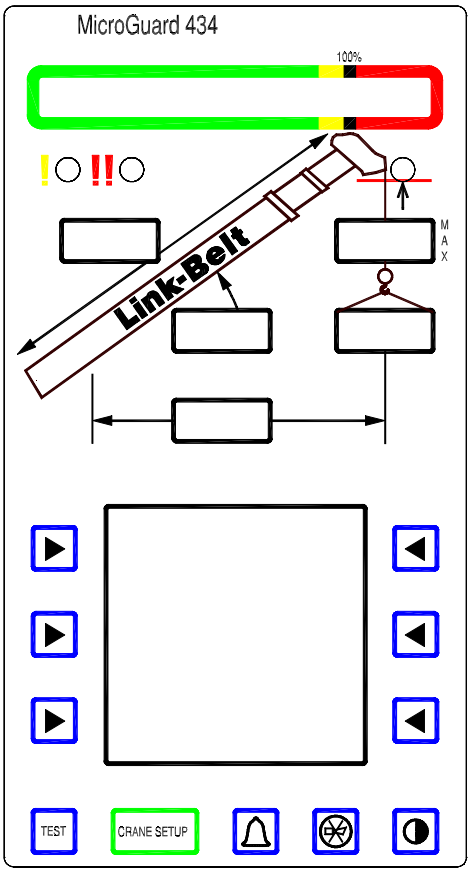
MICROGUARD® 434/500

LINK BELT MODELS



CALIBRATION MANUAL

TABLE OF CONTENTS

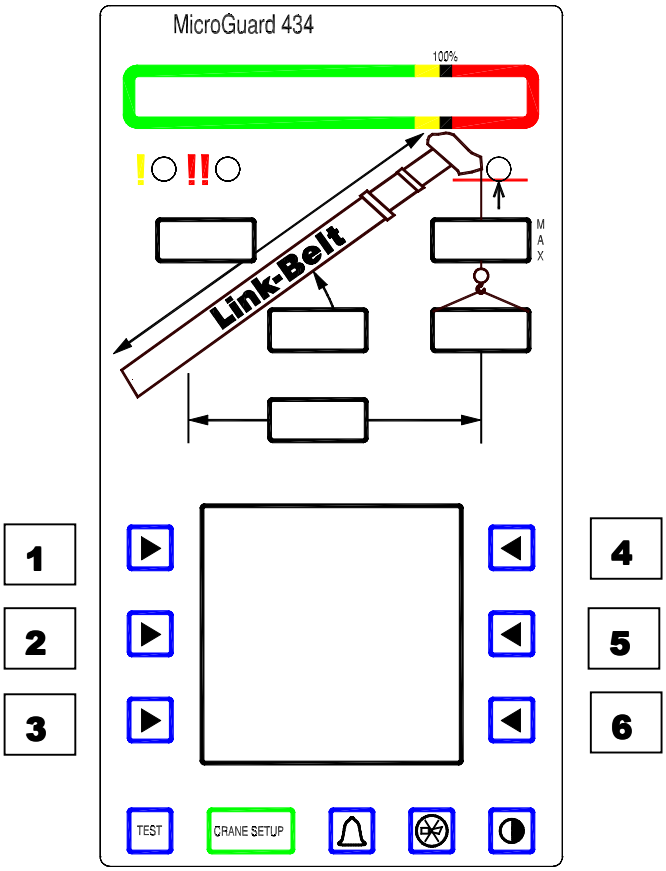
GENERAL INFORMATION

This manual describes functions contained within the 'Calibration Mode' of operation for the MicroGuard® 434/500 System and, as such, may be used as a reference to detailed use of those functions The processes of system prototype calibration, production calibration, and field service diagnosis are covered by other documents.

THE DISPLAY UNIT

The display unit, shown below, provides the interface between the user and the Calibration Mode functions. Six arrow keys surrounding the display screen are used to enter and exit COMMANDS and to respond to on-screen prompts during the function routines.

The arrow keys identified with numerals below are used to operate the MicroGuard® 434/500 System Calibration Mode functions. COMMIT THE NUMERALS AND ASSOCIATED POSITIONS TO MEMORY. THEY WILL BE REFERENCED THROUGHOUT THIS MANUAL. THE 'TEST' KEY AND THE 'CRANE SETUP' KEY POSITIONED AT THE BASE OF THE DISPLAY UNIT ARE ALSO USED IN THIS MANUAL.



THE CALIBRATION MODE

Use of the functions described in this manual requires that the MicroGuard® 434/500 System be in the Calibration Mode of operation.

TO ENTER THE CALIBRATION MODE

SIMULTANEOUSLY PRESS AND HOLD THE TEST AND CRANE SETUP BUTTONS UNTIL PROMPTED BY THE DISPLAY TO ENTER THE CALIBRATION CODE.

TO ENTER THE CALIBRATION CODE

PRESS THE DISPLAY ARROW KEYS IDENTIFIED AS: 1 6 3 4 IN THE SEQUENCE SHOWN (REFER TO PAGE 4.)

NOTE: IF THE WRONG SEQUENCE IS USED OR IF THE ENTRY IS NOT COMPLETED WITHIN 5 SECONDS, THE CALIBRATION ENTRY WILL BE ABORTED AND MUST BE REENTERED.

NOTE: IF A PICTURE OF THE WORKING SCREEN APPEARS, ENTER THE CALIBRATION MODE AND THE CALIBRATION CODE AGAIN.

WHEN IN THE CALIBRATION MODE

THE TWO-BLOCK ALARM AND KICKOUT ARE OPERATIONAL. ALL OTHER ALARM KICKOUTS AND AUDIO ALARMS WILL REMAIN INACTIVE UNTIL THE SYSTEM IS OUT OF THE CALIBRATION MODE.

ALL VISUAL WARNING ALARMS WILL REMAIN ACTIVE.

NUMBER ENTRY

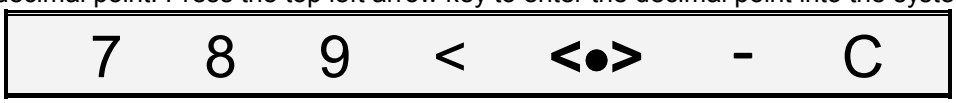
The MicroGuard® 434/500 series displays do not have number entry keys. Use the following number entry procedure to enter a number into the system. The display will change as the numerical data is processed. The symbols used to enter numbers are shown below.

•	**SELECTS A DECIMAL POINT**
0 - 9	**SELECTS A DIGIT FROM 0-9. USE THE CORRESPONDING ROW KEYS TO CHANGE A NUMERAL**
-	**MINUS SIGN**
C	**CLEARS A CURRENTLY DISPLAYED NUMERAL**
<	**DELETES THE LAST ENTRY**

After starting the number entry routine, the display will flash the currently selected numeral surrounded by brackets < >. When entering negative numbers, select the minus sign first. Brackets will always surround the selected entry.

Press the arrow key nearest the first numeral to be entered until brackets surround the numeral. Press the top left arrow key to enter the numeral or symbol into the system. Any number from -999.9 to 999.9 can be selected and entered this way. Press the arrow key nearest the word 'EXIT' after all numerals/symbols are entered.

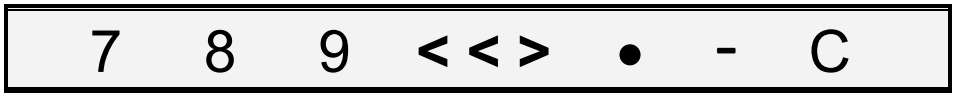
If a number requires a decimal point, press the arrow key nearest the decimal point to move the bracket < > around the decimal point. Press the top left arrow key to enter the decimal point into the system.



Press the arrow key nearest the minus sign and select the minus sign.
Press the top left arrow key to enter the minus sign.

If an error is made in data entry, press the arrow key nearest **C (clear)** and select **C**. Press the top left arrow key, which will delete the complete entry. Move the cursor back to the entry of digits and reenter the correct number.

To delete the last entry, press the arrow key nearest < and select it. Next, press the top left arrow key to complete the action.



NUMBER ENTRY (continued)

THE FOLLOWING STEPS ILLUSTRATE THE NUMBER ENTRY PROCEDURE

WHEN COMPLETED, THE NUMBER SHOULD READ

-123.45

PRESS THE ARROW KEY NEAREST THE REQUIRED SELECTION UNTIL BRACKETS SURROUNDTHE SELECTION.
PRESS TOP LEFT ARROW KEY TO ENTER THE DATA.

1. SELECT THE MINUS SIGN **< − >**
2. ENTER THE MINUS SIGN
3. SELECT THE FIRST DIGIT **< 1 >**
4. ENTER THE FIRST DIGIT
5. SELECT THE SECOND DIGIT **< 2 >**
6. ENTER THE SECOND DIGIT
7. SELECT THE THIRD DIGIT **< 3 >**
8. ENTER THE THIRD DIGIT
9. SELECT THE DECIMAL POINT **< • >**
10. ENTER THE DECIMAL POINT
11. CHOOSE THE FIRST DECIMAL PLACE **< 4 >**
12. ENTER THE FIRST DECIMAL PLACE
13. CONFIRM **< 4 >** AND COMPLETE **< 1 >** THE CALIBRATION

COMMAND 00 ERROR CODES

THIS COMMAND IS USED TO EXECUTE A **SYSTEM SELF-TEST** AND TO DETECT AND DISPLAY ANY ERRORS PRESENT IN THE SYSTEM. THESE ERRORS ARE SHOWN BY MEANS OF AN ERROR CODE.

COMMAND 00 ERROR CODES

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

0. ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE. REFER TO PAGE 5.

1. CHOOSE MENU UP OR MENU DOWN AND GO TO 00 ERROR CODES ..... **2 or 3**
(IF NOT ALREADY DISPLAYED).

2. START 00 ERROR CODES. **1**
(THE SYSTEM GOES THROUGH A SELF TEST IDENTIFYING ANY SYSTEM ERRORS, WHICH ARE THEN DISPLAYED AS ERROR CODES.

3. EXIT THE ROUTINE. **6**

ERROR CODES

GROUP "A" ANALOG SENSORS

CODE

AAA		
000		NO FAULTS
001	TX0	PISTON PRESSURE TRANSDUCER
002	TX1	ROD SIDE PRESSURE TRANSDUCER
004	SENSOR 2	EXTENSION SENSOR
008	SENSOR 3	BOOM ANGLE SENSOR
016	SENSOR 4/5/6/7	SWING POTENTIOMETER
032		TEMPERATURE SENSOR

GROUP "B" INPUTS AND OUTPUTS

CODE

BB		
00		NO FAULTS
01	FAULT 1	ADC FAULT (PISTON SIDE)
02	FAULT 2	ADC FAULT (ROD SIDE)
04	FAULT 4	
08	FAULT 8	ATB FEED FAULT
16	FAULT 16	FRO FEED FAULT

GROUP "C" MEMORY

CODE

CC		
00		NO FAULTS
01	FAULT 1	EXECUTIVE ROM
02	FAULT 2	DUTY ROM
04	FAULT 4	SCRATCHPAD RAM
08	FAULT 8	PERSONALITY ROM
16	FAULT 16	SERIAL EEPROM

GROUP "D" GENERAL

CODE

DD		
00		NO FAULTS
01	FAULT 1	NO DUTY FOUND
02	FAULT 2	BAD EXTENSION
04	FAULT 4	BAD SWING

THE MAIN MICROGUARD® PROGRAM NAME AND NUMBER AND THE UNITS SERIAL NUMBER IS ALSO DISPLAYED.

COMMAND 01 CRANE DATA

WARNING

PERFORMING A CRANE DATA RESET WILL REPLACE
CALIBRATED DATA WITH DATA STORED IN THE SYSTEM CHIP.

NOTE 1: IF THIS IS NOT A PROTOTYPE CALIBRATION, ALL CALIBRATION DATA WILL BE STORED IN THE SYSTEM CHIP. IN ORDER TO MODIFY THIS DATA, DOWNLOAD NEW OR CHANGED DATA. THE 'CRANE DATA RESET' WILL NEED TO BE PERFORMED.

NOTE 2: ALWAYS PERFORM CRANE DATA RESET ON A NEW OR PROTOTYPE SYSTEM BEFORE BEGINNING CALIBRATION OR TESTING.

COMMAND 01 - CRANE DATA

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.
Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

0. ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE. REFER TO PAGE 5.

1. CHOOSE MENU UP OR MENU DOWN AND GO TO 01 CRANE DATA. ..... 2 OR 3

2. START 01 CRANE DATA. 1

3. RESET CRANE DATA. 1

4. CHOOSE YES! CALIBRATE OR NO! ABORT. ..... 1 YES/ 3 ABORT

5. ENTER THE CALIBRATION CODE. 1 6 3 4

6. THE DISPLAY WILL READ: CRANE DATA 'CALIBRATING.'
WHEN THE DISPLAY CHANGES TO 'PERSONALITY GOOD,' EXIT THE ROUTINE. 6

7. IF THE DISPLAY READS: 'PERSONALITY NOT GOOD," RETURN TO STEP 3, 'RESET CRANE DATA' AND CONTINUE.. 1

COMMAND 02 ZERO SENSOR

The Command 02 ZERO SENSOR permits the calibration of the zero of most analog sensors. Two sensors can be zeroed using this Command. Each sensor is allocated a number that corresponds to the input to which it is connected in the system.

THESE SENSORS INCLUDE:

1. Boom extension sensor, Analog input 2.
2. Boom angle sensor, Analog input 3.

The swing sensor has its own routine and is calibrated using Command 04.

COMMAND 02 - ZERO BOOM EXTENSION SENSOR

COMMAND 02 - ZERO BOOM EXTENSION SENSOR

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

0. ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE. REFER TO PAGE 5.

1. CHOOSE MENU UP OR MENU DOWN AND GO TO 02 ZERO SENSOR. ..... **2 OR 3**

2. START 02 ZERO SENSOR. **1**
THE DISPLAY WILL READ: ZERO NO. 2 XXX (ACTUAL INPUT).

3. CONFIRM THE SELECTION OF SENSOR NO. 2. ..... **1**
THE DISPLAY WILL READ: ZERO SENSOR YES! CALIBRATE!
OR NO, ABORT.

4. START THE CALIBRATION OF ZERO SENSOR NO. 2. ..... **1**
THE DISPLAY WILL READ: ZERO NO. 2 XXX (ZEROED INPUT),
OR NO, EXIT/ABORT (THE CALIBRATION) **3**

5. EXIT THE ROUTINE OR SEE STEP 6. ..... **6**

6. CHOOSE MENU UP OR MENU DOWN TO CHANGE SENSOR. ..... **2 OR 3**

COMMAND 02 - ZERO BOOM ANGLE SENSOR

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

0 **ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE.**
REFER TO PAGE 5.

1. **CHOOSE MENU UP OR MENU DOWN AND GO TO 02 ZERO SENSOR.** ..... **2 OR 3**

2. **START 02 ZERO SENSOR.** **1**
THE DISPLAY WILL READ: ZERO NO. 2 XXX (ACTUAL INPUT).

3. **CHOOSE MENU UP OR MENU DOWN AND GO TO ZERO NO. 3.** ..... **2 OR 3**

4. **CONFIRM THE SELECTION.** **1**
THE DISPLAY WILL READ: YES! CALIBRATE! OR NO, EXIT/ABORT!

5. **START THE CALIBRATION OF SENSOR NO. 3.** **1**
THE DISPLAY WILL READ ZERO NO. 3 XXX (ZEROED INPUT)
OR ABORT THE CALIBRATION. **3**

6. **EXIT THE ROUTINE** **6**
OR SEE STEP 7.

7. **CHOOSE MENU UP OR MENU DOWN TO CHANGE SENSOR.** ..... **2 OR 3**

COMMAND 03 SPAN

BOOM ANGLE SENSOR

NOTE: THE INCLINOMETER OR MEASURING DEVICE USED TO CALIBRATE THE ANGLE OF THE MAIN BOOM MUST HAVE AN ACCURACY OF +/- 1°. USE OF A LESS ACCURATE DEVICE MAY RESULT IN CALIBRATION ERRORS.

NOTE: USE GREAT CARE IN THE CALIBRATION OF THE BOOM ANGLE SENSOR. ALL SUBSEQUENT CALCULATIONS ARE DEPENDENT ON THE ACCURACY OF THE CALIBRATION OF THIS SENSOR.

a) Raise the retracted boom to an angle between 60° and 65°; using an inclinometer, measure the angle.
b) **EXAMPLE:** 61.5°
c) Calibrate the span of the boom angle sensor as follows:

COMMAND 03 SPAN - BOOM ANGLE SENSOR

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

0. ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE. REFER TO PAGE 5.

1. CHOOSE MENU UP OR MENU DOWN AND GO TO 03 SPAN SENSOR. ..... 2 OR 3

2. START 03 SPAN. 1

3. CHOOSE MENU UP OR MENU DOWN AND GO TO SPAN NO.3 (IF NOT ALREADY THERE) ..... 2 OR 3
THE DISPLAY WILL READ:
SPAN No. 3 X.XX (or actual input when recalibrating).

4. START THE CALIBRATION OF SPAN NO. 3. 1

5. USE THE NUMBER ENTRY PROCEDURE (PAGE 6) TO ENTER THE MEASURED BOOM ANGLE.

6. START THE CALIBRATION. ..... 1 YES/3 ABORT
THE DISPLAY WILL READ: SPAN NO. 3 X.XX (boom angle entered)

7. EXIT THE ROUTINE 6
OR GO TO STEP 8.

8. CHOOSE MENU UP OR MENU DOWN TO CHANGE SENSOR ..... 2 OR 3

COMMAND 03 SPAN continued.

BOOM EXTENSION SENSOR

THROUGHOUT THIS PROCEDURE: DO NOT FULLY EXTEND THE BOOM IF THIS ACTION COULD CAUSE A TIPPING CONDITION.

CARRY OUT CALIBRATION PROCEDURES ONLY WITHIN THE STABILITY LIMITS OF THE CRANE.

a) With the boom fully retracted in a horizontal position, measure the distance from the boom pivot to the hook centerline. Note the distance.

b) Extend the boom as far as possible without tipping the crane.

c) Measure the distance from the boom pivot to the hook centerline. Note the distance.

d) Calculate boom extension from this formula: **Extended** length minus **Retracted** length equals **Extension** value.

EXAMPLE: IF THE EXTENDED BOOM LENGTH IS 72 FT AND THE RETRACTED BOOM LENGTH IS 30.5 FT THE EXTENSION VALUE IS 72 – 30.5 = 41.5 FT

e) With the boom still fully extended, calibrate the **SPAN** of the **EXTENSION** following the steps below.

COMMAND 03 SPAN -BOOM EXTENSION SENSOR

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

0. ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE. REFER TO PAGE 5.

1. CHOOSE MENU UP OR MENU DOWN AND GO TO 03 SPAN SENSOR. ..... **2 OR 3**

2. START 03 SPAN SENSOR. **1**

3. CHOOSE MENU UP OR MENU DOWN AND GO TO SENSOR NO. 2. ..... **2 OR 3**
THE DISPLAY WILL READ: SPAN NO. 2 X.XX (or actual input when recalibrating).

4. START THE CALIBRATION OF SENSOR NO. 2. ..... **1**

5. USE THE NUMBER ENTRY PROCEDURE (PAGE 6) TO ENTER EXTENSION VALUE.

6. CONFIRM OR ABORT THE CALIBRATION. ..... **1 CONFIRM/ 3 ABORT**
THE DISPLAY WILL READ: SPAN NO. 2 XX.XX (extension value you entered).

7. EXIT THE ROUTINE. **6**

8. CHOOSE MENU UP OR MENU DOWN TO CHANGE SENSOR ..... **2 OR 3**

At this stage of the procedure the boom length display will indicate the extension value that you entered.
After completion of Command 05, main boom radius/moment, it will display boom length.

Retract the boom and continue the procedure.

COMMAND 04 SWING POT ZERO

THIS ROUTINE WILL **ONLY** BE REQUIRED ON MODELS THAT HAVE SWING POTENTIOMETERS.

ZERO

For **all** crane models (lattice and hydraulic or truck and all terrain) the datum for the zero of the potentiometer is **IN LINE OVER THE FRONT OF THE CARRIER**.

DIRECTION

Swing direction is similar to a compass. Swinging to the right will increase the readings and swinging to the left will decrease the readings. If the swing potentiometer is electrically connected in such a way that its output is in the wrong direction, this can be accounted for during this procedure by using the direction command to change the displayed direction.

Calibrate the swing potentiometer, as shown below.

COMMAND 04 SWING POT ZERO

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

0. **ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE. REFER TO PAGE 5.**

1. **CHOOSE MENU UP OR MENU DOWN AND GO TO 04 SWING POT.** ..... **2 OR 3**

2. **START 04 SWING POT.**.....**1**

3. **CHOOSE MENU UP OR MENU DOWN AND GO TO ZERO (IF NOT ALREADY THERE).** ..... **2 OR 3**

4. **SET SLEW ZERO.**.....**1**
NOTE: OVER FRONT OF CARRIER, THE DISPLAY WILL READ: ZERO = XXX.

5. **EXIT** **3**

COMMAND 04 SWING POT DIRECTION

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

0. **ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE. REFER TO PAGE 5.**

1. **CHOOSE MENU UP OR DOWN AND GO TO 04 SWING POT.** ..... **2 OR 3**

2. **START 04 SWING POT.** **1**

3. **CHOOSE DIRECTION.** ..... **2 OR 3**
THE CENTER DISPLAY WILL READ (+ OR -).

4. **ROTATE THE UPPER APPROX. 10° TO THE RIGHT.**

5. **THE NUMBERS ON THE DISPLAY SHOULD INCREASE TO APPROX. 10°.**
IF NOT, CHANGE THE DISPLAY TO REFLECT THE OPPOSITE DIRECTION. **2**

6. **EXIT.** **3**

7. **EXIT THE ROUTINE.** **6**

COMMAND 05 MAIN BOOM RADIUS/MOMENT

If this is not a prototype calibration, then all radius/moment data will be precalibrated and copied over for use during crane data reset. There should be no need to perform this routine.

a) Use this command to calibrate the **radius** and **moment** of the main boom. It requires data at high and low angles retracted, and high and low angles with the boom extended to the prescribed lengths.

b) Carry out calibration at each length. Both high and low angle data must be stored for the calibration to operate. This acquisition of data is described by the word **CALIBRATION** in the procedure. If for any reason the data is not stored, the system will warn with the message, **NO DATA** and the data **CALIBRATION** must be repeated.

c) A high angle is one that is higher than 60°. A low angle is lower than 20°. An attempt to acquire data outside of these limits will result in the warning message "poor angle." When this message occurs as the result of an error, it can be corrected. The procedure may then be continued using correct keyboard entries.

d) When this message occurs as a result of requiring data outside the preferred angles, then the data may be entered using the high angle or low angle key to indicate the unusual angle for which data is being acquired.

CALIBRATE THE RADIUS/MOMENT OF THE MAIN BOOM AS SHOWN ON THE NEXT PAGES.

MAIN BOOM RADIUS/MOMENT

A. EXIT THE CALIBRATION MODE AND PRESS THE **CRANE SETUP** BUTTON AT THE BOTTOM OF THE DISPLAY SCREEN. SELECT **FULLY EXTENDED OUTRIGGERS, MAIN BOOM, NO ATTACHMENTS, OR A STOWED ATTACHMENT.**

B. FULLY RETRACT THE BOOM. THE BOOM ANGLE SHOULD BE 5°.

C. DETERMINE THE WEIGHT OF THE HOOK BLOCK IN USE. MEASURE THE RADIUS FROM THE CENTERLINE OF ROTATION TO THE CENTER OF THE HOOK OR LINE (IF SINGLE PART).

D. CALIBRATE THE RADIUS AND MOMENT OF THE MAIN BOOM AS SHOWN BELOW.

.COMMAND 05 MAIN BOOM RADIUS/MOMENT FIRST LENGTH

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

RAISE THE HOOK BLOCK CLOSE TO THE TWO-BLOCK WEIGHT TO ELIMINATE ROPE WEIGHT.

0. ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE. SEE PAGE 5.

1. CHOOSE MENU UP OR MENU DOWN AND GO TO 05 RADIUS/MOM. ..... 2 OR 3

2. START 05 RADIUS/MOM. 1

3. USE THE NUMBER ENTRY ROUTINE (PAGE 6) TO ENTER WEIGHT OF HOOK (TARE LOAD).

4. STORE LOW ANGLE DATA. 1

5. USE THE NUMBER ENTRY ROUTINE (PAGE 6) TO ENTER THE CURRENT RADIUS
THE DISPLAY WILL READ: BAS. 0 (D).

RAISE THE RETRACTED BOOM TO AN ANGLE BETWEEN 60° AND 65° AND MEASURE THE NEW RADIUS.

6. STORE THE HIGH ANGLE DATA. 1

7. USE THE NUMBER ENTRY ROUTINE TO ENTER THE NEW RADIUS.
THE DISPLAY WILL READ: BAS. 0 (D U).

8. START THE MOMENT CALIBRATION AT THE CURRENT LENGTH. 1

9. CONFIRM OR ABORT THE CALIBRATION. ..... 1 YES /3ABORT

COMMAND 05 MAIN BOOM RADIUS/MOMENT SECOND LENGTH

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

MAINTAIN THE SAME HIGH ANGLE AND EXTEND THE BOOM TO 50% OF EXTENSION OR TO THE FULL EXTENSION
IF THE BOOM MODE EXTENDS LESS THEN 30 FEET, MEASURE THE NEW RADIUS.

1. **STORE THE HIGH ANGLE DATA.** **1**
2. **USE THE NUMBER ENTRY ROUTINE TO ENTER THE NEW RADIUS.**
   THE DISPLAY WILL READ: BAS. 1 (U).

MAINTAIN THE SAME LENGTH AND LOWER THE BOOM TO THE LOWEST ANGLE LISTED ON THE LOAD CHART FOR A FULLY EXTENDED BOOM.

IF THE CRANE HAS 0° CAPABILITIES, LOWER THE BOOM TO 5°. MEASURE THE NEW RADIUS.

3. **STORE THE LOW ANGLE DATA.** **1**
4. **USE THE NUMBER ENTRY ROUTINE TO ENTER THE NEW RADIUS.**
   THE DISPLAY WILL READ BAS. 1 (D U).
5. **START THE MOMENT CALIBRATION AT THE CURRENT LENGTH.** **1**
6. **CONFIRM OR ABORT THE CALIBRATION.** ..... **1 YES/3 ABORT**
7. **EXIT THE ROUTINE.** **6**
   OR REPEAT THE ABOVE FOR UP TO 7 LENGTHS.

Continue the calibration routine with Command 06, BDC. If there is a Manual section or Mode B on the crane, return to Command 05 **after** completing the BDC for the Main Boom.

COMMAND 06 BOOM DEFLECTION CORRECTION

If this is not a prototype calibration, all radius/moment data should be precalibrated and copied over for use during crane data reset. There should be no need to perform this routine.

a) With the boom fully extended at an angle of approximately 65°, pick up the maximum permitted load. (See Data Sheet)

b) Measure the deflected radius and **add 0.2 ft** to the measured radius. The radius is measured from the centerline of rotation to the center of the load.

NOTE: **IF THE RADIUS IS ALREADY CORRECT, SKIP THIS PROCEDURE.**

With the load still suspended, calibrate the boom deflection correction (BDC) following the steps below.

COMMAND 06 BOOM DEFLECTION CORRECTION

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

0. ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE. REFER TO PAGE 5.

1. CHOOSE MENU UP OR MENU DOWN AND GO TO 06 BDC. ..... 2 OR 3

2. START 06 BDC CALIBRATION. 1

3. CHOOSE CALIBRATE NEW F TO STORE THE DATA. 1

4. CHOOSE POOR ANGLE ANGLE OK BAD ANGLE ..... 1, 2, OR 3

5. CONFIRM OR ABORT THE CALIBRATION. ..... 1 CONFIRM/ 3 ABORT

6. USE THE NUMBER ENTRY ROUTINE (PAGE 6) TO ENTER THE NEW RADIUS.

7. EXIT THE ROUTINE. 6

When entering data below 60°, the warning message, "poor angle" will appear. Use the "HIGH ANGLE" or '"LOW ANGLE" arrow key to identify the angle related to the entry.

When this message occurs as the result of an error, correct the error and continue.

COMMAND 07 HEAD ANGLE

The head angle routines allow entry of the boom head deflection angles against extension. These angles are used to correct the computed radius for flys and jibs.
If this system is **not** a prototype, all of this information has been precalibrated and this routine can be ignored.

COMMAND 07 HEAD ANGLE

START WITH THE BOOM FULLY RETRACTED

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

REFER TO PAGE 5.

1. **CHOOSE MENU UP OR MENU DOWN AND GO TO 07 HEAD ANGLE.** ..... **2** OR **3**
2. **START 07 HEAD ANGLE.**..... **1**
3. **CHOOSE LEN.0 TO CALIBRATE THE FIRST HEAD ANGLE AND EXTENSION PAIR.** **1**
4. **CHOOSE NEW EXTENSION.** **1**
5. **CHOOSE 'YES' TO CALIBRATE.**..... **1**
6. **USE THE NUMBER ENTRY ROUTINE TO ENTER THE CURRENT EXTENSION.**
7. **CHOOSE EXIT TO ENTER A NEW HEAD ANGLE.**..... **6**
8. **CONFIRM/ABORT ENTRY.** ..... **1** YES/**3** ABORT
9. **USE THE NUMBER ENTRY ROUTINE TO ENTER THE MEASURED HEAD ANGLE.**
10. **EXIT.** **6**
11. **TELESCOPE THE BOOM TO THE NEXT LENGTH.**
12. **MOVE TO THE NEXT LENGTH LEN.1 (UP TO 7 LENGTHS CAN BE ENTERED). OR GO TO STEP 13.**
13. **EXIT THE ROUTINE.**..... **6**

COMMAND 08 ATTACHMENTS

Command 08 permits "hiding" an attachment when it is not sold with the crane. This action removes unnecessary steps for the Operator. The command operates by making an attachment *selectable* or *hidden.* When an attachment is subsequently added to a crane, this command permits a change to *selectable*. Follow the steps below.

COMMAND 08 ATTACHMENTS

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

0. ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE. REFER TO PAGE 5.

1. CHOOSE MENU UP OR MENU DOWN AND GO TO 08 ATTACHMENT. ..... **2 OR 3**

2. START 08 ATTACHMENT. **1**

3. CHOOSE MENU UP OR MENU DOWN AND GO TO THE ATTACHMENT THAT IS TO BE SELECTABLE OR HIDDEN. ..... **2 OR 3**

4. CONFIRM OR ABORT THE CHANGE. ..... **1 CONFIRM/3 ABORT**

5. EXIT THE ROUTINE. (SEE NOTE ABOVE). **6**

COMMAND 09 WINCHES

This Command permits "hiding" a winch when it is not sold with the crane. This action removes unnecessary steps for the Operator. The command operates by making an attachment *selectable* or *hidden.* Follow the steps below.

COMMAND 09 WINCHES

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

0. ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE. REFER TO PAGE 5.

1. CHOOSE MENU UP OR MENU DOWN AND GO TO 09. ..... **2** OR **3**

2. START 09 WINCHES. **1**

3. CHOOSE MENU UP OR MENU DOWN - GO TO THE WINCH TO BE SELECTABLE OR HIDDEN. ..... **2** OR **3**

4. CONFIRM OR ABORT THE CHANGE. ..... **1** CONFIRM/**3** ABORT

5. EXIT THE ROUTINE. **6**

COMMAND 10 ROPE LIMITS

Maximum hoist rope tension is specified by the crane manufacturer for the size and type of wire rope used on the crane. This value is set at the initialization of the system. When using this command, enter the data as shown in the example below.

The Rope Data command permits the modification of values, which should be entered in units of 1000 #.

Example: 11,700 # is entered as 11.700.

COMMAND 10 ROPE LIMITS

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

0. ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE. REFER TO PAGE 5.

1. CHOOSE MENU UP OR MENU DOWN AND GO TO 10 ROPE LIMITS. ..... **2** OR **3**

2. START 10 ROPE LIMITS. **1**
THE DISPLAY WILL READ: ENTER ROPELIM 0. CURRENTLY = XX.XX.

3. START CALIBRATION OF ROPE LIM 0. ..... **1**

4. CONFIRM OR ABORT THE CALIBRATION. ..... **1** CONFIRM**/ 3** ABORT

5. USE NUMBER ENTRY PROCEDURE TO ENTER THE NEW LIMIT
THE DISPLAY WILL READ: ENTER ROPE LIM 0.
CURRENTLY = XX.XX (VALUE ENTERED).

6. CHOOSE EXIT. **6**
THE DISPLAY WILL READ: ENTER ROPE LIMIT 1.
CURRENTLY = XX.XX.

7. START THE CALIBRATION OF ROPE LIMIT 1. ..... **1**

8. CONFIRM OR ABORT THE CALIBRATION. ..... **1** CONFIRM**/ 3** ABORT

9. USE THE NUMBER ENTRY PROCEDURE TO ENTER THE NEW LIMIT.
THE DISPLAY WILL READ:
ENTER ROPE LIM 1. CURRENTLY = XX.XX (VALUE ENTERED).

10. EXIT THE ROUTINE. **6**

EXAMINE DETAILS OF ROPE DATA FOLLOWING THE STEPS BELOW.

COMMAND 10 DETAILS OF ROPE DATA

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

0. ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE. REFER TO PAGE 5.

1. CHOOSE MENU UP OR MENU DOWN AND GO TO 10 ROPE LIMITS. ..... **2 OR 3**

2. START 10 ROPE LIMITS. **1**
THE DISPLAY WILL READ: ENTER ROPELIM 0.
CURRENTLY = XX.XX.

3. CHOOSE EXIT AND GO TO ROPE LIMIT NO. 1. ..... **6**
THE DISPLAY WILL READ: ENTER ROPELIM 1.
CURRENTLY = XX.XX

4. EXIT THE ROUTINE. **6**

COMMAND 11 ALARMS

Depending on the model of crane being calibrated, the computer can put limits on various functions via alarms. The available alarms with associated limits follow:

- **Free Bm Mode -** This mode allows the operator to select the Main Boom + Manual configuration after the Manual section (if equipped) is already extended.

  NOTE: If the crane being calibrated has Mode A and Mode B selections, this mode must be set to "NO." Damage could result from the wrong selection made.

- **Area Alarm** - This limit activates the Area Alarm. Refer to the crane Operator's Manual for explanation of the Area Alarms.
- **Low Angle Alarm** - Some models have engine covers that stand tall and could be damaged by the boom or the boom hoist cylinders. Two alarms are used to warn the operator of the approach to this potential damage; these are swing arc and boom angle. These alarms have a preset value of:

  Low Arc = 70°

  Low Ang = 4.5°

Alternate Chart - allows activation of alternate charts, if available, in the applications part of the System chip.

Load Scale - is a small scaling factor to allow load trimming. It should not be altered.

Follow the steps on the next page for Command 11.

COMMAND 11 ALARMS continued

COMMAND 11 ALARMS

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

0. ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE. REFER TO PAGE 5.

1. CHOOSE MENU UP OR MENU DOWN AND GO TO 11 ALARMS. ..... **2 or 3**

2. START 11 ALARMS. **1**
THE DISPLAY WILL READ: Free Boom Mode? (y/n)
PRESS KEY UNTIL DESIRED ENTRY (Yes or No) APPEARS. **1**
EXIT FREE BOOM MODE. **6**

3. THE DISPLAY WILL READ: Area Alarm? (y/n)
PRESS KEY UNTIL DESIRED ENTRY (Yes or No) APPEARS. **1**
EXIT AREA ALARM. **6**

4. THE DISPLAY WILL READ: Low Angle Alarm? (y/n)
PRESS KEY UNTIL DESIRED ENTRY (Yes or No) APPEARS. **1**
EXIT LOW ANGLE ALARM. **6**

5. THE DISPLAY WILL READ: Alt Chart? y/n.
PRESS KEY UNTIL DESIRED ENTRY (Yes or No) APPEARS. **1**
EXIT ALT CHART. **6**

IF YES, THE DISPLAY WILL READ: Load Scale X.XXX
THIS NUMBER CAN BE MODIFIED BY USING THE NUMBER ENTRY ROUTINE.

6. EXIT THE ROUTINE. **6**

COMMAND 12 DIGITAL INPUTS

The logic status of digital inputs is displayed using this Command.

The inputs can be high or low. Low is indicated by zero and high is indicated by 1.

COMMAND 12 DIGITAL INPUTS

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

0. ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE. REFER TO PAGE 5.

1. CHOOSE MENU UP OR MENU DOWN AND GO TO 12 DIGITAL INPUTS.....2 or 3

2. START 12 DIGITAL INPUTS. 1
THE DISPLAY WILL READ THE STATUS OF ALL DIGITAL INPUTS.

3. EXIT THE ROUTINE. 6

DIGITAL INPUTS

0.	SWING SWITCH INPUTS
1.	SWING SWITCH INPUTS
2.	SWING SWITCH INPUTS
3.	SWING SWITCH INPUTS
4.	INTERLOCK/ALT CHART INPUTS
5.	INTERLOCK/ALT CHART INPUTS
6.	NOT USED
7.	NOT USED
8.	NOT USED
9.	NOT USED
A	ATB
B	ATB
C	NOT USED
D	NOT USED
E	NOT USED

COMMAND 13 MONITOR

The monitor function allows the operator to view RAW CRANE CALIBRATION DATA. This routine is for data monitoring only! It is not possible to calibrate in this routine.

COMMAND 13 MONITOR

REVIEW THE SAMPLE DISPLAY SCREEN ON PAGE 4.

Use the designated arrow key (**1, 2, 3, 4, or 6**) appearing to the right of each step when ENTERING or EXITING a COMMAND and to CHOOSE, START, CONFIRM, ABORT, RESET, or ENTER an action.

Boom Moment data WG, WT, and Len-s can be viewed for each boom mode (up to 4) and each extension (up to 7). Also the Head Angle and BDC F-Factor, as well as the BDC F-Factor for the currently selected fly is also available.

0. ENTER THE CALIBRATION MODE AND CALIBRATION CODE, IF NOT ALREADY DONE. REFER TO PAGE 5.

1 CHANGE THE BOOM MODE. **1**

2. THE NEXT EXTENSION. **2**

3. THE PREVIOUS EXTENSION. **3**

4. EXIT. **6**

COMMAND 15 PRESSURE MONITOR

Command 15 is also a monitor function. This function allows the operator to view information on the system pressure channels. There is no action required on this screen except for the exit key (6).

COMMAND 15 PRESSURE

AVAILABLE INFORMATION

CURRENT SYSTEM TEMPERATURE

PISTON SIDE HYDRAULIC PRESSURE

ROD SIDE HYDRAULIC PRESSURE

NETT PRESSURE
(THE DIFFERENCE BETWEEN PISTON AND ROD SIDE PRESSURES SCALED BY THE CYLINDER GEOMETRY.)

GLOSSARY OF TERMS

ABORT	STOPS DATA ENTRY INTO THE SYSTEM BEFORE THE ENTRY PROCESS IS FINALIZED.
ALARM	A VISUAL OR AUDIBLE WARNING SIGNAL.
AMPLIFIER	INCREASES - EXAMPLE: A PRESSURE TRANSDUCER IN THE MILLIVOLT RANGE IS AMPLIFIED UP TO TEN VOLTS).
AMPLIFIER GAIN	THE FACTOR USED TO EXPRESS THE LEVEL OF AMPLIFICATION.
ANALOG	A MECHANISM IN WHICH DATA IS REPRESENTED BY CONTINUOUSLY VARIABLE PHYSICAL QUANTITIES.
ANGLE SENSOR	A DEVICE THAT MEASURES THE ANGLE OF THE BOOM RELATIVE TO THE HORIZON.
ANNULAR	RELATING TO, OR FORMING A RING, E.G. THE PRESSURE AROUND THE ROD OF A BOOM HOIST CYLINDER.
ANNULAR GAIN	THE FACTOR USED TO MODIFY THE PRESSURE SIGNAL FROM THE ROD SIDE OF THE BOOM HOIST CYLINDER BASED ON THE DIFFERENCE IN AREAS OF THE ROD AND THE BORE.
BACK-UP	A COPY OF DATA SAVED IN A SEPARATE COMPUTER CHIP.
BOOM DEFLECTION	THE CHANGE OF RADIUS DUE TO THE BENDING OF A BOOM UNDER LOAD.
BOOM MOMENT	THE TURNING MOMENT AROUND THE BOOM PIVOT CAUSED BY THE MOMENT OF THE UNLADEN BOOM.
BORE	THE PISTON SIDE OF A BOOM HOIST CYLINDER.
CALIBRATION	THE ADJUSTMENT OF THE GRADUATION OF SENSORS.
CAPACITY CHART	A TABLE, SUPPLIED BY THE CRANE MANUFACTURER, SHOWING THE SPECIFICATIONS AND RATINGS FOR EACH INDIVIDUAL CRANE.
CENTER OF GRAVITY	THE POINT AT WHICH THE ENTIRE WEIGHT OF A BODY MAY BE CONSIDERED AS CONCENTRATED, SO THAT IF SUPPORTED AT THIS POINT, THE BODY WOULD REMAIN IN EQUILIBRIUM IN ANY POSITION.
COMMISSIONING	PREPARING TO BE PUT INTO SERVICE.

CONFIGURATION	THE POSITION OF THE CRANE SUPPORTING APPENDAGES AND ALL LIFTING ELEMENTS OF A CRANE.
CURSOR	A POINTER ON A DISPLAY THAT INDICATES WHERE DATA IS TO BE ENTERED.
DATA	FACTUAL INFORMATION USED AS A BASIS FOR CALCULATION.
DEDUCT	A REDUCTION IN RATED CAPACITY FOR AN UNUSED, STOWED, OR ERECTED ATTACHMENT.
DEFLECTION	THE BENDING OF A BOOM OR THE STRETCHING OF PENDANT LINES WITHIN THE ELASTIC LIMITS OF THE BOOM OR PENDANTS.
DIGITAL	OPERATING WITH NUMBERS SHOWN AS DIGITS.
DIGITAL INPUTS	COMPUTER - USUALLY CONTROLLED BY EXTERNAL ON/OFF SWITCHES.
DIRECTION	THE COURSE ON WHICH THE UPPER SECTION (SUPERSTRUCTURE) OF A CRANE ROTATES.
DUTY	A WORKING CONFIGURATION OF A CRANE USUALLY FOUND IN A SINGLE COLUMN OF A CAPACITY CHART.
EEPROM	ELECTRICALLY ERASABLE AND PROGRAMMABLE "READ ONLY" MEMORY (ROM).
ELASTIC	CAPABLE OF RECOVERING SIZE OR SHAPE AFTER EXPANSION.
ERECTED ATTACHMENT	AN ATTACHMENT ON THE MAIN BOOM IN WORKING (NOT STOWED) POSITION.
EXTENSION SENSOR	A DEVICE THAT MEASURES THE EXTENSION OF THE TELESCOPING SECTIONS OF A BOOM.
FLY/JIB	AN ATTACHMENT CONNECTED BY ONE EDGE TO A CRANE BOOM, E.G., A LATTICE FLY, OR JIB.
FORCE	ENERGY EXERTED, IN THIS CASE TO SUPPORT THE WEIGHT OF AN OBJECT.
GEOMETRY	A BRANCH OF MATHEMATICS ADDRESSED TO THE MEASUREMENT AND RELATIONSHIPS OF POINTS, LINES, ANGLES, SURFACES, AND SOLIDS.
GRADUATED	MARKED WITH DEGREES OF MEASUREMENT.

HEIGHT	THE VERTICAL DISTANCE FROM THE GROUND TO THE TIP OF THE BOOM OR ATTACHMENT.
HITE	AN ABBREVIATION OF THE WORD HEIGHT. THE HEIGHT OF THE BOOM PIVOT ABOVE GROUND LEVEL.
HORIZONTAL	PARALLEL TO THE HORIZON.
HYDRAULIC CRANES	USING THE PRESSURE OF OIL FOR OPERATION.
INCREMENT	THE ACTION OF INCREASING A NUMBER OR VALUE.
INITIALIZES	ERASES ALL DATA FROM MEMORY PRIOR TO A NEW CALIBRATION.
INTEGRATED CIRCUITS	A TINY COMPLEX OF ELECTRONIC COMPONENTS AND CONNECTIONS ON A SMALL SLICE OF MATERIAL (SUCH AS SILICON).
MEASURE HEIGHT	TO DETERMINE THE VERTICAL DISTANCE FROM BELOW THE BOOM PIVOT TO THE GROUND. RADIUS MEASUREMENTS ARE MADE FROM THESE POINTS WHEN CALIBRATING.
MICROPROCESSOR	A COMPUTER PROCESSOR CONTAINED ON AN INTEGRATED CHIP.
MILLIVOLT	ONE THOUSANDTH OF A VOLT.
MOMENT	THE PRODUCT OF FORCE AND DISTANCE IN RELATION TO A PARTICULAR AXIS OR POINT.
OUT OF DUTY	A POINT THAT IS EITHER LONGER THAN THE LONGEST PERMITTED RADIUS OR LOWER THAN THE LOWEST PERMITTED ANGLE ON A CAPACITY CHART.
OUTRIGGER	A MECHANICAL DEVICE THAT PROJECTS FROM THE MAIN STRUCTURE OF THE CRANE TO PROVIDE ADDITIONAL STABILITY OR SUPPORT.
PERSONALITY	A COMPUTER CHIP STORING ACTIVE CALIBRATION DATA.
PRESSURE	HYDRAULIC PRESSURE IN THE BOOM HOIST CYLINDER.
RADIUS	THE HORIZONTAL DISTANCE FROM THE CENTERLINE OF ROTATION TO THE CENTER OF THE HOOK.
RATED CAPACITY	THE LIFTING CAPACITY OF A CRANE, AS DETERMINED BY THE MANUFACTURER'S PUBLISHED CAPACITY CHART.

RATED CAPACITY	THE LOAD THAT A CRANE CAN SAFELY SUPPORT, BASED ON FACTORS SUCH AS STRENGTH, STABILITY, AND RATING.
RATING	A FACTOR DETERMINED BY LEGISLATION THAT LIMITS THE ACTION OF A CRANE IN A LIFTING OPERATION. USUALLY EXPRESSED AS A PERCENTAGE OF STRENGTH OR STABILITY.
RESTORE	MOVE DATA FROM A BACK-UP CHIP TO THE PERSONALITY "A" ACTIVE CHIP.
ROM	"READ ONLY" MEMORY. DATA CAN BE READ BUT NOT CHANGED AFTER PROGRAMMING.
ROPE LIMIT	THE MAXIMUM PERMITTED SINGLE LINE PULL DETERMINED BY THE CONSTRUCTION AND DIAMETER OF A WIRE ROPE.
SAVE	MOVE DATA FROM THE WORKING PERSONALITY TO A 'WRITE PROTECTED' AREA OF MEMORY.
SCALE	THE USE OF A FACTOR TO SET THE SCALING OF ANALOG SENSORS.
SCALE	SOMETHING GRADUATED WHEN USED IN MEASUREMENT.
SENSITIVITY	THE CAPACITY OF A SENSOR TO RESPOND TO PHYSICAL STIMULUS.
SENSOR	A DEVICE THAT RESPONDS TO A PHYSICAL STIMULUS AND TRANSMITS A RESULTING IMPULSE.
SHEAVE	A GROOVED WHEEL OR PULLEY.
SLEW OFFSET	THE HORIZONTAL DISTANCE FROM THE BOOM PIVOT TO THE CENTER OF ROTATION.
SPAN	AN EXTENT OR SPREAD BETWEEN TWO LIMITS.
SPAN	THE CALIBRATION OF AN ANALOG SENSOR BETWEEN ZERO AND MAXIMUM SPAN.
STOWED ATTACHMENT	AN ATTACHMENT USUALLY STORED IN AN INACTIVE POSITION ON THE MAIN BOOM.
SUPERSTRUCTURE	THE STRUCTURAL PART OF A CRANE ABOVE THE CARRIER, USUALLY ROTATING.
SWING	THE ROTATION OF A CRANE UPPER AROUND ITS CENTERLINE.

SWL (%SWL)	PERCENTAGE OF 'SAFE WORKING LOAD.' THE PROPORTION OF THE CRANE CAPACITY THAT IS BEING UTILIZED AT ANY ONE TIME AND EXPRESSED AS A PERCENTAGE OF RATED CAPACITY.
TRANSDUCER	A DEVICE THAT IS ACTUATED BY ENERGY FROM ONE SYSTEM AND CONVERTS THIS ENERGY TO ANOTHER FORM FOR USE BY A DIFFERENT SYSTEM (AS A LOUDSPEAKER THAT IS ACTUATED BY ELECTRICAL SIGNALS AND SUPPLIES ACOUSTIC POWER).
TX.0	THE PISTON SIDE PRESSURE TRANSDUCER.
TX.1	THE ROD SIDE PRESSURE TRANSDUCER.
UNLADEN	A BOOM THAT HAS NO ADDITIONAL STOWED OR ERECTED ATTACHMENTS AND IS NOT SUPPORTING A LOAD.
VOLT	UNIT OF ELECTRICAL POTENTIAL DIFFERENCE AND ELECTROMOTIVE FORCE.
WEIGHT	THE AMOUNT THAT A BODY WEIGHS.
WRITE PROTECTED	AN AREA OF MEMORY IN A COMPUTER THAT CANNOT BE ACCESSED BY A MICROPROCESSOR FOR DATA ENTRY OR CHANGE.
ZERO	THE ZERO POINT ON A GRADUATED SCALE.

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