

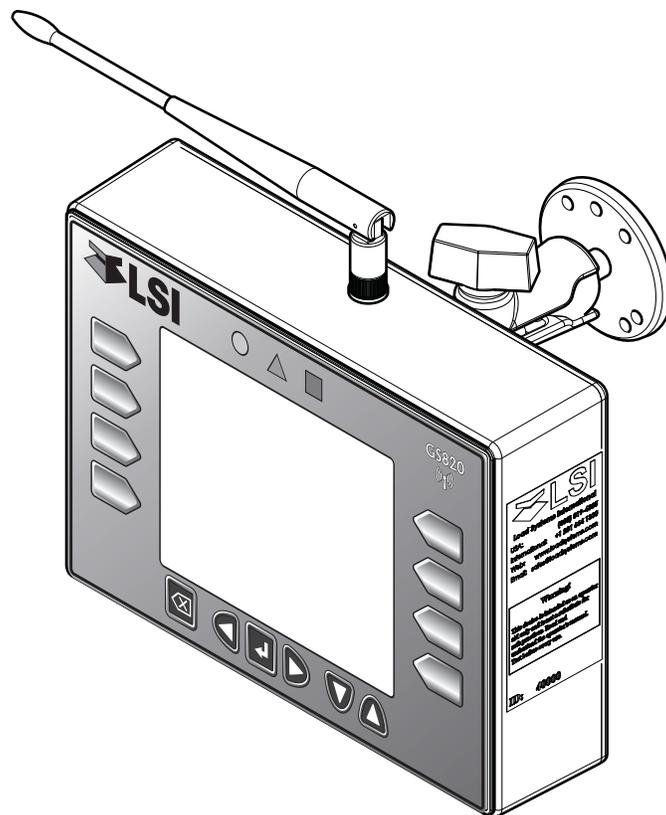
LSI

Load Systems International

Manufacturers of Wireless
Weighing Systems

GS820 Display & GS Series Sensors

INSTALLER AND USER'S MANUAL



WARNING! The GS820 system is designed as an operator aid and is in no way a substitute for safe operating practice.



WARNING! Carefully read and understand this manual before proceeding.



BEFORE PROCEEDING

Read and understand the following:

For your safety and that of the people that come into contact with **LSI** products, understand the significance of the instructions included in this guide, respect all laws and regulations and comply with applicable standards.

Pay particular attention to items bearing the alert symbol  and the following words:



WARNING!

Warning: this denotes an instruction that if not complied with may lead to serious injury or death.



CAUTION!

Caution: this denotes an instruction that if not complied with may lead to product failure or property damage.



IMPORTANT!

Important: this denotes an instruction that if not complied with may lead to product performance issues.



WARNING! Installation must be made in compliance with **LSI** instructions and using **LSI** supplied components only. Failure to install all parts, or replacing parts or components with parts or components not supplied by **LSI**, may lead to system failure, serious injury or death.

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1. INTRODUCTION

1.1 Overview

The GS820 system includes the cabin mounted GS820 radio display and compatible crane mounted sensors. The GS820 creates a two-way radio network with the sensors to bring required lift data to the operator. Hoist load, boom and jib angles, boom length, wind speed and pending two-block can be detected and then indicated to the operator in real time. Working load radius can be calculated and compared to a rated capacity chart (if programmed). Furthermore the GS820 can be programmed to generate warnings, alarms and lockout commands, all triggered by adjustable thresholds and limits. All these events can be recorded by the data logger with a time and date stamp. The exact operational function of the GS820 system depends on the sensor configuration used and the rated capacity charts programmed (where applicable). The GS820 includes a USB port to facilitate software and chart updates and data logger downloads using a USB mass storage device (USB key).

1.2 Start-Up

The GS820 must be correctly programmed for the system sensors installed. Once a reliable radio communication network is established, the display lights will remain lit without flashing. If a sensor is missing or has a problem, a message will be displayed on the LCD (liquid crystal display).

This process may take up to one minute. The delay is created by the battery management function.

Press **Bypass/Exit** to temporarily bypass crane function lockout caused by a missing sensor. If rigging requires a crane configuration outside of the limits defined by the rated capacity chart selected, out of chart alarms can be avoided by placing the display in "rig mode". If the rig mode is enabled in the display, press **Bypass/Exit** for 10 seconds to activate it. If the rig mode is not available, contact your **LSI** representative or **LSI** technical support representative.

WARNING! The GS820 system is designed as an operator aid and is in no way a substitute for safe operating practice.

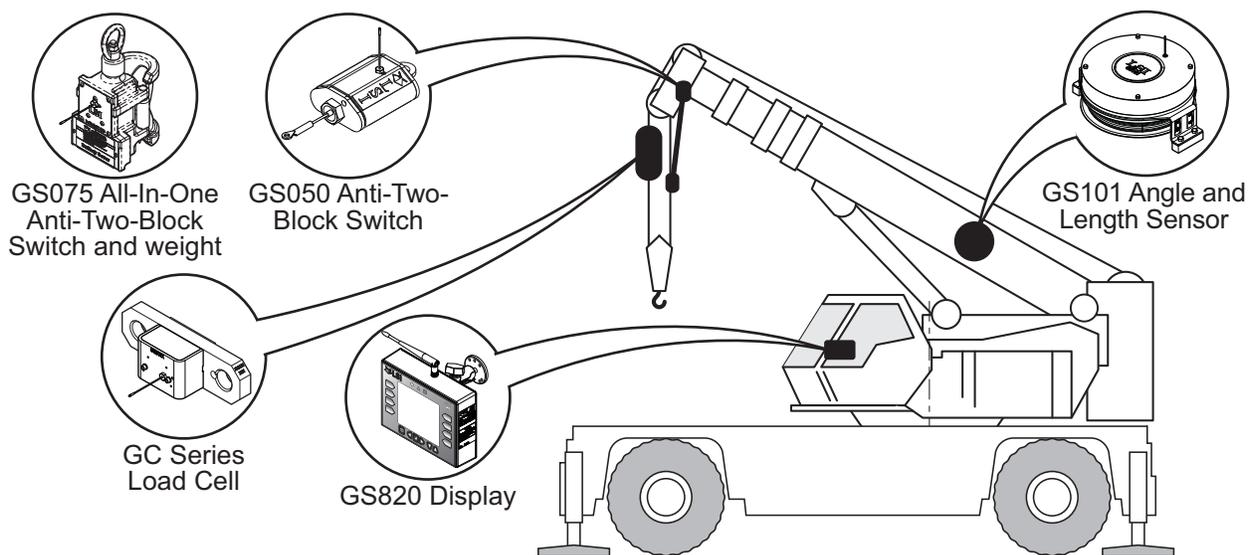


Figure: Key components in a typical system installation. Your product may vary. Not to scale.

2. INSTALLATION

Note: Refer to the **Operation** section for detailed menu navigation instructions for all calibration procedures

WARNING! Installation must be made in compliance with **LSI** instructions and using **LSI** supplied components only. Failure to install all parts, or replacing parts or components with parts or components not supplied by **LSI**, may lead to system failure, serious injury or death.

2.1 Display GS820

IMPORTANT! Do not crack or puncture the membrane fascia. The GS820 display is splash and rain proof. Waterproofing depends in part on the integrity of the membrane.

IMPORTANT! Do not power wash the display. The GS820 display is not designed to withstand high-pressure washing devices that can erode the membrane fascia seal or create fissures in the membrane fascia. Power washing the display voids warranty coverage.

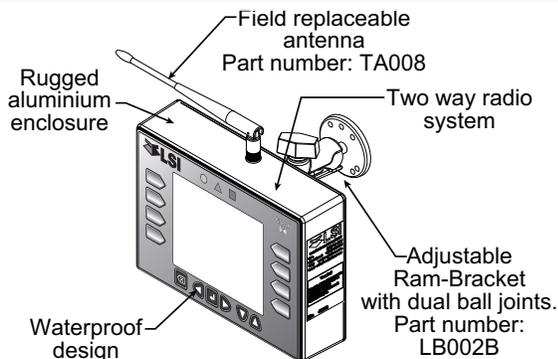


Figure: Display GS820

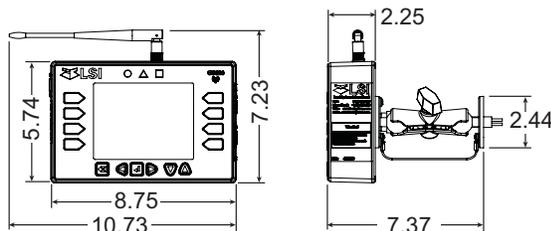


Figure: Display dimensions (inches). Not to scale.

2.1a Mounting Bracket

1. Determine the mounting location; the display may be installed either inside or outside the cab. It can be mounted on the dash, on a

sidewall, or on the ceiling of the cab. To ensure reliable radio communication between sensors and the GS820, the antenna should not be in contact with metal and should have a direct and clear line of sight to the sensor antenna. The mounting bracket requires a flat surface of at least 2.5 inches in diameter on both sides and where the back of the surface is accessible in order to tighten the nuts.

2. Drill 1/4 inch boltholes through the mounting surface with a 1/4 inch bit following either the two, three, or the four holes configuration.

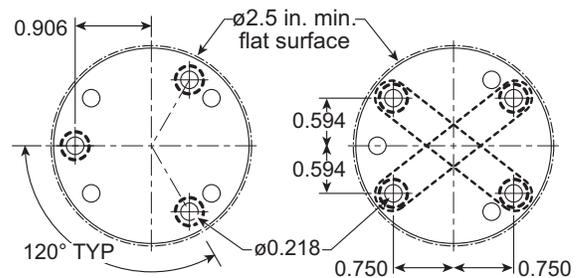


Figure: Display mounting bracket footprint. Not to scale.

3. Install the display with bolts. Add washers and lock nut behind the mounting surface and tighten sufficiently (bolts, nuts and washers not included).

Note: If the nuts are on the outside of the cab, caulk with silicone between the washers and the cab to prevent water entry.

4. Loosen the wing nut of the bracket arm to adjust display orientation to facilitate viewing by the operator and then tighten it back up.

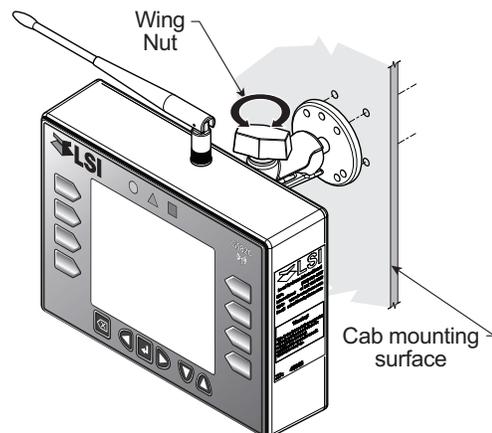


Figure: Install the display and adjust orientation

2.1b Antenna Position

For optimal performance the antenna should be positioned on its side such that it is parallel to the sensor antennas (but not pointing directly to or directly away from them).

1. Adjust the antenna position with the articulating base.
2. The antenna should have 5 inches of clear space all around it.
3. The antenna should have an unobstructed line of sight to all sensor antennas at all boom angles.

2.1c Power Supply and Lockout Connection

1. Connect the black wire (ground) to the negative terminal of the battery or the panel connection; alternatively bolt the black wire to the body of the machine with a 1/4 inch or 5/16 inch bolt. The ground connection must be strong enough to sustain 3 amperes.
2. Connect the red wire to a fused accessory source, rated at least 3 amperes, that supplies +12 or +24 volts when the machine is in use. The GS820 will automatically detect the voltage level and adjust itself.

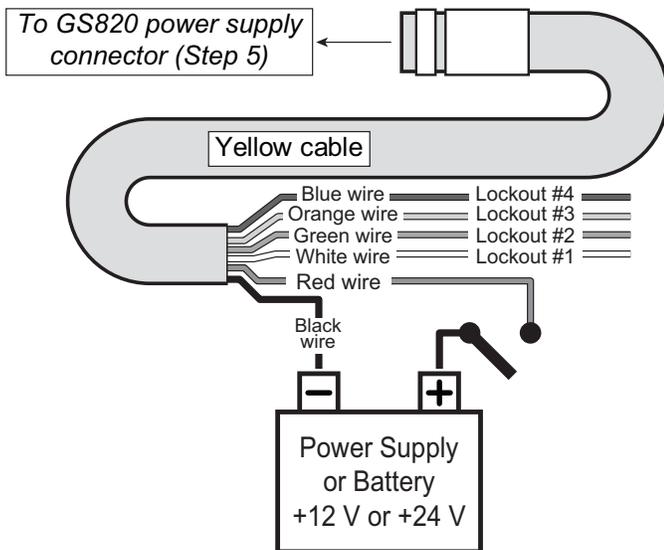


Figure: Connection without lockout.

3. Lockout number 1 (if required): connect the white wire to a Bosch relay coil terminal. Connect the other coil terminal of the relay to the ground. When operating properly the white wire will energize at the battery positive level.

Troubleshooting: if no voltage is present on the white wire remove the load connected to the lockout.

Current over 1 ampere on the white wire triggers an auto re-settable fuse. Current flow will resume several seconds after the short circuit is eliminated.

4. Lockout number 2, 3 and 4 (if required): these wires function in the same way as the white wire described in step 3 above. Each lockout wire can be triggered by a different set of alarm conditions; see the **Lockout Settings** sub section of this manual.

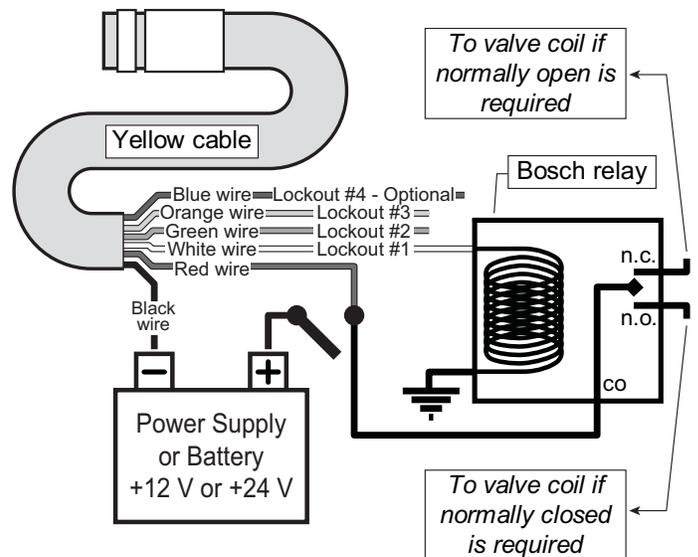


Figure: Connection with white wire lockout and recommended Bosch relay.

5. Connect the yellow cable to the GS820. The connector is waterproof and well rated for external environments. Simply connect the cable to the display and gently tighten the nut. **Do not put a kink in the yellow cable where it enters the connector;** any bend in the cable at the base of the connector must not be so severe as to break the internal connections where the cable meets the connector. **The power cable requires about 4 1/2 in. behind the display to protect the connector.**

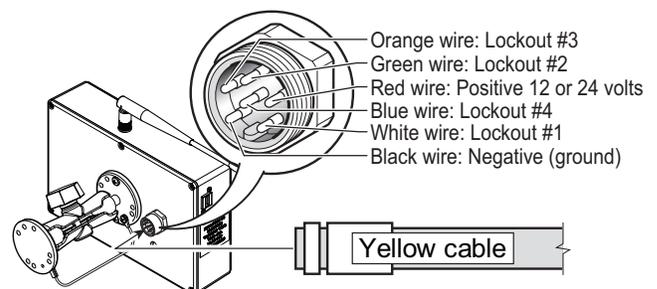


Figure: GS820 power supply connector

2.1d Lockout Settings

Warning, alarm and lockout control is programmed in this menu. The GS820 can be programmed to generate alarms and lockouts for almost all programmed limits and two-block. Furthermore, warnings are generated when approaching programmed load limits and rated capacity (when applicable).

Warning level. When gross load (regardless of tare value) approaches the maximum limit for a load sensor, an intermittent warning message is generated on the LCD. The maximum limit for a load sensor is the lower of; a) the operator set limit (Limit Menu), and b) the working load limit (WLL) if rated capacity charts are used. The proportion of a limit that must be reached to trigger the overload warning is the warning level. The default factory setting for the warning level is 90%.

1. Go to menu **4G) LOCKOUT SETTINGS**.
2. Enter the user password (using **Back, Next, Up** and **Down** as described in **Password settings** section) and press **Enter**.
3. Select **1) WARNING LEVEL** and press **Enter** to modify.
4. Use **Up** and **Down** to adjust the warning level and press **Enter** to confirm any change.
3. Press **Down** to select **2) ALARM LEVEL** or press **Exit** to return to the operation display.

Alarm level. All programmed and rated capacity limits and two-block will generate an audible alarm when the alarm level is reached. Alarms will generate an intermittent alarm message on the LCD. The proportion of a limit that must be reached to trigger an alarm is the alarm level. The default factory setting for the alarm level is 100%.

1. In menu **4G)**, select **2) ALARM LEVEL** and press **Enter** to modify.
2. Use **Up** and **Down** to adjust the alarm level and press **Enter** to confirm any change.
3. Press **Down** to select **3) LOCKOUT LEVEL** or press **Exit** to return to the operation display.

Lockout level. All programmed and rated capacity limits and two-block can generate a lockout signal when the lockout level is reached. By default the lockout wires carry crane power supply voltage as long as the display is in safe condition (to inverse lockout polarity see menu **4G) 8) LOCKOUT RELAY INVERTED**). When a lockout level is reached voltage

is cut on all lockout wires linked to the lockout condition (see menu **4G) 4)** through **4G) 7)**). The proportion of a limit that must be reached to trigger lockout is the lockout level. The default factory setting for the lockout level is 105%.

1. In menu **4G)**, select **3) LOCKOUT LEVEL** and press **Enter** to modify.
2. Use **Up** and **Down** to adjust the lockout level and press **Enter** to confirm any change.
3. Press **Down** to select **4) WHITE WIRE LOCKOUT TRIGGER** or press **Exit** to return to the operation display.

Lockout triggers. Different events can be programmed to cut voltage on the lockout wires of the yellow cable. Each lockout wire can be linked to a different combination of lockout conditions.

1. In menu **4G)**, select **4) WHITE WIRE LOCKOUT TRIGGER** and press **Enter** to modify.
2. Select which alarm conditions will trigger lockout on the white wire (see tables below).
3. Add the lockout codes for the selected alarms together to find the lockout trigger number.
4. Use **Up** and **Down** to adjust the white wire lockout trigger number and press **Enter** to confirm any change.
5. Press **Down** to select the next wire trigger line and repeat steps 1 through 5, or, press **Exit** to return to the operation display.

Table: Default Triggers

Lockout Wire	Default Trigger
White	4301
Green	34
Orange	32767

Table: Lockout Codes

Condition	Code
Maximum wind speed	1
Minimum angle	2
Maximum angle	4
Overload	8
Not used	16
Maximum radius	32
Maximum length	64
Two-block	128
Maximum wind gust	256
Maximum rope payout	512
Minimum slew	1024
Maximum slew	2048
Maximum tip height	4096
Maximum imbalance factor	8192

Table: Lockout Codes (Continued)

Condition	Code
Minimum slack rope	16384
Minimum list angle	32768
Maximum list angle	65536
Minimum trim angle	131072
Maximum trim rope	262144

Table: Example № 1

Maximum radius	32
Minimum angle	+ 2
Default green wire trigger	= 34

Table: Example № 2

Maximum wind speed	1
Maximum angle	4
Overload	8
Maximum length	64
Two-block	128
Maximum tip height	+ 4096
Default white wire trigger	= 4301

Lockout relay inversion. By default the lockout wires carry crane power supply voltage as long as the display is in safe condition. When lockout is triggered voltage is cut on the lockout wires linked to the lockout condition.



WARNING! Inverting lockout relays will allow crane operation in the event the GS820 display fails. Operating a crane without a functioning anti-two-block system and load and angle indication is dangerous and may be against the law.

Exceptionally the lockout relay can be inverted so that lockout wires carry no voltage in safe condition and carry crane power supply voltage when in a triggered lockout condition. In this case if the display fails, crane functions will not lockout.

1. In menu **4G)**, select **8) LOCKOUT RELAY INVERTED** and press **Enter** to modify.
2. Use **Up** and **Down** to switch between “**YES**” and “**NO**” and press **Enter** to confirm any change.
3. Press **Exit** to return to the operation display.

2.1e Password Settings

Two levels of access are available: administrator and user. The administrator password is required to change the user password. In the event both the administrator and the user passwords are lost please call **LSI** technical support. Menus accessible from the operation display can be individually protected by the user password.

1. Go to menu **4) INSTALLATION** and select **4H) PASSWORD SETTINGS**.
2. Enter the administrator password and press **Enter**.
3. Select **1) ADMINISTRATOR PASSWORD** and press **Enter** to modify.
4. Use **Up** and **Down** to adjust the administrator password. Press **Enter** to save any changes.
5. In menu **4G)**, select **2) USER PASSWORD** and press **Enter** to modify.
6. Use **Up** and **Down** to adjust the administrator password. Press **Enter** to save any changes.
7. In menu **4G)**, select **3) TARE PROTECTED** and press **Enter** to modify.
8. Use **Up** and **Down** to switch between “**YES**” and “**NO**” and press **Enter** to save any changes.
9. Repeat steps 7 and 8 to adjust password protection for each menu as required. Press **Enter** at any time to save changes made. Press **Exit** at any time to return to menu **4) INSTALLATION**. If there are any unsaved changes the display will request confirmation: press **Enter** to save before quitting or press **Exit** to quit without saving.

2.2 Load Cell

WARNING! Capacity and safety factor for load cells and adapter plate assemblies are calculated for load along the intended axis of load (vertical with the assembly hanging free); side loading may cause load cell and adapter plate assembly to fail, causing load to drop. Lifts must be rigged such that the load cell and adapter plate assembly hang free and not be subjected to side loading.

CAUTION! The load cell must be centered on the pins to avoid uneven loading on the plate kit assembly.

IMPORTANT! The load cell antenna should not be in contact with metal.

IMPORTANT! For optimal performance and signal reception, the GS820 load cell antenna should have a clear line of sight to the GS820 display.

IMPORTANT! The load cell antenna should point to the left or to the right of the boom; it should not point directly to, or away from, the GS820 display.

1. Install load cell bushings as supplied by *LSI*. Assembly of the load cell and adapter plates must be configured to the pin size required by the specific dead end or hook to which it is to be attached. In all cases, the bushings supplied by *LSI* must be used where possible to adapt the holes in the load cell to the pins. Bushings must be secured with the two allen screws provided, one on each side of the load cell.
2. As required, place a washer between adapter plate and pin head or nut on each end of the pin that links the adapter plates to the load cell. Additional washers should be added equally to each end of the pin as required to inhibit excessive lateral movement of load cell (maximum 1/8" total movement) and adapter plates along the pin.
3. If the dead end or hook to be connected to the adapter plates requires a larger opening, washers may be placed between the load cell and the adapter plates equally on both sides of the load cell.

4. In all cases the washers must be placed symmetrically such that the load cell is centered on the pins to avoid uneven loading.
5. Secure the pins with the nuts and cotter pins provided.
6. A qualified (lift supervisor or crane inspector) person must verify every lift assembly before first use and periodically thereafter (one to twelve months), including before any new, difficult or otherwise different lift.

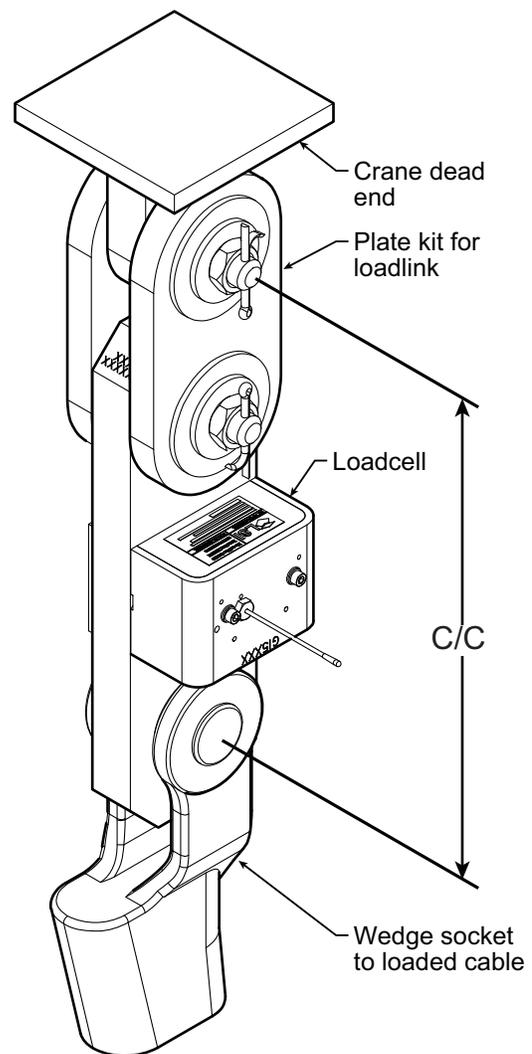


Figure: Typical load cell and adapter plate assembly installed.

2.3 Angle Sensors

IMPORTANT! Keep the angle sensor away from the boom and any connecting metal structures when welding the metal lugs to the boom. Proximity to welding may cause permanent damage to the angle sensor and prevent accurate angle indication.

2.3a Mounting Procedure

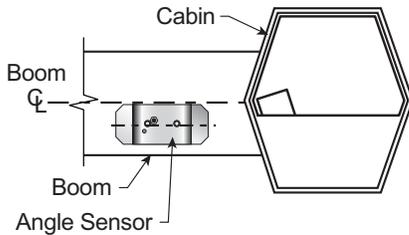


Figure: Angle sensor level with the boom (typical installation) - Side View

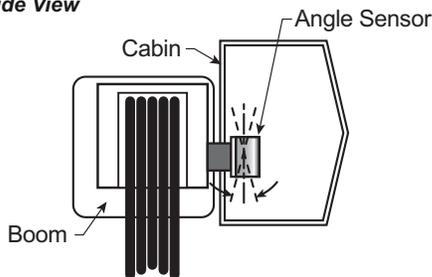


Figure: Angle sensor top/bottom axis within 15° of vertical (typical installation) - Front View

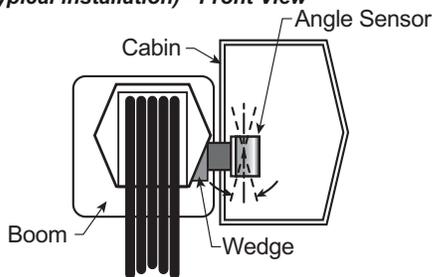


Figure: Wedge used to mount the angle sensor with its top/bottom axis within 15° of vertical (typical installation) - Front View

The GS010 series angle sensors can be turned on by starting up the GS820 display to which they are programmed. The angle sensor can then assist in levelling itself with the red and green LED.

1. Determine the angle sensor position.
 - a. The GS010-01 boom angle sensor can be mounted on either side of the boom.
 - b. The GS010-02 360° angle sensor must be mounted on the port side of the jib.
 - c. The angle sensor must be level with the boom or jib centerline.
 - d. The top / bottom axis of the angle sensor must be within 15 degrees of vertical

- e. The angle sensor should have a clear line of sight to the cabin mounted display.
- f. The angle sensor antenna should not contact a metal object.

WARNING! The angle reading may be affected by vibration and may fluctuate; the angle sensor should not be installed in close proximity to a high RPM electric motor or other source of high frequency vibration.

2. Install the welding pads; keep the angle sensor at least three feet from the weld site and any connecting metal objects while welding.
3. Mount the angle sensor to the weld pads with the screws and washers provided.
4. Verify angle indication on the GS820 LCD.

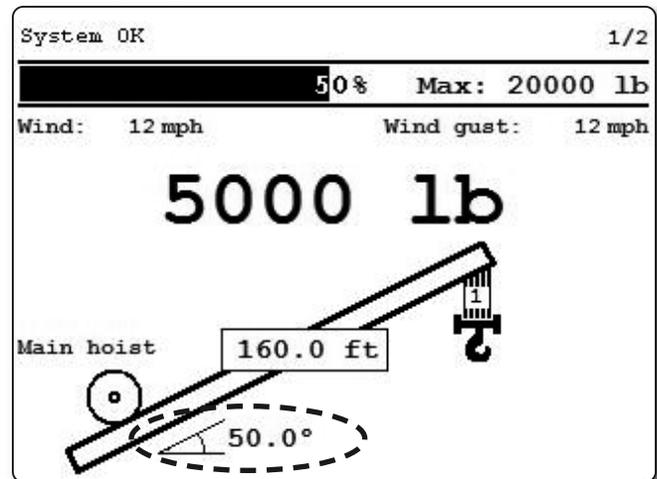


Figure: Typical operation page with boom angle indication

5. If the angle displayed by a GS010-01 boom angle sensor is a high negative value, then tilt the angle sensor up over 45 degrees, and then tilt back down to horizontal. The GS010-01 boom angle sensor will automatically detect on which side of the boom it is installed and correct angle indication accordingly.

2.3b Angle Calibration Procedure No 1: Mechanical Set-Up

1. Level the boom such that it is perfectly horizontal; use a high quality bubble or digital angle sensor. If the GS820 display indicates 0.0 degrees then angle calibration is complete; if not then continue to step 2.

WARNING! Failure to ensure the boom is levelled will result in false reading of the crane's radius hence the risk of structural failure of the crane or crane tipping over.

2. For GS011 angle/length sensors only: Carefully remove the cover of the GS101 cable reel.
3. Loosen the mounting screw in the slotted hole of the angle sensor mounting plate.
4. Pivot the angle sensor slightly until angle indication is correct. Repeat the angle validation (step 1) as required.

Note: When the angle sensor is moved very slowly, it may take several seconds to see an update at the GS820 display. Instead move the sensor up a couple of degrees, and then bring it back down to where it should be. The small light on the angle sensor flashes when it transmits a new value to the display.

2.3c Angle Calibration Procedure № 2: Correct with the GS820

Calibrate angle indication by adjusting the trim (offset) value in the GS820 display; the GS820 will then communicate the updated trim value to the sensor.

1. Position the boom at a precisely known angle.
2. Go to menu **4)** and select **4B) SENSOR CALIBRATION**.
3. Enter the user password and press **Enter**.
4. Select **4B2) MANUAL PARAMETER ADJUSTMENT**.
5. Use **Up** and **Down** to select the angle sensor to be calibrated and press **Enter**.
6. Select **2) TRIM:** and press **Enter** to modify.

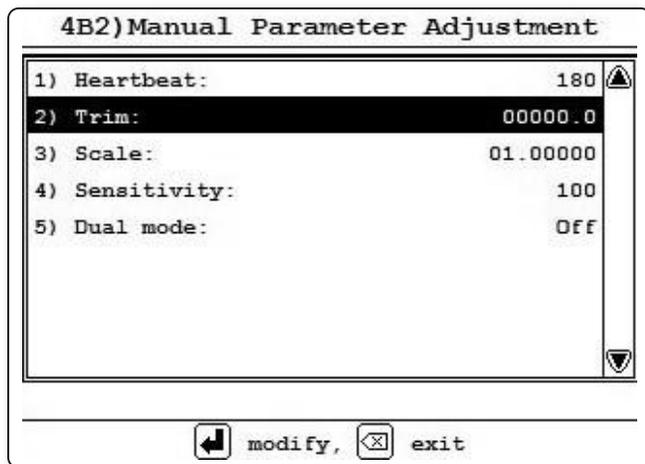


Figure: Angle Calibration Procedure № 2

7. Use **Up** and **Down** to modify the trim value.
 - Example:** If angle indicated is 0.3° over the actual angle, adjust the trim value to -0.3.
 - Example:** If angle indicated is 0.9° below the actual angle, adjust the trim value to 0.9.
8. Press **Enter** to save changes.
9. Press **Exit** to return to the operation display.
10. Verify accurate angle indication at both very high and very low angles.

2.4 Anti-Two-Block Switch

WARNING! Keep the anti-two-block switch away from the boom and any connecting metal structures when welding mounting brackets to the boom. Proximity to welding may cause permanent damage to the anti-two-block switch and render the anti-two-block system unsafe.

IMPORTANT! To ensure reliable radio communication between the anti-two-block switch and the GS820 display the following conditions must be respected:

- The antenna of the anti-two-block switch should not be in contact with metal.
- The anti-two-block switch antenna should point to the left or to the right of the boom; it should not point directly to, or away from, the GS820 display.
- The anti-two-block switch antenna should have a clear line of sight to the GS820 display; in most cases this means mounting the sensor on the same side of the boom as the operator's cab.

Verify the anti-two-block switch is programmed to the GS820 display. Switches shipped with displays are pre-programmed in the factory. *Test:* if the switch has been programmed to the display then the display will go in to two-block alarm when the wire rope of the switch is released. Press **Bypass** to silence the alarm until the next two-block event or simulation. If the switch has not been programmed to the display, this should be done before proceeding with installation. See the section **How to Add a Sensor to the GS820**.

2.4a GS050 Installation

1. Position the sensor mounting bracket. To ensure that the sensor can pivot securely on the mounting bracket throughout the full range of boom angle, the mounting bracket must be positioned at a 30° from horizontal with the boom parallel to the ground and such that the locking pin of the mounting bracket points up. **Bolt or weld securely.**

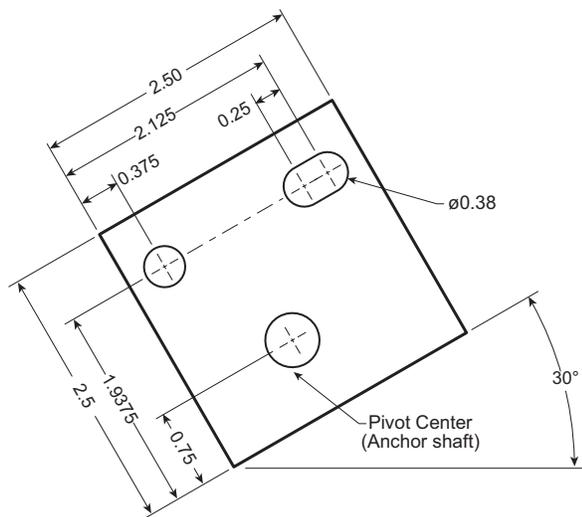


Figure: Bracket footprint and orientation,
All dimensions are in inches. Not to scale.

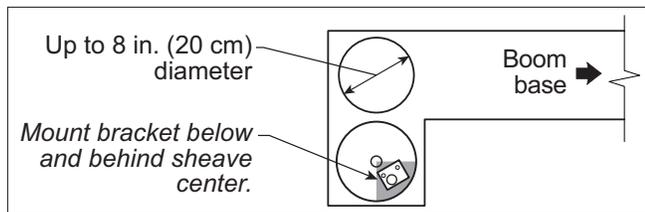


Figure: Anti-two-block switch placement on a telescopic boom

If the head sheave diameter is between 8 and 16 inches (20-41 centimetres) then two mounting brackets will be required to permit both live and dead end mounting.

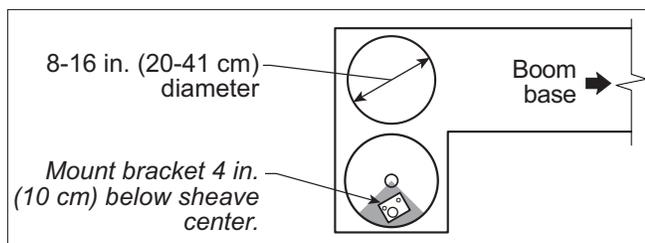


Figure: Anti-two-block switch placement for live end mounting on a lattice boom

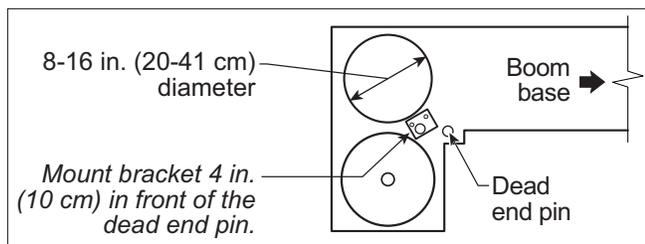


Figure: Anti-two-block switch placement for dead end mounting on a lattice boom

For live end mounting on multiple sheave blocks with sheaves greater than 16 inches (41 centimetres) in diameter consult your service representative.

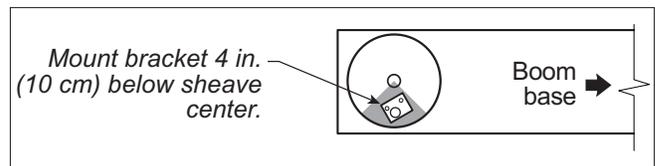


Figure: Jib, rooster or other extension; anti-two-block switch placement for single part of line operation only

For fast line weight installation place the anti-two-block switch mounting bracket directly below the sheave center as low and as close to the edge of the sheave as possible. Place the fast line weight mounting bracket on the opposite side of the sheave with the chain hole pointing down and lined up opposite the pivot of the anti-two-block switch mounting bracket.

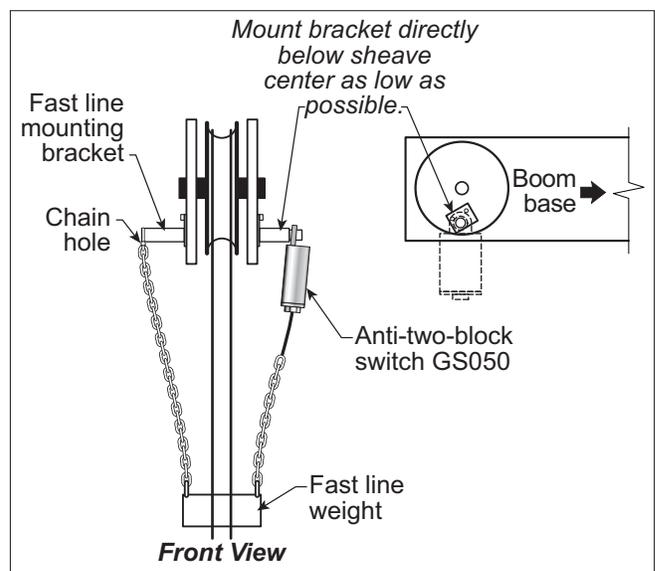


Figure: Fast line weight installation

2. Mount the GS050 on the bracket and verify that the GS050 can rotate freely through all possible boom movements without being able to come off the bracket.
3. Install the weight and chain assembly around the cable and attach the other end of the chain to the GS050. Tighten all the chain links of the chain assembly.
4. Adjust chain length as required, see sub-section **Chain length adjustment**.
5. Test system function.

2.4b GS075 Installation

1. **Optional Bracket:** Position the optional mounting bracket on the boom. **Bolt or weld securely.**
2. Attach one end of the chain assembly to the optional bracket or to the boom and the other end to the eye bolt of the GS075. Tighten all the chain links of the chain assembly.
3. Remove the hair pin and the clevis pin and open the back end of the GS075. Install the GS075 around the cable and then put the clevis pin back in.

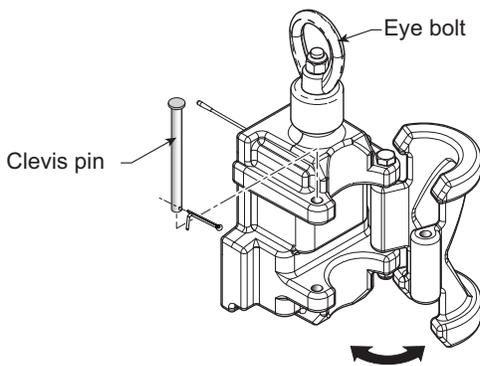


Figure: Install the GS075 around the cable

4. Adjust chain length as required, see sub-section **Chain length adjustment.**
5. Test system function.

2.4c Chain length adjustment

1. Chain length adjustment № 1 – minimum boom angle
 - a. At minimum boom angle, with no additional weight on the hook block and one part of line only, lift the boom just enough to have the hook block suspend and clear the sensor chain and weight.

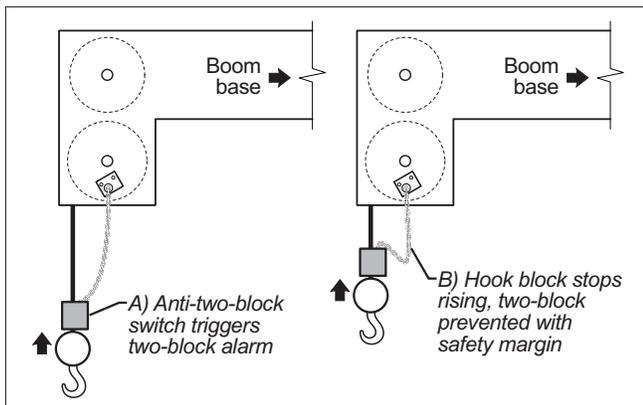


Figure: Chain length test at minimum angle

- b. Hoist slowly until the buzzer sounds. Note the hoisting distance remaining; this distance must be great enough to allow the operator and the lockout system, if installed, to prevent a two-block event. If necessary, add chain between the sensor and weight to increase warning distance. If still insufficient, contact your service representative.

2. Chain length adjustment № 2 – maximum boom angle
 - a. Raise the boom to the maximum angle.
 - b. Hoist slowly as described in **Step 1.b.** Verify that the warning distance is equal to or greater than that determined at the minimum boom angle.

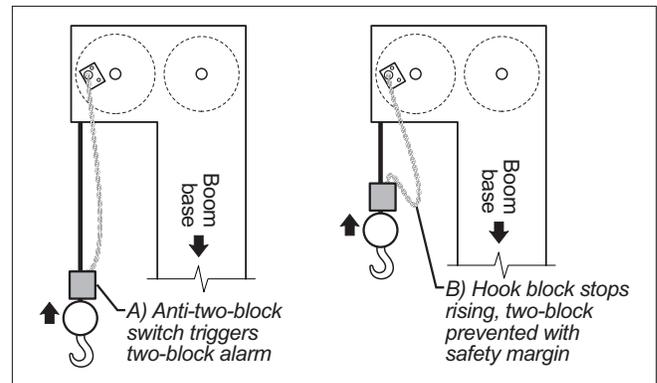


Figure: Chain length test at maximum angle

3. Chain length adjustment № 3 – speed test: Lower the boom until the weight height becomes visually clear to the operator. Repeatedly create two-block, progressively hoisting faster, to ensure that the warning and lockout work within acceptable amount of time and distance. Increase the length of the chain if needed.

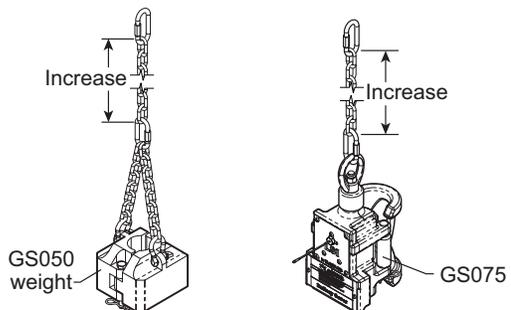


Figure: Chain length adjustment



IMPORTANT!
GS050: to increase chain length, only use lightweight chain.

2.5 Length Sensor Cable Reel

WARNING! Arc welding may damage **LSI** sensors, causing immediate failure or greatly reducing functional life. Arc welding on or near **LSI** equipment will void warranty. Keep **LSI** equipment well clear of any arc welding.

The GS101 includes the LS101 cable reel and the GS011 angle/length sensor. The GS011 is concealed under the cover of the LS101, though the antenna is visible. Following cable reel installation and boom length indication calibration, boom angle indication will have to be verified and possibly calibrated. Refer to **Angle Calibration Procedure № 1: Mechanical Set-Up** and **Angle Calibration Procedure № 2: Correct with the GS820**, sections of this manual.

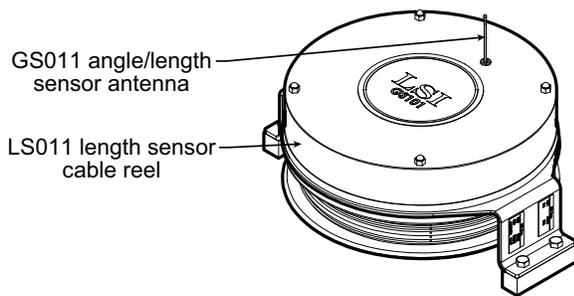


Figure: GS101 angle & length sensor

2.5a Maximum Boom Extension

Confirm the maximum extension of the LS101 cable reel is compatible with the maximum boom length.

Step 1. Note the cable reel maximum extension: 100 feet (30.5 metres) unless specified otherwise.

$$T = \underline{\hspace{2cm}}$$

Step 2. Note the retracted boom length.

$$A = \underline{\hspace{2cm}}$$

Step 3. Note the maximum extended boom length, not including jib.

$$B = \underline{\hspace{2cm}}$$

Step 4. Calculate maximum boom extension.

$$C = B - A = \underline{\hspace{2cm}}$$

Step 5. Compare cable reel maximum extension (T) to maximum boom extension (C).

$$D = T - C = \underline{\hspace{2cm}}$$

Maximum cable reel extension must be greater than maximum boom extension.

2.5b Mounting the Cable Reel

1. Determine placement. Find a clear mounting position on the left side of the first (main) section of the boom. The mounting position should be close to the base of the boom; at least ten feet (three metres) from the tip of the first section and where the cable reel won't obstruct free boom movement at all boom angles and slew positions. Furthermore, the reel must be placed such that the cable has a clear straight line to the end of the last section at all boom lengths.

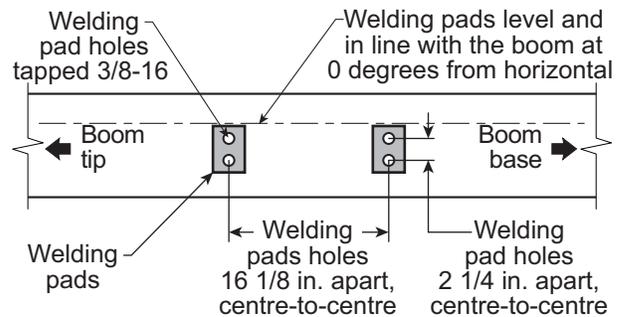


Figure: Cable reel mounting position

2. Mount the welding tabs. They must be placed parallel to each other, with 16 1/8" inches between the holes' centres. Install the tabs such that they create a level mounting position in line with the boom at 0 degrees.

Note: When factory installed the GS011 angle/length sensor transmitter is integrated to the LS101 cable reel with the angle sensor zeroed. If the cable reel is installed perfectly level on the boom at 0 degrees, the angle sensor of the GS011 will also be zeroed. Minor adjustments to the angle sensor (within plus or minus two degrees) are possible after cable reel installation.

3. Attach the reel to the welding tabs with the bolts provided.
4. Install the first cable guide (PA111) about 10 feet (3 metres) from the cable reel. Correct alignment of the first guide is critical to ensure orderly winding of the cable on the reel. Install the other guides at the end of each of the intermediate sections and the anchor (PA113) at the end of the last section. All guides must be aligned so as to permit unobstructed movement of the cable.
5. Pull out at least 5 feet (1-1/2 metres) of cable, but not more than half the excess extension of measurement D. Feed through the cable guides

and attach to the cable anchor on the tip of the last boom section. If additional cable length is required to reach the cable anchor point remove winds from the reel without putting additional tension on the cable reel spring. There should be minimal tension on the cable reel spring when the boom is fully retracted.

- Verify the boom length indicated on the GS820 LCD. Boom length indicated should equal the actual total boom length. The actual boom length is the distance from the boom base pin to the head sheave centre as measured along the boom centreline. Depending on the exact placement of the cable reel and the cable anchor the displayed

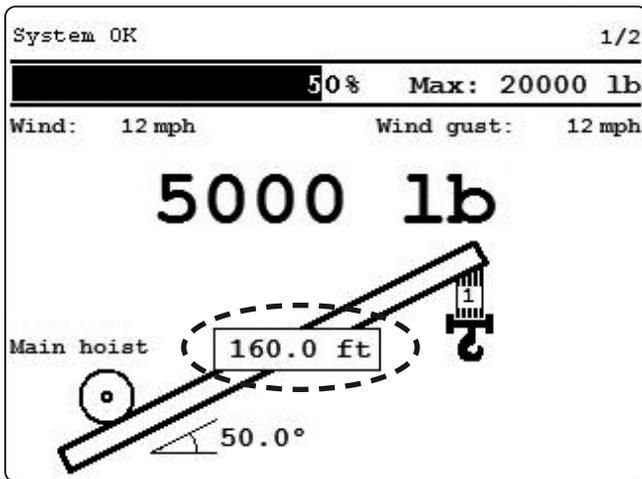


Figure: Typical operation page with boom length indication

length may differ from the actual length.

2.5c Boom Length Calibration

CAUTION! Visually monitor remaining length on the cable reel as the boom is extended for the first time following installation. This generally requires a second person (in addition to the operator).

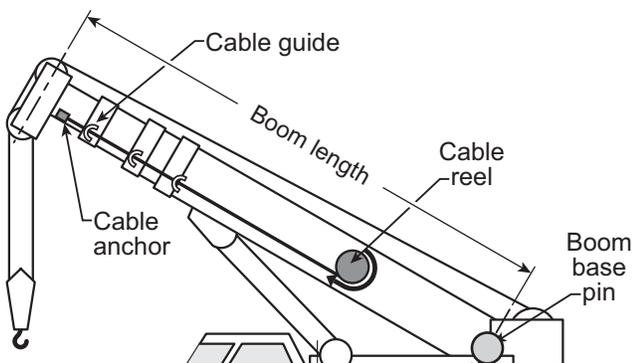


Figure: The actual boom length. Typical installation.

Procedure № 1: Mechanical Set-Up

- Fully retract the boom
- Adjust the loose wire rope at the boom tip so that the displayed boom length matches the actual boom length.
- Fully extend the boom
- Verify the boom length indicated at full boom extension matches the actual fully extended boom length. If not then follow *Boom Length Calibration Procedure № 2: Correct with the GS820*.

2.5d Boom Length Calibration Procedure № 2: Correct with the GS820

If the displayed boom length does not match the actual length of the boom retracted or extended and if it is not possible to easily correct by following 2.6c *Boom Length Calibration Procedure № 1*, then follow this procedure. This procedure is completed in the operators cab, it requires fully retracting, and then fully extending the boom, as prompted by the on screen instructions.

- Go to menu **4) INSTALLATION** and select **4B) SENSOR CALIBRATION**.
- Enter the user password, press **Enter** and go to menu **4B1) AUTOMATIC CALIBRATION WIZARD**.
- Use **Up** and **Down** to select the length sensor, and then press **Enter** to confirm communication with the sensor is possible.
- Start the wizard.
- Press **Enter** to confirm the units that will be used during the calibration wizard.

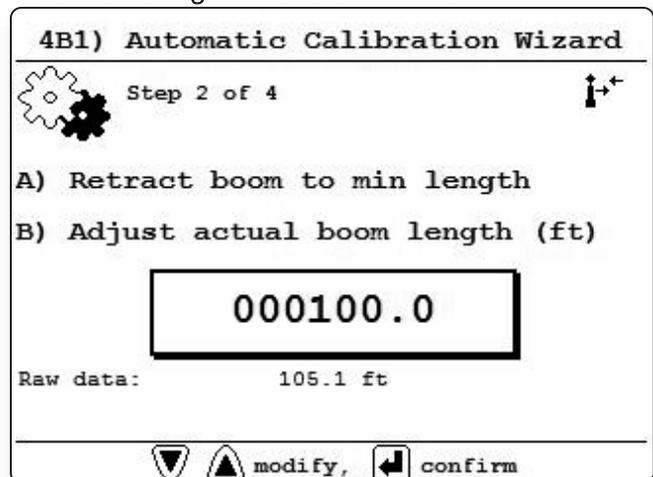


Figure: The boom length calibration wizard, confirm minimum boom length.

- Fully retract the boom, and use **Up** and **Down** to adjust the length value displayed to equal the actual fully retracted boom length, and then press **Enter** to confirm.
- Fully extend the boom, and use **Up** and **Down** to adjust the length value displayed to equal the

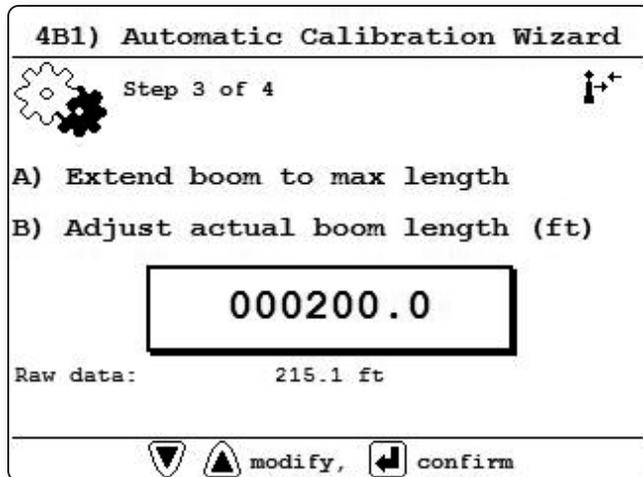


Figure: The boom length calibration wizard, confirm maximum boom length.

actual fully extended boom length, and then

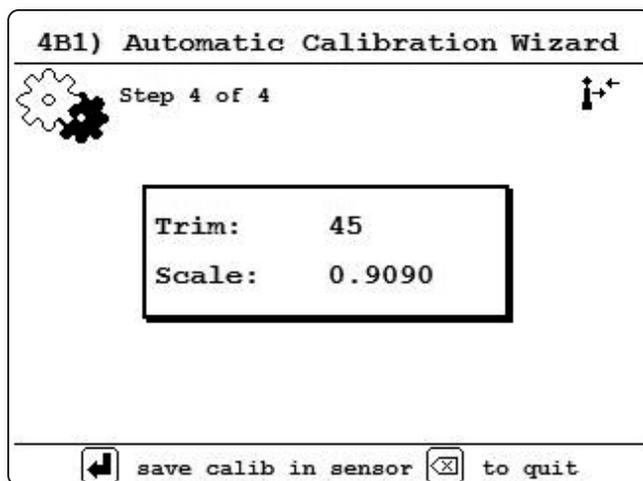


Figure: The boom length calibration wizard, Trim and Scale values.

press **Enter** to confirm.

- Note the new trim and scale values.
- Press **Enter** to send the new calibration to the length sensor.
- Press **Exit** to return to the operation display.

2.6 Radius

2.6a Radius Verification and Adjustment

- Verify the boom and luffing jib* angles, and the boom length**, are indicated correctly.
- Verify the correct rated capacity chart is selected***.
- Test № 1: measure the actual radius and compare to the radius indicated. Repeat with the boom at minimum angle, at 45 degrees, and at maximum angle; repeat at minimum and maximum boom length**. If radius indication is not accurate then go to step 4.
- Measure the **basic radius parameters** on the crane.
- Program the basic radius parameters in the **RADIUS SETTINGS** menu.
- Test № 2: measure the actual radius and compare to the radius indicated. Repeat with the boom at minimum angle, at 45 degrees, and at maximum boom angle; repeat at minimum and maximum boom length**. If radius indication is not accurate then go to the next step.

Note: If the difference between the displayed radius and actual radius remains constant at all boom lengths and angles, then correct by adjusting the slew offset. For example: if the radius displayed is always 2.3 feet longer than the actual radius, then subtract 2.3 from the slew offset.

- If the crane is rigged with the main boom only, then go directly to step 11.
- If the crane is rigged with a rooster, jib, or other extension then the **advanced radius parameters** must be measured on the crane and then programmed in the **RADIUS SETTINGS** menu of the display.
- Test № 3: measure the actual radius and compare to the radius indicated. Repeat with the boom at minimum angle, at 45 degrees, and at maximum boom angle; repeat at minimum and maximum boom length**. If radius indication is not accurate then go to the next step.

- * When the hoist is rigged off of a luffing jib only
- ** Telescopic boom cranes only
- *** Systems with rated capacity charts programmed in the GS820 only

10. Test for boom deflection (telescopic crane only): is the radius indicated equal to the actual radius with the boom at 0 degrees and at 90 degrees but smaller than the actual radius with the boom at 45 degrees? If yes then adjust the boom deflection value to compensate:

- a. Raise the boom to 45 degrees with a known load.
- b. Compare the indicated radius with the actual radius. Change the boom deflection value and again compare the radius displayed with the actual radius. Repeat until the radius displayed equals the actual radius.

Note: with the boom at 45° and the maximum load on the hoist, the boom deflection value should equal the difference between the actual and the displayed radius. With the boom at 45° and half the maximum load on the hoist, the boom deflection value should equal twice the difference between the actual and the displayed radius.

11. Test № 4: measure the actual radius and compare to the radius indicated. Repeat with the boom at minimum angle, at 45 degrees, and at maximum boom angle; repeat at minimum and maximum boom length**. If radius indication is not accurate then refer to **Radius Settings**.

2.6b Radius Settings

1. Go to menu **4) INSTALLATION** and select **4C) RADIUS SETTINGS**.
2. Enter the user password and press **Enter**.
3. Use **Up** and **Down** to navigate between the radius settings, press **Enter** to modify and use **Up** and **Down** to adjust the settings.
4. Press **Enter** to save any changes and press **Exit** to return to the operation display.

IMPORTANT! Radius settings **4C 12) to 4C 17)** are specific to the hoist line.

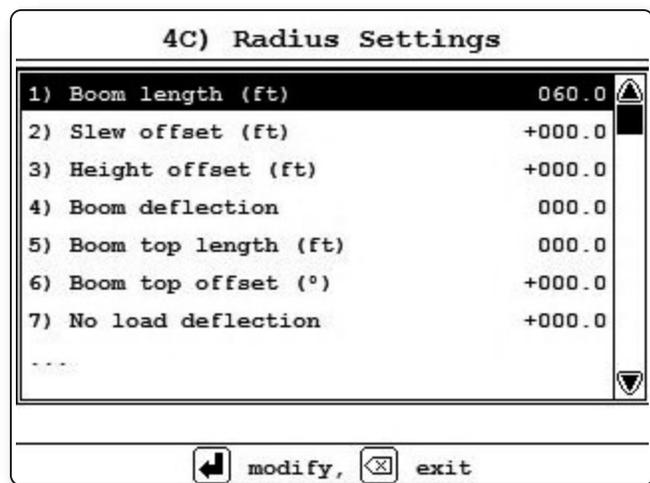


Figure: Radius settings menu

4C) RADIUS SETTINGS

- * 1) Boom length
- * 2) Slew offset
- 3) Height offset
- 4) Boom deflection
- 5) Boom top length
- 6) Boom top offset
- 7) No load deflection
- 8) Jib offset
- 9) Lattice extension offset
- 10) Jib mounting point perpendicular
- 11) Jib mounting point parallel
- 12) Main hoist
 - 12A) Jib length
 - 12B) Luffing jib length
 - 12C) Lattice extension length
 - 12D) Manual length
- * 12E) Sheave head length perpendicular
- 12F) Sheave head length parallel
- * 12G) Sheave radius
- 12H) Deduct
- 13) Auxiliary hoist
 - ... 13A) to 13H): same as 12A) to 12H)
- 14) Auxiliary hoist 2
 - ... 14A) to 14H): same as 12A) to 12H)
- 15) Auxiliary hoist 3
 - ... 15A) to 15H): same as 12A) to 12H)
- 16) Auxiliary hoist 4
 - ... 16A) to 16H): same as 12A) to 12H)
- 17) Auxiliary hoist 5
 - ... 17A) to 17H): same as 12A) to 12H)

** Telescopic boom cranes only

* Basic radius parameters

2.6c Basic Radius Parameters for a Lattice Crane

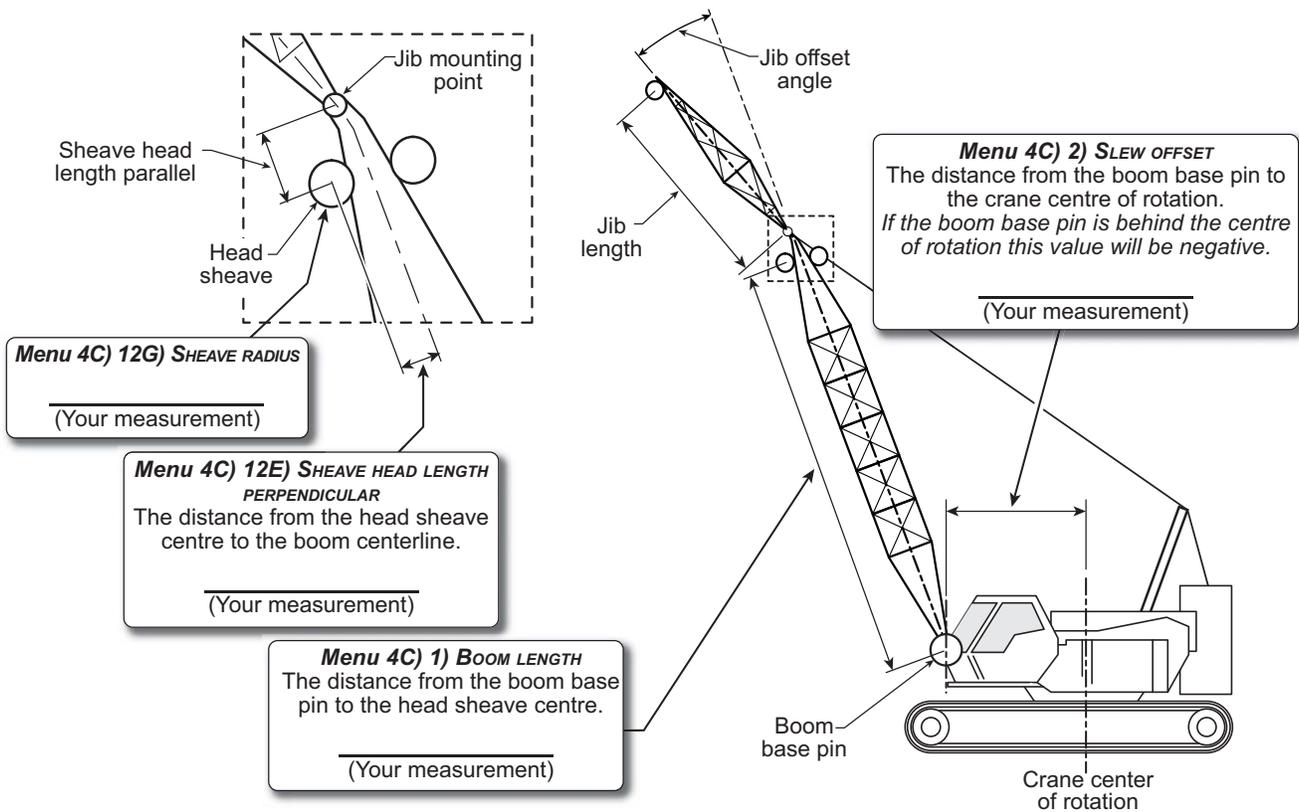


Figure: Basic radius parameters for a lattice crane. Typical installation. Not to scale.

2.6d Basic Radius Parameters for a Telescopic Boom Crane

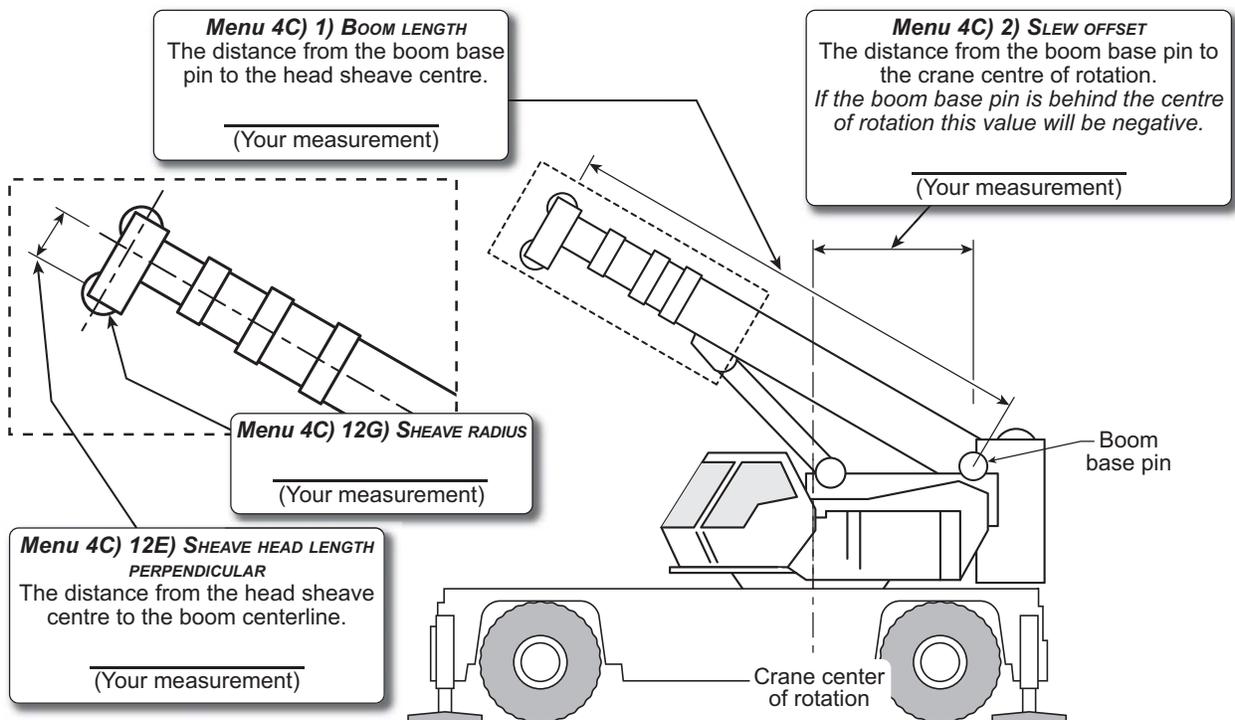


Figure: Basic radius parameters for a telescopic boom crane. Typical installation. Not to scale.

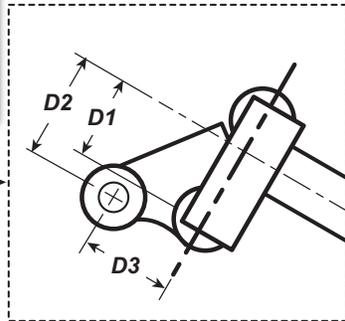
2.6e Advanced Radius Parameters

Typical sheave heads:

- SHEAVE HEAD LENGTH PERPENDICULAR = D1
- SHEAVE HEAD LENGTH PARALLEL = 0 (typical)

Special top sheaves (example: rooster):

- SHEAVE HEAD LENGTH PERPENDICULAR = D2
- SHEAVE HEAD LENGTH PARALLEL = D3



Extensions, two possibilities:

- 1) **MANUAL LENGTH:** the offset is always zero degrees.
- 2) **LATTICE EXTENSION LENGTH:** the offset angle must be adjusted.

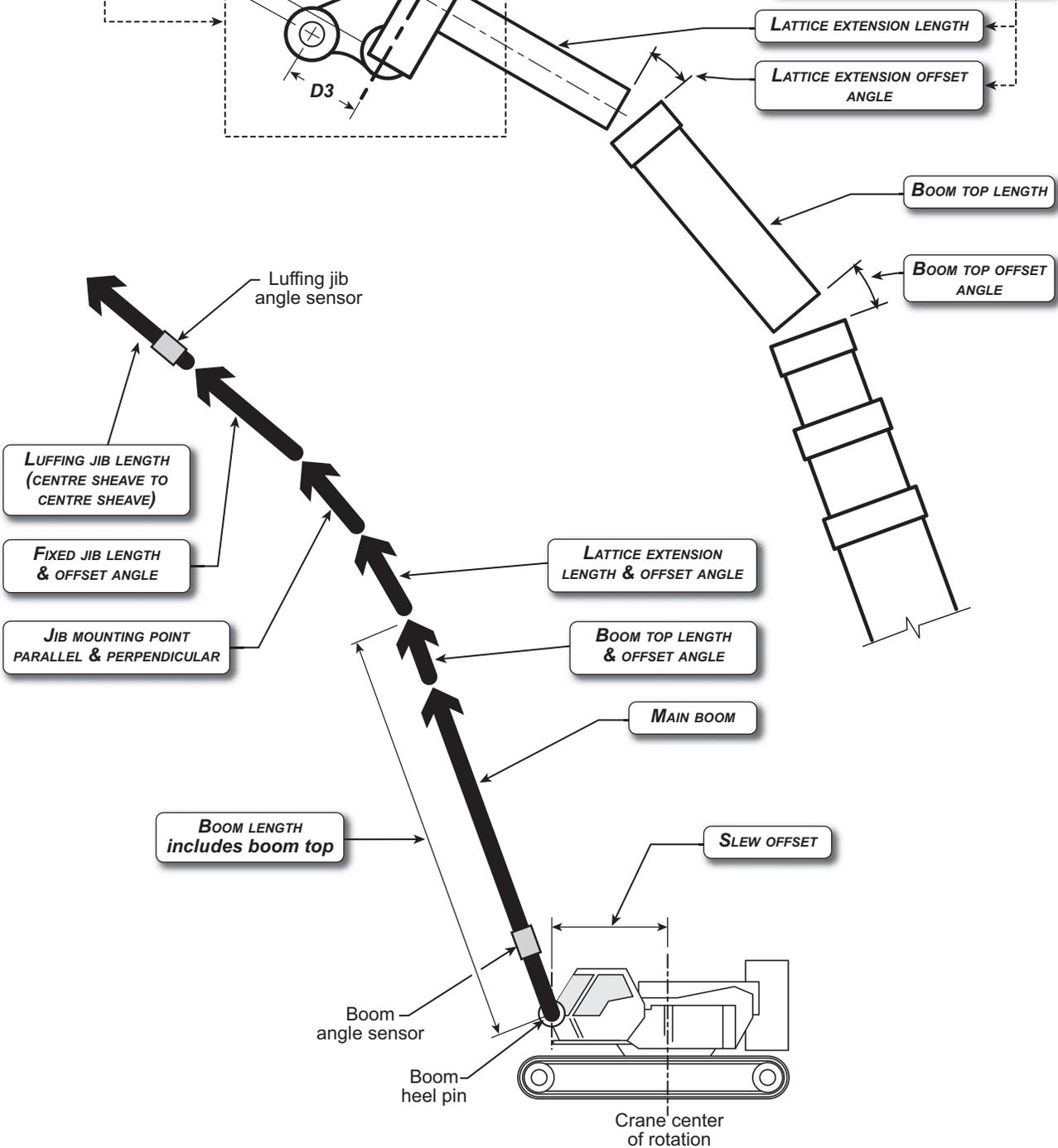


Figure: Advanced radius parameters. Typical installation. Not to scale.

2.7 Wireless Wind Speed Sensor GS020

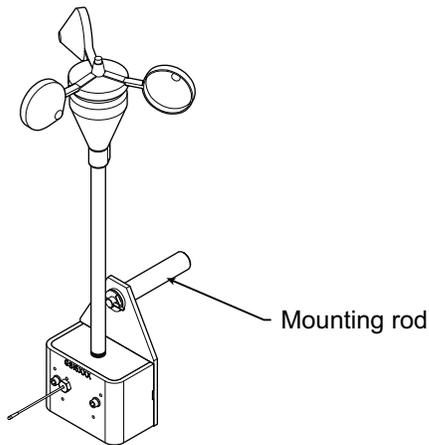


Figure: GS020 wireless wind speed sensor

1. Remove the mounting rod from the wind speed sensor.

IMPORTANT! Do not weld in proximity to LSI sensor/transmitters.

2. Determine the mounting rod position.
 - a. Install the mounting rod on the same side of the boom as the cabin mounted display, perpendicular to the boom, and at the highest point possible.
 - b. The wind speed sensor must pivot freely on the mounting rod at all boom angles.

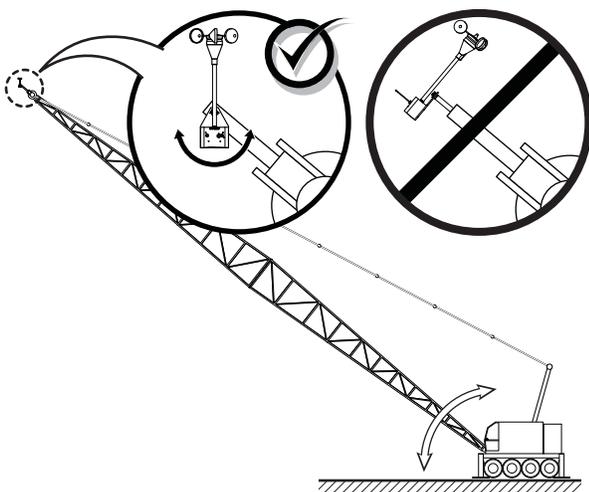


Figure: Swivel orientation

- c. The wind cups must be fully exposed to the wind and spin freely at all boom angles.

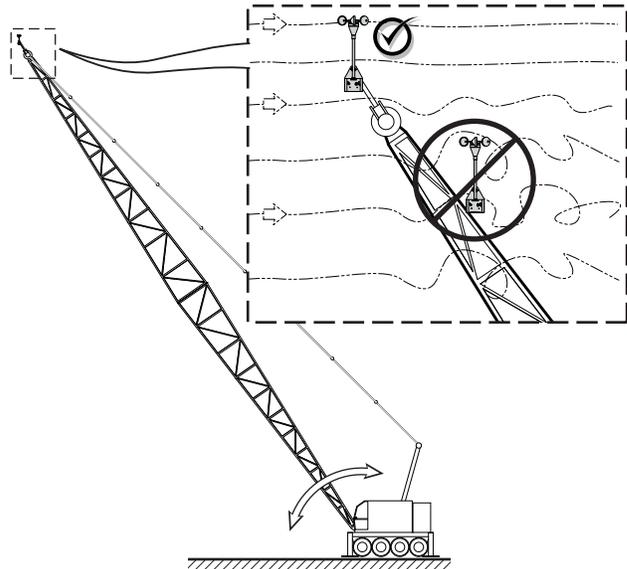


Figure: Wind clearance

- d. There should be a clear and unobstructed line of sight between the wind speed sensor antenna and the cabin mounted display unit.

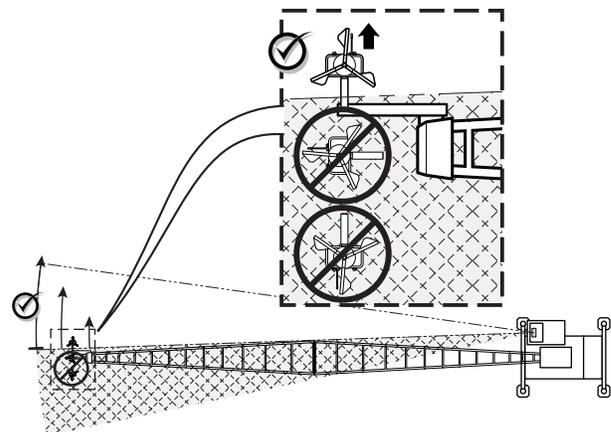


Figure: Radio line of sight - Crane top view

- e. The transmitter antenna should not contact any metal object.

Note: Angle iron can be used to extend the mounting position to be clear of the boom top.

3. Weld or screw the mounting rod to the boom at the selected position.
4. Re-position the wind speed sensor on the mounting rod, add the washer and secure with the cotter pin.

2.8 Wireless Load Pins

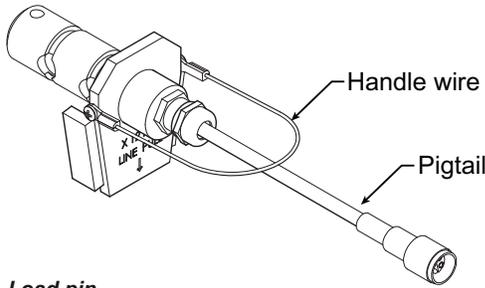


Figure: Load pin

IMPORTANT! Do not pull on a load pin by the pigtail, pull on the handle wire.

2.8a LP011, LP015, and LP026

1. Mount the load pin to the boom tip or block by replacing the pin of the wedge socket. The load pin is directional and must be oriented correctly to indicate load accurately. Install the pin so that the bracket embraces the wedge socket and prevents pin rotation.

Note: When installed at the boom tip the lot number can be read right side up and the "line pull" arrow points down towards the block. When installed at the hook ball or block, the lot number can be read upside down and the "line pull" arrow points up towards the boom tip.

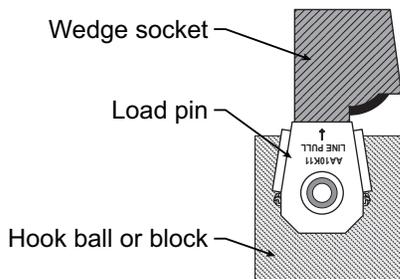


Figure: Load pin LP011, LP015 or LP026 - Installation on a single part block

2. Secure the load pin in place with a cotter pin or other suitable keeper device.

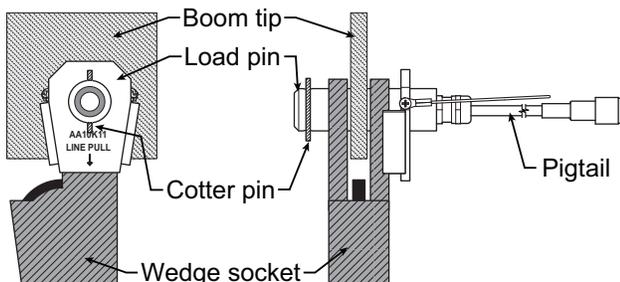


Figure: Load pin LP011, LP015 or LP026 - Installation at boom tip

2.8b Load Pin Transmitter GS001

1. Determine the transmitter mounting position.
 - a. The load pin and transmitter pigtails must connect easily without stretching or kinking at all boom angles and working conditions. The jumper cable may be used between the load pin and transmitter to increase transmitter placement options.
 - b. There must be direct unobstructed line of sight from the transmitter to the display; this may not be required on cranes with a maximum boom length less than 100 feet (33 metres).
 - c. The transmitter antenna must not be in contact with any metal object.
2. Weld the mounting blocks where required.

IMPORTANT! Do not weld in proximity to LSI sensor/transmitters.

3. Mount the load pin transmitter on the mounting blocks.

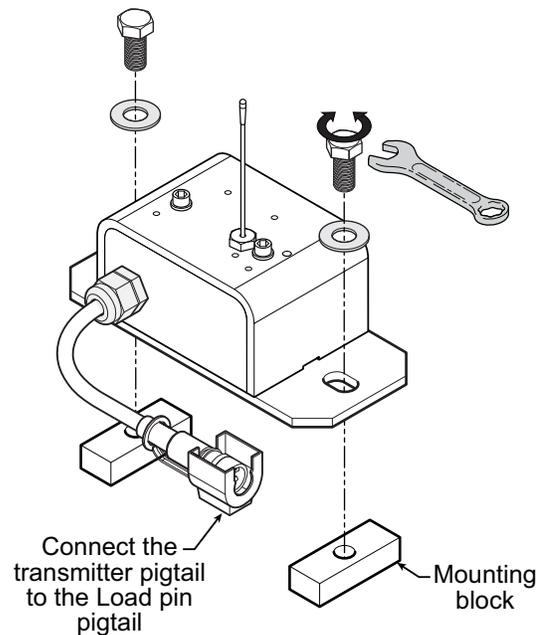


Figure: Install the load pin transmitter GS001

2.9 Line Riding Tensiometer

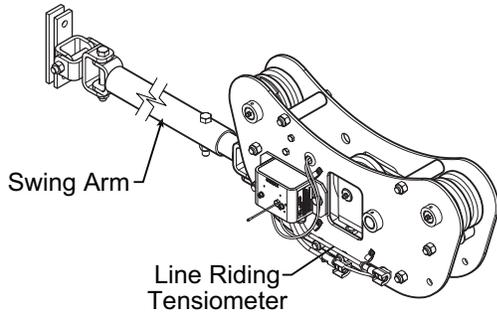


Figure: Line riding tensiometer

2.9a Line Riding Tensiometer Installation



CAUTION!

The Line Riding tensiometer must be held by the swing arm and the tension of the wire rope; do not fix the line riding tensiometer to the boom.

The Ratio of the distance between the line riding tensiometer and the hoist drum must be 18:1 as minimum to allow a normal winding on the drum.

The angle between the swing arm and the measured rope shouldn't exceed 30 degrees.

Two Landing Pads (Wooden cushion) must be added to allow line riding tensiometer sitting when the boom is down.

Nothing should limit free displacement of the swing arm & line riding tensiometer assembly at any boom angle or configuration.

Swing arm mounted

Application:

Most applications, mounted as far up the boom base as practical with the swing arm base attached near the tip of the butt section. This mounting allows the line riding tensiometer to follow the movement of the wire rope path.

Commentary:

Make sure that the swing arm is long enough to allow free movement at any boom angle.

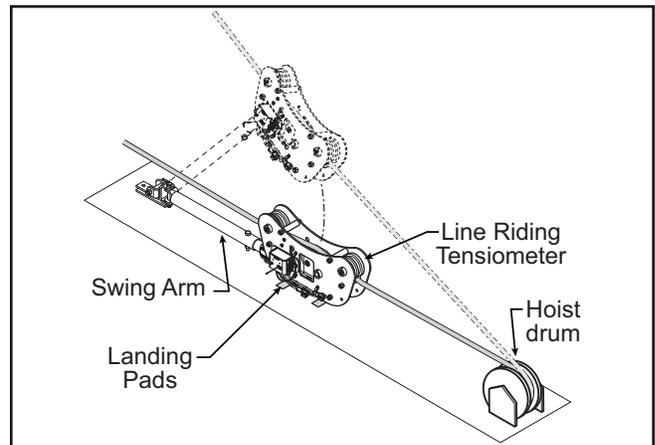


Figure: Typical installation (not to scale)

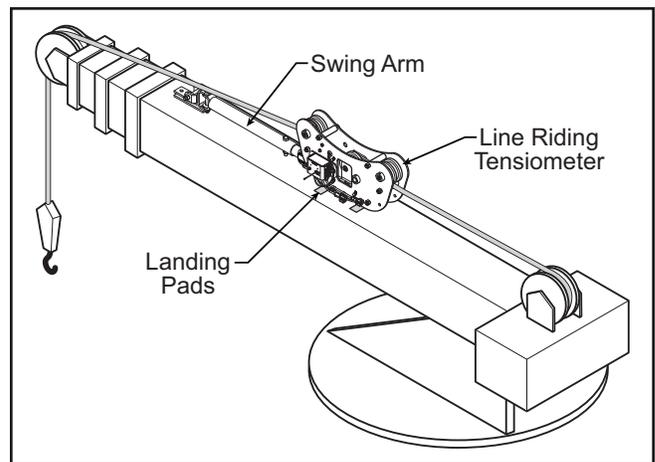


Figure: Example of a typical installation on a telescopic boom crane (not to scale)

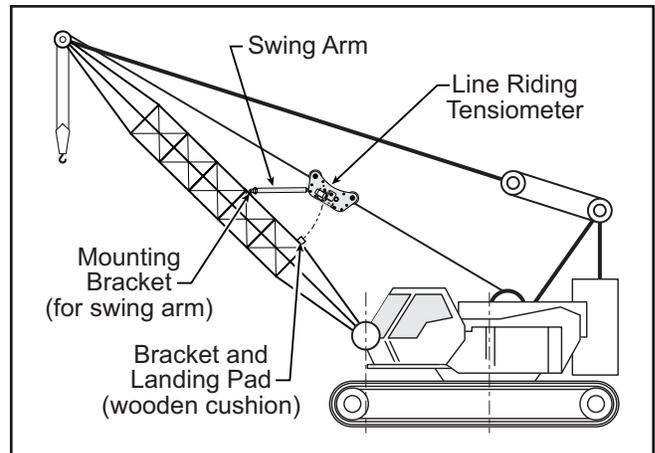


Figure: Example of a typical installation on a lattice boom crane, allows for lower clearance (not to scale)

2.9b Line riding tensiometer installation on a swing arm

1. Verify that the line riding tensiometer size fits with the wire rope diameter.

Table: Line riding tensiometer part number and rope diameter.

Frame Sheave Size	P/N	GS series line-rider with swign-arm and transmitter P/N	Cable size Inches (mm)
Small (4.25")	LD006	GD004-0375	3/8"
Small (4.25")	LD006	GD004-0500	1/2"
Small (4.25")	LD009	GD004-0563	9/16"
Small (4.25")	LD010	GD004-0625	5/8"
Small (4.25")	LD012	GD004-0750	3/4"
Medium (6")	LD015	GD006-0875	7/8"
Medium (6")	LD017	GD006-0945	(24mm)
Medium (6")	LD016	GD006-1000	1"
Medium (6")	LD018	GD006-1125	1 1/8"
Medium (6")	LD020	GD006-1250	1 1/4" (32mm)
Large (8")	LD022	GD008-1375	1 3/8" (36mm)
Large (8")	LD024	GD008-1500	1 1/2"
Large (8")	LD026	GD008-1625	1 5/8"
X-Large (10")	LD028	GD010-1750	1 3/4"
X-Large (10")	LD031	GD010-1890	(48mm)
X-Large (10")	LD032	GD010-2000	2"
X-Large (10")	LD036	GD010-2250	2 1/4"

2. Identify the hoist rope and choose a proper place, normally as far up the butt section as practical, to install the swing arm.
3. Install the swing arm by welding, bolting or strapping it to the boom. It should be located to be as centered as possible with the boom end sheave and positioned such that neither the swing arm nor the line riding tensiometer interfere with the hoist rope or other objects.
4. Remove top sheaves and top bolts & spacers from the line riding tensiometer*. Place the line riding tensiometer on the unloaded hoist rope, oriented such that the transmitter antenna is on the cab side and the swing arm holes are

* The hoist rope can also be installed by passing the wire rope around the pulleys when the hook does not interfere.

directed to the boom top. Re-install bolts and sheaves.

5. Attach the swing arm end to the line riding tensiometer.
6. Verify that the angle the swing arm forms with the boom is not too large and that nothing limits free displacement of the swing arm and line riding tensiometer assembly at any boom angle or configuration. Extend the swing arm as needed.
7. If the line riding tensiometer has been supplied with rope payout, ensure that both proximity switches (led) operate as the appropriate sheave turns.
8. Verify that the sensor antenna is not curved.
9. Verify that all bolts are tight.
10. Operate the hoist to verify correct line riding tensiometer function.
11. Proceed to load pin / Line riding tensiometer calibration of the display/receiver (see **Line Riding tensiometer Calibration** section).

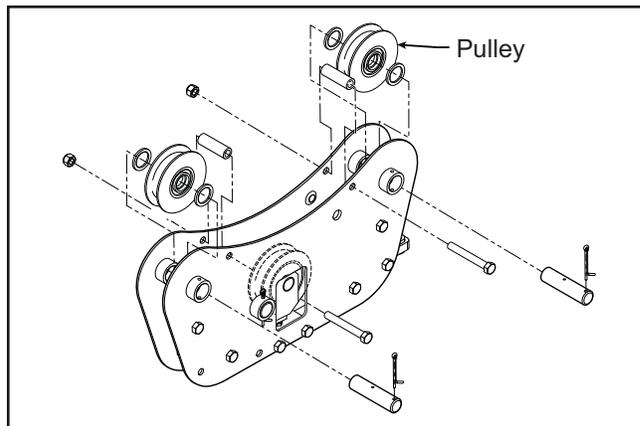


Figure: Removing top sheaves, bolts and spacers on Line Riding tensiometer type 1 (LD008 shown).

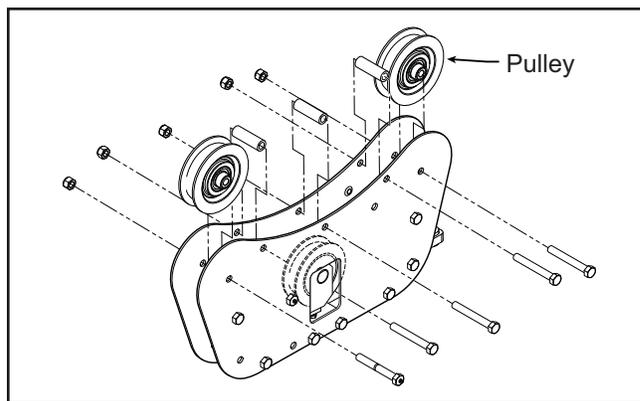


Figure: Removing top sheaves, bolts and spacers on Line Riding tensiometer type 2 (LD024 shown).

2.10 Load Pins, line riding tensiometers and Compression Cells: Calibration

Load pins, line riding tensiometers and compression cells must be calibrated at installation and every time thereafter the installation, the load sensor or the load transmitter is changed.

This procedure requires two known weights. The first (light) weight should be about 10% of load sensor capacity and not less than 5%. The second (heavy) weight should be over 50% of capacity, and absolutely not less than 25%.

1. Go to menu **4) INSTALLATION** and select **4B) SENSOR CALIBRATION**.
2. Enter the user password, press **Enter** and select **4B1) AUTOMATIC CALIBRATION WIZARD**.
3. Use **Up** and **Down** to select the load sensor, and then press **Enter** to confirm communication with the sensor is possible and to start the wizard.
4. Use **Up** and **Down** to adjust the actual parts of

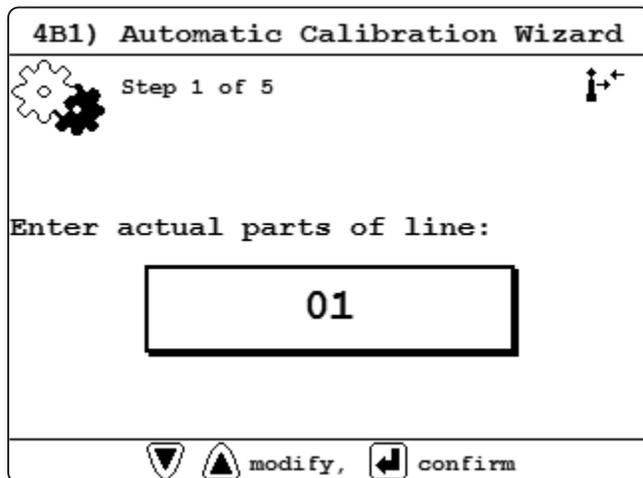


Figure: The automatic load calibration wizard, adjust the actual parts of line

line on the load sensor, and then press **Enter** to confirm.

5. Note the units that will be used during the calibration wizard, and then press **Enter**.
6. Lift the first (lighter) known load, use **Up** and **Down** to adjust the load value displayed to equal the actual known load lifted, and then press **Enter**.

7. Lower the first load, lift the second (heavier) known load, use **Up** and **Down** to adjust the load value displayed to equal the actual known load lifted, and then press **Enter**.

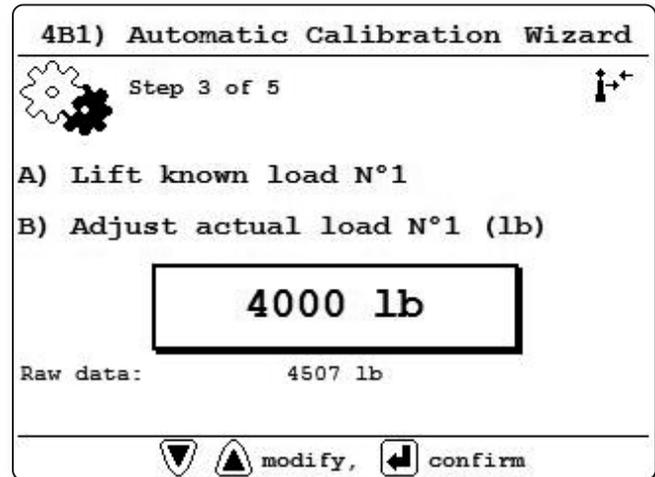


Figure: The automatic load calibration wizard, adjust the load

8. Note the new trim and scale values.

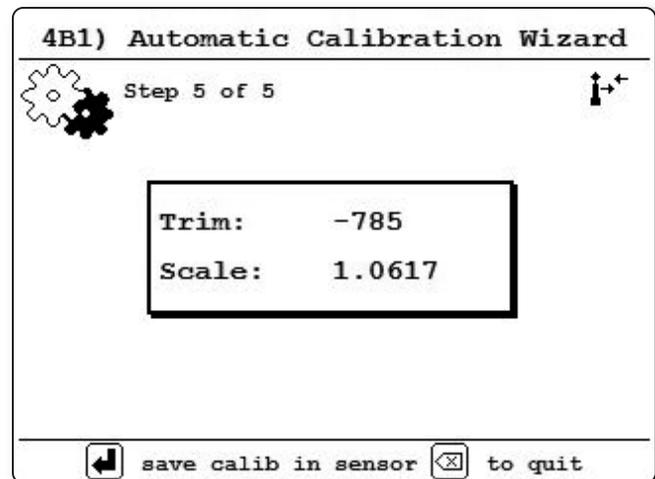


Figure: The automatic load calibration wizard, trim and scale values

9. Press **Enter** to send the new calibration to the load sensor.
10. Press **Exit** to return to the operation display.

2.11 Four Point Lift

The following functions are available for applications such as container cranes and gantry cranes that require load indication from four load sensors simultaneously.

- Sum load indication
- Imbalance
- Slack Rope

These functions can be used to generate an alarm condition on the lockout wires of the GS820.

2.11a Sum Load Indication

When sum load indication is programmed the sum of the loads on the pre-determined load sensors is indicated by the operation display. To activate sum load indication program a “Sum load sensor” in the sensor list. The “ID number” is used to identify the load sensors to be summed.

Sum maximum limit. The maximum limit for the sum load can be adjusted in the limit menu; the default maximum limit for sum load indication is 10000 (lb or kg depending on load display units).

Program sum load indication

1. Go to menu **4) INSTALLATION** and select **4A1) SENSOR LIST**.
2. Enter the user password and press **Enter**.
3. Use **Up** and **Down** to advance to the next available sensor position, usually following the four load sensors and press **Enter** to modify.
4. Determine the sum load cell “ID number”. For example: *ID 1234* to indicate the sum of load sensors № 1, № 2, № 3, and № 4, or *ID 34* to indicate the sum of load sensors № 3 and № 4.
5. Use **Up** and **Down** to select the sensor type “Sum load cell” and press **Enter** to confirm.
6. Use **Up** and **Down** to adjust the ID number and press **Enter**.
7. Press **Enter**.
8. Use **Up** and **Down** to advance to the next available sensor position to program the imbalance sensor or press **Exit** to return to the operation display.
9. Adjust the sum maximum limit in menu **6) SYSTEM LIMITS**.

2.11b Imbalance

Systems programmed for four load sensors and four load sum indication can be programmed with an imbalance sensor to warn against uneven load distribution or against unwanted rope payout if one corner of the load touches down before the others.

Imbalance factor limit. The imbalance factor is the percent difference between the load on one load sensor and the average load on the other three. The imbalance factor is calculated for each of the four load sensors and then compared to an adjustable limit. The default imbalance factor limit is 15%.

Imbalance minimum limit. Imbalance is not calculated when the four load sum is below the imbalance minimum limit. Adjust this limit to avoid generating an imbalance alarm under minimum load conditions (for example: with an empty container or with rigging only). The default imbalance minimum limit is 1000 (pounds or kilograms depending on load display units).

Examples:

Imbalance factor calculation for load sensor № 1

$$\text{Load № 1 (A) Imbalance Factor} = 100 \times \frac{(\text{Average B,C,D}) - A}{(\text{Average B,C,D})}$$

A = Load № 1	B = Load № 2
C = Load № 3	D = Load № 4

If the imbalance factor limit is 15%, then the system is safe.

$$\text{Load № 1 (A) Imbalance Factor} = 100 \times \frac{8100 - 7500}{8100} = 7.5\%$$

A = 7500	B = 8100
C = 8000	D = 8200

If the imbalance factor limit is 15%, then an imbalance alarm is generated.

$$\text{Load № 1 (A) Imbalance Factor} = 100 \times \frac{8100 - 6800}{8100} = 16\%$$

A = 6800	B = 8100
C = 8000	D = 8200

Program the imbalance sensor

1. Go to menu **4) INSTALLATION** and select **4A1) SENSOR LIST**.
2. Enter the user password and press **Enter**.
3. Use **Up** and **Down** to advance to the next available sensor position, usually following the

four load sensors and press **Enter** to modify.

4. Use **Up** and **Down** to select the sensor type “*Imbalance sensor*” and press **Enter**. Only one imbalance sensor is required to calculate imbalance for all four load sensors.
5. The ID can be left at 0, press **Enter**.
6. Press **Enter** to save any changes.
7. Press **Exit** to return to the operation display.
8. Confirm the imbalance factor limit and the imbalance minimum limit in menu **6) SYSTEM LIMITS**.

2.11c Slack Rope

Systems programmed for four load sensors and four load sum indication can be programmed with a slack rope sensor to warn against unwanted rope payout when the load touches down.

Slack rope minimum limit. The slack rope sensor compares the sum load to an adjustable slack rope minimum limit. When the sum load goes below the slack rope limit a slack rope alarm is generated. The slack rope limit is usually adjusted to less than the weight of all rigging below the load sensors. The default slack rope minimum limit for is 1000 (pounds or kilograms depending on load display units).

Program the slack rope sensor.

1. Go to menu **4) INSTALLATION** and select **4A1) SENSOR LIST**.
2. Enter the user password and press **Enter**.
3. Use **Up** and **Down** to advance to the next available sensor position, usually following the four load sensors, the sum load sensor and the imbalance sensor. Press **Enter** to modify.
4. Use **Up** and **Down** to select the sensor type “*Slack rope sensor*”. Only one slack rope sensor is required to calculate slack rope for all four load sensors.
5. The ID can be left at 0, press **Enter**.
6. Press **Exit** to return to the operation display.
7. Adjust the slack rope minimum limit in menu **6) SYSTEM LIMITS**.

2.12 List and Trim Angle Sensor

The GS010-03 is a two axis angle sensor designed to detect both list and trim angle. Minimum and maximum limits for list and trim angle are adjustable in the display. The display will generate an alarm if the limits are exceeded and can be programmed to generate lockout. Furthermore list and trim angle can be used to control rated capacity chart selection where required (example: barge cranes).

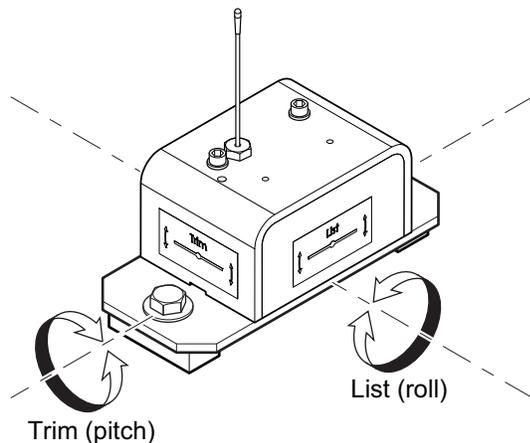


Figure: List and Trim axes

2.12a Programming the GS820 for List and Trim Indication

For list indication, add the GS010-03 ID number to the sensor list (menu **4A**) and select the sensor type "List sensor".

For trim indication, add the GS010-03 ID number to the sensor list (menu **4A**) and select the sensor type "Trim sensor".

The maximum and minimum angles for list and trim indication can be adjusted in the limit menu. The default limits are 10.0° maximum and -10.0° minimum.

2.12b Mounting Instructions



IMPORTANT! Remove the angle sensor from any connecting metal structures or surfaces when welding the metal lugs to the mounting surface. Proximity to welding may cause permanent damage to the angle sensor and prevent accurate angle indication.

1. Determine the angle sensor position.
 - a. The mounting surface should be flat and known to be level (0°) in both the list and trim axes.
 - b. The angle sensor should have a clear line of sight to the cabin mounted display.
 - c. The angle sensor should be installed horizontally, with the antenna pointing up.
 - d. The list and trim axes are indicated on the angle sensor, follow these indications to orient the sensor correctly for accurate list and trim indication.
 - e. The angle sensor antenna should not contact a metal object.
2. Install the welding pads; keep the angle sensor well removed from the weld site and any connecting metal objects while welding.
3. Mount the angle sensor to the weld pads with the screws and washers provided.
4. Verify list and trim angle indication in the operation display.

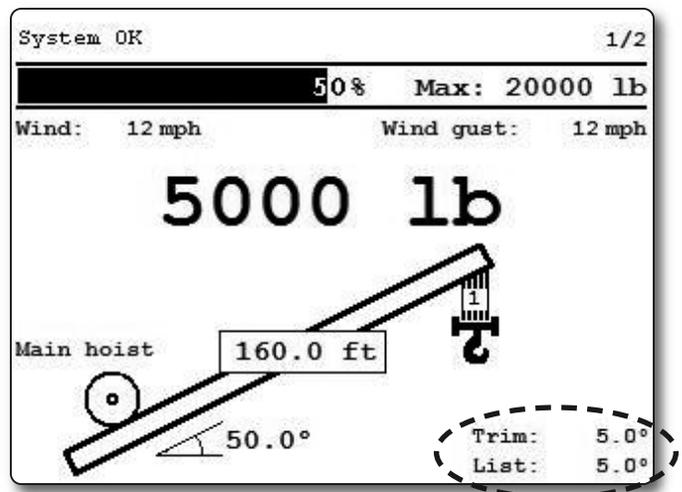


Figure: Trim and list angle indication