

# MicroGuard<sup>®</sup> 586 Retrofit

Rated Capacity Indicator Systems



Calibration  
Testing



Consider Yourself Warned.™



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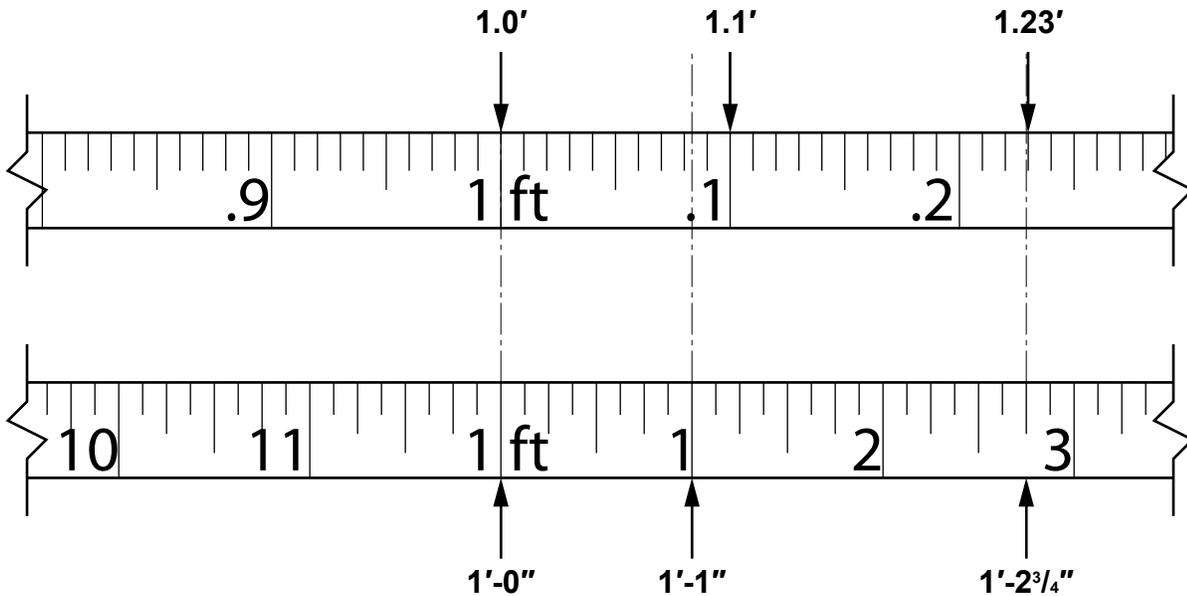
# Introduction

Congratulations on choosing the new MicroGuard® 586 Retrofit Rated Capacity Indicator System.

This manual describes the calibration process for the MicroGuard® Retrofit Rated Capacity Indicator System (hereinafter referred to as “the system”) in an on-site environment and assumes that there is no prior knowledge of the geometry of the crane other than data provided by the manufacturer. This document also assists personnel in obtaining necessary measurements for calibration and in maintaining a record of the measurements and test results for review and/or comparison when changes are made. Recording measurements and test results during the calibration process will ensure an organized and easy to follow calibration.

## Required Tools

- 1/4" nut driver or T15 Torx driver
- Digital or bubble level calibrated and accurate to 0.1° at level
- 100 foot measuring tape - fiber type graduated in tenths of feet



Note: The computer calculates measurements in feet and tenths of a foot, so having the correct measure will facilitate entering measurements.

- Digital volt/Ohm Meter capable of measurements to three decimal places

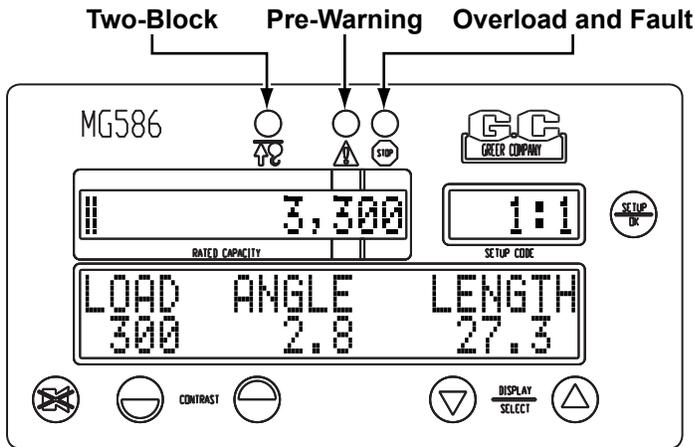
## Number Conversion

If you are using a standard tape measure, the measurement must be converted into feet and tenths of a foot. For example: a distance of 35'-6" would be entered into the system as 35.5 feet. Whole inches can be easily converted by dividing by 12 ( $6/12=.5$ ). Fractions of an inch are converted by dividing the numerator by the denominator. For example: 1/4 inches would be entered as .25 ( $1/4=.25$ ). Conversion of whole inches and fractions of an inch (for example 6-1/4") are converted by first converting the fraction to a decimal and then dividing by 12. In this case 6-1/4" is converted to 6.25 and then divided by 12 which equals 0.520. Refer to the Fraction to Decimal Conversion Chart on page C-5

When entering weights, the number must be converted by moving the decimal three places to the left. For example: a weight of 1,400 pounds would be entered as 1.4, and a weight of 300 pounds would be entered as .300.

# Operator's Display Console

## Warning/Alarm Indicators

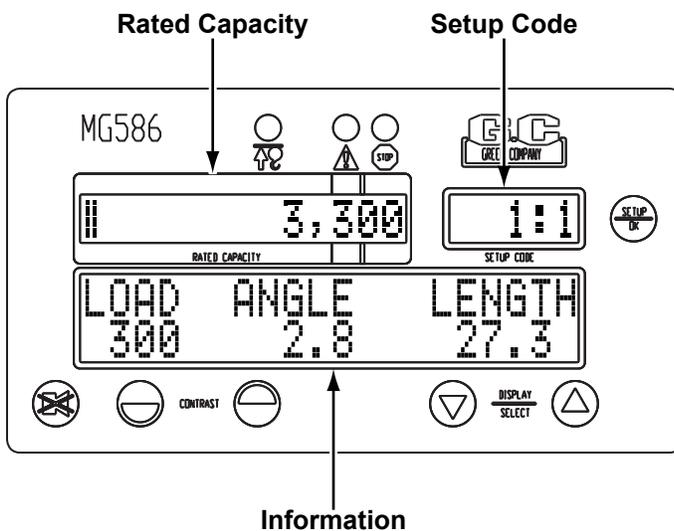


The red two-block lamp will illuminate when a two-block condition occurs (see “Two-Block Warning” on page 8).

The yellow pre-warning lamp will illuminate at 90% of rated capacity (see “Approaching Overload” on page 8).

When the load reaches or exceeds 100% of rated capacity, the red overload warning lamp will illuminate along with the yellow pre-warning lamp (see “Maximum Capacity and Overload” on page 8).

## Display Windows



The current rated capacity for the crane in the current configuration will be displayed in the rated capacity window as well as the percent of rated capacity shown as a meter which progresses to the right as the load increases (see “Normal Operation” on page 7).

The setup codes are shown in the setup code window, as well as the parts-of-line, and the stowed jib option if available (see “Configuration Selection” on page 6).

The information window shows crane specific information regarding boom length,

boom angle, and working radius, along with the load on hook. In addition, information regarding any warnings or alarms will be displayed in this window. If the system has any internal faults, it will display “!WARNING! SYSTEM FAULT” in the information window. The specific fault messages can be viewed by pressing the **UP ARROW** or **DOWN ARROW** key (see “System Fault Messages” on page A-1).

## Push Buttons

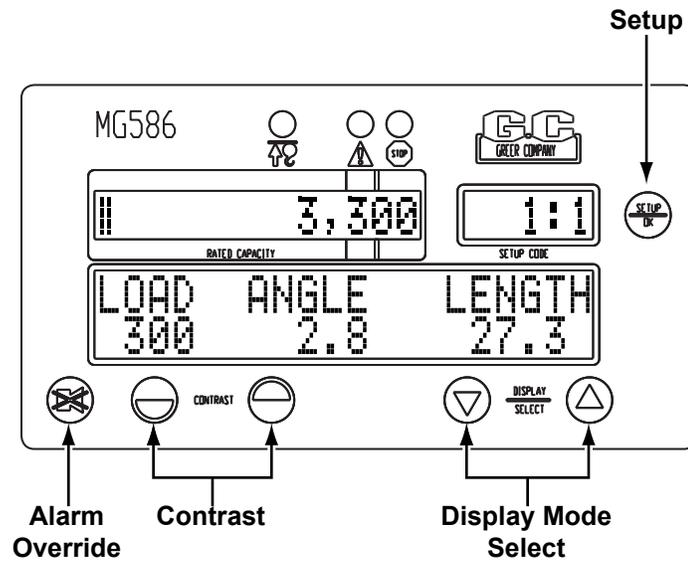
The **SETUP** key enables the operator to configure the system to match the actual setup of the crane. Codes are present for:

- stowed jib attachments; if no stowed options are available, this code will not appear
- crane configuration
- number of parts-of-line

The **ALARM OVERRIDE (CANCEL)** key is used to disable the audible warning and to override the function kick-out for the current alarm condition. It is also used to exit a menu or routine.

The **CONTRAST** keys are used to adjust the lightness or darkness of the display area.

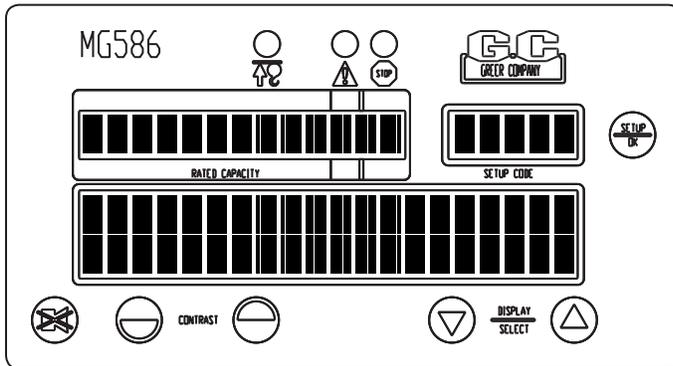
The **DISPLAY MODE/SELECT** keys are used to switch to different display formats showing various combinations of boom angle, boom length, and radius. They can also be used as an **UP ARROW** or **DOWN ARROW** key to scroll through menu selections.



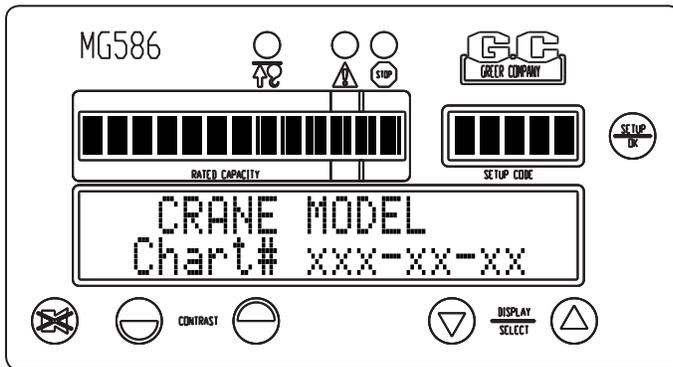
# System Operation

## System Self-Test

When the system is turned on, it goes through a brief self-testing process.



All three alarm indicators will light up, all display windows will appear black, and the audible alarm will sound.



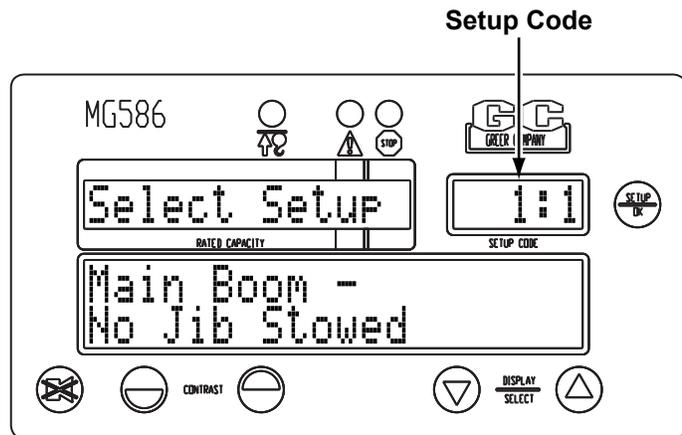
The information display will then show the crane model and capacity chart number for the system configured.

Following self-test, the system will go into the setup mode. The setup code window will display the same setup code used when the system was last powered off. Check that the correct setup code is displayed before operating the crane. Refer to "Configuration Selection" on page 6 for code setup instructions.

## Configuration Selection

Configuration selection is required upon system power up; however, it can also be entered anytime by pressing the **SETUP** key.

The first selection is for the jib. Since no jibs are stowed, the system defaults to the main boom. Press the **SETUP/OK** key to continue.

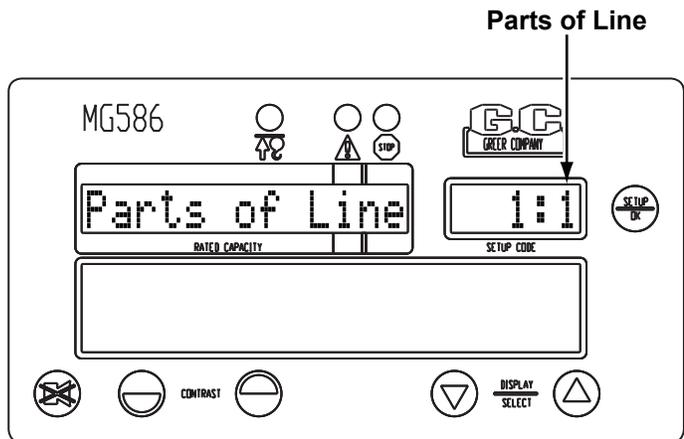


The next selection is for the number of parts-of-line.

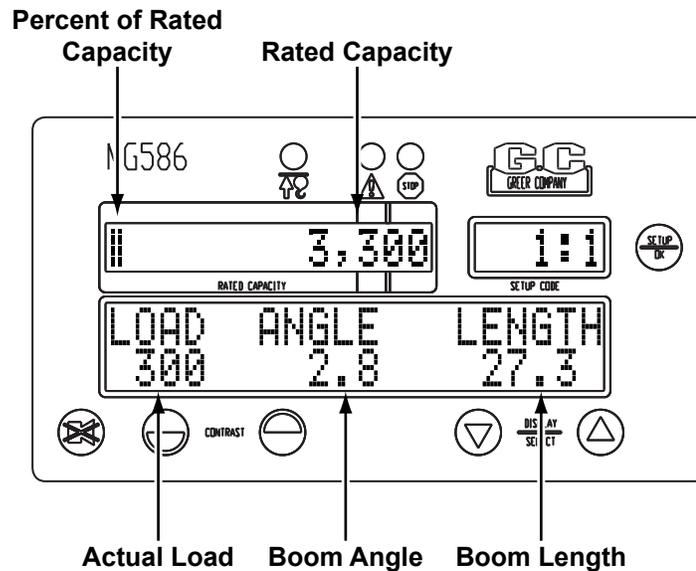
To change the number of parts-of-line, press the **UP ARROW** or **DOWN ARROW** key to change the number and press the **SETUP/OK** key to continue.

Note: Some configurations allow only single part-of-line operation. In these cases, the whole parts-of-line selection phase will be skipped and the parts-of-line will be set to one (1).

Once the correct parts-of-line are entered, the system will exit the configuration mode and return to the normal working screen.



## Normal Operation



**Percent of rated capacity** indicates how near the operation is to full capacity and overload. The percent of rated capacity meter progresses to the right as the percentage increases. As long as the meter remains within the normal (green-bordered) zone, the percent of rated capacity is within normal operating limits. When the percent of rated capacity exceeds 60%, the rated capacity text will move to the left (see “Approaching Overload” on page 8).

**Rated capacity** is the heaviest load that the crane can lift in the current crane position and configuration. This value may be limited by the number of parts-of-line selected.

The **actual load** appears in the information window under the word “LOAD”. The actual load includes the weight of the load plus the weight of everything hanging below the boom tip (hook block, etc.).

The **boom angle** appears in the information window under the word “ANGLE”. This shows the current angle of the boom in degrees and tenths of a degree. Depending on the operation, the “ANGLE” display will change to “RADIUS”, in which case the radius from the centerline of rotation to the center of the suspended load will be shown in feet and tenths of a foot.

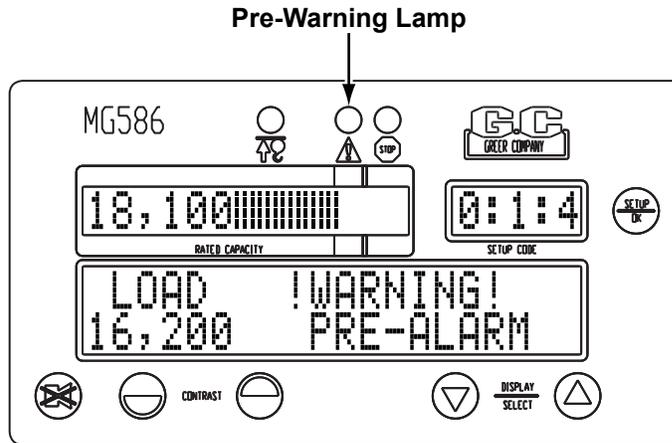
The **boom length** is displayed in the information window under the word “LENGTH”. This shows the current length of the boom in feet and tenths of a foot. By pressing the **UP ARROW** or **DOWN ARROW** key, the display can be changed to show “ANGLE” or “RADIUS”.

If the system has any internal faults, it will display “!WARNING! SYSTEM FAULT” in the information window. The specific fault messages can be viewed by pressing the **UP ARROW** or **DOWN ARROW** key (see “System Fault Messages” on page A-1).

### **!WARNING**

**THE OPERATOR MUST SELECT THE CORRECT CRANE CONFIGURATION CODE NUMBER FOR EACH SETUP CONFIGURATION CHANGE. INACCURATE OR NON-SELECTION OF THE APPROPRIATE CODE NUMBER WILL RESULT IN INCORRECT CALCULATIONS AND READINGS OF THE ACTUAL LOAD WEIGHT AND PERCENT OF RATED CAPACITY. REFER TO “CONFIGURATION SELECTION” ON PAGE 6.**

## Approaching Overload

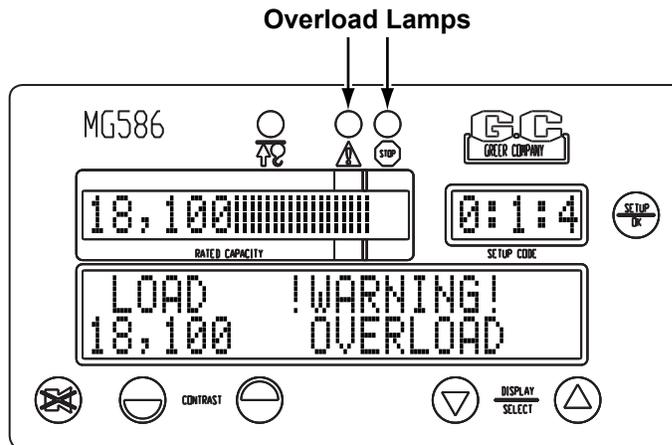


The system continuously monitors the weight of the load suspended below the boom head. The system compares this information with rated capacity data stored within the computer.

When the rated capacity of the configuration reaches 90%, the percent of rated capacity meter progresses from the normal [green-bordered] zone into the caution [yellow-bordered] zone.

A pre-warning lamp will illuminate and an audible alarm will beep continuously. The message “!WARNING! – PRE-ALARM” will flash in the information window.

## Maximum Capacity and Overload

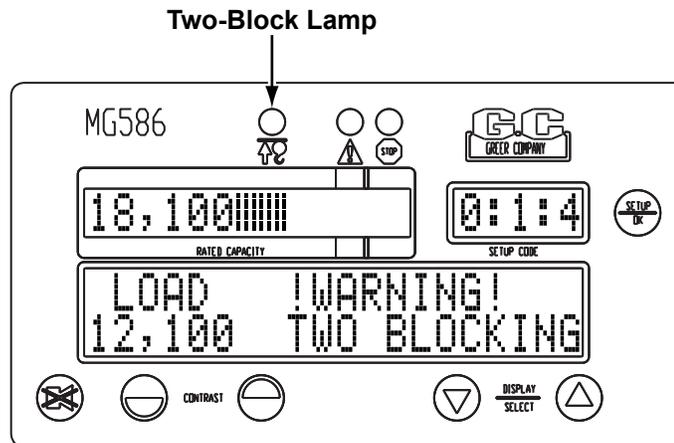


When the rated capacity of the crane reaches 100%, the percent of rated capacity meter moves from the caution [yellow-bordered] zone into the warning [red-bordered] zone.

The overload lamps will illuminate and an alarm will sound continuously. The message “!WARNING! – OVERLOAD” will flash in the information window.

Crane motions [boom extend, boom down, and winch up] are cut in order to prevent damage to the crane and the endangerment of persons near the lifting area.

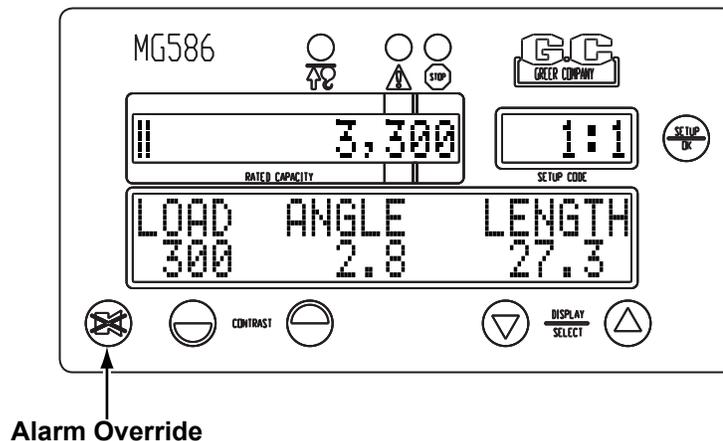
## Two-Block Warning



If the hook block is on a collision course with the head machinery at the end of the boom, the two-block lamp will illuminate and an audible alarm will sound continuously. The message: “!WARNING! TWO BLOCKING” will appear in the information window.

Crane motions (boom extend, boom down, and winch up) are cut in order to prevent damage to the crane and the endangerment of persons near the lifting area.

## Alarm Override



The alarm override button is used to temporarily disable current audible alarm conditions and to disable the automatic motion cutout. The audible alarm will sound again following any subsequent overload or two-block conditions, or any other alarm conditions.

To disable the audible alarm, press the **ALARM OVERRIDE** key. Continue to hold the button down for five (5) seconds to cancel any existing motion cuts. The **ALARM OVERRIDE** key must be held down to continue overriding the motion cut.

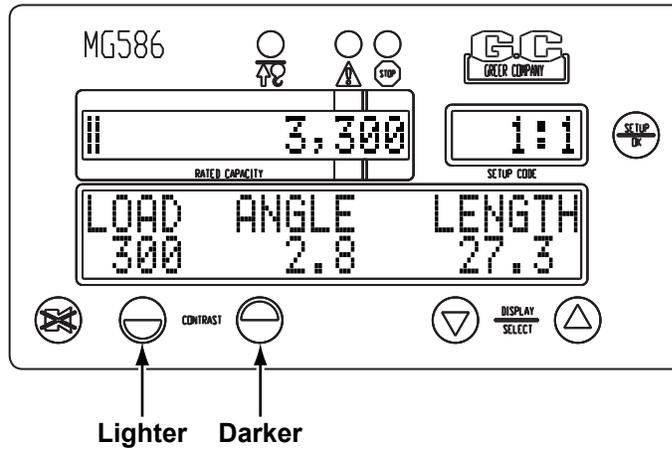
### **⚠WARNING**

**THE ALARM OVERRIDE BUTTON SHOULD BE USED WITH CAUTION. AUTOMATIC AUDIBLE ALARMS WARNING AGAINST OVERLOAD, TWO-BLOCK DANGERS, AND HAZARDOUS TIPPING CONDITIONS ARE TEMPORARILY SILENCED WHEN THIS OPTION IS ACTIVATED. MOTION CUTOUT MAY ALSO BE DISCONTINUED.**

## Adjusting the Contrast

Changes in temperature and lighting conditions may require adjustment of the display contrast.

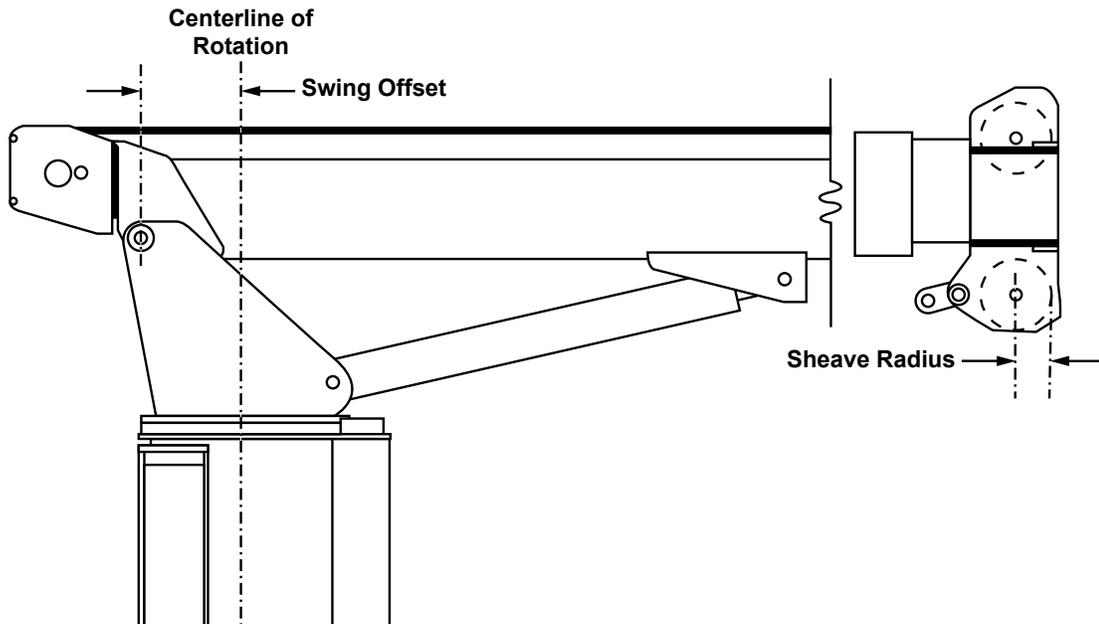
Use the **CONTRAST** keys to lighten or darken the display as required.



# Preliminary Checks and Measurements

The following pages provide a list of measurements that must be recorded and double-checked for accuracy. If measurements exist in the system from a previous application, or if no measurements exist, they must be entered into the system. Any data supplied by the crane manufacturer in the crane application data sheet stored in the system must be validated before calibration begins. All dimensions entered into the computer must be in feet and tenths of a foot.

## Miscellaneous Dimensions



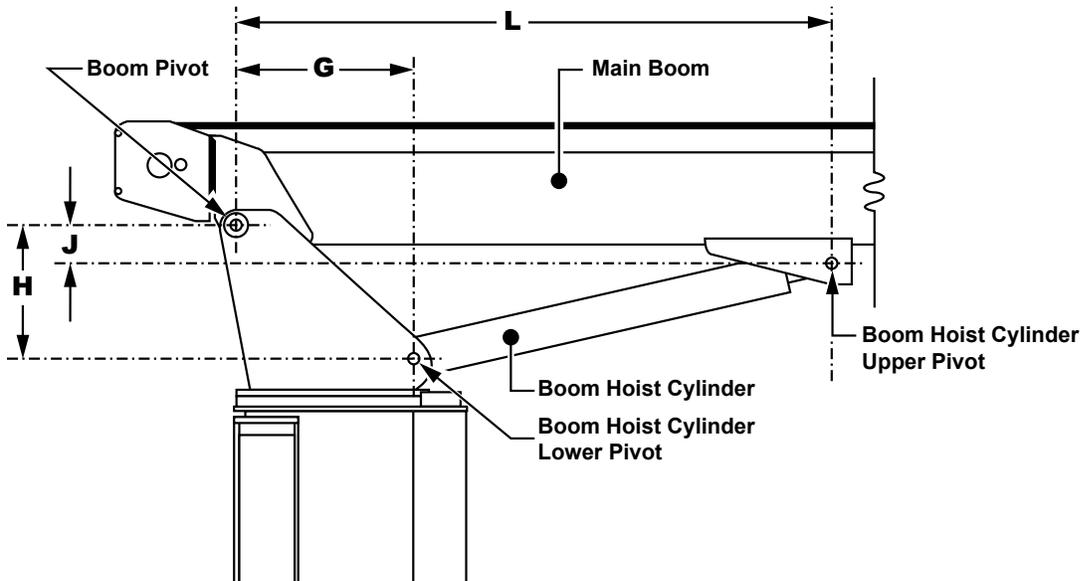
Swing Offset – The horizontal distance between the center of the boom pivot and the centerline of rotation.

Note: If the centerline of rotation is ahead of the boom pivot as shown in the illustration, the dimension will be negative. Make sure to indicate a positive (+) or negative (-) value when noting the measurement.

Sheave Radius – The distance between the center and the outside edge of the bottom sheave.

**USE THE SPACE PROVIDED IN APPENDIX C TO RECORD THE MEASUREMENTS.**

## Boom Pivot Dimensions



The boom should be in a horizontal position ( $0^\circ$ ) when taking the following measurements. Use the space provided in Appendix C to record the measurements:

Dimension "L" – The horizontal distance between the center of the boom pivot and the center of the boom hoist cylinder upper pivot.

Dimension "J" – The vertical distance between the center of the boom pivot and the center of the boom hoist cylinder upper pivot.

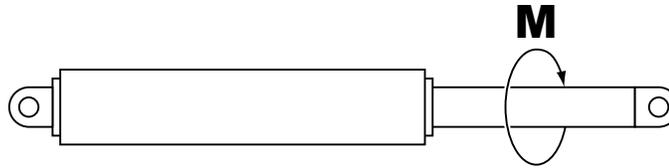
Note: If the Boom Pivot is above the boom hoist cylinder upper pivot the dimension is or negative.

Dimension "G" – The horizontal distance between the center of the boom pivot and the center of the boom hoist cylinder lower pivot.

Dimension "H" – The vertical distance between the center of the boom pivot and center of the boom hoist cylinder lower pivot.

**USE THE SPACE PROVIDED IN APPENDIX C TO RECORD THE MEASUREMENTS.**

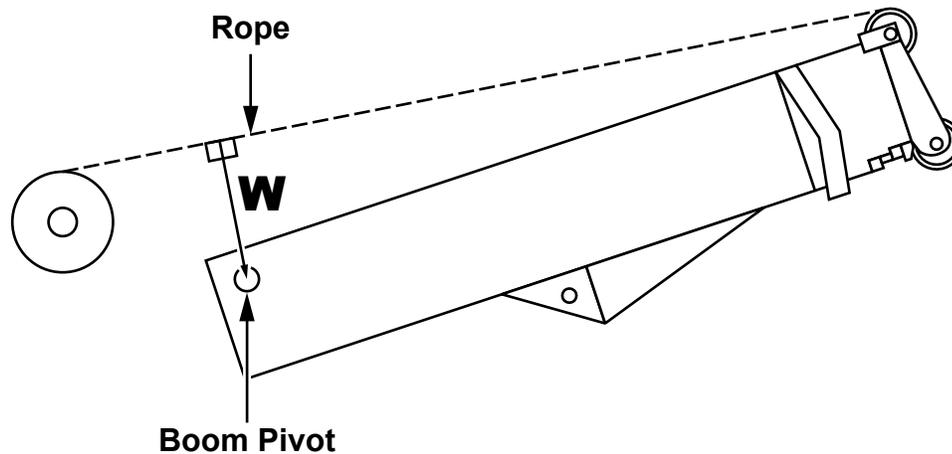
## Boom Hoist Cylinder Dimension



Dimension "M" – This is the distance measured around the outside of the cylinder rod, divided by 12.

**USE THE SPACE PROVIDED IN APPENDIX C TO RECORD THE MEASUREMENTS.**

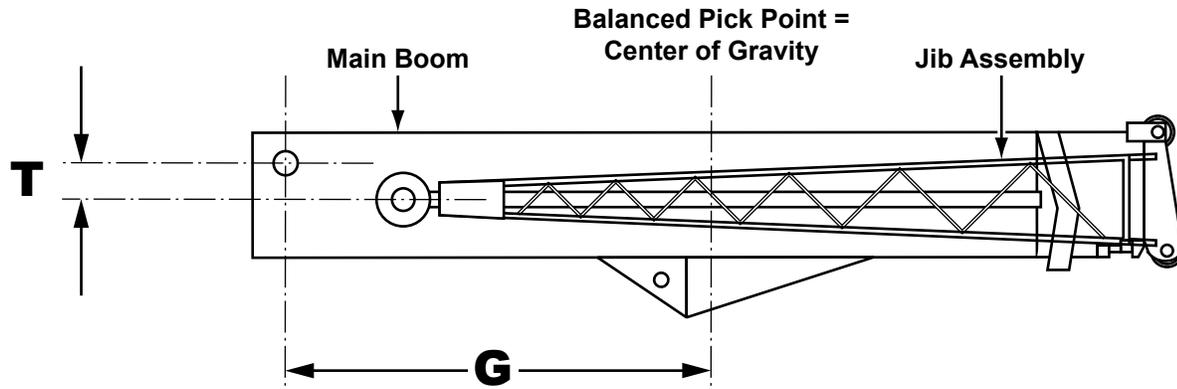
## Rope Dimensions



Dimension "W" – The distance between the center of the boom pivot and the winch rope perpendicular to the rope. Measure at a low angle of  $<20^\circ$  and a high angle of  $>60^\circ$ .

**USE THE SPACE PROVIDED IN APPENDIX C TO RECORD THE MEASUREMENTS.**

## Stowed Jib Dimensions



### IMPORTANT!

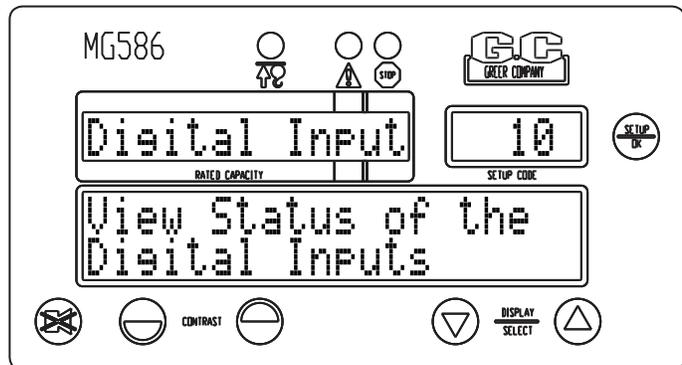
JIB MEASUREMENTS MAY BE TAKEN WITH THE JIB STOWED, HOWEVER JIB MUST BE REMOVED PRIOR TO BOOM CALIBRATION.

USE THE SPACE PROVIDED IN APPENDIX C TO RECORD THE MEASUREMENTS.

## Installation Checks

Check wiring and EPROM installations (on page B-4 for wiring schematic).

Check swing switches, if fitted. Use the digital monitor screen (located under Menu 10 - Digital Inputs) to ensure that the switches operate properly (on page B-5).



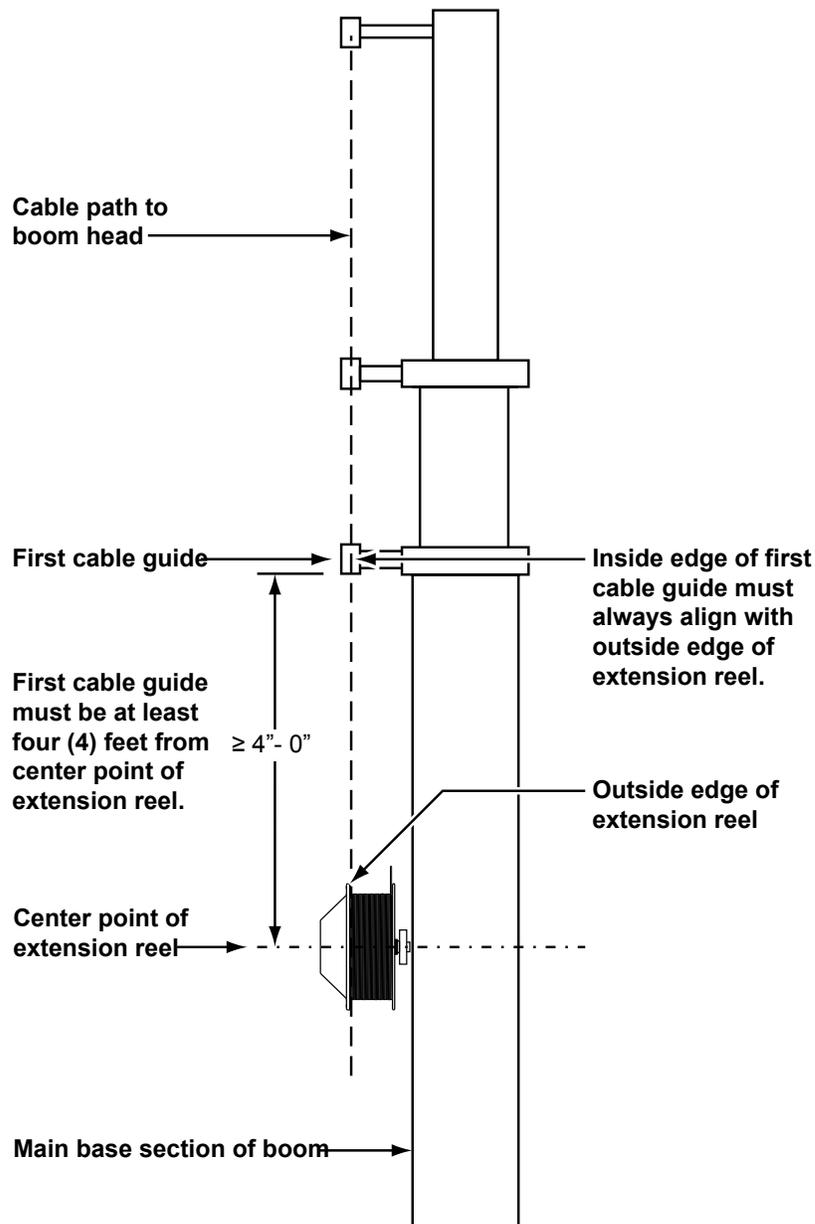
## Installing the Reel-Off Cable

### IMPORTANT!

**THE REEL-OFF CABLE MUST BE PROPERLY PRE-TENSIONED. THIS PROCEDURE KEEPS THE CABLE TAUT AT ALL TIMES, WITH CONTROLLED, STEADY EXIT FROM THE EXTENSION REEL.**

#### Pre-Tension Steps

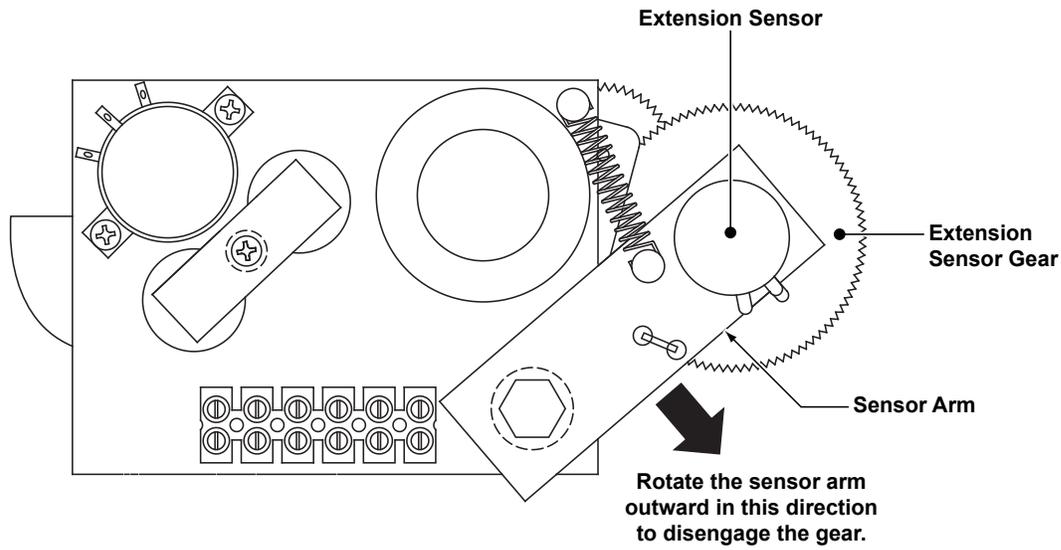
1. Fully retract the boom.
2. Slowly rotate the extension reel clockwise until a “click” is heard, indicating that the clutch inside the reel is engaged.
3. Turn the extension reel counterclockwise five (5) complete rotations.  
Note: A temporary marker placed on the Extension Reel can facilitate the rotation count.
4. The reel must be restrained from turning farther while enough cable is taken off the drum to reach the boom tip. (3 wraps = 10 ft.) Then the cable must be tied off at the boom tip (strain relieved).
5. Pretension is complete.



1.

## Adjusting the Extension Sensor

1. With the level on the boom reading  $0^\circ$ , rotate the extension sensor arm outward to disengage the gear.



2. Rotate the extension sensor clockwise until the end of the pot is reached. Then, continue to rotate [applying more force] to cause the clutch to slip [this is usually identified by a click].
3. Rotate the sensor exactly  $1/2$  turn counter-clockwise to establish a proper voltage signal. Refer to "Extension Reel Voltage Check" on page A-4. After achieving the proper voltage setting, the Zero may be established by the calibration routine on page 27.
4. With the boom still level, measure the voltage of the angle sensor, refer to "Extension Reel Voltage Check" on page A-4. After achieving the proper voltage setting, the Zero may be established by the calibration routine on page 26.
5. Note: This check should be performed on older model cranes in the event the sensor has been removed and reinstalled, or repositioned incorrectly.

# Entering Calibration Data

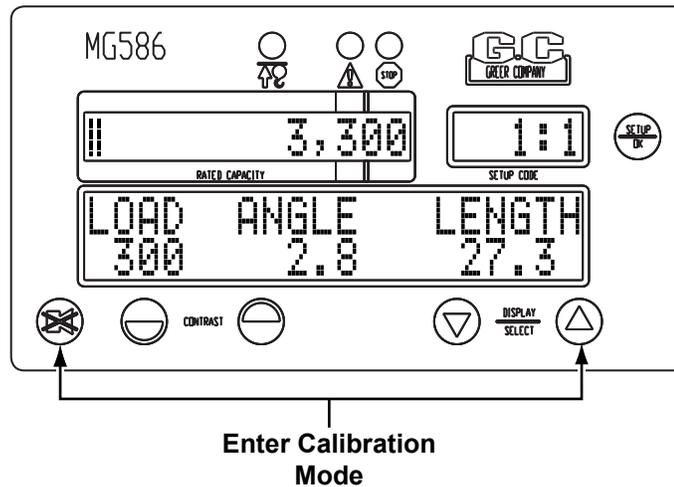
## ⚠WARNING

**WHEN THE SYSTEM IS IN CALIBRATION MODE, AUTOMATIC OVERLOAD CONTROLS ARE DISABLED. THE CRANE OPERATOR IS RESPONSIBLE FOR PROPER LOADING OF THE CRANE WHILE PERFORMING CALIBRATION.**

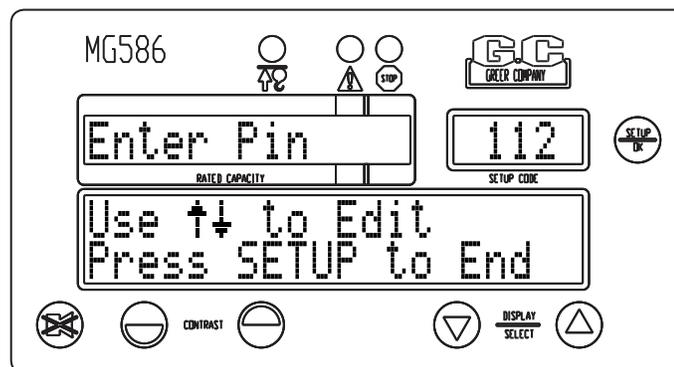
To enter calibration data it is necessary to put the system in calibration mode.

To access calibration mode:

1. Hold down the **CANCEL** and **UP ARROW** keys simultaneously for about six (6) seconds.



2. A message will appear in the information window prompting you to enter the security code. The security code for the system is "112".
3. Use the **UP ARROW** or **DOWN ARROW** keys to change the number in the Setup Code window. When the correct number is showing, press the **SETUP/OK** key to enter the code.



Note: If the incorrect code is entered, the system will return to normal operation.

Note: To exit calibration mode at any time, press the **CANCEL** key to return to normal operation. If the system remains powered on, the calibration routine can be accessed at any time without having to re-enter the security code.

The system is now in calibration mode and ready to receive calibration data. Press the **UP ARROW** or **DOWN ARROW** key to scroll through the following menus:

00 Information – Displays system specific information.

01 Reset Data – Displays the status of the system personality.

02 Dimensions – Enables entry of crane dimensions.

03 Angle Sensor – Enables calibration of the angle sensor.

04 Extension Sensor – Enables calibration of the extension sensor.

05 Pressure – Enables calibration of the boom hoist cylinder diameter.

06 Radius/Moment – Enables calibration of the moment and radius of the boom.

07 Deflection – Enables entry of boom deflection correction.

08 Calibrate Fly – Enables data entry and calibration of fly/jib dimensions.

09 Stowed Jibs – Enables data entry and calibration of stowed jib dimensions.

10 Digital Input – Enables viewing of digital input status.

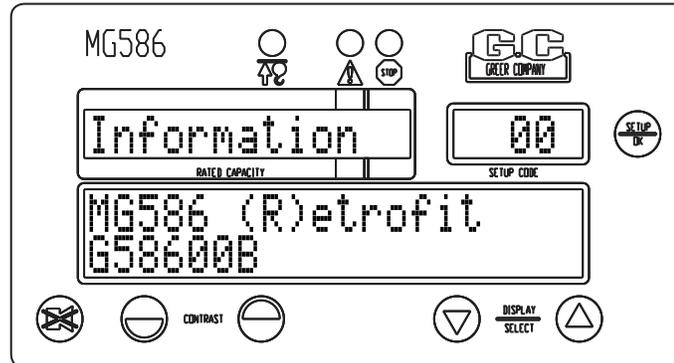
11 Angle Rate – Enables entry of load compensation.

12 Data Viewer – For developmental use only. No description is included in this document.

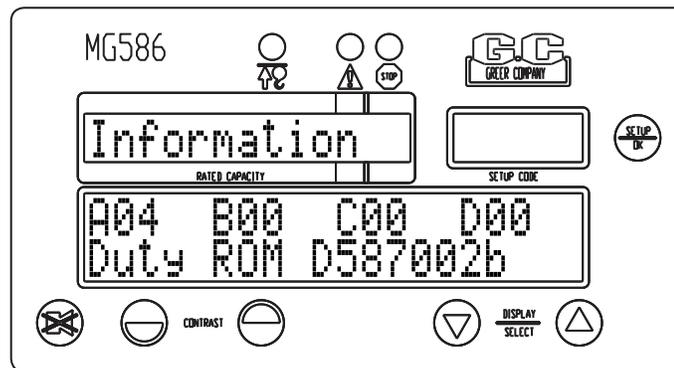
## 00 Information

This menu enables viewing of system specific information, error codes, and recommended diagnostic procedures.

The Main Information screen shows you the display model and Crane Data Chart used.

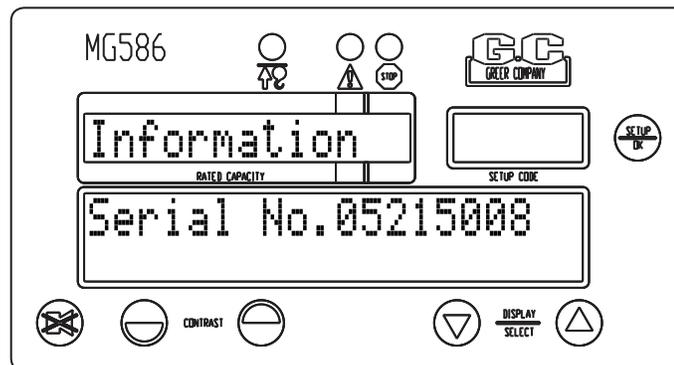


The Error Codes screen enables you to view system error codes (see System Fault Messages on page A-1 for description). From the Main Information screen, press the **SETUP/OK** key.

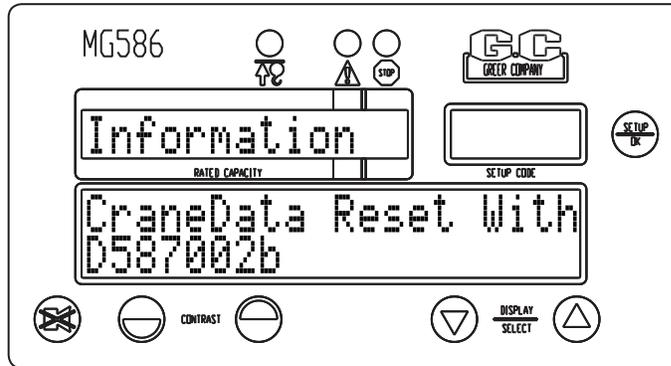


The Serial Number screen shows the serial number of the unit. From the Error Codes screen, press the **UP ARROW** key.

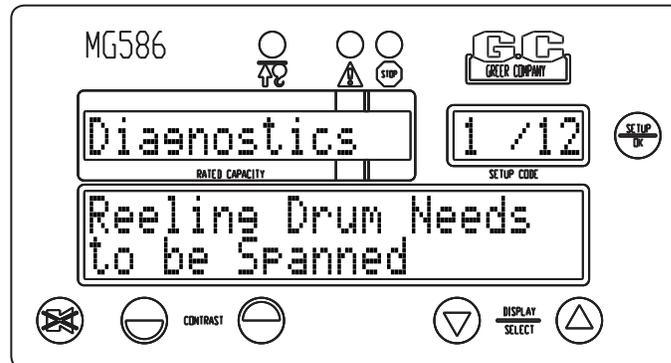
Note: The serial number displayed should match the serial number label on the computer.



The Crane Data screen shows the crane data chart number. This file is used for system RESET. From the Serial Number screen, press the **UP ARROW** key.



The Diagnostics screens display a number of recommended procedures necessary to complete the calibration. This list may vary depending on previous calibrations. All calibration functions are not pertinent to all cranes; therefore, some recommended diagnostics may not apply. From the Crane Data screen, press the **UP ARROW** key, or from the Error Codes screen, press the **DOWN ARROW** key.



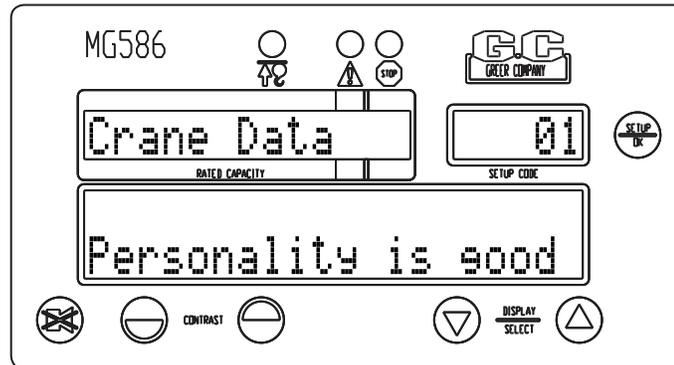
Only the **UP ARROW** key is enabled. Continually pressing the **UP ARROW** key will cycle through all diagnostic screens. At the last screen, pressing the **UP ARROW** key will return to the first diagnostic screen.

Press the **CANCEL** key to exit the diagnostics list and return to the main Information screen.

Press the **UP ARROW** key to go to the next menu.

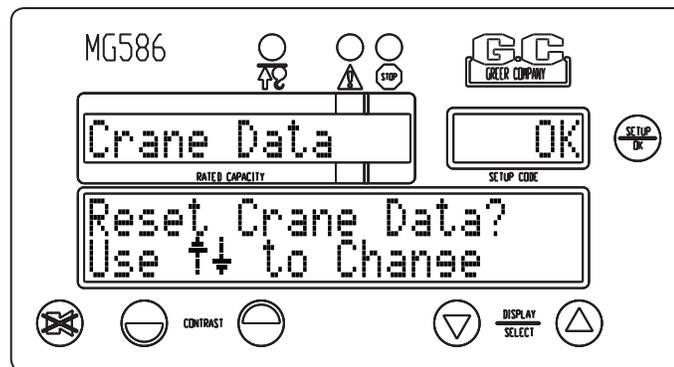
## 01 Crane Data

This menu will display the status of the system personality. If the system has been reset and is functioning correctly, the display will read "Personality is good." If the system has been altered or is not functioning correctly, the display will read "Personality is bad."

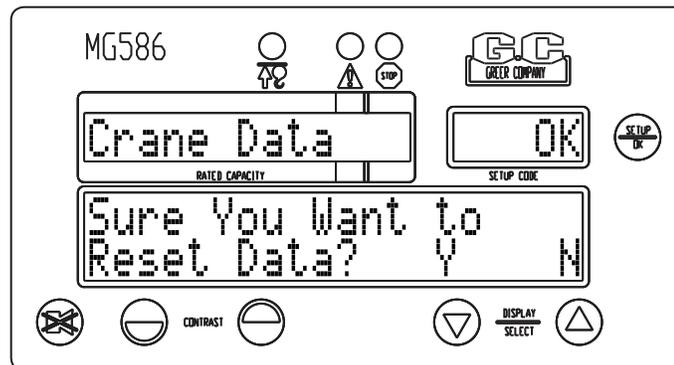


In order for a new calibration to begin, the crane data must be reset. This will erase any existing personality data which stores crane specific data and dimensions. It will also copy any known data from the on-board ROM applications file to the working personality memory for use by the system.

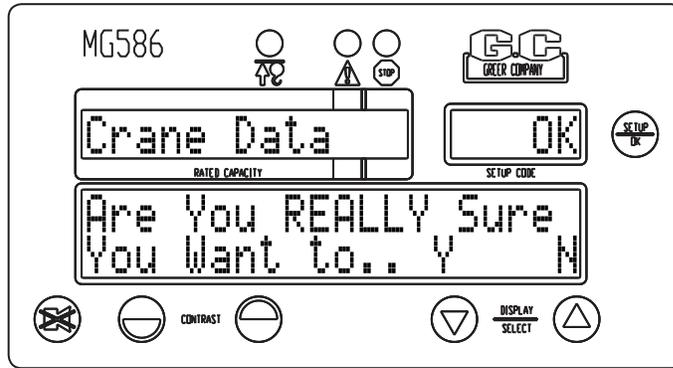
To reset crane data, press the **SETUP/OK** key.



You will be prompted to confirm the reset command by pressing "Y" (**DOWN ARROW** key), or "N" (**UP ARROW** key).



You will be prompted again to confirm the reset command by pressing “Y” (**DOWN ARROW** key), or “N” (**UP ARROW** key).



You will be prompted one more time to confirm the reset command by pressing “Y” (**DOWN ARROW** key), or “N” (**UP ARROW** key).

If yes is selected, the system will erase any and all calibration data stored. While it is resetting, the percent of rated capacity meter will act as a progress bar. When it is completed, the screen will show “Finished” and then automatically return to the Reset Crane Data screen.

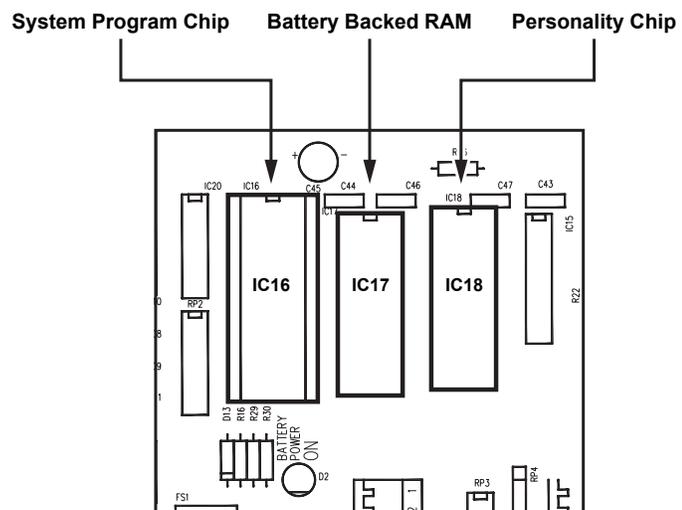
The system also contains a backup function that allows the installer/calibrator to retain a copy of the personality information after the unit is calibrated.

**IMPORTANT!**

**ONCE THE CALIBRATION HAS BEEN COMPLETED AND THE RESULTS ARE SATISFACTORY, MAKE SURE YOU BACKUP THE CALIBRATION DATA.**

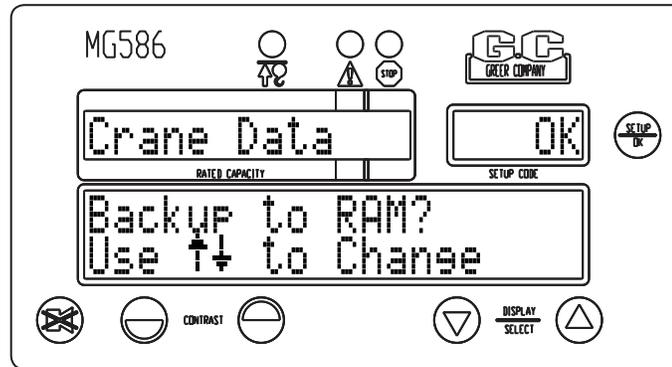
This system consists of the following components:

1. System Program Chip (ROM)
2. Battery Backed RAM
3. Personality Chip

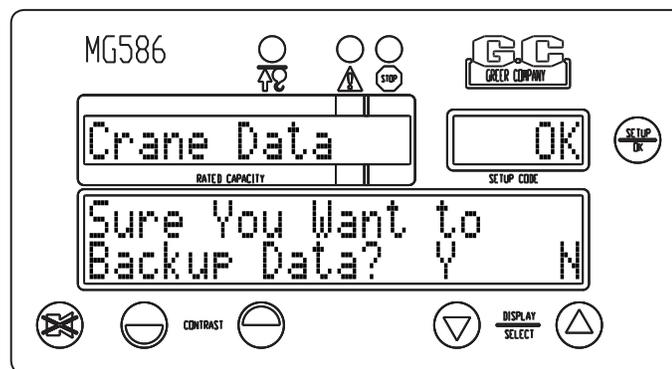


Press the **UP ARROW** key to go to the backup menu.

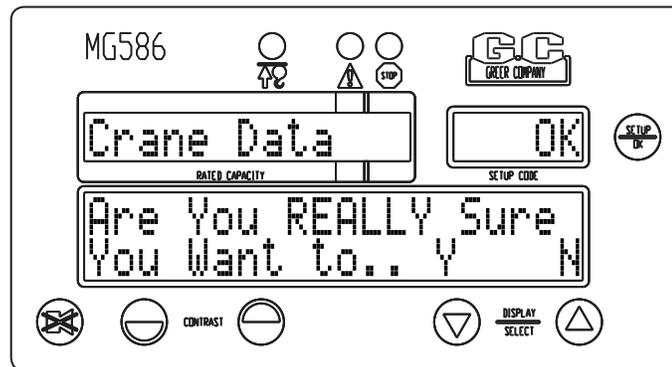
To backup the crane data, press the **SETUP/OK** key.



You will be prompted to confirm the reset command by pressing “Y” (**DOWN ARROW** key), or “N” (**UP ARROW** key).



You will be prompted again to confirm the backup command by pressing “Y” (**DOWN ARROW** key), or “N” (**UP ARROW** key).

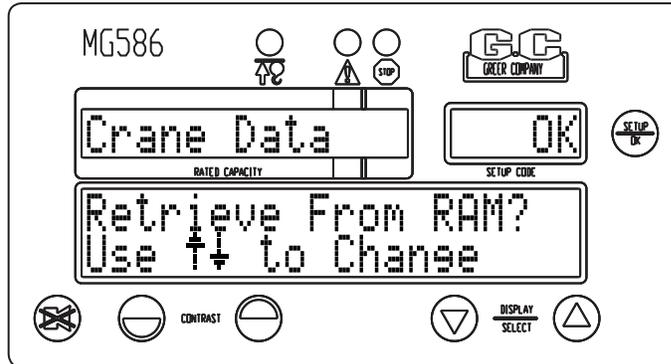


If yes is selected, the system will backup all calibration data from the personality chip to the RAM. While it is resetting, the percent of rated capacity meter will act as a progress bar. When it is completed, the screen will show “Finished” and then automatically return to the Backup Data screen.

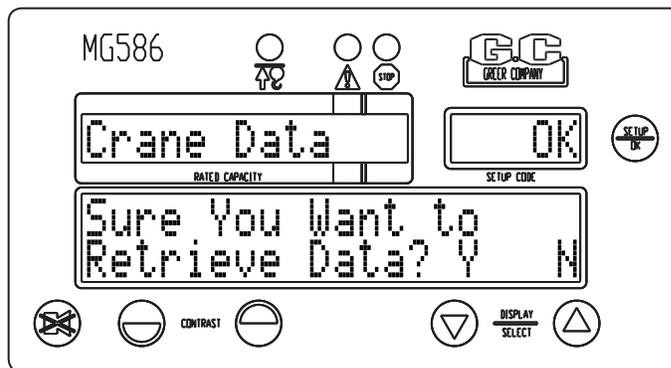
The system also contains a retrieval function that allows the installer/calibrator to restore a copy of the personality information to the program chip in the event of an error.

Press the **UP ARROW** key to go to the reset menu.

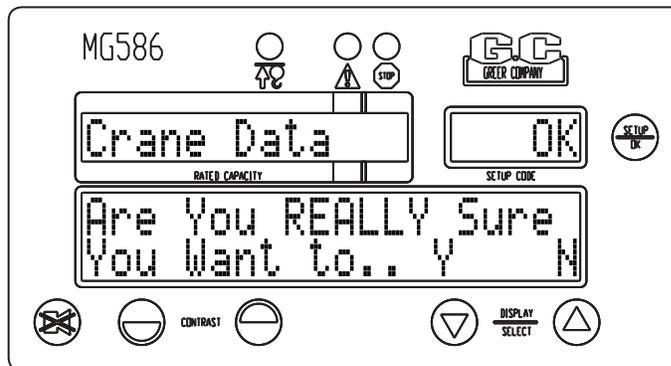
To retrieve the crane data, press the **SETUP/OK** key.



You will be prompted to confirm the retrieve command by pressing “Y” (**DOWN ARROW** key), or “N” (**UP ARROW** key).



You will be prompted again to confirm the retrieve command by pressing “Y” (**DOWN ARROW** key), or “N” (**UP ARROW** key).



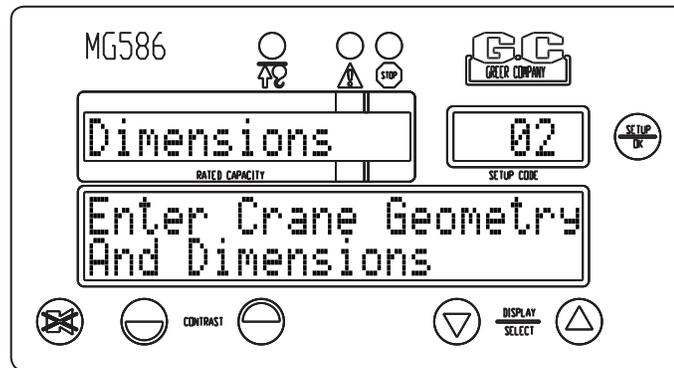
If yes is selected, the system will retrieve all calibration data from the RAM to the personality chip. While it is retrieving, the percent of rated capacity meter will act as a progress bar. When it is completed, the screen will show “Finished” and then automatically return to the Retrieve Data screen.

Press the **CANCEL** key to exit the diagnostics list and return to the main Crane Data screen.

Press the **UP ARROW** key to go to the next menu.

## 02 Dimensions

This menu is for entering the dimensions recorded in Appendix C.



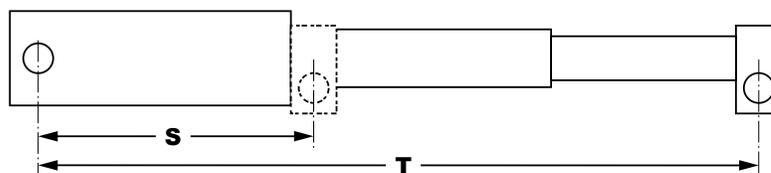
Press the **SETUP/OK** key to enter the routine. Press either the **UP ARROW** or **DOWN ARROW** key to modify the displayed values. When the correct value is displayed, press the **SETUP/OK** key to save and continue. Press the **CANCEL** key to exit the routine.

Enter the following dimensions from the Measurement Record on page C-1:

1. Swing Offset
2. Ram L
3. Ram J
4. Ram G
5. Ram H
6. The system will then ask, "Is the winch mounted on the boom?" Press "Y" (**DOWN ARROW** key), or "N" (**UP ARROW** key). If "YES," the system will not require additional information regarding the crane winch and continue to the next entry. If "NO," the system will ask, "Calibrate Hoist Rope Dimensions?" Unless previously calibrated, press "YES" and work through the following calibration procedure. If the winch is mounted on the boom, all dimensions should be set to "0".

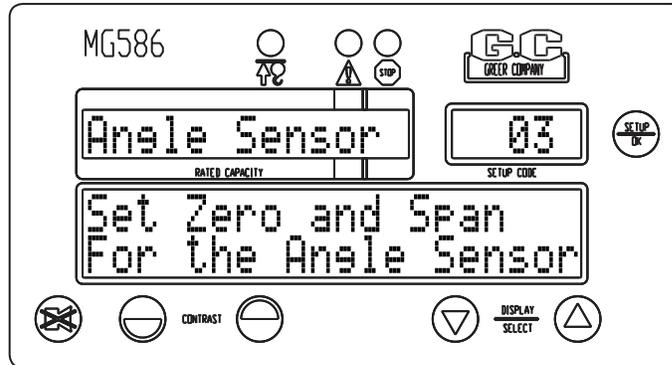
### Calibrating the Hoist Rope

- Follow the instructions provided on the screen, instructing the operator to move the boom to a high and low angle while fully telescoped in.
  - Measure the shortest distance from the boom pivot to the hoist rope. This can be done by placing one end of the tape on the pivot and arcing the tape to find the shortest distance.
  - The dimensions entered are "High Angle W" and "Low Angle W." Refer to Appendix C for previously recorded measurements.
7. Head Shv. Rad
  8. RopeLim (may be located on the crane's rope and reeving load chart)
  9. Max POL (may be located on the crane's rope and reeving load chart)
  10. Max Ext (maximum boom extension allowed)
  11. Load Scale (a load multiplier, usually set to 1.0)
  12. Length Offset (display offset added to length)
  13. Retracted Length (retracted length of boom - Measure it!)

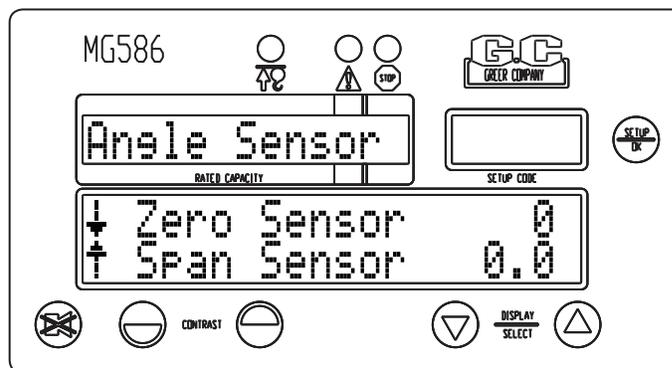


### 03 Angle Sensor

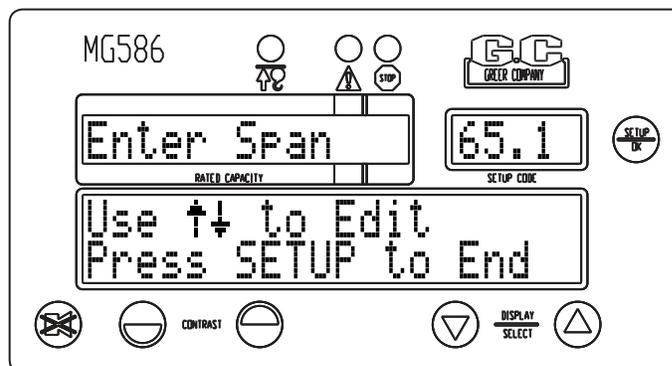
This routine is used to set the Zero and Span of the angle sensor.



1. Press the **SETUP/OK** key to enter the routine.
2. Position the boom at 0° and press the **DOWN ARROW** key. The angle sensor is now zeroed.



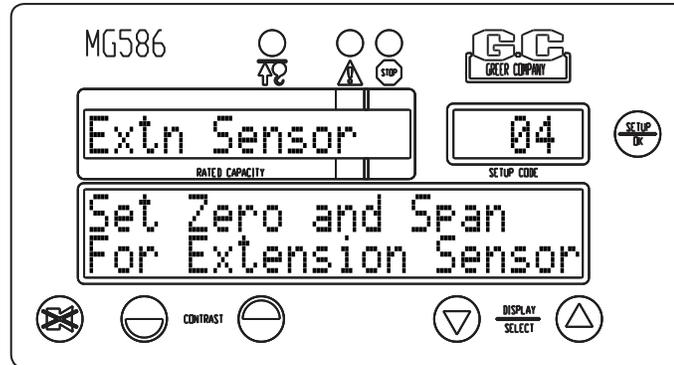
3. Raise the boom to an angle of 65-70° and measure the angle of the boom with an approved digital level or other instrument.
4. Press the **UP ARROW** key to set the angle span. Press either the **UP ARROW** or **DOWN ARROW** key to modify the displayed value and press the **SETUP/OK** key to enter the span.



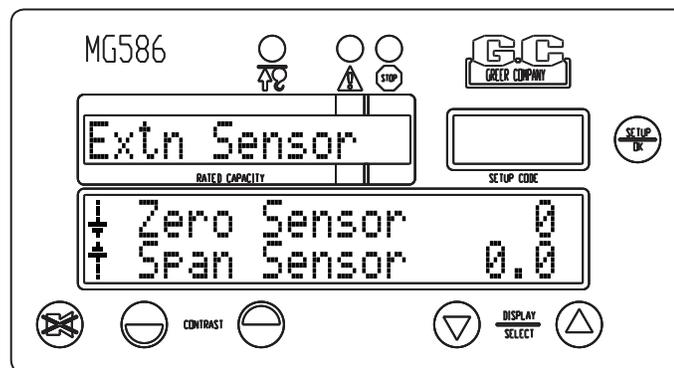
5. Press the **SETUP/OK** key again when finished to return to the main menu.

## 04 Extension Sensor

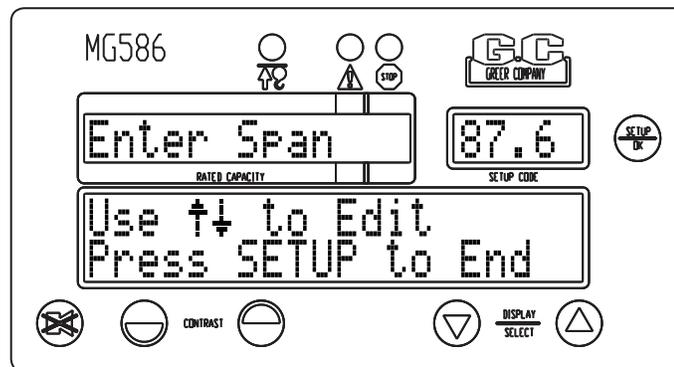
This routine is used to set the Zero and Span of the extension sensor.



1. Press the **SETUP/OK** key to enter the routine.
2. Fully retract the boom and press the **DOWN ARROW** key. The extension sensor is now zeroed.



3. Fully extend the boom and measure the length of the fully extended boom.
4. Press the **UP ARROW** key to set the extension span. Press either the **UP ARROW** or **DOWN ARROW** key to modify the displayed value and press the **SETUP/OK** key to enter the span.



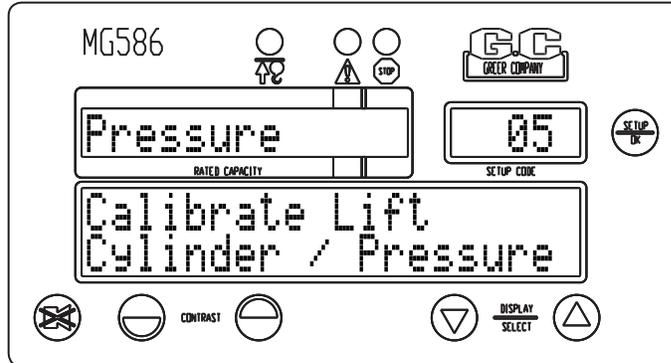
5. Press the **SETUP/OK** key again when finished to return to the main menu.

## 05 Pressure

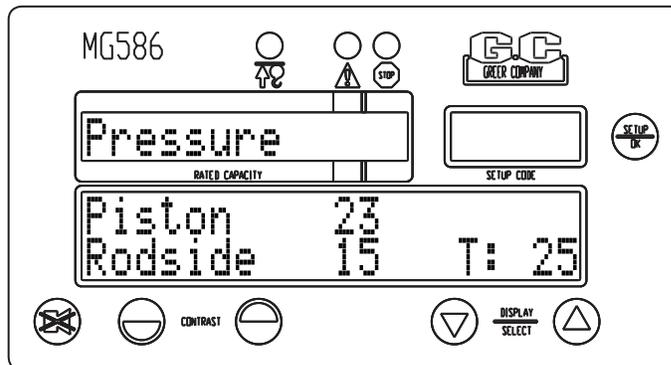
This routine uses a calibration load to compute the diameter of the hoist cylinder, if the diameter is already known or is easily measured, simply skip the calibration option and enter the value directly at the end of this routine.

### IMPORTANT!

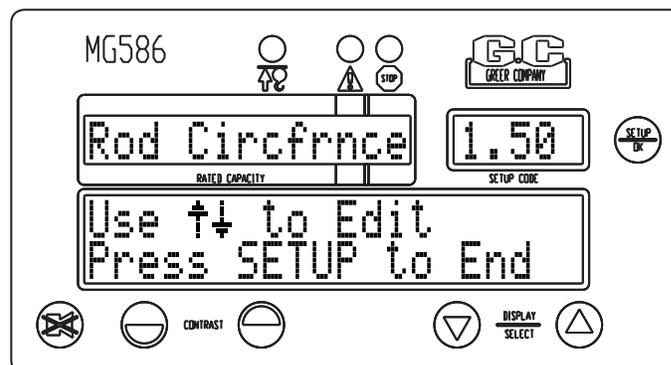
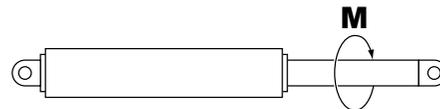
**THIS DIMENSION IS CRITICAL AND SHOULD BE MEASURED TO WITHIN 1/10TH INCH.**



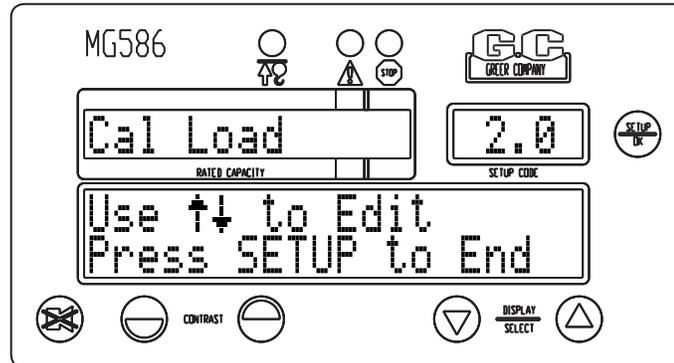
1. Press the **SETUP/OK** key to enter the routine.
2. Examine the piston and rod-side pressures. These should read positive numbers of approximately 20 to 3000 PSI with the boom slightly elevated. Press the **SETUP/OK** key to continue.



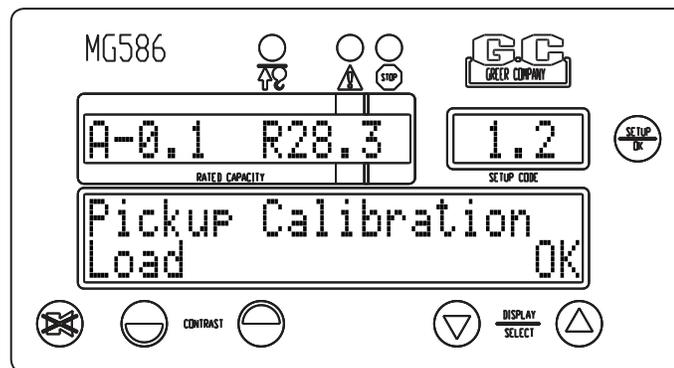
3. Enter the rod circumference recorded in Appendix C.



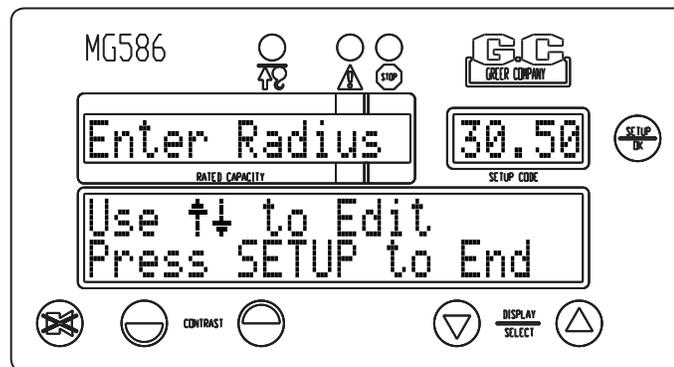
- Enter the weight of the calibration load including all shackles and hook weights. The load should be as large a mass as is safe for the crane to pick with the boom as far retracted as possible at an angle of approximately 60°. If only small test loads are available, use a longer boom length and possibly a little lower boom angle to induce more pressure in the cylinder base.



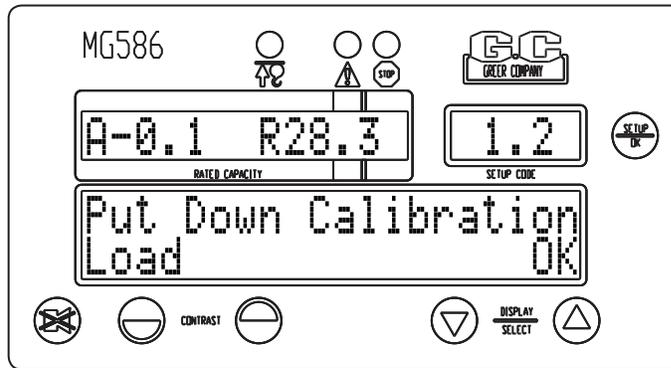
- Pick up the calibration load and hold it steady to settle any pressure fluctuations. Press "OK" (**UP ARROW** key) to continue.



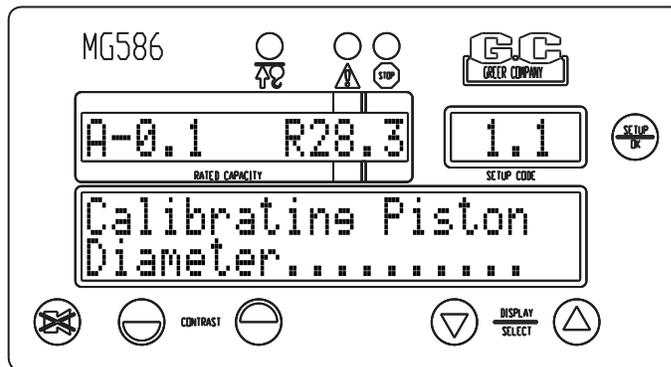
- Measure the radius of the suspended load. Press either the **UP ARROW** or **DOWN ARROW** key to modify the displayed value and press the **SETUP/OK** key to enter the radius.



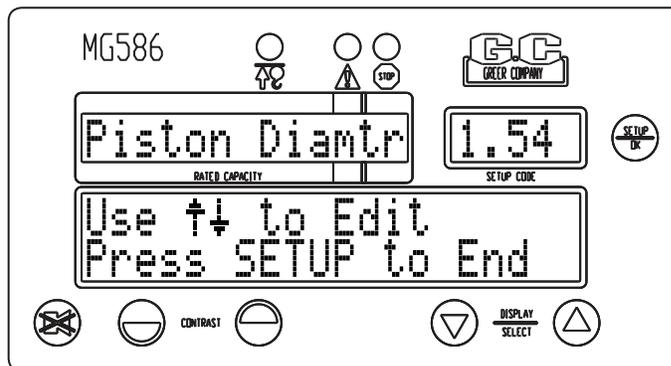
- Set down the calibration load, allow it to settle, and then confirm the weight. Press "OK" (**UP ARROW** key) to continue.



- The computer will then calibrate the piston diameter.



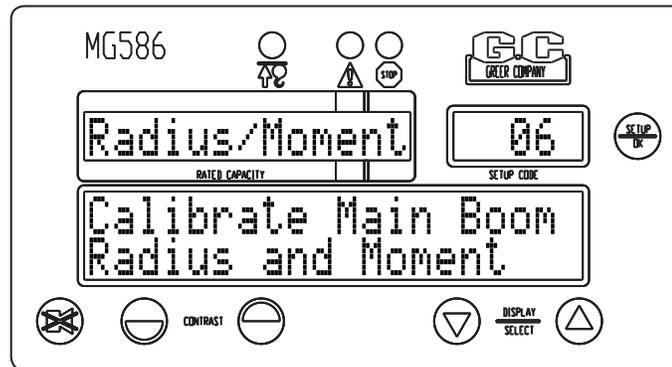
- If the piston diameter was known prior to entering the routine, enter the value. Press either the **UP ARROW** or **DOWN ARROW** key to modify the displayed value and press the **SETUP/OK** key to enter the diameter.



- Press the **SETUP/OK** key to exit and return to the main menu, and then press the **CANCEL** key to return to normal operating mode.
- Pick up the weight again. Check that the displayed load rises by the correct amount.
- Reenter the Calibration Mode and adjust, as appropriate.

## 06 Radius/Moment

This routine calibrates the natural moment and radius of the boom, taking into account its deflection under its own weight.



### **⚠WARNING**

**MAKE SURE THE CRANE IS SET UP IN ACCORDANCE WITH THE MANUFACTURER'S OPERATION MANUAL FOR MAXIMUM STABILITY. ENSURE THAT ALL BOOM EXTENSIONS AND LOADS LIFTED ARE WITHIN THE APPROPRIATE LOAD CHARTS AND LIMITS. FAILURE TO COMPLY WITH MANUFACTURER'S LIMITS MAY RESULT IN SERIOUS INJURY OR DEATH.**

### **IMPORTANT!**

**MAIN BOOM CALIBRATION IS NOT RECOMMENDED WITH STOWED OR ERECTED ATTACHMENTS ON THE UNIT. MAKE SURE TO REMOVE AND STOWED ATTACHMENTS FROM THE MAIN BOOM BEFORE CONTINUING.**

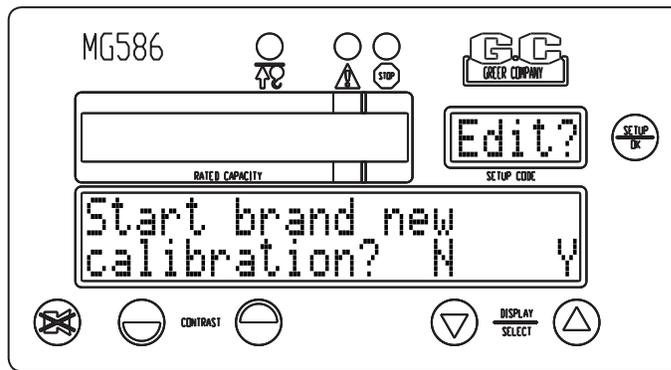
Up to seven points may be stored and must include: 1) boom fully retracted and, 2) boom fully extended. Intermediate points should include individual boom sections extended and/or other individual boom sections that stop telescoping as the boom is extended. Some booms will exhibit a deflection or droop when nearing full extension. This may be due to the design and fitting of wear pads inside the boom, which allows sections to hang on each other when nearing full extension. Though this has little effect on main boom radius accuracy, the radius of a fly or jib may be still be affected. Therefore it is essential to add an extra calibration point at 90% of the boom extension.

For each extension calibration, the system requires a stable measurement of the moment (taken from its own pressure sensors) and radius (taken from manual measurements from the center of rotation, to the center of the load) at both high and low boom angles. Select angles of between 60° and 70° for high boom angles, and as close to zero degrees as possible for low boom angles. Take care to accurately measure the radius at each calibration point. Using a single part of line will aid in this.

The routine can be exited at any time by pressing the **CANCEL** key.

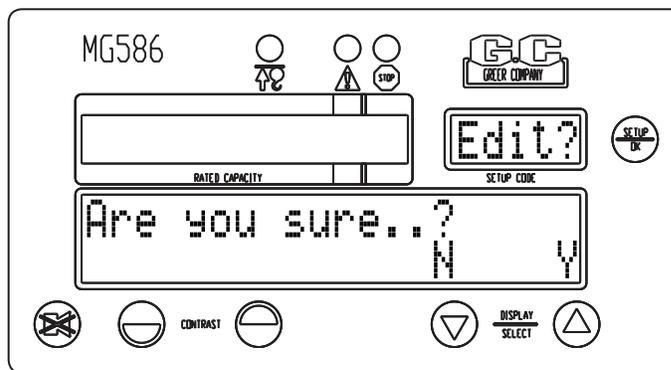
**USE THE SPACE PROVIDED IN APPENDIX C TO RECORD THE MEASUREMENTS.**

Press the **SETUP/OK** key to enter the routine.



To start a new calibration, press “Y” (**UP ARROW** key), otherwise press “N” (**DOWN ARROW** key) to check an existing calibration. If no is selected, you will be prompted for a boom length to calibrate. You may re-calibrate any boom length, by extending to that length and calibrating.

If “Yes” is pressed, you will be asked to confirm your request. Press “Y” (**UP ARROW** key) to continue.

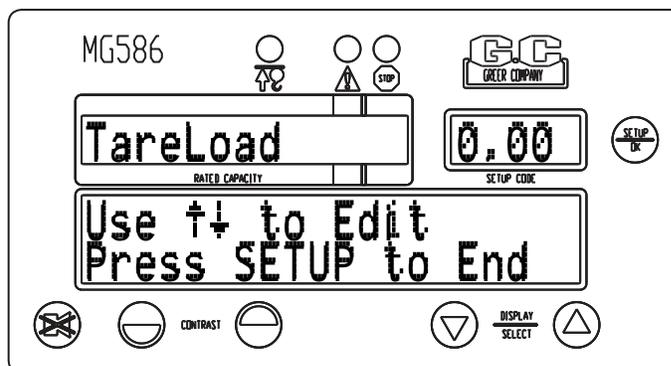


### IMPORTANT!

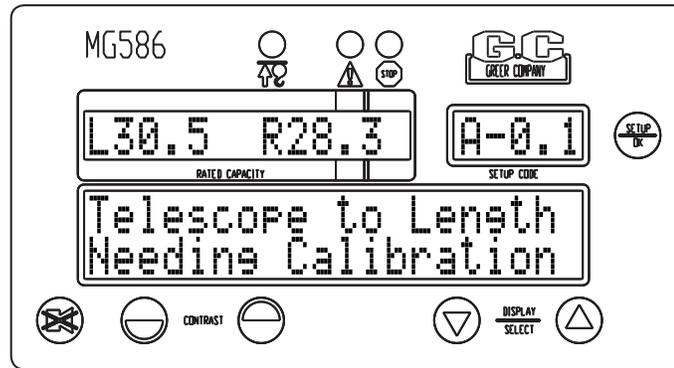
**SELECTING “YES” WILL START A NEW RADIUS MOMENT CALIBRATION AND ALL EXISTING DATA WILL BE ERASSED.**

Follow the instructions for each length/calibration point:

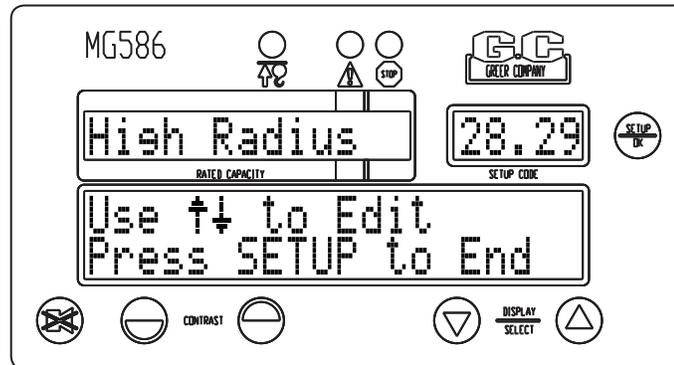
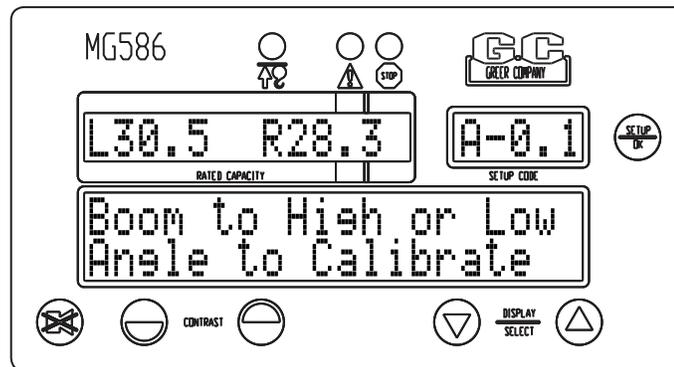
1. Enter the tare load (the only weight should be that of the hook block; if there is a block hanging, add this to the tare). Also, the unit must be configured with a single part line. When entering the tare load in the calibration routine, adding 100 pounds (0.1) to the actual weight will help guarantee a slightly positive load reading in all operating configurations.



- Telescope to the desired length.



- Boom to a high or low angle. Always check the computer to ensure that the angle is identified as a "high" or "low" angle. If the display has indicated a different setting, use the **UP ARROW** key to change to "high" angle, or the **DOWN ARROW** key to change to "low" angle.



- Measure and enter the radius. Press either the **UP ARROW** or **DOWN ARROW** key to modify the displayed value and press the **SETUP/OK** key to enter the diameter. Allow the boom bounce to settle, and then move on.
- Boom to the next angle. Measure and enter the radius.

- Confirm the calibration. Press “Y” (**UP ARROW** key) to store the calibration point, otherwise press “N” (**DOWN ARROW** key) to correct any errors.

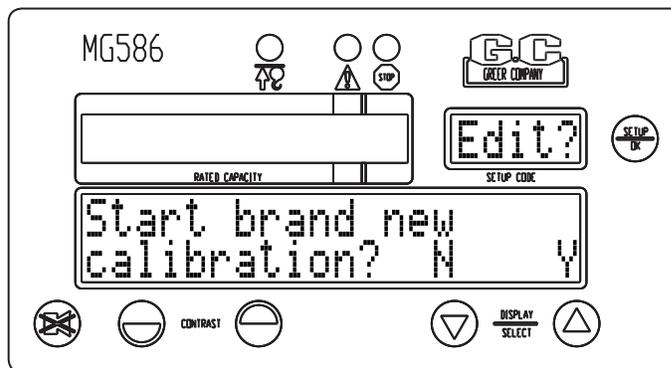


To restart a calibration length, press the **CANCEL** key.

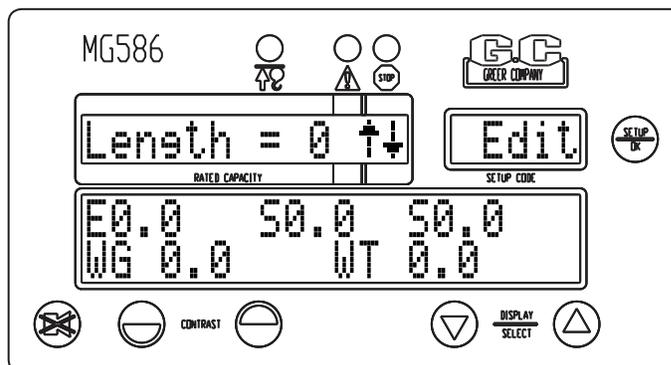
Calibrated lengths are stored in personality memory. To re-enter a single length, restart the radius/moment routine. Select “No” for a single length. Select “yes” for a brand new calibration.

The boom parameters computed during a radius/moment calibration can be entered manually or adjusted using the “EDIT” function available when first entering the routine.

- Press the **SETUP/OK** key to edit the boom parameters manually.



- Press either the **UP ARROW** or **DOWN ARROW** key to change the boom configuration point.
- Press the setup/ok key to enter the information for that point.



- Enter the required values when prompted.
- Press either the **UP ARROW** or **DOWN ARROW** key to change to the next boom configuration point.
- Continue until you have entered the required values for all boom configuration points.
- Press the **CANCEL** key when finished.

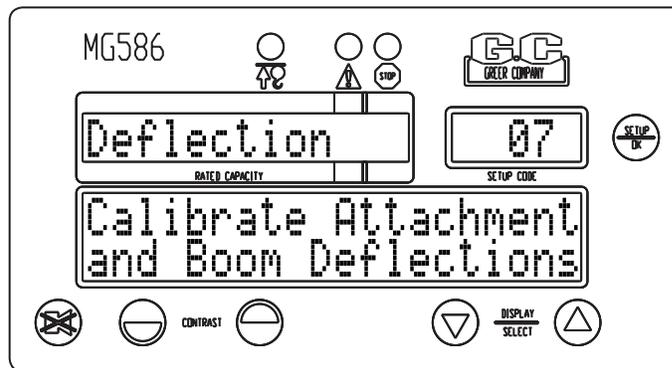
## TIP

After saving this calibration point, the system will be showing the proper hook weight and working with the corrected radius. You can boom up to 45° and recheck the radius (45° is probably the worst case angle, so if the radius still checks good here you can move on to the next point with confidence).

Continue until all boom length points have been entered. When finished, press the **CANCEL** key. After calibrating the radius moment, reenter the radius moment routine, and select "N" (**DOWN ARROW** key) when prompted to start a new calibration. This will take you to an edit screen and will enable you to view the data for each boom length calibrated. Writing these numbers down will save time should the calibration data be lost for any reason (refer to Appendix C to record values).

## 07 Deflection

This routine is used to quantify the amount that a boom or attachment bends, or deflects under load. The boom has its own bending factor called “F.” Each jib combination can have its own independent “F” value. Before entering the routine, the display will show the angle of the boom head under no load and under the current load.



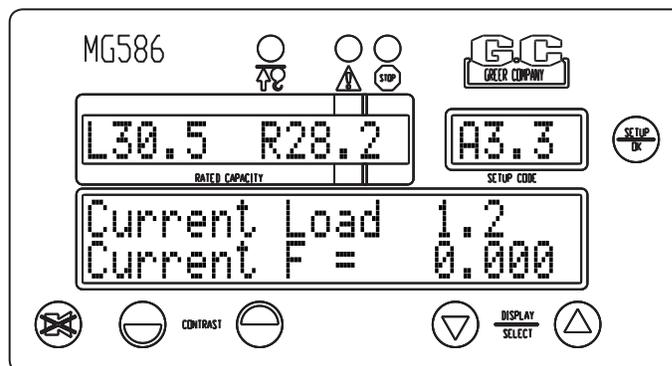
### ⚠WARNING

**MAKE SURE THE CRANE IS SET UP IN ACCORDANCE WITH THE MANUFACTURER'S OPERATION MANUAL FOR MAXIMUM STABILITY. ENSURE THAT ALL BOOM EXTENSIONS AND LOADS LIFTED ARE WITHIN THE APPROPRIATE LOAD CHARTS AND LIMITS. FAILURE TO COMPLY WITH MANUFACTURER'S LIMITS MAY RESULT IN SERIOUS INJURY OR DEATH.**

### IMPORTANT!

**MAKE SURE THAT THE CRANE IS CONFIGURED TO PICK OFF THE MAIN BOOM AND THAT THERE ARE NO ERECTED AND UNUSED ATTACHMENTS.**

1. Fully extend the boom at a high angle of greater than 60 ° and lift a suitable calibration load. The load should induce significant deflection in the boom.
2. Press the **SETUP/OK** key.

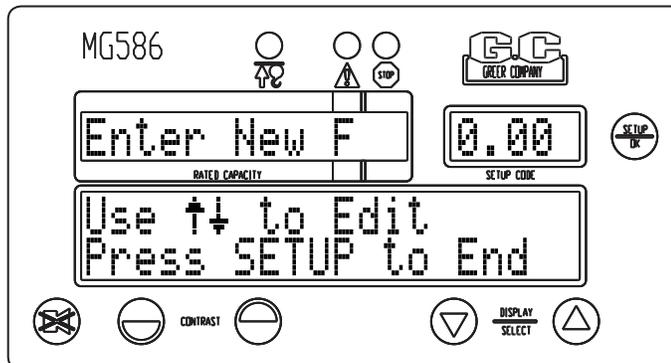


3. Measure the loaded main boom radius. Press the **SETUP/OK** key and enter the radius value. Press either the **UP ARROW** or **DOWN ARROW** key to modify the displayed value and press the **SETUP/OK** key to enter the radius. It is a good idea to add 0.1 ft to the radius when entering the radius in the calibration for boom deflection. This will help ensure a slightly positive radius in most operating conditions.
4. Check that the new displayed radius matches (or slightly exceeds) the actual measured radius.

5. Press either the up arrow key or the down arrow key to edit the “F” number manually without entering a radius; this is useful to trim the BDC up or down a bit. Press either the **UP ARROW** or **DOWN ARROW** key to modify the displayed value and press the **SETUP/OK** key to enter the “F” number.

**IMPORTANT!**

**THIS NUMBER IS GENERATED BY THE SYSTEM DURING THE PROCEDURE AND SHOULD NOT BE ENTERED MANUALLY WITHOUT EXPRESS PERMISSION FROM THE MANUFACTURER.**

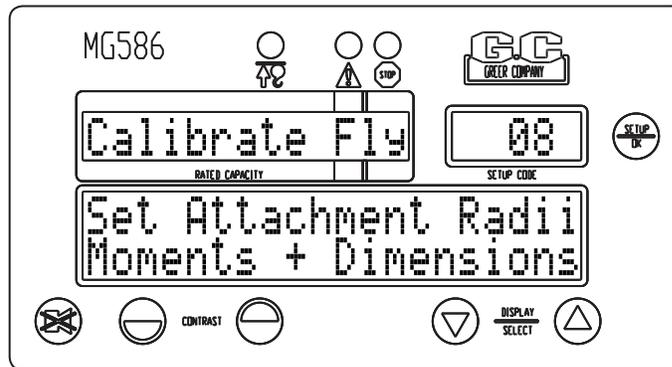


6. Press the **CANCEL** key to exit the routine.

Ensure that the main boom calibrations have been completed (refer to section “Preliminary Checks and Measurements” on page 11) and boom functions have been thoroughly tested before calibrating the attachments (refer to section “08 Calibrate Fly” on page 38). These actions are essential for the collection of good calibration data. Use the worksheet in Appendix C to record test results for lifts.

## 08 Calibrate Fly

This routine is used to perform a calibration on each jib configuration. The “edit” option can be used to manually enter pre-calibrated data. This option assists in trimming an existing calibration.

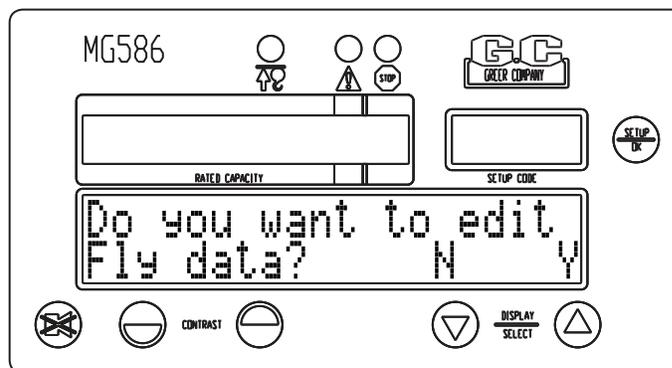


### ⚠WARNING

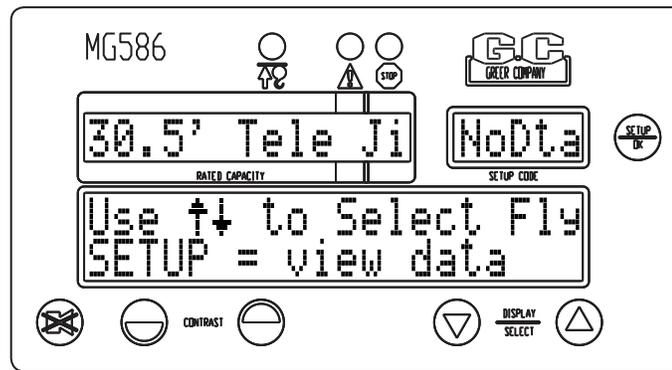
**MAKE SURE THE CRANE IS SET UP IN ACCORDANCE WITH THE MANUFACTURER'S OPERATION MANUAL FOR MAXIMUM STABILITY. ENSURE THAT ALL BOOM EXTENSIONS AND LOADS LIFTED ARE WITHIN THE APPROPRIATE LOAD CHARTS AND LIMITS. FAILURE TO COMPLY WITH MANUFACTURER'S LIMITS MAY RESULT IN SERIOUS INJURY OR DEATH.**

For each fly/jib combination, the system must gather data about the jib moment (through the pressure sensors) and the jib radius contribution (through the engineer's radius measurements). Data must be gathered at high and low angles and for a retracted and extended main boom for EACH configuration.

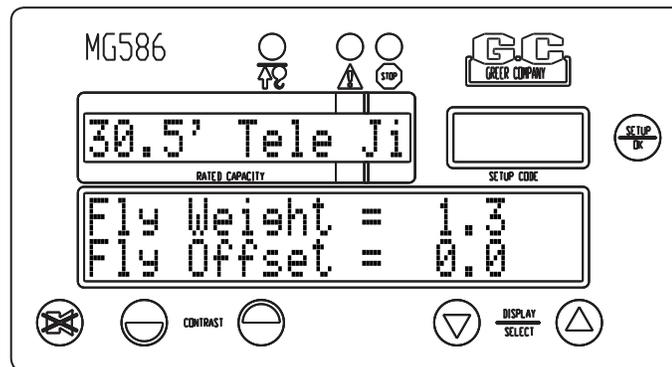
1. Make sure that the crane is configured to be picking off the jib to be calibrated.
2. Press the **SETUP/OK** key to enter the routine.
3. The system will prompt you to edit the data for the selected fly. Select “N” (**DOWN ARROW** key) and continue to step 10 to calibrate the selected fly, otherwise, select “Y” (**UP ARROW** key) and continue to step 4 to enter the data for the selected fly.



4. Press the **SETUP/OK** key to edit the data for the selected fly.



5. Press the **SETUP/OK** key again to enter the data. If jib data is known, it is okay to enter it. If not the system will calibrate the length, weight of jib, etc.



6. Enter the weight of the fly (in tenths of pounds). Press either the **UP ARROW** or **DOWN ARROW** key to modify the displayed value and press the **SETUP/OK** key to enter the weight. Enter the offset of the selected fly. Press either the **UP ARROW** or **DOWN ARROW** key to modify the displayed value and press the **SETUP/OK** key to enter the offset.
7. Press the **UP ARROW** key to select the next group of data to enter and press the **SETUP/OK** key. Enter the remaining data as described previously. When all the data has been entered, press the **CANCEL** key to return to the main menu.
8. At the main menu, press the **SETUP/OK** key to enter the routine. When prompted to edit the fly data, select "N" (**DOWN ARROW** key) to enter the calibration data.
9. Enter the main hook weight (in thousandths of pounds) if there is an unused hook picking off the main boom; otherwise enter 0.0. Press either the **UP ARROW** or **DOWN ARROW** key to modify the displayed value and press the **SETUP/OK** key to enter the weight.
10. Enter the weight of the fly hook (in thousandths of pounds) and any other shackles and rope weights suspended from the fly pick point. Press either the **UP ARROW** or **DOWN ARROW** key to modify the displayed value and press the **SETUP/OK** key to enter the weight.
11. Follow the on-screen prompts to position the boom (fully retracted low angle, fully retracted high angle, fully extended high angle, fully extended low angle). After the boom is positioned, let it settle for several seconds, then, measure and enter the radius. After the four points are finished, the system will store the calibrated values and exit.
12. Check the validity of the calibration with a test load before moving to the next jib combination.

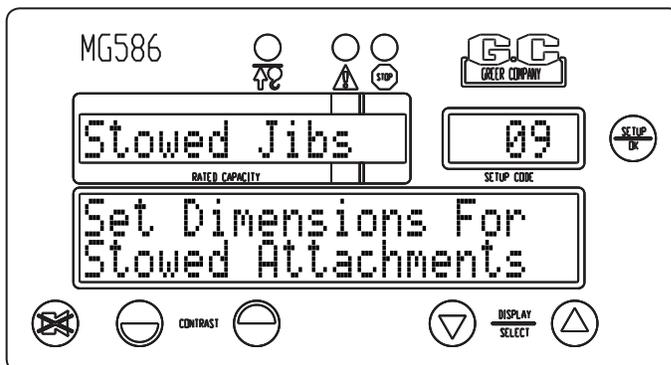
Upon completion of a jib calibration, record the test results on the worksheet in Appendix C.

## 09 Stowed Jibs

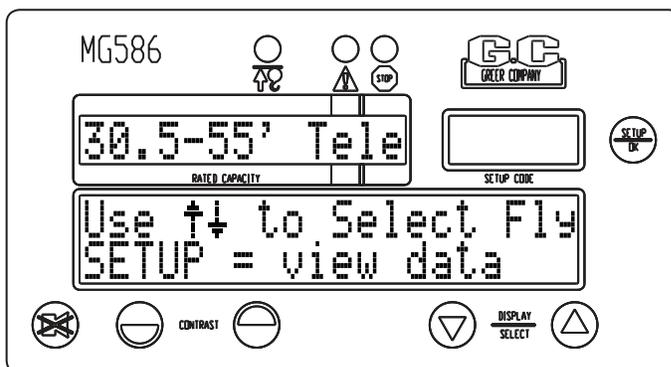
This routine is used to enter data for stowed attachments.

### IMPORTANT!

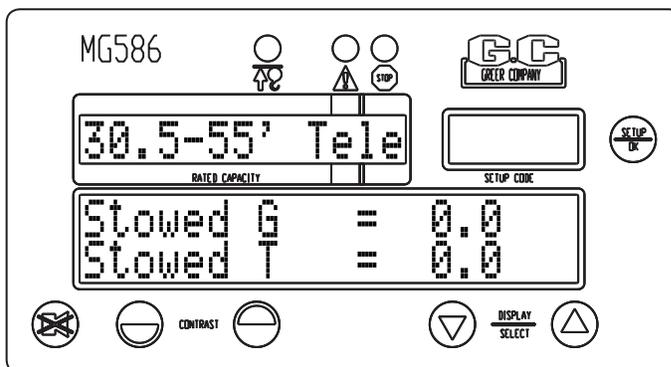
**THIS INFORMATION SHOULD BE ENTERED BEFORE PERFORMING A MAIN BOOM RADIUS/  
MOMENT CALIBRATION, IF IT IS TO BE CALIBRATED WITH A STOWED ATTACHMENT.**



1. Press the setup/ok key to enter the routine.



2. Press the **SETUP/OK** key to edit the data for the selected jib.



3. Press the **SETUP/OK** key again to enter the data.
4. Enter the center point (stowed G) of the jib. Use the data recorded in Appendix C. Press either the **UP ARROW** or **DOWN ARROW** key to modify the displayed value and press the **SETUP/OK** key to enter the dimension. Enter the offset (stowed T) of the selected jib. Use the data recorded in Appendix C. Press either the **UP ARROW** or **DOWN ARROW** key to modify the displayed value and press the **SETUP/OK** key to enter the offset.

5. Press the **UP ARROW** key to select the next group of data to enter and press the **SETUP/OK** key. Enter the remaining data as described previously. When all the data has been entered, press the **CANCEL** key to return to the main menu.

Notes:

Stowed G – Balance the jib on the hook to find the center point. Compute the distance from the boom pivot to this center point when jib is stowed. As an approximation, use the halfway point along the jib.

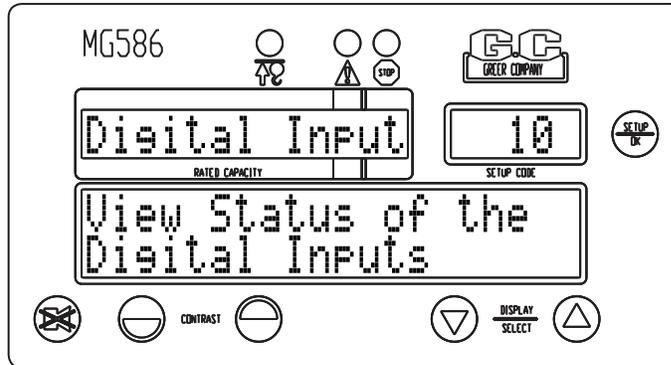
Stowed T – Measure from the boom pivot to the centerline of the jib when stowed, which should be a few inches. The number will be negative if the jib centerline is above the boom pivot (most likely).

Stowed Deduction – Data should be written on the chart or cab plate.

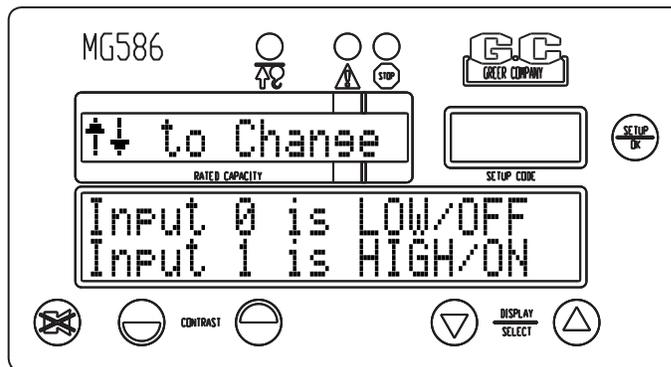
Jib Weight – Use the data gathered during the erected attachment calibration. Refer to the “Edit” function in 08 Calibrate Fly on page 38.

## 10 Digital Input

This routine shows the status of digital inputs and outputs.



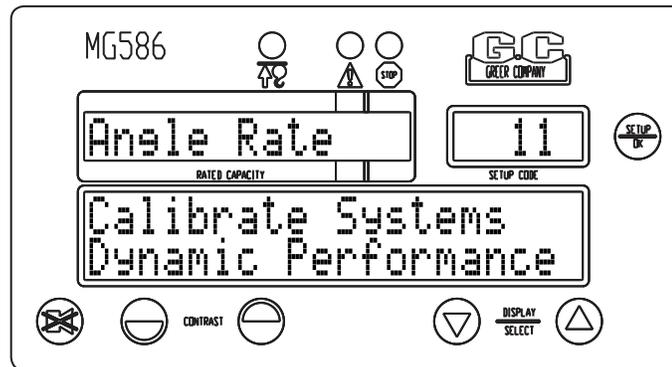
1. Press the **SETUP/OK** key to enter the routine.



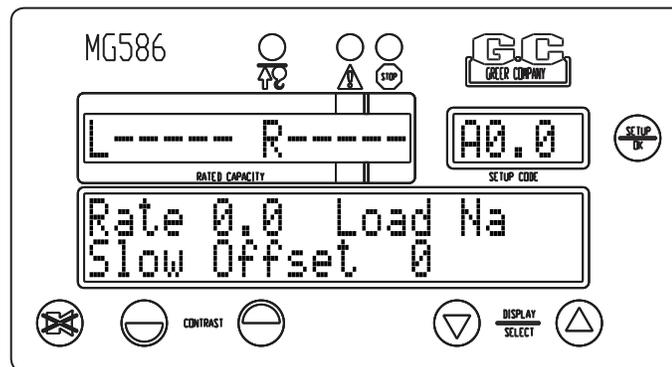
2. Press the **UP ARROW** key or **DOWN ARROW** key to view the status of the inputs.

## 11 Angle Rate

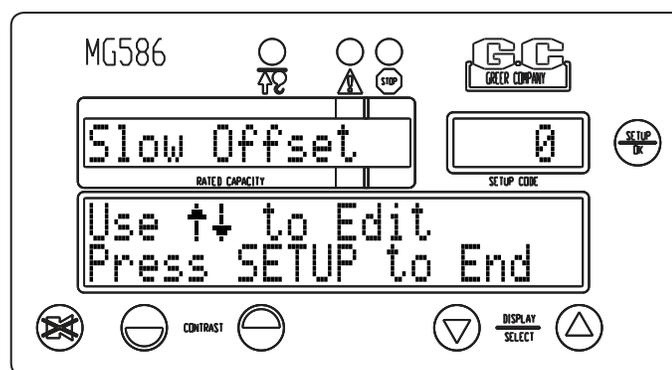
Often loads will change drastically when booming down. This routine compensates for this type of change. Two compensation speeds are allowed: "Slow" rate compensation and "Fast" rate compensation. The "Actual" rate of boom movement is also displayed in this routine.



1. Press the **SETUP/OK** key to enter the routine.
2. Press either the **UP ARROW** key or the **DOWN ARROW** key to select the desired compensation rate and then press the **SETUP/OK** key to edit.



3. Press either the **UP ARROW** key or the **DOWN ARROW** key to select the desired compensation rate and then press the **SETUP/OK** key to enter the compensation rate.



4. Press either the **UP ARROW** key or the **DOWN ARROW** key to select the next compensation rate and repeat as previously stated to enter the data.
5. Press the **CANCEL** key to exit the routine.

Note: "Compensation ONLY" switches in when booming down. The word "BUMP" appearing on the screen indicates that the machine was handled in a rough manner and an additional bump filter was switched in to try and remove the pressure spikes.

# Appendix A - Troubleshooting

## System Fault Messages

When the system detects a fault, the red warning lamp will illuminate and the message, "WARNING: SYSTEM FAULT" will flash on the display. When a more serious fault is detected, the message, "WARNING: SYSTEM OUT OF SERVICE" will flash.

To determine the fault, press the **UP ARROW** or **DOWN ARROW** key once or twice. The information window will display the related fault message. This message will appear for up to 20 seconds before the display returns to its normal display mode. If the **UP ARROW** or **DOWN ARROW** key is pressed before the 20 seconds have elapsed, the display will automatically return to its normal display mode.

Fault messages that can appear on the display and the required corrective action follow:

Fault Message	Corrective Action
Reselect Crane Setup	This message indicates that there is an error in the crane setup selection, or there is an internal computer fault. Reselect the correct crane setup code; the error should correct itself. If not, replace the computer. Refer to "Computer Replacement" on page A-3.
Check Extension	This message indicates a problem with the boom extension sensor. <ol style="list-style-type: none"><li data-bbox="919 974 1484 1079">1. Inspect/check cabling and connections from computer to extension reel on the side of the boom.</li><li data-bbox="919 1100 1484 1163">2. Inspect/check the extension reel-off cable for damage.</li><li data-bbox="919 1184 1513 1268">3. Refer to "03 Angle Sensor" on page 26 and "04 Extension Sensor" on page 27.</li><li data-bbox="919 1289 1507 1394">4. Remove the extension reel cover to verify operation of the extension reel. Refer to "Extension Reel Voltage Checks" on page A-4.</li></ol>
Check Angle	This message indicates a problem with the boom angle sensor. <ol style="list-style-type: none"><li data-bbox="919 1499 1484 1604">1. Inspect/check cabling and connections from computer to extension reel on the side of the boom.</li><li data-bbox="919 1625 1419 1667">2. Refer to "03 Angle Sensor" on page 26.</li><li data-bbox="919 1688 1451 1791">3. Remove the extension reel cover to verify operation of the extension reel. Refer to "Extension Reel Voltage Checks" on page A-4.</li></ol>

Fault Message	Corrective Action
Check ATB Wiring	<p>This message indicates an anti two-block wiring problem usually due to an electrical short to the boom or a damaged cable.</p> <ol style="list-style-type: none"> <li>1. Inspect/check cabling and connections from computer to extension reel on the side of the boom.</li> <li>2. Inspect/check reel-off cable from extension reel to boom tip and Anti Two-Block switch connections.</li> <li>3. Verify electrical signals for the two-block drive and signal within the extension reel. Refer to "Extension Reel Voltage Checks" on page A-4.</li> </ol>
Check FKO	<p>This message indicates a Function Kick-Out wiring problem that is usually caused by a fuse or crane circuit breaker failure. Remove the computer unit lid and check the 10A fuse.</p>
Replace System Chip	<p>This message indicates a problem with the system chip fitted inside the computer.</p> <ol style="list-style-type: none"> <li>1. Remove the computer lid and replace the system chip.</li> </ol> <p>Note: Use only proper chip insertion and removal tools to perform this operation. Never use a screwdriver.</p>
Replace the Computer	<p>This message indicates an internal fault in the computer. In some cases, it may not be necessary to replace the computer unit.</p> <ol style="list-style-type: none"> <li>1. Remove the computer unit lid and check the Internal LED status indicators located on the computer circuit board.</li> <li>2. Refer to "Computer Internal Status Indicators" on page B-1.</li> </ol>

## Computer Replacement

To remove the computer unit:

1. Place the boom in its rest.
2. Turn off electrical power.
3. Disconnect all electrical connectors from/to the computer.
4. Disconnect hydraulic hose connections from/to the computer.
5. Remove computer from mounting.

### **⚠WARNING**

**THE HYDRAULIC HOSES CONNECT DIRECTLY TO THE BOOM HOIST CYLINDER. DO NOT OPERATE THE CRANE UNLESS THE COMPUTER HAS BEEN PROPERLY REPLACED OR THE HYDRAULIC CONNECTIONS ARE PROPERLY CAPPED.**

To install a new computer unit:

1. Mount the computer unit.
2. Ensure that a new system chip has been supplied with the computer.  
Note: Do not use the system chip from the original computer unit.
3. Ensure that all electrical power is turned off.
4. Connect all electrical connectors to the computer unit.
5. Connect hydraulic hoses to the computer pressure ports. (Green is base-side and red is rod-side of the boom hoist cylinder.)
6. Follow the system setup instructions in this manual.

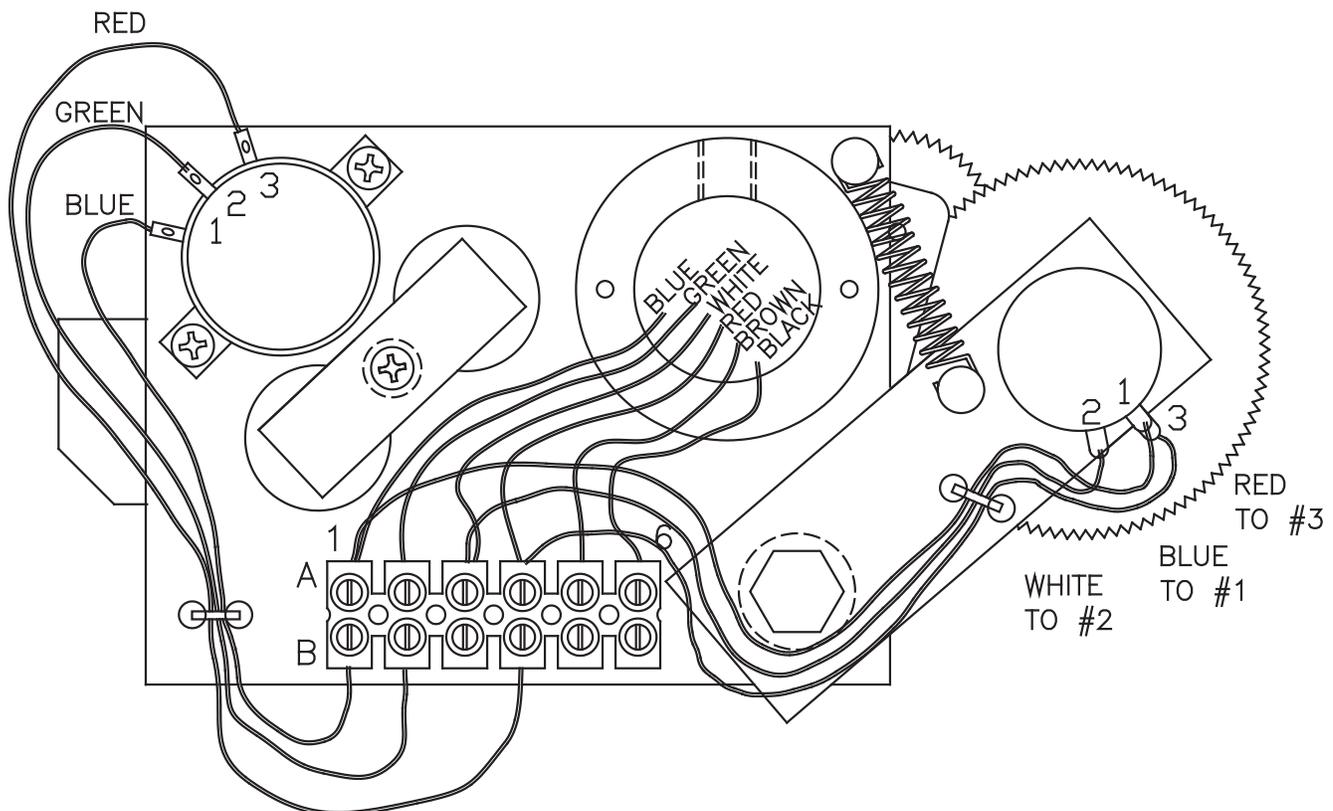
Note: If more than one fault is present, the most serious fault will appear first and must be resolved first. When the first fault is corrected, other existing faults will be displayed and must be resolved one at a time until no further fault codes are listed.

Fault messages should be reported to the Service Representative along with any noticeable damage done during System installation or routine checks. Please refer to Routine Checks and Maintenance in this manual.

## Extension Reel Voltage Checks

If problems occur with the two-block alarm operation, angle, or extension sensor, the following chart details voltage checks that may be made within the extension reel. Follow the action column before measuring voltages at the specified points in the voltmeter connection columns. Measure all voltages with a digital voltmeter set to DC volts range.

SIGNAL	BOOM POSITION/ ACTION	VOLTAGE		VOLTMETER CONNECTION	
		MIN	MAX	RED (+)	BLACK (-)
SENSOR DRIVE	-	+4.7V	+5.3V	TB1/4 - RED	TB1/1 - BLUE
ANGLE SEN- SOR OUTPUT	0 degrees	0.4V	0.6V	TB1/2 - GREEN	TB1/1 - BLUE
EXTENSION SENSOR OUT- PUT	0 ft. (0m) FULL RETRACTED	0.15V	0.35V	TB1/3 - WHITE	TB1/1 - BLUE
TWO-BLOCK DRIVE	A2B WEIGHT DOWN	5.5V	7.5V	TB1/6 - BLACK	TB1/1 - BLUE
	A2B WEIGHT UP	9.5V	10.5V	TB1/6 - BLACK	TB1/1 - BLUE
TWI-BLOCK SIGNAL	A2B WEIGHT DOWN	5.5V	7.5V	TB1/5 - BROWN	TB1/1 - BLUE
	A2B WEIGHT UP	0V	2V	TB1/5 - BROWN	TB1/1 - BLUE



### Notes:

Angle sensor output is set to 10% [1/10th] of sensor drive voltage with boom at zero degrees.

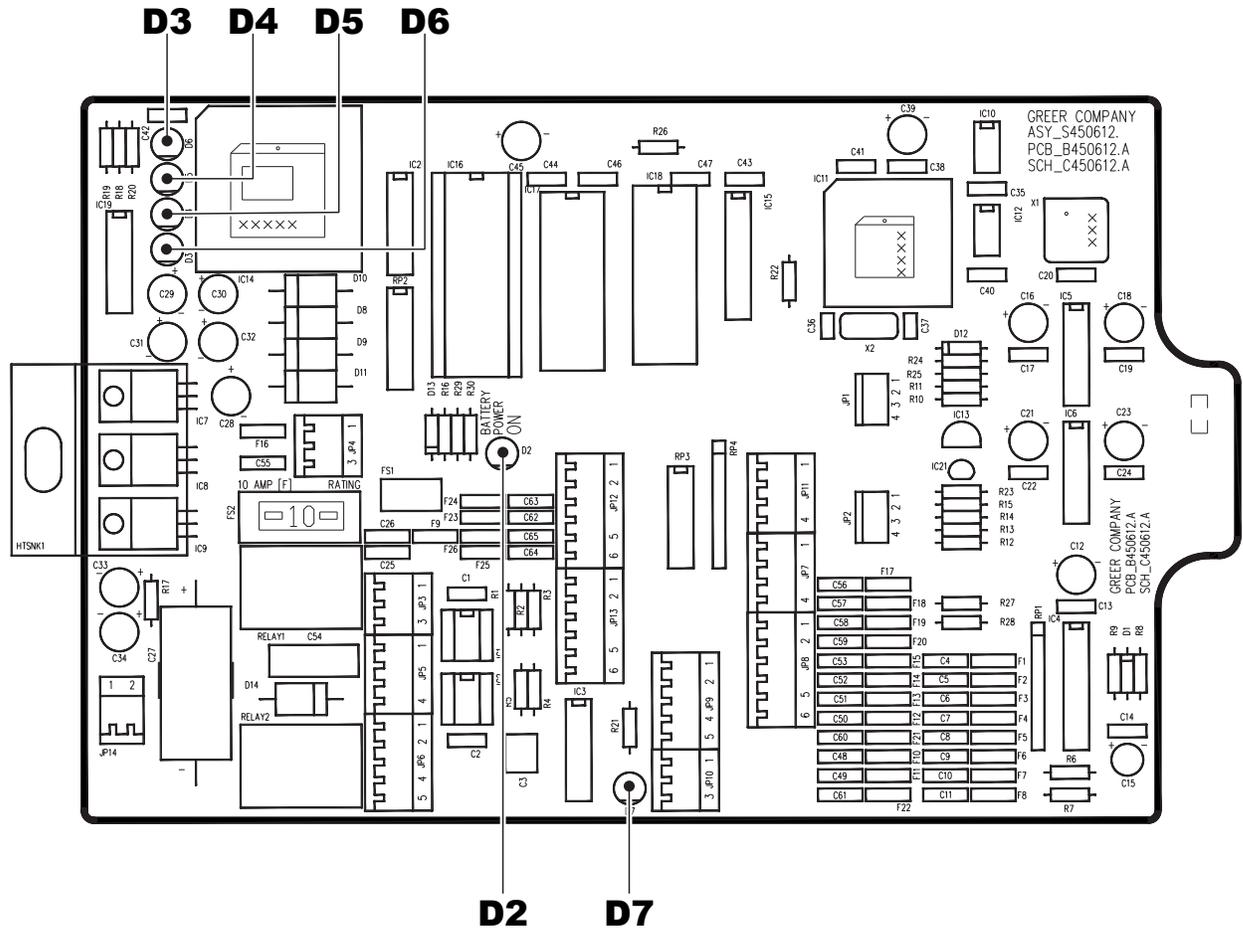
Extension sensor is set to 5% [1/20th] of sensor drive voltage with boom fully retracted.

# Appendix B - Computer Troubleshooting

## Computer Internal Status Indicators

The computer unit contains six LED indicators that provide an aid to checking presence of power supply voltages and communications between the computer and display console. There are five power indicators (D2 through D6) and one communications indicator (D7), all Indicators are bright green light emitting diodes.

With the exception of the communications indicator, all indicators should be illuminated at the same brightness level with the system power on. A missing or dimly lit indicator indicates a power supply problem.



LED Indicator	Function
D2	Battery Power
D3	+5V Analog Poser
D4	+5V Digital Power
D5	+10V Relay Drive Power
D6	Protected Machine Power
D7	Communication Indicator

## Power Indicator States and Actions

Power Indicator State	Corrective Action
All indicators OFF	Check power and ensure that PTO switch is properly engaged.
D2 ON but all other indicators OFF	Check display console cable and connection.
D5 OFF but all other indicators ON	Replace computer
D3, D4 and D7 OFF but all other indicators ON	Replace computer
D3 OFF but all other indicators ON	Check extension reel signal cable and internal voltages within extension reel.

## Communication Indicator

The Communication Indicator provides an indication of the success or otherwise of communication with the display console, and of the running state of the computer program.

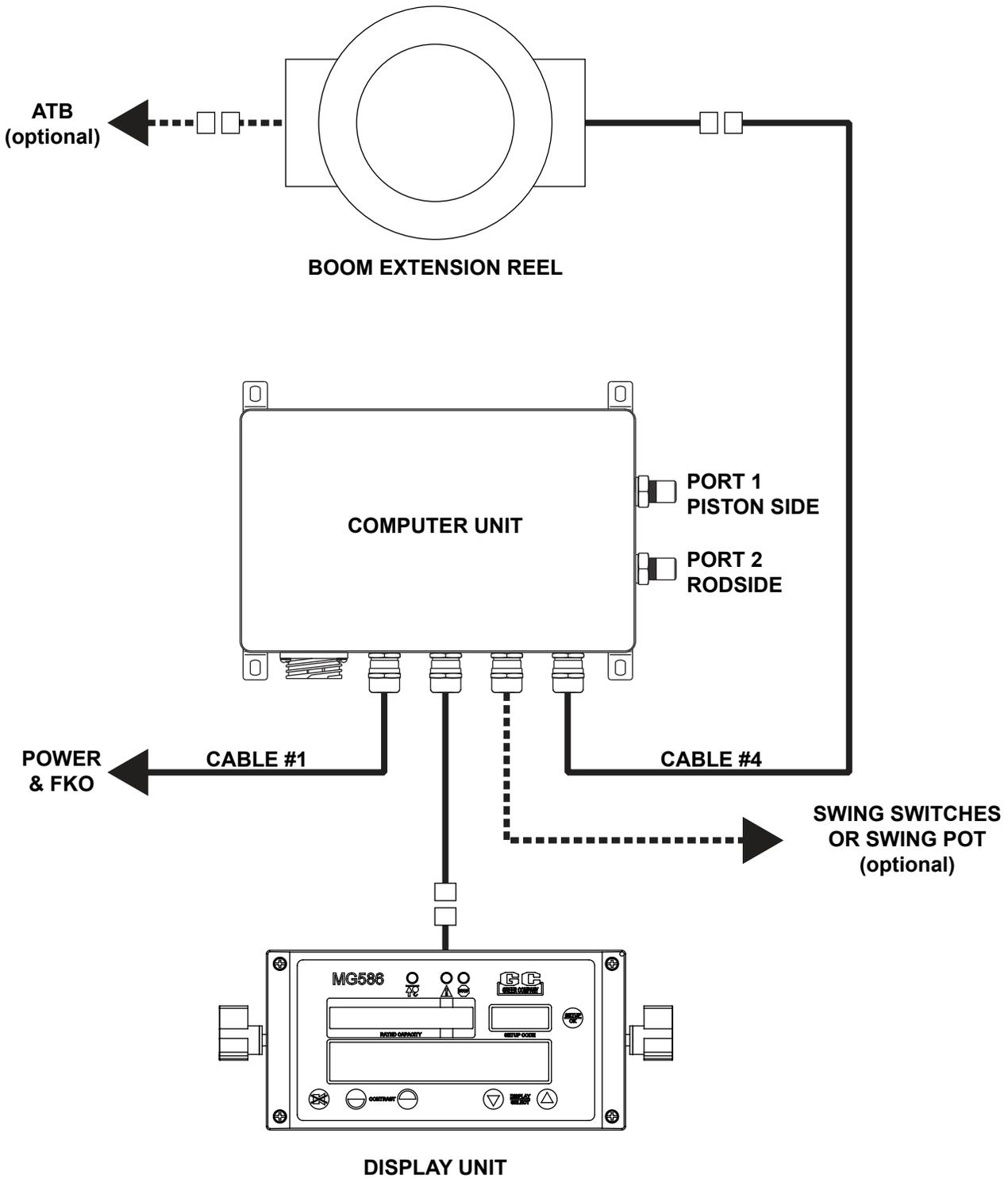
Carefully observe the Communication indicator and the display console at power on and through self-test, and then use the following chart to help decide the course of action.

Communication Indicator Indications At Power On	ACTION
From the moment the system power is applied, the COMM indicator does not illuminate. During and after the self-test period of eight seconds, the COMM indicator remains off.	The computer is not running. Check status indicators (D2 through D6). Try to reset the system by powering off and on again. Listen to the computer for the relays to click. If they do not click, replace the System Chip If not successful, replace the computer. If the relays do click, replace Communication chips IC1, 2.
From the moment the system power is applied, the COMM indicator does not illuminate. The display console, which never goes to normal, continually reads: "No Communication with MicroGuard."	Communication with the display has not been made. Is the display console connected? Check connector and cabling to the display console.
At the moment power is applied, the COMM indicator flashes briefly, then switches off. After a few seconds, the COMM indicator starts to flash at a fast rate and never stops.	This is the normal operation of the communication between the computer and display console.

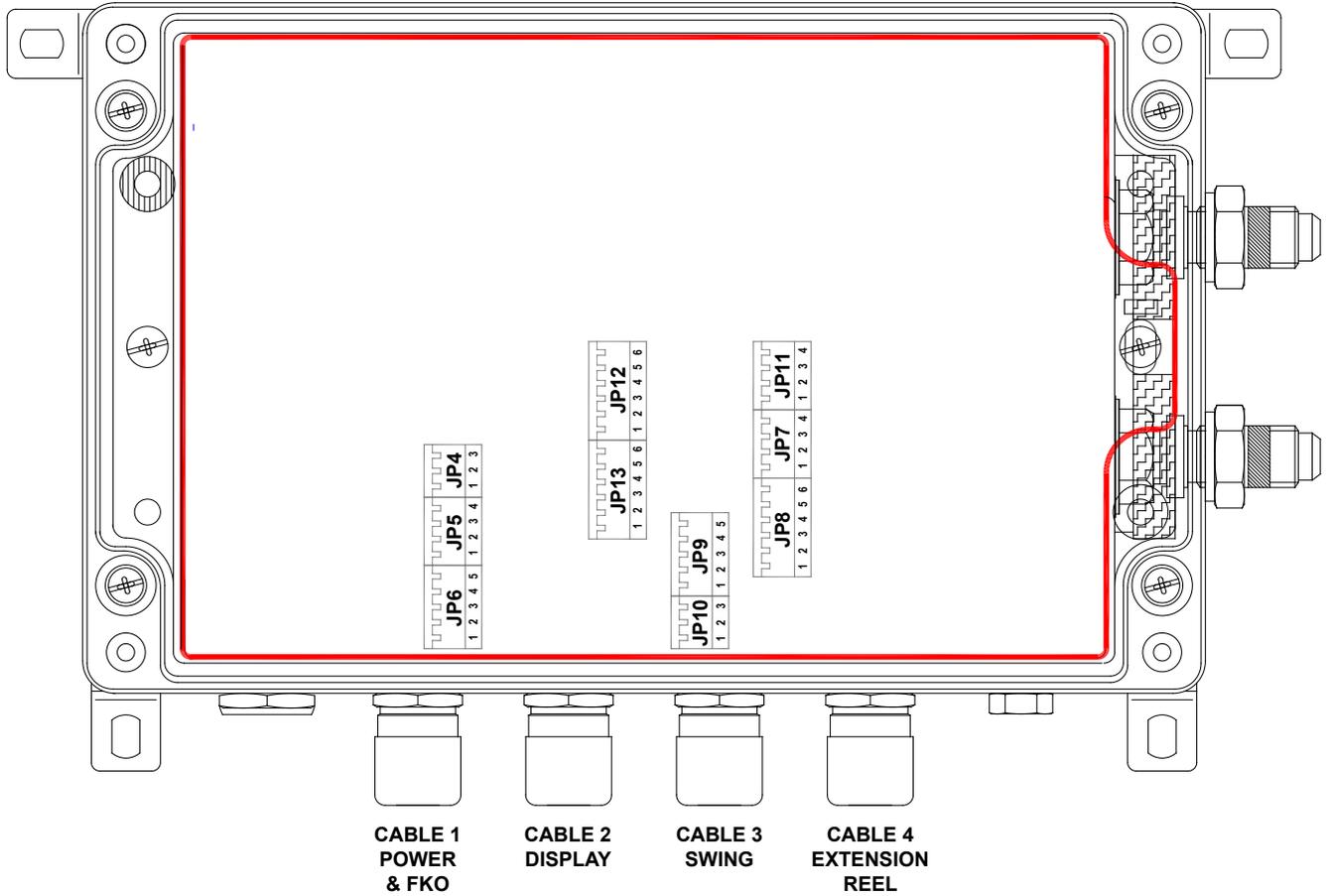
## Start-up Problems

Condition	Corrective Action
Display unit lights and alarms are flashing; the computer unit sounds as if it is buzzing.	<ul style="list-style-type: none"> <li>• Make sure the PTO is fully engaged.</li> </ul>
During system setup, it is not possible to adjust the angle sensor. The display shows “---”.	<ul style="list-style-type: none"> <li>• Make sure the extension reel is installed the correct way up.</li> <li>• Make sure the extension reel signal cable is correctly connected to the computer unit.</li> <li>• Check the extension reel voltages. Refer to “Extension Reel Voltage Checks” on page A-3.</li> </ul>
A few seconds after power up, the display shows “No communications with MicroGuard®” in the load display window.	<ul style="list-style-type: none"> <li>• Computer is possibly not running.</li> <li>• Check that the system program chip is correctly inserted.</li> <li>• Check that all LEDs within the computer are lit and that the communications LED (D6) is flashing; If not replace system chip.</li> <li>• Check the display cable for damage.</li> </ul>

# System Schematic



## Terminal Block Positions and Functions



CABLE 1: Power and FKO Connections		
Color	Function	Connection
Black	System Ground	JP3-1 (Battery -VE)
Red	System Power	JP3-2 (Battery +VE)
Jumper	System Supply	JP3-3 (Battery +VE)
	Power Feed to FKO Relays	JP5-1 (FKO In)
Green	FKO Output to Mach. Solenoids	JP5-2 (FKO Out)
	Not Used	JP5-3 (RLY3 NO)
	Not Used	JP5-4 (RLY3 NC)

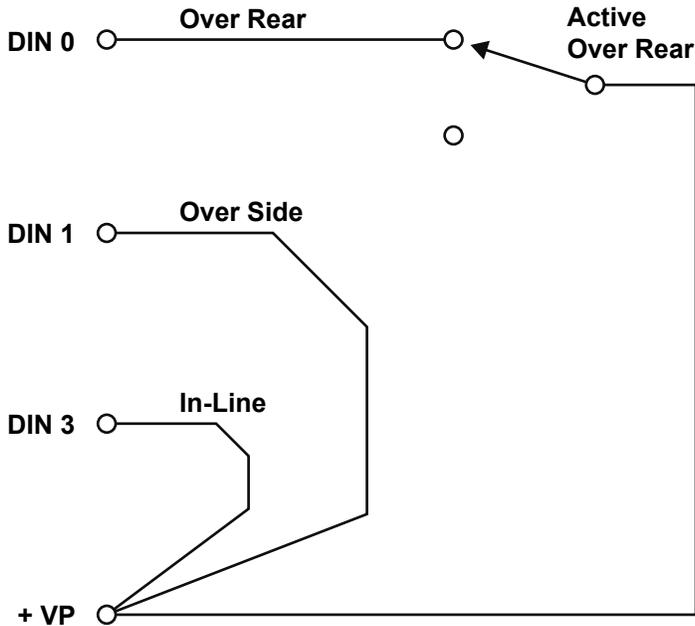
CABLE 2: Display Connections		
Color	Function	Connection
White	Communication A	JP12-1 (Display Data A)
Green	Communication B	JP12-2 (Display Data B)
Blue	Reset	JP12-3 (Reset)
Red/Yellow	+ Power	JP12-4 (DSPLY 1 PWR)
Black/Orange	- Power	JP12-5 (DSPLY 1 GND)

CABLE 2: Display Connections		
Color	Function	Connection
	Not Used	JP12-6 (DSPLY 1 GND)

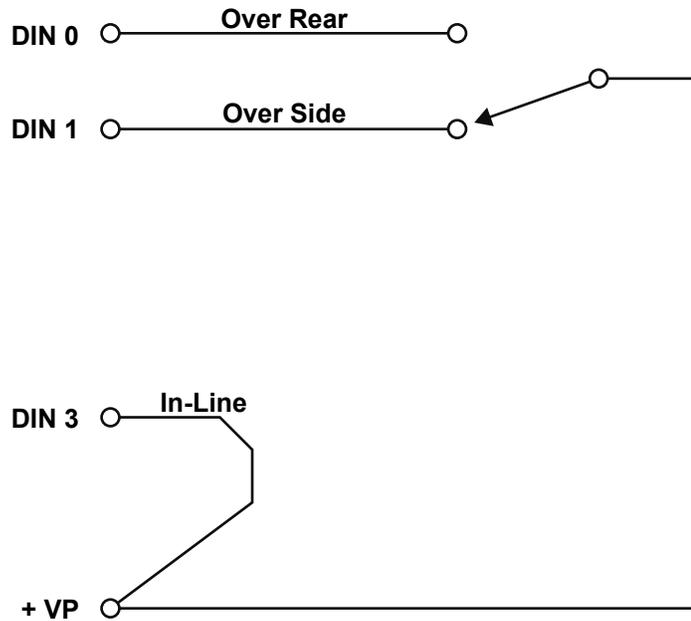
CABLE 3: Swing Connections		
Swing Switch Connections		
Color	Function	Connection
Green	Rear	JP9-1 (DIN0)
White	Side	JP9-2 (DIN1)
	Front	JP9-3 (DIN2)
Black	Bet. Tires in-Line Front/Rear	JP9-4 (DIN3)
Red	+VP	JP9-5 (SW PWR)
		JP10-1 (DIN4)
		JP10-2 (DIN5)
		JP10-3 (SW PWR)
Swing Pot Connections		
		JP11-1 (Positive Drive)
		JP11-2 (Negative Drive)
		JP11-3 (Swing Signal "A")
		JP11-4 (Swing Signal "B")

**Suggested Swing Connections**

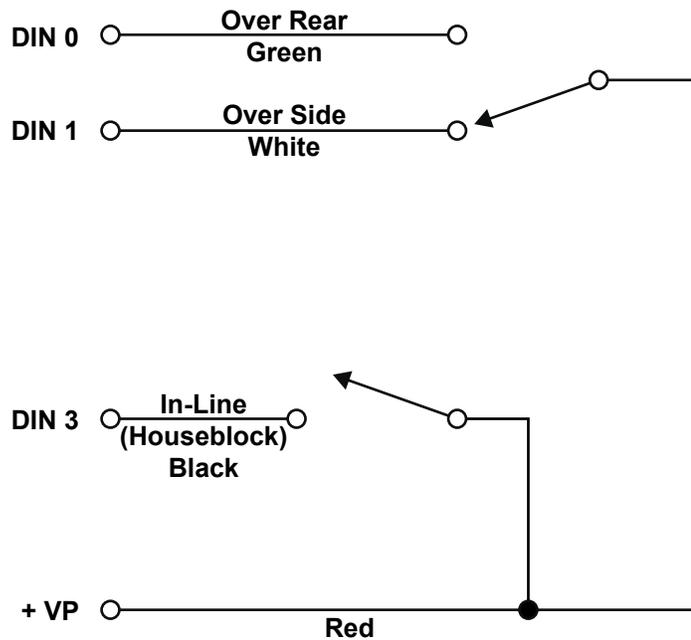
Over Rear Switch Only



Over Rear/Over Side Switch



Over Rear/Side & In-Line/Houselock



CABLE 4: Extension Reel Connections		
Color	Function	Connection
Black	ATB Switch Feed (2)	JP8-1 (ATB FD)
White	Extension Sensor Signal	JP8-2 (BM EXTN SIG)
Green	Angle Sensor Signal	JP8-3 (BM ANG SIG)
Brown	ATB Switch Signal (1)	JP8-4 (ATB SIG)
Red	+ Sensor Drive	JP8-5 (BM SNSR +DR)



## Appendix C - Measurement Record

Use the space provided below to enter the necessary dimensions. Dimensions must be entered into the system in feet and tenths of a foot. Please make sure to convert any measurements if necessary before recording them.

Callout	Description	Measurement
<b>Menu 02 - Dimensions</b>		
<b>Swing Offset</b>	The horizontal distance between the center of the boom pivot and the denterline of rotation (see "Miscellaneous Dimensions" on page 11)	
<b>L</b>	The horizontal distance between the center of the boom pivot and the center of the boom hoist cylinder upper pivot (see "Boom Pivot Dimensions" on page 12).	
<b>J</b>	The vertical distance between the center of the boom pivot and the center of the boom hoist cylinder upper pivot. Note: If the Boom Pivot is above the boom hoist cylinder upper pivot the dimension is or negative (see "Boom Pivot Dimensions" on page 12).	
<b>G</b>	The horizontal distance between the center of the boom pivot and the center of the boom hoist cylinder lower pivot (see "Boom Pivot Dimensions" on page 12).	
<b>H</b>	The vertical distance between the center of the boom pivot and center of the boom hoist cylinder lower pivot (see "Boom Pivot Dimensions" on page 12).	
<b>W (high)</b>	The distance between the center of the boom pivot and the winch rope perpendicular to the rope measured at a boom angle $>60^\circ$ (see "Rope Dimensions" on page 13).	
<b>W (low)</b>	The distance between the center of the boom pivot and the winch rope perpendicular to the rope measured at a boom angle $<20^\circ$ (see "Rope Dimensions" on page 13).	
	Head Sheave Radius	
	Rope Limit	
	Max POL	
	Max Ext	
	Load Scale	
	Length Offset	
	Retracted Length	

Callout	Description				Measurement
<b>Menu 05 - Pressure</b>					
<b>M</b>	This is the distance measured around the outside of the cylinder rod, divided by 12 (see "Boom Hoist Cylinder Dimension" on page 13).				
<b>Menu 07 - Deflection</b>					
<b>F</b>	The deflected radius of the boom under calibrated load.				
<b>Menu 08 - Calibrate Fly</b>					
<b>Fly</b>					
<b>Weight</b>					
<b>Offset</b>					
<b>G</b>					
<b>T</b>					
<b>L</b>					
<b>S</b>					
<b>Sheave Radius</b>					
<b>Max POL</b>					
<b>L ext</b>					
<b>S ext</b>					
<b>G ext</b>					
<b>T ext</b>					
<b>Main Hook Weight</b>					

Callout	Description				Measurement
Fly Hook					
Retracted, Low Angle Radius					
Retracted, High Angle Radius					
Extended, High Angle Radius					
Extended, Low Angle Radius					
<b>Menu 09 - Stowed Jib</b>					
Stowed G					
Stowed T					
Stowed Deduct					
Jib Weight					



















## Fraction to Decimal Conversion Chart

Fraction	Decimal	Fraction	Decimal
1/64	.015625	33/64	.515625
1/32	.03125	17/32	.53125
3/64	.046875	35/64	.546875
1/16	.0625	9/16	.5625
5/64	.078125	37/64	.578125
3/32	.09375	19/32	.59375
7/64	.109375	39/64	.609375
1/8	.125	5/8	.625
9/64	.140625	41/64	.640625
5/32	.15625	21/32	.65625
11/64	.171875	43/64	.671875
3/16	.1875	11/16	.6875
13/64	.203125	45/64	.703125
7/32	.21875	23/32	.71875
15/64	.234375	47/64	.734375
1/4	.25	3/4	.75
17/64	.265625	49/64	.765625
9/32	.28125	25/32	.78125
19/64	.296875	51/64	.796875
5/16	.3125	13/16	.8125
21/64	.328125	53/64	.828125
11/32	.34375	27/32	.84375
23/64	.359375	55/64	.859375
3/8	.375	7/8	.875
25/64	.390625	57/64	.890625
13/32	.40625	29/32	.90625
27/64	.421875	59/64	.921875
7/16	.4375	15/16	.9375
29/64	.453125	61/64	.953125
15/32	.46875	31/32	.96875
31/64	.484375	63/64	.984375
1/2	.50	1	1.00







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