



**LENGTH-ANGLE-RADIUS-LOAD
INDICATING SYSTEM**

EI 65

CALIBRATION HANDBOOK

NOTICE

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Table of Contents

1	GENERAL INFORMATION.....	1
2	WARNINGS.....	1
3	ESSENTIAL INFORMATION FOR CALIBRATION:.....	2
4	CALIBRATION.....	4
5	OPERATIONAL CHECKS.....	10
	APPENDIX A - MECHANICAL ADJUSTMENT OF CABLE REEL SENSORS.....	11

1 GENERAL INFORMATION

The Length-Angle-Radius-Load Indicating System EI 65 must be calibrated after completing installation, crane modification, or anytime there is an indication of inaccuracy. The calibration will match the sensor installed on the industrial crane. Refer to the Installation Handbook for the system and sensor installation.

Prior to starting the calibration, it is advised to first read over this procedure in its entirety. This will also allow you a chance to obtain any necessary information. The purpose of this handbook is to provide calibration information required before operating the system. Refer to the Operator Handbook for system description and console controls.

REFERENCE INFORMATION:

PAT Angle-Length-Radius-Load Indicator System EI 65 Operator's Handbook. 56 065 08 0005.

PAT Angle-Length-Radius-Load Indicator System EI 65 Installation Handbook. 031-300-190-008.

2 WARNINGS

Always refer to operational instructions and load charts provided by the crane manufacturer for specific crane operation and load limits.

The Length-Angle-Radius-Load Indicating System EI 65 is not and shall not be a substitute for good operator judgment, experience, or use of acceptable safe operating procedures.

The operator is responsible for operating the crane within the manufacturer's specified parameters.

The crane operator shall ensure that all warnings and instructions provided by the manufacturer are fully understood, observed, and remain with the crane.

Prior to operating the crane, the operator must carefully read and understand the information in the Operator's Handbook so that he knows the operation and limitations of the Length-Angle-Radius-Load Indicating System EI 65.

3 ESSENTIAL INFORMATION FOR CALIBRATION:

- 3.1 Prior to powering up the system verify all wiring. All unused channels must be occupied with dummy signals meeting the following requirements.
- The second angle channel must have a voltage divider installed. Install two 4.7k resistors, one between X1 #21-22 and the other between X1 #22-23.
 - The second and third A2B channels must have a 4.7k resistor. Install a 4.7k resistor between X1 #11-12 and X1 #13-14.
 - The second force channel must have a jumper installed between X1 #30-31.
 - A no load system must have a jumper installed between X1- #26-27, for the first force channel.
- 3.2 Mechanically set the length and angle sensors as follows: (See Appendix A. Mechanical Adjustment for Sensors).
- Length Sensor - With the boom sections fully retracted set the length potentiometer by turning the center screw counter clock wise slowly to a soft stop.
 - Angle Sensors: Align the angle sensors with the boom at zero degrees.
- 3.3 Write down the following geometric measurements, which will be used during calibration. (See Figure 1. Crane Measurements). The measurements taken should be in units that correspond to the load chart. (i.e. lbs/feet, Kg/meters, US-Tons/feet, Metric-ton/meters).

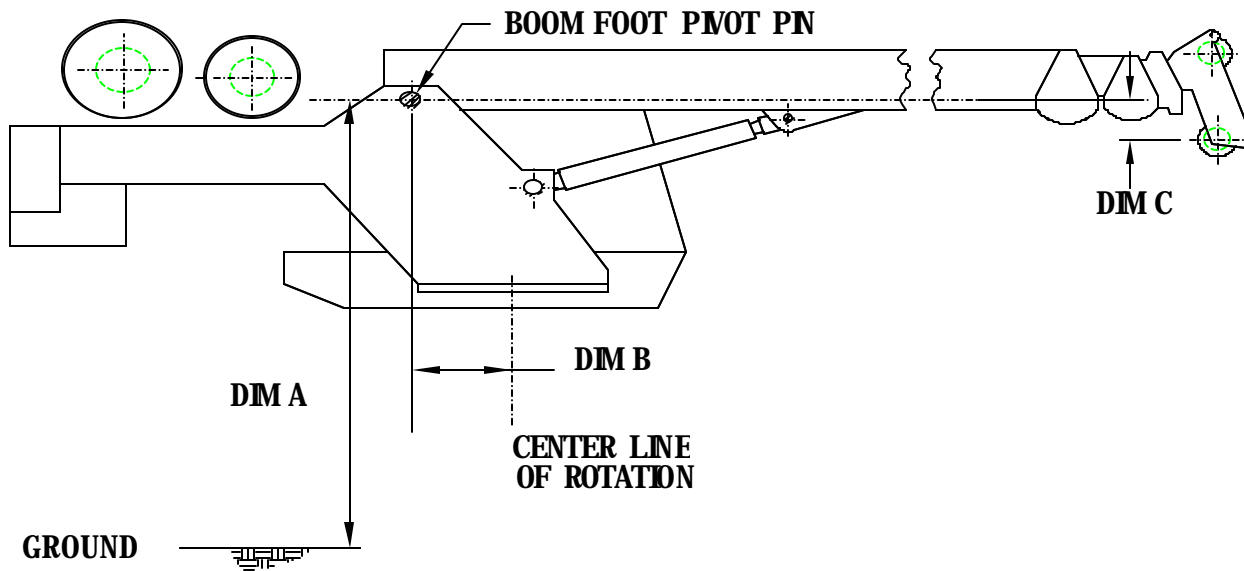


FIGURE 1. CRANE MEASUREMENTS

- The vertical distance from the boom foot pivot pin to the ground. (High Offset)
- The horizontal distance from the boom foot pivot pin to the centerline of rotation. (Rad Offset)
- The head offset, which is the vertical measurement between the boom foot pivot pin to the lower head sheave center pin. (Head Offset)
- Jib extension lengths minimum and maximum

Write the dimensions in the Table provided.

Table 1. Measurements

Dimension A	
Dimension B	
Dimension C	
Jib 1 min/max	
Jib 2 min/max	
Jib 2 angle min/max	

3.4 Calibration of a linerider will require the hoist rope line pull information, which should be provided by the manufacturer. Use single part line when calibrating the linerider. Lineriders require specific wire rope size, see Table 2 to insure your rope size matches your linerider provided.

NOTE: A new wire ropes is normally over sized, the amount oversize will depend on the diameter of the rope. With normal wear the inter core breaks down and diameter decreases, See manufacture guide lines for wire rope replacement conditions.

Table 2. Lineriders should match the wire diameter of your hoist rope.

ITEM NUMBER	DESCRIPTION with WIRE ROPE SIZE	WIRE ROPE DIAMETER ADVISED RANGE
048-311-060-001	SENSOR, LINERIDER SKM311 1/4"	±1/32
048-311-060-002	SENSOR, LINERIDER SKM311 1/2"	±1/32
048-311-060-003	SENSOR, LINERIDER SKM311 9/16"	±1/32
048-312-060-002	SENSOR, LINERIDER SKM312 3/4"	±1/32
048-312-060-001	SENSOR, LINERIDER SKM312 5/8"	±1/32
048-312-060-003	SENSOR, LINERIDER SKM312 7/8"	±3/64
048-312-060-004	SENSOR, LINERIDER SKM312 1"	±3/64
048-312-060-005	SENSOR, LINERIDER SKM312 1 1/8"	±3/64
031-300-060-009	SENSOR, LINERIDER SKM312 1-1/4"	±1/16

3.5 Calibration of dead end force transducers requires two parts of line.

3.6 Always follow the manufacture’s guidelines when operating the crane.

3.7 Always work within the capacity of the rated load charts provided by the manufacturer.

3.8 The total load includes the load, rigging, cables, and hook block.

3.9 Test load should be 75% of maximum rated load for the cranes configuration or condition.

NOTE: To comply with the SAE J376 standards the test load must be to a known accuracy of ±1%.

4 CALIBRATION

- 4.1. Power up the system, the screen will display EI 65/10 software version and date.
- 4.2. Within 5 seconds, simultaneously press the "OK" and "SELECT" buttons in order to start calibration. Hold these buttons (approximately 15 seconds) until the screen changes to "CALIB. PASSWORD". If these buttons are not pressed and held the screen then changes to the existing operating configuration. See operators manual 56 065 08 0005 for operating instructions.
- 4.3. Enter the calibration password "0815". Use the "UP" and "DOWN" buttons to select the number and the "OK" button to confirm each entry.

Enter 0 - OK
8 - OK
1 - OK
5 - OK

NOTE: The sections can be selected by pressing "OK" or skipped by pressing arrow "DOWN".

- 4.4. Select DEFAULT, SAVE TO E-EPROM, and press OK.
- 4.5. Repeat steps 4.1 through 4.3.
- 4.6. CONFIG LANGUAGE - Press "OK" to select and use the arrow "UP and DOWN" buttons to select a language; English, Spanish, or French. When complete press the "OK" button.
- 4.7. CONFIG UNITS - Press "OK" to select and use the arrow "UP and DOWN" buttons to select the load units; LBS (lbs), TONS (t), KILOGRAMS (kg), US-TONS (tons). When complete press the "OK" button.

NOTE: Select the units used in the load charts provided by the manufacturer.

- 4.8. CONFIG CRANE DEF - Calibrates the angle sensor and defines the required geometric measurement of the crane. Press "OK" to select.
 - 4.8.1. WG OFFSET - Measure the boom angle, using an inclinometer or similar device. Press the arrows "UP or "DOWN" to adjust the displayed angle to match the measured angle. Press "OK" to enter angle.

NOTE: Measurements should be in units that correspond to the load chart. (i.e. lbs/feet, Kg/meters, US-Tons/feet, Metric-ton/meters).

- 4.8.2. HIGH OFFSET - This is the vertical measurement from the boom foot pivot pin to the ground, as taken in step 3.3.A. Press the arrows "UP and DOWN" to adjust the display. Press "OK" to enter measurement.
- 4.8.3. RAD OFFSET - This is the horizontal measurement between the boom foot pivot pin and the centerline of rotation, as taken in step 3.3.B. If the Boom Foot Pivot Pin is located behind the CenterLine of Rotation the value needs to be entered as a positive. If the Pivot pin is forward of the CenterLine of Rotation the value needs to be entered as a negative. Press the arrows "UP or "DOWN" to adjust the display. Press "OK" to enter measurement.

4.8.4. HEAD OFFSET - The vertical measurement between the boom foot pivot pin and the lower head sheave center pin, as taken in step 3.3.C. If the center pin is below the boom foot pivot pin enter the value as a negative by using the arrows "UP or DOWN" to adjust the display. Press "OK" to enter measurement.

4.9. CONFIG MAIN BOOM - This section configures the type of main boom, fixed or tele. Press the "OK" button and proceed by answering the questions on the screen.

4.9.1. MAIN BOOM FIXED? - Press "OK" to accept or the arrow "DOWN" for next selection.

4.9.1.1. Enter the minimum length using the arrows "UP or DOWN" to adjust the display. Press "OK" to enter length.

4.9.1.2. Enter the maximum length using the arrows "UP or DOWN" to adjust the display. Press "OK" to enter length.

4.9.2. MAIN BOOM TELE? - Press "OK" to accept or the arrow "DOWN" for next selection.

4.9.2.1. MAIN BOOM MIN? - DRIVE MAIN BOOM ON MIN POSITION! - Fully retract the main boom. Ensure that the length potentiometer has been reset by turning the center screw counter clockwise until you have reached a soft stop. Refer to Section 3.2.

4.9.2.2. Press "OK" to display minimum length preset value.

4.9.2.3. Press the arrows "UP or "DOWN" to adjust the displayed length to minimum or fully retracted length.

4.9.2.4. Press "OK" to enter length minimum preset value.

4.9.2.5. MAIN BOOM MAX? - DRIVE MAIN BOOM ON MAX POSITION! Fully extend the main boom; include the power pin fly extension when applicable.

WARNING: The operator is responsible for operating the crane within the manufacturer's specified parameters.

4.9.2.6. Press "OK" to display maximum preset value.

4.9.2.7. Press the arrows "UP or "DOWN" to adjust the displayed length to maximum or fully extended length.

4.9.2.8. Press "OK" to enter length.

4.10. CONFIG EXTENSION - This section configures two extensions with minimum and maximum length, a minimum and maximum angle (OFFSET MIN/MAX) for the second extension (LENGTH 2), and whip extension or variable angled extension with angle sensor. Use figures 2 through 5 to help identify your configuration. Press "OK" and proceed by entering extension lengths, angle, and calibrating whip extension angle. Configure the extensions that your crane will use and enter zero for unused portions of CONFIG EXTENSION. Recommendation: setup the extensions minimum length as zero, so if this extension is removed you can change the length in the SELECT section of operation instead of entering calibration mode to remove extension.



Figure 2. Fixed Extension
(Enter extension as length 1 minimum and maximum)

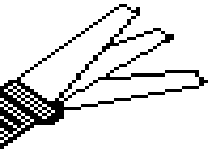


Figure 3. Fixed, Offsettable Extension
(Enter extension as length 2 minimum and maximum and angle offset minimum and maximum)

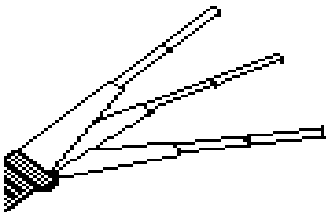


Figure 4. Tele-Offsettable Extension
(Enter extension as length 2 minimum and maximum and angle offset minimum and maximum)

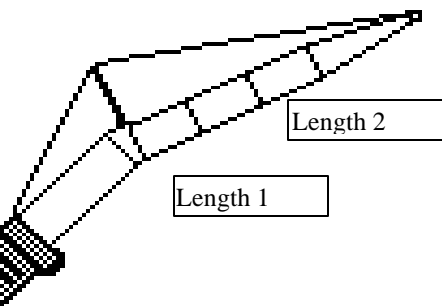


Figure 5. Fixed Extension with Offsettable Jib
(Enter base extension as length 1 minimum and maximum. Enter luffing extension as length 2 minimum and maximum and set whip extension angle sensor.)

- 4.10.1. LENGTH_1 MIN - Press the arrows "UP or "DOWN" to display minimum length. Press "OK" to enter length.
 - 4.10.2. LENGTH_1 MAX - Press the arrows "UP or "DOWN" to display maximum length. Press "OK" to enter length.
 - 4.10.3. LENGTH_2 MIN - Press the arrows "UP or "DOWN" to display minimum length. Press "OK" to enter length.
 - 4.10.4. LENGTH_2 MAX - Press the arrows "UP or "DOWN" to display maximum length. Press "OK" to enter length.
 - 4.10.5. OFFSET MIN - Press the arrows "UP or "DOWN" to display minimum offset angle. Press "OK" to enter angle.
 - 4.10.6. OFFSET MAX - Press the arrows "UP or "DOWN" to display maximum offset angle. Press "OK" to enter length.
 - 4.10.7. WHIP EXTENSION - This is a variable angled extension (luffing) with angle sensor. Press the arrows "UP or "DOWN" to select yes or no and Press "OK" to confirm entry. If no go to Step 9.
 - 4.10.7.1. WG_OFFSET EXT. - Align the offsetable jib with the extension and/or main boom so the angles are equal. Measure the extension angle using an inclinometer or similar device. Press the arrows "UP or "DOWN" to adjust the displayed angle to match the measured angle. Press "OK" to enter angle.
- 4.11. CONFIGURE KMD1 - This step calibrates the main boom force sensor. To calibrate this section you will be required to pick a know test load 75% of permissible line pull.
- 4.11.1. Press "OK" to calibrate the KMD1 - Main Line Rider/Load Cell or press the arrow "DOWN" button to continue.
 - 4.11.2. PARTS OF LINE - Use the arrows "UP or DOWN" to select parts of line. NOTE: Two parts of line are needed for a Load Cell and one part of line for a Line Rider.
 - 4.11.3. KMD1 TYPE - Use the arrows "UP or DOWN" to enter the value for the type of Force Transducer being used. For a load Cell enter (e.g.. 20ton = 20). For Line Rider applications, divide the hoist rope line pull by 2,204 and round up to the next whole number. (i.e. 30,500lbs. Line pull) Divide 30.5 by 2.204 = 13.8, rounded up = 14. The KMD TYPE value is 14.
 - 4.11.4. Press "OK" to confirm type.
 - 4.11.5. KMD1OFFSET - This operation sets the load at zero.
 - 4.11.6. Set the hook block on the ground.
 - 4.11.7. Use the arrows "UP or DOWN" to adjust the display to indicate zero load.
 - 4.11.8. Press "OK" to confirm zero load.

- 4.11.9. KMD1 CONST - Lift a test load of at least 75% of permissible line pull for the crane configuration. See crane manufactures data for approximate load.

NOTE: To comply with the SAE J376 standards the test load must be to a known accuracy of $\pm 1\%$.

- 4.11.9.1. Use the arrows "UP or DOWN" to adjust the display load to indicate your total test load. NOTE: The total load includes the load, rigging, cables, and hook block.

- 4.11.9.2. Press "OK" to confirm total load.

- 4.12. CONFIGURE KMD2 - This step calibrates the auxiliary force sensor. To calibrate this section you will be required to pick a know test load 75% of permissible line pull.

- 4.12.1. Press "OK" to calibrate the KMD2 - Auxiliary or press the arrow "DOWN" button to continue.

- 4.12.2. PARTS OF LINE - Use the arrows "UP or DOWN" to select parts of line. NOTE: Two parts of line are needed for a Load Cell and one part of line for a Line Rider.

- 4.12.3. KMD2 TYPE - Use the arrows "UP or DOWN" to enter the value for the type of Force Transducer being used. For a load Cell enter (e.g.. 20ton = 20). For Line Rider applications, divide the hoist rope line pull by 2,204 and round up to the next whole number. (i.e. 30,500lbs. Line pull) Divide 30.5 by 2.204 = 13.8, rounded up = 14. The KMD TYPE value is 14.

- 4.12.4. Press "OK" to confirm type.

- 4.12.5. KMD2 OFFSET - This operation sets the load at zero.

- 4.12.5.1. Set the hook block on the ground.

- 4.12.5.2. Use the arrows "UP or DOWN" to adjust the display to indicate zero load.

- 4.12.5.3. Press "OK" to confirm zero load.

- 4.12.6. KMD2 CONST - Lift a test load of at least 75% of permissible line pull for the crane configuration. See crane manufactures data for approximate load.

NOTE: To comply with the SAE J376 standards the test load must be to a known accuracy of $\pm 1\%$.

- 4.12.6.1. Use the arrows "UP or DOWN" to adjust the display load to indicate your total test load. NOTE: The total load includes the load, rigging, cables, and hook block.

- 4.12.6.2. Press "OK" to confirm total load.

- 4.13. CONFIG DISPLAY - This section configures the data that will be displayed on the screen.
 - 4.13.1. SHOW LOAD? - YES arrow "UP", NO arrow "DOWN". Press "OK" to confirm.
 - 4.13.2. SHOW HIGH? - YES arrow "UP", NO arrow "DOWN". Press "OK" to confirm.
 - 4.13.3. SHOW HOIST? - YES arrow "UP", NO arrow "DOWN". Press "OK" to confirm.
 - 4.13.4. SHOW RADIUS? - YES ARROW "UP", NO arrow" DOWN". Press "OK" to confirm.
 - 4.13.5. SHOW LENGTH? - YES arrow "UP", NO arrow "DOWN". Press "OK" to confirm.
 - 4.13.6. SHOW ANGLE? - YES arrow "UP", NO arrow "DOWN". Press "OK" to confirm.
 - 4.13.7. SHOW REEVING? - YES arrow "UP", NO arrow "DOWN". Press "OK" to confirm.
- 4.14. CONFIGURATION READY??? - At this point, you may return to any part of the calibration sections by using the arrows "UP" or "DOWN" to change calibration data. Press "OK" to confirm.
- 4.15. SAVE TO E-EPROM??? - Save calibration data to E-EPROM by pressing "OK". Pressing the arrow "DOWN" for NO will disregard data entries made during this calibration session. If the calibration data is disregarded and the system has not been calibrated as stated in this document and the crane must not be operated.
- 4.16. The screen then changes to the operating configuration that is presently set. Press "OK" button to proceed to the working screen. Refer to the operator handbook section 4.2. to set operating conditions.

5 OPERATIONAL CHECKS

After completing calibration do the following operational checks to verify displayed values. These operational checks should be complete at anytime there is an indication of inaccuracy.

NOTE: We recommend completing all operational checks before correcting calibration data.

5.1 Check the angle of the main boom and compare it with the measure value. It should be $\pm 1^\circ$. If the angle is incorrect complete Sections 4.1, 4.2, 4.3 and 4.6.

NOTE: Use the select button to specify crane configuration before performing the following checks. See Operators Handbook 056 065 08 0005.

5.2. Check the radius displayed and compare it with the measured radius. The radius is a horizontal measurement from the centerline of rotation to the center of the hook block. The displayed radius should be equal to or greater than the measured radius by 10%. For example, if the measured radius equals 15ft then the displayed radius should be 15ft to 16.5ft. If displayed value is incorrect, verify the Rad Offset measurement taken in 3.3.B and complete Sections 4.1, 4.2, 4.3, and 4.6.

5.3. Check the total load displayed by picking the known test load. This will require picking a load for each force sensor, KMD1 and KMD2, if applicable. The displayed load should be equal to or greater than the known load by 10%. For example, if the known load equals 12,000lbs then the displayed load should be 12,000lbs to 13,200lbs. If displayed value is incorrect, complete Sections 4.1, 4.2, 4.3, and 4.9 for KMD1 and/or 4.10 for KMD2.

NOTE: To comply with the SAE J376 standards the test load must be to a known accuracy of $\pm 1\%$.

APPENDIX A - MECHANICAL ADJUSTMENT OF CABLE REEL SENSORS

