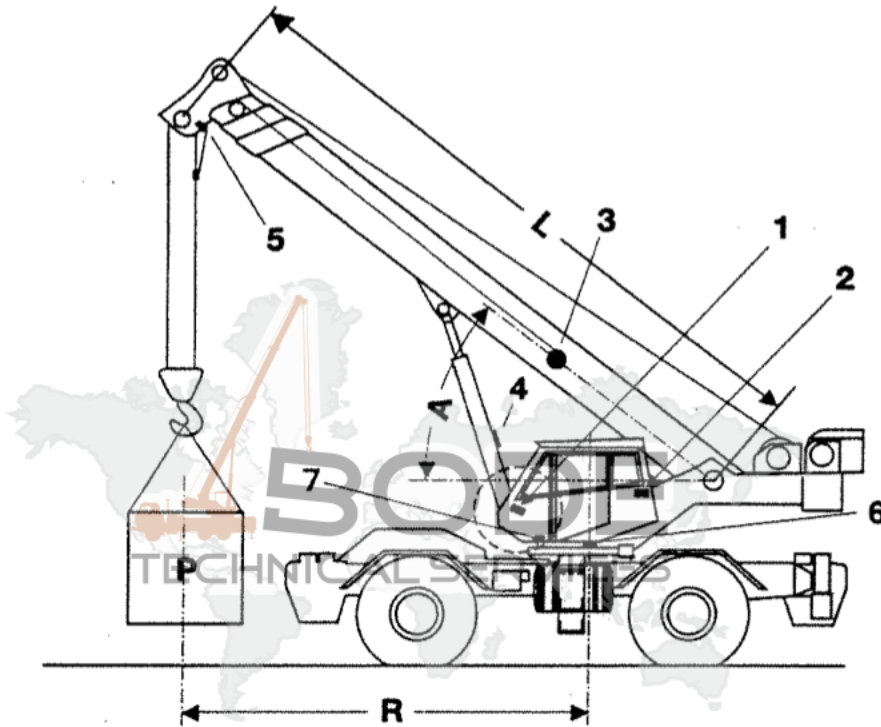
Used to move crane configuration information through the available data, to set parts of line reeved on the boom or jib and to select the programmed main or aux. winch line pull. This button is used to switch between an operational error message and the normal operating display information to assist in correcting the problem that caused the message to be displayed.

**5. "MAX. LOAD" Button**



Used to switch between the actual load and the maximum load indicated by flashing digits.

**MARK 3E/1 LOAD MOMENT INDICATOR  
SYSTEM COMPONENT LOCATION  
AND CRANE DATA**



- 1. Control Panel
- 2. Central Processor
- 3. Cable Reel
- 4. Hydraulic Pressure Sensors
- 5. Anti-2-Block Switch
- 6. Area Definition Sensor(s)
- 7. Crane Function Shut Off - Magnet Valves

A: Boom Angle  
L: Boom Length  
R: Radius  
P: Load on Hook

## **CABLE REEL**

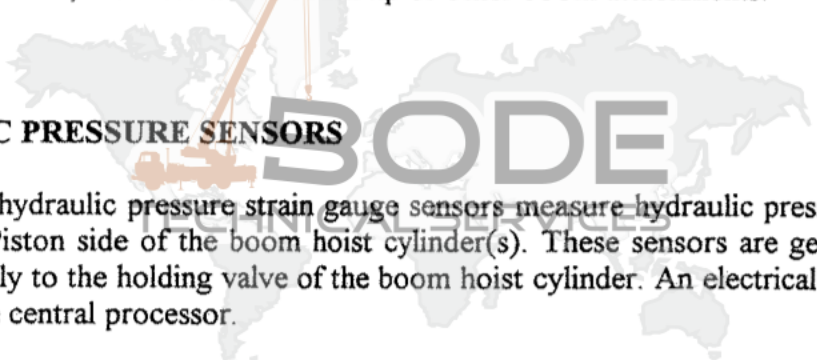
The cable reel, which is mounted on the boom base section of the crane, performs three (3) functions:

Built into the cable reel is a Length sensor. The cable attached to the boom tip drives a variable potentiometer as the boom is extended or retracted. The potentiometer sends an electrical signal to the central processor.

Also built into the cable reel is an Angle sensor. A potentiometer driven by a pendulum sends an electrical signal to the central processor as the boom is raised or lowered.

The cable used for length indication also carries the electrical signal for the A-2-B switch, mounted at the boom tip or other boom attachments.

## **HYDRAULIC PRESSURE SENSORS**



Two hydraulic pressure strain gauge sensors measure hydraulic pressure on the Rod and Piston side of the boom hoist cylinder(s). These sensors are generally mounted directly to the holding valve of the boom hoist cylinder. An electrical signal is carried to the central processor.

## **CENTRAL PROCESSOR**

This unit is located on the crane structure, inside or outside of the crane cab. This box contains the systems processor; the terminals for connection of the various system components; the relays used for shut off; a voltage converter, if the crane system voltage is not 12 VDC and a load moment by-pass key switch.

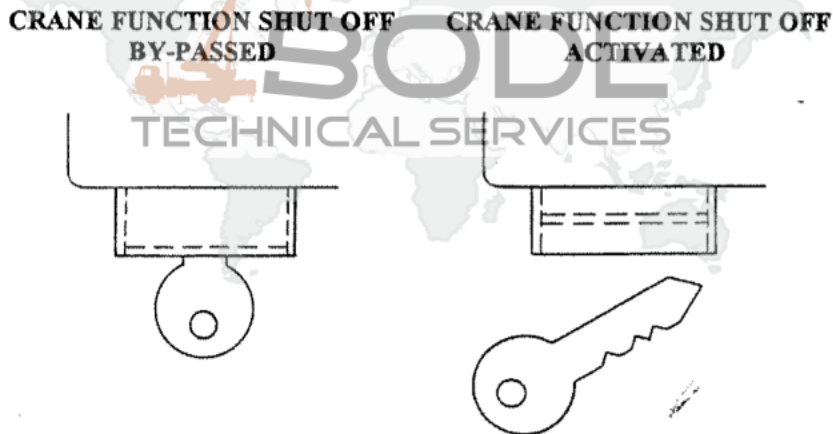
### **NOTE**

The LM by-pass key at the Central Processor will by-pass the Load Moment Shut Off system if installed and connected.

**WARNING**

THE LOAD MOMENT BY-PASS KEY SWITCH SHOULD BE USED WITH DISCRETION AS UNWARRANTED USE OF IT TO OVERRIDE THE CRANE FUNCTION SHUT OFF SYSTEM COULD RESULT IN LOSS OF LIFE, DESTRUCTION OF PROPERTY AND IRREPARABLE DAMAGE TO THE CRANE. THE KEY SWITCH CAN BE USED IN OVERRIDING THE SYSTEM IN CASE OF EXTREME EMERGENCY. SOUND JUDGEMENT MUST BE USED WHEN USING THE BY-PASS KEY.

WHEN THE KEY HAS BEEN REMOVED FROM THE KEY SWITCH, THE CRANE FUNCTION SHUT-OFF SYSTEM IS ACTIVATED TO PROVIDE PROTECTION. TO REMOVE THE KEY, PUSH IT ON THE SWITCH AND ROTATE THE KEY CLOCKWISE. IF THE KEY CANNOT BE REMOVED, THE CRANE FUNCTION SHUT-OFF SYSTEM IS BY-PASSED AND SYSTEM PROTECTION IS LOST.



Push tile of the key switch is flush with the top of the mounting ring. Key CANNOT be removed in this position.

Push tile of the key switch is recessed below the top of the mounting ring. Key SHALL be removed in this position.

**NOTE**

The custody of this key is to be controlled by the distributor/customer and/or his agents and such policies are not dictated or controlled by Krüger Germany or its agents.

## AREA DEFINITION SENSORS

One or more roller switches are installed on the crane structure. In combination with cams these sensors provide data on the relative position of the crane upper structure to the carrier / lower frame as described on the capacity chart.

During crane operation these sensors provide data to the Central Processor for different working areas and select the proper capacity chart for safe operation.

### NOTE

If a roller switch fails, the unit automatically switches to the lowest rating of the capacity chart in use by the Central Processor.



## ANTI-2-BLOCK SWITCH AND COUNTERWEIGHT

This switch is mounted on the main boom tip and on all other boom attachments, where a load line is used. The switch is activated by a counterweight, suspended by chains or ropes.

When the counterweight is lifted by the hook block, the audible/visual warning is activated. If the crane is equipped with a crane function shut off system, the shut off system is activated.

### CAUTION

**THE LENGTH OF THE CHAIN OR ROPE IS IN ACCORDANCE WITH HOOK SPEED AND SENSITIVITY OF THE 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 hoisting line, the counterweight should be attached to the slowest speed line.

**CRANE FUNCTION SHUT OFF SYSTEM**

This is an optional system. It can be of crane manufacturer design or operate through the use of KRÜGER Magnet Valves. The basic function of a Shut Off System is to disable the following crane functions:

- MAIN HOIST UP
- AUXILIARY HOIST UP (if machine is so equipped)
- BOOM DOWN
- TELESCOPE OUT

## START UP PROCEDURE

The Mark 3E/1 Load Moment Indicator System is manufactured and programmed for installation on a specific crane, as the capacity chart data is crane specific. All capacity chart instructions imposed by the crane manufacturer have been incorporated into the Mark 3E/1 system.

### WARNING

**CERTAIN PROGRAMMING STEPS MAY BE REQUIRED BEFORE EACH LIFT. IF INCORRECTLY PROGRAMED, THE SYSTEM WILL NOT SENSE AND ALERT THE OPERATOR TO AN IMMINENT OVERLOAD CONDITION.**

**THE CONTENTS OF THE MARK 3E/1 OPERATORS MANUAL AND THE CRANE MANUFACTURERS HANDBOOKS SHOULD BE READ AND THOROUGHLY UNDERSTOOD BEFORE ATTEMPTING TO OPERATE THE CRANE.**

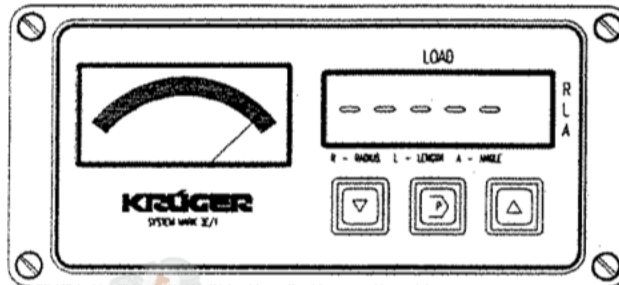
Prior to Start Up of the Mark 3E/1 Load Moment Indicator System inspect the crane for proper installation of:

- A: Counterweight(s) are attached to the Anti-2-Block switches for all load lines being used in the lift.
- B: Install the Jumper Cable at the boom nose receptacle, if auxiliary boom attachments are used.
- C: Install the Dummy Plug in the boom nose receptacle, if the machine is equipped with two (2) winches and NO auxiliary attachments are being used.

The following steps are required to set-up the Mark 3E/1 Load Moment Indicator System for proper operation.

## 1. POWER TO THE SYSTEM

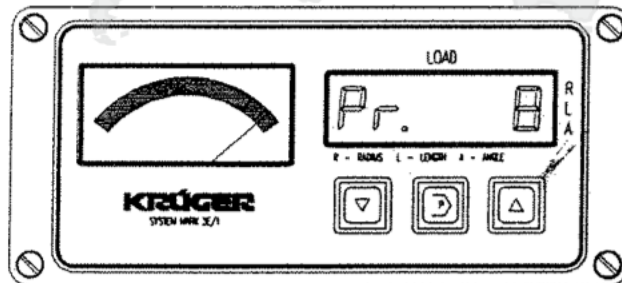
The Mark 3E/1 is normally wired to the crane ignition switch. Start up the crane following the crane manufacturers instructions. After power is applied to the system, the system will run a self-checking test for about 2 seconds, the audible alarm will be on for the same time and the display shows:




The LM Meter needle is in the Red.


## 2. SELECTING THE CRANE CONFIGURATION

After pressing the "PROGRAM" Button , the display shows the previously selected crane configuration by a corresponding program number.



The LM Meter needle is in the Red.


If the operator is sure the machine configuration has not changed since originally programmed, he can press the "PROGRAM" Button  to confirm the selected configuration.

If the machine configuration has changed the operator should press the "SELECT" Button  to search the memory for the appropriate crane configuration program number. If this button is held down for more than a second, it will "automatically repeat" very quickly.



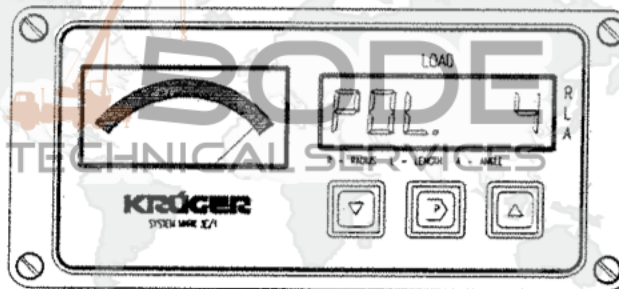
**WARNING**


**CORRECT PROGRAMMING OF THE ACTUAL CRANE CONFIGURATION MUST BE PERFORMED BY THE OPERATOR OR A POSSIBLE INCORRECT RATING CONDITION WILL RESULT.**



Press "PROGRAM" Button  to confirm the selected configuration

**3. SELECTING PARTS OF LINE**

The display now shows the previously selected parts of hoisting line.



If the operator is sure the parts of line have not changed since originally programmed, he can press the "PROGRAM" Button  to confirm the selected parts of line.

If the parts of line have changed the operator should press the "SELECT" Button  to set the appropriate parts of line. Press the "PROGRAM" Button  to confirm the selected parts of line.

**NOTE**

The system takes into consideration the maximum single line pull of the selected winch. If the parts of line value set is lower than the actual parts of line installed on the boom, the system may de-rate the maximum capacity.

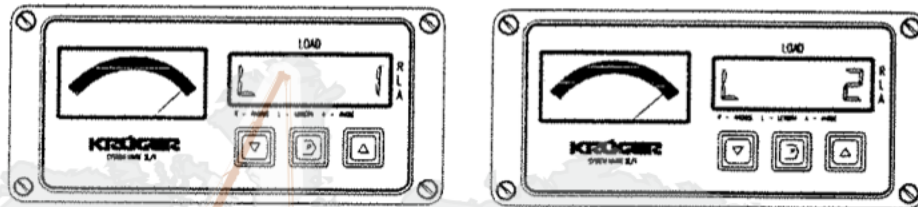
If "0" is set, the system will ignore the parts of line.

#### 4. SELECTING THE WINCH

The display now shows the previously selected winch.

**NOTE**


This feature will only apply when the machine is equipped with an Auxiliary Winch and has a different line pull than the Main Winch.





MAIN WINCH

AUX. WINCH

TECHNICAL SERVICES

If the operator is sure the winch has not changed since originally programmed, he can press the "PROGRAM" Button  to confirm the winch.

If the winch has changed the operator should press the "SELECT" Button . Press the "PROGRAM" Button  to confirm the selected winch.

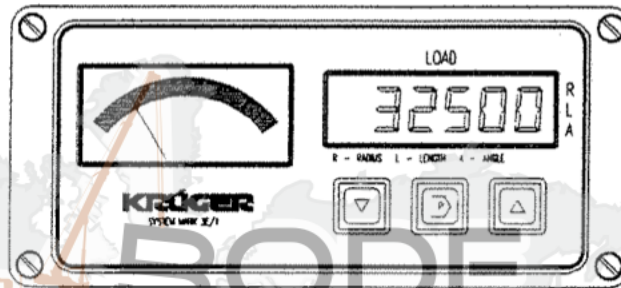
The display now will change to the operating mode. The LM Meter needle returns to the green area.

You are ready to make your lift using the Mark 3E/1 Load Moment Indicator System. Proceed with appropriate care.

## DURING OPERATION


### 1. INDICATION OF LOAD MOMENT AND ACTUAL LOAD

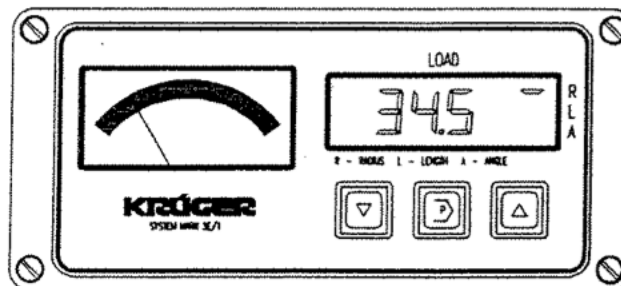
While the crane is in normal operation, The Mark 3E/1 display panel will continuously display updated information concerning Load Moment and Actual Load.




See decal at the top of the display panel, if the system is set to the metric (t or kg and m) or US (pounds and feet) unit of measure.

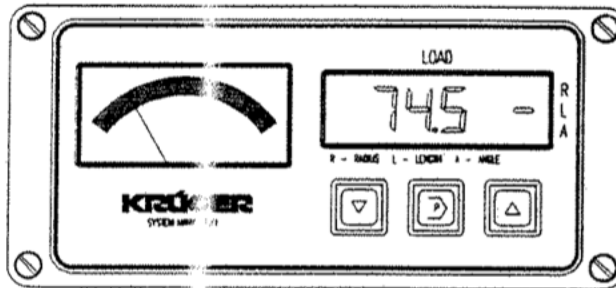
### 2. INDICATION OF RADIUS

To change the LC-Display from Actual Load to Radius, press the "SELECT" Button .



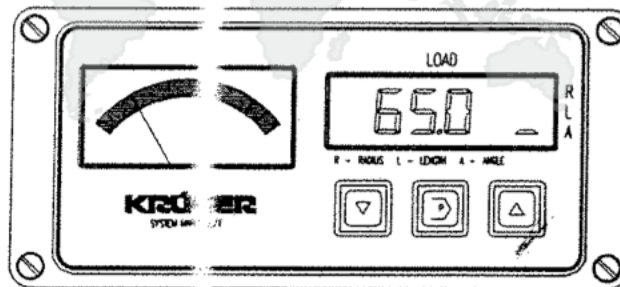
### 3. INDICATION OF BOOM LENGTH

To change the LC-Display from Radius to Length, press the "SELECT" Button .




### 4. INDICATION OF BOOM ANGLE


To change the LC-Display from Length to Angle, press the "SELECT" Button .




### 5. INDICATION OF MAXIMUM LOAD

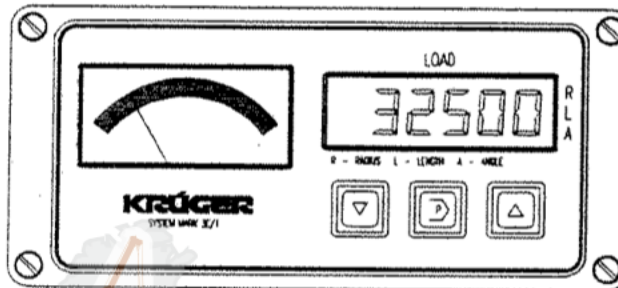
To change the display to maximum load, press the "MAX. LOAD" Button .

The display starts to flash indicating the maximum capacity chart load for the current conditions.

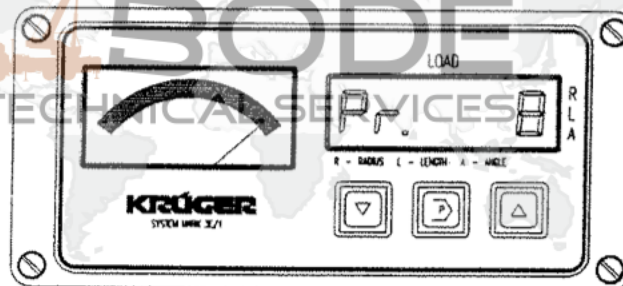
By pressing the "MAX. LOAD" Button  again, the display will return to actual load.


## 6. PROGRAM CHANGE DURING OPERATION

Due to changing job conditions, it may be necessary to change the operational parameters for the crane configuration. This is accomplished using the "PROGRAM" Button  to begin the change sequence. From the display ...




press the "PROGRAM" Button . The display changes to ...



Use the "SELECT" Button  to change the configuration. Follow the "START UP PROCEDURE" instructions to program Parts of Line and Winch selection, if applicable, and to return to the operating mode.

## 7. OPERATING ERRORS

In case of an operating error the LC-Display of the Control Panel starts to flash and gives an indication either in plain language or in Error Code Numbers. These errors are normally caused by operation outside of the programmed machine capacity chart values or when actual machine configuration differs from the programmed configuration.

To monitor the actual conditions that have caused the error message to be displayed, push "SELECT" Button . This will change the display from the error message to the Actual Load, Radius, Length or Angle information. This can be compared to the crane manufacturer's capacity chart to assist the operator in selecting the safest method to correct the problem.

When the condition which caused the error message to be displayed is corrected, the system will automatically reset to the normal operating mode actual.

Unless otherwise noted, all these error messages are accompanied with the audible warning, if installed and properly connected. If the machine is equipped with a Crane Function Shut Off, the system will be activated and the crane functions are inoperable until the error is corrected.

#### APPROACHING TWO-BLOCK CONDITION



A-2-b

This error message is displayed at an approaching two-block condition.

This condition can generally be corrected by either lowering the hook or retracting the boom.

If the machine is equipped with an auxiliary winch, check the following:

- If no other attachment is in use, have you installed the dummy plug?
- If another attachment is installed, have you plugged in the second Anti-Two-Block Switch?

#### MAXIMUM CAPACITY



LOAD

This error message is displayed when the actual load exceeds the rated load, or because the selected parts of line are restricting the lifting capacity of the machine.

This condition should be corrected by reducing the load or operating at a shorter radius.

Change Parts of Line with the actual machine reeving.

## LOAD MOMENT SHUT OFF SYSTEM BY-PASSED

64PASS

This error message will be displayed when the Load Moment Shut Off is by-passed at the Central Processor. While all the other Operating Error messages are displayed at the appropriate times, the Crane Function Shut Off will have no effect on operation.

This condition will be corrected by following the instructions on the proper use of the LM By-pass Key switch. Refer to instructions on pages 10 and 11 of this manual.

E: 24

This error code number is displayed when the operator has lowered the boom to a position less than allowed by the crane manufacturer's angle/load capacity chart. This message can be expected when operating with the manual section extended and/or a Lattice Extension installed.

Compare the actual displayed boom angle to the crane manufacturer's capacity chart.

This condition should be corrected by raising or increasing the boom angle.

E: 25

This error code number is displayed when the operator has raised the boom to a position higher than allowed by the crane manufacturer's angle/load capacity chart. This message can be expected when operating with the manual section extended and/or a Lattice Extension installed.

Compare the actual displayed boom angle to the crane manufacturer's capacity chart.

This condition should be corrected by lowering or reducing the boom angle.

E: 26

This error code number is displayed when the operator reduces the actual operating radius to a value less than approved by the crane manufacturer's capacity chart. This message can be expected when operating with the main powered boom only.

Compare the actual displayed boom radius to the crane manufacturer's capacity chart.

This condition should be corrected by lowering the boom angle or increasing the boom length.

E: 27

This error code number is displayed when the operator increases the actual operating radius to a value greater than approved by the crane manufacturer's capacity chart. This message can be expected when operating with the main powered boom only. Compare the actual displayed boom radius to the crane manufacturer's capacity chart.

This condition should be corrected by raising the boom angle or decreasing the boom length.

E: 28

This error code number is displayed when the actual boom length is shorter than allowed by the programmed machine configuration.

An example would be a fully retracted boom length is measured when the programmed configuration is expecting a main boom length with the powered boom sections retracted and the manual section extended.

Compare the actual displayed boom length to the crane manufacturer's capacity chart.

This condition should be corrected by setting the LMI configuration to match the actual machine configuration or increasing the actual boom length.

E: 29

This error code number is displayed when the actual boom length is longer than allowed by the programmed machine configuration.

An example would be a measured boom length with main boom with manual section fully extended and the program expecting a maximum boom length equal to a fully extended main boom with manual section retracted.

Compare the actual displayed boom length to the crane manufacturer's capacity chart.

This condition should be corrected by setting the LMI configuration to match the actual machine configuration or reducing the actual boom length.



E: 32

This error code number is displayed when the operator is attempting to work in an area that is not approved by the crane manufacturer. For most On Tire conditions this message will create a Shut Off condition. For restricted Over Front Warning On Outriggers, this is an information only.

This condition is corrected by swinging the upper structure over the rear for a truck crane and over the front on a rough terrain crane.

## 8. SYSTEM ERRORS

Analog signal errors are also displayed with an Error Code Number. Cause for these Error Codes could be open or shorted wiring to external analog components and/or defective external components.

Repair of the cause of the problem can possibly be corrected without KRÜGER's onsite assistance. In all cases the first attempt at elimination of the ERROR MESSAGE is to use the Troubleshooting Manual in an attempt to identify and correct the problem.

The Troubleshooting Manual covers only the components of the KRÜGER Load Moment system.

The pressure settings of the Boom Hoist cylinder holding valves affect load indication. If either holding valve is replaced, it may be necessary to re-calibrate the system. It is very important that you contact KRÜGER or an authorized KRÜGER Distributor before operating the crane !!

System errors are normally caused by defective hardware or malfunctioning programmed data stores. System Error Code Numbers will be related to problems that are internal to the system and require evaluation and repair by an experienced KRÜGER technician or an authorized Distributor.

For assistance in identifying the source of a problem indicated by an Error Code No., refer to the Error Code Description for additional information. Those Error Codes which have been shaded indicate to the operator that the repair can only be performed by KRÜGER or its authorized Distributors.

## MARK 3E/1 OPERATING AND SYSTEM ERROR CODES

01	Watchdog Error
02	Checksum PG-EEPROM not correct
03	Checksum D-EEPROM not correct
04	Checksum EEPROM not correct
05	RAM-Fault Port 1
06	RAM-Fault Port 2
07	RAM-Fault 6116
08	NON-VOLITALE RAM-Fault
10	High Output Voltage Channel 0 (Piston or Complete Hydraulic)
11	Low Output Voltage Channel 0 (Piston or Complete Hydraulic)
20	High Output Voltage Channel 1 (Length)
21	Low Voltage Output Channel 1 (Length)
24	Boom Angle below Load Chart
25	Boom Angle above Load Chart
26	Radius shorter than Load Chart
27	Radius longer than Load Chart
28	Boom Length shorter than Load Chart
29	Boom Length longer than Load Chart
30	High Voltage Output Channel 2 (Main Boom Angle)
31	Low Voltage Output Channel 2 (Main Boom Angle)
32	Non Working Area
34	Outtrigger Control
35	Manual Extension Pin
36	Axle Blocking
37	Boom over Front
38	Counterweight Control
50	High Voltage Output Channel 4 (Option)
51	Low Voltage Output Channel 4 (Option)
60	High Voltage Output Channel 5 (Pressure Rod)
61	Low Voltage Output Channel 5 (Pressure Rod)
62	No Load Calculation
63	Program No. not correct (with mech. Ext.)
64	Program No. not correct (without mech. Ext.)
66	Parts of Line not correct
70	PG-EEPROM was Exchanged (Operating System)
71	D-EEPROM was Exchanged (Crane Specific Data)
72	EEPROM was Exchanged (Pressure Profile)
74	Wrong EPROM in EEPROM Location
75	Wrong EPROM in Data EPROM Location
80	Time Clock does NOT Run
81	Converter does NOT Work
82	Error in Shut Off Circuit
83	Incorrect 12V Power Supply
84	Incorrect 5V Analog Voltage

## PREVENTATIVE MAINTENANCE

The Mark 3E/1 Load Moment Indicator System uses electronic, electrical, mechanical and hydraulic components. The system should only be serviced by KRÜGER or their authorized Distributors or those who have received special training from KRÜGER or their authorized Distributors.

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 anti-2-block operation. Individually lift each counterweight. The display on the Control Panel should show "A-2-b" and the audible alarm should sound. If equipped with an optional Crane Function Shut Off System, this system should be activated.
5. EXTEND the boom and check the cable from the cable reel to the boom nose for cuts, abrasions or other physical damage.
6. While RETRACTING the boom check the cable reel for proper spooling of the cable and spring tension.
7. Check the hydraulic connections at the boom hoist cylinders and the Hydraulic Pressure Sensors for leaks.
8. Report all damage to your supervisor for appropriate action.

### **SEMI-ANNUAL INSPECTION**

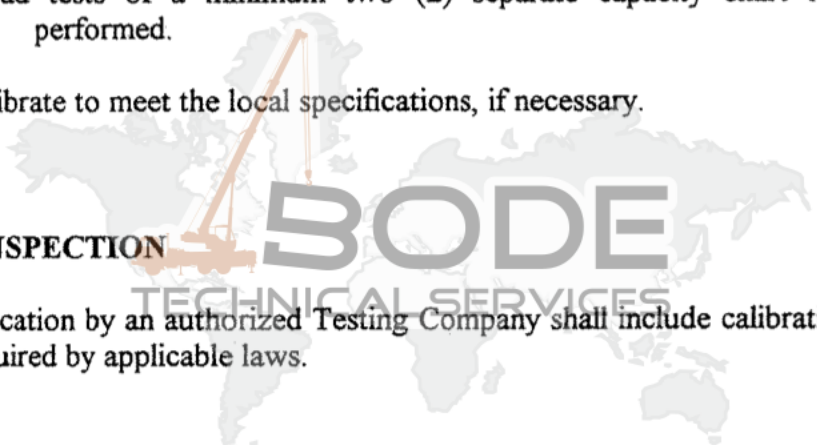
In addition to the requirements of the DAILY INSPECTIONS, the LOAD MOMENT portion of the system should be tested.

Load Moment system testing should be performed by a Service Technician of KRÜGER or their authorized Distributors or someone who has received special training by KRÜGER or their authorized Distributors.

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 the local specifications, if necessary.

### **ANNUAL INSPECTION**

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

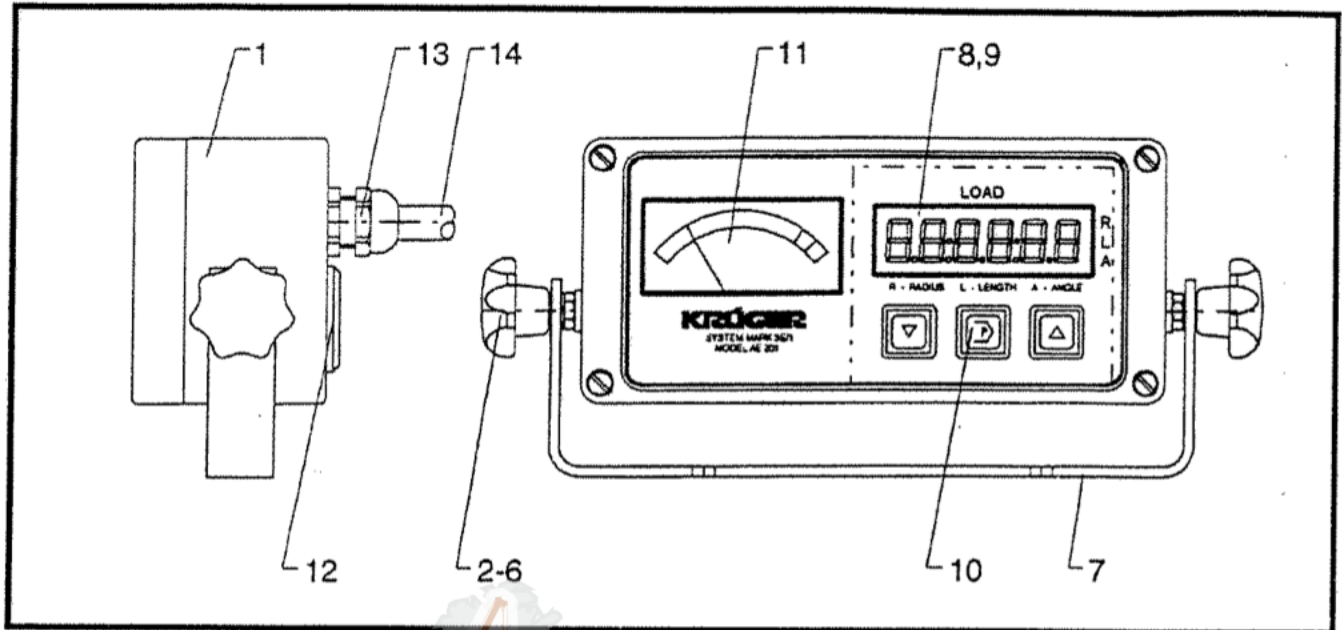




# COMPONENT LISTING

Component: **Panel - Mark 3E/1 Load Moment Ind.**

Article No.: **1-0109372.00**



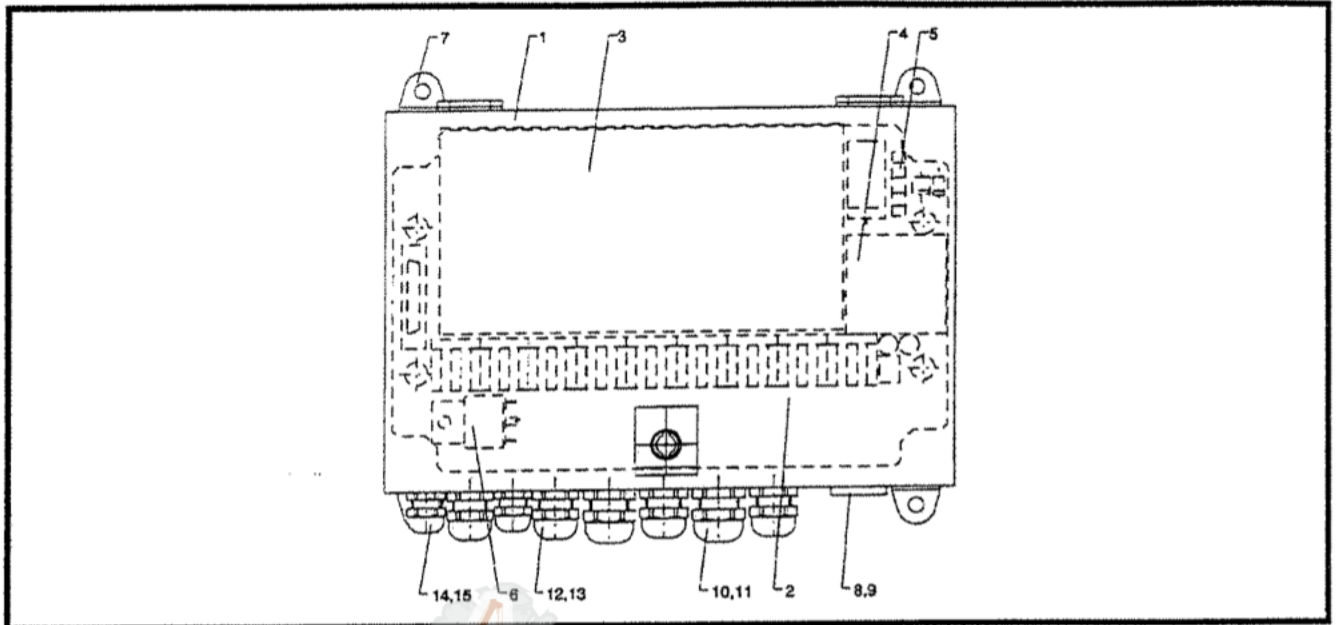
ITEM NO.	DESCRIPTION	QUAN.	ARTICLE NO.
1	Housing	1	1-0107573.00
2	Mounting Knob	2	1-0106678.00
3	Socket Capscrew - M6 x 25	2	1-0017292.00
4	Hex Nut - M6	2	1-0016719.00
5	Lock Washer - M6	2	1-0020543.00
6	Sealing Washer - M6	2	1-0107588.00
7	Mounting Bracket	1	1-0107595.00
8	PCB - LCD Display	1	1-0106603.00
9	PCB - Backlight	1	1-0021328.00
10	Foil - Push Button	1	1-0107604.00
11	Meter - LM w/Scale	1	1-0012342.00
12	Electronic Beeper	1	1-0012135.00
13	Cable Connector - PG 13.5	1	1-0103590.00
14	Shielded Cable - 16 x 0.5	7M	1-0014411.00



# COMPONENT LISTING

Component: **Electronic 12V. - Mark 3E/1**

Article No.: **1-0109437.10**



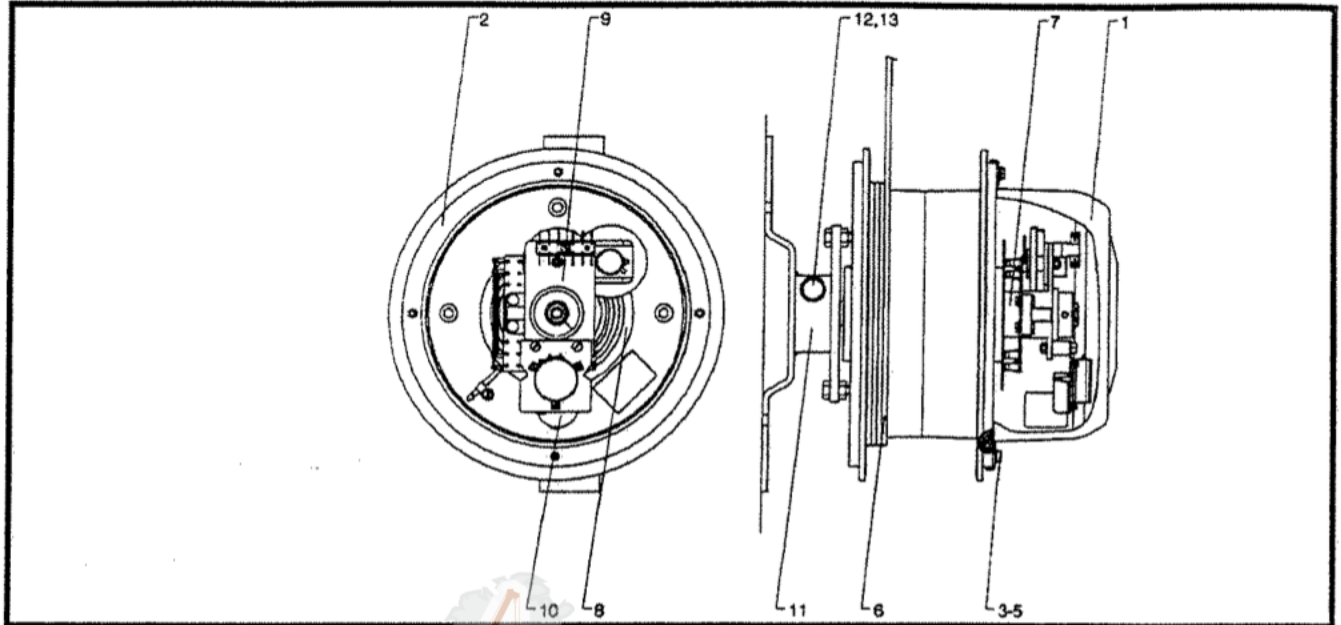
ITEM NO.	DESCRIPTION	QUAN.	ARTICLE NO.
1	Housing	1	1-0107672.00
2	PCB - Basic	1	1-0107919.00
3	PCB - CPU	1	1-0107907.00
4	Not Used		
5	Fuse - (1 AT)	2	1-0011343.00
6	Relay - 12VDC	1	1-0011489.00
7	Mounting Foot - Kit	1	1-0107626.00
8	Blind Plug - PG 16	1	1-0103592.00
9	Hex Nut - PG 16	1	1-0020702.00
10	Cable Connector - PG 13.5	2	1-0103590.00
11	Hex Nut - PG 13.5	2	1-0020701.00
12	Cable Connector - PG 11	4	1-0103589.00
13	Hex Nut - PG 11	4	1-0010700.00
14	Cable Connector - PG 9	2	1-0027705.00
15	Hex Nut - PG 9	2	1-0020699.00



# COMPONENT LISTING

Component: **LMI Cable Reel - 24/30M**

Article No.: **1-0107882.30**



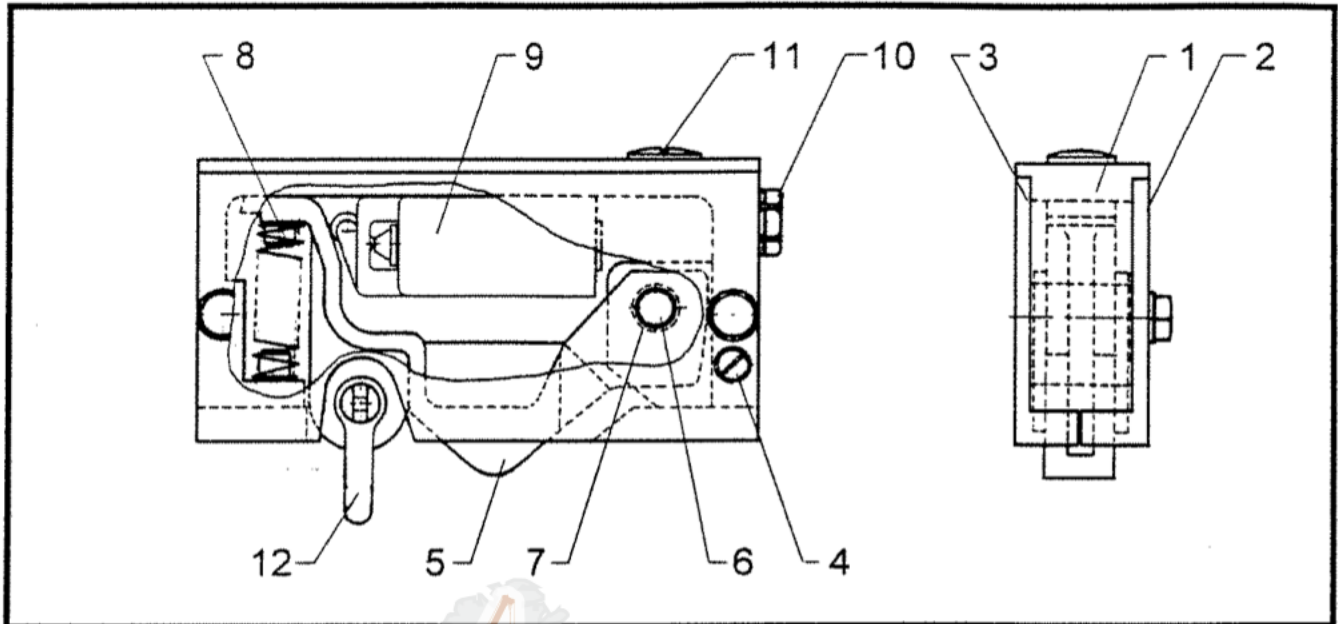
ITEM NO.	DESCRIPTION	QUAN.	ARTICLE NO.
1	Cover Complete	1	1-0107886.00
2	Cable Reel Body	1	1-0107885.00
3	Angle Clamp	4	1-0010613.00
4	Slotted Flat Head Screw - M5 x 14	4	1-0012350.00
5	Nylon Washer - M5	4	1-0010581.00
6	Cable - 2 x 0.14	30	1-0010328.00
7	Receiver Complete	1	1-0010615.00
8	Slip Ring Disk	1	1-0021448.00
9	Length Gear Drive	1	1-0107887.00
	- Angle Bracket	1	1-0010175.00
	- Pot	1	1-0013697.00
	- Terminal Strip	1	1-0011684.00
	- Slipper Complete (2 x 2)	1	1-0017383.00
10	Angle Transducer	1	1-0015601.00
	- Mounting Plate	1	1-0010626.00
	- Pot	1	1-0012157.00
	- Pendulum	1	1-0015113.00
11	Not Used		
12	Not Used		
13	Not Used		



# COMPONENT LISTING

Component: **A-2-B Switch**

Article No.: **1-0024849.20**



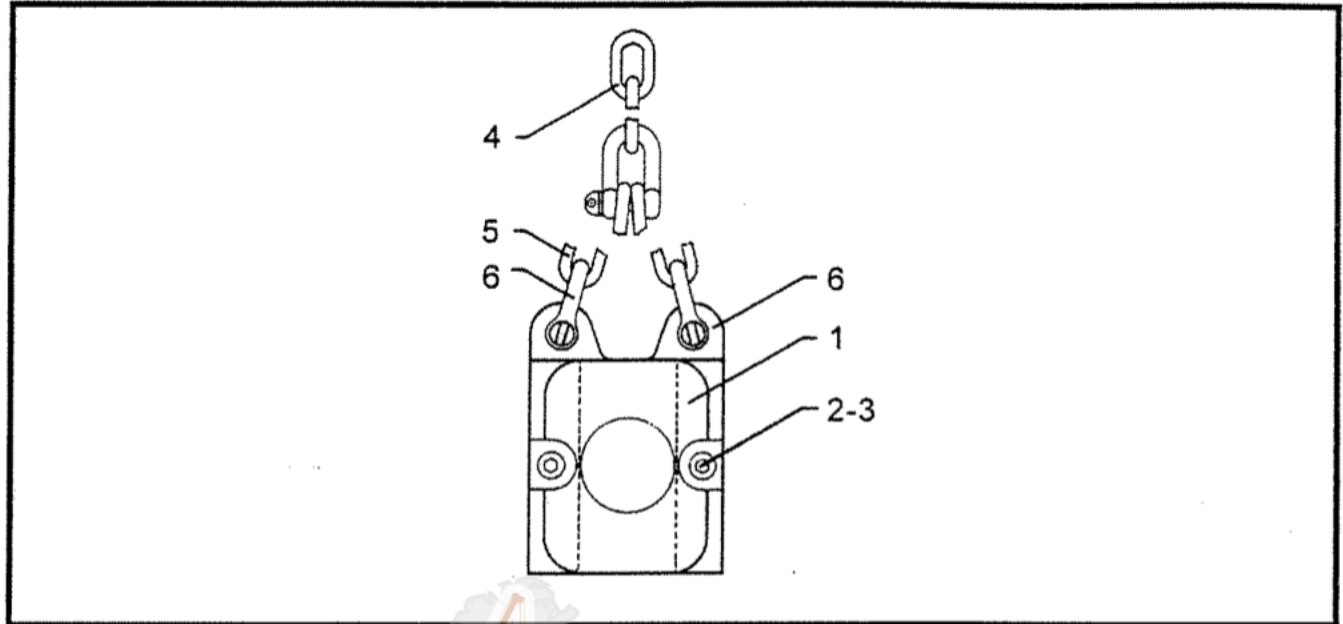
ITEM NO.	DESCRIPTION	QUAN.	ARTICLE NO.
1	Center Housing	1	1-0010040.00
2	Cover #1 - (Front)	1	1-0010044.00
3	Cover #2 - (Back)	1	1-0010045.00
4	Slotted Flat Head Screw - M5 x 8	2	1-0013391.00
5	Lever	1	1-0010041.00
6	Straight Pin	1	1-0010042.00
7	Bushing	1	1-0010104.00
8	Spring	1	1-0100326.00
9	Micro Switch	1	1-0010039.00
10	Cable Connector	1	1-0010037.00
11	Blind Plug	1	1-0010038.00
12	Shackle with Cotter Pin	1	1-0009999.00
<b>Required for Mounting - Order Separately</b>			
	Weld Plate	1	1-0010046.00
	Hex Head Capscrew - M8 x 50	2	1-0010083.00
	Lock Washer - M8	2	1-0010097.00





Component: **Counterweight with Chain**

Article No.: **1-0016800.11**



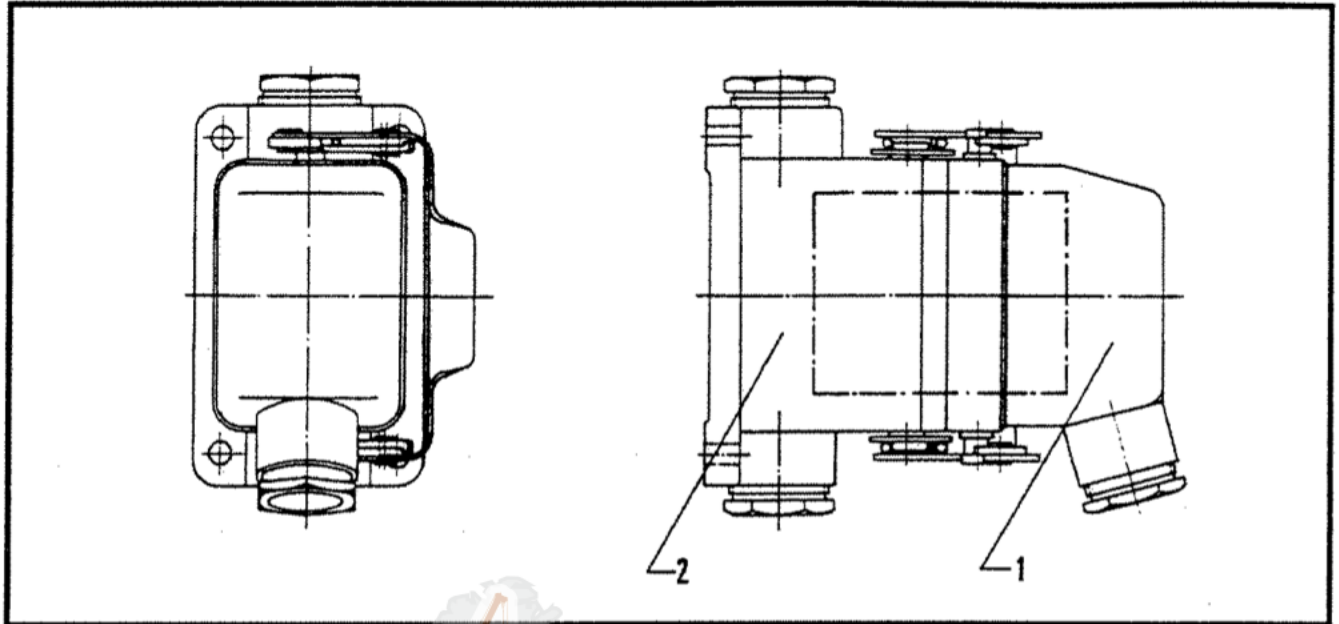
ITEM NO.	DESCRIPTION	QUAN.	ARTICLE NO.
1	Counterweight Half (Drilled)	2	1-0009995.00
2	Clevis Pin	2	2-0001388.00
3	Cotter Pin	2	2-0001389.00
4	Chain #1	1	1-0016908.00
5	Chain #2	2	1-0016909.00
6	Shackle	3	1-0010107.00



# COMPONENT LISTING

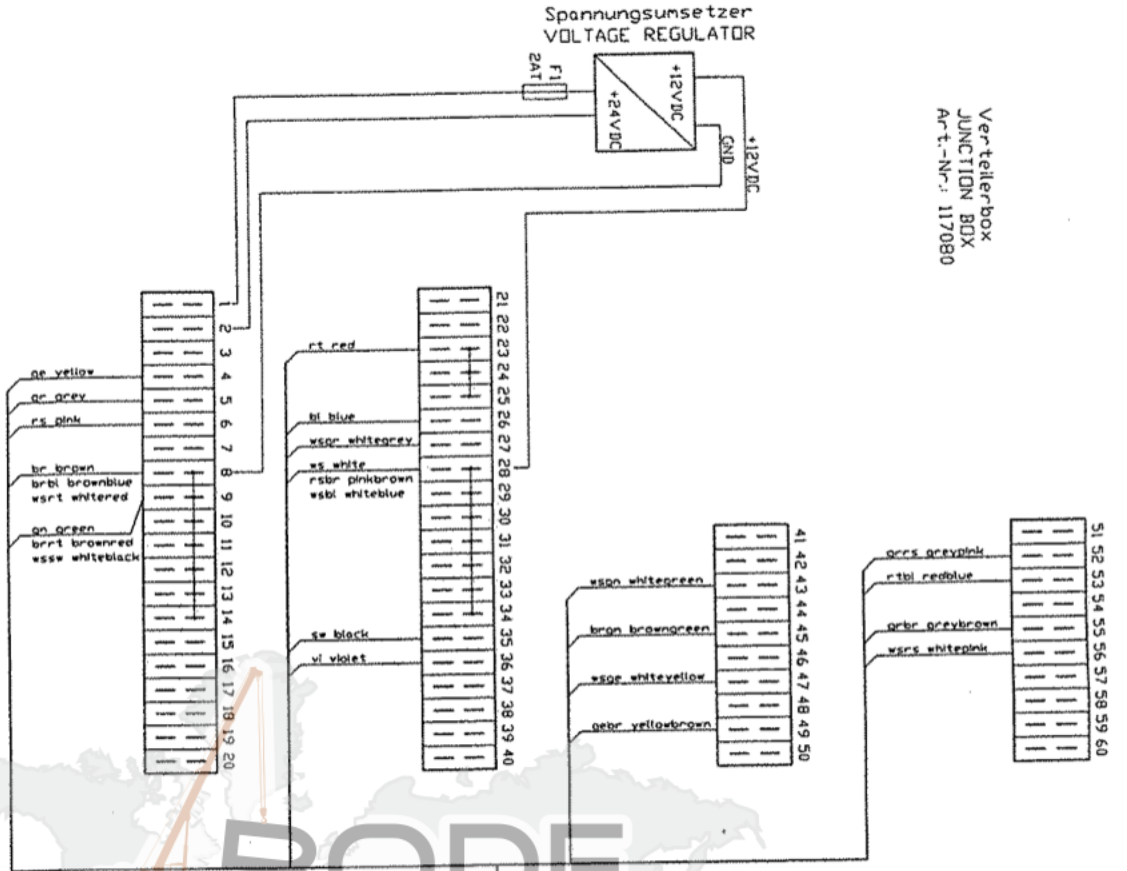
Component: **6 Pin - Plug/Receptacle**

Article No.:



ITEM NO.	DESCRIPTION	QUAN.	ARTICLE NO.
1	6 Pin Plug		<b>1-0011642.00</b>
	- Housing	1	2-0001005.00
	- Male Insert	1	1-0016377.00
Not Shown	- Cable Connector - PG 16	1	1-0011867.00
2	6 Pin Receptacle		<b>1-0011641.00</b>
	- Housing	1	2-0001006.00
	- Female Insert	1	1-0016037.00
Not Shown	- Cable Connector - PG 16	2	1-0011867.00
	- Blind Plug - PG 16 (Metallic)	1	2-0000813.00
Required for mounting - Order separately			
	Weld Plate	1	<b>2-0000255.00</b>

Verteilerbox  
 JUNCTION BOX  
 Art.-Nr.: 117080



\* Die Kabelabschirmung wird durch  
 einkleben über die Pg - Verschraubung  
 mit den Gehäuse verbunden.  
 PG - CONNECTORS CONTACT CABLE SHIELD  
 TO BOX

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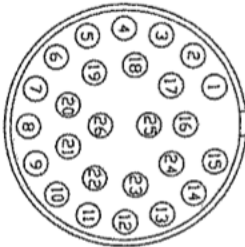
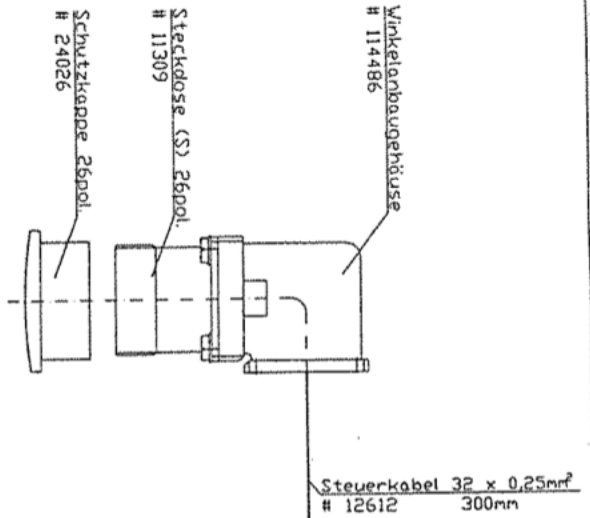
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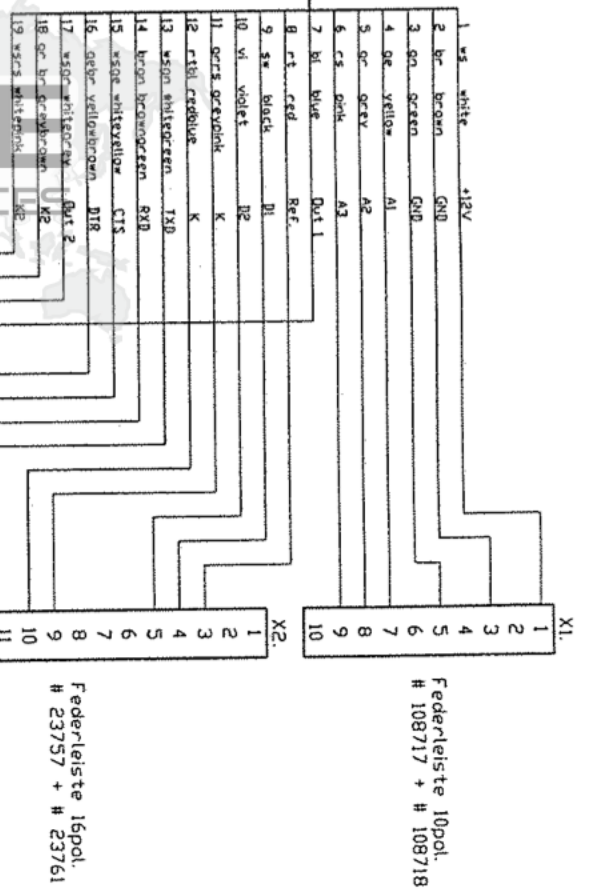
Zum Anzeigergerät Art.-Nr.: 117070  
 TO CONTROL PANEL

	20001	Datum	Name	Anschlußplan Verteilerbox CONNECTION DIAGRAM JUNCTION BOX +24VDC	Nr.: 1 Blatt 2 von 2
	Be.: 19.05. Gep.: 23.5.00	Zeichn.-Nr.: 63.7481/02	Ers. f.: Ers. d.:		
Änderung Datum Name					

- Stift - Nr.:
- 1 ws white
  - 2 br brown
  - 3 gn green
  - 4 ge yellow
  - 5 gr grey
  - 6 bl blue
  - 7 rt red
  - 8 sw black
  - 9 vi violet
  - 10 grs greypink
  - 11 rtbl redblue
  - 12 wsgn whitegreen
  - 13 brgn browngreen
  - 14 wsge whiteyellow
  - 15 gbr greybrown
  - 16 gsr greybrown
  - 17 wsr whitepink
  - 18 gsr greybrown
  - 19 wsr whitepink



Stecker  
Lötseite



Federleiste 10pol.  
# 108717 + # 108718

Federleiste 16pol.  
# 23757 + # 23761

Federleiste 4pol.  
# 23755 + # 23759

Federleiste 2pol.  
# 23754 + # 23758

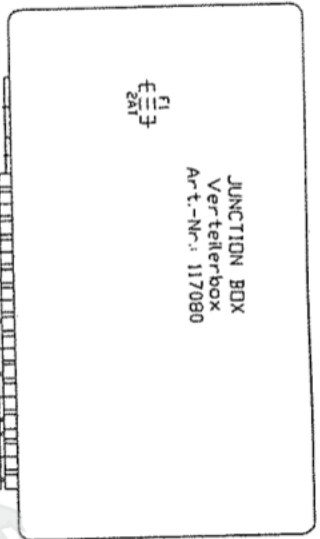
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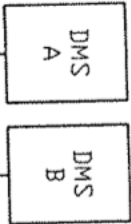
		2000	Datum	Name	Kabelverbindung 19 adr Steckdose (S) 26pol. / Klemmleisten
		Bea.	17.05.	E	
-4-		Zeich.-Nr.:	63.7273/02	Art.-Nr.:	117078
Änderung		Datum	Name	Ers. f.:	Nr.:
					Blatt
					von

Relais RELAY	Last LOAD
K1 Oberlast	↑
K2 Unterlast	↑
UNTERLOAD	↑

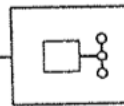


Versorgungsspannung +24VDC  
POWER SUPPLY  
2 x 1,5m<sup>2</sup>  
Art.-Nr.: 10004

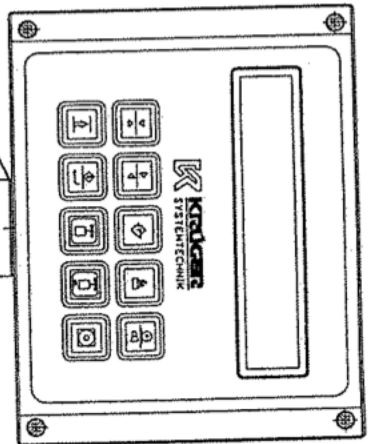
TRANSDUCER  
Messwertaufnehmer



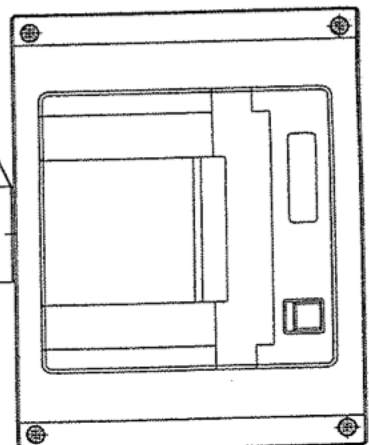
ANEMOMETER  
Windgeschwindigkeitsmesser



LOAD- WIND SPEED PANEL  
Last- Windgeschwindigkeitssanzeige  
Art.-Nr.: 117070

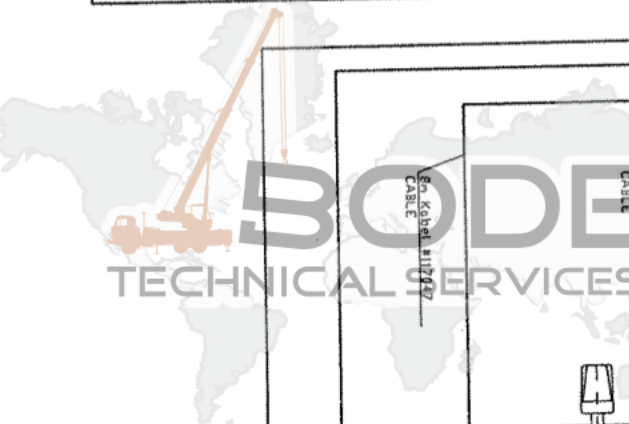


PRINTER  
Drucker  
Art.-Nr.: 114688



Ausgang Meßsignal Summenlast (2,5 - 7,5VDC)  
OUTPUT MEAS.-SIGNAL SUM LOAD

Ausgang Meßsignal Windgeschwindigkeit (2,5 - 7,5VDC)  
OUTPUT MEAS.-SIGNAL WIND SPEED



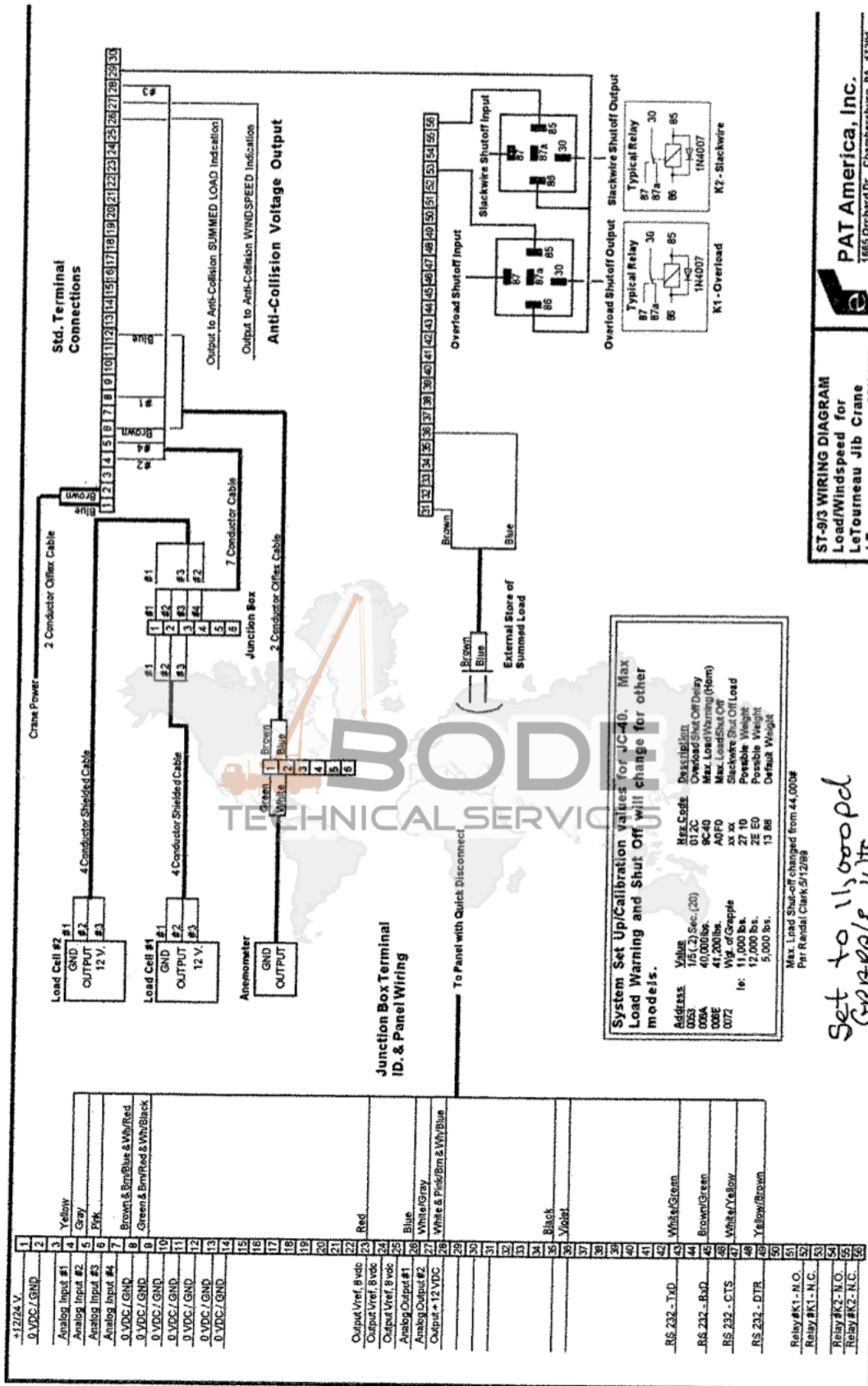
Bei Ersatzteilen sollte immer die Ident-Nr. (Artikel) und die LNB-Nr. angegeben werden.  
FOR SPARE PARTS ALWAYS GIVE THE FOLLOWING INFORMATION:  
- IDENTIFICATION No (ARTICLE No)  
- LNB No

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	2000	Datum	Name	Übersicht Last- Windgeschwindigkeits- anzeige mit Drucker LOAD- WIND SPEED PANEL WITH PRINTER ST9 (LCD)	Art. Nr.: 63.7481/06	Ers. f.: 1	Ers. d.: 1
	Bea. 19.05.	E	Zeichn.-Nr.: 63.7481/06				
Änderung Datum Name							



Set to 11,000 pd  
Grapple/Wts.  
6/26/01

ST-8/3 WIRING DIAGRAM  
Load/Windspeed for  
LeTourneau Jib Crane  
J.F.  
08/01/00

PAT America, Inc.  
1485 Orshkoff Dr. Chambersburg, PA 17281  
Phone: 717/293-7655 Fax: 717/293-2445