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Wylie SYSTEMS
Safety Instrumentation

W2245
Rated Capacity Indicator
Installation and Calibration

For
Telescopic cranes with derrick pressure sensors

(Frame F45TH410 onward)

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Contents

1.0 INTRODUCTION

1.1 System

The Wylie W2245 Rated Capacity Indicator is a Load, Angle, Radius, Lifting capacity and Anti-Two-Block Indicator. A display near the operator gives information to remove the need for guesswork when using the crane. The system can also be set with limits by the operator to warn of an accidental manoeuvre into an unwanted area.

1.2 System Intelligence

The system is “microprocessor based”, meaning that there is a computer inside the box together with operating software. The software is divided into two parts, each having a distinct mode, the normal operating mode and the calibration mode.

The normal mode is the normal operating status of the unit when turned on. It is the only mode that the crane operator needs to know. In this mode the operator is able to read the hook load, radius and angle. The operator is also able to set the limits, select the hoist, parts of line and boom configuration.

The calibration mode, which allows calibration of the sensors, the radius and other variables is accessed by a small slide switch located on the I/O board or by pressing a group of keys on the keypad simultaneously. A password is required to be entered before the calibration can be changed. No other equipment is necessary to calibrate the system.

1.3 Adaptability

The system is designed to be fitted on any crane, lattice or telescopic boom, and with 1 or 2 hoists. Thus its components can vary substantially from one machine to another.

The software in this system is designed to work on telescopic cranes with derrick cylinder pressure sensors, other software versions are available.

The heart of the W2245 is the display unit. This box contains all the electronic components required to convert sensor signals into the meaningful information for the operator.

The other components are the Load Sensors, Angle Sensor, Extension drum and the Anti-Two-Block switches. All the above are connected to the display unit to provide basic data. Junction boxes are also sometimes used to reduce the amount of wiring going to the display box.

2. HOW THE INDICATOR WORKS

2.1 Pressure Sensor

A robust, high quality device designed for reliable and accurate performance over the life of the system. It consists of a strain-gauged diaphragm to give an electrical output proportional to the pressure applied.

2.2 Amplifier

An amplifier is used when the distance between the load cell and the control unit is too high, generally more than 15m. Beyond this distance, radio waves and internal resistance of the cable may noticeably affect performance. An amplifier is also used when signal wires of other devices like angle and length sensors pass through slip rings.

The amplifier not only amplifies the sensor signal, but also converts it from a voltage to a current that is then no longer susceptible to external interference.

It is important that the following instructions are adhered to as failure to do so may result in incorrect calibration of the system

2.3 Angle sensor

A pendulum driven, high precision potentiometer that constantly monitors boom angle relative to true horizon.

2.4 Anti-two-block switch

The Anti-Two-Block switch is a spring-loaded switch. It is attached to the boom tip on one end and to a chain leading to a weight assembled around the hoist line at the other end. When the hook block lifts the weight, the switch becomes disengaged and the signal is cut.

2.5 Length Sensor

The length sensor is a potentiometer which is located inside the extension drum fitted to telescopic cranes. As the boom extends, the drum unwinds and the potentiometer is driven via a gear train. The output is proportional to the boom extension.

2.6 Display box

The display includes both the operator display panel and the processing unit where the sensor signals are read and computed to determine the load. The results are then displayed to the operator using a liquid crystal display screen and indicator lights. The display is composed of two sections: the I/O board and the CPU board.

2.6.1 The W2245 input/output board (I/O Board)

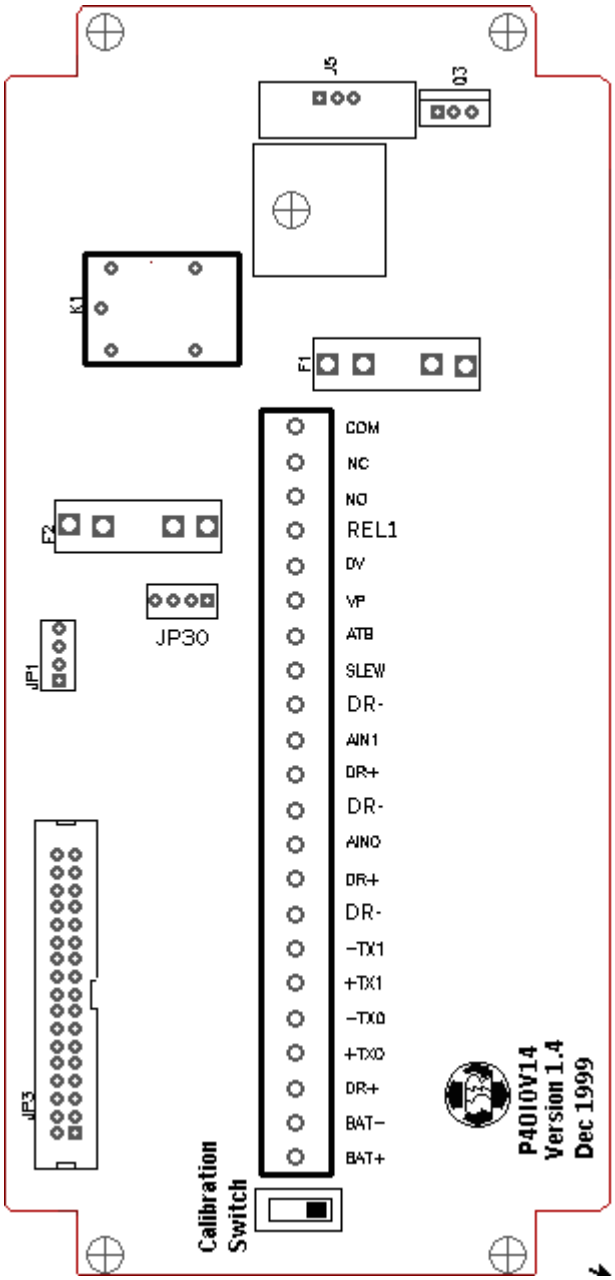
The input/output (I/O board) board includes all the wire connections. On this board, signals are conditioned to be legible for the processor, and the power supply voltage is conditioned from an input range of 11 to 28 VDC to 5 VDC to supply both the processor and the sensors.

The reduced voltages and the processed signals from the sensors are transmitted to the CPU board via a flat ribbon connector. This connector can be unplugged when the power is OFF by pulling open the side clamps of the connector on the board.

Also on this board are two fuses, F1 protects the supply voltage to the unit, use a 2 amp 5x20mm to replace. Fuse F2 protects the VP terminals used to drive external switches and amplifiers. Use a 1 amp 5x20mm to replace.

There is a dry contact relay for both lockout and external alarm. It has a 2 amp 24 VDC rating. It may be used to control a slave relay. The terminals available are common (COM) , normally open (NO) and normally closed (NC). One other relay output driver (OUT1) exists and is used in special applications to drive additional external relays.

There is a serial communication port RS 232 on the terminal identified as JP1. This port is for future use.



Connections Description

BATT+: Power Supply(+) (11-28VDC)
BATT- : Power Supply (-)

DR+ : Supply (+) for sensor
TXO+ : Positive Signal of load #1 sensor.
TX0- : Negative Signal of load #1 sensor.
TX1+ : Positive Signal of load #2 sensor.
TX1- : Negative Signal of load #2 sensor.
DR- : Supply (-) for Sensor
AIN0 : Signal from Boom Angle Sensor
AIN1 : Signal from extension sensor

SLEW: Signal from Slew Switch
ATB : Anti-Two-Block Signal

VP : Supply (+) to External Amplifier
0V : Ground for to VP

REL1 : Driver for External Relay
NC : Normally closed contact of relay
NO : Normally open contact of relay
COM Common contact of relay

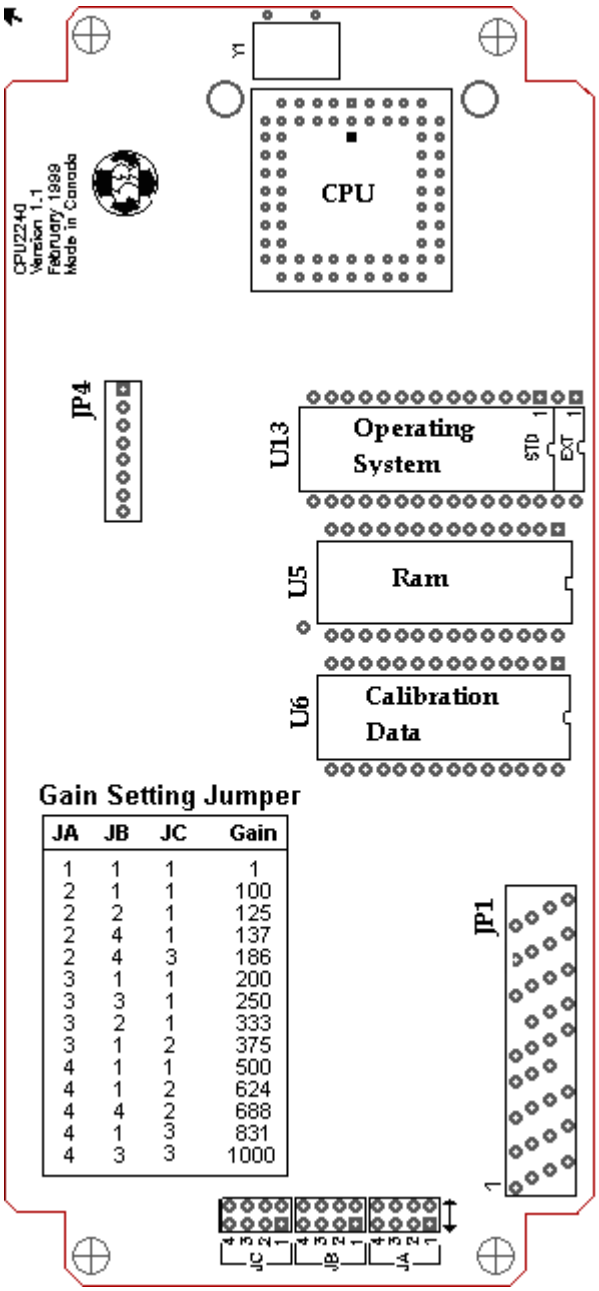
CAL : Calibration slide switch

JP30 : Connection for Bypass Key

2.6.2 The W2245 CPU board

The Central Processing Unit board reads all the sensor signals delivered from the I/O board. On the left of the board is situated a multiplexed amplifier which conditions load cell input. This board can multiplex 2 load sensor signals. Using the stored calibration data, the CPU converts the signals into information for hook load. The CPU then compares the information with the set limits entered by the operator, and the current duty. The CPU will finally trigger the alarms if a limit is reached or lockout output if overload or Two-Block situation is sensed.

This board is the operator interface. It carries the alpha-numerical Liquid Crystal Display (LCD) which provides information such as hook load, boom angle, preset limits, failure messages, hoist used and parts of lines, and also the processing circuitry for the 8 button keypad.



JA	JB	JC	Gain
1	1	1	1
2	1	1	100
2	2	1	125
2	4	1	137
2	4	3	186
3	1	1	200
3	3	1	250
3	2	1	333
3	1	2	375
4	1	1	500
4	1	2	624
4	4	2	688
4	1	3	831
4	3	3	1000

The Gain setting is located on this board, and are denoted JA,JB,JC. 3 small jumpers are used to configure it. The default value is 333

3.0 INSTALLATION

3.1 Load (pressure) sensor

Refer to section 3.4.3.3 before installation. After installing, make sure that the load sensor(s) operate properly at all boom angles by using the diagnostic menu (Refer to operators manual).

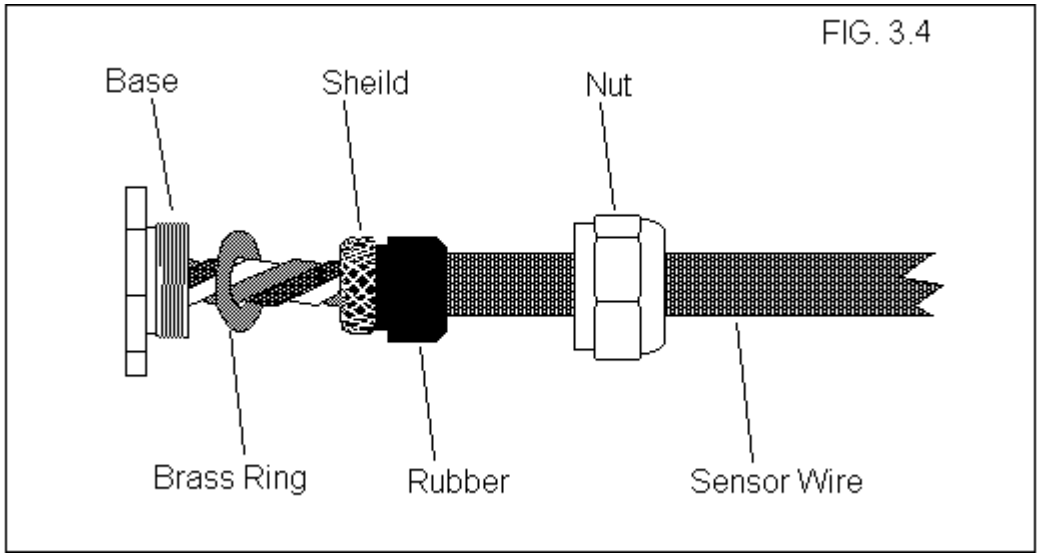
3.2 Anti-Two-Block switch

If two switches are to be used at the same time, make sure the proper switch or junction box is used at the boom tip.
If only one switch will be used and has to be moved from the main tip to the jib tip, it can be done using an extension wire
No extra wiring is needed, since a standard connector is supplied for the switch. If a junction box is used, wire according to the supplied drawing.

3.3 Display

The display should be located at the front of the cab, where it is readily visible from the operator's control position. Take care not to obscure any displays, control levers, switches or the operator view of the load. Leave sufficient room for the sensor wires to be fed to the bottom of the display.
If the unit is pre-wired with connectors, simply plug in the connectors. If the unit is not pre-wired, use the following instructions.
Loosen the four top screws and flip the cover over the box. Proceed gently in order not to damage the wires or the keypad.
Wire according to the supplied drawing on Figure 3.5. or Figure 3.6, depending if you use a junction box. Make sure all connections are made properly and completed before powering the system. When stripping wires, do not drop any wire ends or debris into the box.
All cable screens should be grounded to the glands of the display box only. Fold the screen over the rubber sleeve as shown in the diagram below. Use the brass ring.

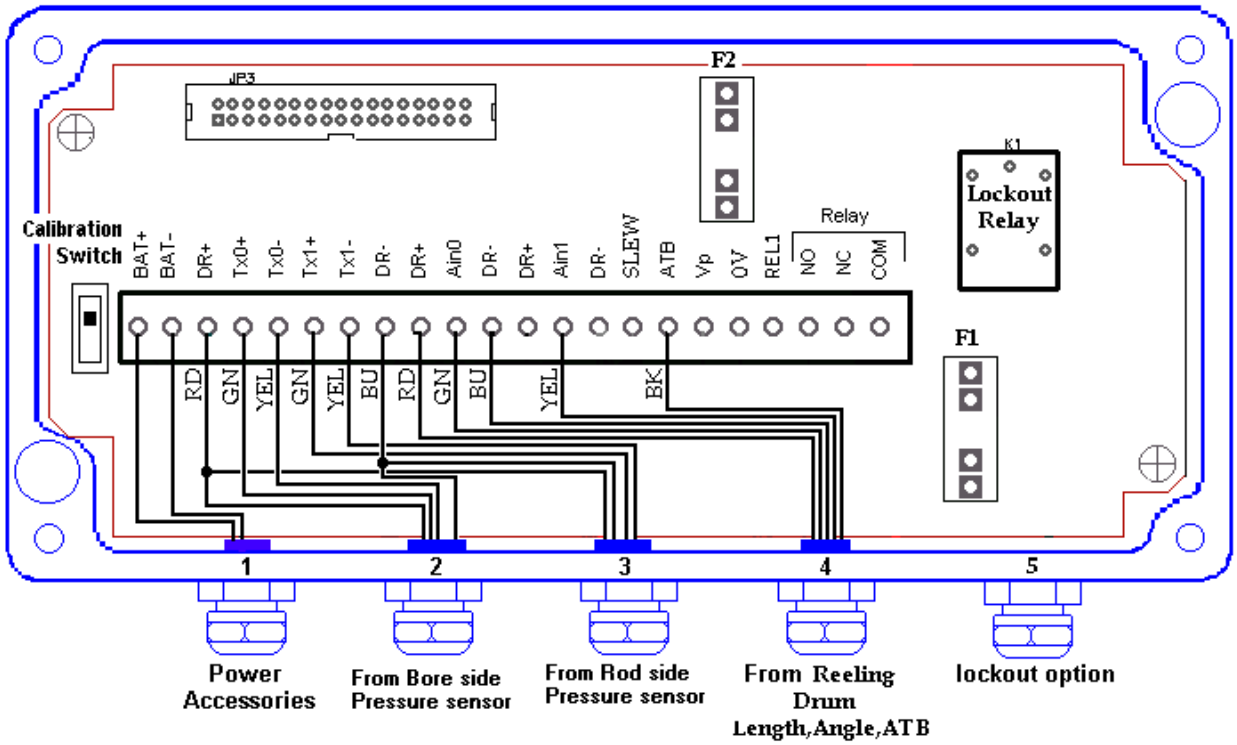
FIG. 3.4



Power supply must be from 11 to 28 Volts DC only. If not available, an external power supply to convert to 12 Volts DC is required. The power lead must be able to sustain a minimum of 11 Volts with a current of 5 amps if the unit is connected to a lockout device.

Lockout wires should not load more than 2 amps on the internal relay.
No wires should pass near a radio antenna. All wires must be shielded.
All wires must be fed away from mechanical parts, keep a minimum bending radii of two inches when static and 4 inches when moving.

Wiring for non-amplified inputs



The lockout connection is according to your lockout configuration. Safe operation (without alarm) gives a relay status of COM-NO. When an ATB or Overload condition is detected, the relay status will change to COM-NC.

The ATB signal is a Pull-Up signal During normal operation the signal must be grounded. When an ATB condition occurs, the ground on ATB Signal must be released. If the ATB is not used, a jumper must be installed between ATB and 0V.

Wire colours are according to the Wylie standard cable.

3.3.1 Internal Amplifier Setting

3.3.1.1
Enter the Diagnostic menu and select sub-section 5, load sensor output (in bits). TX0 and TX1 represent the outputs from the bore and rod side sensors respectively, out of a maximum of 1023 bits. Refer to the Operator Manual for further details of diagnostics.

3.3.1.2
Inside the amplifier, short the two wires designated <CAL> (terminals 1 and 2) together, and note the 'CAL' value and the rated capacity value

engraved on the bore side sensor. **NB.** The sensors should **not**, at this stage be fitted in the hydraulic circuit.

The displayed value of TX0 is required to be in the range 670 to 875 as calculated by the formula:-

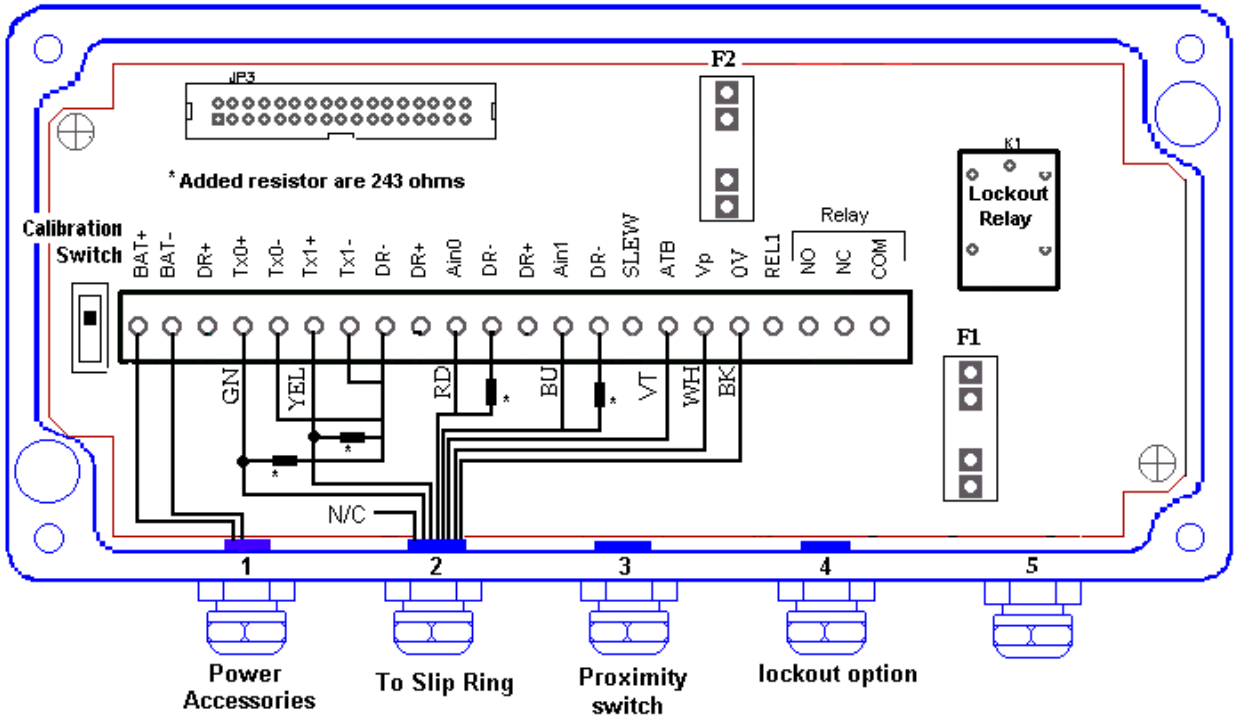
$$\frac{\text{CalValue}}{\text{RatedCapacity(sensor)}} \times 875 \cong \text{TX0}$$

If the displayed value is outside the required range, then adjust the gain settings on the CPU board according to the table below.

JA	JB	JC	GAIN
1	1	1	1
2	1	1	100
2	2	1	125
2	4	1	137
2	4	3	188
3	1	1	200
3	3	1	250
3	2	1	333
3	1	2	375
4	1	1	500
4	1	2	624
4	4	2	688
4	1	3	831
4	3	3	1000

Note: While the transducer is not in the hydraulic line it is advisable to go to section 4.2.8 and set the transducer zero(s) and span(s) as described, this can be done out of sequence and will avoid having to disconnect and rewire the transducer more than once.

Wiring for Amplified inputs



3.3.2 Amplified inputs

When amplified inputs are used, (usually in conjunction with slip-rings) the gain of the display unit must be set to <1> and all gain adjustments carried out in accordance with section 3.4

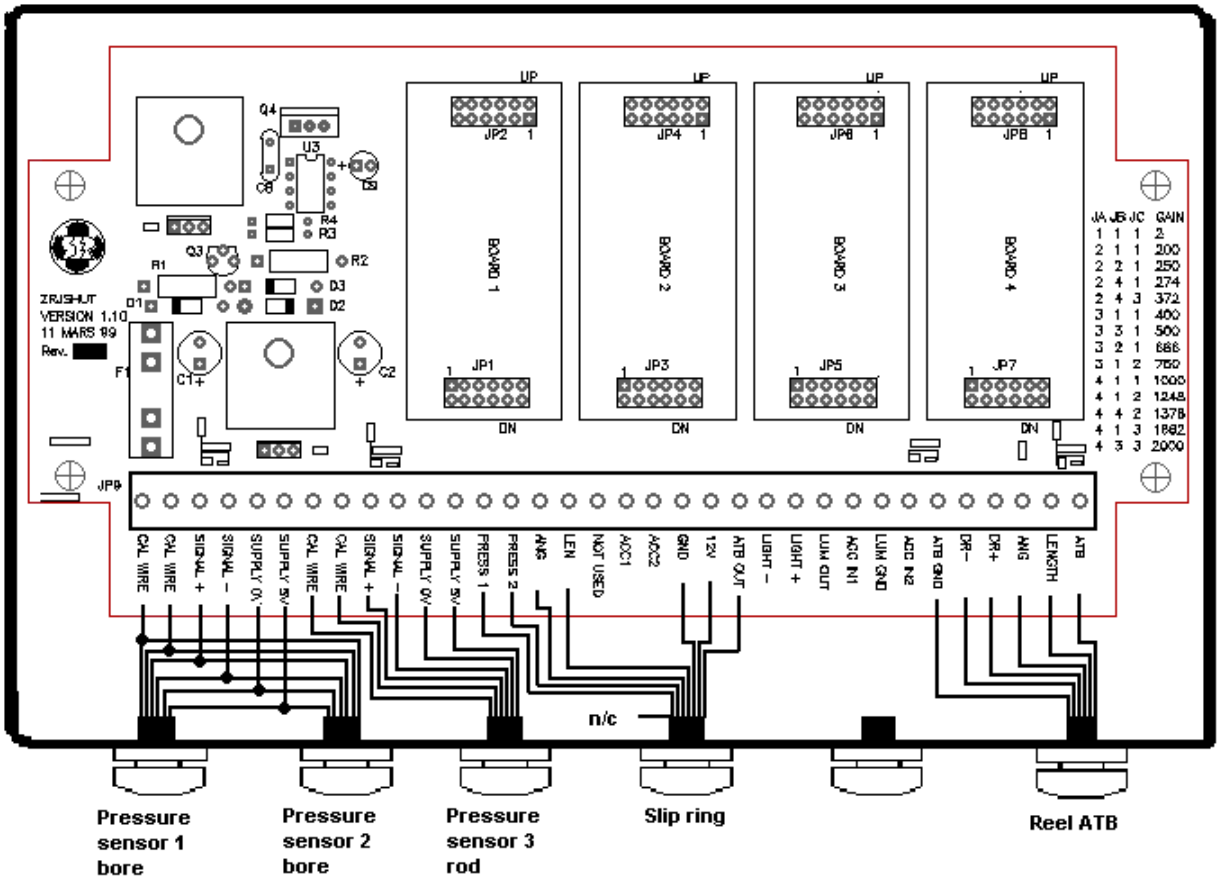
3.4 Multi-channel Amplifier (optional)

3.4.1 Installation

The amplifier must be installed on the upper works (slewing portion) of the crane.

3.4.2 connections

Connections must be made as shown in the diagram below. (Refer also to the customer connection drawing supplied with this equipment)



3.4.3 Gain Settings

3.4.3.1
Set the gain of the display unit to <1> (Refer to section 2.6.2)

3.4.3.2
Enter the Diagnostic menu and select sub-section 5, load sensor output (in bits). TX0 and TX1 represent the outputs from the bore and rod side sensors respectively, out of a maximum of 1023 bits. Refer to the Operator Manual for further details of diagnostics.

3.4.3.3
Inside the amplifier, short the two wires designated <CAL> (terminals 1 and 2) together, and note the 'CAL' value and the rated capacity value engraved on the bore side sensor. **NB.** The sensors should **not**, at this stage be fitted in the hydraulic circuit.

3.4.3.4
The displayed value of TX0 is required to be in the range 670 to 875 as calculated by the formula:-

$$\frac{\text{CalValue}}{\text{RatedCapacity(sensor)}} \times 875 \cong \text{TX0}$$

If the displayed value is outside the required range, then adjust the gain settings on board 1 according to the table below.

3.4.3.5 Amplifier Gain Setting Table

Ja	Jb	Jc	Gain
1	1	1	2
2	1	1	200
2	2	1	250
2	4	1	274
2	4	3	372
3	1	1	400
3	3	1	500
3	2	1	666
3	1	2	750
4	1	1	1000
4	1	2	1248
4	4	2	1378
4	1	3	1882
4	3	3	2000

3.4.3.6
Repeat the whole of this section for TX1 (rod side sensor), adjusting the gain settings on board 2 as necessary.

4.0 CALIBRATION

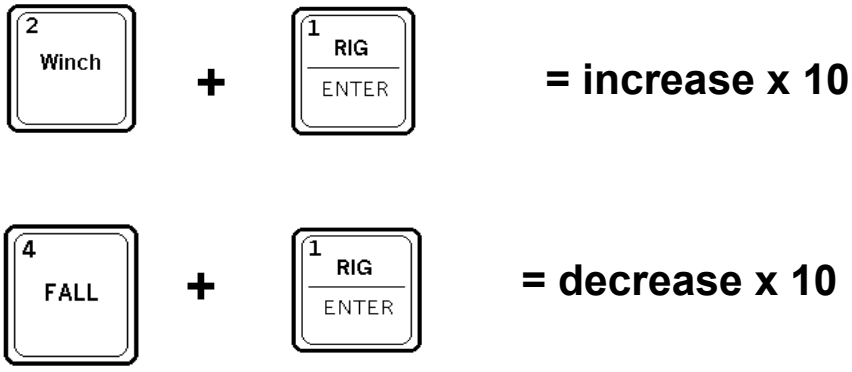
The calibration section guides the technician and explains the procedures to follow, in order to calibrate the system rapidly and efficiently.

Before beginning calibration, it is important to verify that all the sensors are connected properly, that the control unit receives a signal from each sensor, that the signal received from each sensor is within the receiving limits from the minimum to the maximum of the sensor's working range and that each sensor's signal is optimised to improve resolution and accuracy.

The calibration of the sensors is performed using software by entering data using the display's keypad.

4.1 Keypad Operation

When changing a value in calibration mode using the **UP** (#2) and **DOWN** (#4) buttons, it may take a while to go from, for example 300.0 bar to 250 bar in steps of 0.1bar . While pressing on the **UP** (#2) or **DOWN** (#4) buttons, use a finger from the other hand and press the **ENTER** button (#1) or **ESC** button (#3). The value now steps in bars instead of tenths of bar. Release the **ENTER** or **ESC** button while still pressing on the **UP** or **DOWN** button and the steps return to tenths of bar. Do not release the **Up** or **DOWN** button before the **ENTER** button otherwise the value will be entered instantly.



4.2 Calibration – menu Description

The calibration mode is a separate entity of the W2245 system. It is totally independent of the regular operating mode as if it were a different system. The purpose of the calibration mode is to adjust the angle, length and load sensor inputs, to record the datum points of crane operation, and to set up the crane dimensions.

The calibration mode is accessed by a slide switch located on the I/O Board or by pressing predetermined buttons on the key pad. The exact procedures are described in the following section.

The calibration mode is organized into a logical sequence. A series of some 27 items or sections will appear. The ROLL UP (#2) or ROLL DOWN (#4) button allows the technician to scroll through these items. Although once in the calibration menu it is possible to scroll and access any stage of the calibration, it is recommended to follow the progressive order as described in this manual. This will prevent calibration of stages with non-calibrated pre-requisite stages.

The sequence for calibration is shown below

1 = Calibration enable/disable

2 = Zero Angle

3 = Span Angle

4 = Zero Extension

5 = Span Extension

6 = zero pres Bore

7 = zero pres Rod

8 = span pres bore

9 = span pres Rod

10 = Boom Cfg#1

11 = No Deduct

12 = No Rooster H

13 = Part Line : 3

14 = Tare Load : 0.0

15 = P1 : 20º retract

16 = P2 : 60º retract

17 = P3 : 60º 1/3 Ex

18 = P4 : 60º FullEx

19 = Boom Moment

20 = Cal Load : 0.0

21 = Load Bend Corr

22 = Load Adjust

23 = Backup

24 = Memory

25 = Calib. Data

26 = Dimensions

27 = Config Menu

4.2.1 Enquiry Mode:

It is possible to enter the calibration mode to look at the settings made without having to open the display unit. Hold down button 1 and press buttons 3 and 4 simultaneously, then release all three buttons at the same time. The system will enter the calibration mode but no access will be allowed to change anything. Exit by pressing buttons 7 and 8 simultaneously (Reset).

4.2.2 Calibration Mode:

To enter calibration, turn the system on, wait until the system shows the basic screen with load, angle, etc. Then move the calibration switch(on the I/O board) to the CALIBRATION MODE position.

The display will show:-

Calib:#2↑ - #4↓ 1 – Calib Disable

The system is now in the calibration mode.

By pressing the buttons DOWN (#4) or UP (#2), it is possible to scroll through the calibration menu.

4.2.3 Return to Normal Operating Mode

To leave the calibration mode and return to the normal operating mode, simply move the calibration switch, on the I/O board, to the NORMAL MODE position. The system will automatically reset and return to the normal operating mode.
If the system was configured during calibration E.G.: Main winch, 4 falls, Main boom only, it will not retain that configuration and will instead return to the last configuration set during operating mode.

4.2.4 Password Access

Calib:#2↑ - #4↓ 1 – Calib Disable

It is possible to scroll through the entire calibration menu with the calibration enabled or disabled. However, it is not possible to confirm a new calibration or perform any re-calibration unless menu option 1 shows: CALIB ENABLE.

YOUR PASSWORD:

To enable calibration, scroll down to the CALIB DISABLE message. Press button #1(ENTER). The system will ask for the password. The standard password has four numbers, which correspond to the numbers found on the upper left corner of each button.
The standard password is 2,3,4,5 and this is factory set but may be set to other combinations if requested at the time of ordering. Enter the numbers one after the other. If an error is made, start the sequence again or press the ENTER button twice. Once the system receives the correct password, it will automatically display CALIB ENABLE. Calibration of the system can now be performed.

The CALIB ENABLE will remain activate on a permanent basis whether or not the system is turned off and will be indicated by the letters CAL on the display when in normal mode. The calibration **MUST BE DISABLED** once completed to prevent accidental operator access.

To disable the calibration, scroll to CALIB ENABLE and press ENTER. Press ENTER twice. The display will show: CALIB DISABLE.

4.2.5 System Configuration

Before beginning the system calibration, it is important to enter basic information that the calibration function will have to use. This is done using «25 – **Calib. Data**», «26 – **Dimensions**» and «27 –**Config Menu**». These menus have been placed at the end because they are normally accessed just once.
These menus are described in detail later in section 4.3

4.2.6 ANGLE CALIBRATION

4.2.6.1 Zero Angle

Scroll down to «2-ZERO ANGLE» and press ENTER (#1).

Boom down to zero degrees (main boom parallel to ground). The display will show the signal in bits in the upper right-hand corner.

The important aspect of the display in bits is to verify that the signal is variable through the entire working area of the boom angle, and that the resolution is above 3 bits per degree.

Press ENTER (#1) to zero and press ENTER again to confirm.

4.2.6.2 Span Angle

Calib:#2↑ - #4↓
3 – Span Angle

Scroll down to «3 -SPAN ANGLE» and press ENTER (#1).

Boom up over 65 degrees (main boom referred to ground). The display will show, the angle (in degrees) calculated by the system in the upper right corner. On the bottom line the display will show the signal in bits.

Press ENTER to 'free' the angle value (it will flash) and use the set buttons (#2 and #4) to adjust the displayed value. When correct, press ENTER (#1) to request calibration, press ENTER again to confirm.

4.2.7 - LENGTH SENSOR CALIBRATION

4.2.7.1 Zero Extension

Calib:#2↑ - #4↓
4 – Zero Extension

Scroll down to «4-Zero Extension» and press ENTER (#1).

Retract the boom fully. The display will show on the upper right corner the signal in bits. This must be above 50 and around 100 bits.

Press ENTER (#1) to zero and ENTER again to confirm.

Measure the boom length from foot pin to head sheave pin. Keep this measurement. You will need it for the span calibration.

4.2.7.2 Span Extension

Calib:#2↑ - #4↓
5 – Span Extension

Scroll down to «5-SPAN EXTENSION» and press ENTER (#1).

Extend fully and measure the boom length, subtract the retracted boom length from the extended, the result is the extension. This is the value you need to calibrate. The display will show the extension value calculated by the system in the upper right corner and the signal in bits on the bottom line. The system needs a minimum span of 150 bits above the zero.

Press ENTER to 'free' the extension value (it will flash) and use the set buttons (#2 and #4) to adjust the displayed value. When correct, press ENTER (#1) to request calibration, press ENTER again to confirm. The value should be set in metres or feet as defined on the display at start-up.

4.2.8 - PRESSURE SENSOR CALIBRATION

4.2.8.1Pressure Sensor Zero Calibration (Steps 6 and 7)

Calib:#2↑ - #4↓
6 – Zero Pres Bore

Calib:#2↑ - #4↓
7 – Zero Pres Rod

To zero the pressure sensors, open the hydraulic lines to both sensors in order to remove any residual pressure. Make sure the boom is resting at its lowest point to prevent sudden fall when the line is opened.

The pressure sensor must be connected according to the schematics for normal operation.

Scroll to menu 6 ZERO PRES BORE. And press ENTER. The reading on the upper right corner is in bits. The total scale is 1023. The display should read between 20 and 50 bits, 235 and 325 when connected through an amplifier. Press ENTER to zero and press ENTER again to confirm.

With an amplifier, if the reading is above 325 and below 450, the resolution of the system will be lower.
To zero the rod pressure sensor (annulus), Scroll down to 7-ZERO PRES. ANN. Press ENTER. The value on the upper right corner will be greater than the bore side pressure sensor
The expected reading should be between 100 to 200, or 300 to 400 when using an amplifier. If below these values, negative pressure may cause the load reading to drop substantially when a load is left hanging on the hook for an extended period of time. If the value is above 400, the resolution will diminish.

4.2.8.2 Pressure Sensor Span (Bore Side)

Calib:#2↑ - #4↓
8 – Span Pres Bore

The pressure sensor must still be unconnected to the hydraulic line. Then, in the control box or the amplifier box, temporarily connect the black and white wires of the full side pressure sensors together.

Scroll down to 8 - SPAN PRES BORE and press ENTER. The reading on the bottom represents the bits out of 1023 as seen by the control unit. The reading should be above 670 and not exceed 875. Press ENTER. The value to enter is engraved on the pressure sensor below the label. A typical value will read: CAL 285.6 BAR. Enter the value engraved on the pressure sensor. If there are two lift cylinders and one pressure sensor on the full side of each cylinder, collect both calibration values engraved on the sensors and average them. Enter the averaged value as the span calibration value. Press ENTER, then press ENTER again to confirm. Restore the black and white transducer wires to their original connections and reconnect the hydraulic line.

If the bits reading is below or above the recommended values and the pressure sensor is connected directly in the control box, change the amplifier jumpers. Refer to the relevant amplifier table earlier in this manual.

4.2.8.3 Pressure Sensor Span (Rod Side)

Calib:#2↑ - #4↓
9 – Span Pres Rod

The pressure sensor must be disconnected from the hydraulic line.

Short the black and the white wires of the rod pressure sensor. Scroll down to 9 - SPAN PRES ROD and press ENTER.
Repeat calibration procedure as defined for the bore side transducer above.

4.2.9 - RADIUS CALIBRATION

Each boom configuration must be passed through the following 7 steps in order to calibrate the radius. The main boom must be calibrated before any other boom configurations eg. manual, jib at 0 deg., jib at 10 deg, jib at 10 deg with manual, etc...
All values should be set in metres or feet as defined on the display at start-up.

Calibration Mode
10 – Boom Cfg#1

Since the menu 10 automatically defaults to Cfg #1 (main boom), skip this step for the first calibration otherwise select the configuration to be calibrated.

4.2.10 Parts of Line Configuration

Calib:#2↑ - #4↓
13– Part Line : 1

Note: program steps 11 and 12 are not used.
Scroll down to menu 13- PARTLINE:1. Press ENTER, set the proper parts of lines as reeved and press ENTER. This is to take account of the head sheave radius if only one fall is reeved since the ball is in front of the head sheave rather than under it.

4.2.11 Tare Load Configuration

Calib:#2↑ - #4↓
14 – TareLoad : 0.0

Scroll down to menu «14 - TARE LOAD:0.0.» Press ENTER. Set the weight of the block as tare load. Press ENTER for editing. This is to account for the weight of the block as a load during unloaded boom deflection in menu 17 and 18 (P3 and P4). Ignore the weight of the other block. If a jib is erected, ignore the weight of the jib. The jib will have to be either removed or left on the boom through to item 20 - LOAD BEND COR. Check the programmed configuration for details of whether or not unused equipment should be fitted for the calibration.

4.2.12 Main Boom Calibration

4.2.12.1 20° Retracted Boom

Calib:#2↑ - #4↓
15 – P1 : 20º Retrac

Scroll down to menu «15 - P1:20 ° Retrac». Press ENTER to get access. The display will show the boom extension. If this is the main boom done for the first time, it will read 0.0. On the top right, the boom angle is displayed. As the menu instructs, boom down to between 15 and 20 degrees and fully retract the boom.

If the angle or the boom length is incorrect, the display will indicate the expected values. If the message < not retracted > is displayed, the retracted boom length cannot satisfy the requirement. Try to retract the boom. If not, extend and retract it. If the displayed boom length is always above 0.2 feet, (60mm) press ESC and redo menu option 3 -ZERO EXTENS. Then return to 15-P1 and verify menu 10 for correct settings.

Once at the correct angle and extension, press ENTER. The radius will flash. Measure the actual radius and set the value on the display. Press ENTER to request calibration and ENTER again to confirm. The system will scroll automatically to menu «16- P2:60° Retrac».

4.2.12.2 60º Retracted Boom

Calib:#2↑ - #4↓
16 – P2 : 60º Retrac

Press ENTER to get access. The displayed radius and boom length will be wrong, but don't worry. Boom up to between 60 and 65 degrees. Press ENTER for editing. While the radius flashes, set the correct value. Press ENTER to request calibration and ENTER again to confirm. The system will scroll automatically to menu «17- P3:60° 1/3 Ex».

4.2.12.3 60º 1/3rd Extension

Press ENTER to get access. Telescope out about 1/3 of the full extension of the main boom only. Press ENTER for editing. If the length is improper, the system will indicate the acceptable length range. Continue to telescope until within the range and press ENTER. The radius value displayed will flash. Measure the radius. It should be close to and greater or equal to the displayed radius. Enter the radius and

Calib:#2↑ - #4↓
17 – P3 : 60º 1/3 Ex

press ENTER to request calibration. Press ENTER again to confirm. The system will scroll automatically to menu «18- P4:60° FULLEX».

4.2.12.4 60º Full Extension

Calib:#2↑ - #4↓
18 – P4 : 60º FullEx

Press ENTER to get access and extend fully the main boom only. Measure the radius. Again it should be close and greater or equal to the displayed radius. Press ENTER for editing the measured radius and then press ENTER to request calibration. Press ENTER to confirm.

4.2.13 BOOM WEIGHT TARE (BOOM MOMENT)

Calib:#2↑ - #4↓
19 – Boom Moment

Scroll down to menu 19- BOOM MOMENT. Press ENTER. If the radius calibration steps as far as item 18 (P4) are complete for the selected boom configuration, the system will allow the boom weight tare to be performed.

The calibration is done at 3 angles and 3 lengths. The angles should be at least 10 degrees apart. The first angle should be close to the minimum usable angle, the second angle at mid range, and the third angle close to the maximum taking care to avoid the derrick cylinder end stops. The boom lengths should be fully closed, mid range, and fully extended respectively for the duty being calibrated.

Calibrate in the sequence given by the system and shown in the table below, always boom down to the calibration point to keep the piston friction on the same side. When both the extension and the angle are OK, lower the hook block onto the ground with the hoist line totally loose. Then wait approximately 10 seconds and press ENTER. Provided that the machine is in an acceptable position for calibration the system will show accepted for a brief moment and then move to the next point automatically.
When sample 9 is complete, the system will beep twice and return to the main menu.

The display will step through the following 9 calibration points:

Pt#1 *(angle1)* L *(length1)* No Ref___ P *(bore pressure)*	Length1 should be fully retracted, angle1 should be between 10 and 25 degrees ideally
Pt#2 *(angle2)* L *(length2)* No Ref___ P *(bore pressure)*	Length2 should be the same as length1, angle2 should be between 30 and 45 degrees ideally
Pt#3 *(angle3)* L *(length3)* No Ref___ P *(bore pressure)*	Length3 should be the same as length1, angle3 should be between 55 and 75 degrees ideally
Pt#4 *(angle4)* L *(length4)* Ref3 *(angle3)* P *(bore pressure)*	Length4 should be mid extension, angle4 should be the same as angle3 now shown for reference
Pt#5 *(angle5)* L *(length5)* Ref2 *(angle2)* P *(bore pressure)*	Length5 should be the same as length4, angle5 should be the same as angle2 now shown for reference
Pt#6 *(angle6)* L *(length6)* Ref1 *(angle1)* P *(bore pressure)*	Length6 should be the same as length4, angle6 should be the same as angle1 now shown for reference
Pt#7 *(angle7)* L *(length7)* Ref6 *(angle6)* P *(bore pressure)*	Length7 should be fully extended, angle7 should be the same as angle6 now shown for reference
Pt#8 *(angle8)* L *(length8)* Ref5 *(angle5)* P *(bore pressure)*	Length8 should be the same as length7, angle8 should be the same as angle5 now shown for reference
Pt#9 *(angle9)* L *(length9)* Ref4 *(angle4)* P *(bore pressure)*	Length9 should be the same as length7, angle9 should be the same as angle4 now shown for reference

4.2.14 Calibration Load

Calib:#2↑ - #4↓
20 – Cal Load : 0.0

After completing menu 19, scroll down to menu 20 - CAL LOAD: 0.0. Press ENTER. The value to be entered is the weight that will be used to calibrate the loaded boom deflection. The weight must be between 50% and 100% of the cranes capacity fully telescoped and at an angle between 60 and 70 degrees. The value must include the weight of the hook block, the slings, the hoist line weight and any other load applied to the boom tip. Set the value and press ENTER and ENTER again to confirm.

Calib:#2↑ - #4↓
21 - Load Bend Corr

Scroll to menu «21 – Load Bend Corr». Press ENTER (#1) to get access. Move the boom to the fully telescoped position and at an angle of between 60 and 70 degrees. Lift the calibration load defined above when fully telescoped and at the stated angle. Measure the radius. It should be equal to or slightly greater than the displayed radius. Press ENTER for editing, the radius value will flash. Increase the value to the new radius. Never decrease this value below the primary value calculated by the system. Press ENTER to request calibration and press ENTER again to confirm.

4.2.15 HOOK LOAD ADJUSTMENT (Step 22)

Calib:#2↑ - #4↓
22 – Load Adjust

This menu is only for the main boom. Do not perform for manual extensions or jibs.

The system will scroll automatically to menu 22 - LOAD ADJUST. Press ENTER. Retract the boom, and set the angle to about 60 degrees. Lift a load equal to 60% to 90% of the crane’s capacity. Calculate the load including all the weight, the block, the rigging and the hoist line. Press ENTER. The load displayed will flash. Use the set buttons to adjust the displayed value to equal the exact load. Press ENTER and ENTER to confirm.

4.2.16 - SAVING CALIBRATION DATA

Calib:#2↑ - #4↓
23 – Backup

Scroll to menu «23- BACKUP». Press ENTER. The system will save the calibration in a spare bank called bank B. If in the next stages of calibration ,

an error is made, it will be possible with menu item 18 - MEMORY to discard the new changes and retrieve the previously saved calibration.

The use of this function is not necessary to store calibration. Calibration is saved when confirmed, and stored in the calibration bank A. This bank like bank B is a permanent EEPROM bank. Battery back up is not necessary.

4.2.17 MEMORY MANAGEMENT

Calib:#2↑ - #4↓ **24 – Memory**

Scroll to menu 18 - MEMORY. Press ENTER. The top display will indicate the status of both the memory banks A and B. A must read OK for the system to operate. By scrolling up and down, the bottom display will offer various options:

4.2.17.1 Copy A > B

A(Ok!)<>B(Ok!) **Copy A>B**

By pressing ENTER and the safety access code displayed on the top screen, the contents of bank A will be copied into bank B.

4.2.17.2 Copy B > A

A(Ok!)<>B(Ok!) **Copy B>A**

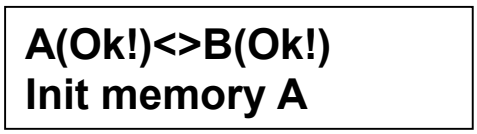
This option will copy the contents of bank B into bank A. The safety code must be entered to proceed. All the data in bank A will be lost.

4.2.17.3 SWAP A <> B

A(Ok!)<>B(Ok!) **Swap A<>B**

This option will place the contents of bank A into bank B and at the same time the contents of bank B in bank A. Both banks will be preserved but switched. The safety code must be entered to proceed.

4.2.17.4 INIT. MEMORY A



This option will obliterate all data from memory bank A. This should only be done when a system is installed for the first time or if an incompatible operating system is installed in the system. This must never be done during or after calibration. The safety code must be entered to proceed.

4.2.17.5 INIT. MEMORY C

This option is not used.

4.3 Calibration data

The calibration data menu is a sub-menu of variables used in general operation of the system.

Calib:#2↑ - #4↓
25 – Calib. Data

Scroll down to menu «25 - CALIB. DATA».
There is no double confirmation when calibrating. Press ENTER to free the displayed value, modify the value using keys 2 or 4, then press ENTER again to store the revised value. Then scroll to the next value.
The variables are listed below, all dimensions are displayed in the units defined on the display at start-up.

4.3.1 Slew Offset

Data: #2↑ - #4↓
31 – Slew Off:-1.0

The distance between the center of rotation of the crane and the boom base pin in units and tenths of units. The value is negative if the boom base pin is behind the center of rotation. Use the set button #4 until the value becomes negative. E.G: 2 feet, 4 inches on a telescopic crane becomes minus 2.3ft (-2.3)

4.3.2 Sheave Radius

Data: #2↑ - #4↓
32 – Sheave R:0.30

The radius of the boom head sheave block in unit and tenths of unit. It is used to compensate the radius when lifting with one part of line.

4.3.4 Main Hoist Rope Limit

Data: #2↑ - #4↓
33 – Rope Mn : 4.5

This is the maximum line pull permitted per part of line on the main hoist according to the chart. This value multiplied by the parts of line is used as the load limitation if lower than the rated capacity obtained from the load chart for the current crane configuration and radius or angle.

4.3.5 Aux Hoist Rope Limit

Data: #2↑ - #4↓
34 – Rope Aux : 1.0

This is the maximum line pull permitted per part of line on the auxiliary hoist. This value will be used as the load limitation as above when an auxiliary hoist duty is selected.

4.3.6 Parts of Line (Falls)

Data: #2↑ - #4↓
35 – Max Parts : 4

Set the maximum number of parts of lines. This will apply to all hoists when pressing the PARTS button, the number of parts will increase up to the set number and return to one.

4.3.7 Rope De-rating

Data: #2↑ - #4↓
36 – %/Part : 2.0 %

This value allows de-rating of the hoist line capacity when reeving with more than one part. The total rope capacity will de-rate by the percent set except for one part.

4.3.8 Block 1 Limit

Data: #2↑ - #4↓
37 – Block 1 : 1.0

This is the value that determines when the rigging mode is disabled for the main hook. The load on the main hook must remain below double this value to enable the rigging mode (see operator manual for more detail).

4.3.9 Block 2 Limit

Data: #2↑ - #4↓
38 – Block 2 : 1.0

This is the value that determines when the rigging mode is disabled for the auxiliary hook. The load on the auxiliary hook must remain below double this value to enable the rigging mode (see operator manual for more detail).

4.3.10 Approach Alarm

Data: #2↑ - #4↓
39 – Alarm#1 : 95.0%

This is the approach alarm on load. When the set percentage is reached, an intermittent buzzer is activated as well as a flashing bell symbol in the alarm zone on the display.

4.3.11 Overload Alarm

Data: #2↑ - #4↓
40 – Alarm#2 : 105.0

This limit is the maximum load limit set by the rope capacity or the chart. The percent used should be 100%. When reached, the bell symbol indicator and the pre-warning indicator bell are on and the buzzer is continuous. The lock-out is not activated.

4.3.12 Cut Alarm

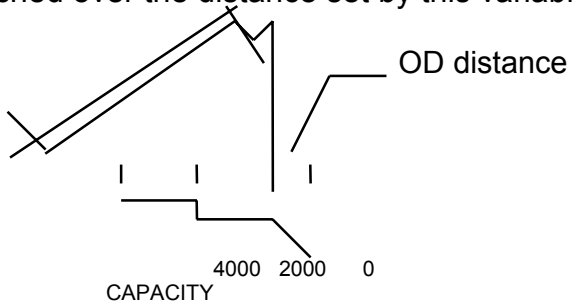
Data: #2↑ - #4↓
41 – Alarm#3 105.0

The alarm 3 is the lock-out activation. It is based on the percent of maximum load and is normally set to the same value as Alarm#2.

4.3.13 Out Of Duty Radius

Data: #2↑ - #4↓
42 – OD Rad : 0.5

This variable represents a transition distance between the last radius rating and zero capacity. If the operator is lifting a load at the outermost radius on the chart, the alarm may sound even if there is no overload if the displayed radius exceeds the chart radius even by one inch. The OD (OUT of DUTY on RADIUS) will allow a straight line capacity from the chart value to zero and stretched over the distance set by this variable.



4.3.14 Out of Duty Angle

Data: #2↑ - #4↓
43 – OD Angle : 0.0

The OD variable on the angle applies to angle based charts and allow a smooth transition from the lowest degree capacity on the chart to zero capacity. This variable is set in degrees. Usually 1.

4.3.15 Outside Duty Length

Data: #2↑ - #4↓
44 – OD Lgth : 0.0

The OD length variable represent the permitted zone where the specific boom length based capacity chart is still accepted. This is a very important factor when the displayed boom length exceeds the maximum boom length on the chart. The distance entered for this variable extends the acceptable boom length for the maximum boom length on the chart.

4.3.16 Inside Duty Length

Data: #2↑ - #4↓
45 – ID Lgth : 0.00

The ID length variable fulfils the same task as the OD length variable but applies to the minimum retracted boom length acceptable to obtain the retracted boom length chart.

4.3.17 Save Limits

Data: #2↑ - #4↓
46 – Save Limits: Y

Set to Y to store limits, this will mean any limits set will be retained until reset even after power off. Set to N to make limits temporary, this will mean that the limits will be lost when the system is turned off.

After entering all the calibration data press ESC (#3) to return to the main menu.

4.4 Dimensions (crane constants)

Calib:#2↑ - #4↓
26 – Dimensions

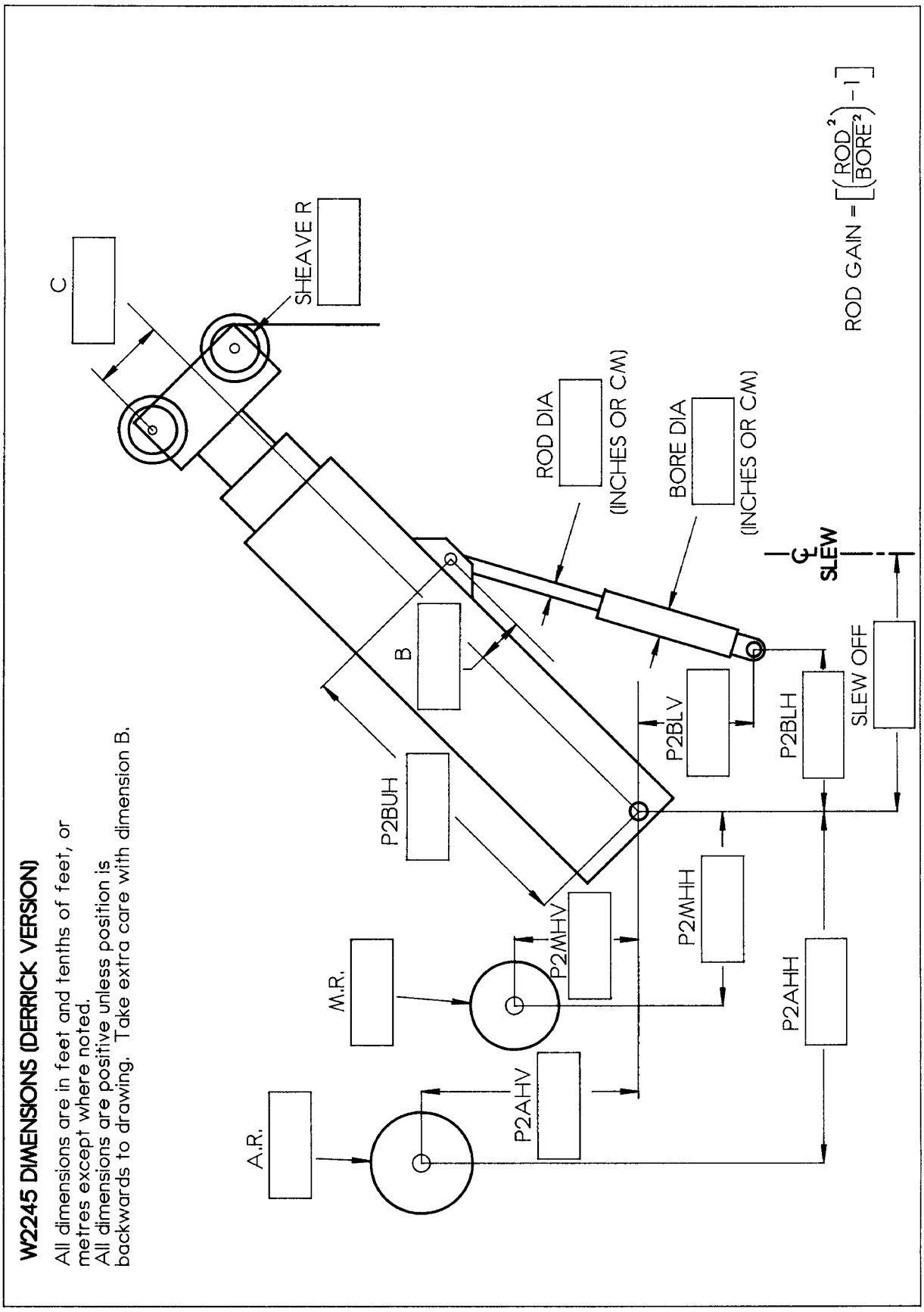
The dimensions menu is a sub-menu of fixed crane dimensions necessary to calculate the hook load from the ram hydraulic pressure.

The dimensions are shown on the following crane dimensions drawing.

In this menu, the ESC button can be used to return to the main menu at step 26. Also, there is no double confirmation when calibrating.

Scroll through to the required variable. Press ENTER to obtain the setting mode. Use the SET buttons (#2 and #4) to change the value and press ENTER once to confirm. Then scroll to the next value.

The variables are listed in the following sections, all dimensions are set in metres or feet as defined on the display at start-up unless otherwise stated.


W2245 DIMENSIONS (DERRICK VERSION)
All dimensions are in feet and tenths of feet, or metres except where noted.
All dimensions are positive unless position is backwards to drawing. Take extra care with dimension B.
C
SHEAVE R
ROD DIA
(INCHES OR CM)
BORE DIA
(INCHES OR CM)
ROD GAIN = [(ROD²/BORE²) - 1]
B
P2BUH
P2BLV
P2BLH
SLEW OFF
SLEW
M.R.
P2MHV
P2MHH
A.R.
P2AHV
P2AHH

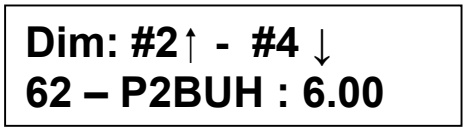
4.4.1 P2BLH

The horizontal distance between the boom base pin and the lift cylinder base pin.

4.4.2 P2BLV

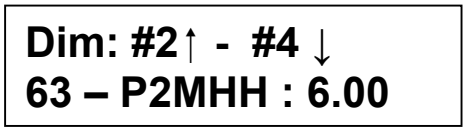
The vertical distance between the boom base pin and the lift cylinder base pin.

4.4.3 P2BUH



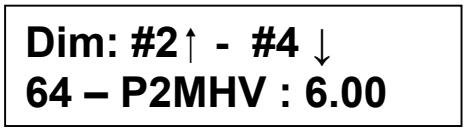
The distance parallel to boom between boom base pin and lift cylinder top pin.

4.4.4 P2MHH



The horizontal distance between center of main hoist drum and boom base pin. If the drum is mounted on the boom, this dimension is 0.00

4.4.5 P2MHV



Vertical distance between centre of main hoist drum and boom base pin. If the drum is mounted on the boom, this dimension is 0.00

4.4.6 P2AHH

Dim: #2↑ - #4 ↓
65 – P2AHH : 6.00

Horizontal distance between centre of auxiliary hoist drum and boom base pin. If the drum is mounted on the boom, this dimension is 0.00 If there is no auxiliary drum enter 0.00

4.4.7 P2AHV

Dim: #2↑ - #4 ↓
66 – P2AHV : 6.00

Vertical distance between centre of auxiliary hoist drum and boom base pin. If the drum is mounted on the boom, this dimension is 0.00. If there is no auxiliary drum enter 0.00

4.4.8 B

Dim: #2↑ - #4 ↓
67 – B : 0.00

The distance perpendicular to the boom between the boom base pin and the lift cylinder top pin. When the boom is horizontal, if the boom base pin his higher than the lift cylinder top pin, the distance is positive. If the boom base pin is below the lift cylinder top pin, the distance is negative.

4.4.9 BORE DIAMETER

Dim: #2↑ - #4 ↓
68 – Bore diam : 4.56

The inside diameter of the lift cylinder in inches or centimetres. If this dimension is not precisely known, the hook load displayed after calibration could be wrong. It can however be corrected by the LOAD ADJUST menu.

4.4.10 ANNULAR GAIN

Dim: #2↑ - #4 ↓
69 – Rod.Gain: -0.26

The annular gain is the ratio between the full side and the rod side of the lift cylinder. The diameter of the rod squared divided by the bore diameter squared minus one equals the value required. ie:-

$$\frac{(\text{Rod Diameter})^2}{(\text{Bore Diameter})^2} - 1$$

The value is negative and must be entered negative on the display by using the set buttons to go below zero.

4.4.11 # OF RAMS

Dim: #2↑ - #4 ↓ **70 – # of Rams : 1**

Enter the number of lift cylinders either one or two.

4.4.12 HST M.R

Dim: #2↑ - #4 ↓ **71 – Hst M.R : 0.8**

The radius of the main hoist drum from the centre to the middle of the hoist line layers. This distance is approximate and does not play a critical role in the load accuracy.

4.4.13 HST A.R

Dim: #2↑ - #4 ↓ **72 – Hst A.R : 0.7**

The radius of the auxiliary hoist drum from the center to the middle of the hoist line layers. This distance is approximate and does not play a critical role in the load accuracy.

4.4.14 C

Dim: #2↑ - #4 ↓ **73 – C : 1.00**

The distance perpendicular to the boom between the boom base pin and the sheave above the boom head sheave block. If the hoist drum is mounted on the boom this dimension is zero. This dimension allows calculation of the angle at which the hoist line applies a luffing tension on the boom.

4.5 System Configuration

Calib Data 27–Config System

To configure the system, simply scroll all the way down to the very last menu: «27 – Config. System». Then press ENTER (#1). In this menu, the ESC(#3) button can be used to return to the main menu, and all setting are saved upon return. By scrolling up and down, the bottom display offers the options listed below:

4.5.1 Charts Interpolation

1) Charts Inter Radius Enable

This option enables or disables the duty chart interpolation between radii. Simply press Enter (#1) to change the status. Note this should normally be set to Enable.

4.5.2 Number of Hoists

2) Nb of Hoist (1-2) N:1

This option is used to set the number of hoists that will be used, set to 1 if main hoist only or set to 2 if main and auxiliary hoists are monitored. Simply press Enter (#1) to change the value. This value will be saved when returning to the main menu with ESC Key (#3).

4.5.3 Boom Moment

3) Boom Moment Bypass Enable

Enable/disable Limit warning in calibration. Note this should normally be set to Disable.

Press ESC (#3) to return to the main menu.