



MicroGuard 424



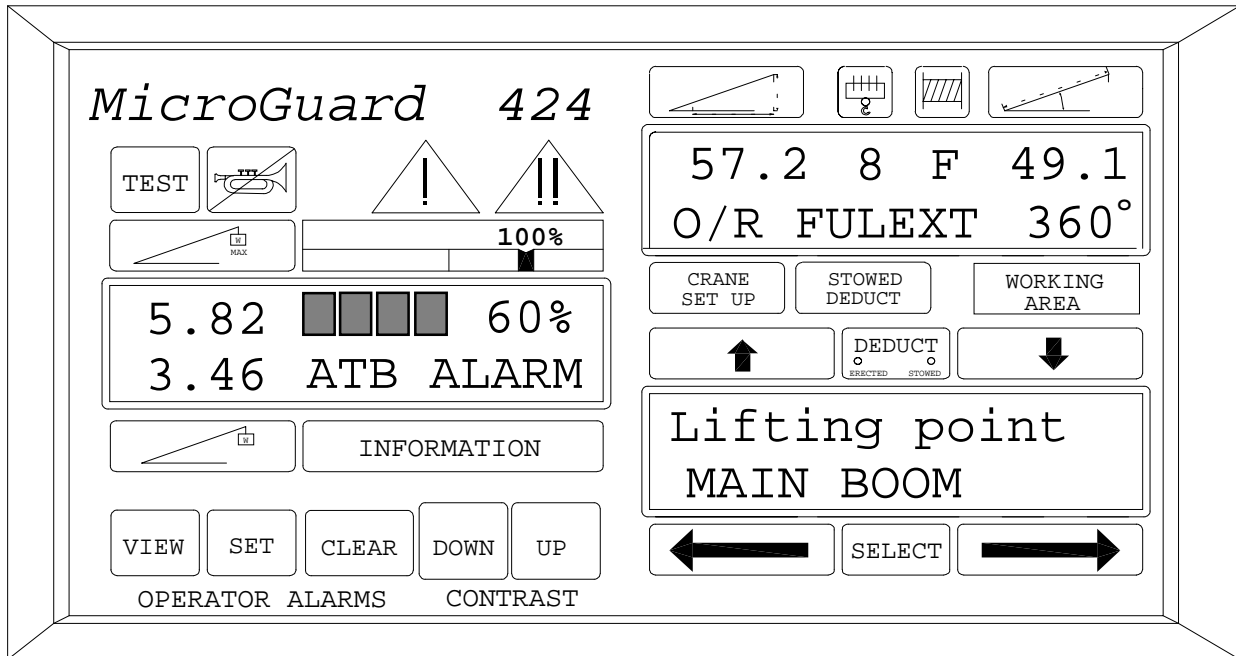
CALIBRATION MANUAL

MICROGUARD®424

for

MODELS USING M414371A & M414380C PROGRAMS

GENERIC



CALIBRATION PROCEDURE

MicroGuard® 424 SYSTEM

GENERIC CALIBRATION MANUAL

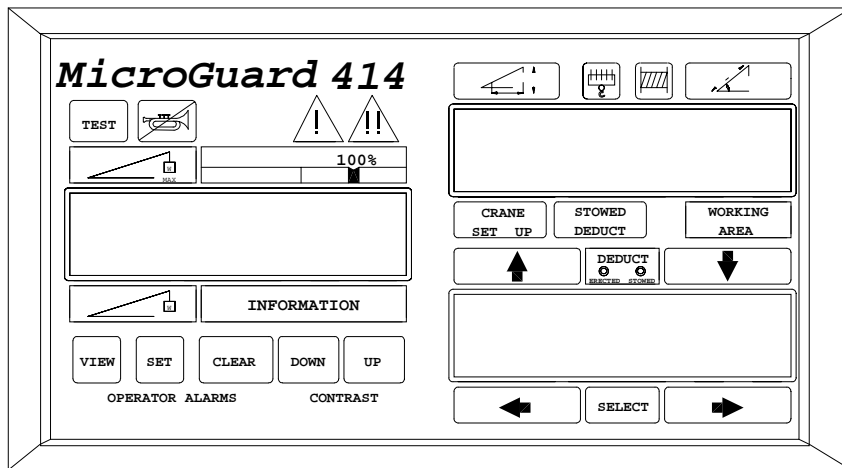
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GENERAL INFORMATION

After satisfactory installation of the complete system, ensure that it is correctly wired in accordance with the Wiring Diagram, which is issued with the duty chip.

Before carrying out any crane operations ensure that the crane is on firm and level ground and that the outrigger beams are fully extended and jacks are correctly extended to level the carrier.



CAUTION: Do not exceed any structural or stability limits throughout this procedure.

For cranes using executive programs labeled

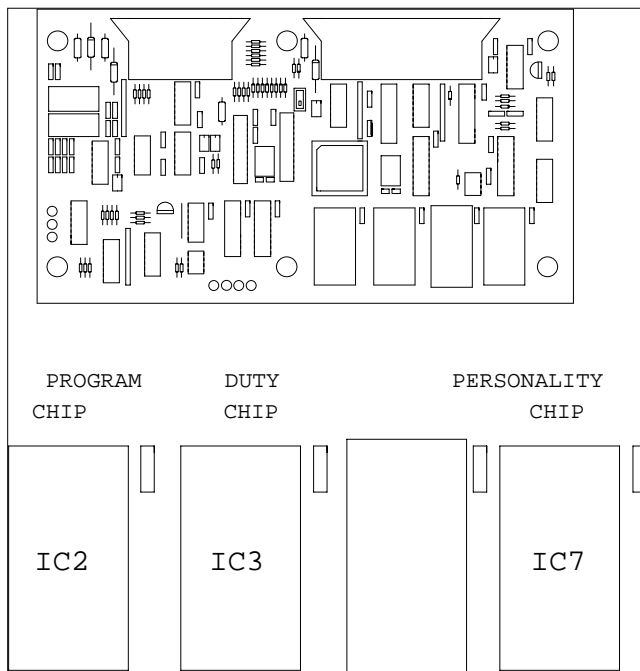
M414370, M414371 or

M414380: Attachments can

remain on as long as they are correctly selected in the computer.

For cranes using other

programs: Remove all attachments which can be optionally stowed or erected on the boom during normal operation (e.g. aux.head flies or jibs). The computer must be fitted with the appropriate program and duty chips. They are found on the main computer board as shown below.



WARNING: 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.

CALIBRATION PROCEDURES

The Display Unit provides the interface between the user and the calibration program. By pressing the various keypads on the Display, the user communicates with the program and executes the calibration. Information and data stored in the Display Unit are activated via on-screen prompts.

The six keypads are shown below with a description of their basic function.

↑	UP ARROW	INCREASES A NUMBER
↓	DOWN ARROW	DECREASES A NUMBER
←	LEFT ARROW	CHANGES A CATEGORY OR SENSOR
→	RIGHT ARROW	CHANGES A CATEGORY AND/OR EXITS
SELECT	SELECT KEY	SELECTS AND CALIBRATE
TEST	TEST KEY	STARTS THE CALIBRATION

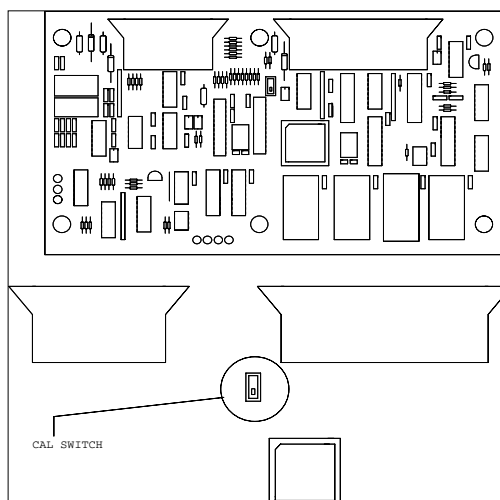
Calibration routines are initiated by simultaneously pressing and holding the **SELECT** and **TEST** keys for approximately 2 seconds. The display will then request entry of the Calibration Security Code.

To enter the Calibration Security Code, press the following keys **IN THE SEQUENCE SHOWN BELOW**.

↑ ↓ ← → **SELECT**

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

Calibration procedures will only work with the CAL switch in the computer set to the CAL position. To gain access to the CAL switch it is necessary to remove the cover from the computer assembly. The switch is located near the center of the computer board between and below the ribbon cable connectors.



COMMAND 00 RUN

Following correct entry of the calibration code, the System will be in the MONITOR mode and will be at Command 00 Run. Execution of this Command will cause the System to carry out a System Self-TEST followed by a return to the working screen.

COMMAND 01 PERSONALITY

Command 01 Personality is used to manipulate the crane calibration data.

The System has storage space for two sets of data in the EEPROM IC7. *Active Personality* is the data actually used by the main program. *Back-up Personality* is used to keep a protected copy of the calibration data.

For convenience the sets of personality data are called:

"A" = the Active Personality in IC7

"B".= the Backup Personality in IC7

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.
- ◆ Copies data to a back-up chip
- ◆ Retrieves data from a back-up chip.

When Command 01 is first selected and after copying data, both "A" and "B" sets are checked for correct check-sum. This is indicated by "good" or "bad" beside the respective reference in the lower display. Set "A" is also checked against set "B". If the data is identical, this is indicated by "same;" if not the same, by "diff." Moving data is by accomplished by means of the sub-commands selected and a special [CAL] sequence. This requires the entry of a Code that is the same as the one used to enter the calibration routines and provides adequate opportunity to abort the procedure. This is necessary because some of the sub-commands cause previously entered data to be irretrievably lost.

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.

WARNING

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.

WARNING

If the System has been previously calibrated and the intention is only to access data or change only a portion of the previous calibration, **DO NOT** perform the initialization process that follows **or the entire previous calibration data will be lost.**

ENTRY TO CALIBRATION ROUTINES

START THE ROUTINE BY PRESSING AND HOLDING FOR APPROXIMATELY 2 SECONDS	SELECT AND TEST
FOLLOW THE CAL ENTRY SEQUENCE	↑ ↓ ← →
CONFIRM THE CALIBRATION (or abort with ⇨)	SELECT

If the wrong sequence is used or if the entry is not completed within 5 seconds, the calibration entry will be aborted and must be restarted. Before the first calibration of a new system, prepare the Personality Memory by following the sequence below.

CAUTION

THIS PROCEDURE TRANSFERS PRE-CALIBRATED DATA TO THE PERSONALITY CHIP. **IF THIS HAS ALREADY BEEN CARRIED OUT AND THE INTENTION IS TO ONLY PARTIALLY CALIBRATE OR TO MODIFY CALIBRATION OR DATA IN AN ALREADY CALIBRATED SYSTEM, DO NOT CARRY OUT THE INITIALIZE ROUTINE. PROCEED DIRECTLY WITH THE CALIBRATION.**

COMMAND 01/2 INITIALIZE

SCROLL TO 01 PERSONALITY BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
SCROLL TO 01/2 INITIALIZE BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
FOLLOW THE CAL ENTRY SEQUENCE	↑ ↓ ← →
CONTINUE THE INITIALIZATION BY PRESSING	SELECT
CONFIRM THE CALIBRATION (or abort with ⇨) SEE NOTE	SELECT
AFTER THE MESSAGE CALIBRATING, EXIT BY PRESSING	⇨

NOTE: The System will return to the MONITOR MODE but will remain in the CALIBRATION ROUTINE. *This procedure completely erases all previous data from the A personality. There is an opportunity to ABORT the procedure at this point by first pressing ⇨. Follow by pressing SELECT to erase the memory.*

COMMAND 01/0 SAVE

Upon completion of a calibration, it is necessary to carry out Command 01/0 SAVE. Refer to at the end of this manual. There is no reason, however, why this command should not be used at any time during the intermediate stages of a calibration, for example at the end of a period of work or if desired after each section of a calibration has been completed. The use of this command will ensure that a copy of the calibration, up to the point of carrying out "save", will be contained in the back-up memory.

SCROLL TO 01 PERSONALITY BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
SCROLL TO 01/0 SAVE BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
FOLLOW THE CAL ENTRY SEQUENCE	↑ ↓ ← →
CONTINUE THE SAVE BY PRESSING	SELECT
CONFIRM THE CALIBRATION (or abort with →) SEE NOTE	SELECT
AFTER THE MESSAGE "CALIBRATING," THE DISPLAY WILL READ "A" GOOD "B" GOOD SAME	
EXIT BY PRESSING	→

NOTE: This procedure completely erases all previous data from the B personality. There is an opportunity to ABORT the procedure at this point by use of the right arrow → Continuing with **SELECT** will erase the memory

COMMAND 02 TEST/FAULT

COMMAND 02 IS USED TO ACTIVATE A SYSTEM SELF-TEST WHICH WILL DETECT AND DISPLAY ANY ERRORS PRESENT IN THE SYSTEM. THESE ERRORS ARE SHOWN BY MEANS OF AN ERROR CODE.

Carry out the Command using the following sequence:-

SCROLL TO 02 TEST/FAULT BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
THE SYSTEM WILL EXECUTE A SELF-TEST AND DISPLAY FAULT CODES	
EXIT FROM THE ROUTINE BY PRESSING	→

FAULT CODES

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	UPPERSTRUCTURE 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

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

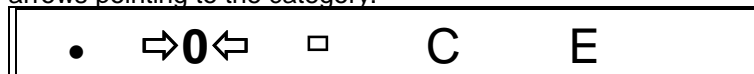
DD		
00		NO FAULTS
01	FAULT 1	NO DUTY FOUND
02	FAULT 2	CURRENT DUTY BAD
04	FAULT 4	CONFIGURATION NOT CALIBRATED

NUMBER ENTRY

The MicroGuard® System does not have number entry keys. A special number entry procedure is used to allow the simple entry of numbers. When numerical entry of data is required, the center display will change to allow the entry of numbers. There are 5 categories in the display, as follows.

•	SELECTS A DECIMAL POINT
0	SELECTS A DIGIT 0-9. THE ↑ AND ↓ KEYS ARE USED TO CHANGE A NUMBER
□	CHANGE SIGN +/-
C	CLEAR A CURRENTLY DISPLAYED NUMBER
E	TERMINATES THE NUMBER AND COMPLETES THE ENTRY PROCESS

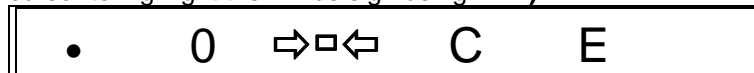
1. When the number entry is started, the display flashes on the number entry category that is highlighted by arrows pointing to the category.



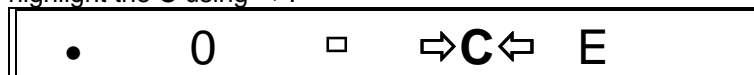
2. Numbers are changed using the ↑ and ↓ keys. When selected, the required number is entered using the **SELECT** key. Successive numbers up to a total of five digits may be entered this way. If a number requires a decimal point, the number is entered by moving the highlighted selection to the decimal point by means of ←. The decimal point then becomes highlighted.



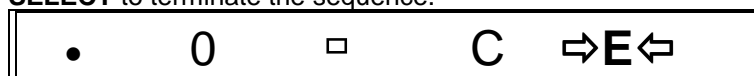
3. The decimal point is entered using the **SELECT** key. After the selection of a decimal point, the highlighted flashing cursor returns to the digits for the completion of the number entry. If a negative value is to be entered, the number digit(s) must be entered first followed by the change sign command (enter the number and then move the cursor to highlight the minus sign using →).



4. Press **SELECT** to change to a negative value. If an error is made in the entry of data, move the cursor to highlight the **C** using →.



5. Press **SELECT** to delete the erroneous number, move the cursor back to the entry of digits and enter the correct number. After entry of all digits, decimal point and sign changes, move the cursor to **E** using → and press **SELECT** to terminate the sequence.



NUMBER ENTRY (continued)

IN THE EXAMPLE THAT FOLLOWS, AN ARBITRARY NUMBER OF **MINUS 123.45** HAS BEEN CHOSEN TO ILLUSTRATE THE USE OF THE PROCEDURE.

SELECT THE FIRST DIGIT ⇨1⇨ BY PRESSING	↑ OR ↓
WHEN AT ⇨1⇨ PRESS	SELECT
SELECT THE SECOND DIGIT ⇨2⇨ BY PRESSING	↑ OR ↓
WHEN AT ⇨2⇨ PRESS	SELECT
SELECT THE THIRD DIGIT ⇨3⇨ BY PRESSING	↑ OR ↓
WHEN AT ⇨3⇨ PRESS	SELECT
MOVE THE CURSOR TO THE DECIMAL POINT ⇨.⇨ BY PRESSING	←
ENTER THE DECIMAL POINT BY PRESSING	SELECT
SELECT THE FIRST DECIMAL PLACE ⇨4⇨ BY PRESSING	↑ OR ↓
WHEN AT ⇨4⇨ PRESS	SELECT
SELECT THE NEXT DECIMAL PLACE ⇨5 ⇨ BY PRESSING	↑ OR ↓
WHEN AT ⇨5⇨ PRESS	SELECT
MOVE THE CURSOR TO THE CHANGE SIGN ⇨ □ ⇨ BY PRESSING	⇒
SELECT THE MINUS SIGN BY PRESSING	SELECT
MOVE THE CURSOR TO ⇨E⇨ BY PRESSINGSEE NOTE	⇒
TERMINATE THE ENTRY BY PRESSING	SELECT

NOTE

AFTER THE ENTRY OF FIVE DIGITS, THE CURSOR WILL MOVE AUTOMATICALLY TO **E**.
IF LESS THAN FIVE DIGITS HAVE BEEN ENTERED, USE ⇒ TO MOVE THE CURSOR TO **E**.

COMMAND 03 ZERO

The Zero Command permits the calibration of the zero of most analog sensors. There are four sensors that can be zeroed using Command 03. Each sensor is allocated a number that corresponds to the input to which it is connected in the System.

These are as follows:

- ◆ 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

The swing sensor has its own routine and is calibrated using Command 05.

ZERO PRESSURE TRANSDUCERS

- ◆ Lower the boom onto its lower end stops (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 sequence **ON THE FOLLOWING PAGE**.

SCROLL TO 03 ZERO BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
SCROLL TO Tx.0 BY PRESSING	↑ OR ↓
CONFIRM SELECTION OF THE SENSOR BY PRESSING	SELECT
THE DISPLAY WILL READ	Tx.0 = XXX (actual input)
START THE CALIBRATION OF Tx.0 BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨)	SELECT
THE DISPLAY WILL READ	Tx.0 = 0 (zeroed input)
CHANGE SENSOR BY PRESSING	⇐
SCROLL TO Tx.1 BY PRESSING	↑
CONFIRM SELECTION OF THE SENSOR BY PRESSING	SELECT
THE DISPLAY WILL READ	Tx.1 = XXX (actual input)
START THE CALIBRATION OF Tx.1 BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨)	SELECT
THE DISPLAY WILL READ	Tx.1 = 0 (zeroed input)
EXIT FROM THE ROUTINE BY PRESSING	⇨

Reconnect all hydraulic lines before resuming crane operation.

ZERO EXTENSION SENSOR

The Extension Sensor is fitted with 130 ft. of shielded 2-wire cable. The cable **cannot** be shortened to accommodate varying boom lengths. The following method of pre-tensioning is recommended.

- ◆ Fully retract all the boom sections.
- ◆ Pre-tension the reel using the following procedure:
- ◆ With the boom fully retracted, remove the clamp on the reel cable and allow it to slowly rewind onto the drum until there is no pre-tension. Continue to rewind the drum until the distance between the attachment point and the end of the cable is approximately 12 ft. At this point, because of the clutch on the reel shaft there will be no pre-tension. Now pull out the cable toward the attachment point and 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, ensuring that there is sufficient cable at the boom head to connect to the A.T.B. switch.
- ◆ When the boom is fully retracted, manually turn the large gear on the MicroGuard[®] potentiometer fully counterclockwise. Then, advance the gear clockwise three clicks (approximately ¼ turn on the gear).
- ◆ Follow the sequence below to calibrate the zero of the sensor.

SCROLL TO 03 ZERO BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
SCROLL TO SENSOR No. 2 BY PRESSING	↑ OR ↓
CONFIRM SELECTION OF THE SENSOR BY PRESSING	SELECT
THE DISPLAY WILL READ	No.2 = XXX (actual input)
START THE CALIBRATION OF SENSOR No.2 BY PRESSING	SELECT
TO CONFIRM THE CALIBRATION PRESS (or abort with ⇨)	SELECT
THE DISPLAY WILL READ	No.2 = 0 (zeroed input)
EXIT THE ROUTINE BY PRESSING.	⇨
OR CHANGE SENSOR BY PRESSING	⇦

(Continue Next Page)

ZERO BOOM ANGLE SENSOR

NOTE

THE INCLINOMETER OR MEASURING DEVICE USED TO CALIBRATE THE ANGLE OF THE MAIN BOOM MUST HAVE AN ACCURACY OF $\pm 0.25^\circ$. USE OF A LESS ACCURATE DEVICE MAY RESULT IN CALIBRATION ERRORS.

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.

- ◆ Using an inclinometer, set the boom in a horizontal position.
- ◆ On all models the boom angle sensor is mounted inside the Extension sensor housing. Ensure that the Extension Sensor is mounted perpendicular to the boom.
- ◆ Calibrate the zero of the boom angle sensor using the following sequence:

SCROLL TO 03 ZERO BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
SCROLL TO SENSOR No.3 BY PRESSING	↑ OR ↓
CONFIRM SELECTION OF THE SENSOR BY PRESSING	SELECT
THE DISPLAY WILL READ	No.3 = XX.X (actual input)
START THE CALIBRATION OF SENSOR No.3 BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨)	SELECT
THE DISPLAY WILL READ	No.3 = 0 (zeroed input)
EXIT FROM THE ROUTINE BY PRESSING	⇨
OR CHANGE SENSOR BY PRESSING	⇦

COMMAND 04 SPAN

BOOM ANGLE SENSOR

NOTE

THE INCLINOMETER OR MEASURING DEVICE USED TO CALIBRATE THE ANGLE OF THE MAIN BOOM MUST HAVE AN ACCURACY OF +/- 0.25°. USE OF A LESS ACCURATE DEVICE MAY RESULT IN CALIBRATION ERRORS.

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.

- ◆ Raise the retracted boom to an angle between 60° and 65° and measure the angle using an inclinometer. (E.G. 61.5°)
- ◆ Calibrate the span of the Boom Angle Sensor:

SCROLL TO 04 SPAN BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
SCROLL TO SENSOR No.3 BY PRESSING	↑ OR ↓
CONFIRM SELECTION OF THE SENSOR BY PRESSING	SELECT
THE DISPLAY WILL READ	No.3 I/P = 0.00 (or actual input when re-calibrating)
START THE CALIBRATION OF SENSOR No.3 BY PRESSING	SELECT
USE NUMBER ENTRY PROCEDURE TO ENTER MEASURED BOOM ANGLE	
CONFIRM THE CALIBRATION (or abort with ⇨)	SELECT
THE DISPLAY WILL READ	No.3 I/P = XX.XX (boom angle entered)
EXIT FROM THE ROUTINE BY PRESSING	⇨

EXTENSION SENSOR

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

- (a) With the boom horizontal and fully retracted, measure the distance from the boom pivot to the hook center line. Note the distance.
- (b) Extend the boom as far as possible without tipping the machine and measure the distance from the boom pivot to the hook center line. Note the distance.
- (c) Calculate the boom extension from the formula **Extended** length minus **Retracted** length equals **Extension** value.
e.g. IF THE EXTENDED BOOM LENGTH IS 72 FEET AND THE RETRACTED BOOM LENGTH IS 30.5 THEN THE EXTENSION VALUE IS $72 - 30.5 = 41.5$
- (d) With the boom still fully extended, calibrate the **SPAN** of the **EXTENSION** by the use of the following sequence:

SCROLL TO 04 SPAN BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
SCROLL TO SENSOR No.2 BY PRESSING	↑ OR ↓
CONFIRM SELECTION OF THE SENSOR BY PRESSING	SELECT
THE DISPLAY WILL READ	No.2 I/P = 0.00 (or actual input when re-calibrating)
START THE CALIBRATION OF SENSOR No.2 BY PRESSING	SELECT
USE NUMBER ENTRY PROCEDURE TO ENTER EXTENSION VALUE	
CONFIRM THE CALIBRATION (or abort with ⇨)	SELECT
THE DISPLAY WILL READ	No.2 I/P = XX.XX (extension value you entered)
EXIT FROM THE ROUTINE BY PRESSING	⇨

At this stage of the procedure the boom length display will indicate the extension value that you entered. After completion of Command 07, main boom radius/moment, it will display boom length.

Retract the boom and continue the procedure.

COMMAND 05 SWING

THIS ROUTINE WILL ONLY BE EXECUTED ON MODELS THAT HAVE SWING POTENTIOMETERS. IF EQUIPPED WITH SWING SWITCHES, CONTINUE WITH COMMAND 06 PRESSURE. Do not calibrate swing if you do not have swing potentiometers

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 datum for the zero of the potentiometer is **IN LINE OVER THE FRONT OF THE CARRIER**.

DIRECTION

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

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

Carry out the calibration of the swing potentiometer using the following sequence.

SCROLL TO 05 SWING BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
THE DISPLAY WILL READ	0 = SCALE
CONFIRM SELECTION OF SCALE BY PRESSING	SELECT
SLOWLY ROTATE THE UPPER STRUCTURE OF THE CRANE FOR AT LEAST 2 REVOLUTIONS	
STOP THE ROTATION AND START THE SLEW SCALE BY PRESSING	SELECT
CONFIRM THE CALIBRATION (or abort with ⇨)	SELECT
THE DISPLAY WILL READ	0 = SCALE
SCROLL TO 1 SLEW ZERO BY PRESSING	↑
THE DISPLAY WILL READ	1 = ZERO
CONFIRM SELECTION OF 1 SLEW ZERO BY PRESSING	SELECT

Continued
on
next page

COMMAND 05 SWING (continued)

POSITION THE CRANE UPPER DIRECTLY IN LINE OVER THE FRONT OF THE CRANE	
START THE SLEW ZERO CALIBRATION BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨)	SELECT
THE DISPLAY WILL READ	1 = ZERO
SCROLL TO 2 DIRECTION BY PRESSING	↑
THE TOP DISPLAY WILL READ	2 = DIRECTION
CONFIRM SELECTION OF 2 DIRECTION BY PRESSING	SELECT
THE CENTER DISPLAY WILL READ	DIRECTION 0.0 (approx.)
ROTATE THE UPPER APPROX. 10° TO THE RIGHT	
IF THE NUMBERS INCREASE TO APPROX. 10° CONFIRM THE DIRECTION BY PRESSING	↑
IF THE NUMBERS DECREASE TO APPROX. 350° REVERSE THE DIRECTION BY PRESSING	↓
START THE DIRECTION CALIBRATION BY PRESSING	SELECT
CONFIRM THE CALIBRATION (or abort with ⇨)	SELECT
EXIT THE ROUTINE BY PRESSING	⇨

CONFIGURATION SELECTION

In the normal operational mode, the System is programmed to use the configuration **last selected**. Each time the System is powered up, it will automatically choose that configuration. Only when the crane is rigged differently must a new configuration be selected.

CRANE SET UP

The menu for the crane set up consists of 6 to 8 consecutive steps depending on the options available.

1. Select Outriggers, Tires, Rigging/Travel mode.
2. Select Counterweight. (If selection is available).
3. Select Boom. (This step is skipped on 3 section boom cranes).
4. Select Auxiliary Head fitted or not fitted.
5. Select Erected Flys.
6. Select Erected Jibs. (This step is used when only equipped with an "A" Frame Jib)
7. Select Lifting Point for Front Winch.
8. Select Lifting Point for Rear Winch.

NOTE: ON SINGLE WINCH CRANES, SELECTIONS 7 AND 8 ARE NOT NECESSARY AND MAY NOT BE IN THE MENU.

PARTS-OF-LINE

Press and hold the PARTS-OF-LINE push-button to scroll through the available parts of line. The new value is automatically registered when the button is released. The number chosen applies only to the winch currently selected and a value must be programmed for both winches.

WINCH

The current selection is shown in the display by using the letter F for front winch and the letter R for rear winch. To change the selection, press the WINCH select push-button. Successive pressing of the button will change the selection from one to the other. After the initial setup, the System can identify the Parts-of-Line, Lifting Point and Deducts for each winch.

RIGGING TRAVEL MODE

The Rigging /Travel mode is selected as part of the carrier options. This mode is used to facilitate the rigging and travel of the crane by inhibiting motion-cut and audible alarm while selected. The information screen is restricted to the display of radius, length, angle, height and precautionary messages during the time that the mode is selected.

To return to normal operation, use CRANE SET UP.

CONFIGURATION SELECTION

START THE SELECTION OF CRANE CONFIGURATION BY PRESSING "CRANE SET UP"

CRANE SET UP	THIS CHART IS AN EXAMPLE ONLY!					
SCROLL TO CARRIER						
↑ OR ↓	OUTRIGGERS FULLY EXT.	OUTRIGGERS HALF EXT.	OUTRIGGERS RETRACTED	ON TIRES STATIONARY	PICK AND CARRY	RIGGING TRAVEL
SELECT						

SCROLL TO SELECT BOOM		
↑ OR ↓	MAIN BOOM (OR MODE A)	MAIN BOOM + MANUAL (OR MODE B)
SELECT		

SCROLL TO AUX. HEAD	NOTE: THE ABOVE STEP IS SKIPPED ON 3 SECTION BOOM CRANES.	
↑ OR ↓	AUX. HEAD FITTED	AUX. HEAD NOT FITTED
SELECT		

SCROLL TO ATTACHMENT							
↑ OR ↓	NO ATTACHMENT	+25' FIXED FLY	+25' OFFSET FLY 2°	+25' OFFSET FLY 15°	+25' OFFSET FLY 30°		
SELECT		+25' TELE FLY 2°	+25' TELE FLY 15°	+25' TELE FLY 30°	+43' TELE FLY 2°	+43' TELE FLY 15°	+43' TELE FLY 30°

NOTE: THIS NEXT STEP IS EXCLUDED UNLESS EQUIPPED WITH AN "A" FRAME JIB

SCROLL TO ATTACHMENT			
↑ OR ↓	NO ATTACHMENT	JIB @ 0° TO 5°	JIB @ 15° TO 17.5°
SELECT			JIB @ 30°

SCROLL TO FRONT WINCH LIFTING POINT							
↑ OR ↓	MAIN BOOM HEAD	MAIN BOOM + MANUAL	AUX. LIFTING SHEAVE	+25' FIXED FLY	+25' OFFSET FLY 2°	+25' OFFSET FLY 15°	+25' OFFSET FLY 30°
SELECT		+25' TELE FLY 2°	+25' TELE FLY 15°	+25' TELE FLY 30°	+43' TELE FLY 2°	+43' TELE FLY 15°	+43' TELE FLY 30°

NOTE: THESE STEPS MAY BE SKIPPED ON SINGLE WINCH CRANES

SCROLL TO REAR WINCH LIFTING POINT							
↑ OR ↓	MAIN BOOM HEAD	MAIN BOOM + MANUAL	AUX. LIFTING SHEAVE	+25' FIXED FLY	+25' OFFSET FLY 2°	+25' OFFSET FLY 15°	+25' OFFSET FLY 30°
SELECT		+25' TELE FLY 2°	+25' TELE FLY 15°	+25' TELE FLY 30°	+43' TELE FLY 2°	+43' TELE FLY 15°	+43' TELE FLY 30°

COMMAND 06 PRESSURE

- ◆ USE "CRANE SET UP" TO SELECT FULLY EXTENDED OUTRIGGERS, MAIN BOOM, AND ATTACHMENTS, IF EQUIPPED.
- ◆ DETERMINE THE WEIGHT OF THE CALIBRATION LOAD. THE CALIBRATION LOAD INCLUDES THE WEIGHT OF THE PINS AND SLINGS BUT DOES NOT INCLUDE THE WEIGHT OF THE BLOCK OR BALL. FOR BEST ACCURACY, USE A LOAD WHICH EXCEEDS 50% OF THE CRANE CAPACITY. SMALLER LOADS MAY BE USED BUT THIS COULD RESULT IN REDUCED ACCURACY.
- ◆ 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 HOIST.
- ◆ BEFORE ACQUIRING DATA, WAIT AT LEAST 10 SECONDS FOR THE PRESSURES TO BECOME STABLE.
- ◆ KEEP THE BOOM BETWEEN 42° AND 48° AND TELESCOPE THE LOAD TO A RADIUS OF APPROXIMATELY 95% OF CAPACITY. VERIFY THIS USING THE LOAD CHART PRIOR TO DOING THE LIFT. **DO NOT EXCEED THE LIMITATIONS OF THE LOAD CHART!**

Calibrate the pressure span using the following sequence:

SCROLL TO 06 PRESSURE BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
USE THE NUMBER ENTRY PROCEDURE TO ENTER THE WEIGHT OF THE CALIBRATION LOAD	
RAISE THE CALIBRATION LOAD USING THE WINCH AND PRESS	↑
USE THE NUMBER ENTRY PROCEDURE TO ENTER THE EXACT RADIUS OF THE CALIBRATION LOAD	
THE UPPER DISPLAY WILL READ (↑) TO INDICATE THAT THE DATA IS ACQUIRED	
LOWER THE LOAD AND WITH THE LOAD ON THE GROUND PRESS	↓
THE UPPER DISPLAY WILL READ (↓ ↑) TO INDICATE THAT THE DATA IS ACQUIRED	
START THE LOAD CALIBRATION BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨)	SELECT
WITH THE LOAD STILL ON THE GROUND, THE LOAD DISPLAY WILL READ ZERO. RAISE THE CALIBRATION LOAD. THE DISPLAY SHOULD READ THE EXACT VALUE OF THE CALIBRATION LOAD ENTERED.	
EXIT THE ROUTINE BY PRESSING	⇨

COMMAND 07 MAIN BOOM (MODE A) RADIUS/MOMENT

- ◆ This command is used to calibrate the **radius** AND **moment** of the main boom. It requires data at high and low angles retracted, and high and low angles with the boom extended to different lengths.
- ◆ Calibration is carried out at each different length, both high and low angle, with data stored for the calibration to operate. This acquisition of data is described by the word STORE in the procedure. If for any reason the data is not stored, the System will warn with the message "NO DATA" and the data STORE must be repeated.
- ◆ A high angle is higher than 60°. A low angle is lower than 20 degrees. An attempt to acquire data outside these limits will result in a warning message "poor angle". When this message occurs as the result of an error, it can be ABORTED using the ⇨⇨ key. The procedure may be continued using correct keyboard entries.
- ◆ When this message occurs as a result of requiring the acquisition of data outside the preferred angles, the data may be entered using the ⇧ or ⇩ key to indicate at which unusual angle data is being acquired.

MAIN BOOM (OR MODE A)

- ◆ Start the routine with the fully retracted boom at an angle of 5°.
- ◆ Determine the weight of the hook-block in use. Measure the radius from the center line of rotation to the center of the load.
- ◆ Calibrate the radius and moment of the main boom using the following sequence:
- ◆ Before entering data, raise the hook-block close to the Two-Block weight prior to pressing "SELECT" in order to eliminate rope weight.

FIRST LENGTH

SCROLL TO 07 RADIUS BY PRESSING	⇧ OR ⇩
START THE COMMAND BY PRESSING	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER WEIGHT OF THE HOOK	
USE THE CRANE SET UP MENU TO SELECT THE CURRENT CONFIGURATION, MAIN BOOM.	
RAISE THE HOOK-BLOCK. THEN STORE THE LOW ANGLE DATA BY PRESSING	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER THE CURRENT RADIUS	
THE DISPLAY WILL READ (⇩)	

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

RAISE THE HOOK BLOCK. THEN STORE THE HIGH ANGLE DATA BY PRESSING	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER THE NEW RADIUS	
THE DISPLAY WILL READ (↓ ↑)	
START THE MOMENT CALIBRATION AT THE CURRENT LENGTH BY PRESSING	SELECT
CONFIRM THE CALIBRATION (or abort with ⇨)	SELECT

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**.

RAISE THE HOOK BLOCK. THEN STORE THE HIGH ANGLE DATA BY PRESSING	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER THE NEW RADIUS	
THE DISPLAY WILL READ (↑)	

Maintain the same length and lower the boom to the lowest angle listed on the load chart for a fully extended boom. If the crane has 0° capabilities, lower the boom to 5°. Measure the **new radius**.

STORE THE LOW ANGLE DATA BY PRESSING	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER THE NEW RADIUS	
THE DISPLAY WILL READ (↓ ↑)	
START THE MOMENT CALIBRATION AT THE CURRENT LENGTH BY PRESSING	SELECT
CONFIRM THE CALIBRATION (or abort with ⇨)	SELECT

Some models with Mode A may have booms fully extended at this point. If that is the case then continue with Command 8 BDC. Otherwise continue with this procedure on the next page.

THIRD LENGTH

Maintain the same low angle, fully extend the main boom, and measure the **new radius**.

RAISE THE HOOK BLOCK. THEN STORE THE LOW ANGLE DATA BY PRESSING	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER THE NEW RADIUS	
THE DISPLAY WILL READ (↓)	

Raise the boom to an angle between 60° and 65° and measure the **new radius**.

RAISE THE HOOK BLOCK. THEN STORE THE HIGH ANGLE DATA BY PRESSING	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER THE NEW RADIUS	
THE DISPLAY WILL READ (↓ ↑)	
START THE MOMENT CALIBRATION AT THE CURRENT LENGTH BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨)	SELECT
EXIT THE ROUTINE BY PRESSING	⇨

Continue the calibration routine with Command 08, BDC. 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.

COMMAND 07 MAIN BOOM + MANUAL (MODE B) RADIUS/MOMENT

- ◆ This command is used to calibrate the **radius AND moment** of the main boom + manual or mode B. It requires data at high and low angles retracted and high and low angles with the boom extended to the different lengths.
- ◆ Calibration is carried out at each length and both high and low angle data must be stored for the calibration to operate. This acquisition of data is described by the word STORE in the procedure. If for any reason the data is not stored, the System will warn with the message "NO DATA" and the data STORE must be repeated.
- ◆ A high angle is higher than 60°. A low angle is lower than 20 degrees. An attempt to acquire data outside these limits will result in the warning message "poor angle". When this message occurs as the result of an error, it can be ABORTED using the ⇨⇨ key and the procedure may then be continued using correct keyboard entries.
- ◆ When this message occurs as a result of requiring the acquisition of data outside the preferred angles, the data may be entered by using the ↑ or ↓ key to indicate at which unusual angle data is being acquired.

MAIN BOOM + MANUAL (OR MODE B)

- ◆ Place the fully retracted boom at an angle of 5°.
- ◆ Start the routine by selecting the main boom + manual or Mode B from crane set-up.
- ◆ Determine the weight of the hook-block in use. Measure the radius from the center line of rotation to the center of the load.
- ◆ Calibrate the radius and moment of the main boom using the following sequence:

SCROLL TO 07 RADIUS BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER WEIGHT OF THE HOOK	
USE THE CRANE SET UP MENU TO SELECT THE CURRENT CONFIG., M/B + MAN OR MODE B	
RAISE THE HOOK-BLOCK. THEN STORE THE LOW ANGLE DATA BY PRESSING	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER THE CURRENT RADIUS	
THE DISPLAY WILL READ (↓)	

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

RAISE THE HOOK BLOCK. THEN STORE THE HIGH ANGLE DATA BY PRESSING	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER THE NEW RADIUS	
THE DISPLAY WILL READ (↓ ↑)	
START THE MOMENT CALIBRATION AT THE CURRENT LENGTH BY PRESSING	SELECT
CONFIRM THE CALIBRATION (or abort with ⇨)	SELECT

SECOND LENGTH

Maintain the same high angle and extend the boom to 50% of extension. (On a HTC8665, extend until the next mode B section is fully extended). Measure the **new radius**.

RAISE THE HOOK BLOCK. THEN STORE THE HIGH ANGLE DATA BY PRESSING	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER THE NEW RADIUS	
THE DISPLAY WILL READ (↑)	

Maintain the same length and lower the boom to the lowest angle listed on the load chart for a fully extended boom. If the crane has 0° capabilities, lower the boom to 5°. Measure the **new radius**.

RAISE THE HOOK BLOCK. THEN STORE THE LOW ANGLE DATA BY PRESSING	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER THE NEW RADIUS	
THE DISPLAY WILL READ (↓ ↑)	
START THE MOMENT CALIBRATION AT THE CURRENT LENGTH BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨)	SELECT

THIRD LENGTH

Maintain the same low angle, fully extend the boom (on a HTC8665, extend until the next mode B section is fully extended) and measure the **new radius**.

RAISE THE HOOK BLOCK. THEN STORE THE LOW ANGLE DATA BY PRESSING	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER THE NEW RADIUS	
THE DISPLAY WILL READ (↓)	

Raise the boom to an angle between 60° and 65° and measure the **new radius**.

RAISE THE HOOK BLOCK. THEN STORE THE HIGH ANGLE DATA BY PRESSING	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER THE NEW RADIUS	
THE DISPLAY WILL READ (↓ ↑)	
START THE MOMENT CALIBRATION AT THE CURRENT LENGTH BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨)	SELECT
IF ON A D6, CONTINUE WITH THIS ROUTINE OR EXIT THE ROUTINE BY PRESSING	⇨

Continue the calibration routine with Command 08, BDC.

(HTC8665 ONLY)

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

RAISE THE HOOK BLOCK. THEN STORE THE HIGH ANGLE DATA BY PRESSING	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER THE NEW RADIUS	
THE DISPLAY WILL READ (↑)	

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

RAISE THE HOOK BLOCK. THEN STORE THE LOW ANGLE DATA BY PRESSING	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER THE NEW RADIUS	
THE DISPLAY WILL READ (↓ ↑)	
START THE MOMENT CALIBRATION AT THE CURRENT LENGTH BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨)	SELECT
EXIT FROM THE ROUTINE BY PRESSING	⇨

Continue the calibration routine with Command 08, BDC.

COMMAND 08 BOOM DEFLECTION CORRECTION

- ◆ With the boom fully extended at an angle of approximately 65°, pick up the maximum permitted load. Check the load chart prior to making the lift. **DO NOT EXCEED THE LOAD CHART.**

NOTE: It is permissible to use a known load less than the chart load for an angle of 65°, but using a smaller load may reduce accuracy.

- ◆ Measure the deflected radius and **add 0.2'** to the measured radius. The radius is measured from the center line of rotation to the center of the load.

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

- ◆ With the load still suspended, calibrate the B.D.C. using the following sequence:

SCROLL TO 08 B D C BY PRESSING	↑ OR ↓
STORE THE DATA BY PRESSING	SELECT
START THE BDC CALIBRATION BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨)	SELECT
USE THE NUMBER ENTRY ROUTINE TO ENTER THE NEW RADIUS	
EXIT THE ROUTINE BY PRESSING	⇨

An attempt to acquire data below 60° will result in the warning message, "poor angle".

When this message occurs as the result of an error, it can be ABORTED using the ⇨⇨ key.

When this message occurs as a result of requiring the acquisition of data below 60°, the data may be entered using the ↓ key to indicate at which unusual angle data is being acquired.

COMMAND 09 ANNULAR GAIN

- ◆ 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 that defines the ratio of the two areas. This is referred to as annular gain (A.G.), which 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. It may need to be modified because of differing pressure transducer sensitivities.
- ◆ If the load reading changes significantly when booming down, the annular gain should be changed.

Change the setting of the annular gain using the following sequence:

SCROLL TO 09 ANNULAR GAIN BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
IF THE LOAD DECREASES WHEN BOOMING DOWN, USE THE UP ARROW TO CORRECT THE DYNAMIC DISPLAYED NUMBER	↑
IF THE LOAD INCREASES WHEN BOOMING DOWN, USE THE DOWN ARROW TO CORRECT THE DYNAMIC DISPLAYED NUMBER	↓
START THE ANNULAR GAIN CALIBRATION BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨)	SELECT
EXIT FROM THE ROUTINE WITHOUT CALIBRATING BY PRESSING	⇨

COMMAND 12 WINCHES

Permits the "hiding" of a winch when it is not sold with the crane, thereby removing unnecessary steps from the Operator's Menu.

This command operates by making a winch *selectable* or *hidden* by using the following sequence:

SCROLL TO 12 WINCHES BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
SCROLL TO THE WINCH TO BE SELECTABLE OR HIDDEN BY USE OF THE UP/DOWN ARROWS	↑ OR ↓
CHANGE FROM SELECTABLE TO HIDDEN (AND VICE VERSA) BY PRESSING	SELECT
CONFIRM THE CHANGE BY PRESSING (or abort with ⇨)	SELECT
EXIT FROM THE ROUTINE BY PRESSING. (See Note below.)	⇨

COMMAND 13 ATTACHMENTS

Permits "hiding" an attachment when it is not sold with the crane, thereby removing unnecessary steps from the Operator's Menu.

Permits a change to *selectable* when an attachment is subsequently added to a crane.

Using the following sequence, Command 13 makes an attachment *selectable* or *hidden*.

SCROLL TO 13 ATTACHMENT BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
SCROLL TO THE ATTACHMENT TO BE SELECTABLE OR HIDDEN BY USE OF THE UP/DOWN ARROWS	↑ OR ↓
CHANGE FROM SELECTABLE TO HIDDEN (AND VICE VERSA) BY PRESSING	SELECT
CONFIRM THE CHANGE BY PRESSING (or abort with ⇨)	SELECT
EXIT FROM THE ROUTINE BY PRESSING. (See Note below)	⇨

NOTE: If any change was made to either one of these Commands, it is recommended that Command 01/0 "SAVE" be completed also.

COMMAND 15 ALARM LIMITS

In this routine, the computer makes provisions to limit various functions depending on which crane model is being calibrated. These alarms/limits follow:

- **Free Bm Mode** - This allows the operator to select the Main Boom + Manual configuration after the Manual section (if equipped) is already extended.
NOTE: If the crane being calibrated has Mode A and Mode B selections, then these must be set to "NO." Damage could result from incorrect selection.
- **FKO Delay** - This limit places a 5 second delay in the reactivation of the function kick-out solenoids.
- **Area Alarm** - This limit activates the Area Alarm. Refer to the Crane Operator's Manual for the explanation of the Area Alarms.

Low Angle Alarm - Model D7 has an engine cover that could be damaged by the boom or the boom hoist cylinders. Two alarms are used to warn the operator of his approach to this potential damage, they are swing arc and boom angle. These alarms have a preset value of:

Low Arc = 70 degrees

Low Ang. = 4.5 degrees

- **%SWL0** - This is the overload alarm setting. This alarm is usually set at 100%. It can be lowered but it must be no more than 100%.
- **%SWL1** - This is the pre-alarm setting. This alarm is usually set at 90%. It can be lowered but it must be no more than 90%.
- **%SWL2** - This is the start of the audible alarm. Usually set for 90%.

NOTE: If any changes are to be made to the alarms, it recommended that Command 01/0 "SAVE" be done also.

Enter details of the alarm settings by use of the following sequence:

SCROLL TO 15 ALARM BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
THE DISPLAY WILL READ	Free Boom Mode? y/n NO
START THE CALIBRATION OF THE FREE BOOM MODE BY PRESSING	↑ =Yes ↓ =No ⇨ =Exit
AFTER THE MESSAGE " CALIBRATING "	⇨ =Exit
THE DISPLAY WILL READ	FKO Delay? y/n NO
START THE CALIBRATION OF THE FKO DELAY BY PRESSING	↑ =Yes ↓ =No ⇨ =Exit
AFTER THE MESSAGE " CALIBRATING "	⇨ =Exit

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THE DISPLAY WILL READ	Area Alarm? y/n NO
START THE CALIBRATION OF THE AREA ALARM BY PRESSING	↑ =Yes ↓ =No ⇨ =Exit
AFTER THE MESSAGE " CALIBRATING "	⇨ =Exit
THE DISPLAY WILL READ	Low Angle Alarm? y/n NO
START THE CALIBRATION OF THE LOW ANGLE ALARM BY PRESSING	↑ =Yes ↓ =No ⇨ =Exit
AFTER THE MESSAGE " CALIBRATING "	⇨ =Exit
THE DISPLAY WILL READ	% SWL 0 = 100.000
START THE CALIBRATION OF % SWL #0 BY PRESSING	SELECT
CONFIRM THE CALIBRATION (or abort with ⇨)	SELECT
USE NUMBER ENTRY PROCEDURE TO ENTER THE NEW SETTING	
AFTER THE MESSAGE " CALIBRATING " THE DISPLAY WILL READ	NEW SETTING
SCROLL TO % SWL #1 BY PRESSING	⇨
THE DISPLAY WILL READ	% SWL 1 = 90.000
START THE CALIBRATION OF % SWL #1 BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨)	SELECT
USE NUMBER ENTRY PROCEDURE TO ENTER THE NEW SETTING	
AFTER THE MESSAGE " CALIBRATING " THE DISPLAY WILL READ	NEW SETTING
SCROLL TO % SWL #2 BY PRESSING	⇨
THE DISPLAY WILL READ	% SWL 2 = 90.000
START THE CALIBRATION OF % SWL #2 BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨)	SELECT
USE NUMBER ENTRY PROCEDURE TO ENTER THE NEW SETTING	
AFTER THE MESSAGE " CALIBRATING, " THE DISPLAY WILL READ	NEW SETTING
EXIT THE ROUTINE BY PRESSING	⇨

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Details of Alarms may be examined by using the following sequence:

SCROLL TO 15 ALARM BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
THE DISPLAY WILL READ	Free Boom Mode? y/n
SCROLL TO FKO DELAY BY PRESSING	⇒
THE DISPLAY WILL READ	FKO Delay? y/n
SCROLL TO AREA ALARM BY PRESSING	⇒
THE DISPLAY WILL READ	Area Alarm? y/n
SCROLL TO LOW ANGLE ALARM BY PRESSING	⇒
THE DISPLAY WILL READ	Low Angle Alarm? y/n
SCROLL TO % SWL #0 BY PRESSING	⇒
THE DISPLAY WILL READ	% SWL 0 = 100.000
SCROLL TO % SWL #1 BY PRESSING	⇒
THE DISPLAY WILL READ	% SWL 1 = 90.000
SCROLL TO % SWL #2 BY PRESSING	⇒
THE DISPLAY WILL READ	% SWL 2 = 90.000
EXIT FROM THE ROUTINE BY PRESSING	⇒

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 the values, which should be entered in units of 1000 #. Example 11,700 # is entered as 11.70

Change data by use of the following sequence:

SCROLL TO 16 ROPE BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
THE DISPLAY WILL READ	ROPE LIMIT 0 = 11.700
START THE CALIBRATION OF ROPE LIMIT #0 BY PRESSING	SELECT
CONFIRM THE CALIBRATION (or abort with ⇨)	SELECT
USE NUMBER ENTRY PROCEDURE TO ENTER THE NEW LIMIT	
AFTER THE MESSAGE, " CALIBRATING, " THE DISPLAY WILL READ	NEW LIMIT
SCROLL TO ROPE LIMIT #1 BY PRESSING	⇨
THE DISPLAY WILL READ	ROPE LIMIT 1 = 11.700
START THE CALIBRATION OF ROPE LIMIT #1 BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨)	SELECT
USE NUMBER ENTRY PROCEDURE TO ENTER THE NEW LIMIT	
AFTER THE MESSAGE " CALIBRATING, " THE DISPLAY WILL READ	NEW LIMIT
EXIT FROM THE ROUTINE BY PRESSING	⇨

Details of Rope Data may be examined by using the following sequence:

SCROLL TO 16 ROPE BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
THE DISPLAY WILL READ	ROPE LIMIT 0 = 11.700
SCROLL TO ROPE LIMIT #1 BY PRESSING	⇨
THE DISPLAY WILL READ	ROPE LIMIT 1 = 11.700
EXIT FROM THE ROUTINE BY PRESSING	⇨

NOTE: If there were any changes to Rope Limits, complete Command 01/0 "SAVE" also.

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 systems. For special application, this gain setting may be modified as necessary.

Refer to the factory before making any changes.

SCROLL TO 17 AMPLIFIER BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
THE DISPLAY WILL READ	AMP GAIN = 2
START THE CALIBRATION OF AMPLIFIER GAIN BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨)	SELECT
CHANGE THE SETTING BY PRESSING	↑ OR ↓
COMPLETE THE CALIBRATION BY PRESSING	SELECT
EXIT THE ROUTINE BY PRESSING	⇨

COMMAND 01/0 SAVE

After completion of a calibration, always carry out Command 01/0 SAVE. Using Command 01/0 as follows will ensure that a copy of the calibration will be contained in the back-up memory.

SCROLL TO 01 PERSONALITY BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
SCROLL TO 01/0 SAVE BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
FOLLOW THE CAL ENTRY SEQUENCE	↑ ↓ ← →
CONTINUE THE SAVE BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨) SEE NOTE	SELECT
AFTER THE MESSAGE "CALIBRATING," THE DISPLAY WILL READ "A" GOOD "B" GOOD SAME	
EXIT BY PRESSING	⇨

COMMAND 01/3 BACK-UP

After completion of a calibration and after the execution of Command 01/0 SAVE, a permanent copy of the calibration may be obtained using the following procedures.

SCROLL TO 01 PERSONALITY BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
SCROLL TO 01/3 BACK BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
FOLLOW THE CAL ENTRY SEQUENCE	↑ ↓ ← →
CONTINUE THE BACK-UP BY PRESSING	SELECT
CONFIRM THE CALIBRATION BY PRESSING (or abort with ⇨) SEE NOTE	SELECT
AFTER THE MESSAGE, "CALIBRATING," EXIT BY PRESSING	⇨

SWITCH OFF POWER TO THE SYSTEM

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 RE-INSTATE THE SYSTEM TO WORKING CONDITION, FIT A NEW CHIP, TYPE 28C65, IN SOCKET IC7. RESTORE POWER TO THE SYSTEM AND CARRY OUT COMMAND 1/4. RESTORE BY USING THE FOLLOWING SEQUENCE.

RESTORE POWER AND ENTER THE CALIBRATION ROUTINE

START THE ROUTINE BY PRESSING AND HOLDING FOR APPROXIMATELY 10 SECONDS	SELECT AND TEST
FOLLOW THE CAL ENTRY SEQUENCE	↑ ↓ ← →
CONFIRM THE CALIBRATION (or abort with ⇨)	SELECT

COMMAND 01/4 RESTORE

SCROLL TO 01 PERSONALITY BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
SCROLL TO 01/4 RESTORE BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
FOLLOW THE CAL ENTRY SEQUENCE	↑ ↓ ← →
CONTINUE THE RESTORE BY PRESSING	SELECT
CONFIRM THE CALIBRATION (or abort with ⇨) SEE NOTE	SELECT
AFTER THE MESSAGE CALIBRATING EXIT BY PRESSING	⇨

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

COMMAND 19 DIGITAL INPUTS

Command19 displays the logic status of digital inputs.

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

SCROLL TO 19 DIGITAL INPUTS BY PRESSING	↑ OR ↓
START THE COMMAND BY PRESSING	SELECT
THE DISPLAY WILL READ THE STATUS OF ALL DIGITAL INPUTS	
EXIT THE ROUTINE BY PRESSING	⇒

DIGITAL INPUTS

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	BY-PASS 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.
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.
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.
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.
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.
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 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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