SkyAzúl
EQUIPMENT SOLUTIONS

qSCALE

LMAP System for Altec Telescopic Crane

Service Manual

TABLE OF CONTENTS

NOTICE

SkyAzúl makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and/or its fitness for a particular purpose.

SkyAzúl will not be liable for errors contained in this manual or for incidental or consequential damages in connection with the furnishing, performance, or use of this manual. This document contains proprietary information, which is protected by copyright, and all rights are reserved.

No part of this document may be photocopied, reproduced, or translated to another language without the prior written consent of SkyAzúl.

SkyAzúl reserves proprietary rights to all drawings, photos and the data contained therein. The drawings, photos and data are confidential and cannot be used or reproduced without the written consent of SkyAzúl. The drawings and/or photos are subject to technical modification without prior notice.

All information in this document is subject to change without notice.

SkyAzúl, Inc.
16 Walnut Street
Middletown, MD 21769
Fax 301-371-0029
info@skyazul.com

Marking of Notices

Dangers and other important notices are marked as follows in this user manual:

WARNING

Warning of direct threat of personal injury and damage to property.

Instructions on precautions to avert the danger.

CAUTION

Warning of dangerous situations. Also warns of damage to property.

Instructions for averting the danger.

IMPORTANT

Warning of possibly damaging situation for the product.

Instructions for avoiding the possibly damaging situation.

NOTE

Usage instructions and information, but no dangerous situation

HINT

Supplementary comments and recommendations for the user.

1 Safety Instructions

WARNING

Imminent threat of personal injury and damage to property due to incorrect system settings!

The correct adjustment of the LMAP to the current set-up status is essential for the correct function of the system and of the crane.

The LMAP can only operate correctly if all settings are entered correctly according to the current set-up status during the SETUP procedure.

The settings can only be carried out by operators who are completely familiar with the operation and functions of the crane and the LMAP.

The correctness of these settings must be guaranteed before starting the crane operations!

IMPORTANT

Connection to the wrong power supply will cause damage to the device.

The device may only be connected to a DC voltage source of 10 V to 30 V!

2 General Information

This service manual is designed to assist a service or maintenance person in identifying system problem areas or malfunctions. A digital voltmeter with the capability to measure current will be required, along with standard maintenance and service tools.

NOTE

Knowledge of how to use a voltmeter to measure both voltage and current is assumed.

HINT

For system operation, refer to the Operator's Manual.

3 Description of the System

3.1 Description of system function

The qSCALE system is a CAN bus system made up of a central microprocessor unit, operating console, length/angle sensor, pressure transducers, and anti-two block switches. All components and sensors are equipped with CAN bus controllers.

The Hirschmann Automation and Control system operates on the principle of reference/real comparison. The real value resulting from the pressure measurement is compared with the reference data stored in the central processor memory and evaluated in the microprocessor. When limits are reached, an overload warning signal is generated at the operator's console. At the same time, the aggravating crane movements, such as hoist up, telescope out, and boom down, will be stopped.

The fixed data regarding the crane, such as capacity charts, boom weights, centers of gravity, and dimensions are stored in memory chips in the central processor unit. This data is the reference information used to calculate the operating conditions.

Boom length and boom angle are registered by the length/angle sensor mounted inside the cable reel which is mounted on the boom. The boom length is measured by the cable reel cable, which also serves as an electrical conductor for the anti-two block switches.

The crane load is measured by pressure transducers attached to the piston and rod side of the hoist cylinders.

3.2 Description of the CAN Bus system

CAN stands for “Controller Area Network” and is intended to be used as a serial bus system for a network of controllers. Each controller connected through a CAN chip is called a "node" and is mostly used to acquire data from a sensor. All nodes are connected to a common bus and all nodes are able to simultaneously read the data on that bus. Also, all nodes are able to transmit data on that bus, but only one node at a given time has write access to the bus. If the message is relevant, it will be processed; otherwise, it is ignored. The unique identifier also determines the priority of the message. The lower the numerical value of the identifier, the higher the priority.

The cable bus is a twisted pair of shielded wire. Data can be transmitted in blocks from 0-8 bytes at a maximum transfer rate of 1 Mbit/s for networks up to 40 meters. For longer network distances, the maximum transfer rate must be reduced to 50 Kbit/s for a 1 km network distance. CAN will operate in extremely harsh environments and the extensive error checking mechanisms ensure that any transmission errors are detected.

3.3 Description of the System Components

The qSCALE system is comprised of various components including the console, control, cable reel, various sensors, and the A2B switch. Each component is described in more detail in this section.

3.3.1 Pressure Transducers

The pressure transducers convert hydraulic pressure into an electric signal. The pressure transducers are connected to the CAN bus junction box. One pressure transducer is connected to the piston side of the lift cylinder and the other to the rod side.

3.3.2 Length-Angle Transducer

The length-angle sensor (LWG), often referred to as the “cable reel”, is installed on the base section of the boom and measures the length and the angle of the boom.

A reeling drum drives a potentiometer which is the length transducer. Part of the length circuit is the length cable on the drum which is a multi-conductor cable. It is connected to one or more anti-two-block switches at the boom head and to a slip ring body in the LWG.

The angle transducer (WGC) is a liquid capacitive angle sensor. Both length and angle transducer are connected to a CAN bus controller board which is connected to the bus system.

3.3.3 Anti-Two-Block (A2B) Switch

The anti-two-block switch monitors the load block and its relationship with the head of the boom. In working condition, the switch is closed. When the load block strikes the weight, the circuit opens, disengaging a relay output to the lock out solenoid valves, where applicable. To check the cable for damage (short circuit to ground) there is a 4.7k resistor between ground and the contact of the switch to give a signal back to the central unit. The weight at the anti-two-block switch keeps the switch closed until the load block strikes it.

3.3.4 Slew (Angle of Rotation) Sensor

This component is an absolute rotary encoder. This slew angle is the angle (rotational positioning) of the crane boom relative to the truck.

3.3.5 Tilt Sensor

This component is a new and very compact generation of MEMS based inclination sensors, applicable for all kinds of angle and position measurements on mobile machines. Typical applications include determination of a crane boom angle, the leveling of an undercarriage, and alignment tasks on mobile machines.

3.3.6 Console (vSCALE)

The graphic console displays all geometrical information such as length and angle of main boom, working radius and tip height of the boom. It also displays the actual load and the maximum load permitted by load chart. Furthermore, it has an audible alarm and warning indication for overload conditions. The graphic display allows for a simple interactive configuration setup as well as sensor calibration (zero adjustment) and sensor output screen. The console has a warning light for anti-two-block conditions.

Refer to the Operator's Manual for detailed operation of the console.

3.3.7 Central Unit (cSCALE)

Inside the central unit, there is a CPU. The central unit has hard-mounted connectors for various inputs, outputs and CAN Bus sensors. Six status lights show the current status of the central unit. See section 7.5.2.

NOTE

Third wrap switches and hoist rotations switches are provided by Altec. Please refer to Altec service manual for further description for these components.

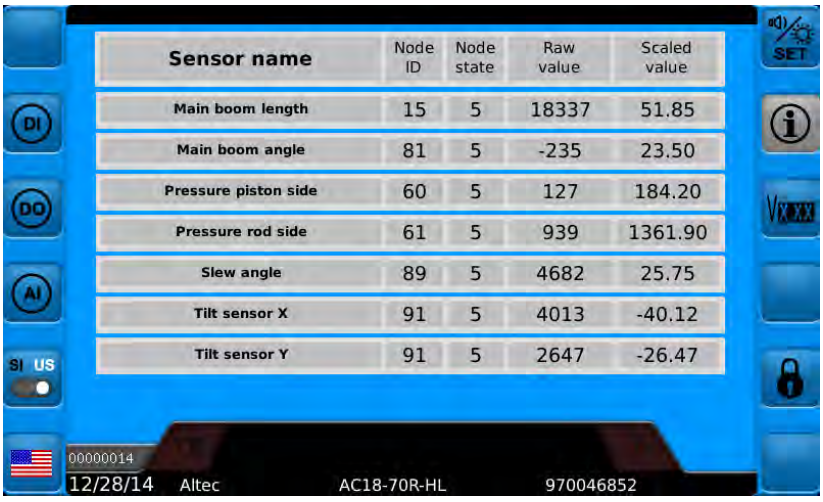
3.4 Sensor Troubleshooting with Display

The status of all inputs and outputs of the system can be checked using several screen displays on the LMAP console.

3.4.1 CAN Sensor troubleshooting

To determine whether there is a problem with a sensor, the system has a built in “CAN Sensors” screen to make trouble-shooting easier. This is the place to start if you suspect a problem with a sensor.

Example CAN Sensor Monitoring



Sensor name	Node ID	Node state	Raw value	Scaled value
Main boom length	15	5	18337	51.85
Main boom angle	81	5	-235	23.50
Pressure piston side	60	5	127	184.20
Pressure rod side	61	5	939	1361.90
Slew angle	89	5	4682	25.75
Tilt sensor X	91	5	4013	-40.12
Tilt sensor Y	91	5	2647	-26.47

NOTE

The Node State will be a “5” when the input sensor is active and running.
The Node State will be a “7” when the sensor is not active.
The Node State will be a “99” when the input sensor is disconnected from the CAN Bus.

3.4.2 Digital Input Troubleshooting

To determine whether there is a problem with a digital input, the system has a built in “Digital Input” screen to make trouble-shooting easier.

HOME → INFO → DIGITAL INPUT

Press the digital input button to scroll between pages 1 and 2.

Example DI Monitoring

The system can determine various kinds of input and output faults and will indicate them on their respective screen display.

Status Indicators

Indicator	Description
INIT	Initialized and running
FAULT	Faulted
SGND	Short to ground
SBAT	Short to battery
ERR	Deactivated

Table 3- 1

3.4.3 Digital Output Troubleshooting

To determine whether there is a problem with a digital output, the system has a built in “Digital Output” screens to make trouble-shooting easier.

HOME → INFO → DIGITAL OUTPUT

Press the digital output button to scroll between pages 1 and 2.

Example DO Monitoring

The system can determine various kinds of input and output faults and will indicate them on their respective screen display.

Status Indicators

Indicator	Description
INIT	Initialized and running
FAULT	Faulted
SGND	Short to ground
SBAT	Short to battery
ERR	Deactivated

Table 3- 2

4 Troubleshooting

4.1 What is Wrong?

In most cases, your problem will fall under the following categories:

Questions:

I HAVE AN ERROR CODE INDICATED ON THE CONSOLE

Please go to Section 4.14 Error Codes.

THE DISPLAYED ANGLE DOES NOT MATCH THE ACTUAL BOOM ANGLE

Start in Section 4.5 Boom Angle Sensing to troubleshoot possible problems with the boom angle measurement.

THE DISPLAYED LENGTH DOES NOT MATCH THE ACTUAL BOOM LENGTH

Start in section 4.6 Boom Length Sensing to troubleshoot possible problems with the boom length measurement.

THE DISPLAYED PRESSURES DOES NOT MATCH THE ACTUAL PRESSURES

Start in section 4.7 Pressure Sensing to troubleshoot possible problems with the pressure transducers.

THE DISPLAYED SLEWING DOES NOT MATCH THE ACTUAL SLEWING ANGLE

Refer to section 4.8 Slew Sensing to troubleshoot possible problems with the slew angle measurement.

THE DISPLAYED LOAD DOES NOT MATCH THE ACTUAL LOAD

Please note that the indicated load is calculated by the system from the geometry information in the computer, the operator's selections, and all the sensor inputs. If the load display is off, it may be due to an error in any or several of these inputs! Refer to section 4.9 Load Sensing to narrow down the source of your problem.

THE DISPLAYED TILT DOES NOT MATCH THE ACTUAL TILT

Start in section 4.10 Tilt XY Sensing to troubleshoot possible problems with the tilt measurement

THE CONSOLE DISPLAY IS BLANK

If the console does not show any sign at all (no lights, no buzzer, and no display), the problem is in the wiring between console and central unit, or the console itself has a problem. Refer to section 4.12 No Console Display for further troubleshooting.

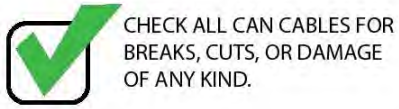
I HAVE AN A2B PROBLEM

Please go to section 4.11 Anti-Two Block Switch (A2B).

I HAVE A CAN BUS PROBLEM

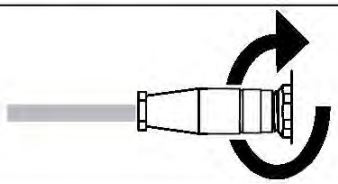
Please go to section 4.13 CAN Bus Communication.

4.2 Initial System Inspection

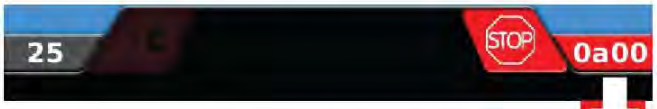


CHECK ALL CAN CABLES FOR BREAKS, CUTS, OR DAMAGE OF ANY KIND.

CHECK CONNECTIONS AT SENSORS AND AT THE CAN JUNCTION BOX



VERIFY THAT ALL PARTS OF THE SYSTEM ARE INTACT PRIOR TO FOLLOWING ANY TROUBLESHOOTING PROCEDURES. THE SITUTATIONS OUTLINED ABOVE COULD PRODUCE ANY OF THE FOLLOWING ERROR CODES:



CONSOLE/TURRET/CONTROLLER ERROR	182c
TILT SENSING ERROR	1838
SLEW SENSING ERROR	1828
PISTON SIDE PRESSURE SENSING ERROR	1802
ROD SIDE PRESSURE SENSING ERROR	1803
LENGTH/ANGLE SENSING ERROR	1800

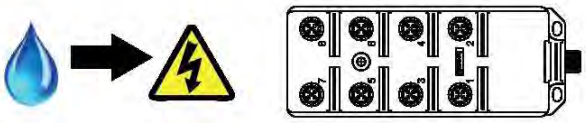
LOW SYSTEM VOLTAGE CAN CAUSE CAN-BUS ERRORS

WAITING FOR CONNECTION ERROR- CAN BE CAUSED BY ANY OF THE FOLLOWING SCENARIOS:

- CYCLING THE SYSTEM POWER ON & OFF TOO QUICKLY:
  THERE MUST BE A MINIMUM OF 10 SECONDS
  BETWEEN POWERING OFF AND BACK ON AGAIN.

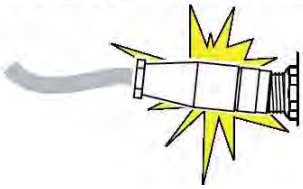
...WAIT 10 SECONDS...

- WATER ACROSS THE TERMINALS INSIDE THE CAN JUNCTION BOX

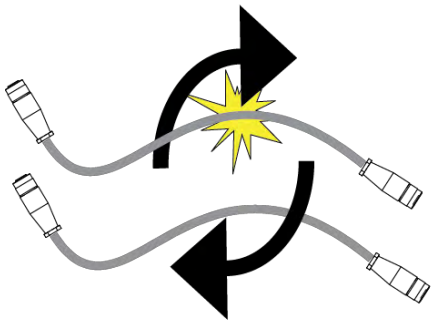


- DAMAGE TO ANY CABLES IN THE iSCALE SYSTEM

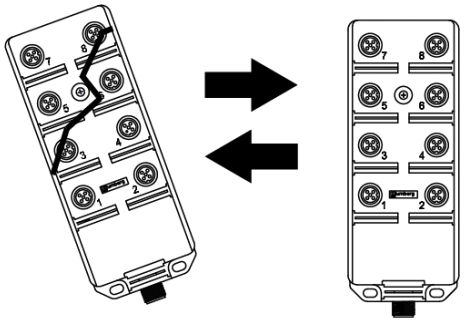
- LOOSE, OR DAMAGED CONNECTIONS



4.3 Simple Corrective Actions



DAMAGE TO A MALFUNCTIONING COMPONENT MAY NOT BE VISIBLE UPON CASUAL INSPECTION. IF POSSIBLE, SUBSTITUTE A SUSPECTED FAILED ELEMENT WITH A KNOWN FUNCTIONING PIECE OF EQUIPMENT.



IF (AFTER COMPLETING THIS STEP) ERRORS ARE STILL BEING PRODUCED, THEN PROCEED IN FOLLOWING TROUBLESHOOTING PROCEDURES SPECIFIC TO THE CODES OF THE SENSOR(S) BEING GENERATED.

NOTE

All codes produced by the LMAP system are "ERRORS". Some codes generated are simply for the event log. Others indicate load chart, limits exceeded, and safety warnings. See the section on Error Code Definitions for a complete list of codes, descriptions, and solutions.

Error Codes are displayed in order of priority – most critical codes first. Therefore, multiple codes are possible depending upon the situation.

4.4 Indicator Definitions

Indicators are located on the Central Control Unit and the Console to assist with troubleshooting basic power and software issues.

4.4.1 Indicators on Central Control Unit

Visual LED indicators are located on the top of the Central Control Unit.

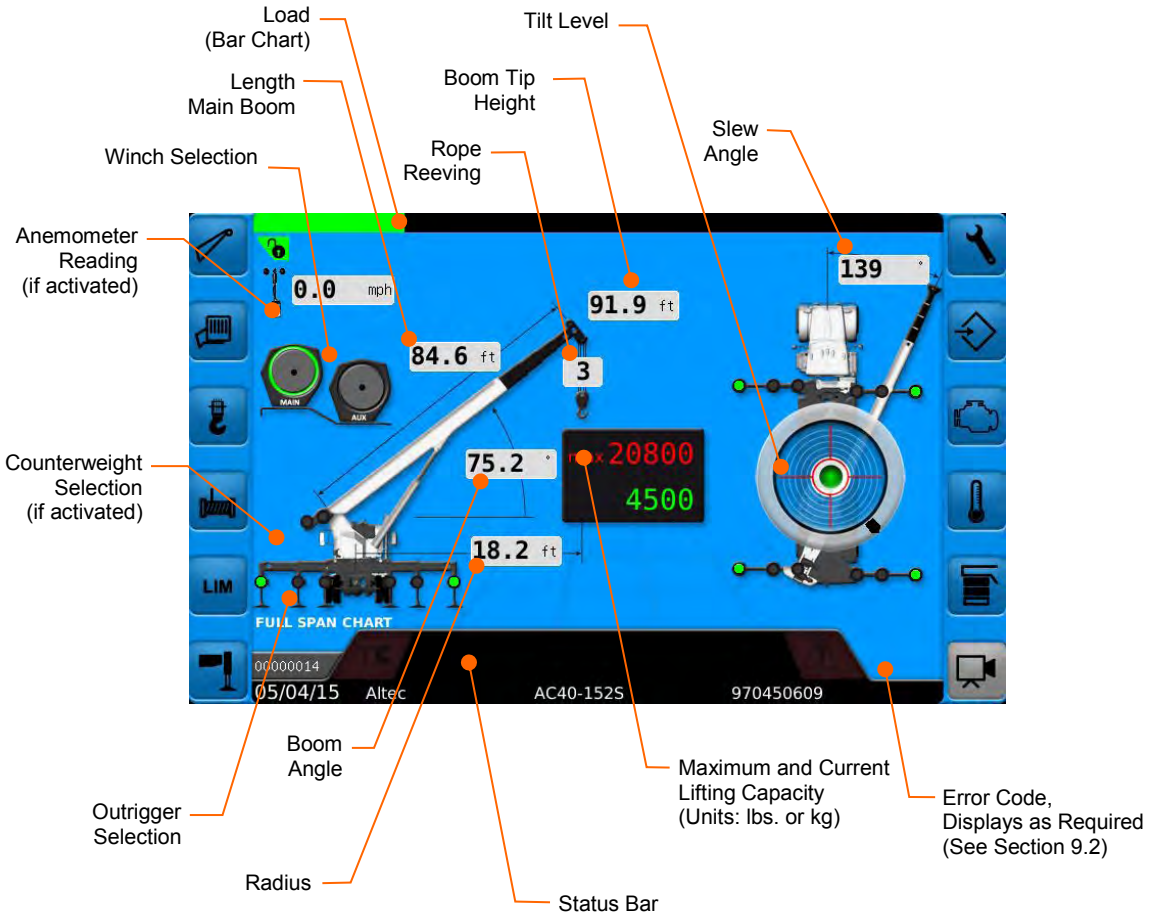
PON	**P**ower **ON**
POK	**P**ower **OK**
SR	**S**afety **R**elay Active
RUN	Application **RUN**ning (CoDeSys)
ERR	Software **ERR**or The system software controls this LED; the normal case is that the LED is off. If the LED is ON, or a flashing code is shown, then there is an error.
S1	Application-**S**pecific control indicator. If the LED is ON solid, the application is running; if it is flashing, there is a safety system malfunction or missing crane information.

4.4.2 Indicator on Console Unit

Operating display: Illuminates green when the supply voltage is connected.

4.4.3 Indicators on Main Working Screen

The LMAP main menu is the central operating image during crane operation and the starting point for the selection of various functions.



HINT

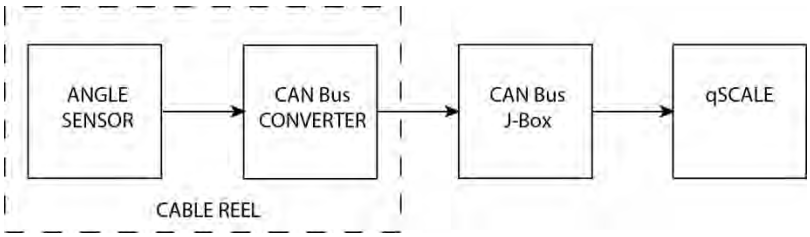
Refer to the Operator's Manual for descriptions of indicators on the status bar.

4.5 Boom Angle Sensing

The system measures the angle of the main boom of the machine with an angle sensor. The angle sensor is contained within the cable reel, located on the main boom.

4.5.1 Boom Angle Sensing Overview

Block Diagram



The signal runs from the angle sensor to the CAN Bus converter board, both located in the cable reel. From there, it travels as digital information on the CAN Bus to the central processing unit.

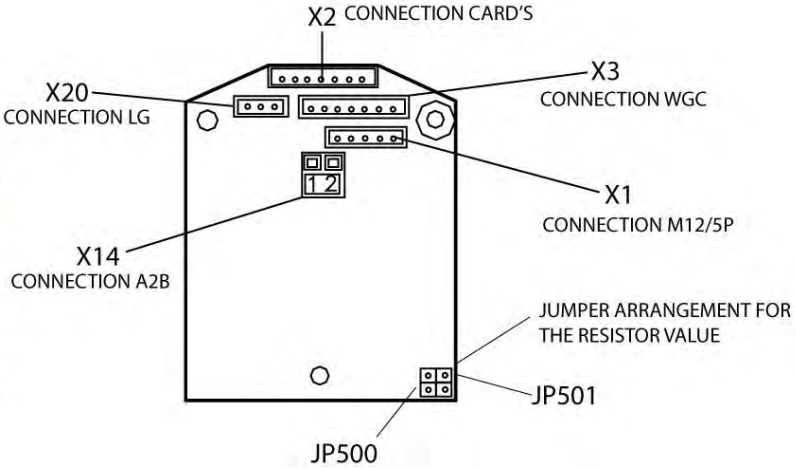
Question: So, what do you do when you are having a problem with your angle indication on the display?

Start by verifying the actual angle to display the angle at several positions. Refer to Section 3.4 Sensor Troubleshooting with Display to call up the sensor signal on your console display. The CAN Bus is digital and as such will either transmit the signal correctly or not at all. If your readings are off, start by opening the cable reel, identify the type, and locate the angle sensor and the CAN Bus converter board:

Reel Assembly

LWG 154

CAN Bus converter board



The angle sensor is based on liquid capacitive inclinometer technology. As the angle changes, so will the fluid, and with it the capacity changes. The converter board supplies a constant voltage of 12V to the angle sensor and in return monitor's an absolute position. The connector used is X3. The angle sensor is connected as follows:

Angle Sensor Connector X3

Connector X3	
1	CAN SHIELD
2	CAN +(~12V)
3	CAN GROUND
4	CAN HI
5	CAN LOW

Table 4 - 1

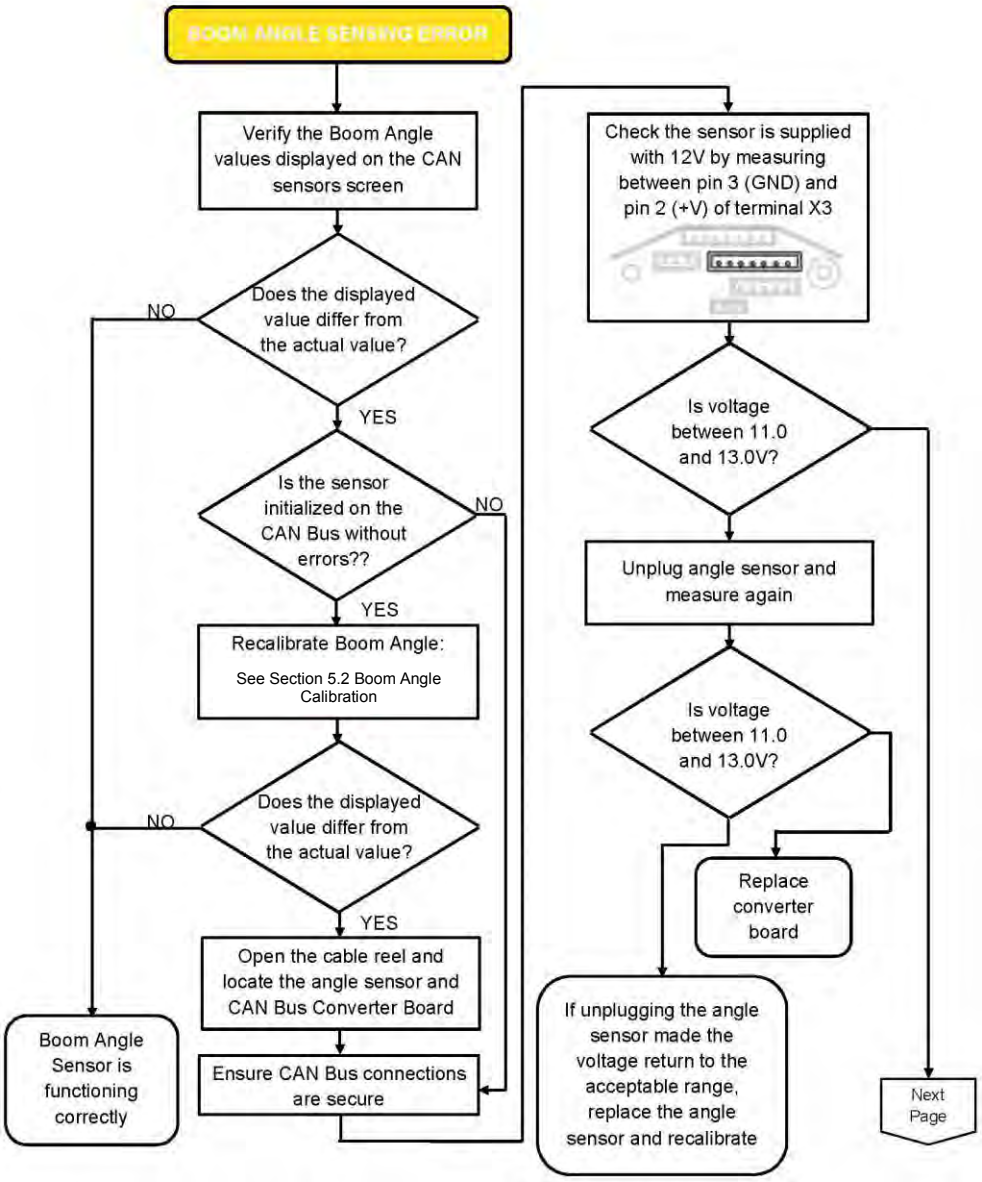
Verify that the sensor is being supplied with 12V by measuring between pin 3 (GND) and Pin 2 (+) of terminal X3. If the voltage is outside of a range of 11.0V to 13.0V, the converter board might be defective. Unplug the angle sensor and measure again. If the voltage is still off, exchange converter board. If unplugging the angle sensor made the voltage return into the acceptable range, exchange angle sensor. If the voltage is correct, continue:

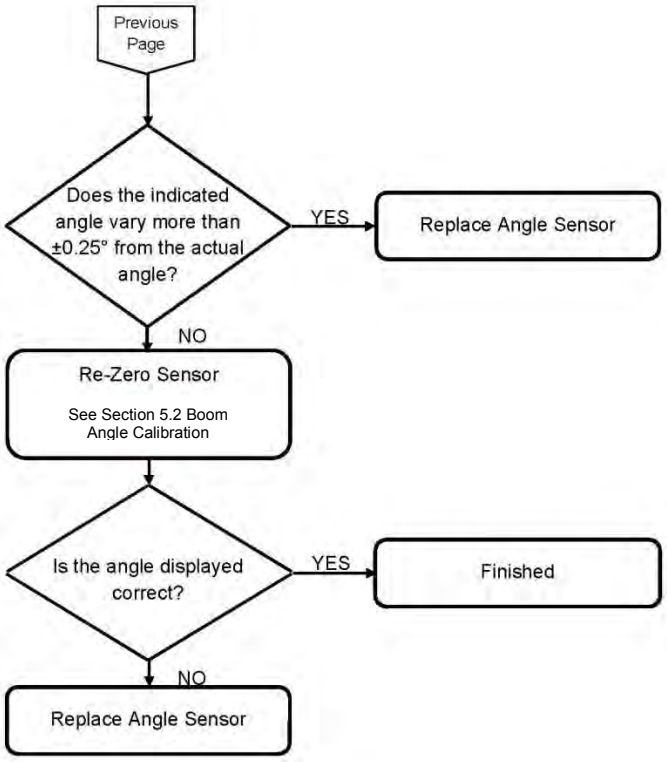
If this angle matches your actual angle, but the indicated angle varies by more than ±0.25°, the angle sensor is fine and the error is somewhere else. If this angle varies significantly from your actual angle, the angle sensor is bad and needs to be exchanged. Otherwise, continue:

4.5.2 Boom Angle Sensing Error – Flow Chart

Use the following flow chart to troubleshoot errors with boom angle sensing.

Flow Chart



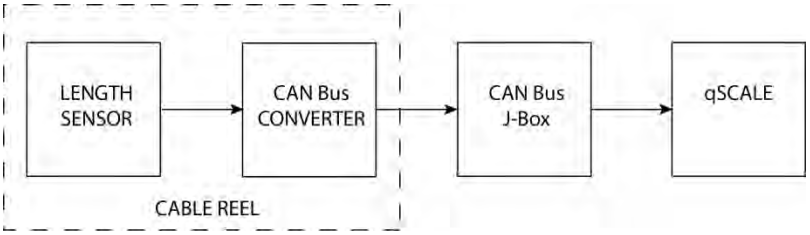

Previous Page
Does the indicated angle vary more than ±0.25° from the actual angle?
YES
Replace Angle Sensor
NO
Re-Zero Sensor
See Section 5.2 Boom Angle Calibration
Is the angle displayed correct?
YES
Finished
NO
Replace Angle Sensor

4.6 Boom Length Sensing

The system measures the length of the main boom of the machine with a length sensor. The length sensor is contained within the cable reel, located on the left side of the main boom.

4.6.1 Boom Length Sensing Overview

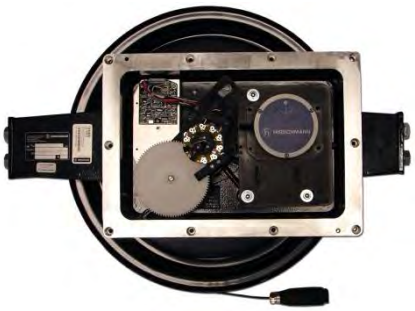
Block Diagram



The signal runs from the length sensor to the CAN Bus converter board, both located in the cable reel. From there, it travels as digital information on the CAN Bus to the J-Box, which combines various CAN Bus signals to run to the console.

Reel Assembly

LWG 154



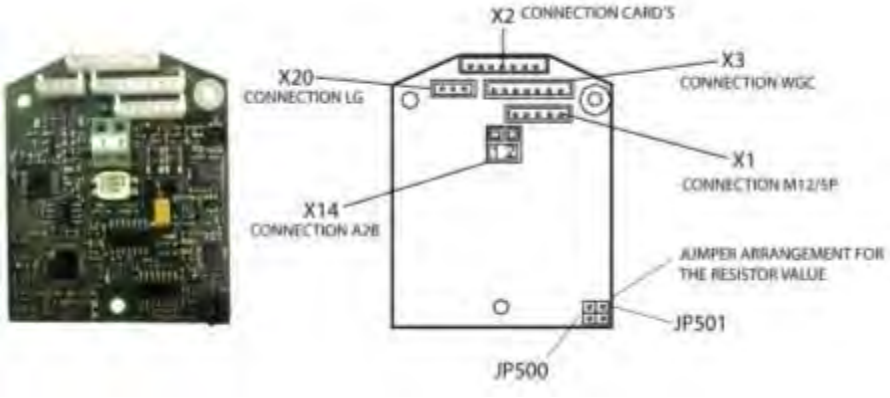
LWG 509

Question: What do you do when you are having a problem with your length read-out?

Start by verifying the actual length to the display. Boom length is the distance from the heel pin to the center of the front sheave wheel. The boom length is displayed on the working screen of the console. The CAN Bus is digital and as such will either transmit the signal correctly or not at all. If your readings are off, you have to determine what is causing the problem. Start by checking the length cable tension. This varies upon the type of cable reel used. Open the cable reel and locate the length sensor and the CAN Bus converter board:

Length Sensor

CAN Bus Converter Board



Sensor Type:

The length sensor has a built in potentiometer that is driven by a gear drive from the cable drum. As the length changes, the cable drum will turn and with it, the potentiometer's axle. The converter board supplies a voltage of about 1.6V to the length potentiometer and in return, monitors the output voltage of the potentiometer. The connector used is X20. The length sensor is connected as follows:

Length Sensor Connector X20

Connector X20		
Pin	**Description**	**Color Wire**
1	+V	Orange
2	Signal	Red
3	GND	Brown

Table 4-2

Fully retract the boom and turn the shaft of the length potentiometer opposite of the cable payoff with a small screwdriver until it comes to a soft stop. That should bring the sensor voltage to 0V (+/- 0.1Volt) between Pin 3 (-) and Pin 2 of connector X20.

NOTE

After this step is done, the length sensor needs to be calibrated.

Measure voltage between Pin 3 (-) and Pin 2 of connector X20 and compare.

Go back to your indication screen and compare length indicated and actual length again. If the indicated length varies significantly from your actual length (more than 0.3 feet), the length sensor might be bad and needs to be exchanged. However, the error could also be in the software or in the converter board.

Supply Voltage

Verify that the sensor is being supplied with about 1.6V by measuring between Pin 3 (-) and Pin 1 (+) of terminal X20. If the voltage is outside of a range of1.4V-1.8V, the converter board might be defective. Unplug the length sensor and measure again. If the voltage is still off, exchange the converter board. If unplugging the length sensor made the voltage return into the acceptable range, exchange the length sensor. If the voltage is correct, continue to Signal Voltage.

Signal Voltage

The length sensor returns a voltage between 0V at 0 turns of the length pot (= fully retracted) and 1.64V at 10 turns. How many turns you get at full extension depends on the gear ratio, the boom length, the length cable used, and the spooling pattern. The following table shows the expected output voltage (measured between X20-3 and X20-2 Signal) for each complete turn of the length potentiometer. Note that this does not synchronize to the number of turns of the cable reel.

Length Sensor Signal on Pin 3

Turns	Voltage X20-3 to X20-2
0	0.00
1	0.16
2	0.33
3	0.49
4	0.66
5	0.82
6	0.98
7	1.15
8	1.31
9	1.47
10	1.64

Table 4 - 2

Note: Actual voltages will vary slightly.

Go back to your indication screen and compare length indicated and actual again. If the indicated length varies significantly from your actual length (more than 0.3 feet), the length sensor should be exchanged.

4.6.2 Cable Reel Length Cable Replacement Procedure

Replace the length cable using the following procedure:

Procedure for Length Cable replacement

1. Cut old cable at cable drum.
2. Disconnect damaged length cable from junction box at the boom tip.
3. Remove cable reel from mounting brackets.
4. Remove damaged length cable, which is connected to the slip rings in the cable reel, from slip ring terminal.
5. On the backside of the cable reel, open the strain relief attached to the axle in the center of the drum. Pull existing length cable out of the cable reel.
6. Pull new length cable through the hole, pipe, and strain relief and push it through the axle of the reeling drum. Tighten new strain relief to ensure sealing.
7. Reconnect the length cable to the slip ring.
8. Remount cable reel to the boom.
9. Re-spool the drum by rotating the reeling drum clockwise (reverse) until all cable length is neatly wrapped in drum.
10. Let the reel unwind to a neutral state after drum has been re-spooled.
11. For AC40 (152" boom), set pre-tension on cable reel by rotating the drum counterclockwise (forward) 10 rotations. For all other units (127" boom and below), rotate the drum counter-clockwise (forward) 3 rotations. Connect the length cable into the boom tip junction box.
12. After setting pre-tension, hold the reel in place so that the cable can be unwound to run it through the boom.
13. Remove appropriate number of cable wraps from the drum to get enough cable length to run through the boom. Depending on the length of the boom, the number of cable wraps will differ:

    13.1 - For an AC40 and AC45, remove 9-10 wraps.

    13.2 - For a 70' Boom, remove 10 wraps.

    13.3 - For a 95' Boom, remove 12 wraps.

    13.4 - For a 103' Boom, remove 12 wraps.

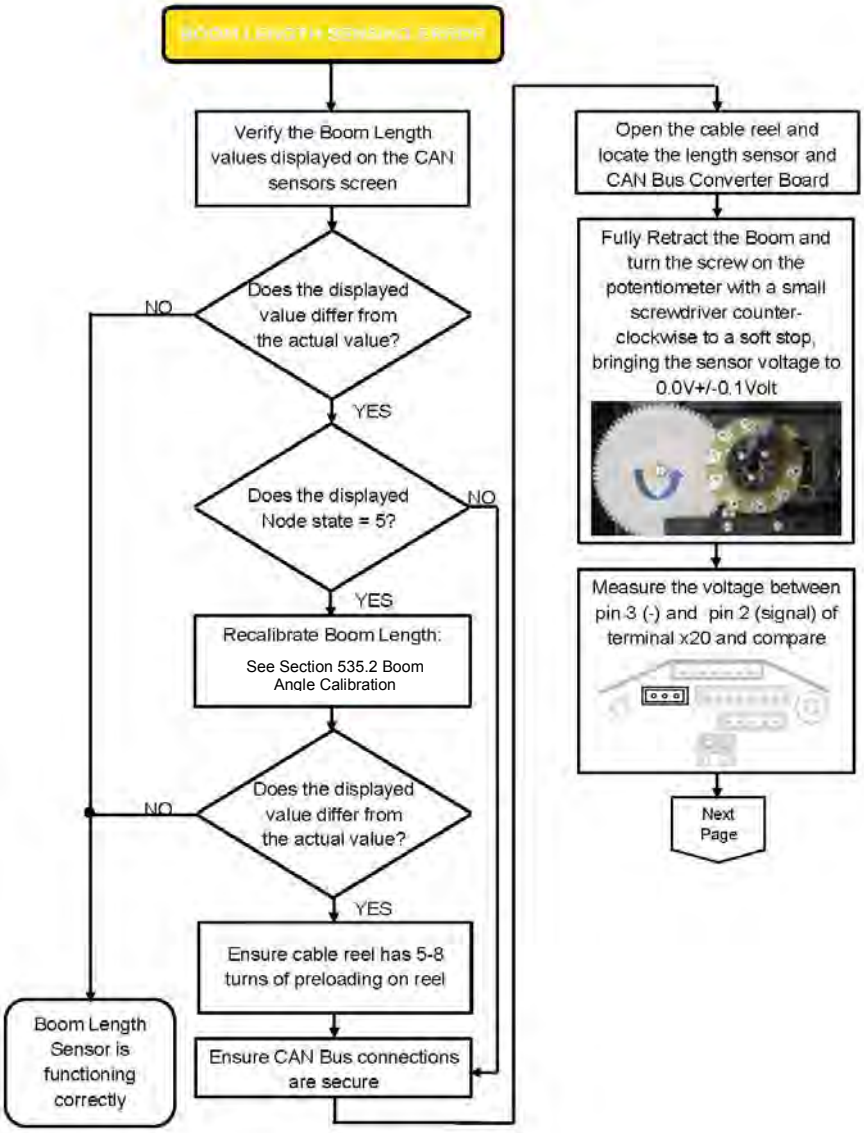
    13.5 - For a 127' Boom (excluding the AC45), remove 14 wraps.
14. Run the new length of cable through the boom to the boom tip junction box.
15. After installing the appropriate plug to the cable, connect the new length of cable into the boom tip junction box.

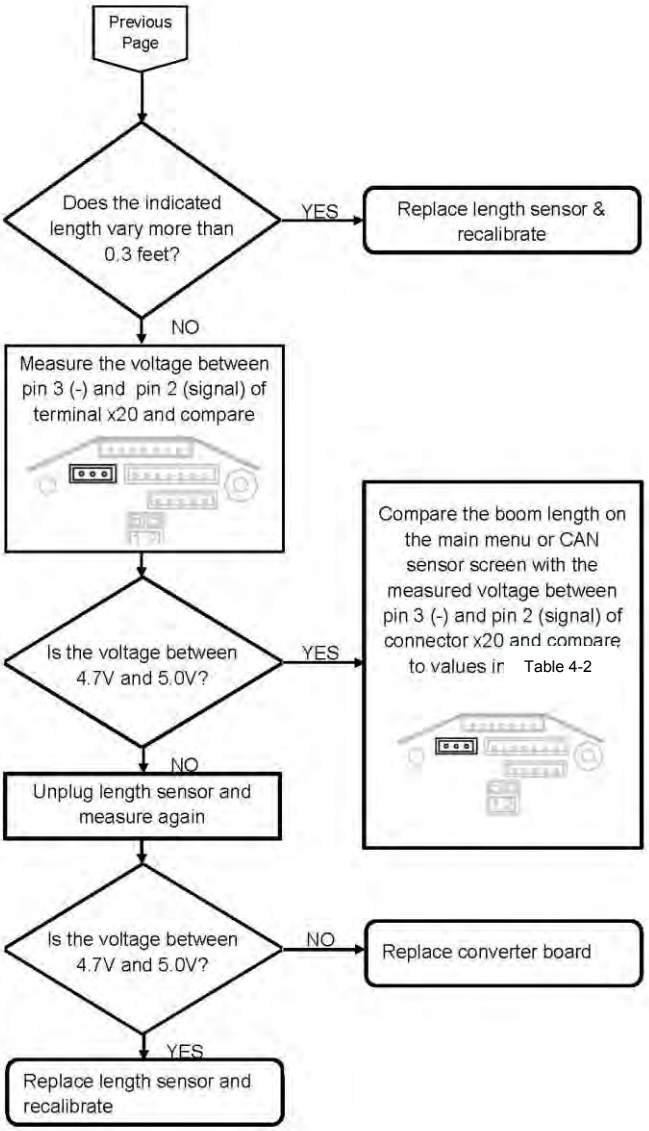
16. Reset length potentiometer in length angle transducer (screw is located in center of white gear); with boom fully retracted, turn potentiometer carefully counterclockwise until it stops. Recheck length and angle display.
17. Follow the procedure in Section 5.5 Boom Length Calibration.

4.6.3 Boom Length Sensor Error – Flow Chart

Use the following flow chart to troubleshoot errors with length sensing.

Flow Chart



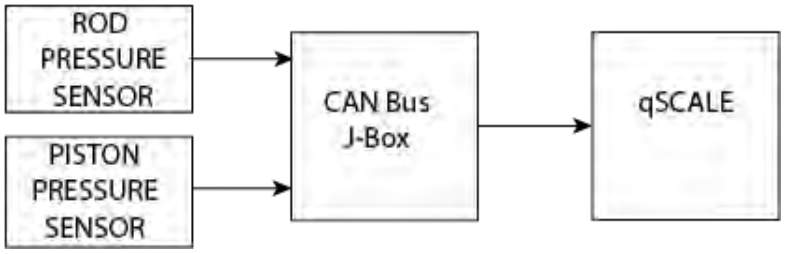

Previous Page
Does the indicated length vary more than 0.3 feet?
YES
Replace length sensor & recalibrate
NO
Measure the voltage between pin 3 (-) and pin 2 (signal) of terminal x20 and compare
Is the voltage between 4.7V and 5.0V?
YES
Compare the boom length on the main menu or CAN sensor screen with the measured voltage between pin 3 (-) and pin 2 (signal) of connector x20 and compare to values in Table 4-2
NO
Unplug length sensor and measure again
Is the voltage between 4.7V and 5.0V?
NO
Replace converter board
YES
Replace length sensor and recalibrate

4.7 Pressure Sensing

The System measures the pressure of the boom lift cylinder for both rod and piston side. Both sensors communicate on the CAN Bus.

4.7.1 Pressure Sensing Overview

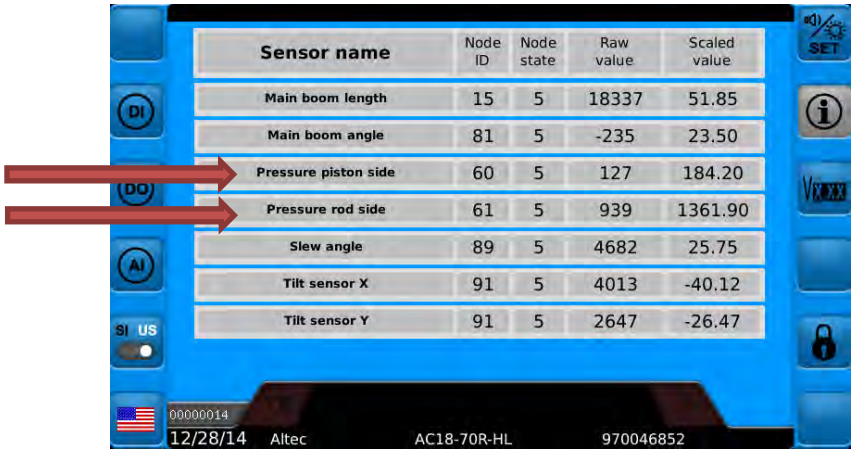
Block Diagram



The signal runs from the pressure transducer as digital information on the CAN Bus to the central unit.

HOME → INFO → CAN

Pressure Monitor



Sensor name	Node ID	Node state	Raw value	Scaled value
Main boom length	15	5	18337	51.85
Main boom angle	81	5	-235	23.50
Pressure piston side	60	5	127	184.20
Pressure rod side	61	5	939	1361.90
Slew angle	89	5	4682	25.75
Tilt sensor X	91	5	4013	-40.12
Tilt sensor Y	91	5	2647	-26.47

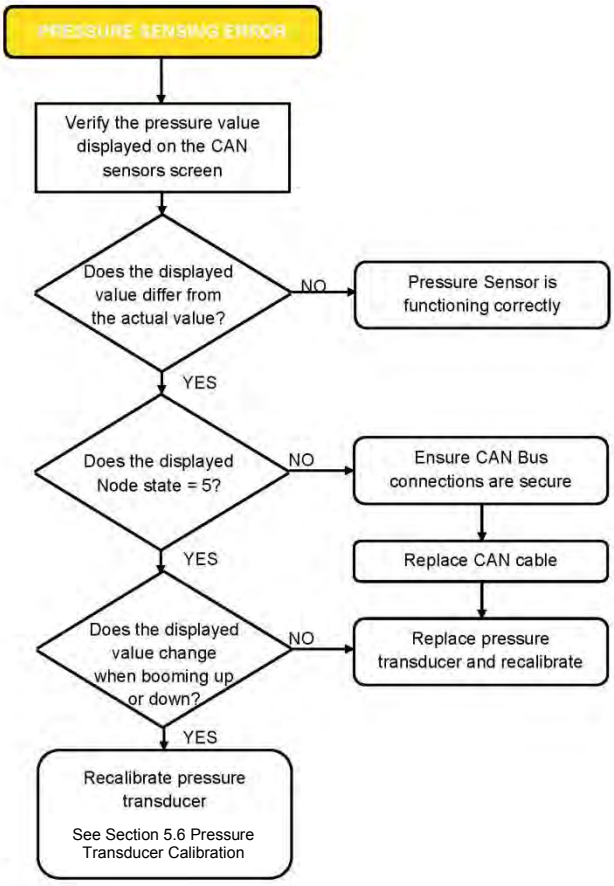
HINT

Perform a calibration procedure on any new pressure transducer switch before connecting to the hydraulic lines.

4.7.2 Pressure Sensing Error – Flow Chart

Use the following flow chart to troubleshoot errors with length sensing.

Flow Chart

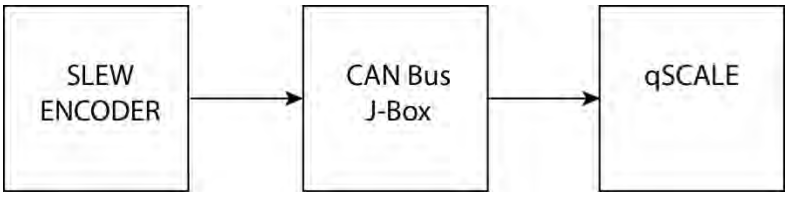


4.8 Slew Sensing

The system measures the slewing (rotational position) of the crane's boom with a slewing sensor. The slewing sensor is contained within the slip ring assembly.

4.8.1 Slew Sensing Overview

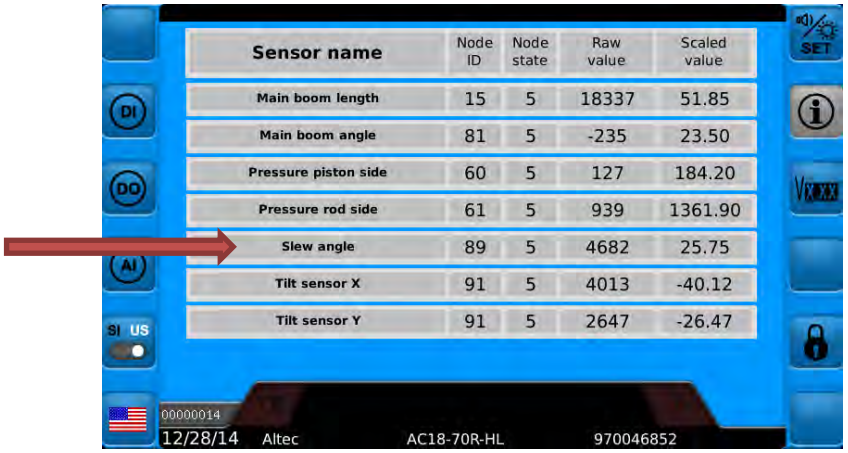
Block Diagram



The slew encoder is driven by the slip ring axle. The slew angle is displayed on the CAN Sensor Screen.

HOME → INFO → CAN

Slew Sensor Monitor

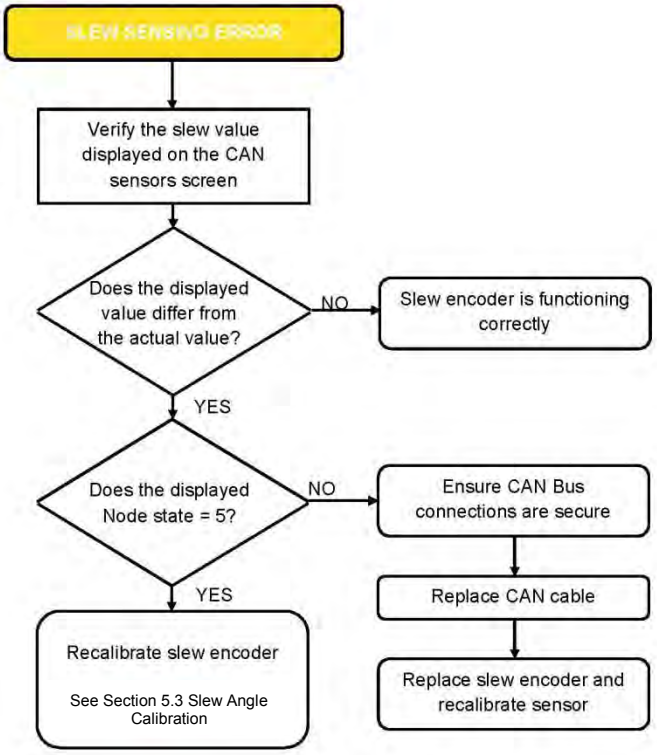


Sensor name	Node ID	Node state	Raw value	Scaled value
Main boom length	15	5	18337	51.85
Main boom angle	81	5	-235	23.50
Pressure piston side	60	5	127	184.20
Pressure rod side	61	5	939	1361.90
Slew angle	89	5	4682	25.75
Tilt sensor X	91	5	4013	-40.12
Tilt sensor Y	91	5	2647	-26.47

4.8.2 Slew (Rotation Angle) Sensing Error – Flow Chart

Use the following flow chart to troubleshoot errors with slew sensing.

Flow Chart



4.9 Load Sensing

Please note that the load displayed by the LMAP is not a direct measurement, but a calculated value that is based on many factors. Factors included that are outside of the measured values include:

- Operator settings such as:
  - Operating mode/configuration
  - Parts of Line/Reeving
  - Outrigger position

- Rigging parts such as:
  - Hook block weight
  - Sling weights, etc.
  - Tip height (length of load line used)
  - Boom weights

- Boom attachments such as:
  - Stowed jibs
  - Glass jib, telescopic jib, etc.

Before checking the system for a load-reading problem, make sure all of the above has been ruled out. When you still feel the system is reading a sensor wrong and thus displaying an incorrect load, use the following:

Use the previous sections and the individual sensor signal displayed on the screen to double-check the following:

- boom length reading
- angle transducer reading
- pressure transducer readings

If all are correct, use the zero setting and calibration screens to zero pressure transducers, calibrate angle, and length. If you still have a problem, replace pressure transducer(s).

4.10 Tilt Sensing

The system measures the tilt (level) of the crane.

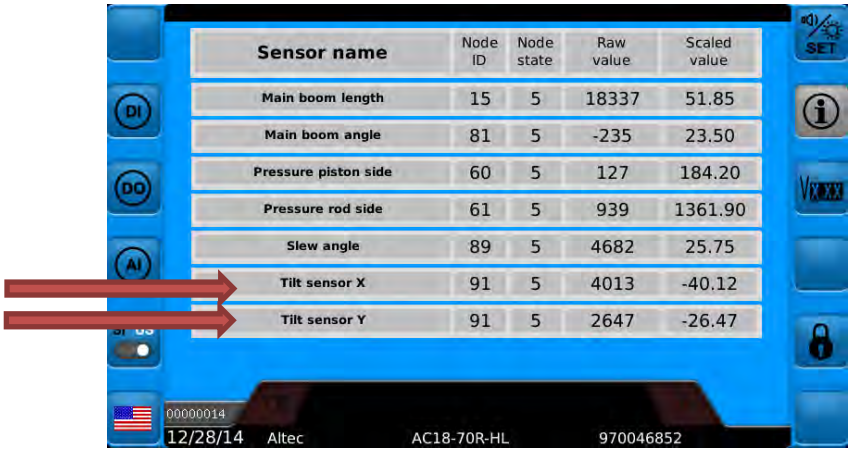
4.10.1 Tilt XY Sensing Overview

Block Diagram

The signal runs from the tilt sensors as digital information on the CAN Bus to the central unit. The Tilt sensor for X and Y are displayed on the CAN Sensor Screen.

HOME → INFO → CAN

Tilt Sensor Monitor

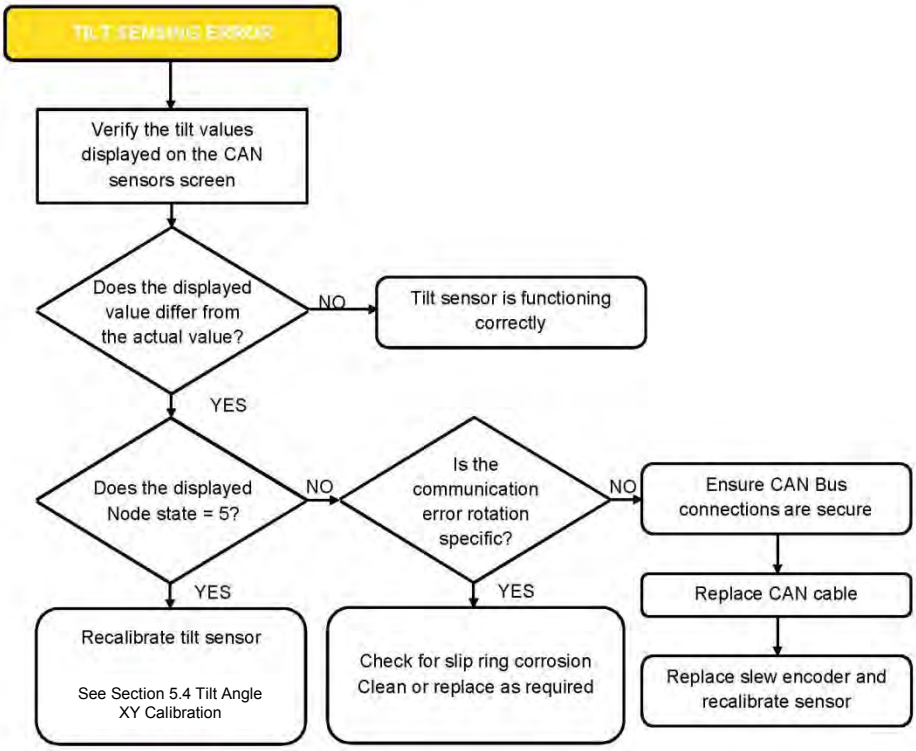


Sensor name	Node ID	Node state	Raw value	Scaled value
Main boom length	15	5	18337	51.85
Main boom angle	81	5	-235	23.50
Pressure piston side	60	5	127	184.20
Pressure rod side	61	5	939	1361.90
Slew angle	89	5	4682	25.75
Tilt sensor X	91	5	4013	-40.12
Tilt sensor Y	91	5	2647	-26.47

4.10.2 Tilt XY Sensing Error – Flow Chart

Use the following flow chart to troubleshoot errors with Tilt sensing.

Flow Chart

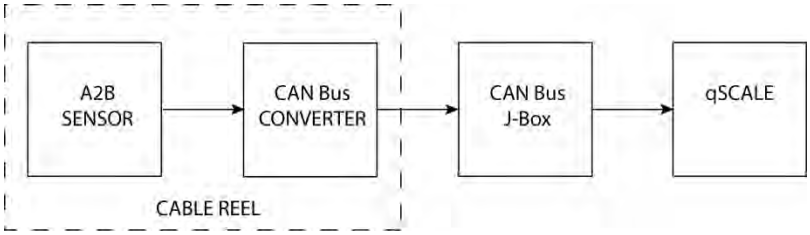


4.11 Anti-Two Block Switch (A2B)

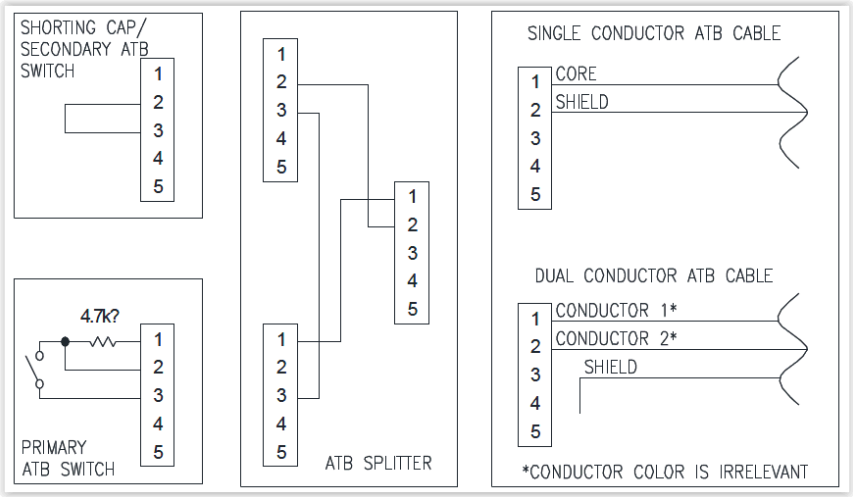
The system measures the load block and its relationship to the head of the boom. The A2B switch is located at the tip of the boom.

4.11.1 A2B Switch Overview

Block Diagram



The signal runs from the A2B as a CAN Bus input of the central unit.



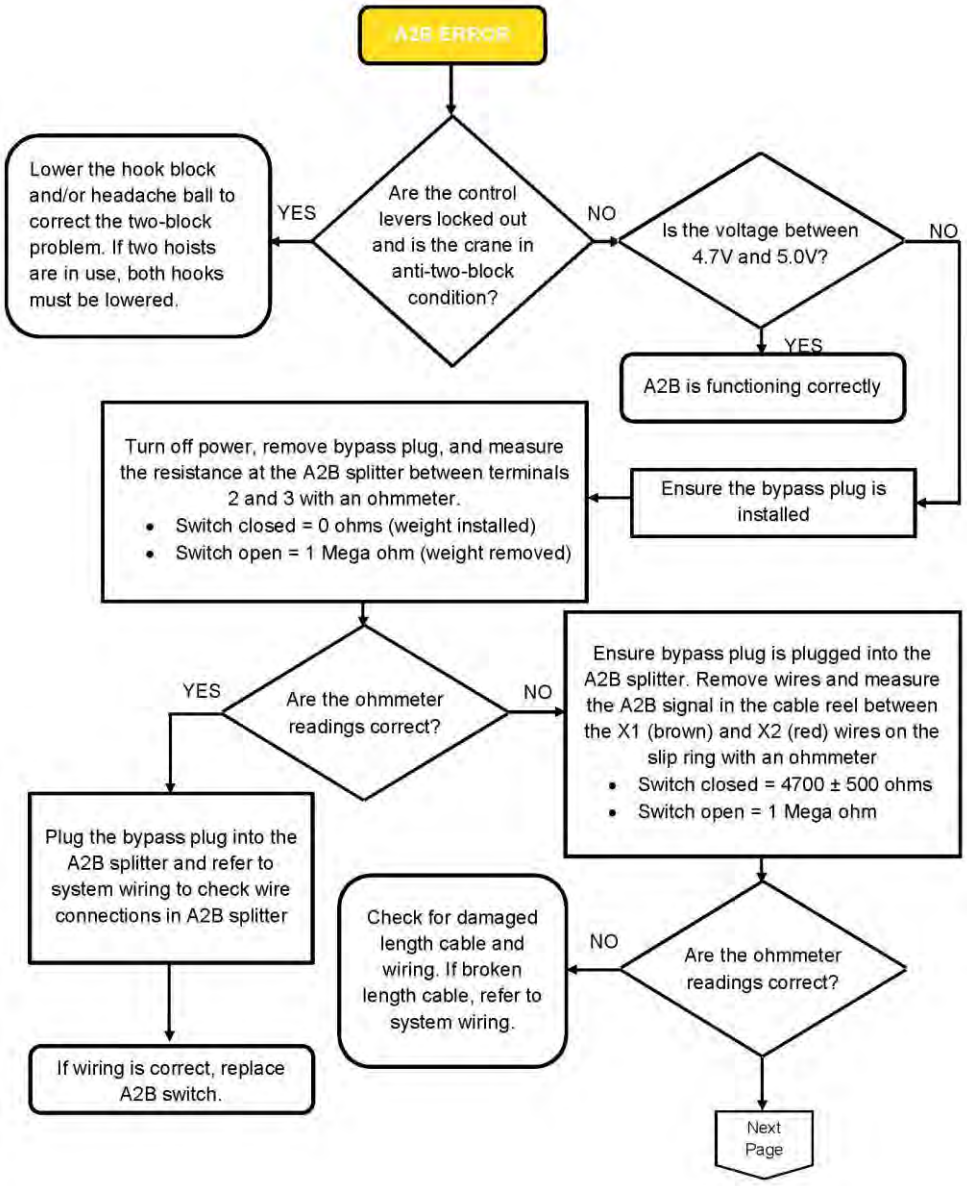
NOTE

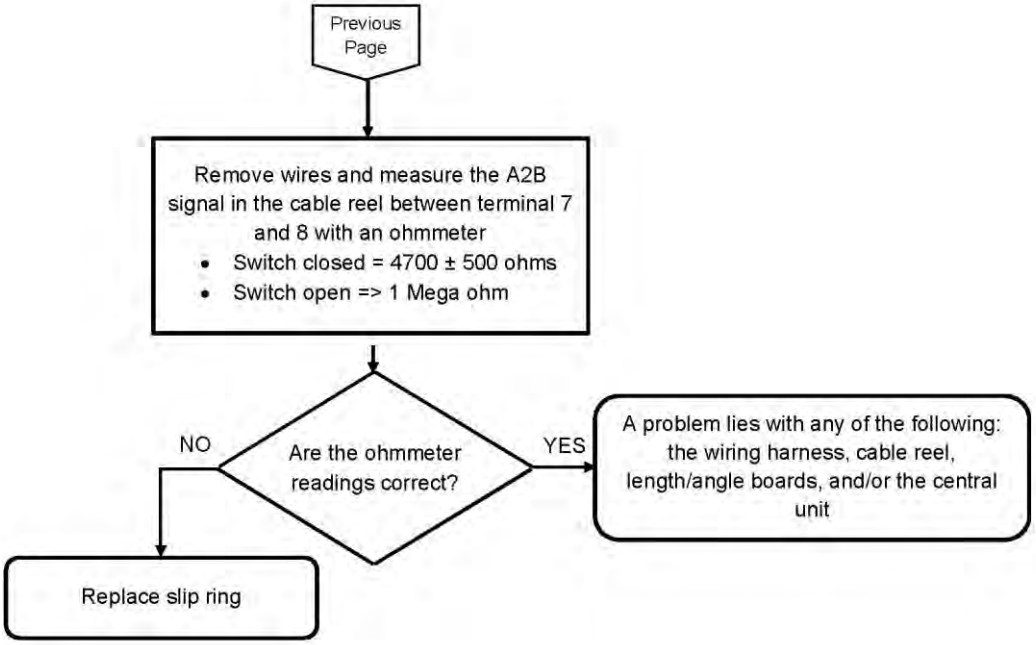
Some systems have two (2) A2B switches wired in series.

4.11.2 A2B Problem – Flow Chart

Use the following flow chart to troubleshoot errors with A2B switch input.

Flow Chart

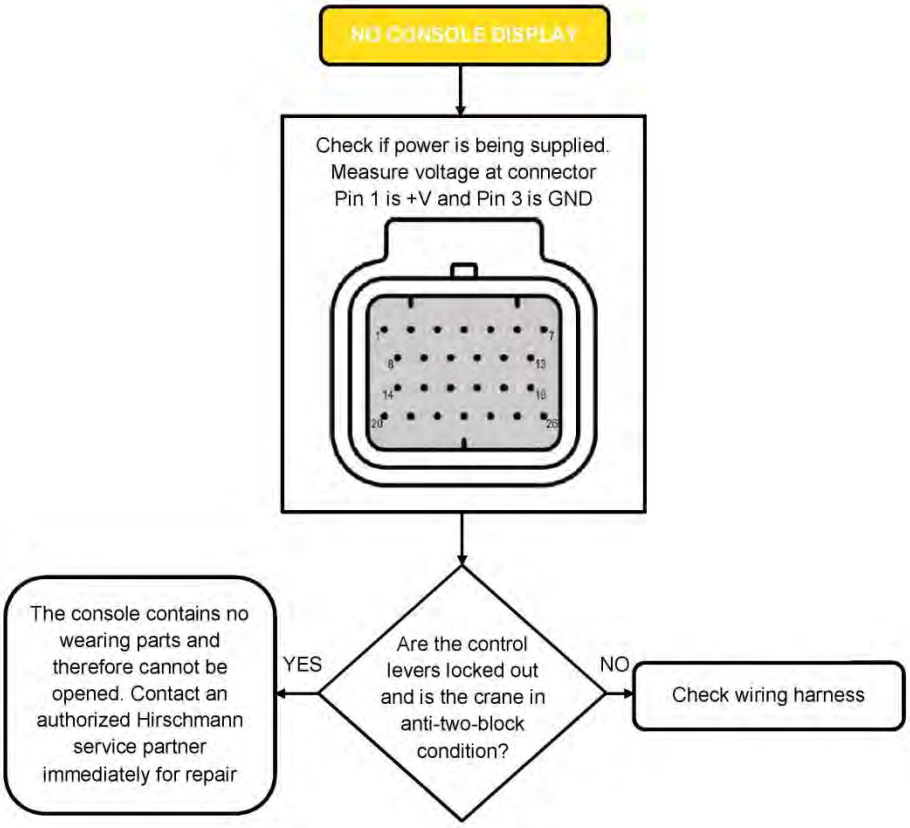



Previous Page
Remove wires and measure the A2B signal in the cable reel between terminal 7 and 8 with an ohmmeter
• Switch closed = 4700 ± 500 ohms
• Switch open => 1 Mega ohm
Are the ohmmeter readings correct?
NO
YES
A problem lies with any of the following: the wiring harness, cable reel, length/angle boards, and/or the central unit
Replace slip ring

4.12 No Console Display

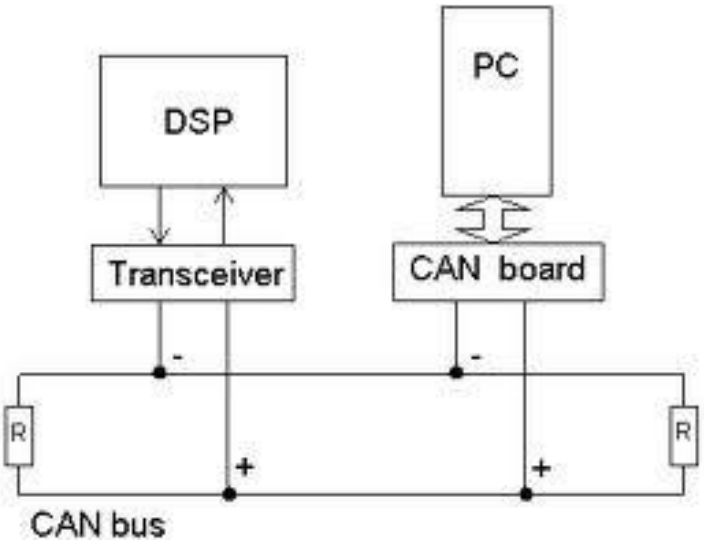
Use the following flow chart to troubleshoot a problem with console display.

Flow Chart

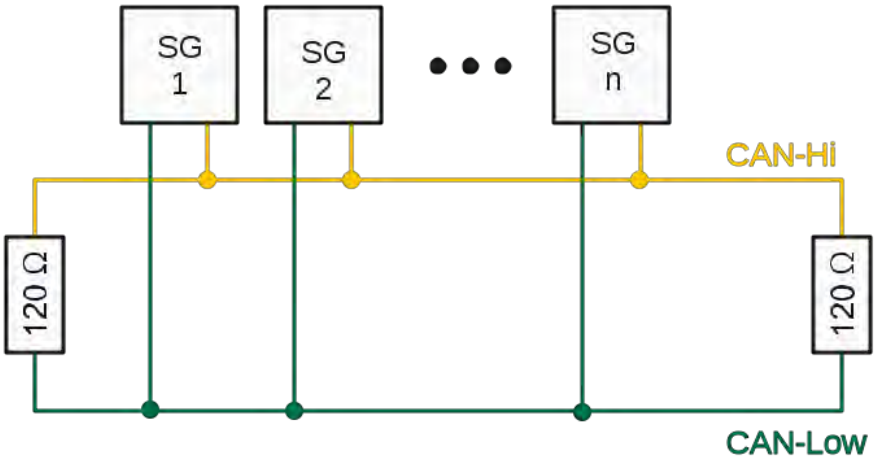


4.13 CAN Bus Communications

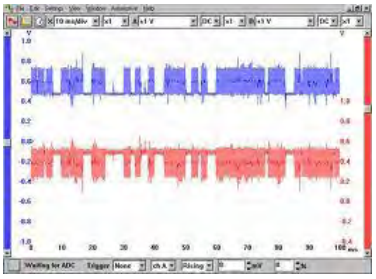
CAN Bus - a serial bus protocol to connect individual systems and sensors as an alternative to conventional multi-wire cables. It allows crane components to communicate on a single bus: a dual-wire networked data bus with speed up to 1Mbps.

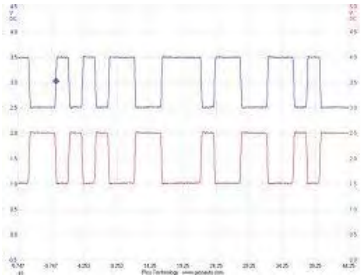


The use of a CAN Bus design allows for all nodes (sensor, controller and console) signals to be networked over a common pair of cables. The signals generated by all sensors are slave signals sent with a digital identifier over common cables. The data transmitted is used by the controller (master). The data can be interpreted, and information and controls sent from the controller to provide crane safety functions. Each node has a unique identifier. This allows for a common pair of shielded wires (the bus) to carry all signals.



The CAN Bus requires that 120 Ohm resistors be at each end of the CAN BUS. The resistors in parallel yield 60 Ohms of resistance between the CAN High and CAN Low cables.





The signals are generated by nodes on the CAN BUS. The nodes generate, consume, or both generate and consume data over a CAN Bus. The CAN High signal is a mirror image of the CAN Low signal.

Adequate voltage supply is required for power to the sensor and all nodes on the CAN Bus. A common source of problems over a CAN Bus is a Voltage drop because of resistance when a connection is corroded. As resistance increases, a corresponding voltage drop occurs corrupting the signal generated. The CAN signal will begin to lose the top of the high signal and no longer mirror the reflection (parity) of the CAN low signal.

NOTE

See Appendix for CAN Bus layout.

You can verify that power is being supplied to the sensor by testing the CAN connectors per this layout:

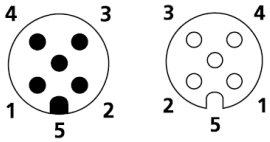
Connector M12, 5 contacts
Pin Layout (CiA DR-303-1 7.2)
(**Female Sockets shown**)

Pin 1	Shield
Pin 2	+ U_b
Pin 3	Ground
Pin 4	CAN High
Pin 5	CAN Low

Connector M12, 5 contacts
Pin Layout (CiA DR-303-1 7.2)
(**Solid** for **Male Pins**)
(**Hollow** for **Female Sockets**)

Pin 1	Shield
Pin 2	+ U_b
Pin 3	Ground
Pin 4	CAN High
Pin 5	CAN Low

5 pole



Male **Female**

(Pins) **(Sockets)**

Measure between pins 3 and 2 for crane voltage. If you see voltage, check all pins for continuity.

X1 Pin	CAN
1	CAN_SHLD
2	CAN +UB
3	CAN GND
4	CAN_H
5	CAN_L

Table 4 - 3

4.14 Error Codes

The LMAP system uses various error codes to report and log various activity. In this section, various types of error codes are explained. See the section in the appendix, Error Code Tables, for a complete list of codes, their cause, and possible solution.

IMPORTANT

For all codes that are reset by switching off then on: wait 10 seconds or longer before switching power back on.

4.14.1 Limit Error Codes

The **LMAP** system measures the length of the main boom, the angle of the main boom, the angle of rotation, the pressures of the lift cylinder, and the A2B state of the machine via a CAN Bus connection. Since this is a digital bus connection, it is not possible to measure the signals on the bus with a multi-meter. Instead, the RCL provides you with error codes that give you an indication of the bus state.

Error codes such as: **0a21** show the location of the error with the **0a** describes the nature of the error (exceeded set limit), and the **21** locates the error (set limits for slew, height, radius etc.).

Error Code	Error
01xx	Cutout of Crane Functions
02xx	Crane Functions Limited
03xx	Error / Failure
04xx	Warning (near limit)
05xx	Advance Warning
0Axx	Logical Error Utilization - (parameter error)
0Bxx	Error - (Short across system)

Table 4-5

5 Sensor Calibration

This section will explain how to calibrate the various sensors used in the LMAP System.

IMPORTANT

The LMAP is an operating aid that warns the crane operator of imminent overloading or of the approach of the hook block to the boom head in order to avoid possible property damage or injury to personnel.

The device is not a substitute for good operator judgment and/or experience. It does not remove the need for utilizing only recognized safe procedures during crane operations.

CAUTION

The crane operator continues to bear ultimate responsibility for safe operation of the crane. The operator must ensure that he fully understands and follows the displayed notes and instructions in their entirety.

WARNING

The LMAP is not able to provide aid to the crane operator unless it has been properly adjusted and the correct load capacity chart and the correct operating code have been entered for the respective rigging configuration. The correctness of the LMAP settings must be guaranteed before beginning crane work in order to avoid damage to property and severe or even fatal injuries to personnel.

WARNING

This system can be equipped with an external key-operated switch located in the crane operator's cab. This key-operated switch overrides control lever function switch-off by the LMAP or by the hoist limit switch system. This switch may only be used during emergency situations, and even then, only by authorized personnel. Failure to observe these instructions could result in damage to property and severe or even fatal injuries to personnel.

WARNING

The LMAP cannot perform correctly unless it has been properly adjusted. The prerequisite for this is making conscientious and correct entries during the set-up procedure in accordance with the actual configuration of the crane. The correctness of the LMAP settings must be ensured before beginning crane work in order to avoid damage to property and severe or even fatal injuries to personnel.

The calibration menu is used to calibrate the sensors.

NOTE

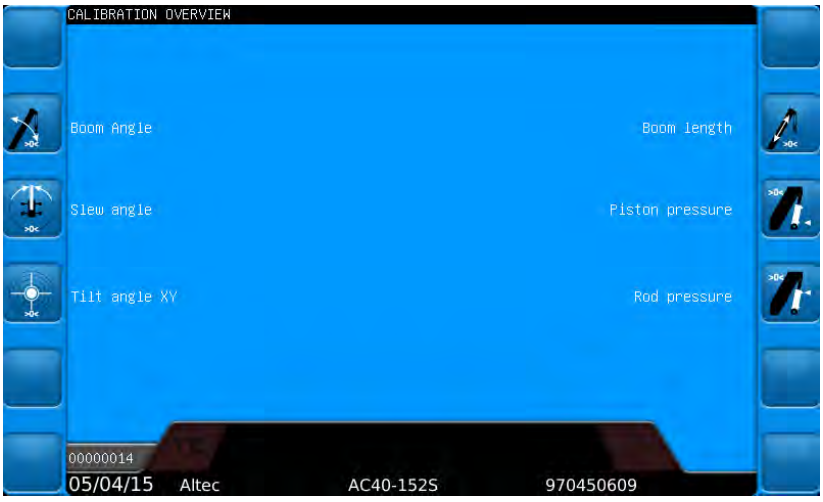
The calibration menu functions are password protected by an administrative password. This password is good for a 24 hour period and must be obtained from Altec Customer Service by calling the service number indicated on the machine start-up screen.

5.1 Sensor Calibration Selection

Calibration is selected under the system menu. To calibrate sensors a user or administrative password is required. See appendix for password entry.

Calibration menu is selected under the protected area menu, which is under the system menu.

HOME → SYSTEM → PROTECTED INFO → SENSOR CALIBRATION



Function Keys

Angle Calibration (see Section 5.2)

Slew Calibration (see Section 5.3)

Tilt Calibration (see Section5.4)

Boom Length Calibration (see Section 5.5)

Piston Calibration (see Section 5.6.1)

Rod Calibration (see Section 5.6.2)

5.2 Boom Angle Calibration

This section describes how to calibrate the boom angle sensor.

Boom Angle Calibration from the calibrate menu

IMPORTANT

The crane must be on a level surface to properly calibrate this sensor.

Instructions

1. Fully retract the boom 2. Press the SET  key to confirm this is completed.	
3. Lower the boom to exactly 0º. 4. Press the SET  key to confirm this is completed.	
5. Set the 0° point of the boom. Using a digital level on the boom, move the boom until the level reads 0º. 6. Press the SET  key to confirm this is completed.	

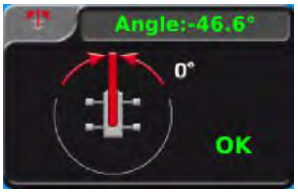
7. The “OK” on the screen should now appear green. Press the SET  key to confirm this is completed.	
8. Raise the boom up to an angle anywhere between +5° and +80°. The measured angle will appear on the screen as the boom is raised. 9. Press the SET  key to confirm this is completed.	
10. The “OK” on the screen should now appear green. Press the SET  key to complete the calibration procedure.	

5.3 Slew Angle Calibration

This section describes how to calibrate the slew angle sensor.

Slew Angle Calibration from the calibrate menu

Instructions

1. Swing the boom so that it is centered over the front. 2. Press the SET  key to confirm this is completed.	
3. The “OK” on the screen should now appear green. Press the SET  key to confirm this is completed.	
4. Swing the boom to the right anywhere between +5º and +80º. 5. Press the SET  key to confirm this is completed.	
6. The “OK” on the screen should now appear green. Press the SET  key to complete the calibration procedure.	

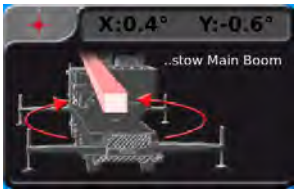
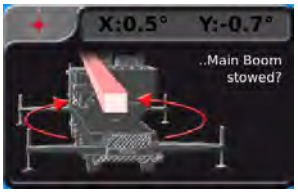
5.4 Tilt Angle XY Calibration

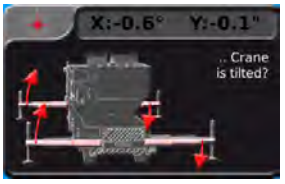
This section describes how to calibrate the tilt sensor.

NOTE

Steps 1-4 will be reversed for rear-mounted cranes.

Tilt Angle Calibration from the calibrate menu

1. Swing the boom so that it is centered over the front. 2. Press the SET key to confirm this is completed.	
3. Press the SET key to confirm main boom is stowed.	
4. Tilt the front of the crane up 0.8° 5. Press the SET key to confirm this is completed.	
6. Press the SET key again to confirm the crane is tilted	

7. Tilt the crane to the right 0.8° 8. Press the SET key to confirm this is completed.	
9. Press the SET key again to confirm the crane is tilted	
10. Validate the display shows the correct inclination. Press the SET key to complete the calibration procedure.	

5.5 Boom Length Calibration

This section describes how to calibrate the boom length sensor.

Boom Length Calibration from the calibrate menu

IMPORTANT

The crane must be on a level surface to properly calibrate this sensor.

Instructions

1. Fully retract the boom 2. Press the SET  key to confirm this is completed.	
3. The "**OK**" on the screen should now appear **green**. Press the SET  key to confirm this is completed.	
4. Fully extend the boom. 5. Press the SET  key to confirm this is completed.	
6. The "**OK**" on the screen should now appear **green**. Press the SET  key to confirm the calibration procedure.	

5.6 Pressure Transducer Calibration

This section describes how to calibrate either the rod or the piston pressure sensor.

5.6.1 Piston Pressure Calibration

This section describes how to calibrate the piston pressure sensor.

The only thing adjustable for the pressure transducers is the zero point which is the signal the transducer output when there is no (zero) pressure sensed.

CAUTION

Ensure there is <u>NO PRESSURE</u> in the hydraulic line when disconnecting the hoses from the pressure transducers!

Instructions for Piston Pressure Transducers

1. Ensure there is no (zero) pressure trapped in the hydraulic line to the piston pressure transducer. 2. Press the SET  key to confirm this is completed.	
3. The “OK” on the screen should now appear green. 4. Press the SET  key to confirm this is completed.	

5.6.2 Rod Pressure Calibration

This section describes how to calibrate the rod pressure sensor.

The only thing adjustable for the pressure transducers is the zero point which is the signal the transducer output when there is no (zero) pressure sensed.

CAUTION

Ensure there is <u>NO PRESSURE</u> in the hydraulic line when disconnecting the hoses from the pressure transducers!

.

Instructions for Rod Pressure Transducers

1. Ensure there is no (zero) pressure trapped in the hydraulic line to the rod pressure transducer. 2. Press the SET  key to confirm this is completed.	
3. The “OK” on the screen should now appear green. 4. Press the SET  key to confirm this is completed.	

6 Operation Setup

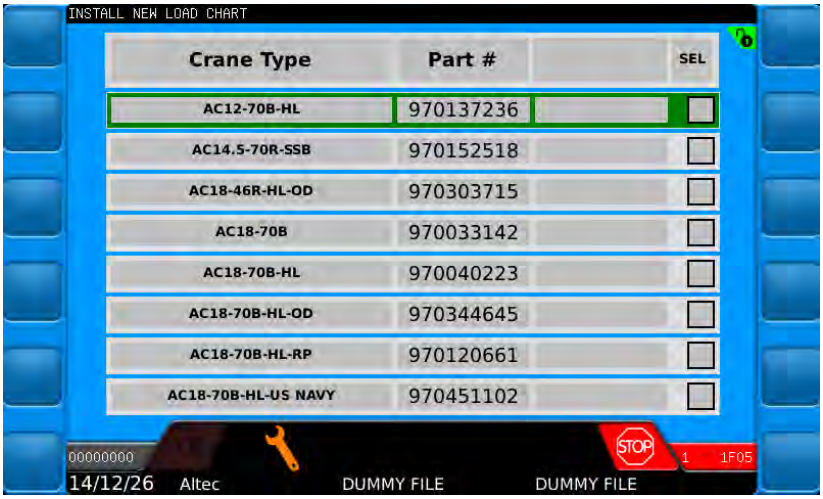
6.1 Crane Type / Part Number Setup

This section describes how to select the crane type / part number for the system. This is protected with the administrator password.

HOME → SYSTEM → PROTECTED INFO → PART NUMBER SETUP

After initially installing the software, the status bar will show “Dummy File” where the Crane Type and Part # are shown until the appropriate part number is chosen.

Initial Load Chart Selection Screen



Instructions

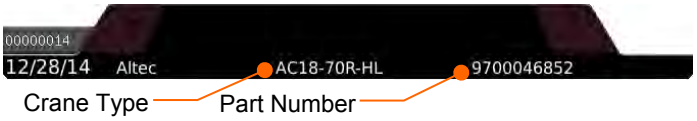
1. Scroll through the various options by rotating the rotary control. The active selection will be highlighted in green

select: 

- If this is the first time a crane type is selected, all options will be disabled (gray)
- If the crane type needs to be changed after initial set up, the green check box indicates the crane type that is currently enabled.

2. To select a crane type, press the rotary encoder.

3. To install, press the “SET”  key
4. The system will need to reboot. When the screen displays “REBOOT” power cycle the system. This may take several minutes.
5. Once the system reboots, the crane type that was selected will appear in the status bar.



6.2 Available Operating Mode Selections

Line Pull and OM (Operating Mode) Selections are made under the protected menu. To make modifications to these settings, the console will request a password to be entered.

HINT

For password entry, refer to the Appendix.

The modes of operation need to be set based on the possible configurations of the crane. These include: boom/jib configuration, platform, outrigger, counterweight, and available hoists.

HOME → SYSTEM → PROTECTED INFO → CRANE CONFIGURATION

Function Keys


Boom/Jib Configuration


Counterweight Configuration

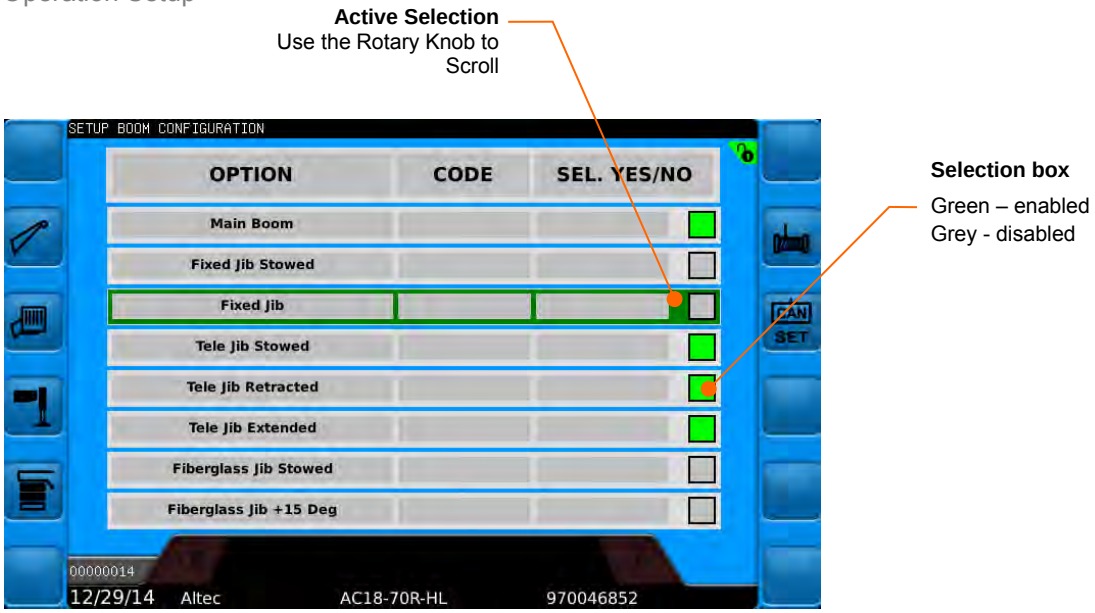

Platform Configuration


Hoist Configuration


Outrigger Configuration

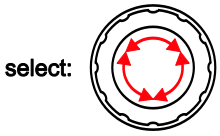
CAN Sensor Configuration

Example
Boom Configuration



Instructions

6. Select which configuration needs to be set up by using the function keys.
7. Scroll through the various options by rotating the rotary control. The active selection will be highlighted in green



8. To turn enable/disable an option, press the rotary control. The green check box indicates that it is currently enabled; a grey box indicates the selected option is disabled.

9. After all options are set correctly, press the SET  key to save.

At any time during the selection process pressing the ESCAPE  key will abort selection and return to the OM Selection menu.

6.3 Hoist Rope Selection

This section describes how to select the rope type along with its specifications for either Main or Aux hoists. The line pull hoist can be changed with the operator's password.

HOME → SYSTEM → PROTECTED INFO

Protected Info Screen

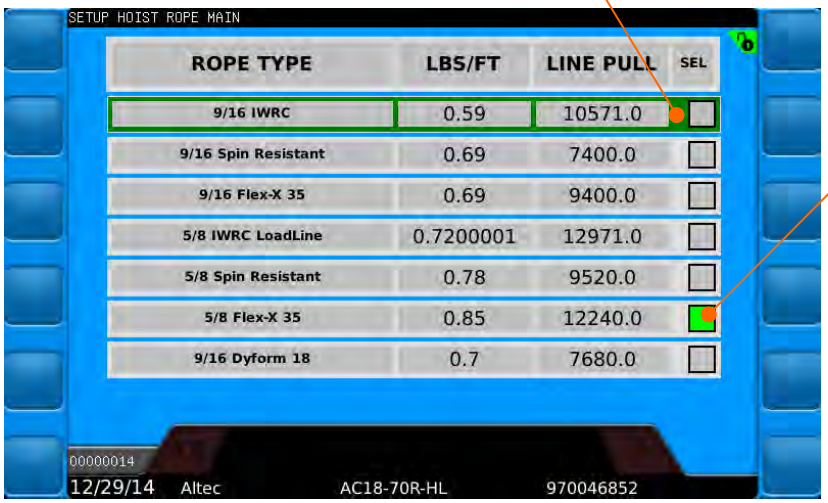
Function Keys

Line Pull – Main Hoist (see Section 5.2)

Line Pull – Aux Hoist (see Section 5.3)

Active Selection
Use the Rotary Knob to Scroll

Example
Main Hoist



Current Rope Setting
Green – enabled

Instructions

1. Using the function keys select either Main or Aux hoist
2. Scroll through the various options by rotating the rotary control. The active selection will be highlighted in green

select: 

3. To turn enable/disable an option, press the rotary control. The green check box indicates that it is currently enabled; a grey box indicates that option is disabled.

Enable/ Disable: 

4. After all options are set correctly, press the SET  key to save.

At any time during the selection process pressing the ESCAPE  key will abort selection and return to the OM Selection menu.

7 System Setup

7.1 Unit Serial Number Setting

This section describes how to setup the unit serial number in the control. The serial number needs to correspond with the crane's serial number.

HOME → SYSTEM → PROTECTED INFO → CRANE SERIAL #

Example

N

Instructions

The unit serial number entry is done by the following instructions:

- Turn the rotary knob to select the first value.
- Press the rotary knob to continue to the next value.
- Continue this process until all values have been entered.

Press the SET key to save.

Press the ESCAPE key to abort entry and return to the previous menu.

7.2 Date and Time Setup

This section describes how to setup the date and time in the control. The date and time are protected by an administrator password.

HOME → SYSTEM → PROTECTED INFO → DATE / TIME

Example

Function Keys

Set Date

Set Time

Instructions

Changing the date and time display is done by the following instructions:

- Turn the rotary knob to select the first value.
- Press the rotary knob to continue to the next value.
- Continue this process until all values have been entered.

Press the SET key to save.

Press the ESCAPE key to abort

NOTE

The time does not auto correct for time zone and daylight savings time.

7.3 Uploading Software

7.3.1 vSCALE Console Software Upload

This section will instruct you on how to upload software into a vSCALE Console.

NOTE

Item needed: 2 GB or more USB flash drive.

Instructions

1. Ensure the qSCALE system is turned off (crane ignition key turned to the “OFF” position)
2. Insert the USB flash drive with the software loaded into the USB port on the vSCALE console (the USB port is located behind the rubber flap to the left or below the selection knob.

3. Press and hold the top two function keys on the top or left side and turn the system ON (crane ignition key turned to “on” or ACCY” position). Continue to hold for an additional 10 seconds to ensure system recognizes the selection.

4. The system will now begin the uploading process. The screen will begin to display various messages as the software loads. This process may take several minutes.
5. Once step 4 has been completed, the console will display the crane model and serial number and then the home screen. You may now power down the qSCALE system (crane ignition key turned to the “OFF” position).
6. You can now safely remove the USB flash drive and replace the flap.
7. The software has now been uploaded and the vSCALE console is ready for use.

7.3.2 Central Unit Software Upload

This section will instruct you on how to upload software into a Central Unit.

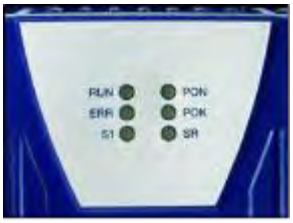
NOTE

Items needed: a 4 GB or larger USB flash drive and a USB Adapter Cable (P/N 536428)

Instructions

1. Ensure the qSCALE system is turned off (crane ignition key turned to the “OFF” position).
2. Remove the dust cap from the USB port and insert the adapter cable on the cSCALE controller (tighten the connector to ensure proper connection).

3. Insert the flash drive with the software loaded into the USB adapter cable
4. Now, take note of the grey colored area on the top of the cSCALE controller. This is the indication light area. You will need to look at these lights in the following steps.



5. Once the USB flash drive and adapter cable have been properly connected, power on the qSCALE system (crane ignition key turned to “ON” or “ACCY” position).

6. As the controller is booting up, the red error LED “ERR” is displayed.

7. The update process starts; the yellow LED “S1” is switched on, resulting in one of the LED patterns.

8. Important data is backed up; the green light is switched on.

9. New data will be flashed into the controller; the green LED “RUN” blinks.

10. Flashing is completed; green “RUN” LED is on, yellow “S1” LED is off.

11. Turn the qSCALE system off.

12. Remove the flash drive and replace the dust cap on the USB port.

13. Wait for five (5) seconds.

14. Power off qSCALE controller.

18. Remove USB drive and adapter cable from the controller.

16. Power on qSCALE controller

8 Maintenance and Repair

8.1 Maintenance

The vSCALE D3 operating console contains no wearing parts and therefore cannot be opened. If you notice malfunctions or differences between actual and displayed measured values, you should switch the device off and have it checked and, if necessary, repaired immediately by an authorized SkyAzul service partner.

8.2 Cleaning

Clean the surface and the front screen of the device occasionally with a damp cloth and a mild detergent. Never use abrasive or aggressive detergents however as these may damage the device.

IMPORTANT

Device may be damaged by the use of high-pressure washer.

The device must not be treated with high-pressure cleaner or similarly aggressive methods under any circumstances!

8.3 Repair

Damage to the front foil can lead to the penetration of moisture and dirt into the interior of the device. It must then be repaired properly and immediately. Keep the contacts and the area around the device connectors clean and check occasionally that all connections are secure. If parts are damaged, these must be repaired properly or replaced immediately.

The qSCALE system contains electronic components in various locations, such as central unit, sensors, junction boxes etc. These internal components cannot be designed to withstand exposure to moisture over a longer period of time. For this reason, the housings of the components are water protected according to IP 67. If you find water or moisture inside any of the housings, the source for the water ingress has to be detected and corrected to ensure proper operation.

There are two major possibilities for the occurrence of excessive moisture inside an enclosure:

- Water ingress
- Condensation

This outline gives instructions for detecting the cause for excessive moisture by using simple troubleshooting methods and how to prevent the moisture ingress from happening again.

8.3.1 Water Ingress

There are different possibilities for water ingress. It is possible to find out the source of water ingress by going through the following steps and ruling out one possibility after the other until the cause is identified:

1. Spray Cleaning
The enclosures used for the Hirschmann qSCALE system are water protected to IP 67. This means protection against the environment, such as rain. However, through the use of spray cleaner at short distances, it is possible to force water through the gasket or strain reliefs. For this reason, avoid spraying any components from short distances with spray cleaners. Convey this fact to any member of a maintenance crew.

2. Missing /Loose Screws
All screws have to be present and equally tight to ensure water protection of the enclosure. If there are screws missing, replace them. If no screw is missing, check the tightness. If any were loose, open all screws and then re-tighten them equally.

3. Bent Lid
An enclosure will only seal correctly if the lid is not bent. To check this, loosen all screws of the lid, take the lid off the box, and visually inspect it for deflection. If the lid is bent or damaged, it needs to be replaced. Try to determine what has caused the lid to be bent and eliminate the reason for that. Order a new lid through your SkyAzul representative.

4. Defective Gasket
The gasket underneath the lid seals the unit. The gasket needs to be in good condition in order to seal correctly. If the gasket is torn, brittle, or severely bent, it needs to be replaced. Order a new gasket through your SkyAzul representative.

5. Loose Strain Relieves
The strain relieves allow cabling to enter the box without allowing water to enter it. The strain relieves have to be correctly tightened in order to do this. Check the tightness by taking the external cable into one hand and carefully trying to turn it. If the internal wires turn with the outer cable, the strain relief is loose. Get a new grommet (insert) through your SkyAzul representative and replace the existing one with the new one. Tighten the strain relief correctly. Note: Whenever a strain relief is opened, i.e. to replace a cable, a new grommet needs to be used. Never re-use any grommet or the strain relief will not seal properly!

6. Water Entry Through External Cabling
Even with a tight strain relief, water may still enter the box through the inside of the cable. In this case, you have to find out why and where water enters the cable. Look for damage to the cable itself

and inspect the opposite side of the cable. For example, if the cable comes from a connector that is full of water, the water will run through the inside of the cable and fill up the central unit too.

8.3.2 Condensation

In a climate with high humidity and rapidly changing temperatures, condensation can happen inside any enclosure. Usually the larger the volume of the box, the more likely it is to have condensation. In this case, water drops build up on the inner components when humid air is trapped inside the box. With condensation, water tightness is not a problem – the box is sealed just fine, which is what prevents the trapped air from exiting the box.

9 Appendix

9.1 Password Entry

There are two passwords:

1. User password, which is set to a fixed value
2. Administrator password, which changes every 24 hour period.
    - Note: The administrator password must be obtained from Altec Customer Service by calling the service number indicated on the machine start-up screen.

NOTE

Safety-relevant settings can only be carried out by authorized personnel after inputting a password (Service Code).

This prevents inadvertent changes being made to the settings.

Instructions

All password entry is done by the following instructions:

- Turn the rotary knob to select the first digit of the password
- Press the rotary knob to continue to the second digit.
- Continue this process until all four digits have been entered

Press the SET key to enter the password.

Press the ESCAPE key to abort entry and return to the previous menu.

9.2 Error Code Tables

This section list error codes reported by the system along with their possible cause and solution.

9.2.1 Zero Event Codes – 0001-00FF

Error Code	Description	Cause	Notice/Solution
0000	Empty / Deactivated event		
0001	System Start-up	Normal Start-up	Message in the event log. No error.
0002	System Forced Initialization	Normal start-up caused by parameterization	Message in the event log. No error.
0011	System Version Information	Informational	Message in the debugging log. No error.
0021	Machine Information	Informational	Message in the debugging log. No error.
00AA	System Debug Output	Informational	Message in the debugging log. No error.
00FE	System Restart after Cold Reset	Informational	Message in the debugging log. No error.
00FF	System Shutdown	Normal Stop	Message in the event log. No error.

Table 9 - 1

9.2.2 Limit Error Codes – 0100-019F

The first two (2) digits of a limit error code signify the function of a given error.

01xx Overall Cut
02xx Single Cut
03xx Error / Failure
04xx Warning
05xx Advance Warning

Error Code	Description	Cause	Notice/Solution
0100	Load Tables - Fallen below radius range	Below minimum load radius allowed in the load chart.	Move the load out to a radius allowed in the load chart.
0101	Load Tables - Radius range exceeded	Above maximum load radius allowed in the load chart.	Move the load in to a radius allowed in the load chart.
0102	Load Tables - Fallen below angle boom range	Below minimum boom angle allowed in the load chart.	Move the boom angle up to an angle allowed in the load chart.
0103	Load Tables - Angle boom range exceeded	Above maximum boom angle allowed in the load chart.	Move the boom angle down to an angle allowed in the load chart.
0104	Load Tables - Fallen below angle jib range	-	-
0105	Load Tables - Angle jib range exceeded	-	-
0106	Load Tables - Fallen below angle jib diff range	-	-
0107	Load Tables - Angle jib diff range exceeded	-	-
010A	Load Tables - Slewing zone not permitted left	Slew angle (angle of rotation) not allowed in the load chart.	Move the slew angle to an angle allowed in the load chart.
010B	Load Tables - Slewing zone not permitted right	Slew angle (angle of rotation) not allowed in the load chart.	Move the slew angle to an angle allowed in the load chart.
010C	Load Tables - Fallen below length range	Below minimum boom length allowed in the load chart.	Extend the boom to a length allowed in the load chart.
010D	Load Tables - Length range exceeded	Above maximum boom length allowed in the load chart.	Retract the boom to a length allowed in the load chart.
010E	Load Tables - Fallen below height range	Below minimum boom height allowed in the load chart.	Raise the boom to an allowed height in the load chart.
010F	Load Tables - Height range exceeded	Above maximum boom height allowed in the load chart.	Lower the boom to an allowed height in the load chart.
0110	Load Tables - Placeholder – Not a Valid Code	-	-
0111	Load Tables - Wind speed range exceeded	-	-
0112	Load Tables - Fallen below temperature range	-	-
0113	Load Tables - Temperature range exceeded	-	-

0120	Load Tables – Pre Fallen below radius range	Approaching minimum load radius allowed in the load chart.	Warning the load radius is approaching the radius minimum limit allowed in the load chart.
0121	Load Tables – Pre Radius range exceeded	Approaching maximum load radius allowed in the load chart.	Warning the load radius is approaching the radius maximum limit allowed in the load chart.
0122	Load Tables – Pre Fallen below angle boom range	Approaching minimum boom angle allowed in the load chart.	Warning the boom angle is approaching the minimum limit allowed in the load chart.
0123	Load Tables – Pre Angle boom range exceeded	Approaching maximum boom angle allowed in the load chart.	Warning the boom angle is approaching the maximum limit allowed in the load chart.
0124	Load Tables – Pre Fallen below angle jib range	-	-
0125	Load Tables – Pre Angle jib range exceeded	-	-
0126	Load Tables – Pre Fallen below angle diff jib range	-	-
0127	Load Tables – Pre Angle diff jib range exceeded	-	-
012A	Load Tables – Pre Slewing zone not permitted left	Approaching a slew angle (angle of rotation) not allowed in the load chart.	Warning the slew angle is approaching the left limit allowed in the load chart.
012B	Load Tables – Pre Slewing zone not permitted right	Approaching a slew angle (angle of rotation) not allowed in the load chart.	Warning the slew angle is approaching the right limit allowed in the load chart.
012C	Load Tables – Pre Fallen below length range	Approaching the minimum boom length allowed in the load chart.	Extend the boom to a length allowed in the load chart.
012D	Load Tables – Pre Length range exceeded	Approaching the maximum boom length allowed in the load chart.	Retract the boom to a length allowed in the load chart.
012E	Load Tables – Pre Fallen below height range	Approaching the minimum boom height allowed in the load chart.	Raise the boom to an allowed height in the load chart.
012F	Load Tables – Pre Height range exceeded	Approaching the maximum boom height allowed in the load chart.	Lower the boom to an allowed height in the load chart.
0130	Load Tables – Placeholder – Not a Valid Code	-	-
0131	Load Tables – Pre Wind speed range exceeded	-	-
0132	Load Tables – Pre Fallen below temperature range	-	-
0133	Load Tables – Pre Temperature range exceeded	-	-
0140	User Limit – Fallen below radius range	Below minimum load radius allowed by a user limit.	Move the load out to a radius allowed by a user limit.

0141	User Limit – Radius range exceeded	Above maximum load radius allowed by a user limit.	Move the load in to a radius allowed by a user limit.
0142	User Limit – Fallen below angle boom range	Below minimum boom angle allowed by a user limit.	Move the boom angle up to an angle allowed by a user limit.
0143	User Limit – Angle boom range exceeded	Above maximum boom angle allowed by a user limit.	Move the boom angle down to an angle allowed by a user limit.
0144	User Limit – Fallen below angle jib range	-	-
0145	User Limit – Angle jib range exceeded	-	-
0146	User Limit – Fallen below angle jib diff range	-	-
0147	User Limit – Angle jib diff range exceeded	-	-
014A	User Limit – Slewing zone not permitted left	Slew angle (angle of rotation) not allowed by a user limit.	Warning the slew angle is approaching the left limit allowed by the user limits.
014B	User Limit – Slewing zone not permitted right	Slew angle (angle of rotation) not allowed by a user limit.	Warning the slew angle is approaching the right limit allowed by user limits.
014C	User Limit – Fallen below length range	Below minimum boom length by a user limit.	Extend the boom to a length allowed by the user limits.
014D	User Limit – Length range exceeded	Above maximum boom length allowed by a user limit.	Retract the boom to a length allowed by the user limits.
014E	User Limit – Fallen below height range	Below minimum boom height allowed by a user limit.	Raise the boom to an allowed height by the user limits.
014F	User Limit – Height range exceeded	Above maximum boom height allowed by a user limit.	Lower the boom to an allowed height by the user limits.
0150	User Limit – Fallen below wind speed range	-	-
0151	User Limit – Placeholder – Not a Valid Code	-	-
0152	User Limit – Fallen below temperature range	-	-
0153	User Limit – Temperature range exceeded	-	-
0160	User Limit – Pre Fallen below radius range	Approaching minimum load radius allowed by a user limit.	Warning the load radius is approaching the radius minimum limit allowed by a user limit.
0161	User Limit – Pre Radius range exceeded	Approaching maximum load radius allowed by a user limit.	Warning the load radius is approaching the radius maximum limit allowed by a user limit.
0162	User Limit – Pre Fallen below angle boom range	Approaching minimum boom angle by a user limit.	Warning the boom angle is approaching the minimum limit allowed by a user limit.
0163	User Limit – Pre Angle boom range exceeded	Approaching maximum boom angle allowed by a user limit.	Warning the boom angle is approaching the maximum limit allowed by a user limit.
0164	User Limit – Pre Fallen below angle jib range	-	-
0165	User Limit – Pre Angle jib range exceeded	-	-

0166	User Limit – Pre Fallen below angle jib diff range	-	-
0167	User Limit – Pre Angle jib diff range exceeded	-	-
016A	User Limit – Pre Slewing zone not permitted left	Approaching a slew angle (angle of rotation) not allowed by a user limit.	Warning the slew angle is approaching the left limit allowed by a user limit.
016B	User Limit – Pre Slewing zone not permitted right	Approaching a slew angle (angle of rotation) not allowed by a user limit.	Warning the slew angle is approaching the right limit allowed by a user limit.
016C	User Limit – Pre Fallen below length range	Approaching the minimum boom length allowed by a user limit.	Extend the boom to a length allowed by a user limit.
016D	User Limit – Pre Length range exceeded	Approaching the maximum boom length allowed in the load chart.	Retract the boom to a length allowed by a user limit.
016E	User Limit – Pre Fallen below height range	Approaching the minimum boom height by a user limit.	Raise the boom to an allowed height in the load chart.
016F	User Limit – Pre Height range exceeded	Approaching the maximum boom height allowed by a user limit.	Lower the boom to an allowed height by a user limit.
0170	User Limit – Pre Fallen below wind speed range	-	-
0171	User Limit – Placeholder – Not a Valid Code	-	-
0172	User Limit – Pre Fallen below temperature range	-	-
0173	User Limit – Pre Temperature range exceeded	-	-

Table 9 - 2

9.2.3 Application Error Codes – 0A00 – 0A9F

Error Code	Description	Cause	Notice/Solution
0A00	Utilization / Rated Capacity Alarm 1	The default maximum utilization of the load chart has been exceeded ≥100%	Drop Load; Operate crane only in the allowed parameters.
0A01	Utilization / Rated Capacity Alarm 2	The default maximum utilization of the load chart has been exceeded ≥110%	Drop Load; Operate crane only in the allowed parameters.
0A02	Utilization / Rated Capacity Alarm 3	The default maximum utilization of the load chart has been exceeded ≥120%	Drop Load; Operate crane only in the allowed parameters.
0A03	Utilization / Rated Capacity Alarm 4	-	-
0A04	Utilization / Rated Capacity Alarm 5	-	-
0A05	Utilization / Rated Capacity Alarm 6	-	-
0A06	Utilization / Rated Capacity Alarm 7	-	-
0A07	Utilization / Rated Capacity Alarm 8	-	-
0A08	Utilization / Rated Capacity Warning 1	The default maximum utilization of the load chart has been exceeded ≥ 90%	Warning, the crane is operated close to the cut-off
0A09	Utilization / Rated Capacity Warning 2	-	-
0A0A	Utilization / Rated Capacity Warning 3	-	-
0A0B	Utilization / Rated Capacity Warning 4	-	-
0A0C	Utilization / Rated Capacity Warning 5	-	-
0A0D	Utilization / Rated Capacity Warning 6	-	-
0A0E	Utilization / Rated Capacity Warning 7	-	-
0A0F	Utilization / Rated Capacity Warning 8	-	-
0A10	Utilization / Rated Capacity Limit 1	-	-
0A11	Utilization / Rated Capacity Limit 2	-	-
0A12	Utilization / Rated Capacity Limit 3	-	-
0A13	Utilization / Rated Capacity Limit 4	-	-
0A14	Utilization / Rated Capacity Limit 5	-	-
0A15	Utilization / Rated Capacity Limit 6	-	-
0A16	Utilization / Rated Capacity Limit 7	-	-
0A17	Utilization / Rated Capacity Limit 8	-	-
0A20	Overall Load Cut	The default maximum capacity is exceeded.	Shutdown due to overload. Drop Load; Operate crane only in the allowed parameters.
0A21	Overall Load Warning	The default warning limit was exceeded. Limits set by operator on the console	Warning, the crane is operating near their maximum permissible load, and operator set limits.
0A22	Overall Safety Cut	-	-
0A23	Overall Speed Cut	-	-

0A24	A2B Switch	The limit switch has been activated, lifting load is not possible	Lower the load.
0A25	Third Watch Switch	-	-
0A26	High Voltage Detection Unit	-	-
0A27	Overall Load Cut Tracking	-	-
0A28	Overall Load Warning Tracking	-	-
0A29	Overall Safety Cut Tracking	-	-
0A2A	Overall Speed Cut Tracking	-	-
0A2B	A2B Switch Tracking	-	-
0A2C	Third Watch Switch Tracking	-	-
0A2D	High Voltage Detection Unit Tracking	-	-
0A2E	Overall Cut	A limit has been exceeded	Shutdown due to limit or overload. Operate crane only in the allowed parameters.
0A2F	Overall Cut Tracking	-	-
0A30	Setup Mode	-	-
0A31	Rigging Mode (without tables)	The setup mode for the assembly at the factory has been selected.	No monitoring functions active. No load charts available. Warning: The operation is only permitted with no load.
0A32	Cutoff Bridged (non EN13000)	Bypass switch is activated.	Caution: Does not actively monitor the load.
0A33	Cutoff Bypass (EN13000 key)	Bypass switch is activated (according EN13000)	Caution: Does not actively monitor the load.
0A34	Enable Boom Up	-	-
0A35	A2B Switch Bridged	Bridging the hoist limit switch activated	Note: No active monitoring of the load increase
0A36	Third Wrap Switch Bridged	-	-
0A37	Cutoff Bridged (Hardwired)	-	-
0A38	High voltage Detection Bridged	-	-
0A3C	Jib Up Disabled	-	-
0A3D	Jib Up Disabled Motion Tracking	-	-
0A3E	Jib Down Disabled	-	-
0A3F	Jib Down Disabled Motion Tracking	-	-
0A40	Boom Up Disabled	-	-
0A41	Boom Up Disabled Motion Tracking	-	-
0A42	Boom Down Disabled	-	-
0A43	Boom Down Disabled Motion Tracking	-	-
0A44	Tele Out Disabled	-	-
0A45	Tele Out Disabled Motion Tracking	-	-
0A46	Tele In Disabled	-	-
0A47	Tele In Disabled Motion Tracking	-	-
0A48	Slew Left Disabled	-	-
0A49	Slew Left Disabled Motion Tracking	-	-
0A4A	Slew Right Disabled	-	-
0A4B	Slew Right Disabled Motion Tracking	-	-
0A4C	Winch Up Disabled	-	-
0A4D	Winch Up Disabled Motion Tracking	-	-
0A4E	Winch Down Disabled	-	-
0A4F	Winch Down Disabled Motion Tracking	-	-
0A50	Invalid Operation Mode	An invalid operating mode has been selected.	Review and select an allowable operating mode.
0A51	Invalid Tele Mode	An invalid telescopic jib operating mode has been selected.	Review and select an allowable operating mode.

0A52	Invalid Reeving Mode	An invalid reeving operating mode has been selected.	Review and select an allowable operating mode.
0A53	Invalid Hosting Mode	An invalid hoist operating mode has been selected.	Review and select an allowable hoist operating mode.
0A54	Invalid Outrigging Mode	An invalid outrigger operating mode has been selected.	Check outrigger sensors and actuators. Choose a suitable mode. Proper support for restore.
0A55	Invalid Pinning Mode	-	-
0A56	Invalid Counterweight Mode	An invalid counterweight operating mode has been selected	Review and select an allowable operating mode.
0A57	Invalid Winch Mode	An invalid winch operating mode has been selected	Review and select an allowable operating mode.
0A58	Invalid Boom Mode	An invalid boom operating mode has been selected	Review and select an allowable operating mode.
0A59	Invalid Flags Mode	-	-
0A5A	Operation Mode not Possible	The operating mode selected is not possible	Review and select an allowable operating mode.
0A5B	Invalid Utilization Value	It was not calculated or an invalid usage.	The projected loads in the load chart to check and correct.
0A61	Mode Sanity Check 1 Failed	-	-
0A62	Mode Sanity Check 2 Failed	-	-
0A63	Mode Sanity Check 3 Failed	-	-
0A64	Mode Sanity Check 4 Failed	-	-
0A65	Mode Sanity Check 5 Failed	-	-
0A66	Mode Sanity Check 6 Failed	-	-
0A67	Mode Sanity Check 7 Failed	-	-
0A68	Mode Sanity Check 8 Failed	-	-
0A6A	Invalid Radius Calculated	Negative radius calculated	Check sensors and actuators. Crane data not covered from the programming mode. Change after consultation with Customer service.
0A6B	Invalid Height Calculated	Negative height is calculated.	Check sensors and actuators. Crane data not covered from the programming mode. Change after consultation with Customer service.
0A6C	Invalid Length Calculated	Negative length is calculate.	Check sensors and actuators. Crane data not covered from the programming mode. Change after consultation with Customer service.
0A70	Redundancy Failure for length	Redundancy error for the boom length determined.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact customer service.
0A71	Redundancy Failure for height	Redundancy error for the boom height determined.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact customer service.
0A72	Redundancy Failure for radius	Redundancy error for the observed radius.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact customer service.

0A73	Redundancy Failure for load	Redundancy error for the load determined.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact customer service.
0A74	Redundancy Failure for angle	Redundancy error for the observed boom angle.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact customer service.
0A75	Redundancy Failure for pressure	Redundancy error for the observed pressure.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact customer service.
0A76	Redundancy Failure for force	Redundancy error for the force detected.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact customer service.
0A77	Redundancy Failure for slewing angle	Redundancy error for the observed slewing angle.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact customer service.
0A7F	Redundancy Failure for Operation Mode	It was a redundancy mode for the mistakes found.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact customer service.

Table 9 - 3

9.2.4 CAN and I/O Error Codes – 1100-119F

The first two (2) digits of a CAN Bus or I/O error code signifies the type of failure.

11xx Cable Break / Open Load / Lower Limit
12xx Short-Circuit to Ground / Upper Limit
13xx Short-Circuit Battery / Upper Limit
14xx Error on Module
15xx Output deactivated
16xx Battery Error
17xx Data Error / CAN not initialized
18xx Timeout / CAN Device not responding
19xx Safety Failure
1Axx Parameter Failure
1Bxx I/O not o.k. – unspecified error

Error Code	Description	Cause	Notice/Solution
1100	Failure for length tele 1	Defective or faulty length sensor input module. (bad boom length potentiometer in the cable reel)	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken sensor. Check length and replace length potentiometer.
1101	Failure for angle luffing 1	Incorrect boom angle or incorrect input module.	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken boom angle sensor
1102	Failure for pressure piston 1	Pressure errors or erroneous input module on the piston side pressure transducer	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken pressure transducer sensor.
1103	Failure for pressure rod 1	Pressure errors or erroneous input module on the rod side pressure transducer.	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken pressure transducer sensor.
1104	Failure for length tele 2	Defective or faulty length sensor input module. (bad boom length potentiometer in the cable reel)	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken sensor. Check length and replace length potentiometer.
1105	Failure for angle luffing 2	Incorrect boom angle or incorrect input module.	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken boom angle sensor
1106	Failure for pressure piston 2	Pressure errors or erroneous input module on the piston side pressure transducer	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken pressure transducer sensor.
1107	Failure for pressure rod 2	Pressure errors or erroneous input module on the rod side pressure transducer.	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken pressure transducer sensor.

1108	Failure for length tele 3	Defective or faulty length sensor input module. (bad boom length potentiometer in the cable reel)	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken sensor. Check length and replace length potentiometer.
1109	Failure for angle luffing 3	Incorrect boom angle or incorrect input module.	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken boom angle sensor
110A	Failure for pressure piston 3	Pressure errors or erroneous input module on the piston side pressure transducer	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken pressure transducer sensor.
110B	Failure for pressure rod 3	Pressure errors or erroneous input module on the rod side pressure transducer.	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken pressure transducer sensor.
110C	Failure for length tele 4	Defective or faulty length sensor input module. (bad boom length potentiometer in the cable reel)	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken sensor. Check length and replace length potentiometer.
110D	Failure for angle luffing 4	Incorrect boom angle or incorrect input module.	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken boom angle sensor
110E	Failure for pressure piston 4	Pressure errors or erroneous input module on the piston side pressure transducer	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken pressure transducer sensor.
110F	Failure for pressure rod 4	Pressure errors or erroneous input module on the rod side pressure transducer.	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken pressure transducer sensor.
1110	Failure for pinning 1	-	-
1111	Failure for pinning 2	-	-
1112	Failure for pinning 3	-	-
1113	Failure for pinning 4	-	-
1114	Failure for pinning 5	-	-
1115	Failure for pinning 6	-	-
1116	Failure for pinning 7	-	-
1117	Failure for pinning 8	-	-
1118	Failure for misc input 1	-	-
1119	Failure for misc input 2	-	-
111A	Failure for misc input 3	-	-
111B	Failure for misc input 4	-	-
111C	Failure for misc input 5	-	-
111D	Failure for misc input 6	-	-
111E	Failure for misc input 7	-	-
111F	Failure for misc input 8	-	-
1120	Failure for force transducer 1	-	-
1121	Failure for force transducer 2	-	-
1122	Failure for force transducer 3	-	-
1123	Failure for force transducer 4	-	-
1124	Failure for force transducer 5	-	-
1125	Failure for force transducer 6	-	-
1126	Failure for force transducer 7	-	-

1127	Failure for force transducer 8	-	-
1128	Failure for slewing angle 1	Defective or faulty slew angle encoder.	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace slew angle encoder.
1129	Failure for slewing angle 2	Defective or faulty slew angle encoder.	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace slew angle encoder.
112A	Failure for slewing angle 3	Defective or faulty slew angle encoder.	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace slew angle encoder.
112B	Failure for slewing angle 4	Defective or faulty slew angle encoder.	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace slew angle encoder.
112C	Failure for misc angle 1	-	-
112D	Failure for misc angle 2	-	-
112E	Failure for misc angle 3	-	-
112F	Failure for misc angle 4	-	-
1130	Failure for outrigger 1	Outrigger position signal errors or incorrect input module. (Loss of outrigger position signal)	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace outrigger sensor.
1131	Failure for outrigger 2	Outrigger position signal errors or incorrect input module. (Loss of outrigger position signal)	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace outrigger sensor.
1132	Failure for outrigger 3	Outrigger position signal errors or incorrect input module. (Loss of outrigger position signal)	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace outrigger sensor.
1133	Failure for outrigger 4	Outrigger position signal errors or incorrect input module. (Loss of outrigger position signal)	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace outrigger sensor.
1134	Failure for wind speed 1	-	-
1135	Failure for wind speed 2	-	-
1136	Failure for counterweight 1	-	-
1137	Failure for counterweight 2	-	-
1138	Failure for inclination x 1	Tilt Sensor errors or incorrect input module. Low Supply Voltage.	Low Supply Voltage. Minimum supply 10 volts. CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken sensor.
1139	Failure for inclination y 1	Tilt Sensor errors or incorrect input module. Low Supply Voltage.	Low Supply Voltage. Minimum supply 10 volts. CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken sensor.
113A	Failure for inclination x 2	Tilt Sensor errors or incorrect input module. Low Supply Voltage.	Low Supply Voltage. Minimum supply 10 volts. CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken sensor.

113B	Failure for inclination y 2	Tilt Sensor errors or incorrect input module. Low Supply Voltage.	Low Supply Voltage. Minimum supply 10 volts. CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken sensor.
113C	Failure for A2B Switch 1	A2B Limit switch defective, or faulty input module.	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken sensor.
113D	Failure for A2B Switch 2	A2B Limit switch defective, or faulty input module.	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken sensor.
113E	Failure for Third Wrap Switch 1	Third Wrap switch defective, or faulty input module.	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken sensor.
113F	Failure for Third Wrap Switch 2	Third Wrap switch defective, or faulty input module.	CAN wiring and electrical connections. Sensor calibration and check CAN project. Replace broken sensor.
1140	Failure for Setup Switch 1	-	-
1141	Failure for Setup Switch 2	-	-
1142	Failure for Luffing Up Button 1	-	-
1143	Failure for Luffing Up Button 2	-	-
1144	Failure for Cut Bypass Switch 1	-	-
1145	Failure for Cut Bypass Switch 2	-	-
1146	Failure for Engine Stop Message 1	-	-
1147	Failure for Engine Stop Message 2	-	-
1148	Failure for Joysticks in Base Position 1	-	-
1149	Failure for Joysticks in Base Position 2	-	-
114A	Failure for High Voltage Detection Unit 1	-	-
114B	Failure for High Voltage Detection Unit 2	-	-
114C	Failure for A2B Switch Bypass 1	-	-
114D	Failure for A2B Switch Bypass 2	-	-
114E	Failure for Third Wrap Switch Bypass 1	-	-
114F	Failure for Third Wrap Switch Bypass 2	-	-
1150	Failure for Telescope 1 active	-	-
1151	Failure for Telescope 2 active	-	-
1152	Failure for Telescope 3 active	-	-
1153	Failure for Telescope 4 active	-	-
1154	Failure for Telescope 5 active	-	-
1155	Failure for Telescope 6 active	-	-
1156	Failure for Telescope 7 active	-	-
1157	Failure for Telescope 8 active	-	-
1158	Failure for Telescope 1 limit switch	-	-
1159	Failure for Telescope 2 limit switch	-	-
115A	Failure for Telescope 3 limit switch	-	-
115B	Failure for Telescope 4 limit switch	-	-
115C	Failure for Telescope 5 limit switch	-	-
115D	Failure for Telescope 6 limit switch	-	-
115E	Failure for Telescope 7 limit switch	-	-
115F	Failure for Telescope 8 limit switch	-	-
1160	Failure for Safety Cut Output	-	-
1161	Failure for Cut Output	-	-
1162	Failure for Speed Cut Output	-	-
1163	Failure for Rigging Mode Output	-	-
1164	Failure for Enable Telescope In Output	-	-
1165	Failure for Enable Telescope Out Output	-	-
1166	Failure for Enable Boom Up Output	-	-

1167	Failure for Enable Boom Down Output	-	-
1168	Failure for Enable Slew Left Output	-	-
1169	Failure for Enable Slew Right Output	-	-
116A	Failure for Enable Winch Up Output	-	-
116B	Failure for Enable Winch Down Output	-	-
116C	Failure for Green Lamp Output	-	-
116D	Failure for Yellow Lamp Output	-	-
116E	Failure for Red Lamp Output	-	-
116F	Failure for Horn Output	-	-
1170	Failure for Safety Checkback 1	-	-
1171	Failure for Safety Checkback 2	-	-
1172	Failure for Safety Checkback 3	-	-
1173	Failure for Safety Checkback 4	-	-
1174	Failure for Safety Cut Output 1	-	-
1175	Failure for Safety Cut Output 1	-	-
1176	Failure for Safety Cut Output 1	-	-
1177	Failure for Safety Cut Output 1	-	-
1178	Failure for Left Output	-	-
1179	Failure for Right Output	-	-
117A	Failure for Left Output	-	-
117B	Failure for Right Output	-	-
117C	Failure for Temperature 1	-	-
117D	Failure for Temperature 2	-	-
117E	Failure for misc output 1	-	-
117F	Failure for misc output 2	-	-
1180	Failure for misc output 3	-	-
1181	Failure for misc output 4	-	-
1182	Failure for misc output 5	-	-
1183	Failure for misc output 6	-	-
1184	Failure for misc output 7	-	-
1185	Failure for misc output 8	-	-
119F	Failure for Non Specified Sensor	-	-

Table 9 - 4

9.2.5 System Error Codes – 0F00-1FFF

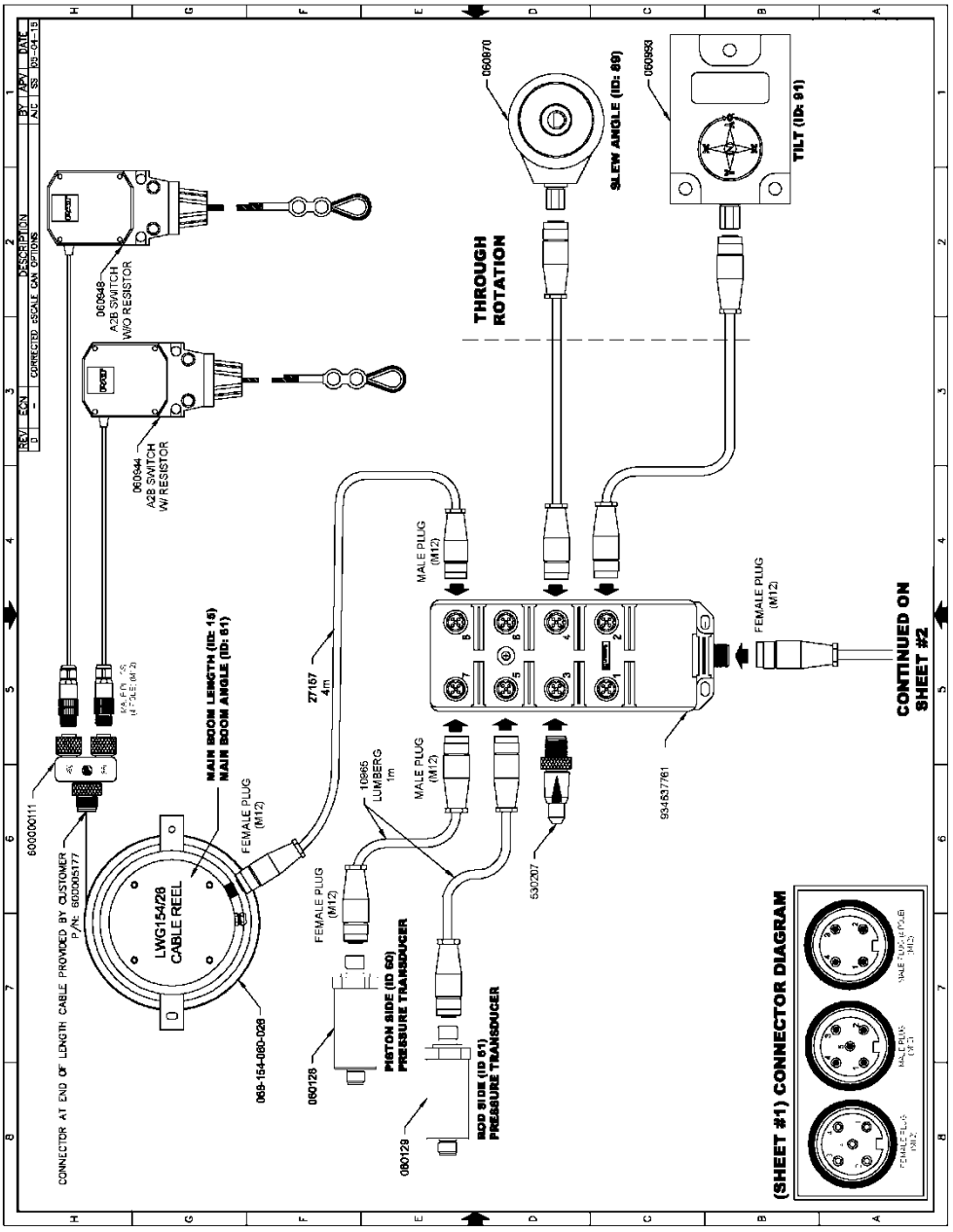
Error code	Description	Cause	Notice/Solution
1F01	Console communication error / timeout	Error during initialization	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F02	Kinematics communication error / timeout	Communication with the Kinematics module is faulty.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F03	Limiter communication error / timeout	Communication with the limiter module is faulty.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F04	Data logger communication error / timeout	Communication with the data logger module is faulty.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F05	Ext System 1 communication error / timeout	The communication with the external system is disturbed.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F06	Ext System 2 communication error / timeout	The communication with the external system is disturbed.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F07	Ext System 3 communication error / timeout	The communication with the external system is disturbed.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F08	Ext System 4 communication error / timeout	The communication with the external system is disturbed.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F10	Scalable Control Library Error	Internal failure of the system application program	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F11	Parameter Manager Error	Internal failure of the system application program	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F12	File Operations Error	Internal failure of the system application program	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F13	Version Service Error	Internal failure of the system application program	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F14	Version Device Error	Internal failure of the system application program	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.

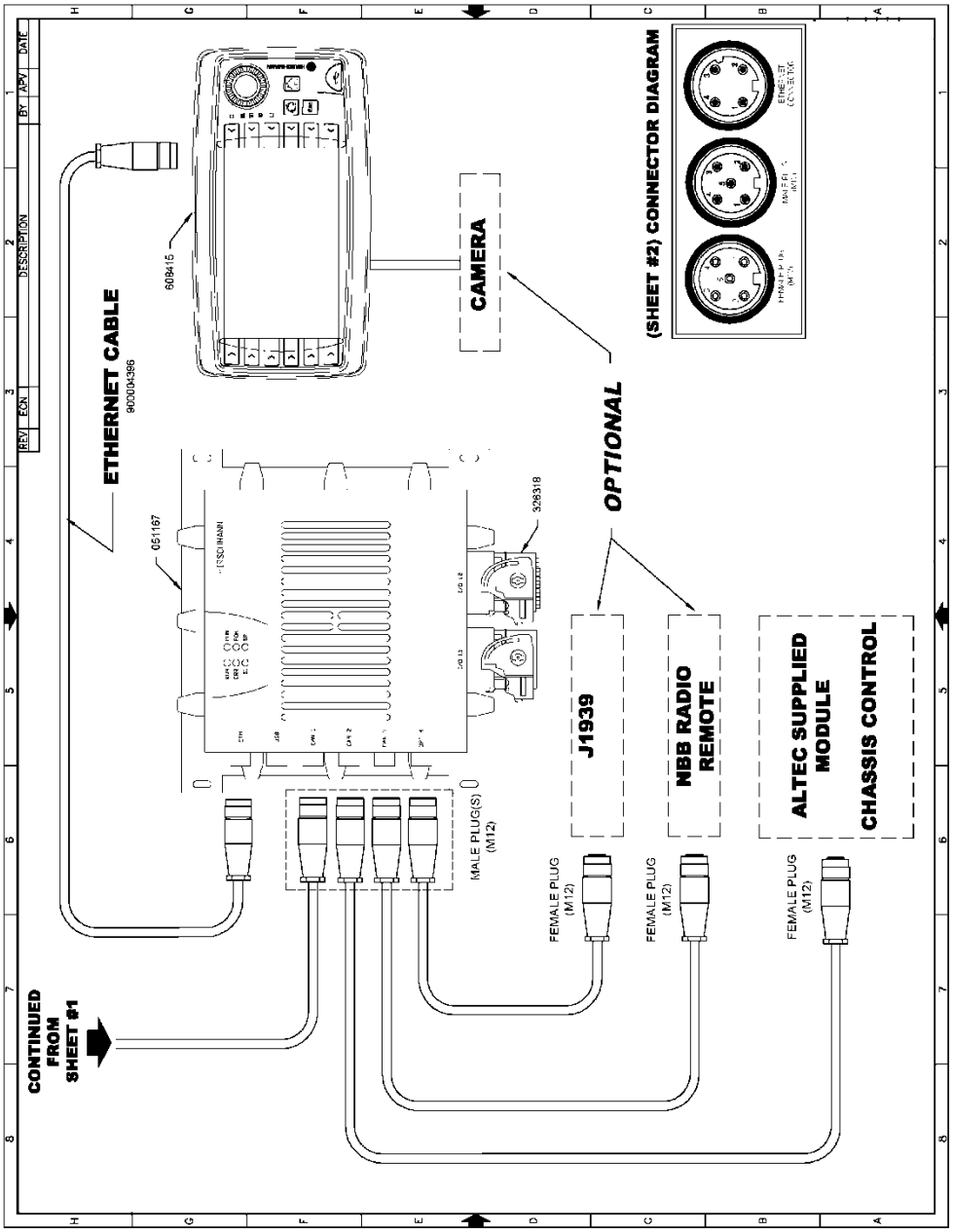
Error code	Description	Cause	Notice/Solution
1F15	Blackbox Error	Internal failure of the system application program	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F16	Data / Blackboard Error	Internal failure of the system application program.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F17	Wrong Machine Variant Error		Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F30	Redundancy Relay Checkback Invalid	Contact and feedback control for the monitoring of redundancy do not match	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F31	Redundancy System 1 Failure	Errors in redundant system 1	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F32	Redundancy System 2 Failure	Error redundancy system 2	Switch ignition off 10 seconds and then on again. If the error occurs again, contact the customer service.
1F40	Error Power Supply Voltage	Power (low voltage) The excitation voltage of the system is too low	Check the battery voltage of the crane, testing the wiring of the supply voltage.
1F41	Error Battery Voltage	Battery voltage problem. The voltage of the buffer battery of the system is too low	Contact Customer service representative, replace the unit.
1F42	Error Temperature Power Supply	The temperature of the power supply is too high	Installation conditions of the unit test. Switch ignition off and on again. If the error occurs again communicate to customer service.
1F43	Error Temperature CPU	The temperature of the CPU is too high	Installation conditions of the unit test. Switch ignition off and on again. If the error occurs again communicate to customer service.
1F44	Error CanOpen Fatal	Error in CAN Bus system	Installation conditions of the unit test. Switch ignition off and on again. If the error occurs again communicate to customer service.
1F1F	Outputs Deactivated by Application	Outputs are deactivated by the application software.	Information: sequence errors from another system error.
1F2F	Outputs Deactivated by Firmware	Outputs are deactivated by the firmware.	Information: sequence errors from another system error.

Error code	Description	Cause	Notice/Solution
1F3F	Machine data does not match application	The version of the rating charts / data programming does not match the application version	Contact Customer service representative, replace equipment / software.
1F4F	Machine parameters does not match app	The version of the parameter data does not match the application version	Contact Customer service representative, replace equipment / software.
1FFF	System Safety Fault	The system has detected errors in the RAM or FLASH memory that cannot be eliminated. The unit can no longer be operated safely.	Switch ignition off 10 seconds and then on again. If the error occurs again, contact customer service.

Table 9 – 5

9.3 Drawings


REV
ECN
DESCRIPTION
BY
APV
DATE
D
-
CORRECTED ESCALE CAN OPTIONS
AJC
SS
05-04-18
060948
A2B SWITCH
W/O RESISTOR
060944
A2B SWITCH
W/ RESISTOR
600000111
CONNECTOR AT END OF LENGTH CABLE PROVIDED BY CUSTOMER
P/N: 600005177
LWG154/28
CABLE REEL
069-154-060-028
MAIN BOOM LENGTH (ID: 48)
MAIN BOOM ANGLE (ID: 61)
FEMALE PLUG
(M12)
27167
4m
FEMALE PLUG
(M12)
060128
PISTON SIDE (ID 60)
PRESSURE TRANSDUCER
060129
ROD SIDE (ID 51)
PRESSURE TRANSDUCER
10965
LUMBERG
1m
MALE PLUG
(M12)
MALE PLUG
(M12)
530207
THROUGH
ROTATION
MALE PLUG
(M12)
934637761
FEMALE PLUG
(M12)
CONTINUED ON
SHEET #2
060970
SLEW ANGLE (ID: 60)
060953
TILT (ID: 61)
(SHEET #1) CONNECTOR DIAGRAM


REV
ECN
DESCRIPTION
BY
APV
DATE
ETHERNET CABLE
900004396
608415
CAMERA
(SHEET #2) CONNECTOR DIAGRAM
OPTIONAL
051167
329318
J1939
NBB RADIO REMOTE
ALTEC SUPPLIED MODULE
CHASSIS CONTROL
MALE PLUG(S) (M12)
FEMALE PLUG (M12)
FEMALE PLUG (M12)
FEMALE PLUG (M12)
CONTINUED FROM SHEET #1

Notes

SkyAzúl, Inc.
16 Walnut Street
Middletown, MD 21769
Phone 301-371-6126
Fax 301-371-0029
info@skyazul.com

www.skyazul.com