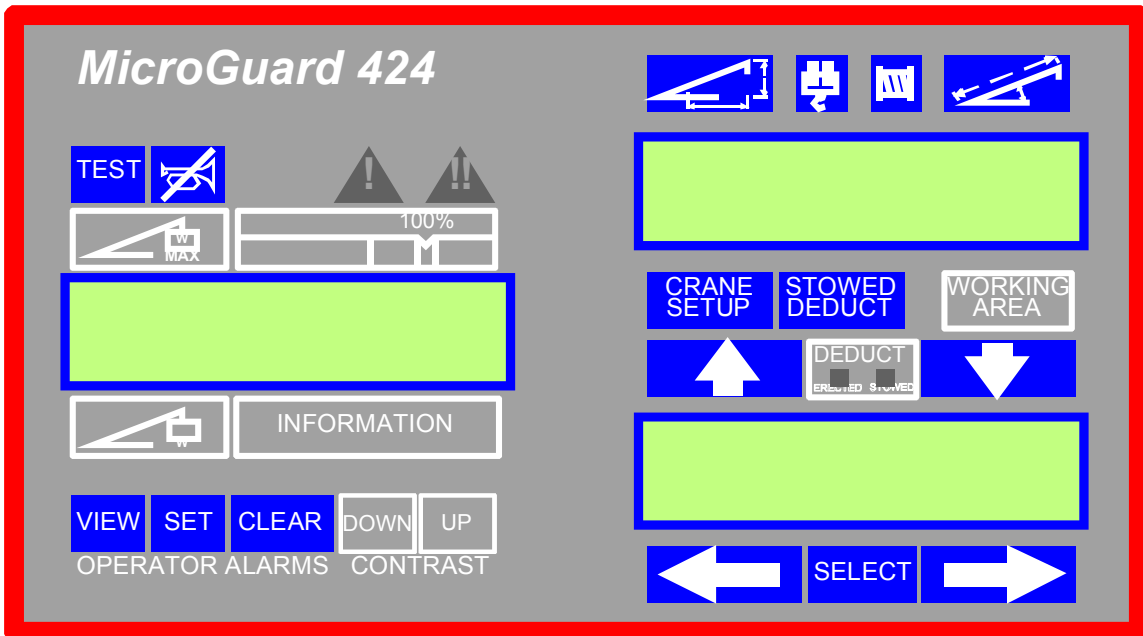


MicroGuard[®] 424 System



CALIBRATION PROCEDURE



WARNING

This MicroGuard® 424 System Manual is designed to assist the fully trained and experienced crane technician in the safe and proper calibration of the MicroGuard® 424 System.

At no time may this System be used as a substitute for the usual safety practices and precautions required for the safe setup and operation of the crane.

Please read pages 5-12 in this manual carefully before proceeding with the calibration routines.

MICROGUARD® 424 CALIBRATION PROCEDURE

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PRECALIBRATION REQUIREMENTS

This manual has been developed to assist the user in calibrating the MicroGuard® 424 System.

Baseline requirements prior to calibration:

- Satisfactory installation of the **complete** System, including the fitting of the appropriate **PROGRAM** and **DUTY** chips, as specified in the installation manual.
- Wiring that conforms to the appropriate wiring diagram.
- Crane positioned on firm, level ground with outrigger beams fully extended and jacks extended appropriately to level the carrier.
- Removal of all attachments that can be stowed or erected during operation (e.g., fly, jib, or auxiliary head).

NOTE: This is only applicable during calibration of the main boom.

NOTE: Care must be taken during these calibration procedures to ensure that structural or stability limits of the crane are not exceeded.

WARNING: When the System is in **CALIBRATION MODE**, all **audible** MicroGuard® 424 System **alarms** are **inactive** and **crane motions cutout is DISABLED**.

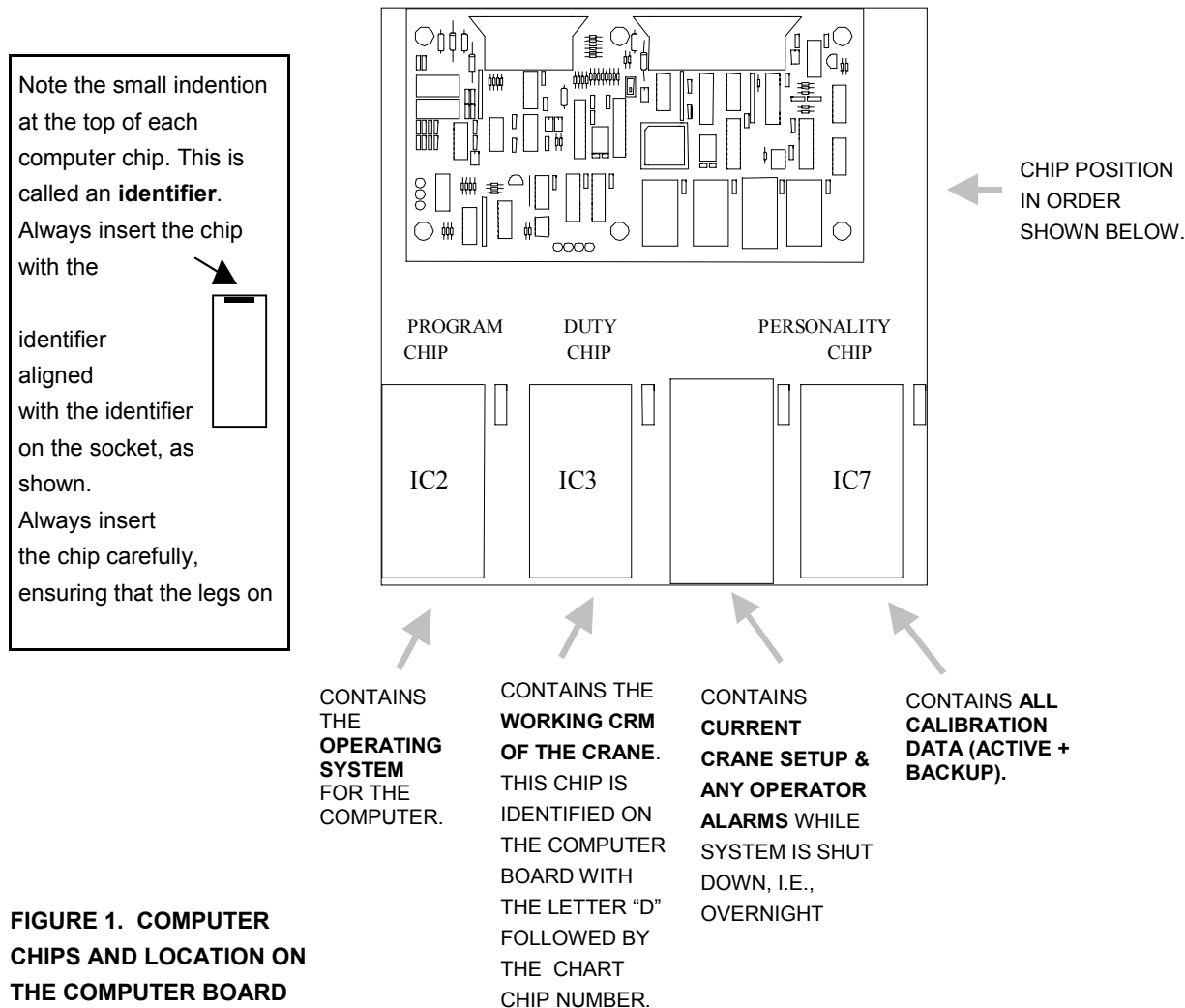


FIGURE 1. COMPUTER CHIPS AND LOCATION ON THE COMPUTER BOARD

ACCESSING THE CALIBRATION ROUTINES

1. To access the calibration routines, **simultaneously press and hold** the SELECT (S) and TEST (T) keys on the Display Unit for approximately 2 seconds. See Figure 3, page 7.

2. Now enter the **CALIBRATION CODE: ↑↓←→ SELECT**

NOTE: If the wrong sequence is used, or if the entry is not completed within 5 seconds, the calibration code entry will be aborted and must be reentered.

NOTE: If changes are to be made to existing instructions, set the CAL. SWITCH on the computer board to the CAL. "ON" position. Set at any time prior to the change. If the CAL. SWITCH has not been turned on, the Display window will read: CAL. SWITCH DISABLED. Using a screwdriver, remove the cover from the computer assembly. The switch is on the top computer board between and below the ribbon cable connectors. See Figure 2.

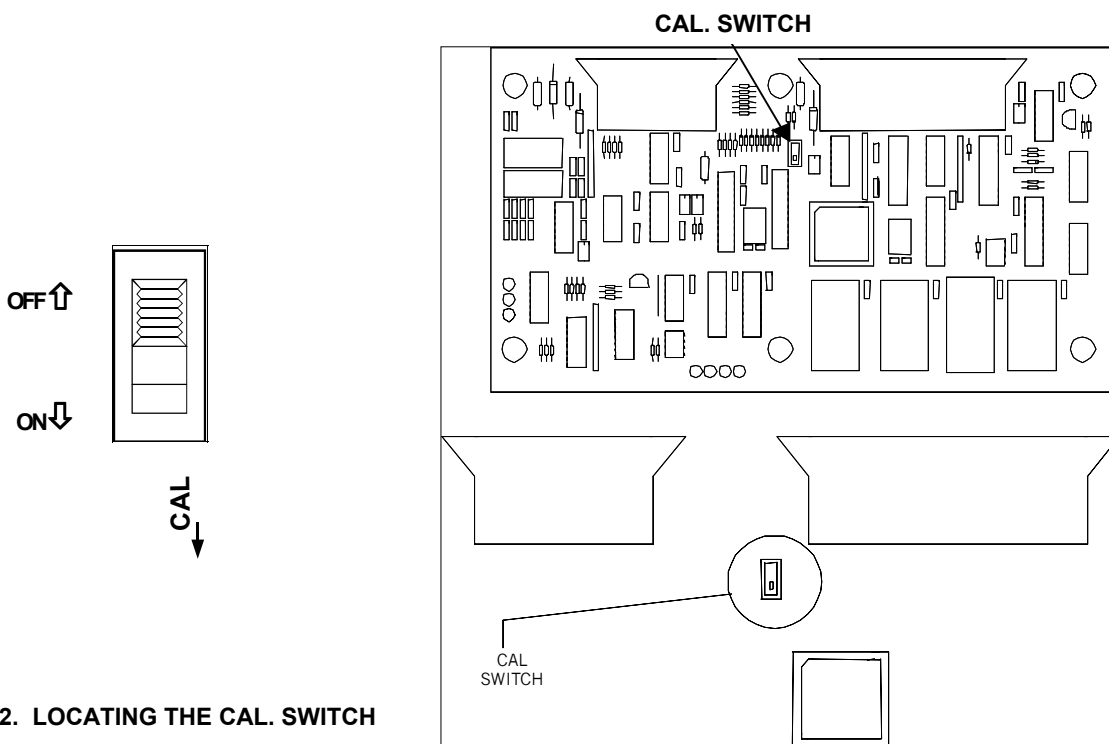


FIGURE 2. LOCATING THE CAL. SWITCH

OPERATING THE DISPLAY UNIT DURING CALIBRATION ROUTINES

The Display Unit, shown in Figure 3 on the next page, is the tool used by the operator to calibrate the System. Using the arrow and text keys on the Display Panel, the operator can enter, change, delete, and finalize calibration information.

Relevant information is shown in the Display Windows. The Display Windows are identified as A, B, and C. Window A shows the operator the selection entered. Window B directs the operator's next action or identifies an action in process. Window C provides information to the operator.

FORMAT

The format used in this manual is designed to identify the keys to be pressed to complete each calibration routine. These keys are identified in large black print in each routine. The format also tells the operator what will be seen in the Display Windows as the keys are pressed. This information is shown in regular face type.

OPERATING THE DISPLAY UNIT DURING CALIBRATION ROUTINES CONTINUED

ARROW AND SELECT KEY ACTION:

- A) The **↑** and **↓** arrow keys are used to scroll up or down to change a Command or category within a Command, to increase or decrease a number, etc. All selections are in a revolving format allowing the operator to press either **↑** or **↓** to reach the desired option in a category.
- B) When entering numbers, the operator must press the SELECT key after each number entry before moving to the next number.
- C) A set of arrows (**← 5 →**) is used to identify the item selected for entry into the System.
- D) Used individually, the **←** or **→** can be pressed to move within a field when several options are offered (as in the number selection steps).
- E) The **→** is also used to abort a calibration entry before the calibration is finalized, or to exit a routine once the calibration is completed.
- F) The **←** can also be used to change to certain selections within a Command (e.g., change to another sensor).
- G) When exiting a Command, it may be necessary to press **→** repeatedly, scrolling through the various options within that Command, before returning to the general Command options.
- H) Arrow keys and the SELECT key pressed in the FOLLOWING sequence
↑ ↓ ← → SELECT constitute the CALIBRATION CODE, which is used throughout this procedure.

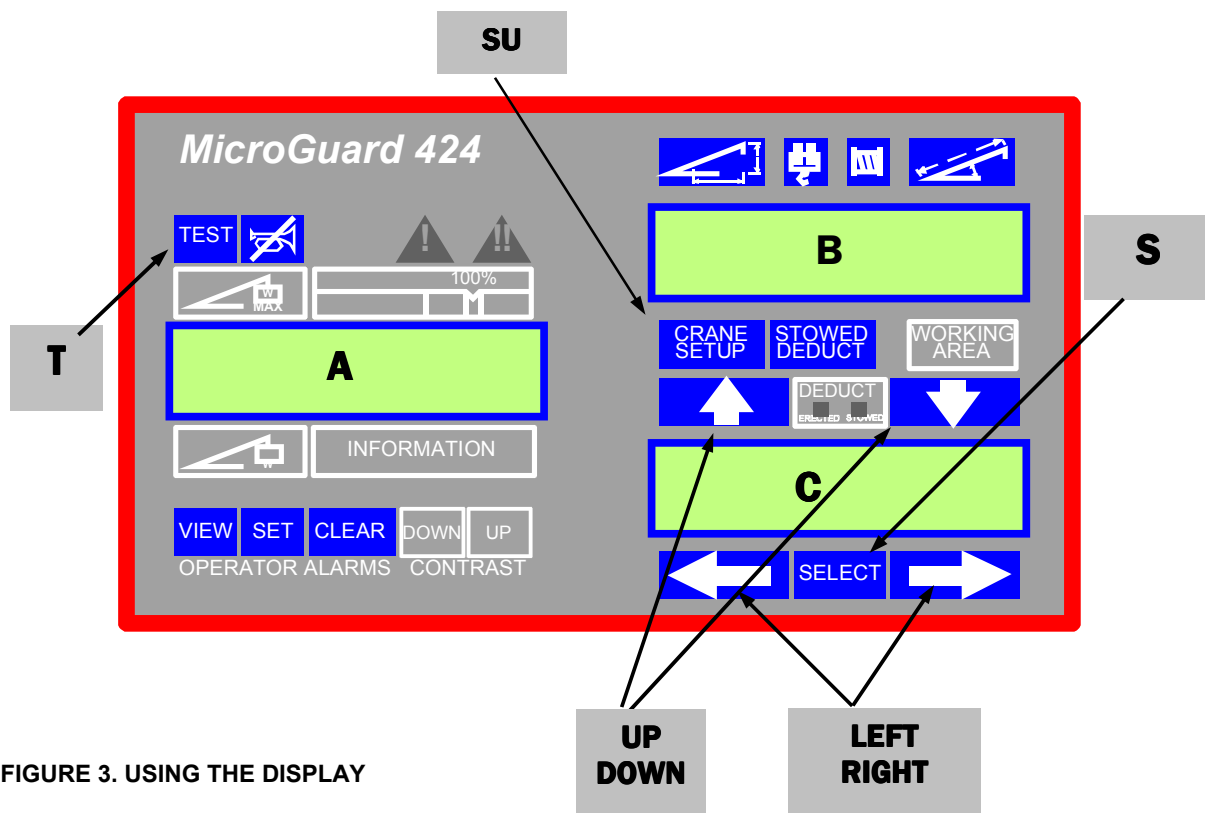


FIGURE 3. USING THE DISPLAY

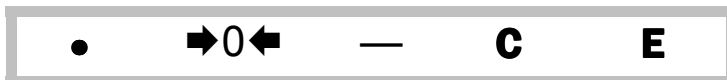
ENTERING NUMBERS

The MicroGuard® 424 Display does not have number entry keys. When entering numerical data, the following five symbols appear in WINDOW B of the Display. Using the left \leftarrow or right \rightarrow arrow key, the operator selects the appropriate symbols. The selected symbol flashes and appears with an arrow on either side ($\rightarrow 5 \leftarrow$). As each item is selected and entered, it appears in Window A of the Display. The following options allow:

- SELECTION OF A DECIMAL POINT.
- 0** SELECTION OF A NUMBER FROM 0-9.
- CHANGE TO A NEGATIVE VALUE.
- C** CLEARING OF A CURRENTLY DISPLAYED NUMBER.
- E** COMPLETION OF STEPS FOR NUMBER ENTRY INTO THE SYSTEM.

HOW TO ENTER:

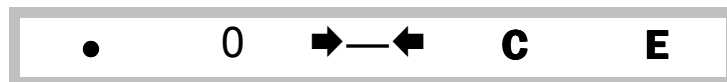
NUMBERS. PRESS \rightarrow or \leftarrow to the number category. Using \uparrow or \downarrow , scroll to the appropriate number. **PRESS SELECT** to enter the number.



DECIMAL POINTS. If a decimal point is required, **PRESS** \leftarrow to decimal point. **PRESS SELECT.** After entering a decimal point, the $\rightarrow \leftarrow$ automatically return to number category for entry of additional numbers.



NEGATIVE VALUES. If a number or series of numbers is a negative value, enter all numbers **FIRST**, pressing **SELECT** after each number is selected. Use \rightarrow to select minus sign. To enter minus sign, **PRESS SELECT.** **ALWAYS** select and enter the minus sign **LAST.**



CLEARING ERRORS. If an error is made in entry of data, **PRESS** \rightarrow to C (clear). **PRESS SELECT.**

**COMPLETING THE NUMBER ENTRY.**

PRESS \leftarrow to number category. Correct numbers, if necessary. After entry of all numbers (decimal point, and/or minus sign, if required), **PRESS** \rightarrow to $\rightarrow \mathbf{E} \leftarrow$. **PRESS SELECT.**



COMPLETING THE CALIBRATION. Window B will flash, "Calibration? TO CALIBRATE and end routine, **PRESS SELECT.** (TO ABORT, **PRESS** \rightarrow .) **PRESS** \rightarrow **AGAIN** and CONTINUE.)

ENTERING NUMBERS (continued)**ENTERING A SERIES OF NUMBERS**

THE EXAMPLE USED HERE, (MINUS) -123.45 IS FOR ILLUSTRATION PURPOSES ONLY

THE NUMBER ENTRY PANEL, SHOWN ON PAGE 8, WILL AUTOMATICALLY APPEAR IN WINDOW B
WHEN NUMBER ENTRY IS REQUIRED.

1. **PRESS ← OR → TO NUMBER CATEGORY (→0←) IN WINDOW B.
PRESS ↑ TO →1←.
PRESS SELECT.** (NUMBER 1 WILL APPEAR IN WINDOW A.)
2. **PRESS ↑ TO →2←. PRESS SELECT.**
(NUMBERS 1 2 WILL APPEAR IN WINDOW A.)
3. **PRESS ↑ TO →3←.
PRESS SELECT.** (NUMBERS 123 WILL APPEAR IN WINDOW A.)
4. **PRESS ← TO DECIMAL POINT (→·←) IN WINDOW B.
PRESS SELECT.**
5. WHEN DECIMAL POINT APPEARS IN WINDOW A, SELECTORS (→←) IN WINDOW B
WILL AUTOMATICALLY RETURN TO NUMBER CATEGORY(→0←).
PRESS ↑ TO →4←. PRESS SELECT.
6. WHEN WINDOW A READS: 123.4, **PRESS ↑ TO →5←.
PRESS SELECT.**
7. WHEN WINDOW A READS: 123.45
**PRESS → TO MINUS SIGN →—← IN WINDOW B.
PRESS SELECT.**
8. **PRESS → TO →E←. PRESS SELECT.** (SEE NOTE 2 BELOW.)
WINDOW B WILL READ: CALIBRATION?
TO CALIBRATE, **PRESS SELECT.**
(TO ABORT, **PRESS →. PRESS →** AGAIN AND CONTINUE.)
9. **TO EXIT, PRESS →.**

NOTE: WHEN ENTERING NUMBERS FOR COMMANDS 8 AND 9, ALWAYS USE A DECIMAL POINT.
EXAMPLE: WHEN ENTERING A RADIUS OF 10 FEET, ENTRY WILL READ: 10.0

NOTE: IF A SEVEN DIGIT ENTRY, THE SELECTORS AUTOMATICALLY MOVE TO (E).

NOTE: A DECIMAL POINT OR MINUS SIGN IS COUNTED AS A DIGIT.

ENTERING VALUES (ENTER NUMERALS ONLY.) “Feet” and “LBS.” are already programmed into the computer.

1,000 **POUNDS** — ENTERED INTO THE SYSTEM AS **1.** (include decimal)

1,000 **FEET** — ENTERED INTO THE SYSTEM AS 1000

AIN2 ENTRIES REPRESENT LENGTH – in feet and tenths of feet. (Example: 1.25 = 1 foot 3 inches)

AIN3 ENTRIES REPRESENT DEGREES

CRANE SETUP MODE (CONFIGURATION SELECTION)

In normal operating mode, the System will automatically return to the configuration last selected. A new configuration must be selected only when the crane rigging has changed.

During the calibration routines, the operator may be requested to alter the crane configuration. Once these changes have been made physically, the operator must go into the CRANE SETUP MODE and validate those changes on the working screen.


ENTERING THE CRANE SETUP MODE

PRESS THE TEST KEY. (Wait for the Self-Test to complete.)

PRESS THE CLEAR BUTTON.

PRESS CRANE SETUP.

INPUTTING THE CONFIGURATION SPECIFICATIONS OF THE CRANE

1. **PRESS**  and choose the **configuration** below that matches the actual crane setup.
Caution: The **actual** crane setup **must be the same** as the crane configuration selected.

OUTRIGGERS

TIRES

RIGGING/TRAVEL MODE

After identifying the correct configuration, **PRESS SELECT.**

2. The categories that relate to the **configuration** chosen will automatically appear. Steps in the menu that are not necessary are automatically skipped. **PRESS SELECT** after entering information in a required category. Possible categories include:
 - A) COUNTERWEIGHT CONFIGURATION (IF AVAILABLE).
 - B) MAIN BOOM CONFIGURATION OR TELESCOPIC MODE (IF AVAILABLE).
 - C) AUXILIARY HEAD (FITTED OR NOT FITTED).
 - D) LIFTING ATTACHMENTS.
 - E) LIFTING POINT FOR FRONT WINCH.

(Continued on page 11)

F) LIFTING POINT FOR REAR WINCH.

STOWED ATTACHMENTS

The Display will now return to the NORMAL MODE. Press the STOWED DEDUCT BUTTON (SD),

CRANE SETUP MODE (CONFIGURATION SELECTION) CONTINUED

USING THE DISPLAY IN THE CRANE SETUP MODE

The following illustration identifies some of the keys used on the Display Unit when in Crane Setup Mode. The windows display information somewhat differently when in this Mode. Window A states how to take action. Window B shows the status prior to action. Window C identifies steps to take.

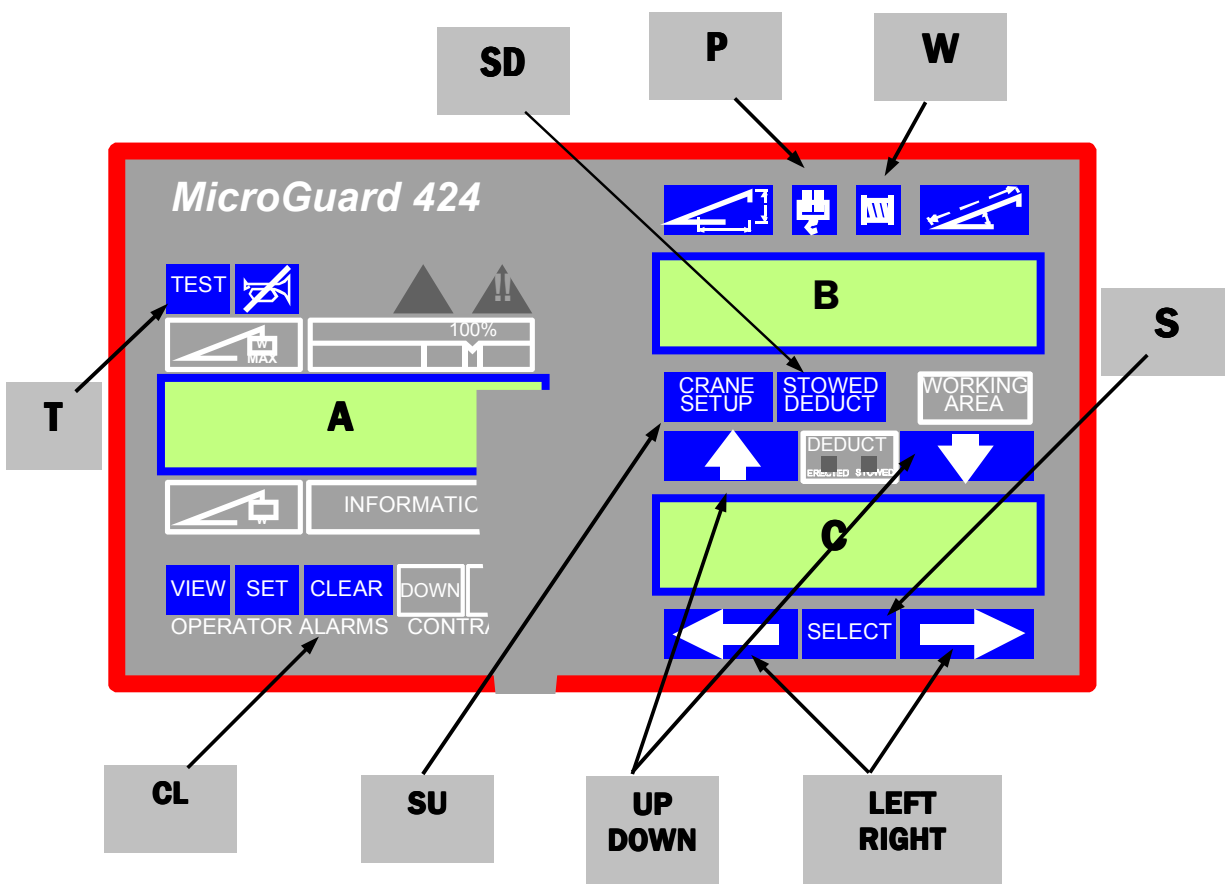


FIGURE 4. USING THE DISPLAY PANEL IN THE CRANE SETUP MODE.

AFTER THE SELECTIONS ON THE LAST PAGE ARE MADE DURING CRANE SETUP, PRESS THE WINCH KEY (W) TO SELECT THE LIFTING POINT. ALL INFORMATION REQUIRED BY THE SYSTEM IS ENTERED DURING CRANE SETUP. PRESS THE PARTS OF LINE KEY (P) AND MAKE THE APPROPRIATE SELECTION FOR EACH WINCH. ALL OF THE ABOVE MUST BE SET FOR THE SYSTEM TO OPERATE CORRECTLY.

COMMAND 00 RUN

After accessing the CALIBRATION ROUTINES (see page 6) and following entry of the calibration code, the System will be in the MONITOR mode at 00 RUN.

NOTE: Do NOT execute COMMAND 00 RUN by pressing SELECT unless you want to exit the CALIBRATION MODE. Execution of this Command will cause the System to perform a System SELF-TEST followed by a return to the working screen.

COMMAND 01 PERSONALITY -- MANAGING DATA

COMMAND 01 "Personality" is used to manage crane calibration data. These data are stored in two sets in the EEPROM IC7 Personality chip. The sets are identified as Active Personality or "A" which contains the calibration data used in the System and Backup Personality or "B" which contains a protected copy of the calibration data. COMMAND 01 provides the following functions:

- ◆ Displays the status of the Personality sets.
- ◆ Moves data between the two sets.
- ◆ Deletes data from the Active Personality set.
- ◆ Copies data to a backup chip.
- ◆ Retrieves data from a backup chip.

When COMMAND 01 is first selected, both "A" and "B" calibration sets are checked for correct check-sum. The results for check-sum are indicated in Window A as "good" or "bad" beside the respective references A and B. Set A is also checked **against** set B. Identical data will be indicated by "same" nonidentical data will be indicated by "diff."

PERSONALITY 01 SUB-COMMANDS

The following PERSONALITY 01 SUB-COMMANDS indicate the action associated with each routine. Some of the SUB-COMMANDS cause previously entered data to be lost. For protection against unwanted deletions (as in SUB-COMMAND 2), it is possible to abort an action as long as it has not been finalized. A calibration is not finalized until the operator **gives the OK TO CALIBRATE**. Please see example on next page.

SUB-COMMAND 0 SAVE Saves A into B (B data is lost).

SUB-COMMAND 1 XCHG Exchanges A with B (data is not lost).

SUB-COMMAND 2 INIT Initializes A prior to new calibration (**A data is lost**).

SUB-COMMAND 3 BACK Copies the active calibration to a back-up chip (data is not lost).

SUB-COMMAND 4 RETR Retrieves the calibration from a back-up chip.

SUB-COMMAND 5 DFLT (DEFAULT) Reloads Duty data into A without affecting Zero and Span data.

WARNING: SWITCH OFF POWER TO SYSTEM BEFORE INSERTING OR REMOVING COMPUTER CHIPS. FAILURE TO OBSERVE THIS PRECAUTION MAY CAUSE PERMANENT DAMAGE TO SYSTEM OR ITS COMPONENTS AND RESULT IN LOSS OF CALIBRATION DATA.

WARNING: THE ACTUAL CONFIGURATION MUST MATCH THE CONFIGURATION SELECTED.

CALIBRATION PROCEDURE FOR PERSONALITY 01 SUB-COMMANDS**PERSONALITY 01 SUB-COMMAND 2 INIT**

SUB-COMMAND 2 INIT, illustrated below, is used to transfer pre-calibrated data from the DUTY chip to the PERSONALITY chip. **The calibration procedure for the five Personality 01**

Sub-Commands is the same. However, STEP 2, see chart below, must identify the individual Command (e.g., 01 PERSON 2 = INIT, or 01 3 BACK, or 01 4 RETR, etc.).

WARNING: Sub-COMMAND 2 removes all previous calibration data from the A (ACTIVE) Personality.

WARNING: Data entered into the System **can be aborted as long as the CALIBRATION process has not been finalized.** FINALIZATION OCCURS WHEN THE OPERATOR PRESSES THE SELECT KEY **AFTER** WINDOW B READS: 'CALIBRATION?' SEE NO. 4 BELOW.

CAUTION: If only **partial** or **modified** calibration data in an already calibrated System is to be entered, do not carry out the **INITIALIZE** routine. Simply proceed with the calibration once you have entered the calibration routines.

ENTRY TO CALIBRATION ROUTINES

PRESS 'TEST' AND 'SELECT' SIMULTANEOUSLY FOR 2 SECONDS

THEN PRESS THE CALIBRATION CODE: ↑ ↓ ← → SELECT.

(Complete this code entry within 5 seconds. Window A will read 00 RUN)

EXAMPLE: SUB-COMMAND 2 INIT (INITIALIZE)

1. SEE FIGURE 4. **PRESS ↑ OR ↓ TO 01 PERSONALITY. PRESS SELECT.**
2. **PRESS ↑ TO: 01 PERSON 2=INIT**
A GOOD B GOOD DIFF OR SAME **PRESS SELECT.**
(IF "A" DOES NOT READ 'GOOD,' CONTACT FACTORY FOR FURTHER DIRECTION.)
3. WINDOW A WILL READ: 01 PERSON 2 = INIT A NEW.
PRESS CALIBRATION CODE: ↑ ↓ ← → SELECT.
(IF WINDOW B READS: 'CAL. SWITCH DISABLED,' TURN ON CAL. SWITCH. THE ROUTINE WILL AUTOMATICALLY START OVER AT STEP 2 ABOVE. SEE PAGE 6.)
4. WINDOW B WILL READ: CALIBRATION?
TO CALIBRATE, PRESS SELECT.
(TO ABORT, PRESS →. PRESS → AGAIN AND CONTINUE.)
5. WINDOW B WILL READ: CALIBRATING.
AFTER CALIBRATION, WINDOW A WILL READ: 01 PERSON 2 = INIT
A GOOD B GOOD DIFF. **TO EXIT, PRESS →.**

NOTE: THE SYSTEM WILL RETURN TO THE MONITOR MODE BUT WILL REMAIN IN THE CALIBRATION ROUTINE.

SUB-COMMAND O SAVE

Data entered in the calibration process must be retained in back-up memory. COMMAND 01 PERSON O SAVE may be used at any time to ensure that work in progress is not lost. Always save again following the completion of each calibration routine to ensure that the entire entry has been saved.

Note: The “**SAVE**” procedure **ERASES ALL PREVIOUS DATA** FROM THE B PERSONALITY. If necessary, NEW DATA CAN BE ABORTED **BEFORE** COMPLETING STEP 4 BELOW.

SUB-COMMAND O SAVE - SAVING DATA

(FOR OTHER SUB-COMMAND EXAMPLES, SEE PAGES 42-43.)

1. **PRESS ↑ OR ↓ TO 01 PERSONALITY.
PRESS SELECT.**
(IF ALREADY IN THE PERSONALITY MODE, PRESS ↑ or ↓ TO THE FOLLOWING.)
2. WINDOW A WILL READ: O1 PERSON O = SAVE
A GOOD B GOOD DIFF OR SAME.
PRESS SELECT.
3. WINDOW A WILL READ: 01 PERSON 0=SAVE A >> B.
PRESS CALIBRATION CODE: ↑↓←→ SELECT.
4. WINDOW B WILL READ: CALIBRATION?
**TO CALIBRATE, PRESS SELECT.
(TO ABORT, PRESS →. PRESS → AGAIN AND CONTINUE.)**
5. WINDOW B WILL READ: CALIBRATING.
AFTER THE 'CALIBRATING' MESSAGE STOPS, WINDOW A WILL READ:
A GOOD B GOOD SAME.
6. **TO EXIT, PRESS →.**

COMMAND 02 TEST/FAULT

This Command is used to carry out a System Self-Test and to detect and display errors present in the System. These errors are indicated in fault codes, as shown on the next page.

SYSTEM SELF-TEST

1. **PRESS ↑ or ↓ TO 02 TEST/FAULT.
PRESS SELECT.** THE SYSTEM WILL EXECUTE A SELF-TEST AND DISPLAY FAULT CODES.
2. **TO EXIT, PRESS →.**

FAULT CODES

The tables below and on the following page have been created to simplify the identification of Faults detected by the Computer. Some Faults involve a combination of Code Numbers, indicating that there may be more than one problem or that a single problem is affecting other operations. Each Fault Code Number has been identified in the following pages on the left side of the tables and described in the column to the right.

For Example: If Code Number 009 appears in the Fault Code window, the Operator would check the table below under 009 in the left column. To the right, the Operator would see the description as Faults 001 and 008. Looking again in the left column, we see that 001 indicates a Piston Pressure Sensor problem and 008 indicates a Boom Angle Sensor problem. Report your findings to your Service Representative.

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	UPPERSTRUCTURE ANGLE SENSOR
032	SENSOR 5	SWING POTENTIOMETER "A"
064	SENSOR 6	SWING POTENTIOMETER "B"

CODE BB**GROUP "B" INPUTS AND OUTPUTS**

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

CODE CC**GROUP "C" MEMORY**

00		NO FAULTS
01	FAULT 1	EXECUTIVE ROM
02	FAULT 2	DUTY ROM
04	FAULT 4	SCRATCH PAD ROM
08	FAULT 8	PERSONALITY ROM

CODE DD**GROUP "D" GENERAL**

00		NO FAULTS
01	FAULT 1	NO DUTY FOUND
02	FAULT 2	CURRENT BAD DUTY
04	FAULT 4	CONFIGURATION NOT CALIBRATED
08	FAULT 8	FLY/JIB NOT CALIBRATED

COMMAND 03 ZERO

COMMAND 03 Zero permits the calibration of the zero of most analog sensors. COMMAND 03 ZERO CODES for the MICROGUARD® 424 System follow:

ANALOG INPUT NUMBERS

Input TX.0 Piston Side Pressure Transducer OF HYDRAULIC CYLINDER.

Input TX.1 Rod Side Pressure Transducer OF HYDRAULIC CYLINDER.

NO. 0 NOT USED.

NO. 1 NOT USED.

NO. 2 BOOM EXTENSION SENSOR -- ANALOG INPUT 2 (AIN2) --ON REEL OF REELING DRUM ASSEMBLY.

NO. 3 BOOM ANGLE SENSOR -- ANALOG INPUT 3 (AIN3) --ENCLOSED IN REELING DRUM.

NO. 4 NOT USED.

NO. 5 SWING SENSOR. SEE NOTE.

NO. 6 SWING SENSOR. SEE NOTE.

NO. 7 NOT USED.

NOTE: THE SWING SENSORS INPUTS (AIN5 & AIN6) HAVE ANOTHER ROUTINE AND ARE CALIBRATED USING COMMAND 05.

ZERO – PRESSURE TRANSDUCERS

- ◆ Lower the boom into its cradle (boom hoist cylinder fully retracted).
- ◆ Stop the hydraulic pump and reconnect electrical power to the System.
- ◆ With the boom hoist cylinder fully retracted, ensure that no pressure remains in the boom hoist cylinders by de-pressurizing the hydraulic tank and opening the hydraulic lines to the pressure transducers.
- ◆ With the pressure transducers open to atmosphere, calibrate the zero of the piston and rod pressure transducers using the procedure ON THE NEXT PAGE.

COMMAND 03 ZERO – PRESSURE TRANSDUCERS TX.0 & TX.1

PISTON AND ROD PRESSURE TRANSDUCERS -- CALIBRATING THE ZERO

1. **PRESS ↑ OR ↓ TO 03 ZERO SENSOR.
PRESS SELECT.**
2. WINDOW A WILL READ:
TX.0.
PRESS SELECT.
3. WINDOW A WILL READ:
TX.0 I/P= (ACTUAL INPUT).
PRESS SELECT.
4. WINDOW B WILL READ:
CALIBRATION?
**TO CALIBRATE, PRESS SELECT.
(TO ABORT, PRESS →. PRESS → AGAIN AND CONTINUE.)**
5. WINDOW A WILL SHOW: TX.0 I/P = 0
PRESS ← TO CHANGE TO ANOTHER SENSOR.

-
6. **PRESS ↑ TO TX.1.
PRESS SELECT.**
 7. WINDOW A WILL READ:
TX.1 I/P = (ACTUAL INPUT).
PRESS SELECT.
 8. WINDOW B WILL READ: CALIBRATION?
**TO CALIBRATE, PRESS SELECT.
(TO ABORT, PRESS →. PRESS → AGAIN AND CONTINUE.)**
 9. WINDOW A WILL SHOW: TX.1 I/P = 0
TO EXIT, PRESS →.

WARNING: RECONNECT ALL HYDRAULIC LINES AND RE-INSTALL THE TANK PRESSURE RELIEF VALVE BEFORE RESUMING CRANE OPERATION.

COMMAND 03 ZERO –BOOM EXTENSION SENSOR (NO.2)

The reeling drum is fitted with 130 ft. of shielded 2-wire cable, which is terminated in a 3-pin socket on the Extension Sensor Reeling Drum Assembly. The cable **cannot** be shortened to accommodate varying boom lengths. The following method of pre-tensioning is recommended.

- a) Fully retract all of the boom sections.
- b) Pre-tension the reel as follows:

With the boom fully retracted, remove the clamp on the reel cable and allow it to slowly rewind onto the drum until the distance between the connector at the end of the cable and the reeling drum is approximately 12 ft. and **all pre-tension has been dissipated. Now**, pull the cable line toward the anchor point on the boom. Continue until the end of the cable is 3 ft. beyond the anchor point. Secure the cable to the anchor point with at least 4 wraps. Ensure 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. Manually turn the large gear on the MicroGuard[®] potentiometer fully counter-clockwise, and then advance it clockwise three clicks.

CALIBRATING THE ZERO OF BOOM THE EXTENSION SENSOR (NO. 2)

1. **PRESS ↑ OR ↓ TO 03 ZERO SENSOR.
PRESS SELECT.**
2. **PRESS ↑ or ↓ TO SENSOR NO. 2.
PRESS SELECT.**
3. WINDOW A WILL READ:
03 ZERO SENSOR
NO.2 I/P= (ACTUAL INPUT).
PRESS SELECT.
4. WINDOW B WILL READ: CALIBRATION?
**TO CALIBRATE, PRESS SELECT.
(TO ABORT, PRESS ➡. PRESS ➡ AGAIN AND CONTINUE.)**
5. WINDOW A WILL READ:
03 ZERO SENSOR
NO.2 I/P= 0.
TO CALIBRATE ANOTHER SENSOR, PRESS ←.
6. **TO EXIT, PRESS ➡.**

COMMAND 03 ZERO – BOOM ANGLE SENSOR (NO.3)

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.

NOTE: TO ENSURE CALIBRATION ACCURACY, THE INCLINOMETER OR MEASURING DEVICE USED TO CALIBRATE THE ANGLE OF THE MAIN BOOM MUST MEET AN ACCURACY STANDARD OF +/- 0.25°.

CALIBRATING THE ZERO OF THE BOOM ANGLE SENSOR (NO. 3)

USING AN INCLINOMETER, SET THE BOOM IN A HORIZONTAL POSITION. THE BOOM ANGLE SENSOR IS MOUNTED INSIDE THE HOUSING OF THE REELING DRUM ASSEMBLY. THEREFORE, ENSURE THAT THE EXTENSION REEL IS MOUNTED PERPENDICULAR TO THE BOOM.

- 1. PRESS ↑ OR ↓ TO 03 ZERO SENSOR. PRESS SELECT.**
- 2. PRESS ↑ TO SENSOR NO.3. PRESS SELECT.**
3. WINDOW A WILL READ:
03 ZERO SENSOR
NO.3 I/P= (ACTUAL INPUT).
PRESS SELECT.
4. WINDOW B WILL READ: CALIBRATION?
TO CALIBRATE, PRESS SELECT.
(TO ABORT, PRESS →. PRESS → AGAIN AND CONTINUE.)
5. WINDOW A WILL READ:
03 ZERO SENSOR NO.3 I/P=0
TO CALIBRATE ANOTHER SENSOR, PRESS ←.
- 6. TO EXIT, PRESS →.**

COMMAND 04 SPAN

BOOM ANGLE SENSOR SPAN NO. 03

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.

NOTE: TO ENSURE CALIBRATION ACCURACY, THE INCLINOMETER OR MEASURING DEVICE USED TO CALIBRATE THE ANGLE OF THE MAIN BOOM MUST MEET AN ACCURACY STANDARD OF +/- 0.25°.

CALIBRATING THE SPAN OF THE BOOM ANGLE SENSOR (NO. 03)

**RAISE THE RETRACTED BOOM TO AN ANGLE BETWEEN 60° AND 65°.
MEASURE THE ANGLE USING AN INCLINOMETER. (E.G. 61.5°)**

- 1. PRESS ↑ OR ↓ TO 04 SPAN.
PRESS SELECT.**
2. WINDOW A WILL READ:
04 SPAN SENSOR NO. 3.
PRESS SELECT.
3. WINDOW A WILL READ:
NO.3 I/P=0.00 (OR ACTUAL INPUT WHEN RE-CALIBRATING).
PRESS SELECT.
4. **ENTER BOOM ANGLE MEASUREMENT.** FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING ➡ TO **E** AND THEN PRESSING SELECT.)
5. WINDOW B WILL READ: CALIBRATION?
**TO CALIBRATE, PRESS SELECT.
(TO ABORT, PRESS ➡ . PRESS ➡ AGAIN AND CONTINUE.)**
6. WINDOW A WILL READ:
NO.3 I/P = SPAN VALUE.
7. **TO EXIT, PRESS ➡ .**

BOOM EXTENSION SENSOR SPAN NO. 2

CARRY OUT CALIBRATION PROCEDURES ONLY WITHIN THE STABILITY LIMITS OF THE CRANE. DO NOT FULLY EXTEND THE BOOM THROUGHOUT THIS PROCEDURE, IF THIS COULD CAUSE A TIPPING CONDITION.

- a) With the boom horizontal and fully retracted, **measure and note the distance** from the boom pivot to the hook center line.
- b) Extend the boom as far as possible without tipping the crane. **Measure and note the distance** from the boom pivot to the hook centerline.
- c) Calculate the Boom Extension using the following formula:

EXTENDED LENGTH - RETRACTED LENGTH = EXTENSION VALUE

EXAMPLE: IF THE EXTENDED BOOM LENGTH IS 72 FEET AND THE RETRACTED BOOM LENGTH IS 31.5, **THE EXTENSION VALUE IS:** $72 - 30.5 = 41.5$.

- d) **With the boom still extended, calibrate the SPAN of the EXTENSION.**

CALIBRATING THE SPAN OF THE EXTENSION SENSOR (NO.2)

1. **PRESS ↑ OR ↓ TO 04 SPAN. PRESS SELECT.**
2. **PRESS ↑ OR ↓ TO SENSOR NO.2. PRESS SELECT.**
3. WINDOW A WILL READ: NO.2 I/P = 0.00 (or actual input when re-calibrating). **PRESS SELECT.**
4. **CALCULATE "EXTENSION VALUE," AS SHOWN ABOVE. ENTER THIS DATA.** FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING ➡ TO E AND THEN PRESSING SELECT.)
5. WINDOW B WILL READ: 'CALIBRATION?' **TO CALIBRATE, PRESS SELECT. (TO ABORT, PRESS ➡. PRESS ➡ AGAIN AND CONTINUE.)**
6. WINDOW A WILL SHOW EXTENSION VALUE. SEE NOTE BELOW.
7. **TO EXIT, PRESS ➡.**

NOTE: Upon completion of Command 09, which is main boom radius/moment, WINDOW A will display **THE ACTUAL BOOM LENGTH.**

COMMAND 05 SWING POTENTIOMETER (AIN5 & AIN6)

The Swing Sensor inputs (AIN5 & AIN6) are calibrated using COMMAND 05. If the crane is NOT fitted with a swing potentiometer, do not carry out Command 05

SCALE

The swing command does not require the entry of measured data. All measurements of swing data are acquired automatically by the System during the calibration of the swing sensor. However, it is essential that when the crane upper is rotated during the **scale** procedure, it must be rotated **slowly**. This is especially important at the nodes which occur at 180° and 360°. These points can be observed on the display during the procedure.

ZERO

For all crane models whether lattice or hydraulic and whether truck or all terrain, the zero of the potentiometer is calculated **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 reading. If the swing potentiometer is mounted so that output is in the wrong direction, this can be corrected during the procedure by using the direction command to change the displayed direction.

The 3 routines are carried out consecutively. ZERO and DIRECTION can be done in isolation of SCALE but any time that SCALE is re-done, it is followed by ZERO and DIRECTION.

CALIBRATING THE SWING POTENTIOMETER

- 1. PRESS ↑ OR ↓ TO 05 SWING.
PRESS SELECT.**
- 2. THE DISPLAY WILL READ: 0=SCALE. PRESS SELECT.**
- 3. SLOWLY ROTATE THE UPPER STRUCTURE OF THE CRANE FOR
AT LEAST 2 REVOLUTIONS.**
- 4. STOP THE ROTATION. PRESS SELECT TO START SLEW SCALE.**
- 5. TO CALIBRATE, PRESS SELECT.
(TO ABORT, PRESS → PRESS → AGAIN AND CONTINUE.)**

continued on next page.

CALIBRATING THE SWING POTENTIOMETER CONTINUED

6. THE DISPLAY WILL READ: **0=SCALE. PRESS SELECT.**
7. **PRESS ↑ TO 1 SLEW ZERO.**
8. THE DISPLAY WILL READ: **1 = ZERO. PRESS SELECT.**
9. **POSITION THE CRANE UPPER DIRECTLY IN LINE OVER THE FRONT OF THE CRANE.**
10. **PRESS SELECT** TO START THE SLEW ZERO CALIBRATION.
11. **TO CALIBRATE, PRESS SELECT.**
(TO ABORT, PRESS → PRESS → AGAIN AND CONTINUE.)
12. THE DISPLAY WILL READ: 1 = ZERO.
13. **PRESS ↑ TO 2 DIRECTION.**
14. THE TOP DISPLAY WILL READ: 2 = DIRECTION.
15. **PRESS SELECT.**
16. THE CENTER DISPLAY WILL READ: DIRECTION 0.0 (APPROX.).
17. **ROTATE THE UPPER APPROX. 10° TO THE RIGHT.**
18. **IF THE NUMBERS INCREASE TO APPROX. 10°, PRESS ↑.**
19. **IF THE NUMBERS DECREASE TO APPROX. 350°, PRESS ↓.**
20. **PRESS SELECT .**
21. **TO CALIBRATE, PRESS SELECT.**
(TO ABORT, PRESS → PRESS → AGAIN AND CONTINUE.)
22. **TO EXIT, PRESS →.**

COMMAND 06 RAM DIMENSION

Boom Hoist (RAM) Data: See Figure 5 on next page.

All dimensions are referenced from the Boom Pivot.

L Along boom to upper Ram Pin..... →

J Across boom To Upper Ram Pin..... →

Negative Value Shown.
 Correct any **positive** value to a very small
 negative value (-.01).

G Horizontal to Lower Ram Pin →

H Vertical to Lower Ram Pin..... →

A.G. Annular Gain →

{A.G. = (R²÷B²) – {1.00}}..... →

Results will be negative.
 Refer to Section on Annular Gain, page 34.

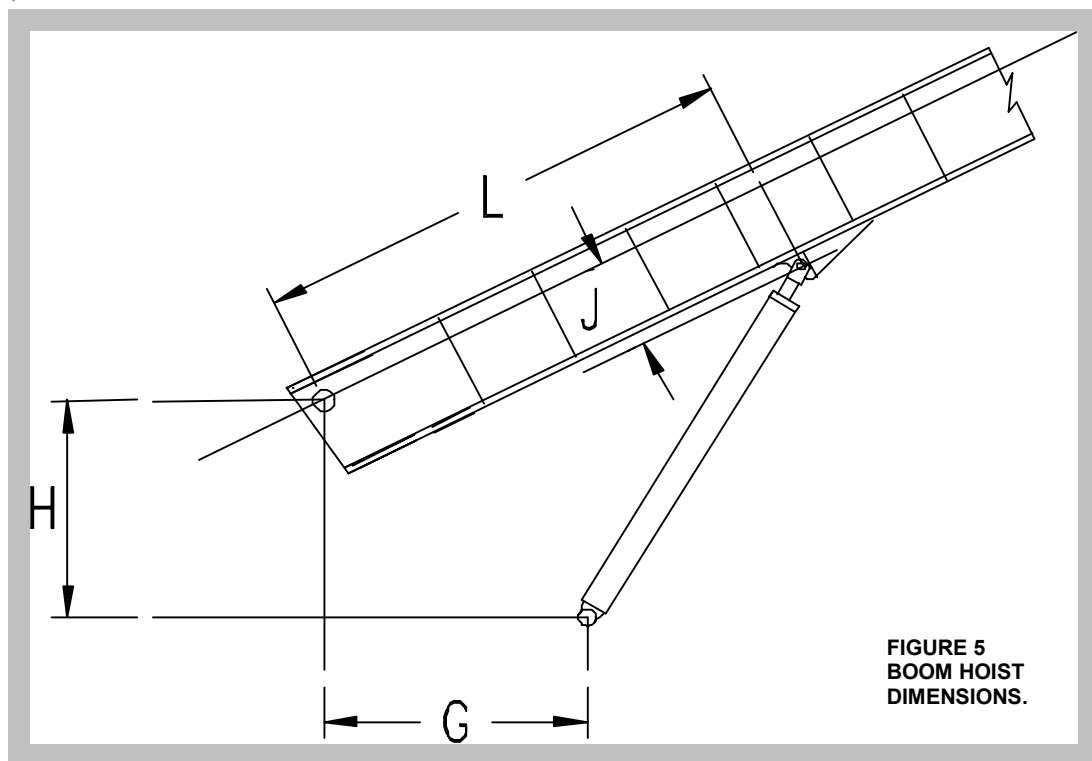


FIGURE 5
BOOM HOIST
DIMENSIONS.

LENGTHS

L – HORIZONTAL ALONG BOOM FROM BOOM PIVOT TO UPPER CYLINDER PIN

J – VERTICAL ACROSS BOOM FROM BOOM PIVOT TO UPPER CYLINDER PIN
NOTE: DIMENSION IS NEGATIVE WHEN BOOM PIVOT IS ABOVE UPPER CYLINDER PIN.

G – HORIZONTAL BETWEEN BOOM PIVOT AND LOWER CYLINDER PIN

H – VERTICAL BETWEEN BOOM PIVOT TO LOWER CYLINDER PIN

B – DIAMETER OF BOOM HOIST CYLINDER BORE

R -- DIAMETER OF BOOM HOIST CYLINDER ROD

A.G. – ANNULAR GAIN

$$\{A.G. = (R^2 + B^2) - 1.00\}$$

Note: Result will be a negative value.

COMMAND 07 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 the values that should be entered in units of 1000 #.

Example 11,700 # is entered as 11.70 in the Display.

Change data using the following sequence:

Winch Data: (Separate Data for each Winch).

All dimensions are referenced from Boom Pivot.

L Along boom to top sheave rope leadoff point $\pm 6"$.

J Across boom to top sheave rope leadoff point $\pm 6"$.

G Horizontal to center of winch rotation.

H Vertical to center of winch rotation.

R Winch radius (including 2-3 layers of rope).

(See drawing below.)

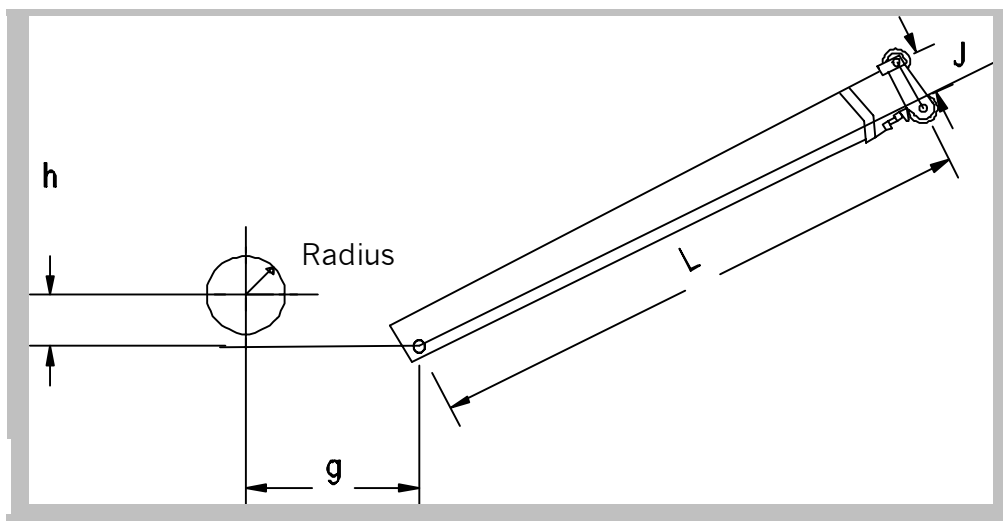


FIGURE 6. ROPE DIMENSIONS.

L – HORIZONTAL ALONG BOOM FROM BOOM PIVOT TO TOP SHEAVE CENTER (BOOM RETRACTED)

J – VERTICAL FROM BOOM PIVOT TO TOP SHEAVE CENTER (BOOM RETRACTED)

G – HORIZONTAL BETWEEN BOOM PIVOT AND WINCH CENTER OF ROTATION

H – VERTICAL BETWEEN BOOM PIVOT AND WINCH CENTER OF ROTATION

NOTE: THIS DIMENSION IS NEGATIVE WHEN BOOM PIVOT IS ABOVE WINCH CENTER OF ROTATION.

R – WINCH RADIUS (INCLUDE 2 OR 3 LAYERS OF ROPE)

F – MAXIMUM RATED LINE PULL STANDARD ROPE

MAIN/FRONT WINCH AUX/REAR WINCH

MAIN/FRONT WINCH	AUX/REAR WINCH

COMMAND 07 ROPE DATA CONTINUED

1. **PRESS ↑ OR ↓ TO 07 ROPE DIM'S. PRESS SELECT.**
2. WINDOW A WILL READ: ROPE LIM0 = XX.XXX. (0 = FROM FRONT WINCH)
PRESS SELECT.
3. WINDOW B WILL READ: CALIBRATION?
PRESS SELECT.
4. **ENTER NEW LIMIT.** FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING ➡ TO **E** AND THEN PRESSING SELECT.)
5. WINDOW A WILL READ THE NEW LIMIT.
6. **PRESS ➡ TO ROPE LIM1..**
7. WINDOW A WILL READ: ROPE LIM1 = XX.XXX. (1 = FROM REAR WINCH)
PRESS SELECT.
8. WINDOW B WILL READ: CALIBRATION? **PRESS SELECT.**
(TO ABORT, PRESS ➡ PRESS ➡ AGAIN AND CONTINUE.)
9. **ENTER NEW LIMIT.** FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING ➡ TO **E** AND THEN PRESSING SELECT.)
10. WINDOW A WILL READ THE NEW LIMIT.
11. **TO EXIT, PRESS ➡.**

EXAMINING DETAILS OF ROPE DATA

1. **PRESS ↑ OR ↓ TO 07 ROPE DIM'S. PRESS SELECT.**
2. WINDOW A WILL READ: ROPE LIM0 = XX.XXX. **PRESS ➡ TO ROPE LIMIT #1.**
3. WINDOW A WILL READ: ROPE LIM1 = XX.XXX. **TO EXIT, PRESS ➡.**

NOTE: FOR ROPE STRENGTH, CONTACT THE CRANE MANUFACTURER (IF ORIGINAL ROPE), THE ROPE MANUFACTURER, OR REVIEW THE LOAD CHART.

COMMAND 08 PRESSURE

CAREFULLY REVIEW EACH OF THE FOLLOWING POINTS:

- a) Check the **crane configuration** and make any required changes.
See CRANE SETUP, PAGE 10.
- b) Set up with full outriggers on the **main boom only** with no attachments stowed or erected.
- c) Extend boom at an angle of 45° to approximately **mid-point** full extension.
- d) Measure the radius. Check the maximum permitted load at that extension, angle, and radius.
Prepare to lift that load at that extension, angle, and radius.
- e) The calibration load includes weight of pins and slings but not weight of hook-block or ball.
The pins and slings become part of the calibration load.
- f) When load is resting on the ground, slings should also be resting and not supported by the hook.
- g) When raising and lowering load, **use the winch**. Do not use the boom hoist.
- h) Before acquiring data, wait at least 10 seconds for pressures to become stable.
- i) The weight of the hook block(s) AND /OR ball = the TARE LOAD.

SEE THE ROUTINE FOR CALIBRATING THE PRESSURE SPAN ON THE NEXT PAGE.

COMMAND 08 PRESSURE continued**CALIBRATING THE PRESSURE SPAN**

USE A DECIMAL POINT WITH ALL NUMBER ENTRIES.

SEE FIRST FOOTNOTE PAGE 9.

- 1. PRESS ↑ OR ↓ TO COMMAND 08 PRESSURE.
PRESS SELECT.**
- 2. ENTER WEIGHT OF CALIBRATION LOAD.** FOLLOW STEPS FOR NUMBER ENTRY.
(ALWAYS COMPLETE NUMBER ENTRY BY PRESSING ➡ TO **E** AND THEN PRESSING
SELECT.)
- 3. RAISE CALIBRATING LOAD USING WINCH. PRESS ↑.**
IF WINDOW B READS DATA ERROR, CHECK TO ENSURE THAT THE PRESSURE
TRANSDUCERS ARE CONNECTED.
- 4. ENTER EXACT RADIUS OF CALIBRATING LOAD.** FOLLOW STEPS FOR NUMBER
ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING ➡ TO **E** AND THEN
PRESSING SELECT.)
- 5. WINDOW B WILL READ ↑ INDICATING THAT DATA IS ACQUIRED.**
- 6. LOWER LOAD AND WITH LOAD ON GROUND, PRESS ↓.**
- 7. WINDOW B WILL READ: (↑ OR ↓) INDICATING THAT DATA IS ACQUIRED.
PRESS SELECT.**
- 8. TO CALIBRATE, PRESS SELECT.
(TO ABORT, PRESS ➡. PRESS ➡ AGAIN.)**
- 9. WITH LOAD STILL ON GROUND, WINDOW A SHOWING LOAD WILL READ ZERO.**
- 10. RAISE THE CALIBRATING LOAD.**
WINDOW A WILL READ EXACT VALUE OF CALIBRATING LOAD.
- 11. TO EXIT ROUTINE, PRESS ➡.**

IMPORTANT: WHENEVER COMMAND 8 IS CHANGED, COMMAND 9 DATA
MUST BE ENTERED AGAIN.

COMMAND 09 RADIUS AND MOMENT OF THE MAIN BOOM

COMMAND 9 is used to calibrate the **RADIUS AND MOMENT** of the main boom. It requires obtaining data taken at high and low angles with boom retracted and at high and low angles with boom extended to the following five prescribed lengths: FULLY RETRACTED, 50% of FULL EXTENSION, 75% of FULL EXTENSION, 90% of FULL EXTENSION, and FULL EXTENSION, as illustrated in the following routines. Total Moment = weight x distance.

PLEASE READ CAREFULLY:

- a) Calibration is carried out at each length. Both high and low angle data **MUST** be stored for the calibration to operate. This acquired data is described as 'STORE.' If the data is not stored, Window A will read: NO DATA.
- b) A high angle is between 60° and 65°. A low angle is lower than 20°. Data entered outside of these limits will cause the warning message, 'poor angle' to appear in Window B.

If data is **correct and outside the preferred angles**, press **↑** or **↓** to enter the unusual angle. If entered in error, **PRESS →**. Then, **PRESS → AGAIN** and continue.

CALIBRATING THE RADIUS AND MOMENT OF THE MAIN BOOM – BASE 0**FULLY RETRACTED BOOM AT AN ANGLE OF 5°.**

DETERMINE THE WEIGHT OF THE HOOK-BLOCK IN USE.

USE A DECIMAL POINT WITH ALL NUMBER ENTRIES.

- 1. PRESS ↑ OR ↓ TO 09 RADIUS. PRESS SELECT.**
- 2. ENTER WEIGHT OF HOOK BLOCK(S) AND/OR BALL (TARE LOAD).**
FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING → TO **E** AND THEN PRESSING SELECT.)
- 3. SELECT CURRENT CONFIGURATION, MAIN BOOM.** SEE CRANE SET UP PAGE 10.
(IF ALREADY DONE, SKIP TO NO. 4.)
- 4. MEASURE NEW RADIUS. THEN, RAISE BLOCK UP TO ATB WEIGHT.**
- 5. STORE LOW ANGLE DATA.** TO DO THIS, **PRESS SELECT.**
- 6. ENTER CURRENT RADIUS.** FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING → TO **E** AND THEN PRESSING SELECT.)
- 7. WINDOW A WILL READ: (↓.) PRESS ↓ AND CONTINUE.** see next page.

RAISE THE RETRACTED BOOM TO AN ANGLE BETWEEN 60° & 65°.USE A DECIMAL POINT WITH ALL NUMBER ENTRIES.

- 1. MEASURE THE NEW RADIUS. THEN, RAISE BLOCK UP TO ATB WEIGHT.**
- 2. STORE HIGH ANGLE DATA. TO DO THIS, PRESS SELECT.**
WINDOW A WILL READ: (↓).
- 3. ENTER NEW RADIUS.** FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING ➡ TO **E** AND THEN PRESSING SELECT.)
4. WINDOW A WILL READ: (↑↓).
- 5. PRESS ↑ OR ↓ TO MOMENT CALIBRATION AT CURRENT LENGTH. PRESS SELECT.**
- 6. TO CALIBRATE, PRESS SELECT. TO ABORT, PRESS ➡.**

MAINTAIN THE SAME HIGH ANGLE AND EXTEND THE BOOM TO 50% EXTENSIONUSE A DECIMAL POINT WITH ALL NUMBER ENTRIES.

- 1. MEASURE NEW RADIUS. THEN, RAISE BLOCK UP TO ATB WEIGHT.**
- 2. STORE HIGH ANGLE DATA. TO DO THIS, PRESS SELECT.**
- 3. ENTER NEW RADIUS.** FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING ➡ TO **E** AND THEN PRESSING SELECT. **WINDOW A WILL READ: ↑.**

MAINTAIN THE SAME LENGTH AND LOWER THE BOOM TO 5°. THEN, RAISE THE BOOM TO 5.1°USE A DECIMAL POINT WITH ALL NUMBER ENTRIES.

- 1. MEASURE NEW RADIUS. THEN, RAISE BLOCK UP TO ATB WEIGHT.**
- 2. STORE LOW ANGLE DATA, TO DO THIS, PRESS SELECT.**
- 3. ENTER NEW RADIUS.** FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING ➡ TO **E** AND THEN PRESSING SELECT.)
4. WINDOW A WILL READ: ↑↓.
- 5. PRESS SELECT.**
TO CALIBRATE, PRESS SELECT. TO ABORT, PRESS ➡. PRESS ➡ AGAIN.

COMMAND 09 RADIUS AND MOMENT OF THE MAIN BOOM *continued***MAINTAIN THE SAME LOW ANGLE, EXTEND THE BOOM TO 75% EXTENSION.**

USE A DECIMAL POINT WITH ALL NUMBER ENTRIES.

1. **MEASURE THE NEW RADIUS. THEN, RAISE BLOCK UP TO ATB WEIGHT.**
2. **STORE LOW ANGLE DATA. TO DO THIS, PRESS SELECT.**
3. **ENTER THE NEW RADIUS.**
FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING **➡** TO **E** AND THEN PRESSING SELECT.)
4. WINDOW A WILL READ: **↓**.

RAISE THE 75% EXTENDED BOOM TO AN ANGLE BETWEEN 60° AND 65° .

USE A DECIMAL POINT WITH ALL NUMBER ENTRIES.

1. **MEASURE THE NEW RADIUS. THEN, RAISE BLOCK UP TO ATB WEIGHT .**
2. **STORE HIGH ANGLE DATA. TO DO THIS, PRESS SELECT.**
3. **ENTER NEW RADIUS.**
FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING **➡** TO **E** AND THEN PRESSING SELECT.)
4. WINDOW A WILL READ: **↓↑**.
5. **START MOMENT CALIBRATION AT CURRENT LENGTH. TO DO THIS, PRESS SELECT.**
6. **TO CALIBRATE, PRESS SELECT.**
TO ABORT, PRESS ➡. PRESS ➡ AGAIN.
7. **TO EXIT, PRESS ➡.**

NOTE: REPEAT THE ABOVE STEPS FOR BOTH THE 90% EXTENDED BOOM AND THE FULLY EXTENDED BOOM.

COMMAND 10 BOOM DEFLECTION

Boom deflection is the change of radius due to the bending of the boom as it lifts a load. To check or correct a boom deflection, follow the steps below.

- a) With the boom fully extended at an angle of approximately 65 degrees, pick up the maximum permitted load.
- b) 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.
- c) With the load still suspended, calibrate the Boom Deflection Correction (BDC) following the routine below.

IF THE RADIUS IS ALREADY CORRECT, SKIP THE FOLLOWING ROUTINE.

USE A DECIMAL POINT WITH ALL NUMBER ENTRIES.

- 1. PRESS \uparrow OR \downarrow TO 10 BOOM DEFL'N. PRESS SELECT.**
- 2. PRESS SELECT TO START THE BOOM DEFLECTION CORRECTION.**
- 3. TO CALIBRATE, PRESS SELECT. (TO ABORT, PRESS \Rightarrow PRESS \Rightarrow AGAIN.)**
- 4. ENTER NEW RADIUS. FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING \Rightarrow TO E AND THEN PRESSING SELECT.)**
- 5. PRESS \Rightarrow TO EXIT.**

COMMAND 11 ANNULAR GAIN

COMMAND 11 ANNULAR GAIN is usually used to make any final adjustments following calibration.

There are two pressure transducers fitted in the System. One measures the piston side pressure and the other measures the rod side pressure. Because these are not identical cross-sectional areas, data must be entered which defines the ratio of the two areas. This is referred to as Annular Gain (A.G.). Below is an example using a rod diameter of 8" and a bore (cylinder I.D.) diameter of 10". This is calculated from the rod (R) and bore (B) diameters as follows:

$$\text{A.G.} = [(r \times r) / (B \times B)] - 1 \quad \text{e.g. } R = 8 \text{ and } B = 10 \quad \text{A.G.} = - 0.360$$

This value is automatically entered at the time of initialization. If the calibration is being completed using the MICROGUARD® 414 program, this value may need to be modified because of differing pressure transducer sensitivities.

If when booming down the load reading changes significantly, the Annular Gain should be changed.

CHANGING THE SETTING OF THE ANNULAR GAIN

1. **PRESS ↑ OR ↓ TO 11 ANNULAR GAIN. PRESS SELECT.**
2. IF LOAD DECREASES WHEN BOOMING DOWN,
PRESS ↑ AND CORRECT THE LOAD DISPLAY. (SEE WINDOW B).
3. IF LOAD INCREASES WHEN BOOMING DOWN,
PRESS ↓ AND CORRECT THE LOAD DISPLAY. (SEE WINDOW B).
4. **PRESS SELECT.**
5. **TO CALIBRATE, PRESS SELECT.**
(TO ABORT, PRESS ➡. PRESS ➡ AGAIN.)
6. **TO EXIT, PRESS ➡.**

After completing **MAIN BOOM CALIBRATION**, reconfigure crane for **Additional Boom Mode**.

Example: Manual Section, Power Pinned, Tip Section Pinned, Active Tip, etc.

Return to COMMAND 09 and calibrate RADIUS/MOMENT and COMMAND 10 BOOM DEFLECTION CORRECTION (BDC) on additional Boom Mode.

COMMAND 12 FLY/JIBS

COMMAND 12 is used to calibrate the **RADIUS AND MOMENT** of all configurations other than the main boom and main boom + manual, etc. Data must be collected at high and low angles retracted, and high and low angles extended.

The preferred angle range is between 20° and 60°. Data acquired outside of these limits will result in a "poor angle" message. When this message occurs as the result of an error, the incorrect entry can be aborted by pressing **➡➡**. Continue with reentry of correct data. If the data is correct and outside of the angle parameters, the data may be entered using the SELECT key.

- ERECT THE FLY/JIB IN THE CONFIGURATION DESIRED.
- GO INTO CRANE SETUP AND SELECT THE CONFIGURATION THAT MATCHES THE FLY/JIB ERECTED.
- WITH THE BOOM FULLY RETRACTED, AND AT A LOW ANGLE, MEASURE THE RADIUS.
- DETERMINE THE WEIGHT OF THE MAIN HOOK.
- DETERMINE THE WEIGHT OF THE FLY HOOK.

CALIBRATING THE RADIUS AND MOMENT OF THE FLY/JIB

THE CALIBRATION ROUTINE FOR FLYS/JIBS WILL NOT OPERATE UNTIL A FLY OR JIB CONFIGURATION IS SELECTED. **NOTE:** IF THE **TEL'D IN LOW OR TEL'D IN HIGH** READINGS DO NOT **AUTOMATICALLY** APPEAR, ON YOUR DISPLAY WHEN MAKING COMMAND 12 ENTRIES, USE YOUR ARROW KEY TO SCROLL TO THEM.

**WARNING: THE CORRECT CONFIGURATION MUST BE SELECTED
BEFORE STARTING THIS ROUTINE.**

USE A DECIMAL POINT WITH NUMBER ENTRIES INVOLVING RADIUS.

1. **PRESS **↑** OR **↓** TO 12 FLYS. PRESS SELECT.**
2. **ENTER WEIGHT OF MAIN HOOK.** FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING **➡** TO **E** AND THEN PRESSING SELECT.)
3. **ENTER WEIGHT OF FLY HOOK.** FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING **➡** TO **E** AND THEN PRESSING SELECT.)
4. **MEASURE THE NEW RADIUS. THEN, RAISE BLOCK UP TO ATB WEIGHT.**
5. **PRESS **←** TO TEL'D IN, LOW X.** IN WINDOW C. (**X** = INCOMPLETE).
5. **PRESS SELECT.**
6. **ENTER RADIUS.** FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING **➡** TO **E** AND THEN PRESSING SELECT.)
7. WINDOW C WILL READ: **TEL'D IN, LOW /.** (**/** = COMPLETED.)

RAISE THE RETRACTED BOOM TO AN ANGLE GREATER THAN 60°

USE A DECIMAL POINT WITH NUMBER ENTRIES.

1. **MEASURE THE NEW RADIUS. THEN, RAISE BLOCK UP TO ATB WEIGHT.**
2. **PRESS ← TO TEL'D IN HIGH X.** (X = INCOMPLETE)
3. **PRESS SELECT.**
4. **ENTER NEW RADIUS (f).** FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING → TO **E** AND THEN PRESSING SELECT.)
5. WINDOW C WILL READ: TEL'D IN HIGH (/). (/ = COMPLETED).

MAINTAIN THE SAME HIGH ANGLE AND EXTEND THE BOOM AS FAR AS IS SAFE.

USE A DECIMAL POINT WITH NUMBER ENTRIES.

1. **MEASURE THE NEW RADIUS. THEN, RAISE BLOCK UP TO ATB WEIGHT.**
2. **PRESS ← TO TEL'D OUT HIGH X.** (X = INCOMPLETE).
3. **PRESS SELECT.**
4. **ENTER NEW RADIUS (f).** FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING → TO **E** AND THEN PRESSING SELECT.)
5. WINDOW C WILL READ: TEL'D OUT HIGH /. (/ = COMPLETED).

COMMAND 12 FLY/JIBS CONTINUED

MAINTAIN THE SAME LENGTH AND LOWER THE EXTENDED BOOM AS FAR AS STABILITY WILL ALLOW. DO NOT LOWER THE UNLADEN BOOM BELOW THE MINIMUM ANGLE SPECIFIED ON THE CAPACITY CHART.

USE A DECIMAL POINT WITH NUMBER ENTRIES.

- 1. MEASURE THE NEW RADIUS. THEN, RAISE BLOCK UP TO ATB WEIGHT.**
- 2. PRESS ← TO TEL'D OUT LOW X. (X =INCOMPLETE).**
- 3. PRESS ↓ TO ACQUIRE LOW ANGLE DATA.**
- 4. ENTER NEW RADIUS (f). FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING ➡ TO E. THEN PRESS SELECT.)**
- 5. WINDOW C WILL READ: TEL'D OUT LOW /. (/ = COMPLETED). PRESS SELECT.**
- 6. TO CALIBRATE, PRESS SELECT.
TO ABORT, PRESS ➡.**
- 7. TO EXIT, PRESS ➡.**

COMMAND 13 WINCHES

COMMAND 13 is used when a second winch is not sold with the crane or when another winch is added at a later date. The action removes unnecessary steps from the Operator's Menu. A winch may be shown in the Display window as either 'Selectable' (S'able) or 'Hidden.' At the start of the routine, the Display window will call out the present status of the winch. By completing the following routine, the status can be changed to the opposite option.

'HIDING' A WINCH OR MAKING IT 'SELECTABLE'

- 1. PRESS ↑ OR ↓ TO 13 WINCHES.
PRESS SELECT.**
- 2. PRESS ↑ OR ↓ TO DESIRED WINCH. WINCH WILL BE DESIGNATED AS
'SEL'able' (SELECTABLE) OR 'HIDDEN.'**
- 3. TO CHANGE STATUS OF WINCH TO OPPOSITE OPTION,
PRESS SELECT.**
- 4. TO CALIBRATE, PRESS SELECT.
(TO ABORT, PRESS ➡. PRESS ➡ AGAIN.)**
- 5. TO EXIT, PRESS ➡.**

COMMAND 14 ATTACHMENTS

COMMAND 14 is used when an **attachment** is not sold with the crane or when it is added at a later date. This option removes unnecessary steps from the Operator's Menu. The **current** status of the attachment is viewed in the Window A as "S'able" (selectable) or "HIDDEN." Complete the following routine to reverse the current status to the opposite option.

ATTACHMENTS: 'HIDDEN' OR 'S'ABLE.' (SELECTABLE)

1. **PRESS ↑ OR ↓ TO 14 ATTACHMENT.
PRESS SELECT.**
2. **PRESS ↑ TO DESIRED ATTACHMENT** SHOWING CURRENT STATUS:
('SELECTABLE' OR 'HIDDEN'). **PRESS SELECT TO CHOOSE OPPOSITE OPTION.**
3. WINDOW B WILL READ: CALIBRATION?
**TO CALIBRATE, PRESS SELECT.
(TO ABORT, PRESS →. PRESS → AGAIN.)**
4. WINDOW A WILL READ NEW STATUS.
5. **TO EXIT, PRESS →.**

COMMAND 15 STOWED OR ERECTED DEDUCTS

A DEDUCT is a stowed or erected attachment that is **unused**. Attachments in this category must be taken off of the crane and weighed. The weight is deducted from the total weight which will result in a reduction of the rated capacity of the crane.

COMMAND 16 UNASSIGNED

COMMAND 17 ALARM LIMITS

The SYSTEM WORKING LIMITS (SWL) are set at initialization and follow SAE STANDARDS.

- ◆ 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

MODIFYING ALARM LIMITS

**THE ABOVE ALARM LIMITS (ENTERED AS PERCENTAGES)
MAY BE LOWERED OR ELEVATED.**

- 1. PRESS ↑ OR ↓ TO 17 ALARM LIMITS. PRESS SELECT.**
- 2. WINDOW A WILL READ: % SWL 0 = 0.000 (OR EXISTING VALUE). PRESS SELECT.**
- 3. WINDOW B WILL READ: "CALIBRATION?" PRESS SELECT.
(TO ABORT, PRESS →. PRESS → AGAIN.)**
- 4. ENTER NEW SETTING.** FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING → TO **E** AND THEN PRESSING SELECT.)
- 5. AFTER MESSAGE "CALIBRATING," WINDOW A" WILL READ: NEW SETTING.**

- 6. PRESS → TO % SWL 1 =, PRESS SELECT.**
- 7. WINDOW A WILL READ: % SWL 1 = 90.000. PRESS SELECT.**
- 8. WINDOW B WILL READ: CALIBRATION? TO CALIBRATE, PRESS SELECT.
(TO ABORT, PRESS →. PRESS → AGAIN.)**
- 9. ENTER NEW SETTING.** FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING → TO **E** AND THEN PRESSING SELECT.
- 10. AFTER MESSAGE 'CALIBRATING,' WINDOW A WILL READ NEW SETTING.**

- 11. PRESS →. TO % SWL 2 =. PRESS SELECT.**
- 12. WINDOW A WILL READ: % SWL 2 = 90.000. PRESS SELECT.**
- 13. WINDOW B WILL READ: CALIBRATION? TO CALIBRATE, PRESS SELECT.
(TO ABORT, PRESS →. PRESS → AGAIN.)**
- 14. ENTER NEW SETTING.** FOLLOW STEPS FOR NUMBER ENTRY. (ALWAYS COMPLETE NUMBER ENTRY BY PRESSING → TO **E** AND THEN PRESSING SELECT.)
- 15. AFTER MESSAGE: "CALIBRATING," WINDOW A WILL READ:NEW SETTING.**
- 16. TO EXIT, PRESS →.**

COMMAND 17 ALARM LIMITS CONTINUED

EXAMINING ALARM DETAILS

1. **PRESS ↑ OR ↓ TO 17 ALARM LIMITS.
PRESS SELECT.**
WINDOW A WILL READ: % SWL 0 = 100.000 (or new value, as entered).
2. **PRESS → TO % SWL1,**
WINDOW A WILL READ: % SWL 1 = 90.000 (or new value, as entered).
3. **PRESS → TO % SWL2,**
WINDOW A WILL READ: % SWL 2 = 90.000 (or new value, as entered).
4. **TO EXIT, PRESS →.**

COMMAND 18 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 System. For special application, this gain setting may be modified, as necessary.

Refer to the factory before making any changes.

1. **PRESS ↑ OR ↓ TO 18 AMPLIFIER. PRESS SELECT.**
2. WINDOW A WILL READ: AMP GAIN = 2. (OR ANY NEW VALUE ENTERED)
PRESS SELECT.
3. WINDOW B WILL READ: CALIBRATION? **PRESS SELECT.**
4. **PRESS ↑ OR ↓ TO CHANGE SETTING. PRESS SELECT.**
5. WINDOW B WILL READ: CALIBRATING. WINDOW A WILL READ: AMP GAIN = (NEW VALUE).
6. **TO EXIT, PRESS ➡.**

SUB-COMMAND 01/3 BACKUP

On completion of a calibration and after execution of Command 01/0 SAVE (SEE PAGE 14), a permanent BACKUP copy of the calibration SHOULD BE MADE.

SAVING THE CALIBRATIONS TO A BACKUP FILE

1. **PRESS ↑ OR ↓ TO 01 PERSONALITY.
PRESS SELECT.**
2. **PRESS ↑ TO 01 PERSON 3=BACK.
PRESS SELECT.**
3. **PRESS CALIBRATION CODE: ↑↓←→ SELECT.**
4. WINDOW A READS: 01 PERSON 3 = BACK A >> RAM.
WINDOW B READS: CALIBRATION?
**TO CALIBRATE BACKUP, PRESS SELECT.
(TO ABORT, PRESS → PRESS → AGAIN.)**
5. AFTER MESSAGE: 'CALIBRATING,' WINDOW A SHOULD
READ: A GOOD B GOOD.
6. **PRESS → TO EXIT.**
7. **SWITCH OFF POWER TO THE SYSTEM.**

REMOVING AND/OR INSERTING COMPUTER CHIPS

WARNING: Always switch System power to "OFF" before removing or inserting computer chips.

A copy of the data in Personality "A" 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 re-instate the System to working condition:

- ◆ Fit a new chip, type 28c65, in socket IC7.
- ◆ Turn on power to the System and carry out Command 01/4-Restore using the following routine.

RESTORE POWER AND ENTER THE CALIBRATION ROUTINE

1. **PRESS AND HOLD THE SELECT AND TEST KEYS FOR APPROXIMATELY 10 SECONDS.**
2. **TO CALIBRATE, PRESS THE CALIBRATION ENTRY CODE: ↑ ↓ ← → SELECT. (TO ABORT, PRESS →. PRESS → AGAIN.)**

SUB-COMMAND 01/4 RESTORE (RETR)

1. **PRESS ↑ OR ↓ TO 01 PERSONALITY. PRESS SELECT.**
2. **PRESS ↑ TO RETR PRESS SELECT.**
3. **PRESS THE CALIBRATION ENTRY CODE: ↑ ↓ ← → SELECT.**
4. **WINDOW A WILL SHOW RESTORED DATA: RAM >> A
WINDOW B WILL READ: CALIBRATION?
TO CALIBRATE, PRESS SELECT.
(TO ABORT, PRESS →. PRESS → AGAIN.).**
5. **WINDOW A WILL READ A GOOD B GOOD SAME.**
6. **AFTER 'CALIBRATING' MESSAGE STOPS, PRESS → TO EXIT.**

NOTE: A COPY OF THE CALIBRATION PERSONALITY IS NOW RESTORED TO THE "A" SECTION OF IC7. IT SHOULD NOW BE SAVED TO THE "B" SECTION USING **COMMAND 1/0 SAVE**. SEE **SUB-COMMAND 01/3 BACKUP**, PAGE 42.

COMMAND 19 DIGITAL INPUT

COMMAND 19 allows display of the logic status of digital inputs.

The inputs can be high or low. 0 indicates low. One (1) indicates high.

VIEWING THE STATUS OF DIGITAL INPUTS

- 1. PRESS ↑ OR ↓ TO 19 DIGITAL INPUT.
PRESS SELECT.**
- 2. WINDOW B WILL READ THE STATUS OF ALL DIGITAL INPUTS.**
- 3. TO EXIT, PRESS →.**

1	NOT USED	
2	NOT USED	
3	NOT USED	
4	NOT USED	
5	NOT USED	
6	NOT USED	
7	NOT USED	
8	NOT USED	
9	NOT USED	
10	BYPASS MESSAGE	HI = NO MESSAGE
11	SELECT OPTIONAL CHART	HI = SELECT CHART
12	NOT USED	
13	ATB IN	HI = NO ALARM
14	NOT USED	
15	NOT USED	

GLOSSARY OF TERMS

ABORT	To stop data entry into the System before the entry process is finalized.
ALARM	A visual or audible warning signal.
AMPLIFIER	Increases magnitude –Example: a pressure transducer in the millivolt range is increased or 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.
BACKUP	In this case, a copy of data saved in a separate computer chip.
BOOM DEFLECTION	A change in radius due to the bending of the boom caused by the weight of 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.

GLOSSARY OF TERMS CONTINUED

CONFIGURATION	The position of the crane, supporting appendages, and all lifting elements.
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 inputs usually controlled by external on/off switches.
DIRECTION	The course on which the upper section (superstructure) of a crane rotates.
DUTY	The working configuration of a crane that can usually be 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 required, in this case, to support the weight of an object.
GEOMETRY	Mathematics addressed to the measurement and relationship 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 height. The height of the boom pivot above ground level.
HORIZONTAL	Parallel to the horizon.

GLOSSARY OF TERMS CONTINUED

HYDRAULIC CRANES	Using the pressure of oil for operation.
INCREMENT	The action of increasing a number or value.
INITIALIZES	Prepares PERSONALITY A computer memory chip for new calibrations. Erases all existing data during this process.
INTEGRATED CIRCUITS	A tiny complex of electronic components and connections collected 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.
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	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 provided by the manufacturer in a capacity chart.
RATED CAPACITY	The load that a crane can safely handle 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	To move calibration data from a back-up chip to the Personality "A" ACTIVE chip.

GLOSSARY OF TERMS CONTINUED

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	To 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 stimuli.
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 center line.
SWL (%SWL)	Percentage of 'safe working load.' The proportion of the crane capacity that is being utilized at any one time expressed as a percentage of rated capacity.
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.O	The piston side pressure transducer.
TX.1	The rod side pressure transducer.

GLOSSARY OF TERMS CONTINUED

UNLADEN	A boom that has no additional stowed or erected attachments and is not
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 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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