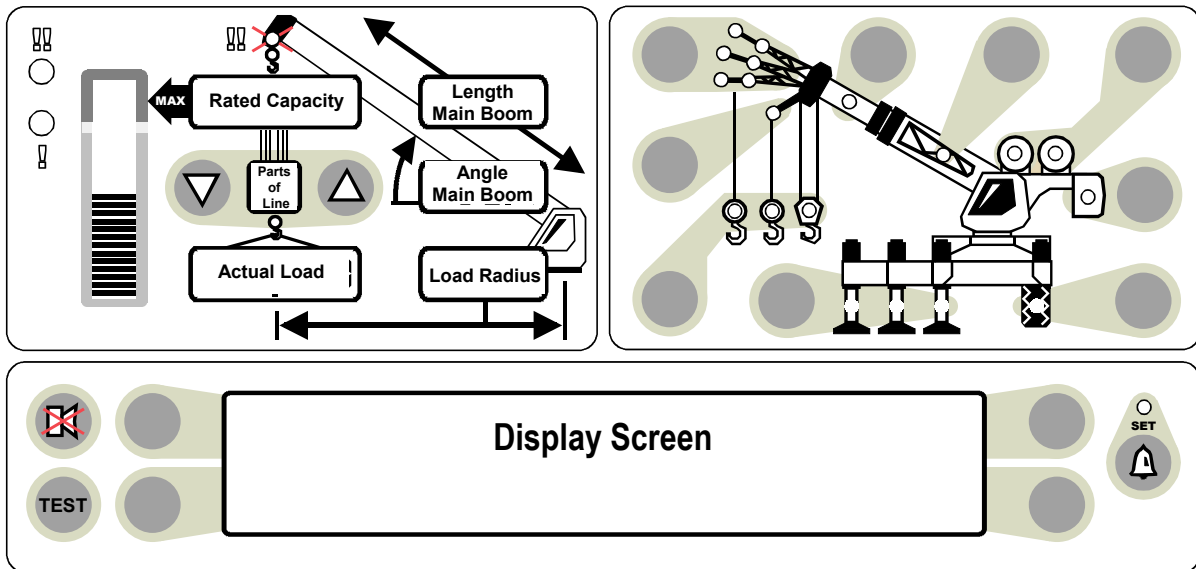


MICROGUARD[®]

TEREX RCI 510/400 SYSTEM

TELESCOPIC BOOM CRANE



CALIBRATION PROCEDURE



**MICROGUARD® TEREX RCI 510/400 SYSTEM
TELESCOPIC BOOM CRANE**

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PRE-CALIBRATION REQUIREMENTS

Following satisfactory installation of the complete RCI 510/400 System:

- ◆ Ensure that the system is wired in accordance with the appropriate wiring diagram, which is available upon request from Greer.
- ◆ Ensure that the crane is on firm and level ground, that the outrigger beams are fully extended, and that the jacks are correctly extended to level the carrier.
- ◆ Ensure that throughout the procedure any structural or stability limits are not exceeded.
- ◆ Ensure that any attachments (aux. head, fly, jib, etc.) that can be optionally stowed or erected on the boom during normal operation are removed prior to calibration of the main boom.
- ◆ Ensure that the computer is fitted with the program and duty chips specified in the installation manual.

Using the RCI 510/400 System display, proceed with the calibration commands, as directed in this manual.

OVERVIEW

When accurately calibrated, this System provides the operator with a continuous display of the following:

- ◆ Rated Load
- ◆ Actual Load
- ◆ Bar Graph showing Percentage of Rated Load
- ◆ Radius of the Load
- ◆ Boom Angle
- ◆ Main Boom Length
- ◆ Working Area
- ◆ Crane Configuration

The RCI 510/400 Display shown on the cover of this manual identifies where this data will appear.

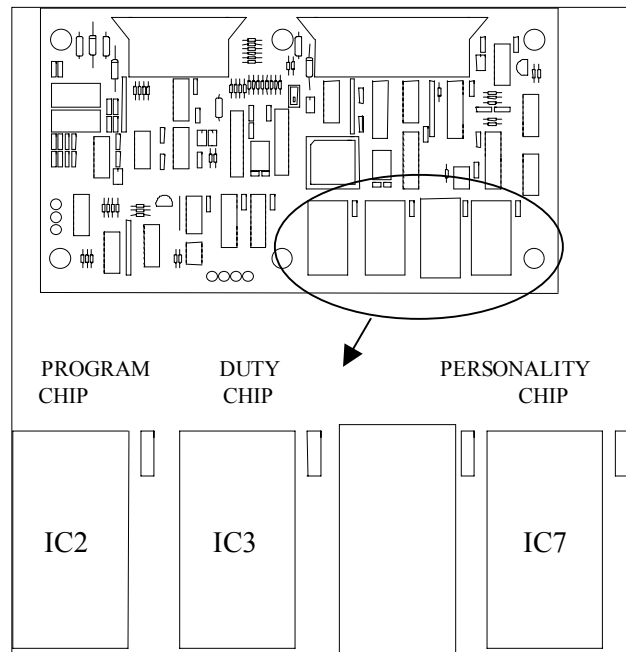
Messages on the display screen provide the operator with visual warnings of conditions that occur during operation of the system.

THIS MANUAL PROVIDES STEP-BY-STEP DIRECTIONS FOR EACH COMMAND USED IN THE CALIBRATION OF THE RCI 510/400 SYSTEMS.

OVERVIEW continued



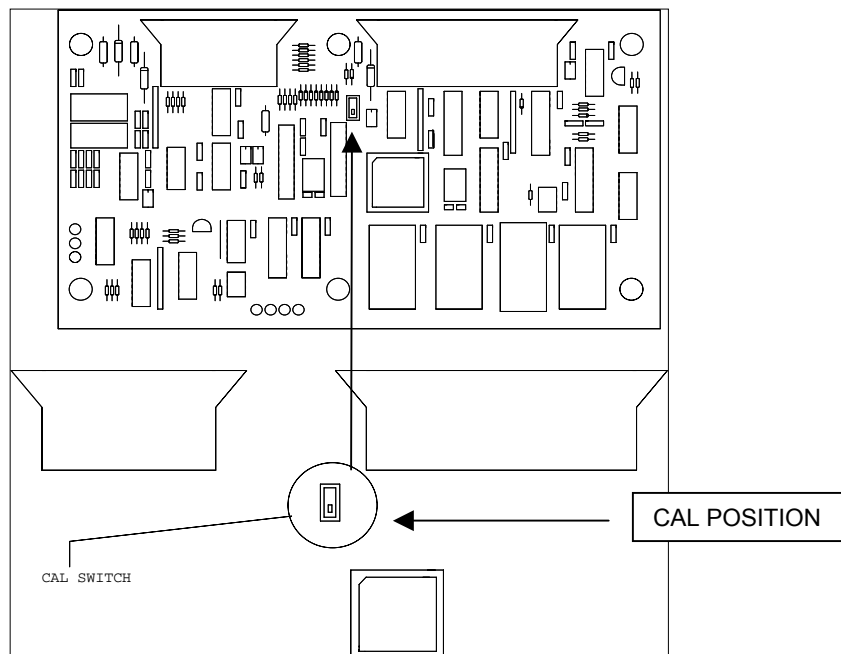
When the system is in the Calibration Mode, the audible alarm and function kick-outs are inhibited and there is no protection from two-block or overload. All crane operations are at the sole discretion of the operator.



THE CAL SWITCH

The CAL switch in the computer must be set to the "CAL" POSITION when performing calibration procedures.

To access the CAL switch, REMOVE the cover from the computer assembly. Locate the switch near the center of the computer board just between and below the ribbon cable connectors.



IMPORTANT: IF THE CALIBRATION SWITCH IS NOT ON (PULLED DOWN OR FORWARD) THE DISPLAY SHOULD READ: 'CAL DISABLED' AND THE ROUTINES CANNOT BE ACCESSED.

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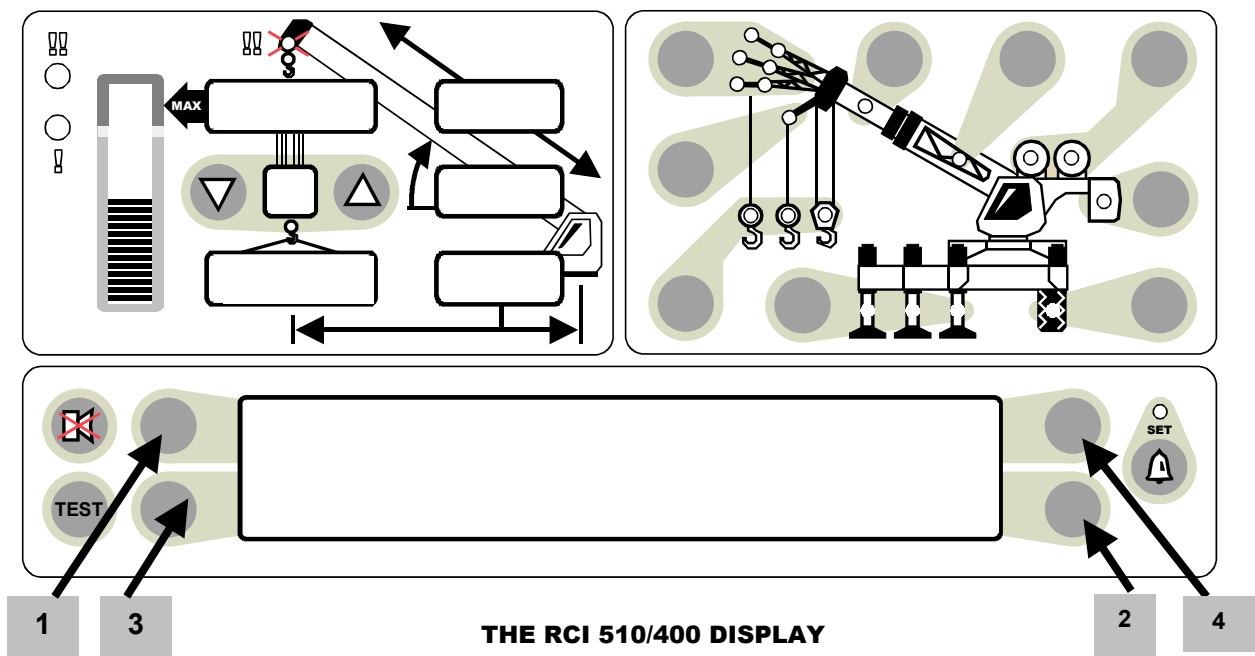
ENTERING THE CALIBRATION MODE

To perform any calibration routine, the System must operate in the “Calibration Mode.” To access the Calibration Mode, **press the Test and Set keys** simultaneously for approximately two seconds.

ENTERING THE CALIBRATION SECURITY CODE

Entry of the **Calibration Security Code** will be required often throughout these procedures.

Press keys 1 2 3 4 below in this sequence to enter the Calibration Security Code. If the wrong sequence is used or if the entry is not completed within 5 seconds, the entry will be aborted and must be entered again. This code will be used often throughout these routines. It is helpful to memorize these key positions.



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USING THE DISPLAY KEYS IN COMMAND ROUTINES

During the calibration routines, the **A B C D** display keys are used to enter data.

When entering the Calibration Security Code, use the 1234 format shown on page 6.

PRESS A to scroll forward to a command or option, to enter a current selection into the system, etc.

PRESS B to scroll backward to an option or command, etc.

PRESS C to start a command, to confirm an entry, to calibrate, or to respond to screen questions, etc.

PRESS D to exit a routine or abort a calibration.

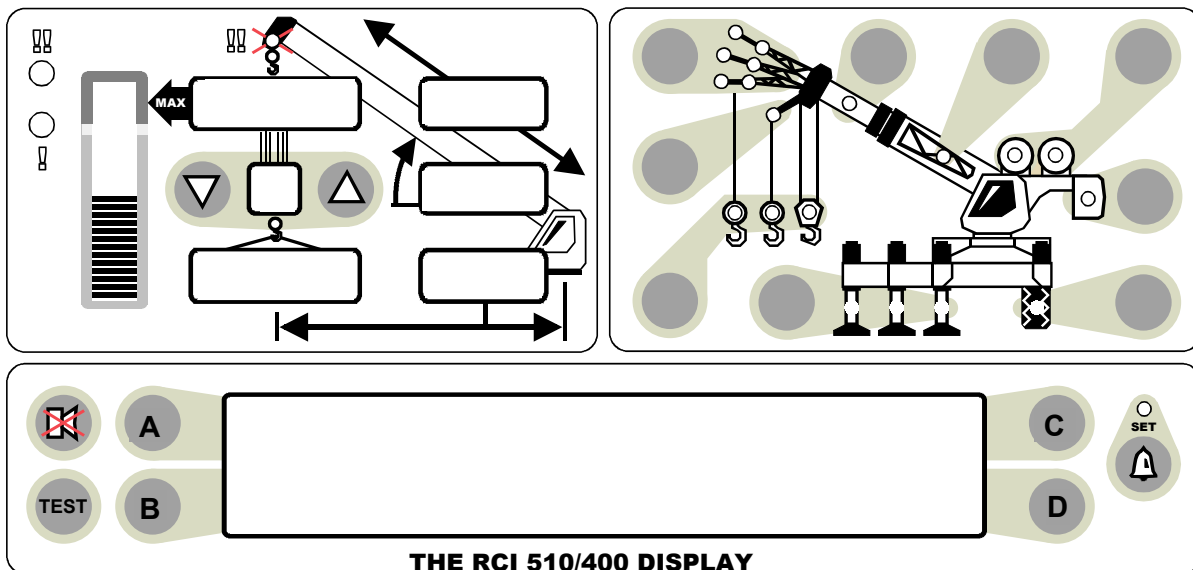
Follow directions in each command carefully. To enter numbers other than the security code, use the number entry procedure.

If the display reads: "system out of service," simultaneously press the **"Test"** and **"Hold"** keys for a few seconds. The display will request entry of the calibration security code. Following entry of the correct code, the user will be returned to the calibration mode.

When using the number entry routine, always press **C** before exiting the routine to enter the data into the system.

Display scrolling keys (**A** and **B**) can be moved full circle allowing all options listed to be viewed when moving in either direction.

The term **"repeat last entry"** is an option not a request. It allows the operator to repeat entered information if a mistake is made.



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COMMAND 00 RUN

After accessing the Calibration Mode and entering the Calibration Security Code (see page 6), the system will be in the “Monitor Mode” at **Command 00 Run**.

Do not execute this Command when preparing to calibrate the system; to do so will cause the system to carry out a “system test” followed by a return to the working screen.

Press “A” (menu up) or “B” (menu down) to view all commands. See the illustration on page 7. Stop at **Command 01 Personality**.

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COMMAND 01 PERSONALITY

Command 01 Personality is used to manipulate the crane calibration data. The system stores two sets of data in EEPROM IC7.

“**A**” Active Personality (IC7) –contains the data actually used by the main program.

“**B**” Backup Personality (IC7) –contains a “protected” copy of the calibration data.

COMMAND 01 FUNCTION

- ◆ DISPLAYS THE STATUS OF THE PERSONALITY SETS.
- ◆ MOVES DATA BETWEEN THE TWO SETS.
- ◆ DELETES DATA FROM THE ACTIVE PERSONALITY.
- ◆ COPIES DATA TO A BACK-UP CHIP.
- ◆ RETRIEVES DATA FROM A BACK-UP CHIP.

When the command is first selected (after copying data), both “A” and “B” sets are checked for correct Check-Sum. This is indicated on the display screen by “Good” or “Bad.”

Set “A” is also checked against set “B.” Data that is identical is indicated by “Same” or if not the same, by “Diff.”



Data can be moved using selected sub-commands and the calibration security code. Data entered may also be aborted before completion of the routine. Special care must be taken when working with the sub-commands as some of the sub-commands can cause previously entered data to be

irretrievably lost.

SUB-COMMAND 01/0 SAVE SAVES “A” INTO “B” (“**B**” **DATA IS LOST**).

SUB-COMMAND 01/1 XCHG EXCHANGES “A” WITH “B” (**DATA IS NOT LOST**).

SUB-COMMAND 01/2 INIT INITIALIZES “A” PRIOR TO NEW CALIBRATION (“**A**” **DATA IS LOST**).

SUB-COMMAND 01/3 BACK COPIES THE ACTIVE CALIBRATION TO A BACK-UP CHIP (**DATA IS NOT LOST**).

SUB-COMMAND 01/4 RETR RETRIEVES THE CALIBRATION FROM A BACK-UP CHIP (**PREVIOUS “A” DATA IS LOST**).

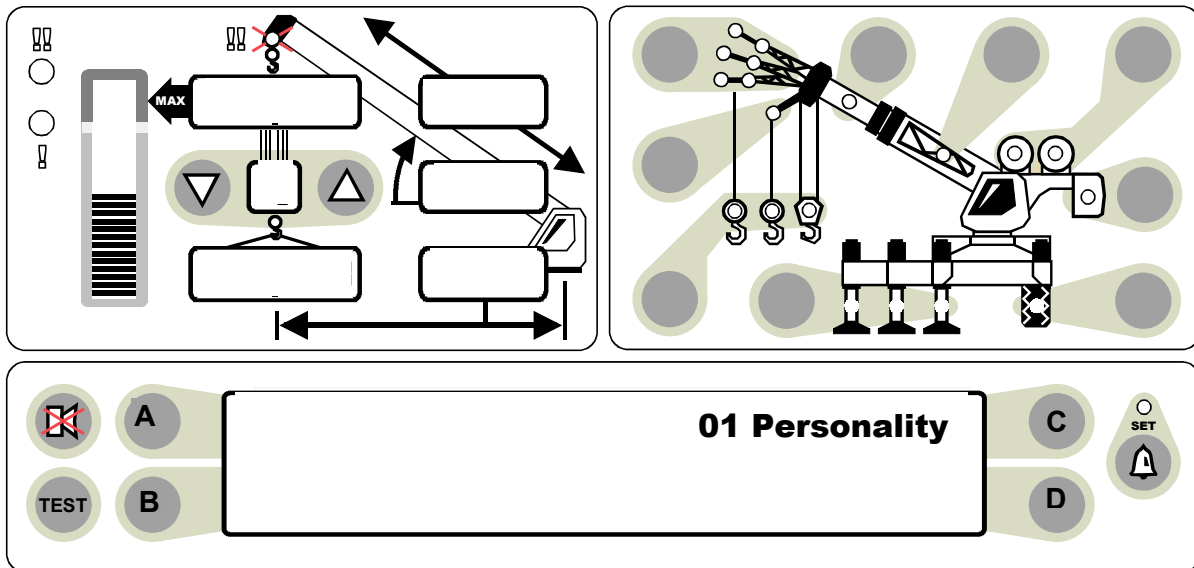


Power to the system should be switched off before inserting or removing any integrated circuits. Failure to observe this precaution may cause permanent damage to the system or its components and result in the loss of calibration data.

COMMAND 01/2 INITIALIZE



Command 01/2 is used only when calibrating the System **for the first time**. The use of this command causes all previously entered “A” side calibration data to be erased. If the system has been previously calibrated and data from a previous calibration is to be accessed or changed, proceed directly to the command to be changed. Do not perform the initialization command below.



COMMAND 01/2 INITIALIZE ROUTINE

This Procedure Completely Erases All Previous Data From “A” Personality. To cancel this routine, PRESS D, ABORT before completing Step 5.

- 1) **PRESS A** TO **01 PERSONALITY**.
- 2) **PRESS C** TO START THE COMMAND.
- 3) **PRESS A** TO 2 INIT PERS A ONLY.
- 4) **PRESS C** TO START THE CALIBRATION.
- 5) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
- 6) **PRESS 1234 (CALIBRATION SECURITY CODE)**

AFTER THE MESSAGE, “CALIBRATING” ENDS, THE DISPLAY SHOULD READ: **“AGOOD BGOOD SAME”** (See page 6).

- 7) **PRESS D** TO EXIT ROUTINE. THE SYSTEM WILL RETURN TO THE MONITOR MODE BUT WILL REMAIN IN THE CALIBRATION ROUTINE.

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COMMAND 01/0 SAVE

- **If calibrating the entire system**, execute Command 01/0 Save after completing **each** calibration routine to ensure that a complete copy of the calibration data is entered in the backup memory of the system.
- **If modifying or correcting an existing calibration**, do not save until satisfied with the results of the calibration.

This Command can be used at any time to ensure that **data entered up to the time that this routine is completed** will be saved in the system.

COMMAND 01/0 SAVE ROUTINE

(applicable to all calibration routines in this manual)

- 1) **PRESS A** TO **01 PERSONALITY**.
- 2) **PRESS C** TO START THE COMMAND.
- 3) **PRESS A** TO 01/0 SAVE.
- 4) **PRESS C** TO START THE CALIBRATION.
- 5) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
- 6) **PRESS 1234** (SECURITY CODE).
- 7) AFTER MESSAGE, "CALIBRATING" ENDS, **PRESS D** TO EXIT THE ROUTINE.

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COMMAND 02 TEST/FAULT

Command 02 activates a System "Self-Test" to detect and display errors (faults) in the system.

- 1) **PRESS A** TO 02 TEST/FAULT.
- 2) **PRESS C** TO EXECUTE A SYSTEM SELF-TEST AND TO DISPLAY ERRORS.
- 3) **PRESS D** TO EXIT THE ROUTINE.

FAULTS

GROUP "A" ANALOG SENSORS

CODE

AAA		
000		NO FAULTS
001	SENSOR 0	PISTON PRESSURE TRANSDUCER
002	SENSOR 1	ROD SIDE PRESSURE TRANSDUCER
004	SENSOR 2	EXTENSION SENSOR
008	SENSOR 3	BOOM ANGLE SENSOR
016	SENSOR 4	S'STRUCTURE ANGLE SENSOR
032	SENSOR 5	SWING POTENTIOMETER "A"
064	SENSOR 6	SWING POTENTIOMETER "B"

GROUP "B" INPUTS AND OUTPUTS

CODE

BB		
00		NO FAULTS
01	FAULT 1	DIGITAL INPUT AND OUTPUT
02	FAULT 2	ANALOG INPUT AND OUTPUT
04	FAULT 4	DISPLAY UNIT

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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

GROUP "D" GENERAL

CODE

DD		
00		NO FAULTS
01	FAULT 1	NO DUTY FOUND
02	FAULT 2	CURRENT DUTY BAD
04	FAULT 4	ROPE OR RAM DIMENSION MISSING
08	FAULT 8	FLY NOT CALIBRATED

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NUMBER ENTRY

The Microguard® RCI 500 does not have number entry keys. When numerical entry of data is required, the display will change to allow the entry of numbers.

- A strip like the one below will appear with numerals from 0 to 9 followed by the three symbols shown.
- The upper left corner identifies the Command (in this case, 06 Pressure). The upper right displays each numeral as entered until the complete number to be calibrated appears, including decimals and minus sign.
- The keys operate as in the calibration routines (A B C D).

06 Pressure										(1.0)		
Calibration Load												
0	1	2	3	4	5	6	7	8	9	<	<·>	-

- 1) When the number entry panel appears, the selectors < > will surround the zero < 0 > numeral which will be flashing. Use “key B” or “key D” to select a numeral. If **key B** is pressed, the cursor will jump to the opposite end of the display panel and the selectors will surround the minus sign. With each press of **key B** the cursor will backtrack by one digit toward the original site 0 (zero). When **key D** is used, the identical process occurs in reverse.
- 2) When not at the starting point (“0” or “-“), pressing **key B** or **key D** will cause the cursor to move one digit at a time toward its original site. **Example:** if the cursor were flashing at numeral 5, pressing **key B** once would cause the cursor to move one digit toward 0 (zero).
- 3) **WHEN ENTERING A MINUS SIGN FOR A NEGATIVE VALUE, ALWAYS DO SO AFTER ALL NUMERALS HAVE BEEN SELECTED.**
- 4) **As each digit is selected, press key A to enter it into the system.** The numeral will then appear in the upper right bracket. Continue entering numerals and decimal point, as appropriate, until the complete number appears in the upper right box. A total of five digits may be entered in this way.
- 5) If an error is made when entering a numeral, immediately select the “less than” symbol (<) and press **key A**. The number should be removed from the right upper selection box. Numbers can be removed this way one digit at a time.
- 6) When all digits look correct, press **key C** to calibrate the complete number.

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COMMAND 03 ZERO

Command 03 Zero permits calibration to zero for most analog sensors, including the four system sensors shown below. Each sensor is allocated a number corresponding to the input connection in the system.

- ◆ PISTON SIDE PRESSURE TRANSDUCER INPUT TX. 0
- ◆ ROD SIDE PRESSURE TRANSDUCER INPUT TX. 1
- ◆ BOOM EXTENSION SENSOR ANALOG INPUT 2
- ◆ BOOM ANGLE SENSOR ANALOG INPUT 3

DURING COMMAND 03 ZERO ROUTINES, THE BOOM MUST ALWAYS BE IN A HORIZONTAL POSITION.

COMMAND 05 IS USED TO CALIBRATE THE SWING SENSOR.

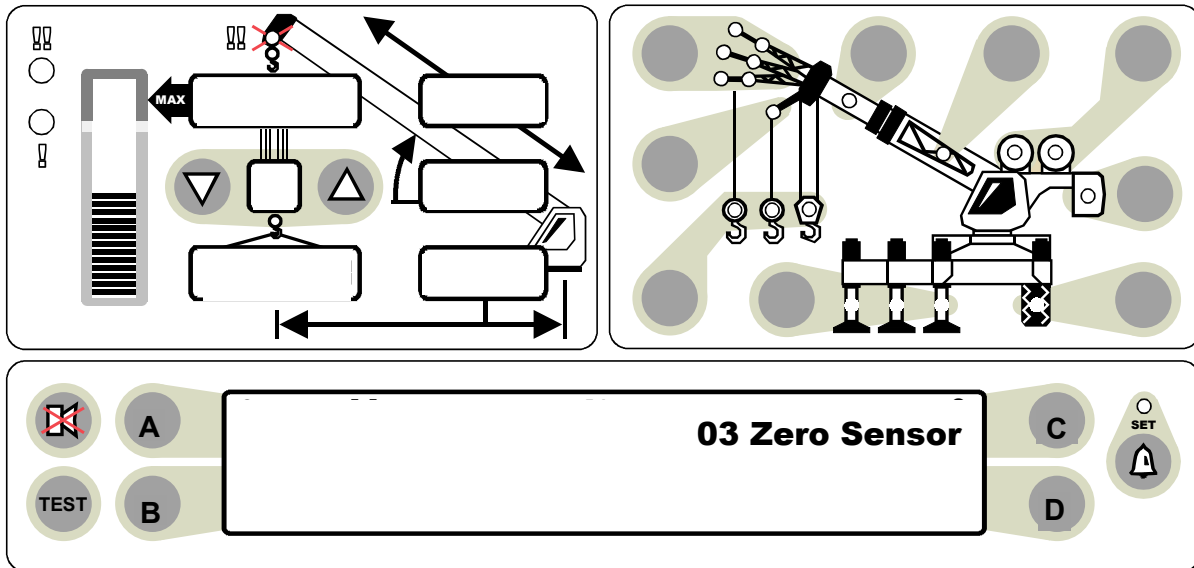
Continue with the Command 03 Zero calibration routines on the following pages.

COMMAND 03 ZERO - PRESSURE TRANSDUCERS

- ◆ Lower the boom until its lower end stops (boom hoist cylinder fully retracted). The boom must be in a horizontal position when performing the zero routines.
- ◆ Stop the hydraulic pump and reconnect electrical power to the system.
- ◆ With the boom hoist cylinder fully retracted, depressurize the hydraulic tank and open the hydraulic lines to the pressure transducers until no pressure remains in the boom hoist cylinders.
- ◆ With the pressure transducers open to atmosphere, calibrate the zero of the piston and rod pressure transducers, as shown on the next page.

IMPORTANT: Ensure that the boom is in a horizontal position when performing all zero routines.

COMMAND 03 ZERO - PRESSURE TRANSDUCERS continued



COMMAND 03 ZERO ROUTINE - PRESSURE TRANSDUCERS

IMPORTANT: ENSURE THAT THE BOOM IS IN A HORIZONTAL POSITION WHEN PERFORMING THIS ROUTINE.

- 1) **PRESS A** TO **03 ZERO SENSOR**.
- 2) **PRESS C** TO START THE COMMAND.
THE DISPLAY SHOULD READ: **ZERO TX. 0 XXXX (ACTUAL input)**.
- 3) **PRESS C** TO START CALIBRATION OF TX. 0. SENSOR.
- 4) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION OF TX. 0.
AFTER THE MESSAGE, "CALIBRATING" ENDS,
THE DISPLAY SHOULD READ: **ZERO TX. 0 XXXX (ZEROED input)**.
- 5) **PRESS A** TO ZERO TX. 1. 0.
- 6) **PRESS C** TO START CALIBRATION OF TX.1 SENSOR.
- 7) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION OF TX. 1.
AFTER THE MESSAGE, "CALIBRATING" ENDS,
THE DISPLAY SHOULD READ: **ZERO TX.1 XXXX (ZEROED input)**.
- 8) **PRESS D** TO EXIT ROUTINE.

Reconnect all hydraulic lines and reinstall the tank pressure relief valve before resuming crane operation.

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COMMAND 03 ZERO - EXTENSION SENSOR

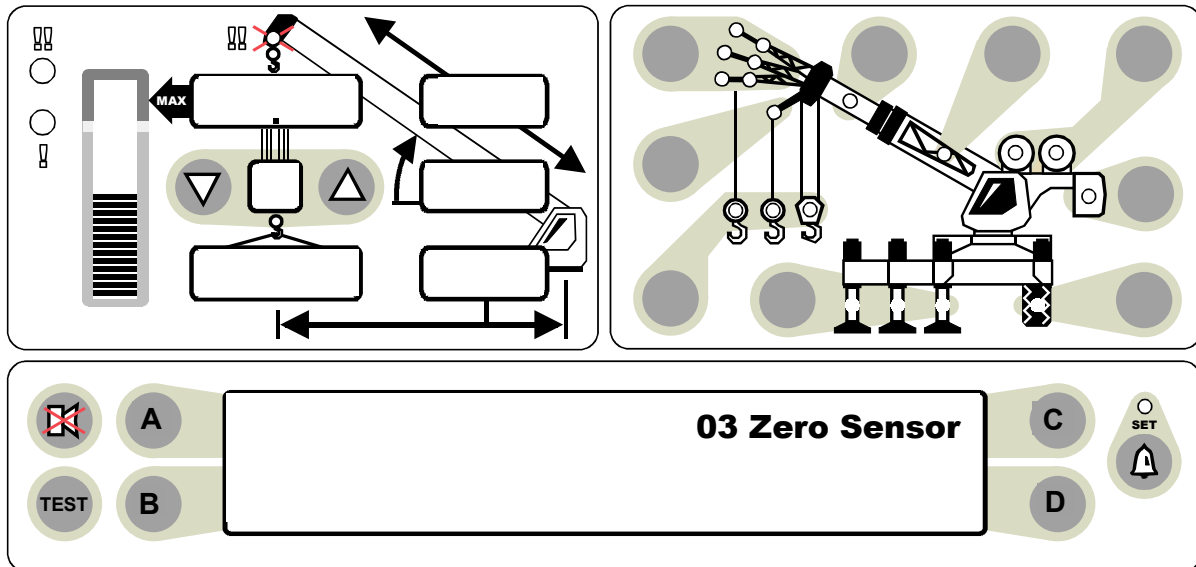
The extension reel, fitted with 130 ft. of shielded 2-wire cable, cannot be shortened to accommodate varying boom lengths.

IMPORTANT: Ensure that the boom is in a horizontal position when performing this routine.

COMMAND 03 ZERO PRETENSION ROUTINE – EXTENSION SENSOR

- 1) Fully retract all boom sections.
- 2) Remove the clamp on the reel cable and allow it to slowly rewind onto the reel until there is no pretension.
- 3) Continue to rewind the reel until the distance between the attachment point and the end of the cable is approximately 12 ft. Due to the clutch on the reel shaft, there will now be no pre-tension.
- 4) Pull the cable toward the anchor point, continuing until the end of the cable is 3 ft. Beyond the anchor point.
- 5) Secure the cable to the anchor point with at least 4 wraps, ensuring that there is sufficient cable at the boom head to connect to the anti two-block switch, which is terminated in a 3-pin plug.
- 6) Manually turn the large gear on the potentiometer fully counterclockwise. Then, advance the gear clockwise three clicks.
- 7) Calibrate the zero of the sensor, as shown on the next page.

COMMAND 03 ZERO - EXTENSION SENSOR CONTINUED



COMMAND 03 ZERO ROUTINE – EXTENSION SENSOR

IMPORTANT: Ensure that the boom is in a horizontal position when performing this routine.

- 1) **PRESS A** TO **03 ZERO SENSOR**.
- 2) **PRESS C** TO START THE COMMAND.
- 3) **PRESS A** TO ZERO NO. 2 XXXX (ACTUAL INPUT).
- 4) **PRESS C** TO START CALIBRATION OF THE 03 ZERO SENSOR.
- 5) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION OF ZERO NO. 2.
AFTER THE MESSAGE, "CALIBRATING" ENDS,
THE DISPLAY SHOULD READ: **ZERO NO. 2 XXXX** (ZEROED INPUT).
- 6) **PRESS D** TO EXIT THE ROUTINE OR **PRESS A** TO CHANGE THE SENSOR.

COMMAND 03 ZERO - BOOM ANGLE SENSOR

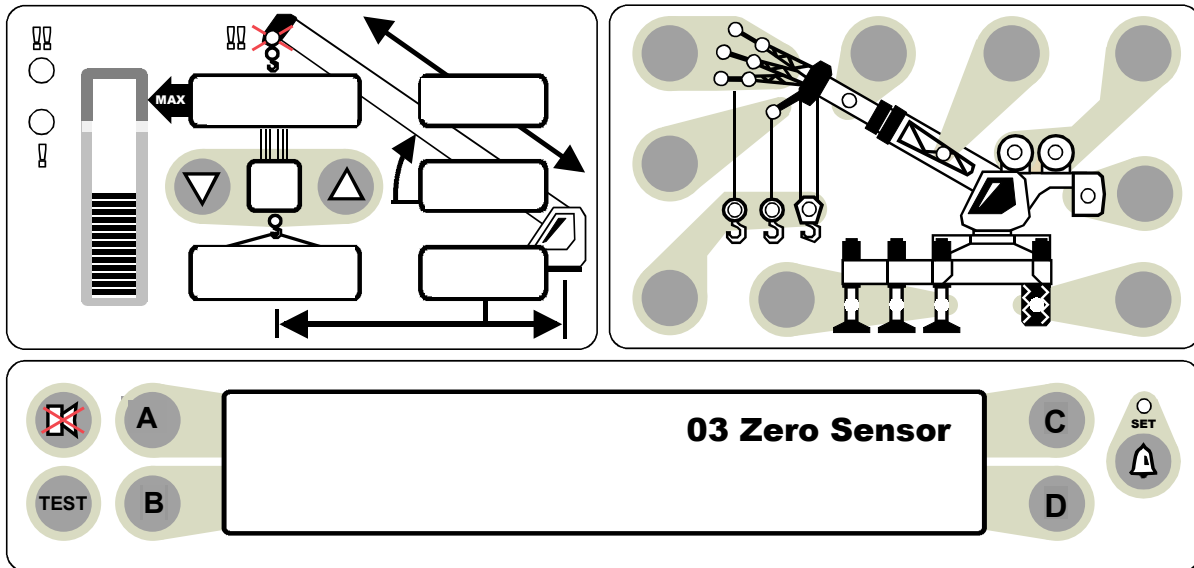
Use great care when calibrating the boom angle sensor. **All subsequent calculations are dependent on the accuracy of this calibration.**

Use an inclinometer or measuring device with an accuracy of +/- 0.25 when calibrating the boom angle sensor. Use of a less accurate device may result in calibration errors.

IMPORTANT: Ensure that the boom is in a horizontal position when performing this routine.

- ◆ Using an inclinometer, set the boom in a horizontal position.
- ◆ The boom angle sensor is mounted inside the d3I0022 housing. Mount the extension sensor perpendicular to the boom.
- ◆ Calibrate the zero of the boom angle sensor (page 21).

COMMAND 03 ZERO - BOOM ANGLE SENSOR



COMMAND 03 ZERO ROUTINE – BOOM ANGLE SENSOR

IMPORTANT: Ensure that the boom is in a horizontal position when performing this routine.

- 1) **PRESS A** TO **03 ZERO SENSOR**.
- 2) **PRESS C** TO START THE COMMAND.
- 3) **PRESS A** TO ZERO NO. 3.
- 4) **PRESS C** TO CONFIRM SELECTION OF THE SENSOR.
- 5) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION OF ZERO NO. 3.

AFTER THE MESSAGE, "CALIBRATING" ENDS,
THE DISPLAY SHOULD READ:

ZERO NO. 3 XXXX (ZEROED INPUT).

- 6) **PRESS D** TO EXIT THE ROUTINE OR **PRESS A** TO CHANGE THE SENSOR.

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COMMAND 04 SPAN

Command 04 Span includes the boom angle sensor and the extension sensor.

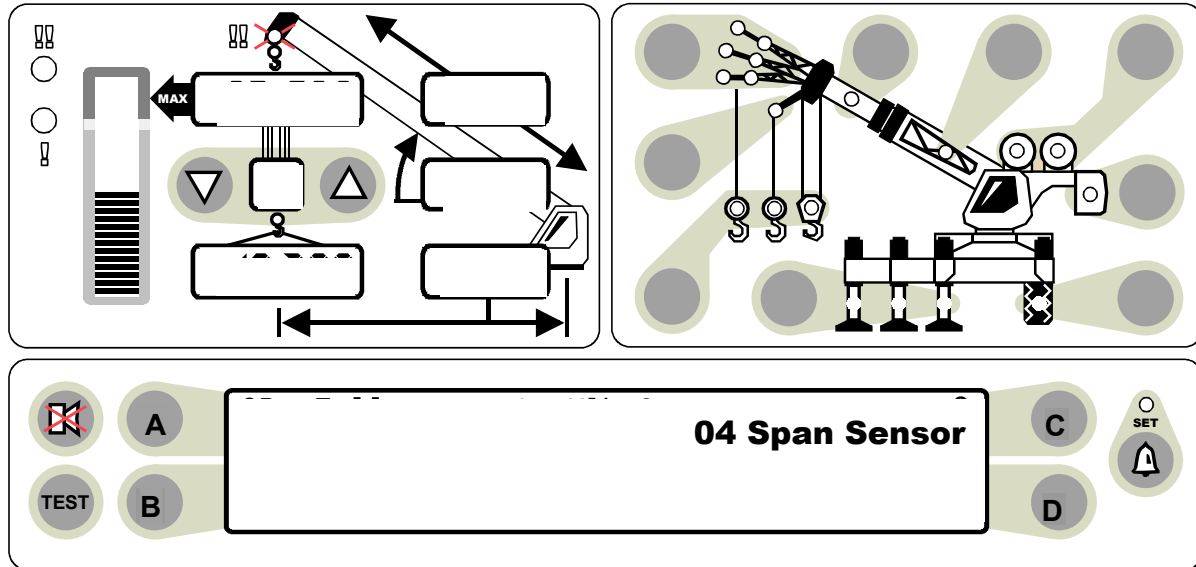
BOOM ANGLE SENSOR

Use great care when calibrating the boom angle sensor. **All subsequent calculations are dependent on the accuracy of the calibration of this sensor.**

- ◆ Use an inclinometer or measuring device with an accuracy of +/- 0.25 when calibrating the angle of the main boom. Use of a less accurate device could result in calibration errors.
- ◆ Calibrate the span of the boom angle sensor, as shown on the next page.

COMMAND 04 SPAN

BOOM ANGLE SENSOR continued



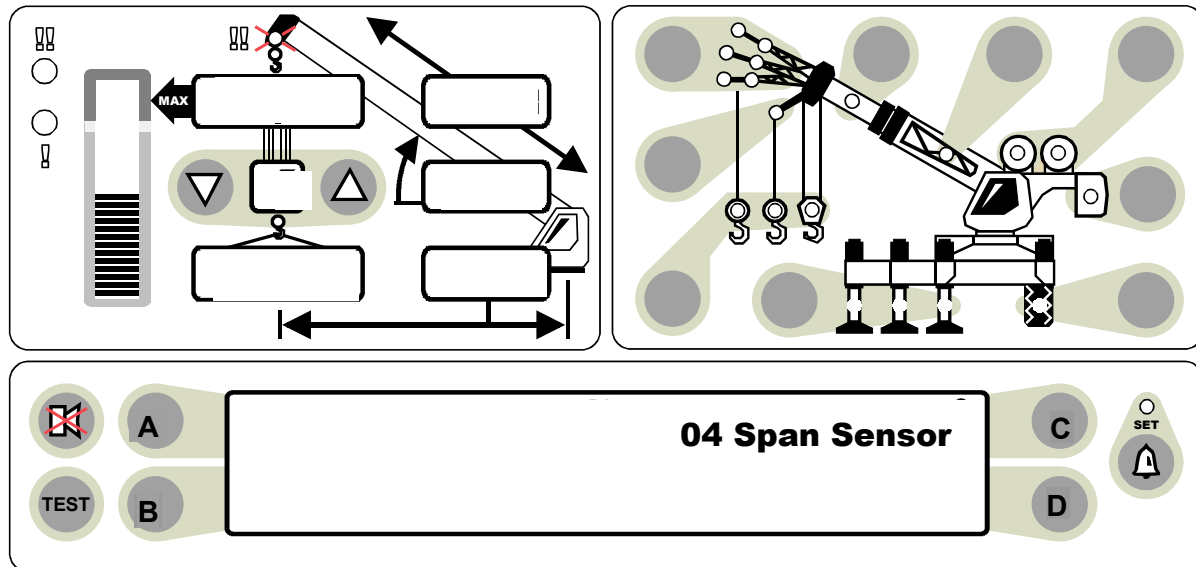
COMMAND 04 SPAN - BOOM ANGLE SENSOR ROUTINE

- 1) **PRESS A** TO **04 SPAN SENSOR**.
- 2) **PRESS C** TO START THE COMMAND.
THE DISPLAY SHOULD READ: **SPAN NO. 3**.
- 3) **→** RAISE THE BOOM TO AN ANGLE 65° OR HIGHER. MEASURE THE ANGLE USING AN INCLINOMETER. (e.g., 65.5°)
- 4) **PRESS C** TO CONFIRM SELECTION OF THE SENSOR.
- 5) **PRESS C** TO START THE SPAN CALIBRATION OF SENSOR NO. 3.
- 6) **→** USE THE NUMBER ENTRY PROCEDURE (PAGE 14) TO ENTER THE MEASURED BOOM ANGLE.
AFTER THE MESSAGE, "CALIBRATING" ENDS,
THE DISPLAY SHOULD READ: SPAN NO. 3 XX (ACTUAL INPUT, AS ENTERED).
- 7) **PRESS B** TO SPAN NO. 2 (CONTINUE WITH STEP 4 ON THE NEXT PAGE).

COMMAND 04 SPAN continued

EXTENSION SENSOR

The fully extended boom with no load (3 section or 4 section) will not cause a tipping condition. Carry out the calibration procedure below with the main boom sections fully extended. **The “extension value” is the fully extended boom length minus the fully retracted boom length.**



COMMAND 04 SPAN – EXTENSION SENSOR ROUTINE

If continuing from span 3 on page 23, go directly to step 4 below:

- 1) **PRESS A** TO 04 SPAN SENSOR.
- 2) **PRESS C** TO START THE COMMAND.
- 3) **PRESS B** TO SPAN NO. 2.
- 4) **—————>** FULLY EXTEND THE BOOM.
- 5) **PRESS C** TO CONFIRM SELECTION OF THE SENSOR.
- 6) **PRESS C** TO START THE CALIBRATION OF SPAN NO. 2.
- 7) **—————>** USE THE FORMULA ABOVE TO DETERMINE THE EXTENSION VALUE.
- 8) **—————>** USE THE NUMBER ENTRY PROCEDURE (PAGE 14). TO ENTER THE EXTENSION VALUE.
- 9) **—————>** AFTER THE MESSAGE, “CALIBRATING” ENDS, THE DISPLAY SHOULD READ: Span NO. 2 XXXX (EXTENSION VALUE).
- 10) **PRESS D** TO EXIT THE ROUTINE.

The above procedure will show the boom extension as the EXTENSION VALUE (xx FT.). After completion of COMMAND 07 (Main Boom radius/moment), the display will exhibit THE ACTUAL BOOM LENGTH.

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COMMAND 05 SWING

Perform this Command ONLY if the crane has a swing potentiometer.

Command 05 includes the scale, zero, and direction routines. These routines are usually carried out consecutively. However, zero and direction can be done in isolation of scale.

When scale is redone, zero and direction must follow.

SCALE

Command 05 does not require the entry of measured data. Measurements of swing data are acquired automatically during the calibration of the swing sensor. **However, it is essential that the crane upper be rotated slowly during this procedure.**

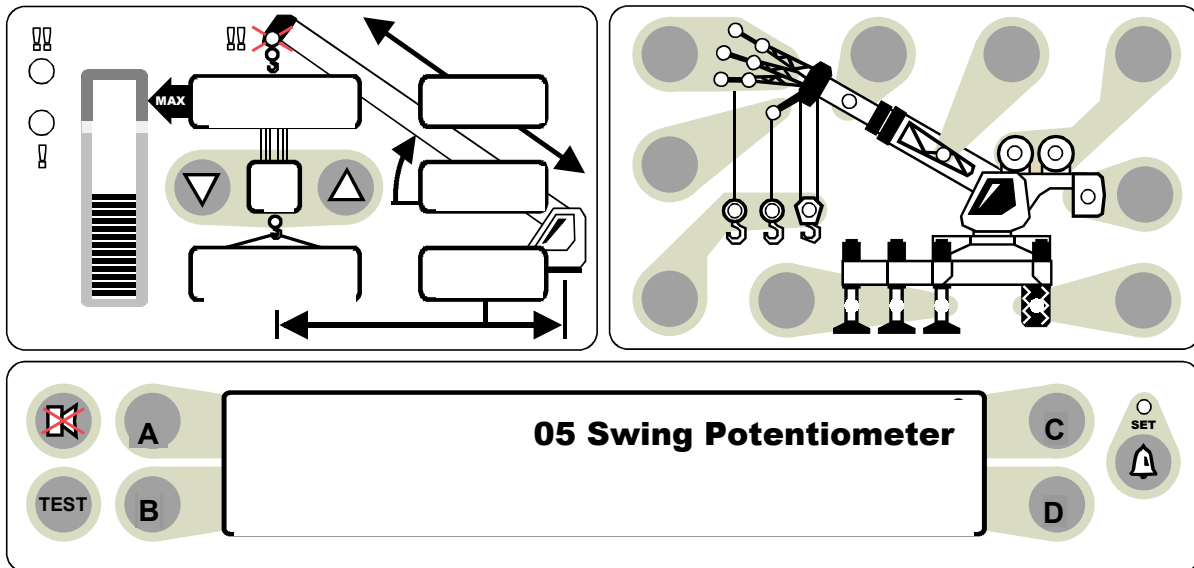
ZERO

To obtain the data required for the zero of the potentiometer, the **crane upper must be directly in line over the front of the crane.** This applies to **all** crane models, lattice or hydraulic and truck or all terrain.

DIRECTION

Swing direction is similar to a compass. Swinging to the right increases the readings and swinging to the left decreases the readings. If the swing potentiometer is mounted so that output is in the wrong direction, use the direction command to change the displayed direction.

COMMAND 05/0 SWING POT SCALE

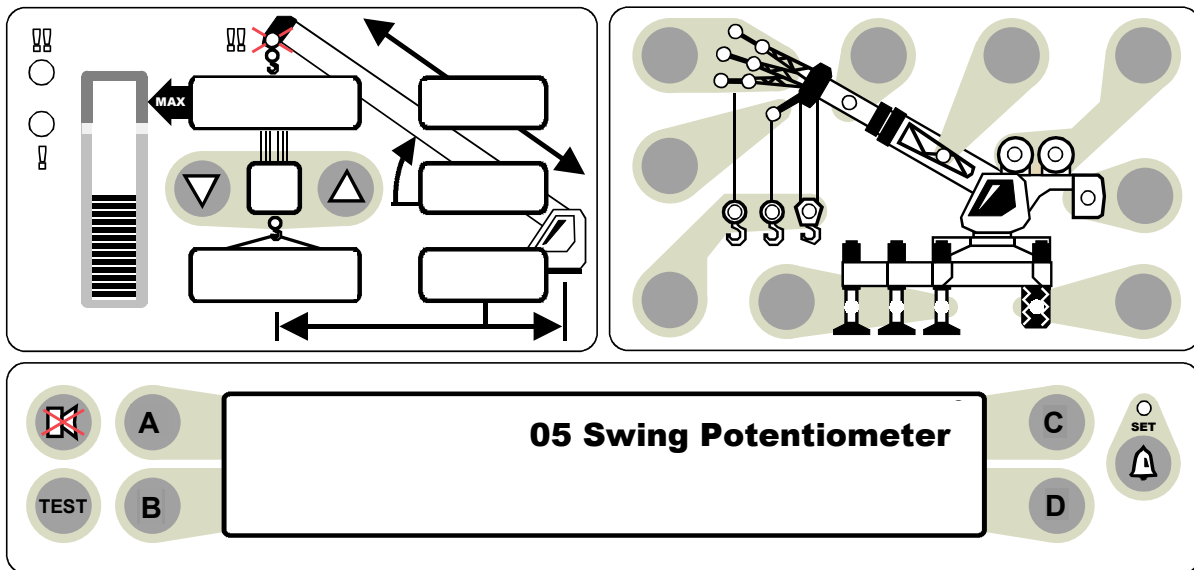


Please **review the notes on page 25** before performing any of the swing routines. It is essential that the crane upper be rotated **slowly** during the **scale** procedure. This is especially important at the nodes which occur at 180° and 360°. These points can be observed on the display during the procedure.

COMMAND 05 SWING ROUTINE

- 1) **PRESS A** TO **05 SWING POTENTIOMETER**.
- 2) **PRESS C** TO START THE COMMAND.
THE DISPLAY SHOULD READ: **0 SCALE SWING POT XXX.X**.
- 3) **PRESS C** TO CONFIRM SELECTION OF SCALE.
- 4) **SLOWLY** ROTATE THE UPPER STRUCTURE OF THE CRANE FOR AT LEAST 2 REVOLUTIONS.
- 5) STOP THE ROTATION.
- 6) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
AFTER THE MESSAGE, "CALIBRATING" ENDS,
THE DISPLAY SHOULD READ: **0 SCALE SWING POT. XX. X**
- 7) **PRESS D** TO EXIT THE ROUTINE OR **PRESS A** TO 1 SET SWING POT ZERO.

COMMAND 05/1 SWING POT ZERO



COMMAND 05 SWING ROUTINE

For all crane models, lattice or hydraulic and 'truck' or 'all terrain,' the data required for the zero of the potentiometer is obtained with the crane upper directly in-line over the front of the crane. If already in Command 05, go directly to step 4 below.

- 1) **PRESS A** TO **05 SWING POTENTIOMETER.**
- 2) **PRESS C** TO START THE COMMAND.
- 3) **PRESS A** TO 1 SET SWING POT ZERO 0.0.
- 4) POSITION CRANE UPPER DIRECTLY IN LINE OVER FRONT OF CRANE.
- 5) **PRESS C** TO START CALIBRATION OF 1 SET SWING POT ZERO.
- 6) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.

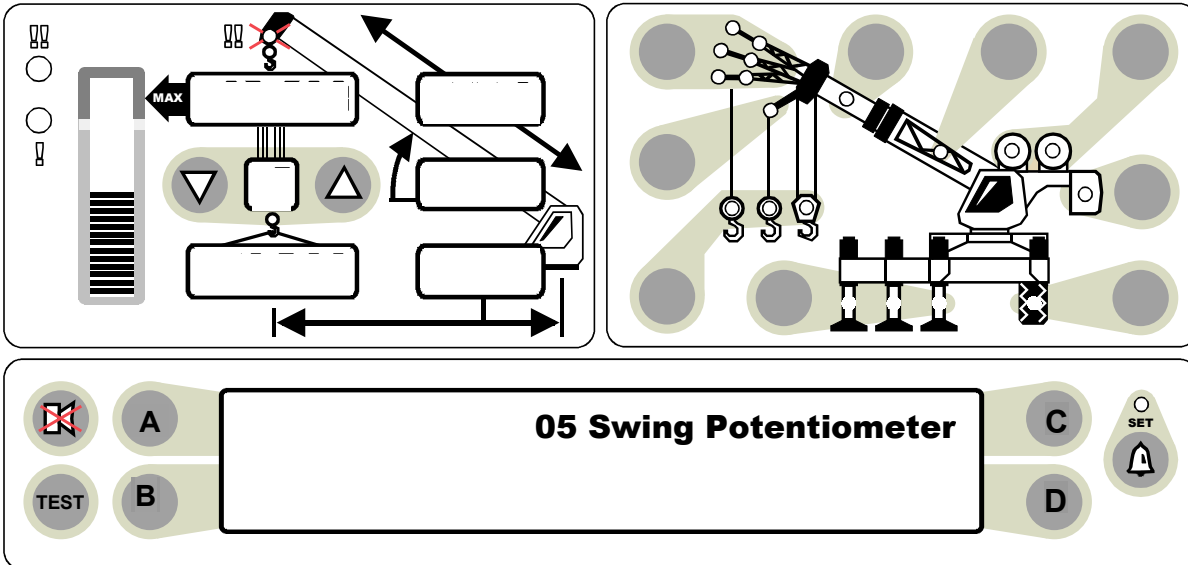
AFTER THE MESSAGE, "CALIBRATING" ENDS,
THE DISPLAY SHOULD READ: **1 SET SWING POT ZERO 0.0**
(ACTUAL SWING ANGLE).

- 7) **PRESS C** ROTATE THE CRANE UPPER TO THE RIGHT (**CLOCKWISE**) ABOUT 10°.

IF THE SWING ANGLE INCREASES, PRESS D TO EXIT. THE SWING ROUTINE IS COMPLETED. SKIP COMMAND 05/2 ON THE NEXT PAGE.

IF THE SWING ANGLE DECREASES, PRESS A TO 2 SET SWING DIRECTION +. CONTINUE WITH COMMAND 05/2, STEP 4 (NEXT PAGE).

COMMAND 05/2 SWING - DIRECTION



Swing direction is similar to a compass. Swinging to the right will increase and swinging to the left will decrease the readings. If the swing potentiometer is mounted so that output is in the wrong direction, use the direction command to change the displayed direction.

COMMAND 05 SWING ROUTINE - DIRECTION

If continuing from Command 05/1, page 27, skip to No. 4 below.

- 1) **PRESS A** TO **05 SWING POTENTIOMETER**.
- 2) **PRESS C** TO CONFIRM THE SELECTION.
- 3) **PRESS A** TO 2 SET SWING DIRECTION - (can be plus + or minus -)
- 4) **PRESS C** TO START CALIBRATION OF 2 DIRECTION.
- 5) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
 IN THIS CASE FOLLOWING CALIBRATION, THE DISPLAY SHOULD READ: 2 SET SWING DIRECTION + THUS REVERSING THE PREVIOUS DIRECTION (-).
- 6) **PRESS B** TO VIEW ACTUAL ANGLE OF SWING POT ZERO.
- 7) \longrightarrow **ROTATE** THE UPPER APPROXIMATELY 10° TO THE RIGHT.THE NUMBERS SHOULD **INCREASE**.
- 8) \longrightarrow **ROTATE** THE UPPER APPROXIMATELY 10° TO THE LEFT. THE NUMBERS SHOULD **DECREASE**.
- 9) \longrightarrow IF NUMBERS DO NOT CHANGE IN STEPS 7 AND 8, AS INDICATED, RETURN TO STEP 4 AND REPEAT THE ENTIRE ROUTINE.
- 10) **PRESS D** TO EXIT THE ROUTINE.

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CONFIGURATION SELECTION

Before proceeding with further calibrations, ensure that the crane configuration setup is correct and that the calibration configuration selection is correct.

- ◆ The system automatically chooses the configuration last selected each time the system is powered up.
- ◆ The system automatically records the configuration last selected when in the normal operational mode.
- ◆ If changes have been made to the crane configuration, return to **the normal operational mode** and reenter the crane configuration data applicable to the area of change **before calibrating**.
- ◆ When changes are made after the initial calibration, **only** the area(s) relating to the change will require recalibration.
- ◆ When calibrating the main boom, always select “lifting over the main boom.” All calibrations pertaining to the main boom require that the operator lift and measure from the main boom.
- ◆ If there is a stowed attachment on the boom, select it on the display as “stowed.” If nothing is stowed, select “nothing stowed.”

ACCESSING THE NORMAL OPERATIONAL MODE

Press A to Command 01 Run. A system safety check will begin followed by a printed warning message and a return to the **normal operational mode**.

or

Press Exit repeatedly until it no longer says “Exit” to access the **normal operational mode**.

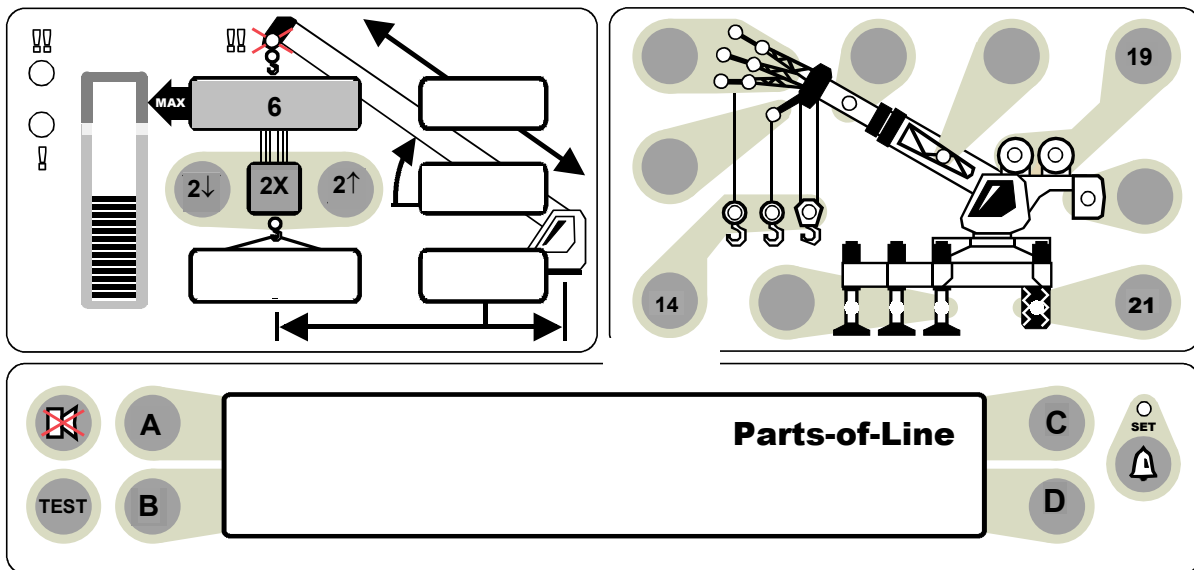
CRANE SET UP CATEGORIES

Review the operator’s manual and the following categories before starting the crane setup routine on page 31.

- 1) Outriggers, tires, rigging/travel mode.
- 2) Applicable to cranes with multiple boom mode selections: active tip, modes A & B, main boom + manual, etc. If the crane has no boom options other than the main boom, skip this step.
- 3) Auxiliary head, fitted or not fitted.
- 4) Erected attachments (see notes below).
- 5) Lifting point for front winch.
- 6) Lifting point for rear winch.

Cranes equipped with one winch can omit No. 5, but still require a lifting point selection when 2 or more lift point options exist. **Note: Any stowable attachment (stowed or not stowed) that will be selected for erection must first be selected as ‘stowed.’**

CONFIGURATION SELECTION continued



PARTS-OF-LINE

Press and hold 2↓ or 2↑ to view the available **parts-of-line**. The latest value (2x) appears when the button is released. This number applies only to the winch currently selected. A value, however, must be entered for **both** winches.

WINCH

Refer to the illustration above.

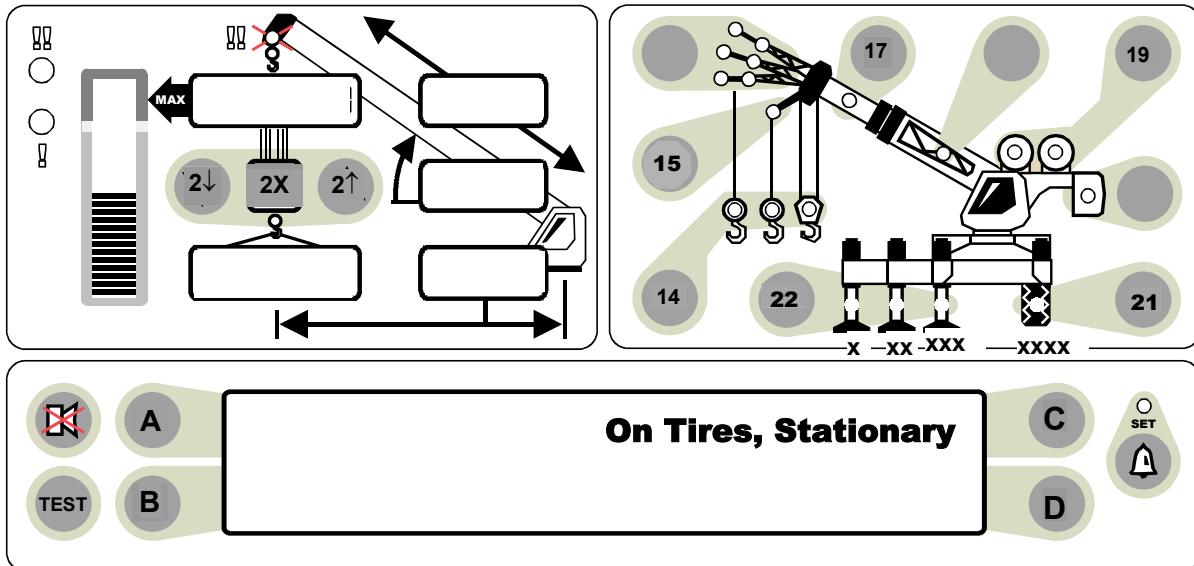
After the initial setup, the system records the parts-of-line (2x), lifting point (14), and permits calculation of deducts (6) for each winch. **Press** 19 to switch back and forth between the first and second winch. The red led's on the **winch** (19) indicate the current winch selected (if using two winches) and are lifting from two separate picking points.

RIGGING TRAVEL MODE

The Rigging/Travel Mode (21) may be selected as part of the carrier options. When selected, this mode controls the rigging and travel of the crane by inhibiting crane motion and silencing the audible alarm. The display readout is restricted to radius, length, angle, height, and precautionary messages.

See the notes on page 29.

CONFIGURATION SELECTION continued



STEPS FOR CRANE SETUP

STEP 1

The display screen, shown above, will exhibit the following positions. Press the appropriate key (21 or 22) and select an option.

TIRE SELECTION (21)

- If 'tires' is selected, the display will exhibit the following positions with slight variations.
 - On Tires, Stationary
 - On Tire, Creep Pick Centered Front
 - On Tire, 2.5 Centered Front
 - Rigging, Travel Mode (Tires, Creep, Static, 2 1/2 Mph)

● **OUTRIGGERS (22)**

- Full Ext Outriggers Xxx
- Mid Ext Outriggers, Xx
- Retracted Outriggers X

Note: Some cranes have fully extended outriggers only.

CONFIGURATION SELECTION continued

STEP 2

Your crane may have only the main boom. If so, pressing button 17 on the display may produce the message, "No other boom options available."

PRESS KEY 17.

The display screen SHOULD READ:

- ◆ **MAIN BOOM**
- ◆ **MAIN BOOM + MANUAL**

Select an option and press the corresponding key.

STEP 3

PRESS KEY 15 to indicate whether or not the auxiliary head is fitted. If fitted, the display will relay a message and a red lamp will illuminate on the aux head (15).

STEP 4

For the purpose of calibrating, jibs/flys should be stowed or removed from the crane and selected as such on the computer.

Enter data for each attachment on the crane. There are varying options. Enter the type of jib used. Press the key next to the appropriate selection.

JIB SELECTION The display will request the selection of one of the following items.

NO FLY

26' OFFSET

26' 43' TELE JIB

STEP 5 see next page

CONFIGURATION SELECTION continued

STEP 5

1. Program each of the two winches, front and rear. The selected winch will appear on the display illuminated by a green light.
2. Identify the lifting point (14) for each winch.
3. Select the number of parts-of-line (2) for each winch to be used.

When both winches are programmed, switch between the lifting points by changing the winch in use (19) on the display.

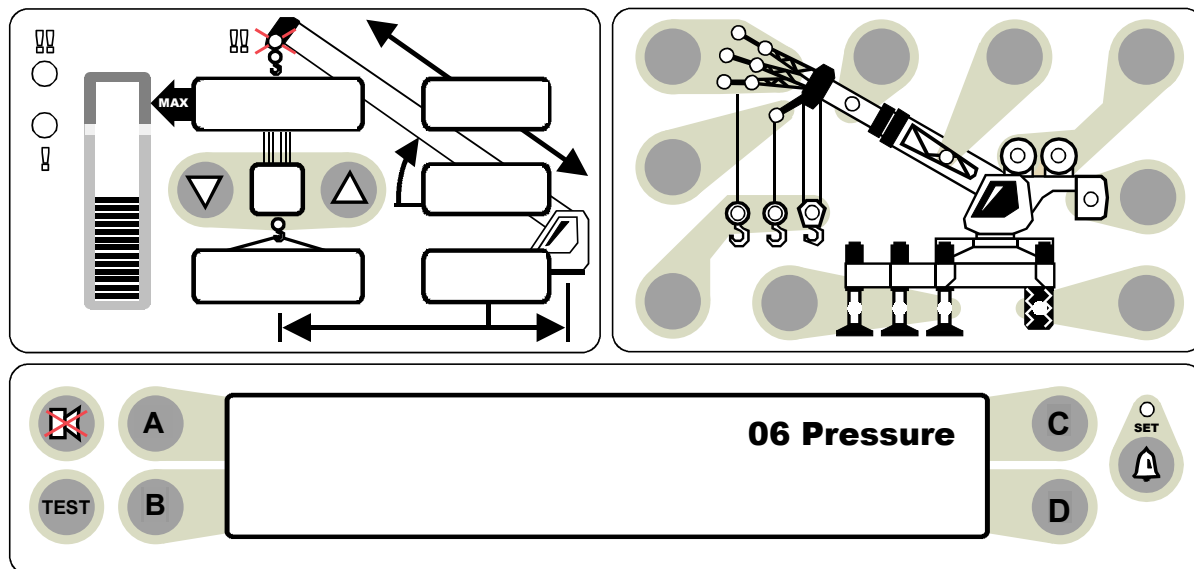
COMMAND 06 PRESSURE

IMPORTANT: Command 06 requires special attention. If the routine directions are not followed carefully, other routines in the system can also become invalidated.

1. Select fully extended outriggers, Main Boom, & No. of Attachments (preferably none).
2. Prepare to lift a known calibration load (preferably certified) at a precise angle of $45^{\circ} \pm 2^{\circ}$. Use 90 to 100% of the crane's capacity (as defined by the crane capacity chart) to put as much pressure as possible on the lift cylinders. This action is accomplished (depending on the capacity chart) by either extending or retracting the boom.
 - ◆ The calibration load includes the weight of the pins and slings but does not include the weight of the block or ball.
 - ◆ When the load is grounded, the slings should also be grounded and not supported by the hook.
 - ◆ When raising and lowering the load, use the winch. Do not use the boom.
 - ◆ Before acquiring data, wait at least 10 seconds for the pressures to become stable.

CALIBRATE THE PRESSURE SPAN FOLLOWING THE STEPS ON THE NEXT PAGE.

COMMAND 06 PRESSURE continued



U = "LOAD ON" DATA **D** = "LOAD OFF" DATA

COMMAND 06 PRESSURE ROUTINE


- 1) **PRESS A** TO **06 PRESSURE**.
- 2) **PRESS C** TO START THE COMMAND.
- 3) \longrightarrow USE THE NUMBER ENTRY PROCEDURE (PAGE 14) TO ENTER THE WEIGHT OF THE CALIBRATION LOAD.
- 4) \longrightarrow USING THE WINCH, RAISE THE CALIBRATION LOAD.
- 5) **PRESS A** "LOAD ON" DATA.
- 6) \longrightarrow USE THE NUMBER ENTRY PROCEDURE TO ENTER THE EXACT RADIUS OF THE CALIBRATION LOAD WHILE SUSPENDED.
THE DISPLAY SHOULD READ: **RADIUS ----- LOAD ----(U) ("LOAD ON" DATA ACQUIRED)**.
- 7) \longrightarrow LOWER THE LOAD TO THE GROUND WITH SLINGS HANGING SLACK, HOOKS SUSPENDED.
- 8) \longrightarrow WAIT 30 SECONDS AFTER SETTING THE LOAD ON THE GROUND; THEN, **PRESS B** "LOAD OFF" DATA.
THE DISPLAY SHOULD READ: **RADIUS -----LOAD ----- (DU)**
(LOAD ON/OFF DATA ACQUIRED).

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COMMAND 06 PRESSURE continued

COMMAND 06 PRESSURE ROUTINE CONTINUED

- 9) **PRESS C** TO START THE LOAD CALIBRATION.
- 10) **PRESS C** TO CONFIRM OR **PRESS D** TO ABORT THE CALIBRATION.
WITH THE LOAD STILL ON THE GROUND,
THE LOAD DISPLAY SHOULD READ: "ZERO."
- 11)  RAISE THE CALIBRATION LOAD.
THE DISPLAY SHOULD READ THE EXACT VALUE OF THE CALIBRATION LOAD,
AS ENTERED.
IF THE DISPLAYED LOAD IS NOT THE LOAD ENTERED,
REPEAT THE ENTIRE ROUTINE.
- 12) **PRESS D** TO EXIT THE ROUTINE.

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COMMAND 07 RADIUS/MOMENT MAIN BOOM

COMMAND 07 is used to calibrate the radius and moment of the main boom.

Before starting Command 07, ensure that the crane is appropriately configured and that the related data has been entered into the computer (see pages 29-33).

This Command requires computer entry of the radius measured with the boom retracted at both high and low angles, and the radius measured with the boom extended to the prescribed lengths at both high and low angles. The radius is the distance between the centerline of rotation and the center of the hook load.

Calibration is carried out at each length. Both high and low angle radius measurements for each length are required for the calibration to operate. This data is called "store data."

If this data is not stored, a warning message "no data" will appear requiring re-entry of this information.

Radii are entered in tenths of feet. Recommend using a surveyor's tape that is marked in tenths.

A high angle is between 60 ° and 65 ° and will have a shorter radius. A low angle is below 20 ° and will have a longer radius. Entering data outside of these limits will result in the warning message, "**poor angle.**" If entered in error, **Press D** to abort the entry. Continue the procedure using correct keyboard entries.

When this message occurs due to entry of data outside of the preferred angles, press A or B to select the desired function; then enter the radius.

The routine on pages 38-41 is used for the main boom. The routine on pages 42-45 is used for the main boom + manual. Select the appropriate routine and continue.

If and when calibrating the main boom + manual, first select main boom + manual as well as setting up the crane in that physical configuration.

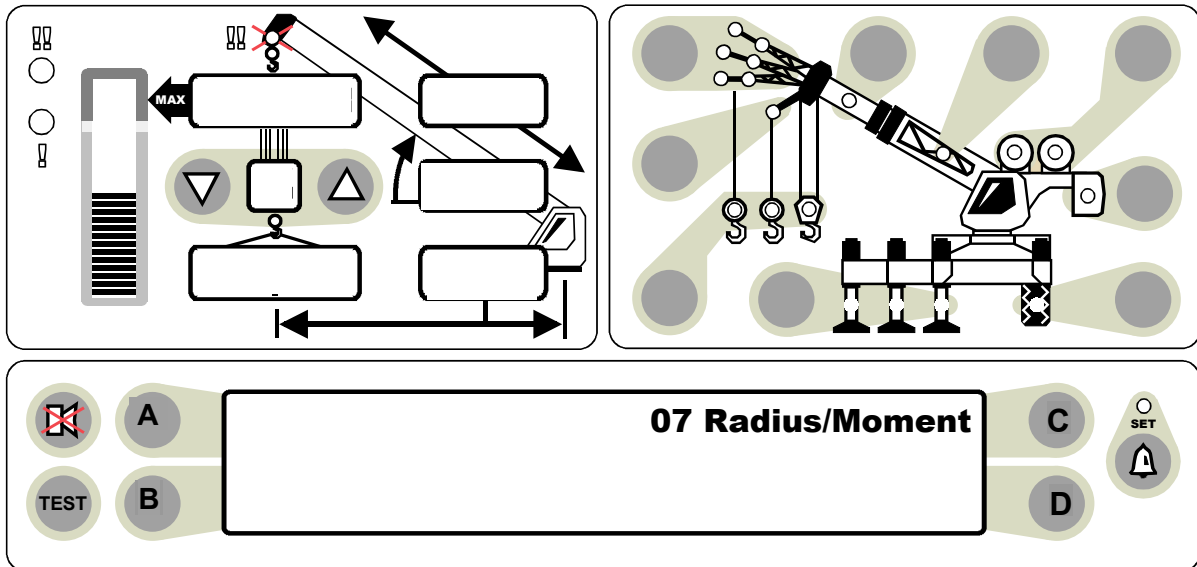
Interpretation of the display Command 07 output is as follows:

(D) = LOW ANGLE DATA ACQUIRED.

(U) = HIGH ANGLE DATA ACQUIRED.

(DU) = HIGH AND LOW ANGLE DATA ACQUIRED.

COMMAND 07 RADIUS/MOMENT MAIN BOOM continued



(D) = LOW ANGLE DATA ACQUIRED. (U) = HIGH ANGLE DATA ACQUIRED.
 (DU) = HIGH AND LOW ANGLE DATA ACQUIRED.

Before starting Command 07, carefully review the material on page 37. Ensure that the crane is appropriately configured and that the related data has been entered into the computer (see pages 29-33).

COMMAND 07 RADIUS/MOMENT ROUTINE - MAIN BOOM

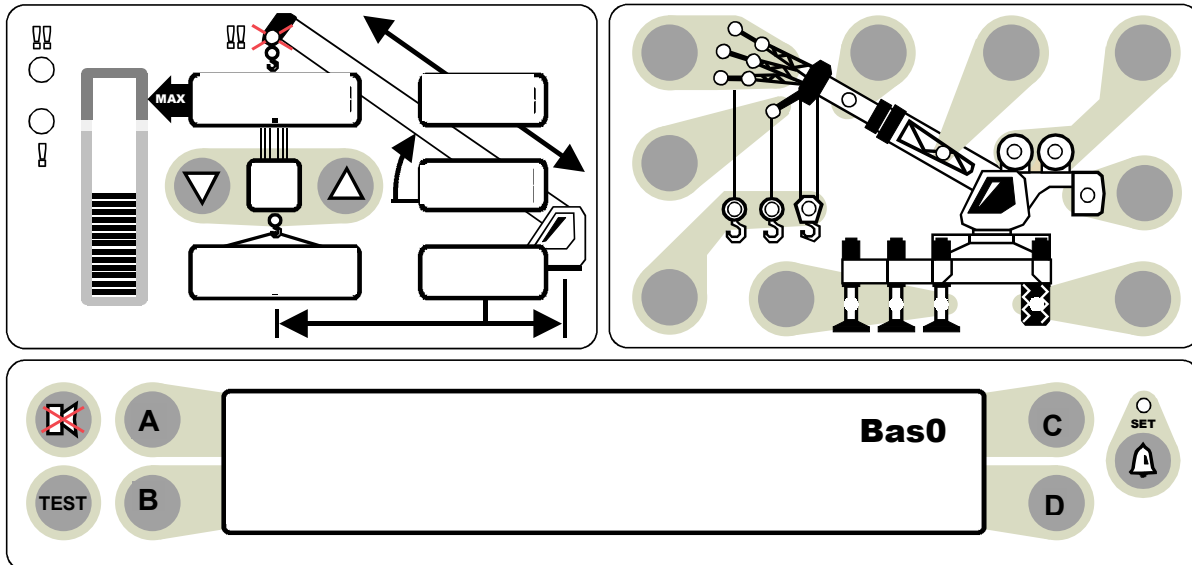
FIRST LENGTH

Fully retract the boom at an angle of 5 ° or less. Measure the radius. (Measurement is from the centerline of rotation to the centerline of the main hook.)

Determine the weight of the hook-block in use. If an auxillary hook is fitted, its weight must be added to the main hook weight. **Example: if hook block(s) = 1200 lbs., the number for entry would be 1.2.**

- 1) **PRESS A** TO **07 RADIUS/MOMENT**.
- 2) **PRESS C** TO START THE COMMAND.
- 3) **→** USE THE NUMBER ENTRY ROUTINE (PAGE 14), TO ENTER THE WEIGHT OF THE HOOK-BLOCK(S). THE DISPLAY SHOULD READ: **Bas0 ()**.
- 4) **PRESS C** TO STORE THE LOW ANGLE DATA. (THE HOOK(S) MUST BE ABOVE THE GROUND AND SUPPORTED BY THE BOOM ONLY.)
- 5) **→** USE THE NUMBER ENTRY ROUTINE (PAGE 14), TO ENTER THE **CURRENT RADIUS**.
- 6) **→** THE DISPLAY SHOULD READ: **Bas0 (D) (LOW ANGLE DATA ACQUIRED)**.

COMMAND 07 RADIUS/MOMENT MAIN BOOM continued



FIRST LENGTH continued

Raise the retracted boom to an angle between 60 ° and 65 °. Measure the new radius.

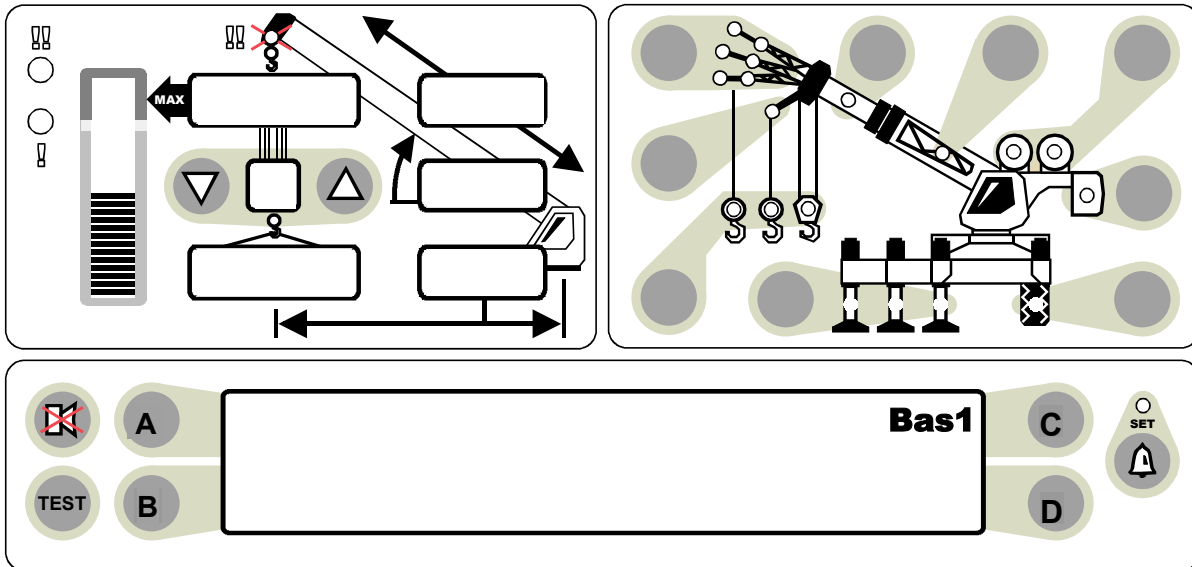
- 7) —————> THE DISPLAY SHOULD STILL READ: **Bas0 (D)**.
- 8) **PRESS C** TO STORE THE HIGH ANGLE DATA.THE HOOK(S) MUST BE ABOVE THE GROUND AND SUPPORTED BY THE BOOM ONLY.
- 9) —————> USE THE NUMBER ENTRY ROUTINE (PAGE 14) TO ENTER THE **NEW** RADIUS. THE DISPLAY SHOULD READ: **Bas0 (DU) (LOW/HIGH ANGLE DATA ACQUIRED)**.
- 10) **PRESS C** TO START THE MOMENT CALIBRATION AT THE CURRENT LENGTH.
- 11) **PRESS C** TO CALIBRATE **OR PRESS D** TO ABORT THE CALIBRATION.
- 12) —————> THE DISPLAY SHOULD READ: **Bas1 ()**.

SECOND LENGTH

Maintain the same high angle and extend the boom to 50% of extension or to the full extension if the boom mode extends less than 30 feet. Measure the new radius.

- 13) —————> THE DISPLAY SHOULD STILL READ: **Bas1 ()**.
- 14) —————> RAISE THE HOOKS CLOSE TO THE BOOM TIP (THIS REMOVES EXCESS ROPE WEIGHT FROM THE BOOM).
- 15) **PRESS C** TO STORE THE HIGH ANGLE DATA.
- 16) —————> USE THE NUMBER ENTRY ROUTINE TO ENTER THE **NEW** RADIUS.
- 17) —————> THE DISPLAY SHOULD READ: **Bas1 (U) (HIGH ANGLE DATA ACQUIRED)**.

COMMAND 07 RADIUS/MOMENT MAIN BOOM continued



SECOND LENGTH CONTINUED

Maintain the same length and lower the main boom to the lowest angle listed on the load chart for a fully extended boom. If the crane has zero capabilities, lower the boom to 5°. Measure the new radius.

- 18) —————> THE DISPLAY SHOULD STILL READ: **Bas1** (U).
- 19) **PRESS C** TO STORE THE LOW ANGLE DATA. THE HOOK(S) MUST BE ABOVE THE GROUND AND SUPPORTED BY THE BOOM ONLY.
- 20) **PRESS C** USE THE NUMBER ENTRY ROUTINE (SEE PAGE 14), TO ENTER THE **NEW** RADIUS.
- 21) —————> THE DISPLAY SHOULD READ: **Bas1** (DU). (LOW/HIGH ANGLE DATA ACQUIRED.)
- 22) **PRESS C** TO START THE MOMENT CALIBRATION AT THE CURRENT LENGTH.
- 23) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
- 24) —————> THE DISPLAY SHOULD READ: **Bas2** ().

Some models with Mode A have been fully extended at this point. If so, continue with Command 08, (Boom Deflection Correction), page 46.

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COMMAND 07 RADIUS/MOMENT MAIN BOOM continued

THIRD LENGTH

**MAINTAIN THE SAME LOW ANGLE AND FULLY EXTEND THE MAIN BOOM.
MEASURE THE NEW RADIUS.**

- 25) **→** THE DISPLAY SHOULD STILL READ: **Bas2 ()**.
- 26) **PRESS C** TO STORE THE LOW ANGLE DATA. THE HOOK(S) MUST BE ABOVE THE GROUND AND SUPPORTED BY THE BOOM ONLY.
- 27) **→** USE THE NUMBER ENTRY ROUTINE (PAGE 14) TO ENTER THE **NEW RADIUS**.
- 28) **→** THE DISPLAY SHOULD READ: **Bas2 (D) (LOW ANGLE DATA ACQUIRED)**.
- 29) **PRESS C** TO START THE CALIBRATION AT THE CURRENT LENGTH.
- 30) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.

THIRD LENGTH CONTINUED

**RAISE THE FULLY EXTENDED BOOM TO AN ANGLE BETWEEN 60 ° AND 65 °.
MEASURE THE NEW RADIUS.**

- 31) **→** THE DISPLAY SHOULD STILL READ: **Bas2 (D)**.
- 32) **PRESS C** TO STORE THE HIGH ANGLE DATA. THE HOOK(S) MUST BE ABOVE THE GROUND AND SUPPORTED BY THE BOOM ONLY.
- 33) **→** USE THE NUMBER ENTRY ROUTINE (PAGE 14), TO ENTER THE **NEW RADIUS**.
- 34) **→** THE DISPLAY SHOULD READ: **Bas2 (DU) (LOW/HIGH ANGLE DATA ACQUIRED)**.
- 35) **PRESS C** TO START THE MOMENT CALIBRATION AT THE CURRENT LENGTH.
- 36) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
- 37) **PRESS D** TO EXIT THE ROUTINE.

**CARRY OUT COMMAND 08 BDC PRIOR TO DOING THE MAIN BOOM + MANUAL RADIUS AND
MOMENT CALIBRATION.**

**IF THERE IS A MANUAL SECTION OR MODE B EQUIPPED ON THE CRANE, RETURN TO
COMMAND 07 AFTER COMPLETING THE BDC FOR THE MAIN BOOM.**

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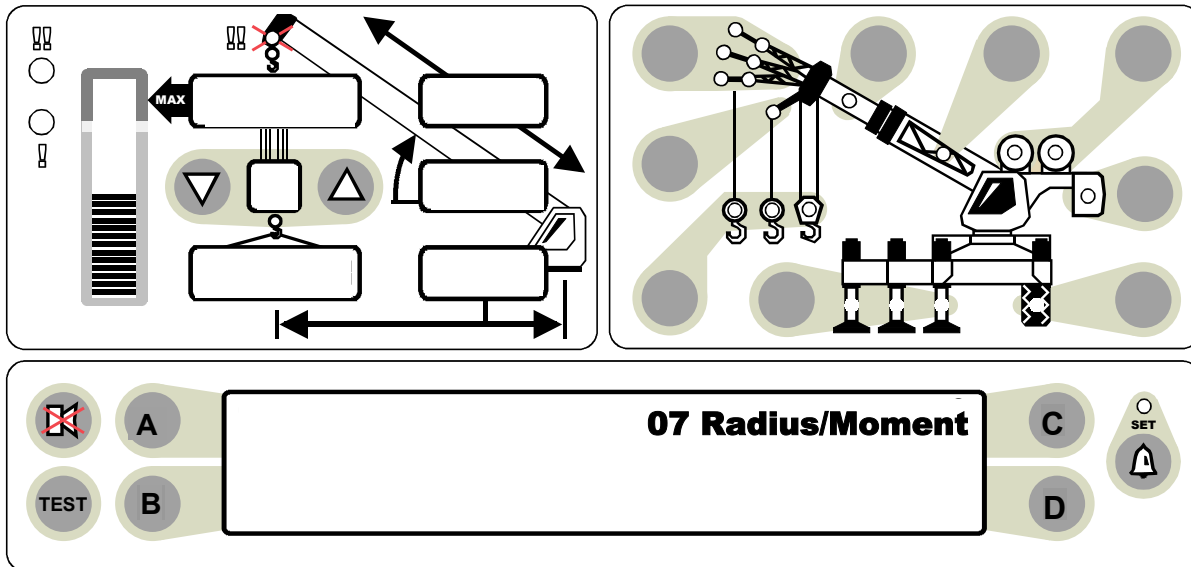
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COMMAND 07 RADIUS/MOMENT MAIN BOOM + MANUAL

MAIN BOOM + MANUAL

- ◆ EXIT THE CALIBRATION MODE.
- ◆ SELECT MAIN BOOM + MANUAL. SEE CRANE SET-UP (NORMAL WORKING SCREEN).
- ◆ EXTEND THE MANUAL SECTION.
- ◆ FULLY RETRACT THE BOOM AT 5°.
- ◆ DETERMINE THE WEIGHT OF THE HOOK-BLOCK IN USE.
- ◆ RAISE THE HOOK-BLOCK TO ELIMINATE ROPE WEIGHT.
- ◆ CALIBRATE THE RADIUS AND MOMENT OF THE MAIN BOOM + MANUAL (NEXT PAGE).

COMMAND 07 MAIN BOOM + MANUAL - RADIUS/MOMENT



(D) = LOW ANGLE DATA ACQUIRED. (U) = HIGH ANGLE DATA ACQUIRED.
 (DU) = HIGH AND LOW ANGLE DATA ACQUIRED.

COMMAND 07 RADIUS/MOMENT ROUTINE - MAIN BOOM + MANUAL

Before starting this routine, carefully review the material on page 42.

FIRST LENGTH

Exit the calibration Mode. From the normal working screen, select Main Boom + Manual. Extend the Manual section and fully retract the boom to an angle of 5 ° or less.

Determine the weight of the hook-block in use. If an auxillary hook is fitted, its weight must also be added to the main hook weight. **Example: if hook block(s) = 1200 lbs., the number for entry would be 1.2.**

Return to the calibration Mode.

- 1) **PRESS A** TO **07 RADIUS/ MOMENT.**
- 2) **PRESS C** TO START THE COMMAND.
- 3) **→** USE THE NUMBER ENTRY ROUTINE (PAGE 14) TO ENTER THE WEIGHT OF THE HOOK-BLOCK(S). THE DISPLAY SHOULD READ: **Bas0 ()**.
- 4) **PRESS C** TO STORE THE LOW ANGLE DATA. (THE HOOK(S) MUST BE ABOVE THE GROUND AND SUPPORTED BY THE BOOM ONLY.)
- 5) **→** USE NUMBER ENTRY ROUTINE (PAGE 14) TO ENTER **CURRENT** RADIUS.
- 6) **→** THE DISPLAY SHOULD READ: **Bas0 (D) (LOW ANGLE DATA ACQUIRED)**.

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


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COMMAND 07 MAIN BOOM - RADIUS/MOMENT

MAIN BOOM + MANUAL continued





FIRST LENGTH continued

Raise the retracted boom to an angle between 60 ° and 65 °. Measure the new radius.

- 7)  THE DISPLAY SHOULD STILL READ: **Bas0(D)**.
- 8) **PRESS C** TO STORE THE HIGH ANGLE DATA. THE HOOK(S) MUST BE ABOVE THE GROUND AND SUPPORTED BY THE BOOM ONLY.
- 9)  USE THE NUMBER ENTRY ROUTINE (PAGE 14) TO ENTER THE **NEW** RADIUS. THE DISPLAY SHOULD READ: **Bas0 (DU) (LOW/HIGH ANGLE DATA ACQUIRED)**.
- 10) **PRESS C** TO START THE MOMENT CALIBRATION AT THE CURRENT LENGTH.
- 11) **PRESS C** TO CALIBRATE **OR PRESS D** TO ABORT THE CALIBRATION.
- 12)  THE DISPLAY SHOULD READ: **Bas1 ()**.




SECOND LENGTH

Maintain the same high angle and extend the boom to 50% of boom extension. Measure the new radius.

- 13)  THE DISPLAY SHOULD STILL READ: **Bas1 ()**.
- 14)  RAISE THE HOOKS CLOSE TO THE BOOM TIP (THIS REMOVES EXCESS ROPE WEIGHT FROM THE BOOM).
- 15) **PRESS C** TO STORE THE HIGH ANGLE DATA
- 16)  USE THE NUMBER ENTRY ROUTINE (PAGE 14) TO ENTER THE **NEW** RADIUS.
- 17)  THE DISPLAY SHOULD READ: **Bas1(U) (HIGH ANGLE DATA ACQUIRED)**.

SECOND LENGTH continued

Maintain the same length and lower the boom to 5 °. Measure the new radius.

- 18)  THE DISPLAY SHOULD STILL READ: **Bas1 (U)**.
- 19) **PRESS C** TO STORE THE LOW ANGLE DATA. THE HOOK(S) MUST BE ABOVE THE GROUND AND SUPPORTED BY THE BOOM ONLY.
- 20)  USE THE NUMBER ENTRY ROUTINE TO ENTER THE **NEW** RADIUS.
- 21)  THE DISPLAY SHOULD READ: **Bas1 (DU). (LOW/HIGH ANGLE DATA ACQUIRED)**.

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COMMAND 07 MAIN BOOM + MANUAL RADIUS/MOMENT

MAIN BOOM + MANUAL ROUTINE - SECOND LENGTH continued

- 22) **PRESS C** TO START THE MOMENT CALIBRATION AT THE CURRENT LENGTH.
- 23) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
- 24) \longrightarrow THE DISPLAY SHOULD READ: **Bas2 ()**.

Some models with Mode A have been fully extended at this point. If so, continue with Command 08 (Boom Deflection Correction) on page 46.

THIRD LENGTH

**Maintain the same low angle and fully extend the boom.
Measure the new radius.**

- 25) \longrightarrow THE DISPLAY SHOULD STILL READ **Bas2 ()**.
- 26) **PRESS C** TO STORE THE LOW ANGLE DATA. THE HOOKS MUST BE ABOVE THE GROUND AND SUPPORTED BY THE BOOM ONLY.
- 27) \longrightarrow USING THE NUMBER ENTRY ROUTINE, ENTER THE NEW RADIUS.
- 28) \longrightarrow THE DISPLAY SHOULD READ: **Bas2 (D)** LOW ANGLE DATA ACQUIRED.
- 29) **PRESS C** TO START THE MOMENT CALIBRATION AT THE CURRENT LENGTH.
- 30) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.

THIRD LENGTH CONTINUED

**Raise the fully extended boom to an angle between 60 ° and 65 °.
Measure the new radius.**

- 31) \longrightarrow THE DISPLAY SHOULD STILL READ: **Bas2 (D)**
- 32) **PRESS C** TO STORE THE HIGH ANGLE DATA. THE HOOKS MUST BE ABOVE THE GROUND AND SUPPORTED BY THE BOOM ONLY.
- 33) \longrightarrow USING THE NUMBER ENTRY ROUTINE, ENTER THE NEW RADIUS.
- 34) \longrightarrow THE DISPLAY SHOULD READ: **Bas2 (DU)**. (HIGH AND LOW ANGLE DATA ACQUIRED)
- 35) **PRESS C** TO START THE MOMENT CALIBRATION AT THE CURRENT LENGTH.
- 36) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
- 37) **PRESS D** AFTER THE MESSAGE, 'CALIBRATING' ENDS, TO EXIT THE ROUTINE.

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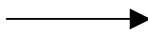
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COMMAND 08 BOOM DEFLECTION CORRECTION (BDC)

- ◆ With the boom fully extended at an angle of approximately 65°, pick up the maximum permitted load.
- ◆ Measure the deflected radius and add 0.2' to the measured radius. The radius is measured from the centerline of rotation to the center of the load.

With the load still suspended, calibrate the bdc as follows:

IF THE RADIUS IS ALREADY CORRECT, SKIP THIS PROCEDURE.

- 1) **PRESS A** TO **08 BOOM DEFLECTION**.
- 2) **PRESS C** TO START THE COMMAND.
- 3) **PRESS C** TO START THE BDC CALIBRATION.
- 4) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
- 5)  USING THE NUMBER ENTRY ROUTINE, ENTER THE NEW RADIUS.
- 6) **PRESS D** TO EXIT THE ROUTINE.

"Ofld ang" ON THE DISPLAY SCREEN = OFFLOAD ANGLE.

"Onld ang" ON THE DISPLAY SCREEN = ONLOAD ANGLE.

Any attempt to enter data outside of the above limits will result in the warning message, "**poor angle.**"

- When the message "**poor angle**" occurs as the result of an error, **Press D (bad angle)** to abort the entry. Continue the procedure using correct keyboard entries.
- When the message "**poor angle**" occurs as a result of entering data outside of the preferred angles, **Press C (angle ok)** to approve the out of range angle data.
- If the angle is not accepted by the system, the operator must abort or accept it. If accepted, the boom must be adjusted to the appropriate angle.
- If this procedure has just been carried out on the main boom, continue with main boom + manual radius and moment, Command 07.

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COMMAND 09 ANNULAR GAIN

There are two pressure transducers fitted in the system. One measures piston side pressure and the other measures rod side pressure.

Because these are not identical cross-sectional areas, data must be entered that define the ratio of the two areas. This ratio is referred to as annular gain (a.g.). Annular gain is calculated from the rod (r) and bore (b) diameters as follows:

$$A.G. = [(RXR)/(BXB)] - 1 \quad \text{E.G. } R = 8 \text{ AND } B = 10 \quad A.G. = - 0.360$$

- ◆ Although the annular gain value is automatically entered at the time of initialization, modification of this value may be required due to differing pressure transducer sensitivities.
- ◆ If the load reading changes significantly when booming down, the annular gain should be changed.

TO CHANGE THE SETTING OF THE ANNULAR GAIN:

- 1) **PRESS A** TO 09 ANNULAR GAIN.
- 2) **PRESS C** TO START THE COMMAND.

IF THE **LOAD DECREASES** WHEN BOOMING DOWN,
PRESS THE **UP ANNULAR GAIN KEY (A)**.

IF THE **LOAD INCREASES** WHEN BOOMING DOWN,
PRESS THE **DOWN ANNULAR GAIN KEY (B)**.
- 3) **PRESS C** TO START THE ANNULAR GAIN CALIBRATION.
- 4) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
- 5) **PRESS D** TO EXIT THE ROUTINE.

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COMMAND 12 WINCHES

Command 12 permits "**hiding**" a winch that is not in use or "**activating**" a winch that is hidden. Winches are classified as "active" or "hidden." Watch the display screen showing the two winches. After completing the routine below, a green light will flash above the active winch.

TO HIDE OR ACTIVATE A WINCH:

- 1) **PRESS A** TO **12 WINCHES**.
- 2) **PRESS C** TO START THE COMMAND.
- 3) **PRESS B** TO TOGGLE BETWEEN THE TWO WINCHES.
- 4) **PRESS C** TO CHANGE FROM 'SELECTABLE' TO 'HIDDEN' (OR VICE VERSA).
- 5) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
- 6) **PRESS D** TO EXIT THE ROUTINE.

COMMAND 13 ATTACHMENTS

Command 13 permits "**hiding**" an **attachment** not in use or returning a hidden attachment to a "**selectable**" (active) status.

- 1) **PRESS A** TO **COMMAND 13 ATTACHMENTS**.
- 2) **PRESS C** TO START THE COMMAND.
- 3) **PRESS B** TO THE ATTACHMENT TO BE CHANGED.
- 4) **PRESS C** TO CHANGE FROM 'SELECTABLE' TO 'HIDDEN' OR VICE VERSA.
- 5) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT CALIBRATION.
- 6) **PRESS D** TO EXIT THE ROUTINE.

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COMMAND 14 BOOM HEAD

Command 14 boom head relates to the **length** and **angle** of the boom.

There are seven (0-6) possible entries for the **length** of varying boom segments.

After len.0, **Press A** to the next length(s). **Press B** to previous length(s).

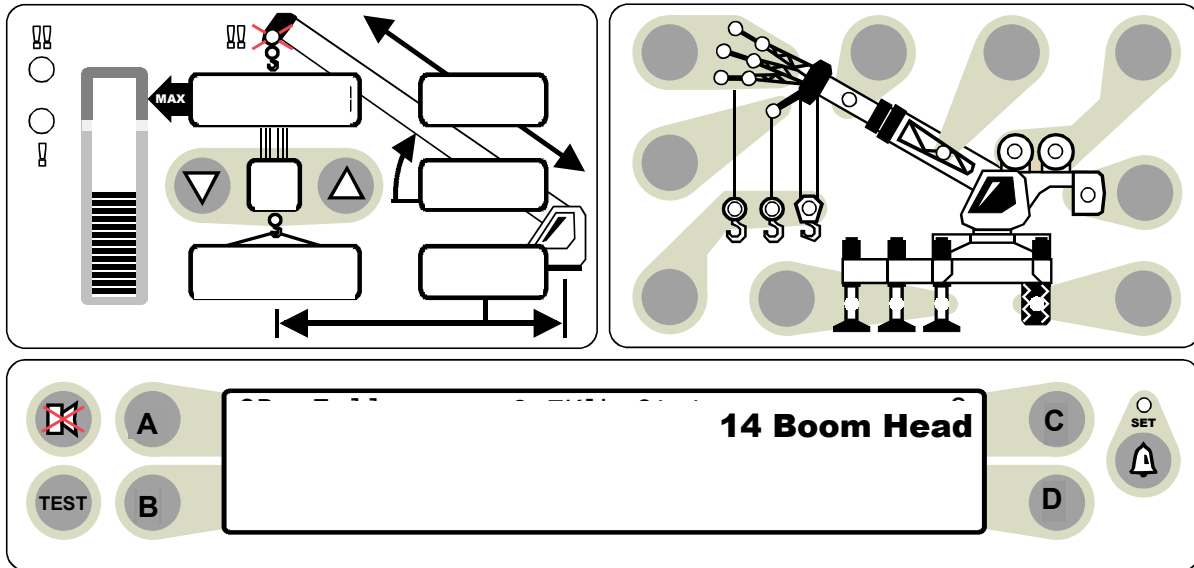
When the length entry calibration is completed, **Press D** to the boom angle data entry section.

There are seven (0-6) categories for angle data corresponding to each entry for boom length.

Proceed as usual following the routine on the next page.

COMMAND 14 BOOM HEAD

CAREFULLY REVIEW THE COMMENTS ON PAGE 49.



- 1) **PRESS A** TO **14 BOOM HEAD**.
- 2) **PRESS C** TO START THE COMMAND.
- 3) **PRESS A** THE DISPLAY SHOULD READ: **LEN.0 X.XX**.
- 4) **PRESS C** TO START THE CALIBRATION OF LEN.0. (LENGTH)
THE DISPLAY SHOULD READ: **"ENTER NEW EXTENSION."**
- 5) **PRESS C** TO MODIFY
- 6) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE ENTRY.
- 7) **→** USE THE NUMBER ENTRY PROCEDURE (PAGE 14) TO ENTER THE NEW SETTING.
AFTER MESSAGE, "CALIBRATING," THE DISPLAY SHOULD READ:
CURRENT VALUE XXX.XXX.
- 8) **PRESS C** TO START THE CALIBRATION FOR THE NEXT SEGMENT, REPEAT THE ABOVE PROCESS.
- 9) **PRESS C** TO START THE CALIBRATION OF THE NEW HEAD ANGLE.
THE DISPLAY SHOULD READ: **ENTER NEW HEAD ANGLE**.
- 10) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
- 11) **→** USE THE NUMBER ENTRY PROCEDURE (PAGE 14) TO ENTER THE NEW SETTING.
AFTER THE MESSAGE, "CALIBRATING,"
THE DISPLAY SHOULD READ: **CURRENT VALUE XXX.XXX**.
- 12) **PRESS D** TO EXIT THE ROUTINE.

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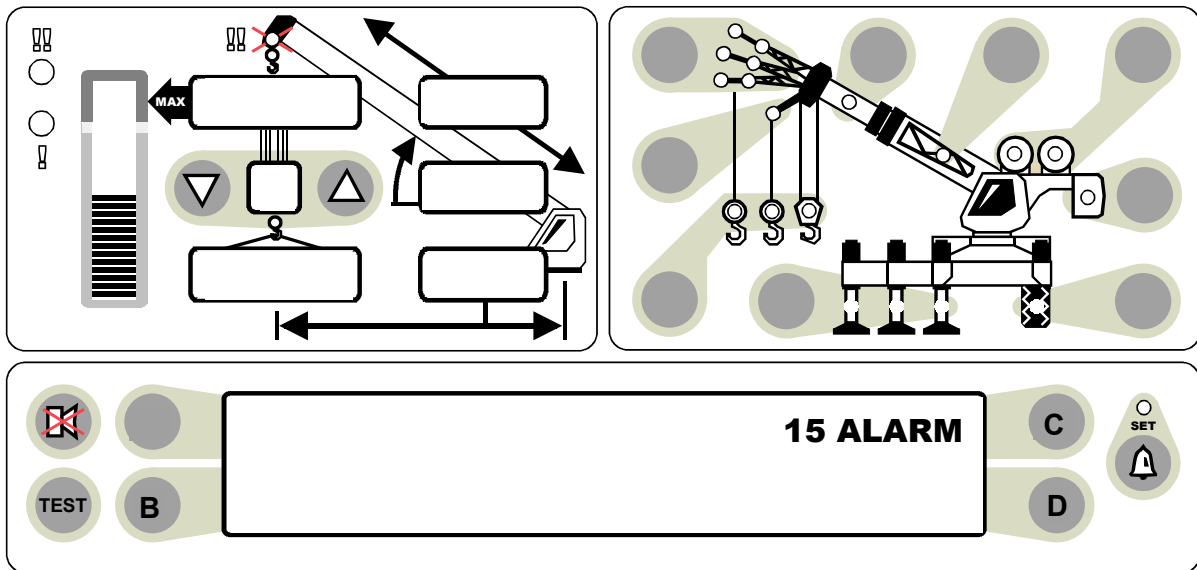
COMMAND 15 ALARM LIMITS

At the initialization of the system the following values are set.

- ◆ ALARM 0 100% SWL RED LAMP AND MOTION-CUT RELAY
- ◆ ALARM 1 90% SWL AMBER LAMP AND PRE-ALARM RELAY
- ◆ ALARM 2 90% SWL INTERNAL AUDIBLE ALARM

The alarm command may be modified. Entry should be as percentages using decimals. Follow the routine on the next page.

COMMAND 15 ALARM LIMITS continued



- 1) **PRESS A** TO **15 ALARM**.
- 2) **PRESS C** TO START THE COMMAND.
THE DISPLAY SHOULD READ: **CURRENT VALUE: XXX.XXX**.
- 3) **PRESS C** TO START THE CALIBRATION OF % SWL #0.
- 4) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
- 5) **→** USE THE NUMBER ENTRY PROCEDURE TO ENTER THE NEW SETTING.
AFTER THE MESSAGE, "CALIBRATING," THE DISPLAY SHOULD READ:
CURRENT VALUE XXX.XXX.
- 6) **PRESS A** TO % SWL #1.
THE DISPLAY SHOULD READ: **CURRENT VALUE XX.XXX**.
- 7) **PRESS C** TO START THE CALIBRATION OF % SWL #1.
- 8) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
- 9) **→** USE THE NUMBER ENTRY PROCEDURE TO ENTER THE NEW SETTING.
AFTER THE MESSAGE "CALIBRATING," THE DISPLAY SHOULD READ:
CURRENT VALUE XX.XXX.

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COMMAND 15 ALARM LIMITS continued

- 10) **PRESS D** TO % SWL #2.
THE DISPLAY SHOULD READ: CURRENT VALUE XX.XXX.

- 11) **PRESS C** TO START THE CALIBRATION OF % SWL #2.
- 12) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
- 13) **—————▶** USE THE NUMBER ENTRY PROCEDURE TO ENTER THE NEW SETTING.
AFTER THE MESSAGE, "CALIBRATING," THE DISPLAY SHOULD READ: CURRENT VALUE: XX.XXX.

- 14) **PRESS D** TO EXIT THE ROUTINE.

TO EXAMINE DETAILS OF ALARMS:

- 1) **PRESS A** TO 15 ALARM.
- 2) **PRESS C** TO START THE COMMAND.
THE DISPLAY SHOULD READ: CURRENT VALUE: XXX.XXX.
- 3) **PRESS A** TO % SWL #1.
THE DISPLAY SHOULD READ: CURRENT VALUE: XX.XXX.
- 4) **PRESS D** TO % SWL #2.
THE DISPLAY SHOULD READ: CURRENT VALUE: XX.XXX.
- 5) **PRESS D** TO EXIT THE ROUTINE.

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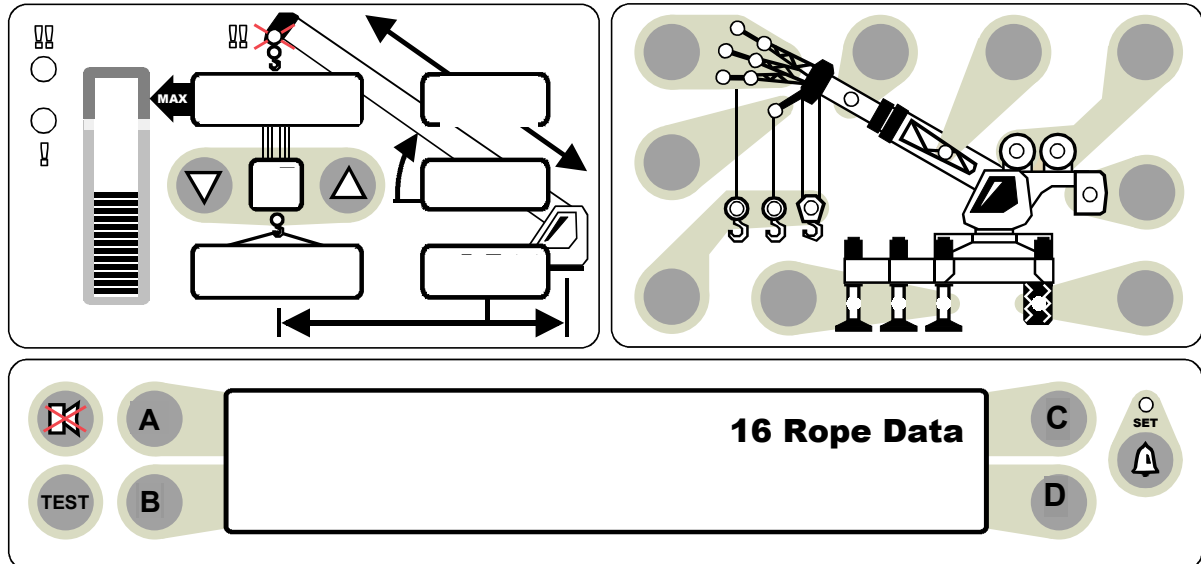
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COMMAND 16 ROPE DATA

- ◆ 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.
- ◆ The rope data command permits the modification of these values, which should be entered in units of 1000 #. Example 11,700 # is entered as 11.70

To change this data, continue with the routine on the next page.

COMMAND 16 ROPE DATA continued



- 1) **PRESS A** TO **16 ROPE DATA**.
- 2) **PRESS C** TO START THE COMMAND.
THE DISPLAY SHOULD READ: CURRENT VALUE (EXAMPLE: 12.000).
- 3) **PRESS C** TO START THE CALIBRATION OF **ROPE LIMIT #0**.
- 4) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
- 5) **→** USE THE NUMBER ENTRY PROCEDURE TO ENTER THE **NEW LIMIT**.
AFTER THE MESSAGE, "CALIBRATING," THE DISPLAY SHOULD READ:
CURRENT VALUE XX.XXX.
- 6) **PRESS A** TO **ROPE LIMIT #1**.
THE DISPLAY SHOULD READ: **CURRENT VALUE (EXAMPLE: 9.080)**.
- 7) **PRESS C** TO START THE CALIBRATION OF **ROPE LIMIT #1**.
- 8) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
- 9) USE THE NUMBER ENTRY PROCEDURE (PAGE 14) TO ENTER THE **NEW LIMIT**.
AFTER THE MESSAGE, "**CALIBRATING**," THE DISPLAY SHOULD READ:
CURRENT VALUE (XX.XXX).
- 10) **PRESS D** TO EXIT THE ROUTINE.

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COMMAND 16 ROPE DATA continued

TO EXAMINE THE DETAILS OF ROPE DATA:

- 1) **PRESS A** TO **16 ROPE DATA**.
- 2) **PRESS C** TO START THE COMMAND.
THE DISPLAY SHOULD READ: **CURRENT VALUE: 12.000 (EXAMPLE)**.
- 3) **PRESS D** TO **ROPE LIMIT #1**.
THE DISPLAY SHOULD READ: **CURRENT VALUE 9.080 (EXAMPLE)**.
- 4) **PRESS D** TO EXIT THE ROUTINE.

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COMMAND 17 AMPLIFIER GAIN

At the time of initialization the amplifier gain is set to the preferred value of 2. This value is suitable for the standard load cells and pressure transducers supplied with the systems. This gain setting may be modified, as necessary, for special application, using the following routine.

Confer with the factory before making any changes.

- 1) **PRESS A** TO **17 AMPLIFIER**.
- 2) **PRESS C** TO START THE COMMAND.
THE DISPLAY WILL READ THE CURRENT VALUE.
- 3) **PRESS C** TO START THE CALIBRATION OF AMPLIFIER GAIN.
- 4) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT CALIBRATION OF ABOVE DATA.
- 5) **PRESS B** TO CHANGE THE SETTING.
- 6) **PRESS C** TO COMPLETE THE CALIBRATION.
- 7) **PRESS C** TO EXIT THE ROUTINE.

COMMAND 01/3 BACK-UP

After completing a calibration routine and after executing command 01/0 save, use the following procedure to obtain a permanent copy of the calibration.

- 1) **PRESS A** TO **01 PERSONALITY**.
- 2) **PRESS C** TO START THE COMMAND.
- 3) **PRESS A** TO **3 BACKUP A TO RAM**.
- 4) **PRESS C** TO START THE COMMAND.
- 5) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION OF ABOVE DATA.
- 6) **PRESS 1234** (CALIBRATION CODE)
- 7) **PRESS D** AFTER THE MESSAGE, "CALIBRATING" TO EXIT THE ROUTINE.

SWITCH OFF POWER TO THE SYSTEM

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SWITCH OFF POWER TO THE SYSTEM BEFORE REMOVING OR INSERTING INTEGRATED CIRCUITS.

A copy of the contents of the "A" portion of the "Personality" is now stored temporarily in memory in the computer. The chip in socket ic7 is removed and will be the service back-up chip. To reinstate the system to working condition, fit a new chip, type 28c65, in socket IC7. Restore power to the system and carry out Command 01/4-restore as follows:

RESTORE POWER AND ENTER THE CALIBRATION ROUTINE

- 1) **PRESS AND HOLD** THE TEST AND SET KEYS FOR APPROXIMATELY 10 SECONDS.
- 2) **PRESS 1234** (CALIBRATION ENTRY CODE).
- 3) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.

COMMAND 01/4 RESTORE

- 1) **PRESS A** TO 01 PERSONALITY.
- 2) **PRESS C** TO START THE COMMAND.
- 3) **PRESS A** TO 01/4 RESTORE.
- 4) **PRESS C** TO START THE COMMAND.
- 5) **PRESS C** TO CALIBRATE OR **PRESS D** TO ABORT THE CALIBRATION.
- 6) **PRESS 1234 (CALIBRATION ENTRY CODE)**.
- 7) **PRESS D** AFTER THE MESSAGE," CALIBRATING" TO EXIT.

THE COPY OF THE CALIBRATION PERSONALITY IS NOW RESTORED TO THE "A" SECTION OF IC7. **SAVE IT NOW TO THE "B" SECTION USING COMMAND 1/0 SAVE.**

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COMMAND 19 DIGITAL INPUTS

The logic status of digital inputs is displayed using Command 19.

The inputs can be high or low. Low is indicated by 0 and high is indicated by 1.

- 1) **PRESS A** TO **19 DIGITAL INPUTS**.
- 2) **PRESS C** TO START THE COMMAND.
THE DISPLAY SHOULD READ THE STATUS OF ALL DIGITAL INPUTS.
- 3) **PRESS D** TO EXIT THE ROUTINE.

DIGITAL INPUTS

0	OPTINAL SWING INPUT	
1	OPTINAL SWING INPUT	
2	OPTINAL SWING INPUT	
3	OPTINAL SWING INPUT	
4	OPTINAL SWING INPUT	
5	OPTINAL SWING INPUT	
6	OPTINAL SWING INPUT	
7	OPTINAL SWING INPUT	
8	NOT USED	
9	NOT USED	
A	BY-PASS MESSAGE	HI = NO MESSAGE
B	SELECT OPTIONAL CHART	HI = SELECT CHART
C	NOT USED	
D	ATB IN	HI = NO ALARM
E	NOT USED	
F	NOT USED	

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GLOSSARY OF TERMS

ABORT	Interrupts and cancels data as it is being entered into the computer.
ALARM	A signal that warns or alerts (a flashing light or loud noise).
AMPLIFIER	A device that takes an input and produces an output of greater magnitude (as in the case of a pressure transducer where a signal 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 a boom.
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 bore.
BACK-UP	Move data from the working area of memory to a microchip which is stored elsewhere, e.g. in a service department.
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 showing the rating of a 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.

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COMMISSIONING	Preparing to be put into service.
CONFIGURATION	An arrangement of the lifting elements of a crane.
CURSOR	A pointer on a display that indicates the position where data is to be entered.
DATA	Factual information used as a basis for calculation.
DECREMENT	The action of decreasing a number or value.
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 expressed directly as digits.
DIGITAL INPUTS	Computer inputs which usually are either on or off as determined by external switches.
DIRECTION	The direction of rotation of the superstructure.
DUTY	A working configuration on a crane usually contained 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 deformation.
ERECTED ATTACHMENT	An attachment on the main boom fitted in its working position.
EXTENSION SENSOR	A device that measures the extension of the telescoping sections of a boom.
FLY/JIB	Something attached by one edge such as a lattice fly or jib on a crane boom.
FORCE	Energy exerted, in this case by the suspended weight of an object.
GEOMETRY	A branch of mathematics that deals with the measurement and relationships of points, lines, angles, surfaces and solids.

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GRADUATED	Marked with degrees of measurement.
HEIGHT	The vertical distance from the ground to the tip of the boom or attachment.
HORIZONTAL	Parallel to the horizon.
HYDRAULIC CRANES	Operated using the pressure of oil.
INITIALIZE	Erase all data from a 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	The vertical distance below the boom pivot at which radius measurements are to be made when calibrating.
MICROPROCESSOR	A computer processor contained on an integrated chip.
MILLIVOLT	One thousandth of a volt.
MOMENT	The product of force and distance 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 projecting support run out from a main structure to provide additional stability or support.
PERSONALITY	Data stored in the calibration EEPROM.
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 published capacity chart.
RATED CAPACITY	The load that a crane can safely handle based on factors such as strength, stability and rating.

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RATING	A factor determined by legislation that limits the proportion of a crane's capability that may be utilized in a lifting operation. Usually expressed as a percentage of strength or stability.
RESTORE	Move data from a back-up chip into the working personality.
ROM	"Read only" memory from which data can only be read, i.e. 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	A measure of 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 stowed on the main boom when not in use.
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 which is being utilized at any one time expressed as a percentage of rated capacity

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TRANSDUCER	A device that is actuated by energy from one system and converts this 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 or the poundage to be carried by a horse in a handicap race.
WRITE PROTECTED	An area of memory to which a microprocessor cannot write data.
ZERO	The point from which graduation of a scale begins.

