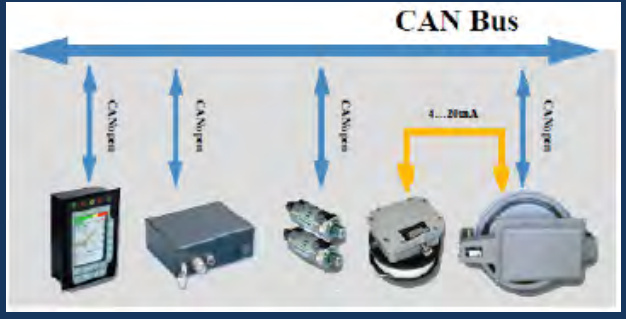
SkyAzúl
EQUIPMENT SOLUTIONS

HC4900



SERVICE MANUAL

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MANUAL REVISIONS

REV	DATE	NAME	DESCRIPTION
-	08/09/13	SC	HC4900 System Service Manual (SkyAzúl)

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

CONTENTS

This service manual is designed to assist a service or maintenance person in identifying system problems 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.

1 WARNING

The LMI is an operational aid that warns a crane operator of approaching overload conditions and over hoist conditions that could cause damage to equipment and personnel.

The device is not, and shall not be, a substitute for good operator judgment, experience and use of accepted safe crane operating procedures.

The responsibility for the safe crane operation shall remain with the crane operator who shall ensure that all warnings and instructions supplied are fully understood and observed.

Prior to operating the crane, the operator must carefully and thoroughly read and understand the information in this manual to ensure that he knows the operation and limitations of both the indicator and the crane.

Proper functioning depends upon proper daily inspection and observance of the operating instructions set forth in this manual. Refer to Section 6. *Pre-Operation Inspection and Calibration Verification* of the operator’s manual.

⚠ WARNING

The LMI will only work correctly if all adjustments have been properly set. For correct adjustment, the operator has to correctly answer all of the questions during the setup procedure in accordance with the current configuration of the crane. To prevent material damage and serious or even fatal accidents, the correct adjustment of the LMI has to be ensured before starting the crane operation.

2 SYSTEM DESCRIPTION

2.1 SYSTEM FUNCTION

The HC4900 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 Load Moment Indicator system operates on the principle of reference/real comparison. The real value, resulting from the pressure measurement, is compared with the reference data which is stored in the central processor memory and is evaluated in the microprocessor. When limits are reached, an overload warning signal is generated through the operator’s console. At the same time, crane functions, 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 processing 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 and are mounted inside the cable reel, which is mounted on the boom. The boom length is measured by cable installed on a cable reel which also serves as an electrical conductor for the anti two-block switches.

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

The interactive setup procedure simplifies the input of the operating modes as well as the setting of geometry limits.

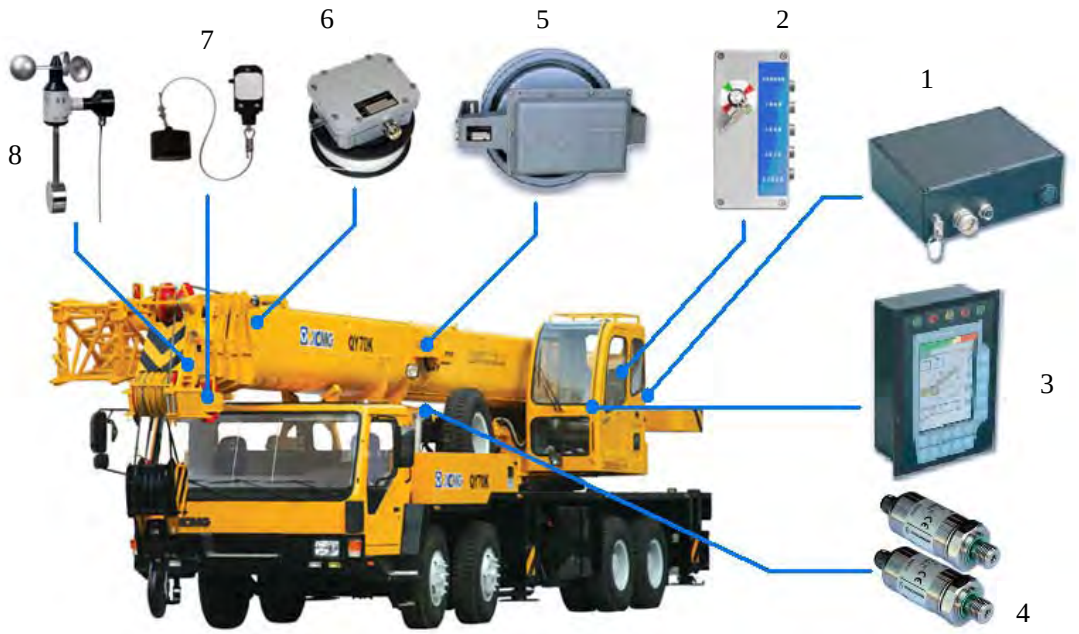
2.2 DESCRIPTION OF A CAN BUS SYSTEM

CAN stands for “Controller Area Network”. It is intended for use 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. However, 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.

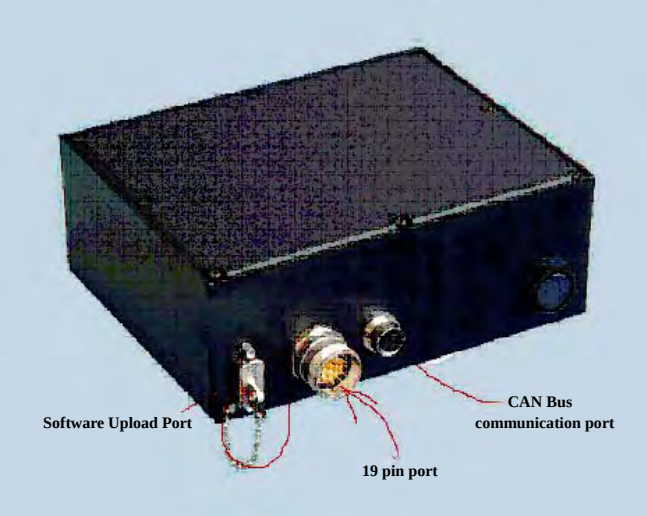
The cable bus is a twisted pair of shielded wire. Data can be transmitted in blocks from 0-8 bytes at a maximum transfer rate of 1 Mbit/s for networks up to 40 meters. For longer network distances, the maximum transfer rate must be reduced to 50 Kbit/s for a 1 km network distance. CAN will operate in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

3 SYSTEM STRUCTURE



1. HC4900 Central Unit
2. CAN Junction-Box
3. HC4600 Console
4. Pressure Transducers
5. Length and Angle Sensors
6. Length Sensor
7. A2B
8. Wind Speed

3.1 HC4900 CENTRAL UNIT



The HC4900 (**mentor)** safe load moment indicator includes a central microprocessor unit. The system components are connected via CAN Bus.

3.1.1 Performance parameters of the central unit

1. Voltage supply：10~30 V DC
2. Digital input：4 circuits（0~30V , could be used as calculator）
3. PWM output：4 circuits（50-400 Hz, 2 A, current control or calibrated by digital output port)
4. I/O port (configured)：4 circuits I/O
5. Housing：Aluminum metal board
6. System connector：M23×1, 19 poles socket
7. Protection grade：IP66
8. Dimension：181 × 141 × 70.5 mm (L × B × H)
9. Working temperature：-30 °C to + 70 °C
10. Storage temperature：-40 °C to + 80 °C
11. CAN communication protocol：CANopen2.0B
12. CAN connector：M12×1, 5 poles socket
13. Relay：2 circuits (max. 4 A)
14. Calibration port：RS 232
15. Processer ：Motorola MPC 561, 40 MHz, 32bit, FPU
16. SRAM：2M
17. Flash-EPRAM：4M

3.1.2 Port configuration of the central unit

The HC 4900 central unit (also called mentor) is the CAN master of the system that is in charge of controlling the other nodes. It has the function of LMI calculation, port configuration; management, and control of CAN Bus and so on.

The HC 4900 central unit has nineteen ports. The specific configuration for each is as follows：

Port SN	Port Function	Port SN	Port Function	Port SN	Port Function
1	DIN0	8	PWMOUT0/DOUT0	15	K1_MK
2	DIN1	9	PWMOUT1/DOUT1	16	K1_AK
3	DIN2	10	PWMOUT2/DOUT2	17	K2_MK
4	DIN3	11	PWMOUT3/DOUT3	18	K2_AK
5	DIN4/DOUT4	12	GND	19	UBS
6	UBP	13	DIN6/DOUT6		
7	DIN5/DOUT5	14	DIN7/DOUT7		

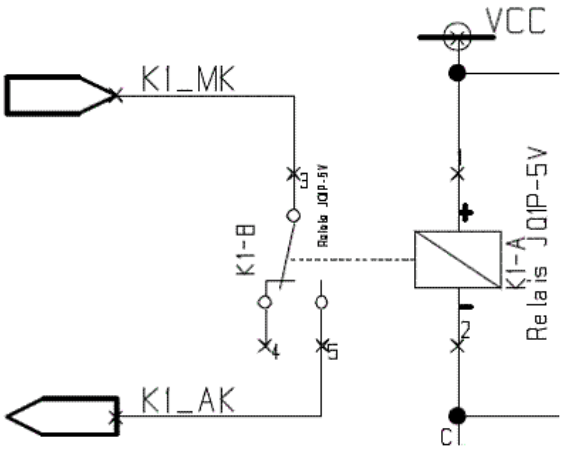
3.1.3 Port configuration for the application on the XCMG telescopic crane

Port SN	Wire Color	Port Function	Application
1	green	DIN0	Front and rear
2	orange	DIN1	Half and full extended outrigger
3	white	DIN2	Override input
4	white-red	DIN3	Boom telescope out signal input
5	Blue	DIN4/DOUT4	Boom telescope in signal input
6	brown	UBP	24V
7	purple	DIN5/DOUT5	Free-slew signal input(only when use iflexc3)
8	white-orange	PWMOUT0/DOUT0	red warning light output
9	white-yellow	PWMOUT1/DOUT1	yellow warning light output
10	white-green	PWMOUT2/DOUT2	green warning light output
11	white-blue	PWMOUT3/DOUT3	Boom telescope control signal
12	yellow	GND	GND
13	black	DIN6/DOUT6	Luffing lamp
14	grey	DIN7/DOUT7	Telescope lamp
15	white-purple	K1_MK	24V
16	white-black	K1_AK	Overload output
17	white-brown	K2_MK	24V
18	black-red	K2_AK	Free-slew valve signal
19	Red	UBS	24V

3.1.4 Power and Ground Port

UBS: 24V power supply (power on first before system power on)
UBP: 24V power supply
GND: system ground

3.1.5 Relay Port



There are two relay K1\K2 for extended usage on the mentor main board.

K1_MK: public port of relay 1 (COM)，could be connected with 24V voltage or ground

K1_AK: usual port of relay 1 (NO)

K2_MK: public port of relay 2 (COM)，could be connected with 24V voltage or ground

K2_AK: usual port of relay 2 (NO)

3.2 CAN JUNCTION BOX

The CAN Bus junction box contains a CAN patch board with five sockets which can be connected with five different CAN nodes.

The CAN Bus junction box is a CAN Bus communication net collecting all signals of CAN equipment in the system.

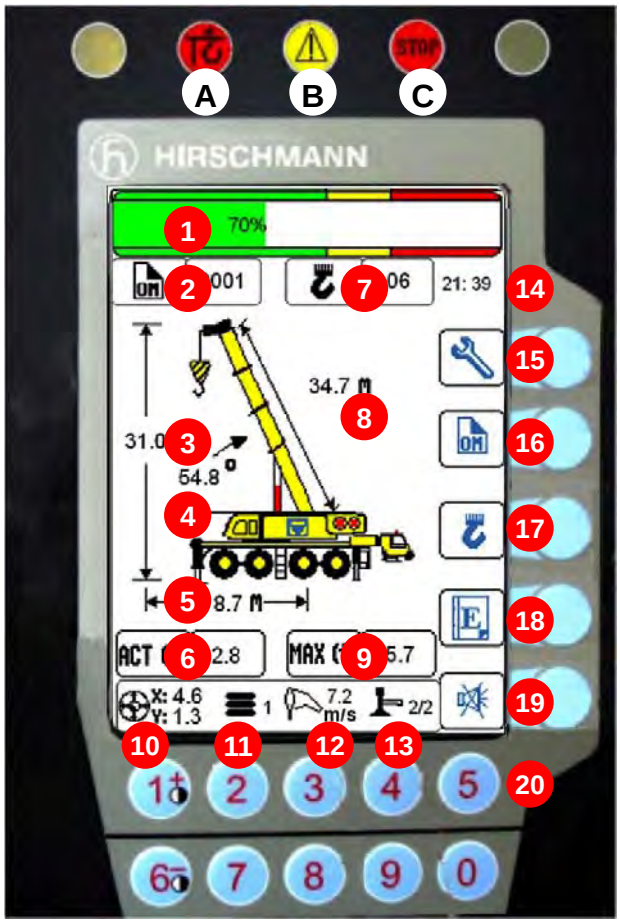
3.3 IC4600 CONSOLE

The IC4600 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 the crane's load chart. It also has an alarm, a warning light for overload, and a pre-warning light. The graphic display allows for a simple interactive configuration setup, as well as sensor calibration (zero adjustment), and troubleshooting sensor output screen. The console has a warning light for anti-two-block conditions and an override switch for overload or anti-block condition.

3.3.1 IC4600 Console Specification

Type	In-dash
Housing	sheet metal
Protection class front Back	 IP65 IP20
Supply Voltage	11…36 VDC
Processor	16-bit C167CS @20MHz
Program memory	2MB FLASH 1MB RAM
Data memory	16Kb FRAM Serial Memory
Real time clock	.
Watchdog	.
Cut-off Relay	—
Indicator & buzzer	3 LEDs and 1 buzzer
Digital Input	—
PWM Output	—
Digital Output	—
Dimensions(in mm) front plate (W×H) cut-out/depth (W×H×D)	 160×230 mm 136×210×68 mm
Display pixel Size Color	 QVGA(320×240) 5.7 inch256 colors LED backlight
Serial interface	CANopen 2.0B RS232
Operating temperature	-20…+70ºC
Storage temperature	-35…+80ºC
CoDeSys compatible	.

3.3.2 Console Layout



Warning light:

A. A2B warning light
B. Pre-warning light
C. Alarm light

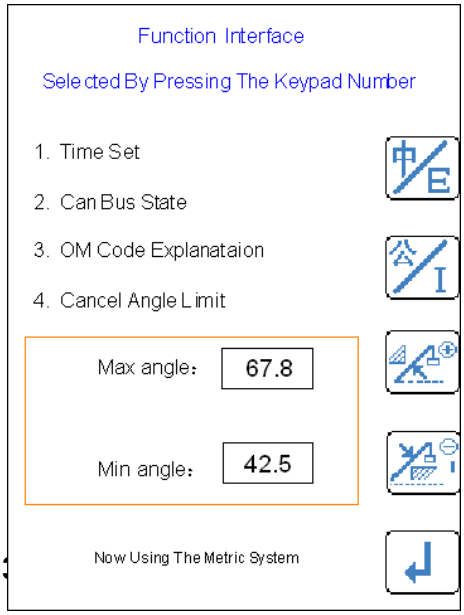
The parameters of the main interface:

1. Bar graph and Percent
2. Operating Mode Code
3. Boom Tip Height
4. Main Boom Angle
5. Working Radius
6. Actual Load
7. Reeving (Parts of Line)
8. Main Boom Length
9. Rated Load
10. List and Trim
11. Counter Weight
12. Wind Speed
13. Outrigger Status (1/2 is half，2/2 is full）
14. Current Time

Function key:

15. Function Interface
16. Set Operating Mode
17. Set Reeving (Parts of Line)
18. Error Codes
19. Horn Off
20. Digital Number Keys

3.3.3 Function Operation



On the main interface, press the key that corresponds to the icon  . Go to the Function set interface. In this interface, you can do the following operations:

- Set language (Chinese and English)
- Units converted between Metric and Imperial
- Set the maximum angle limit
- Set the minimum angle limit
- Set Time and Date
- CAN Bus State checking
- Operating Mode code explanation (Helper)
- Cancel Angle Limit

3.3.4 Angle Limit

Boom angle limits can be set through the LMI to warn the operator to use extreme caution under dangerous conditions such as working in the vicinity of buildings, bridges, high-voltage wire, etc.

ATTENTION

The limit function provides warning only (no function lockout). Each time the LMI system is reset the limit value also must be reset.

►Maximum angle limit

Depending on the situation,raise the main boom to the maximum safe angle, press key  , the indicator area will display the angle, the LMI will record this angle as the maximum limit. When the angle is higher than the limit value, the  indication light will appear and an audible alarm will sound to warn the operator to take extreme caution.

► Minimum angle limit

Depending on the situation, lower the main boom to the minimum safe angle， press key  . The indicator area will display the angle, the LMI will record this angle as the minimum limit. When the angle

is lower than the limit value, the STOP indication light will appear and an audible alarm will sound to warn the operator to take extreme caution.

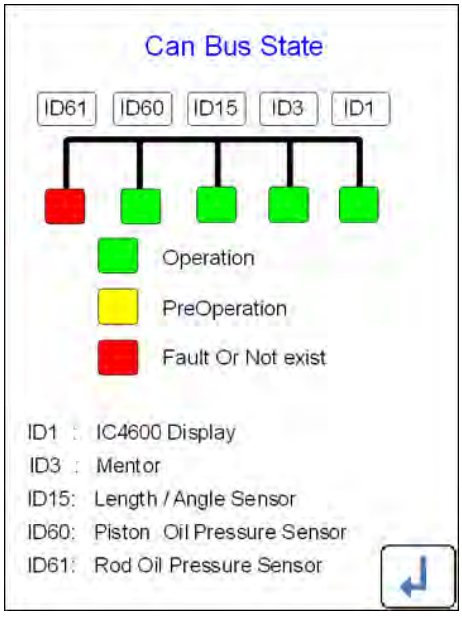
► Cancel angle limitation

Press the number “4” to cancel the set value in the function setting interface.

Setting the Time and Date

Press the key ↑ and ↓ to choose the item you want to set. When the item is chosen, the background color will change from green to blue. Then input the current date or time by pressing the corresponding number. If the value you input is correct, press Y to confirm. If the value is incorrect, press N to set the value to zero and try again. Press ↵ to leave this interface.

3.3.5 CAN Bus state

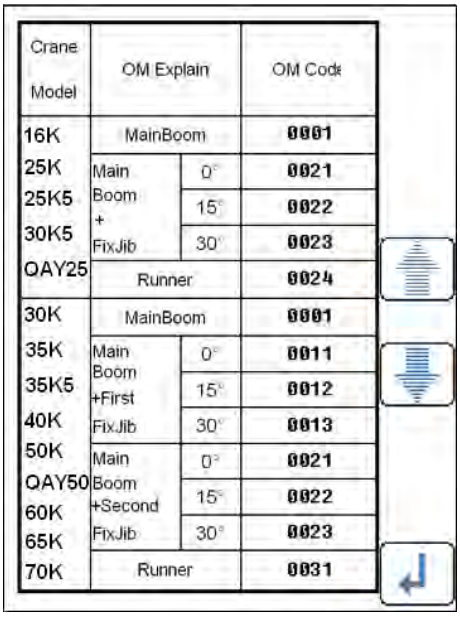


IC4600 display incorporates the advanced CAN communication technology and monitors the status of every node. If a node has a communication error, the error node is determined through the interface of CAN Bus status checking.

The node’s working state is distinguished by different colors:

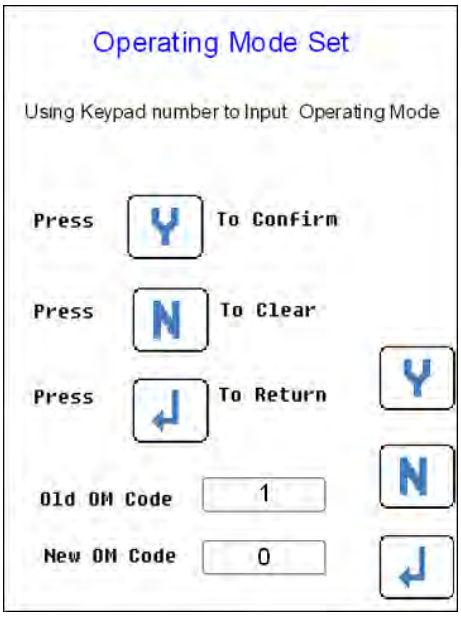
- Green: Operational
- Yellow: Pre-Operational
- Red: Error or does not exist

3.3.6 OM code inquire



Crane Model	OM Explain		OM Code
16K	MainBoom		0001
25K 25K5 30K5 QAY25	Main Boom + FixJib	0°	0021
		15°	0022
		30°	0023
	Runner		0024
30K	MainBoom		0001
35K 35K5 40K	Main Boom +First FixJib	0°	0011
		15°	0012
		30°	0013
50K QAY50 60K 65K	Main Boom +Second FixJib	0°	0021
		15°	0022
		30°	0023
70K	Runner		0031

3.3.7 OM code setting

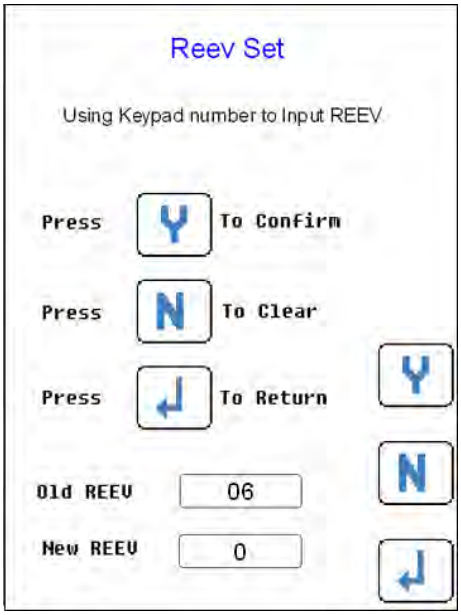


Before operating the crane, make sure the current Operating Mode is correct. If the value is incorrect, set the Operating Mode to be the same as the actual one.

Go to the Operating Mode Set interface by pressing OM in the main LMI interface.

In order to input the correct Operating Mode code, press the corresponding number. If the value is correct press Y to confirm. If the value is incorrect, press N to set the value to zero and try again. Press ↵ to leave this interface.

3.3.8 Reeving setting



The reeving setting interface is used for setting the parts of line. Before operation, the operator should adjust the displayed value to the same value as the actual one.

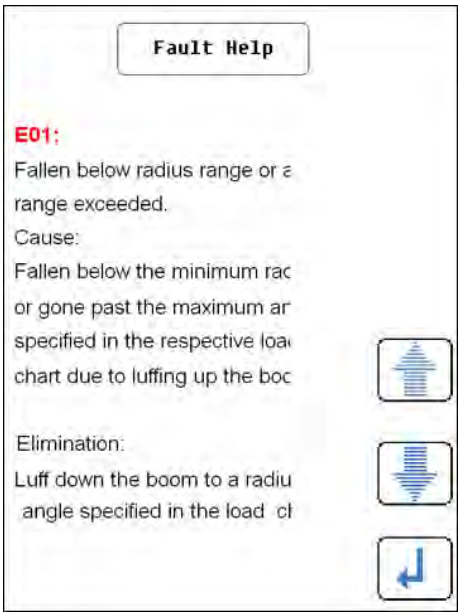
The relation of displayed reeving and actual reeving is one-to-one as follows.

Console display：1——12
Number of steel cable ： 1——12

Go to the Reeving Set interface by pressing in the main LMI interface.

Input the right Operating Mode code to what you want by pressing the corresponding number. If the value is correct, press to confirm. If the value is incorrect, press to set the value to zero and try again. Press to leave this interface.

3.3.9 Fault Help



Press the button on the main LMI interface to enter into the error interface help. This interface will explain what the error code means and offer a solution for maintenance and usage.

Press the button and for checking an error code and press the button to return back to the main interface.

3.3.10 Horn off

The IC4600 console will sound an audible alarm warning if one of the following situations occur：

—— Exceeds the max. Rated load moment
—— Hook is close to the height limit
—— Exceeds the working range
—— LMI system error
—— Wrong operation

Press the button  on the interface to stop the audible alarm warning sound for 30 seconds.

3.3.11 A2B indicating light

This red warning light lights up when the hoist limit switch contacts open, i.e. when a hoist limit situation has occurred. The acoustic alarm sounds and load-moment-increasing crane movements are switched off at the same time.

A hoist limit situation occurs when the hook block comes into contact with the boom head. The danger exists in such situations that the hoist rope will break, causing the load to fall. A hoist limit situation could arise from the load being pulled against the boom head or from the boom being extended or lowered without the hoist rope being spooled off the winch.

3.3.12 Pre-warning light

When the actual load moment has reached 90%～100% of the rated load moment, the yellow pre-warning light will appear on the operator's console. This means an overload situation is approaching and the operator shall proceed with caution.

3.3.13 Overload warning light

This red display light lights up to indicate that the maximum capacity has been reached or exceeded. At the same time, the acoustic alarm sounds an uninterrupted signal and, depending on the system wiring, load moment-increasing boom movements are stopped.

3.4 PRESSURE TRANSDUCER

The pressure transducer converts hydraulic pressure into an electric signal. Every pressure transducer has its own CAN Bus converter board, and it has its own device Node-ID. The piston oil pressure transducer is connected to the piston side of the lift cylinder, its Node-ID is 0x3C; The rod oil pressure transducer is connected to the rod side of the lift cylinder, its Node-ID id 0x3D.

There are five pins on the transducer:

1	2	3	4	5
PE（shield）	＋UB	0V	CAN_H	CAN_L

The default baudrate is 125K.

3.5 LENGTH AND ANGLE SENSOR

The Length-Angle Transducer: The length-angle sensor (LWG), often referred to as the “cable reel”, is a combination of two transducers in one unit. It 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 transducer circuit is the length cable on the drum, which is a multi-conductor cable. It is connected to the anti-two-block switch at the boom tip and to a slip ring in the LWG, and is also connected to the CAN conversion board, which is connected to the Bus system.

The angle transducer is a potentiometer driven by a weighted pendulum that is oil dampened. Both length and angle transducer are connected to a CAN Bus conversion board, which is connected to the Bus system.

3.6 LENGTH SENSOR

The length sensor (LG105), also known as a “cable reel”, the reeling drum drives a potentiometer, which is the length transducer.

We are using current signal length sensor, 4-20mA, when it is connected in a whole CAN BUS system, it should be converted to CAN signal by the CAN conversion board inside the length and angle sensor (the big cable reel).

3.7 A2B SWITCH

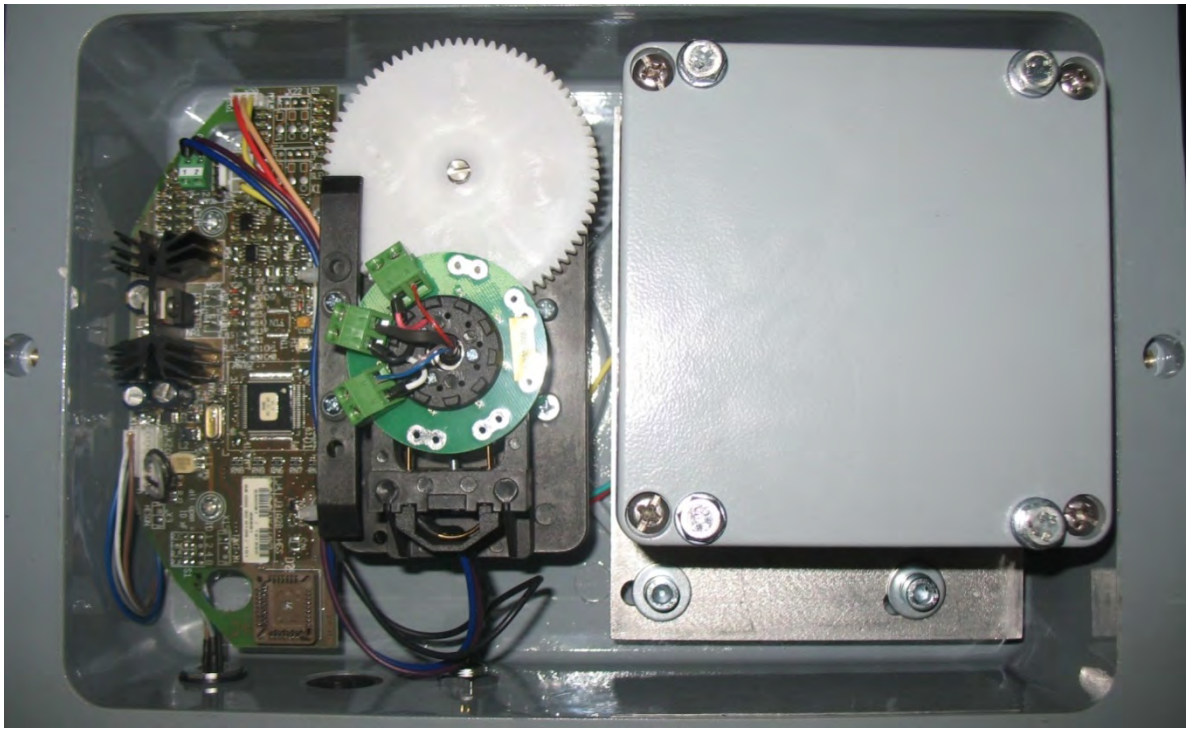
Anti-Two-Block Switch: The anti-two-block switch monitors the hook block and its relationship with the head of the boom. In working condition the switch is closed. When the load block strikes the weight, the circuit opens, disengaging a relay output to the lock out solenoid valves, where applicable. 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.

3.8 WIND SPEED

The wind speed sensor (anemometer) is used to measure the speed of the wind. It converts the wind into an electric signal. The HC4900 system supports current and voltage signal wind speed sensors.

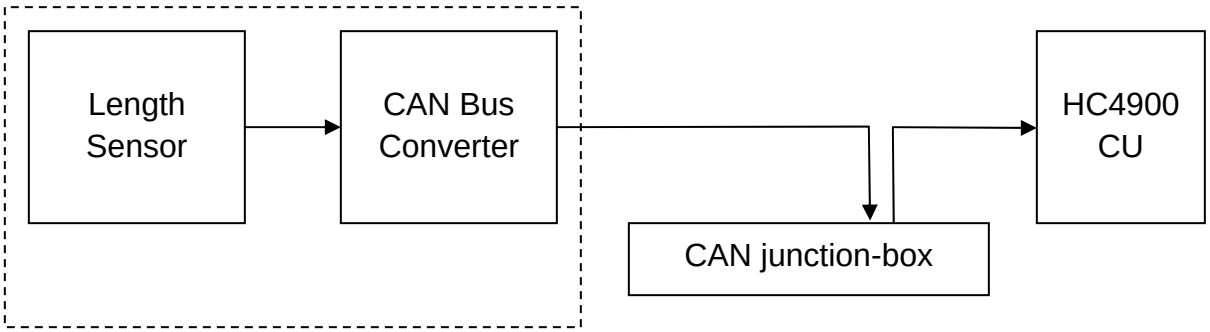
4 TROUBLE SHOOTING

4.1 LENGTH SENSING



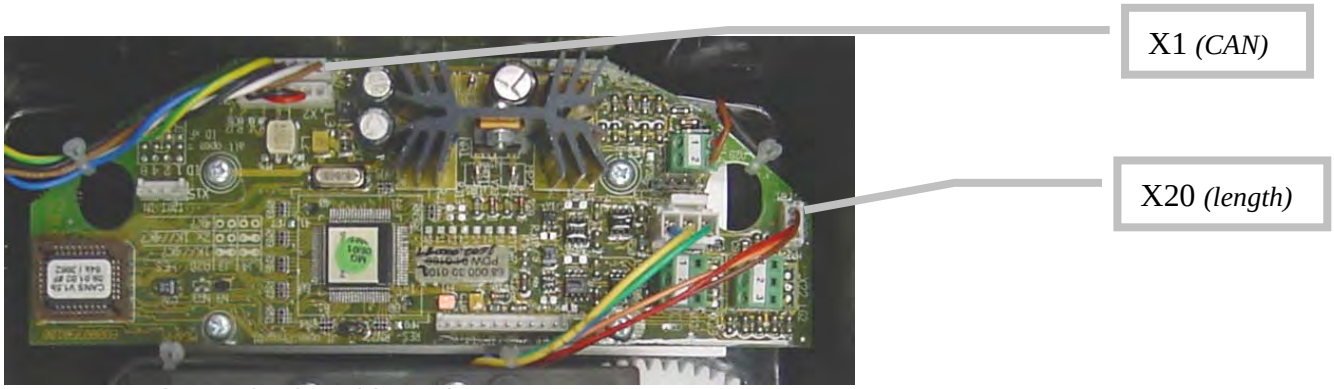
The system measures the length of the main boom of the machine with a length sensor. The length sensor is contained within the cable reel, located on the left side of the main boom.

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 CAN junction box， This acts as the main CAN Bus running to the central unit.

Troubleshooting length read-out:



CAN Bus electronics in cable reel.

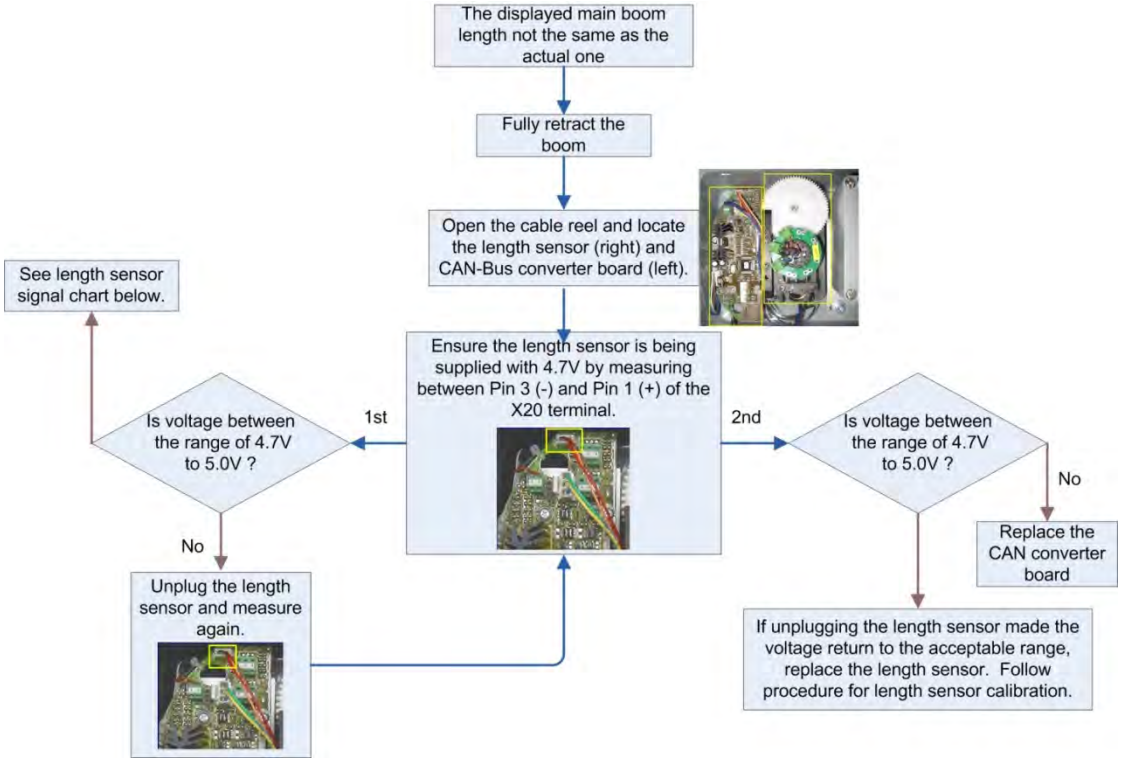
The length sensor has a built in potentiometer that is driven by a gear drive from the cable drum. As the length changes, the cable drum will turn and with it the potentiometer's axle. The converter board supplies a voltage of about 4.7V to the length potentiometer and in return monitors the output voltage of the potentiometer. The terminal used is X20. The length sensor is connected as follows:

Terminal X20	
1	+ 4.71V
2	Signal
3	+ 0.29V

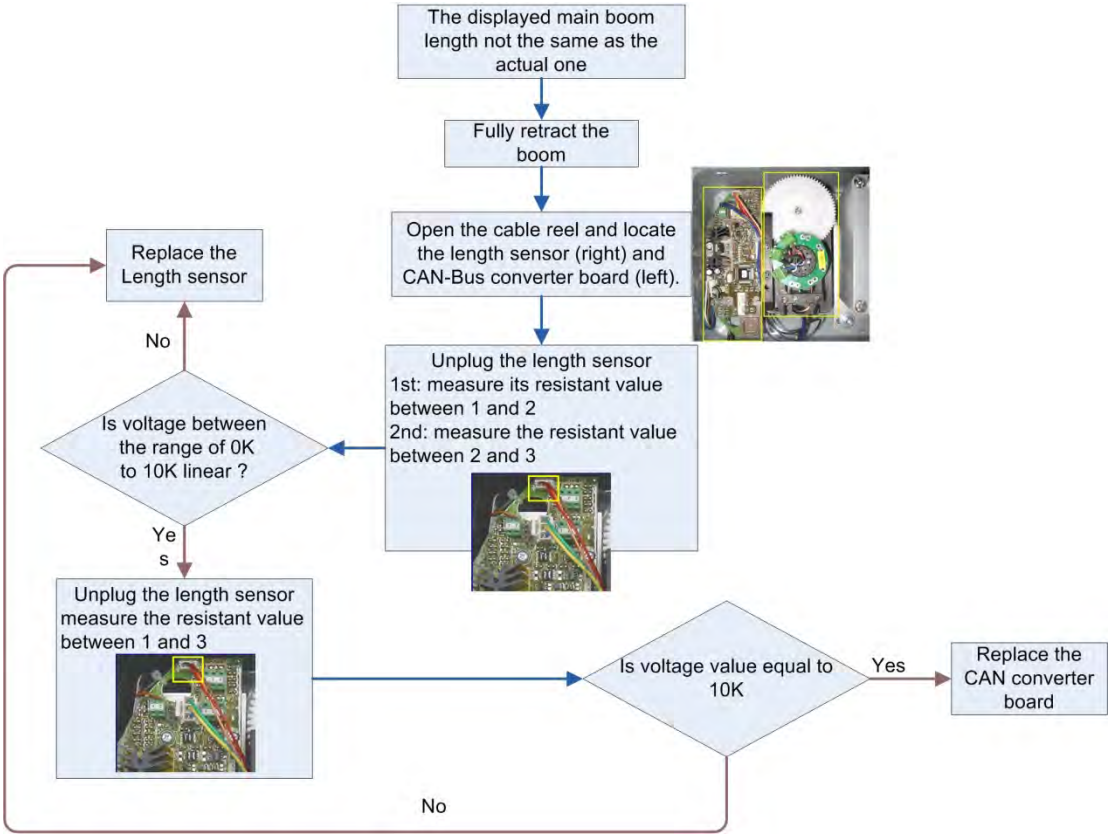
The length potentiometer is 10K and 10 rings and it has three pins. The resistance between pin1 and pin3 is constant and equal to 10K. The resistance between pin1 and pin2 from 0 to 10K, and the resistance between pin2 and pin3 from 10K to 0.

To troubleshoot the Length channel, perform one of the following options:

Option 1:



Option 2:


The displayed main boom length not the same as the actual one
Fully retract the boom
Open the cable reel and locate the length sensor (right) and CAN-Bus converter board (left).
Unplug the length sensor
1st: measure its resistant value between 1 and 2
2nd: measure the resistant value between 2 and 3
Is voltage between the range of 0K to 10K linear ?
No
Replace the Length sensor
Ye s
Unplug the length sensor measure the resistant value between 1 and 3
Is voltage value equal to 10K
Yes
Replace the CAN converter board
No

The length sensor returns a voltage between 0.29V at 0 turns of the length pot (= fully retracted) and 4.71V at 10 turns. The number of turns at full extension will depend on the gear ratio, the boom length, the length cable used, and the spooling pattern. Due to these variables, we cannot provide a standard table for it.

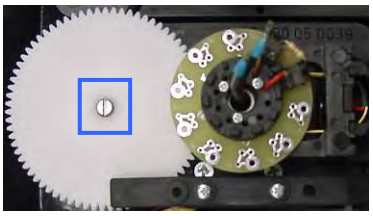
We can provide the following trouble-shooting table that shows the expected output voltage (measured between X20-2 and X20-3 Signal) for each complete turn of the length potentiometer.

Length Sensor Signal on Pin 3			
Turns	Resistance value between pin1 and pin2	Voltage X20-2 to X20-3	Voltage X20-2 to GND
0	0	0	0.29
1	1K	0.44	0.73
2	2K	0.88	1.17
3	3K	1.33	1.62
4	4K	1.77	2.06
5	5K	2.21	2.5
6	6K	2.65	2.94
7	7K	3.09	3.38
8	8K	3.54	3.83
9	9K	3.99	4.27
10	10K	4.42	4.71

Note: Actual voltages will vary slightly.

Length sensor zero point set

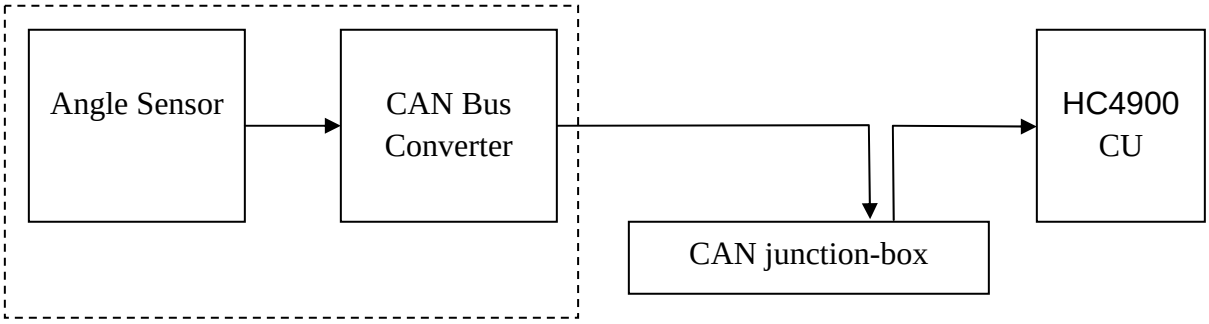
1. Fully retract the main boom
2. Open the cover of the cable reel
3. Turn the screw (reference the picture below, specifically the blue box) of the length potentiometer with a small screwdriver counter-clockwise to a soft stop. The Length should be the same as the basic boom's length, if not perform an error check



4.2 ANGLE SENSING

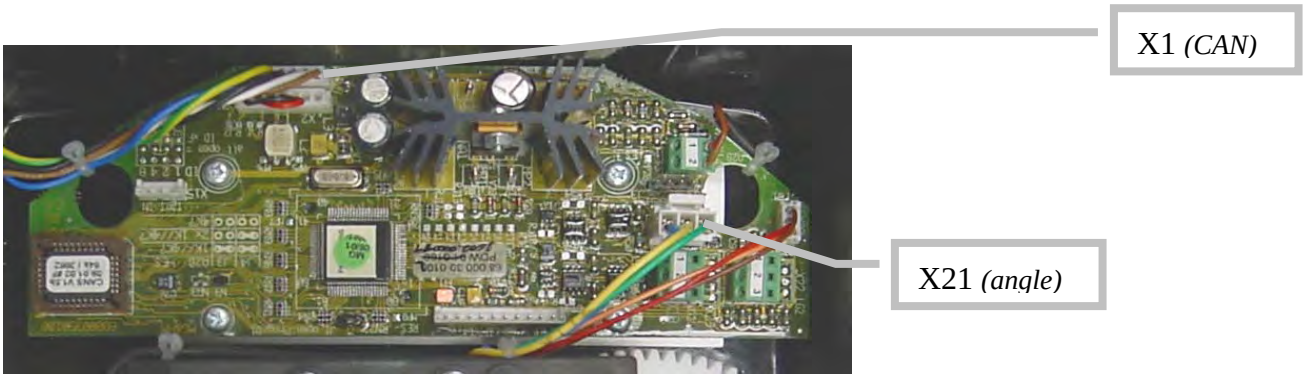
The System measures the angle of the main boom of the machine with an angle sensor. The angle sensor is contained within the cable reel, located on the left side of the main boom.

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 CAN junction box, which acts as the main CAN Bus running to the central unit.

Troubleshooting angle read-out:



CAN Bus electronics in cable reel

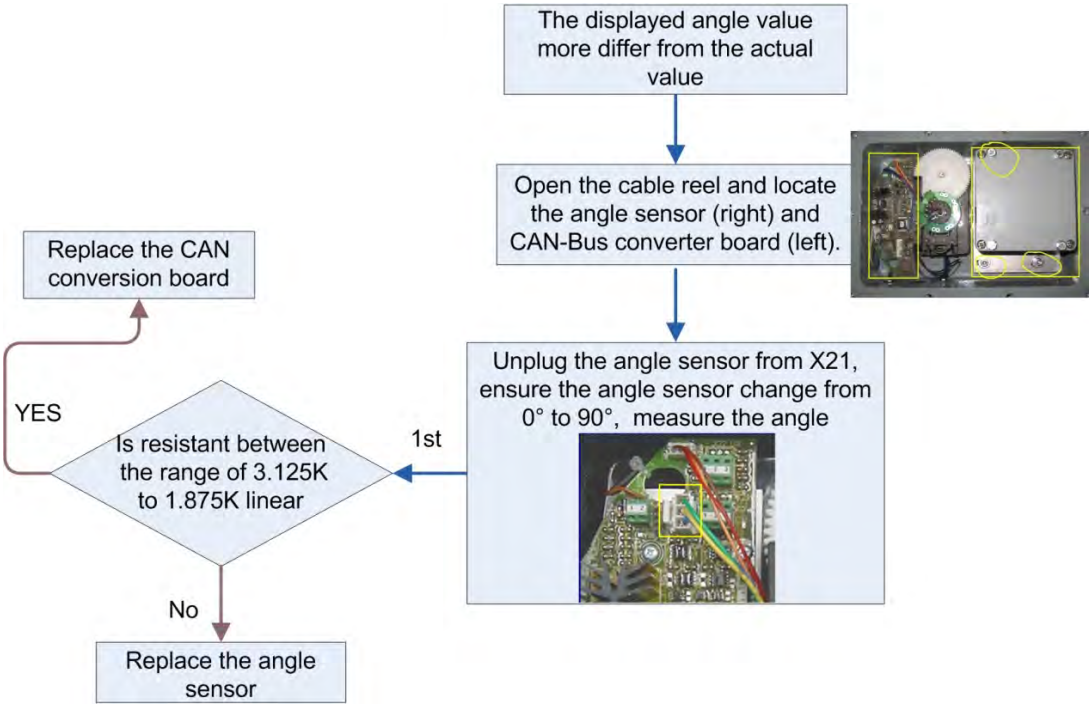
The angle sensor has a built in potentiometer that is driven by a pendulum. As the angle changes, the pendulum will drive the potentiometer's axle. The converter board supplies a constant voltage of 5V to the angle sensor and in return monitors the voltage of the potentiometer.

The terminal used is X21. The angle sensor is connected as follows:

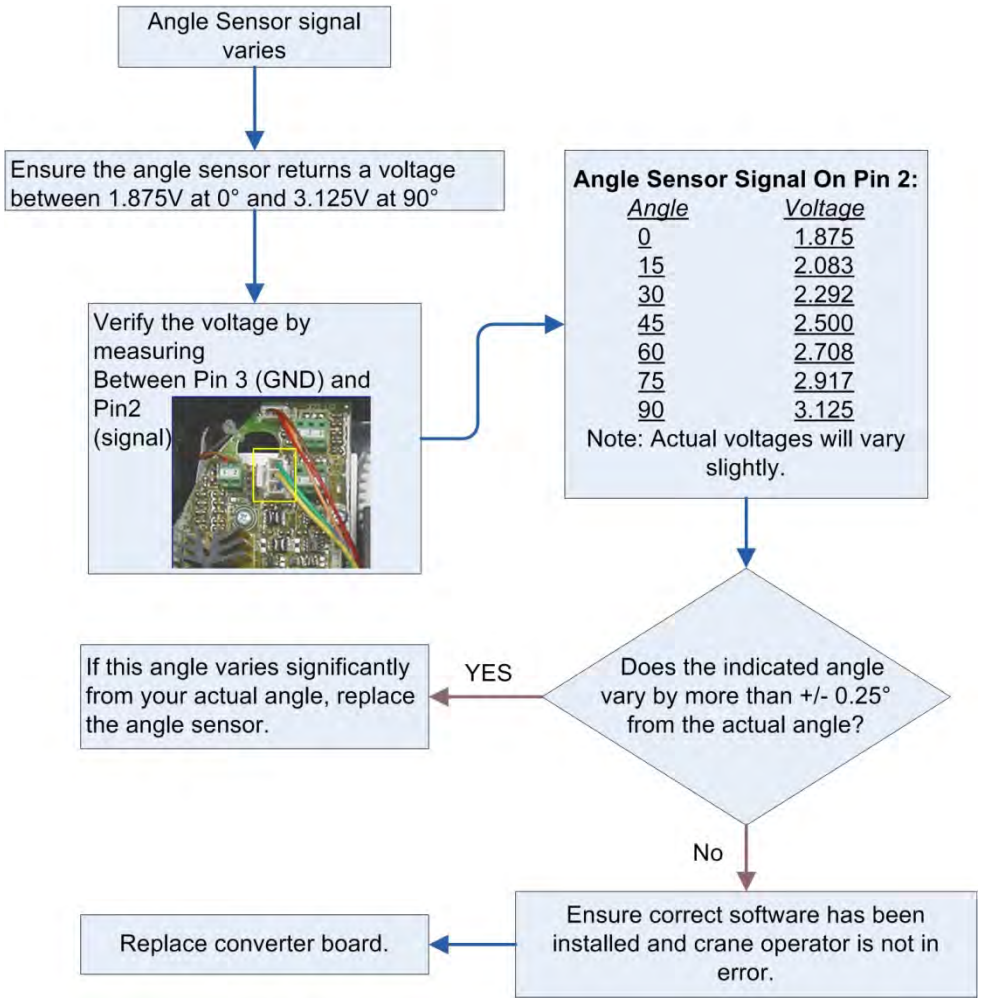
Terminal X21	
1	+ 5V
2	Signal
3	GND

To troubleshoot the Angle channel, perform one of the following options:

Option 1:



Option 2:

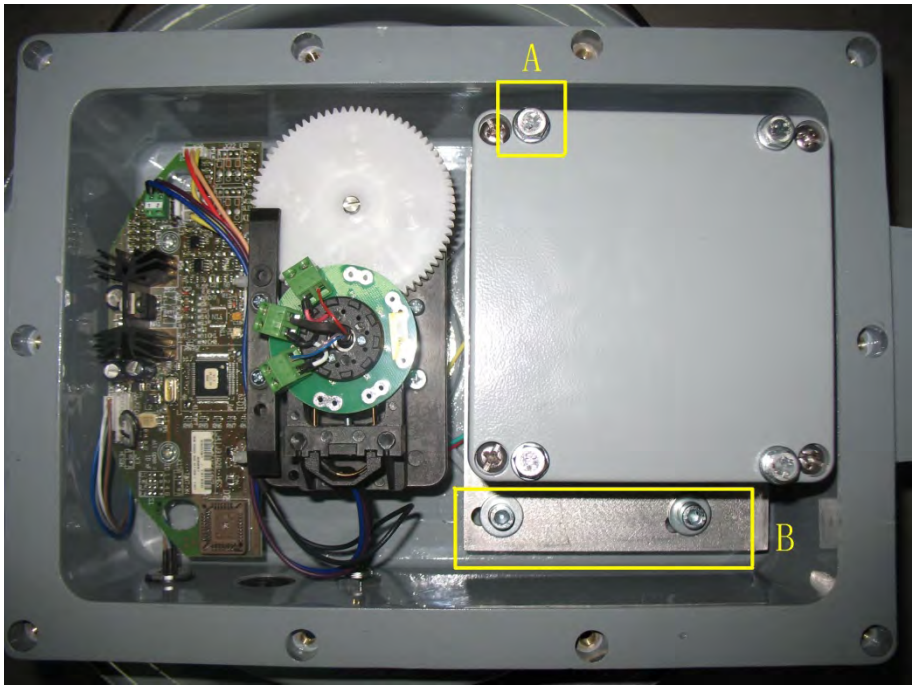


Note: If you need to determine the angle for voltages other than shown above, do so by using the following formula:

Angle (degrees) = 90 degrees – ((Voltage-1.875) * 72)

Setting the Angle zero point

1. Lower the main boom to zero degrees
2. Open the cable reel
3. Use an allen wrench (6mm) to loosen the screw shown in Box B below, then use an allen wrench (10mm) to loosen the screw in Box A below, until you can turn the angle sensor.
4. Rotating the angle sensor counter clockwise will decrease the angle and rotating clockwise will increase the angle. Adjust the displayed angle to be the same as the value measured by the angle device. The error must not exceed ±0.2°



4.3 CAN CONVERSION BOARD

The signal runs from the length sensor and the angle sensor to the CANbus converter board, located in the cable reel. From there, it travels as digital information on the CANbus.

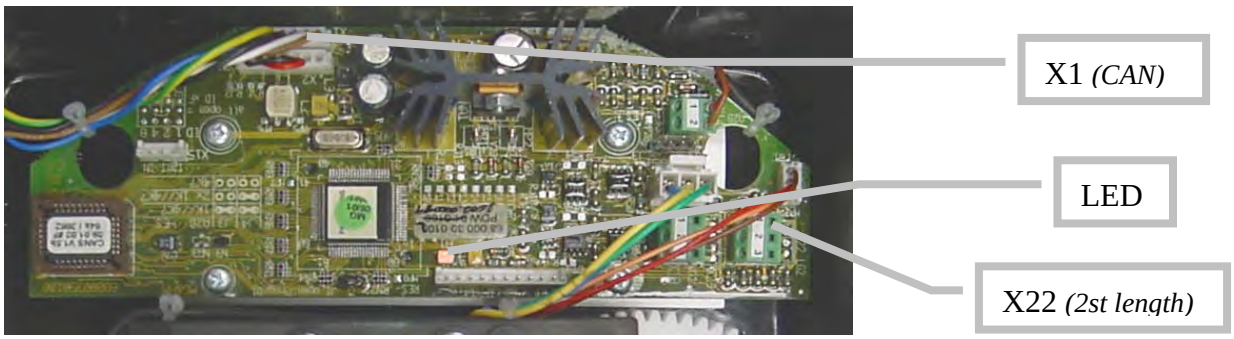
4.4 PRESSURE TRANSDUCER

A pressure transducer converts hydraulic pressure into a CAN signal. One (or two) pressure transducer(s) is (are) connected to the piston side of the lift cylinder and one to the rod side.

4.5 LENGTH SENSOR (LG105/11.5)

This cable reel is used to measure inner-mid length, to finish boom control telescope out sequence.

This length sensor sends a current signal, from 4mA to 20mA. When the potentiometer is at the zero position, it outputs 4mA. The fully out signal will depend on the cable on the reel.

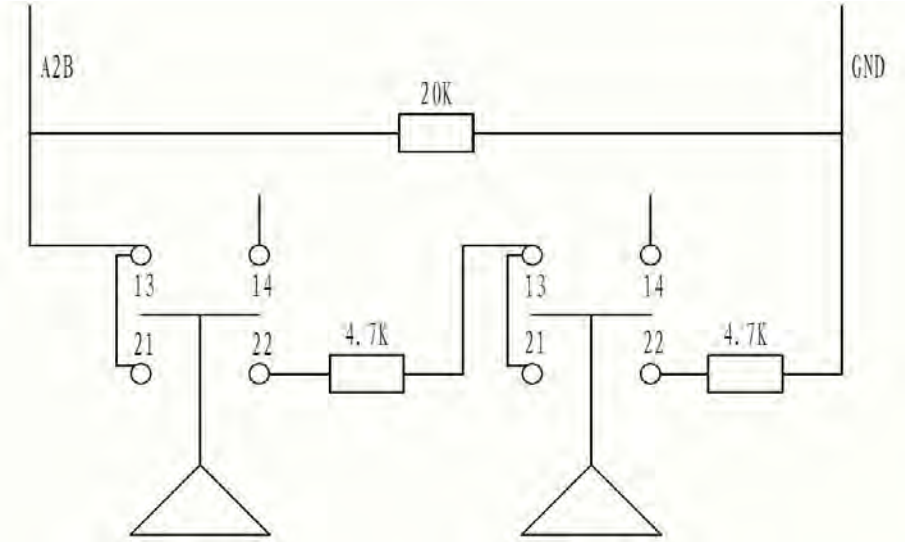


4.6 A2B SWITCH

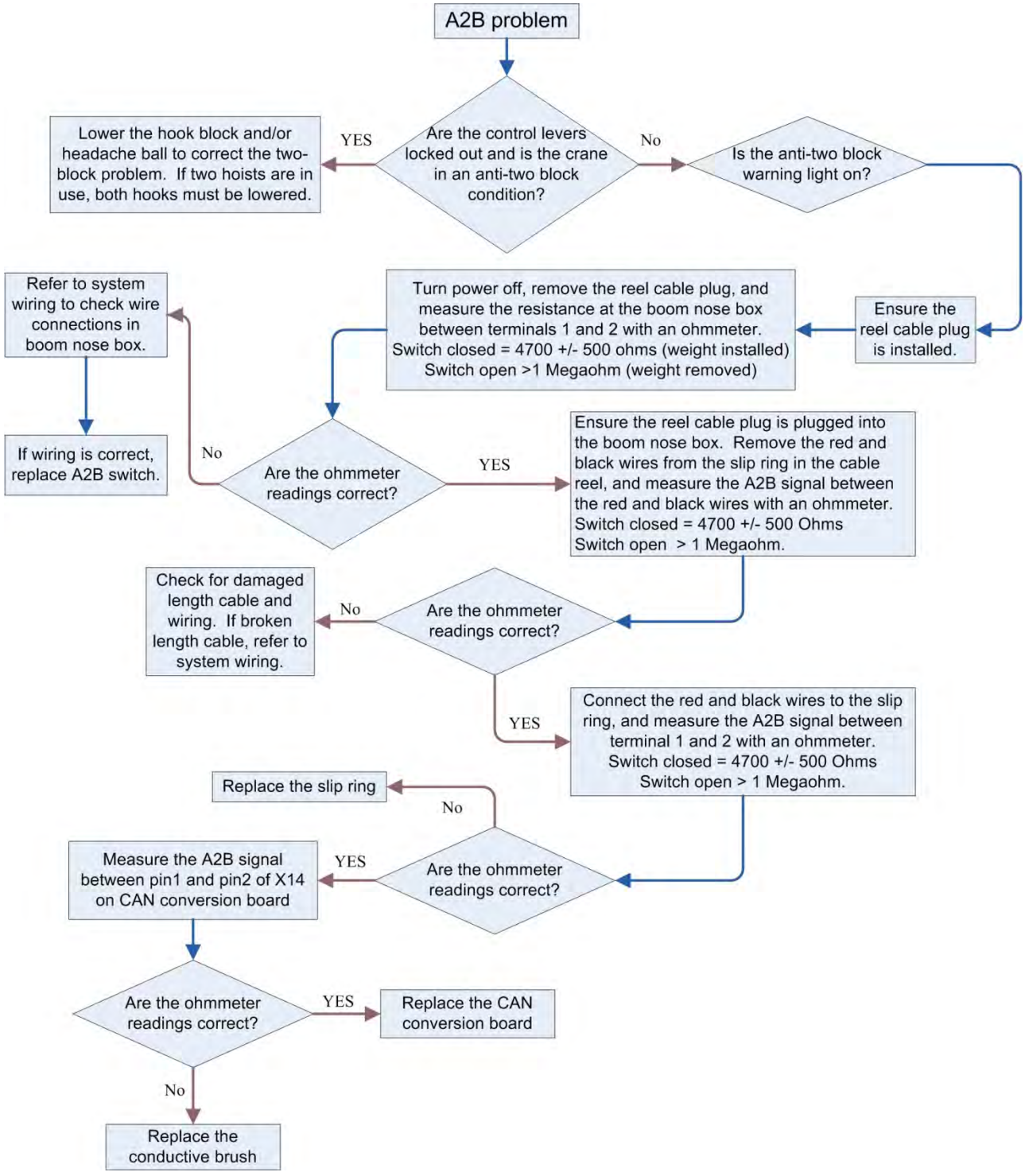
The HC4900 system uses a 4.7KΩ/open-circuit A2B switch. The central unit can check the resistance value among 3.11KΩ to 8.1KΩ.

In working conditions, a weight hangs from the A2B switch. There is a 4.7KΩ resistant signal between the plug's pin2 and pin3, when the hook strikes the weight, A2B switch will open-circuit cutting off the signal output.

In order to be sure that the A2B of the main and the jib hook can work at the same time, we must serial-connect the two A2B's, otherwise parallel connection of a piece of 20K resistance is necessary to reduce the value range of resistance.



When there is a problem with the A2B, perform the following steps:



4.7 WIND SPEED

The wind speed is a current signal; the effective measurement range is 0~40m/s.

4mA ------ 0m/s
20mA ------ 40m/s

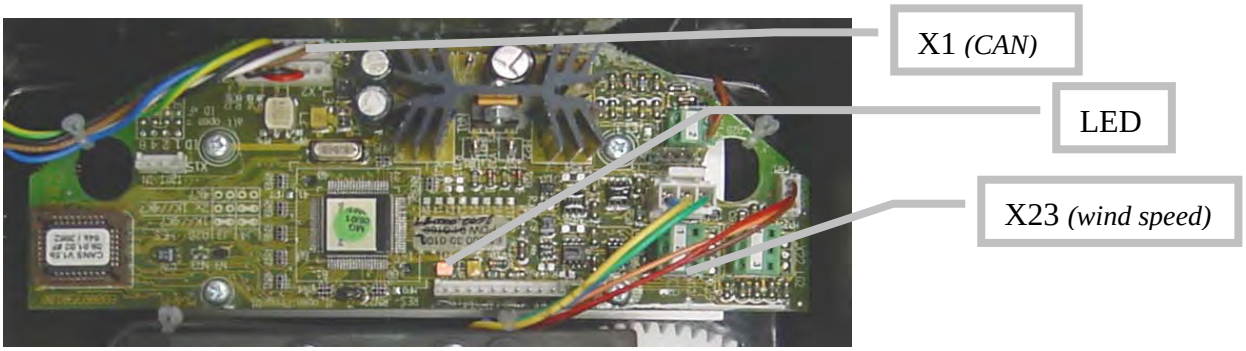
The wind speed signal must also be converted by the CAN conversion board which is located inside the LWG (large) cable reel (length/angle sensor). By monitoring the PDB variable the digital value will be obtained.

Sampling Resistor of wind speed is 200Ω, so:

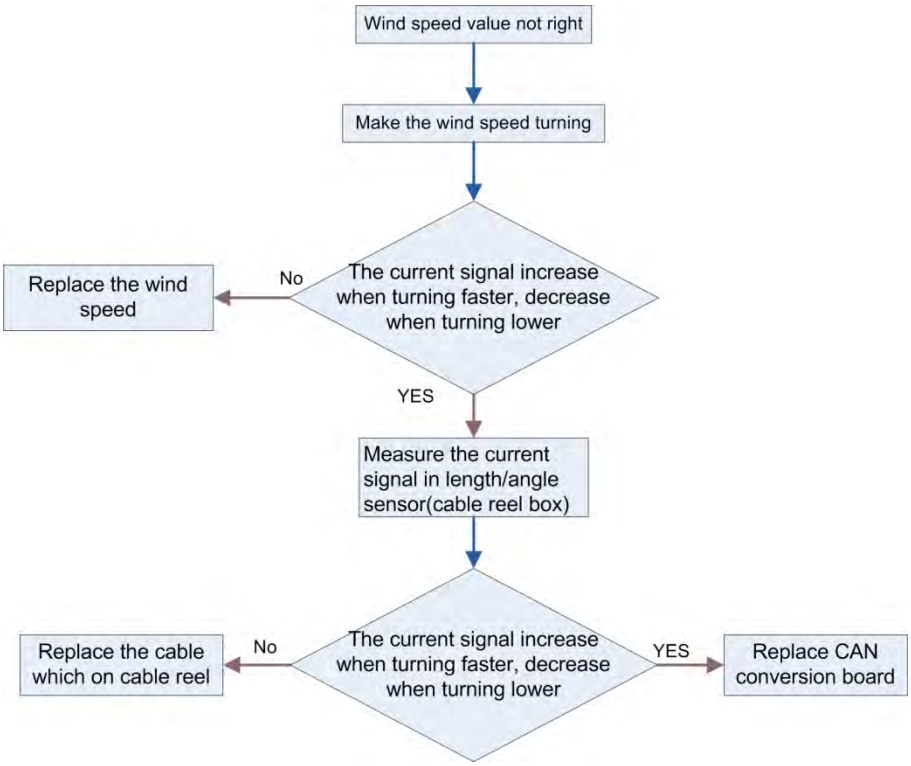
4mA ------ 0m/s ------ 0.8V
20mA ------ 40m/s ----- 4V

The standard sampling voltage is 5V, and 5V corresponds to digital 32768, so:

4mA (0.8/5)*32768=5242.88
20mA (4/5)*32768=26214.4



If the wind speed sensor spins normally, but the display does not vary, perform the following check steps:

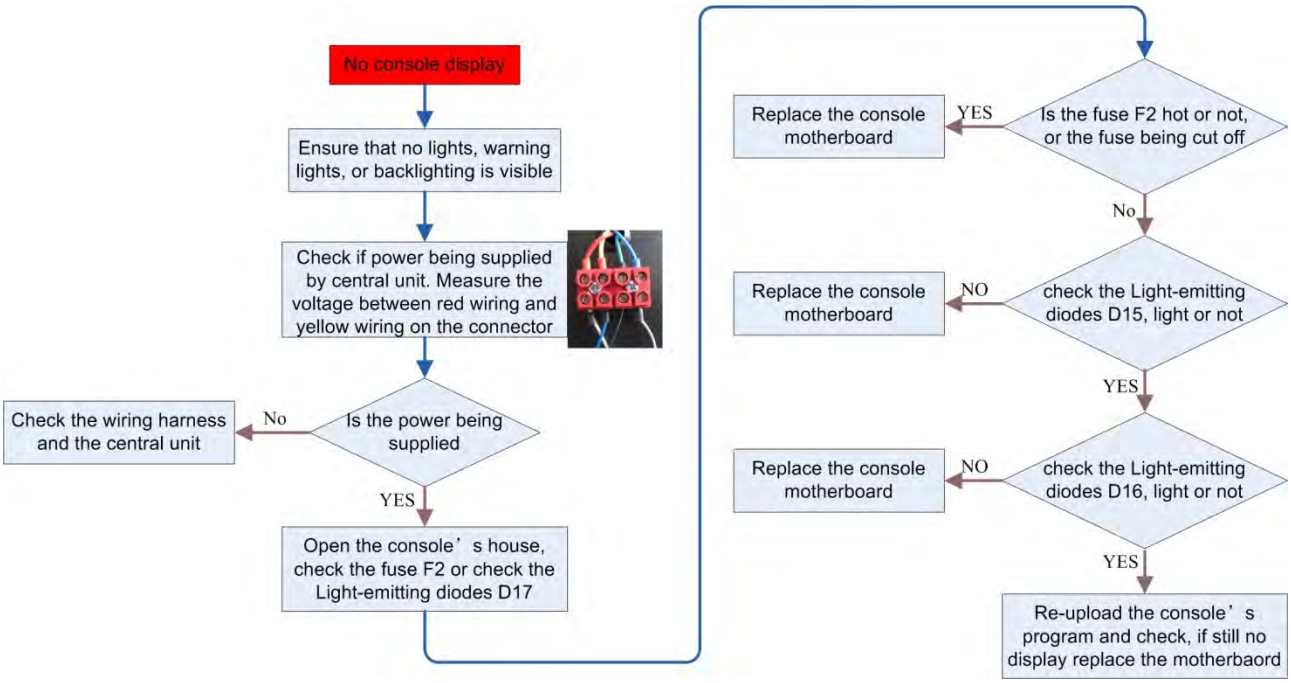


4.8 NO CONSOLE DISPLAY

If the console displays all of the information, but does not display a warning light when in dangerous situations, replace the warning light board.

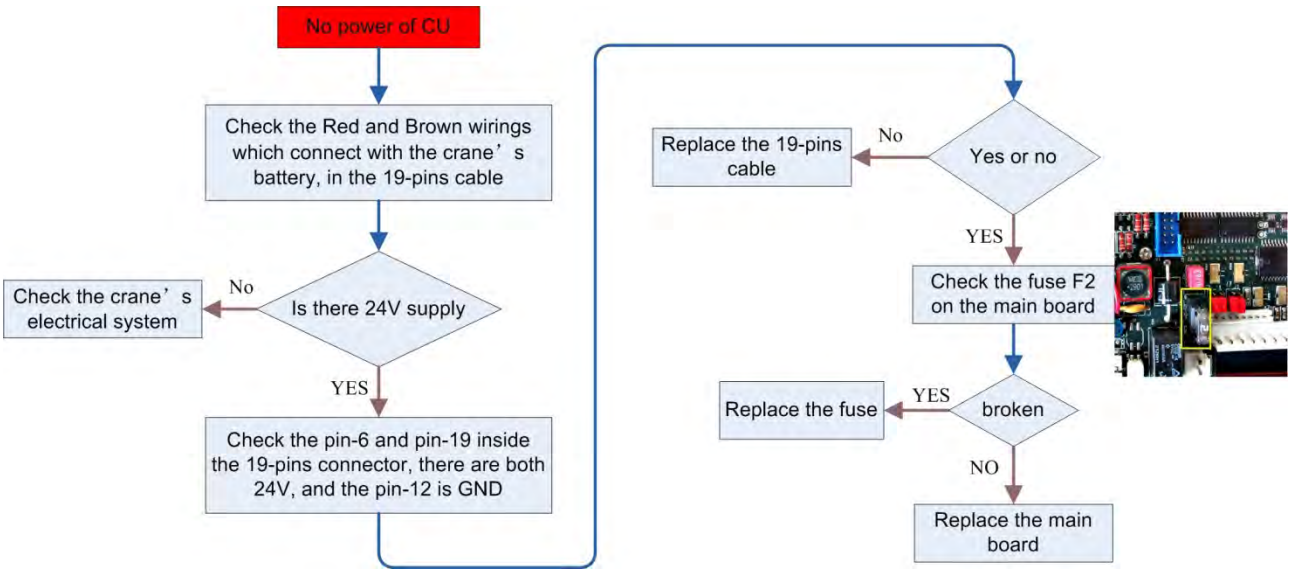
If the console has warning lights and back-lighting, but does not display any information on the LCD, replace the LCD screen.

If there are no lights, warning lights or back-lighting, follow the steps below:



4.9 NO POWER IN CENTRAL UNIT

If there is no power supply to the sensors and display, check the central unit and the 19-pin cable which is connected to the CU.



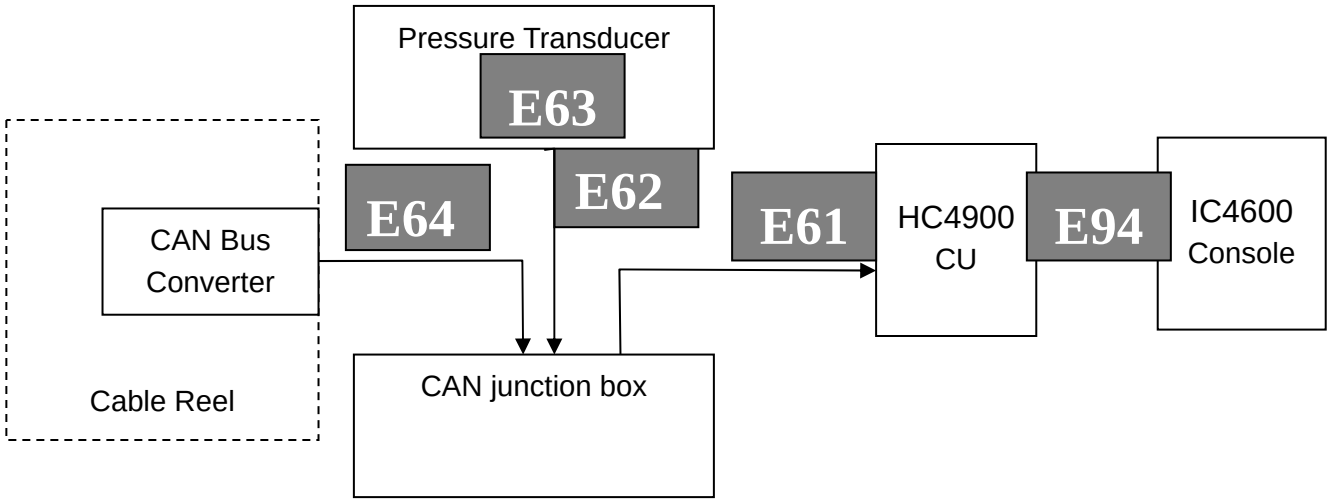
4.10 CAN BUS COMMUNICATION

The System measures the length of the main boom, the angle of the main boom, the pressure in the lift cylinder, and the A2B status 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 LMI provides you with error codes that give you an indication of the bus status.

The error codes are one of the following:

E61 Error in the CAN Bus data transfer for all CAN units
E62 Error in the CAN Bus data transfer of the pressure transducer sensor unit
E63 Error in the CAN Bus pressure transducer sensor unit
E64 Error in the CAN Bus data transfer of the length/angle sensor unit
E94 Error in the CAN Bus data transfer between the CU and Console

Block Diagram



The block diagram illustrates that if the CU does not see a CAN Bus component, it will report an E61 Error. If it sees only the cable reel, it will report an E62 Error (the pressure transducer is missing). If it sees only the pressure transducer, it will report an E64 Error (the cable reel is missing). An E63 Error indicates that the pressure transducer is available, but there is an internal error.

What to do when there are problems with one of these codes:

4.10.1 E61

A E61 Error indicates that there is an error in the CAN bus data transfer for all CAN units.

4.10.2 E62

An E62 Error indicates that there is an error in the can bus data transfer of the pressure transducer sensor unit.

4.10.3 E63

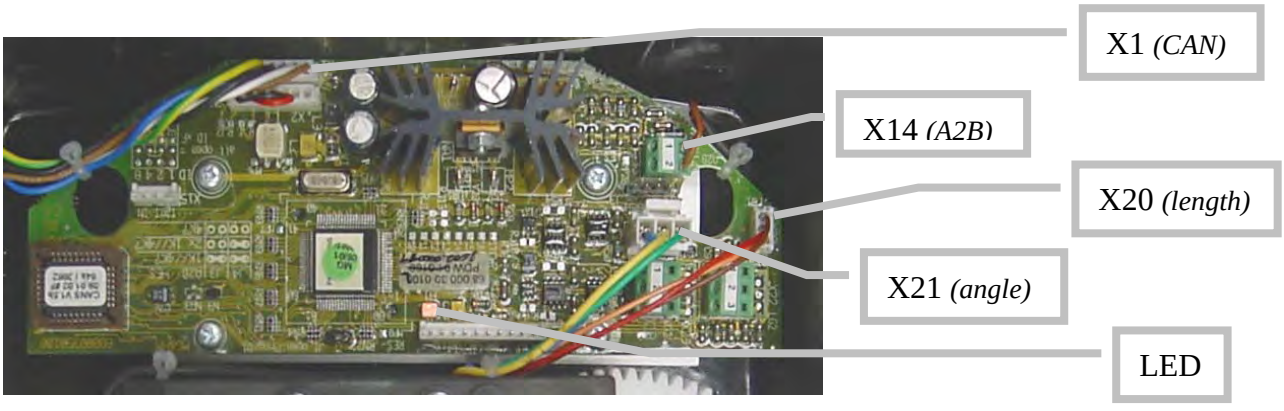
A E63 Error indicates that the pressure transducer is reporting an internal problem. You cannot troubleshoot any further, but the pressure transducer will need to be replaced.

4.10.4 E64

A E64 Error indicates that the CU is reporting no signal from the cable reel unit. Start by changing the plug position of cable with the pressure transducer's cable on the CAN junction box. If the E62 Error occurs, replace the CAN junction box; if not, measure the cable from the CAN junction box to the cable reel with an Ohm-meter. Check all pins of the CAN Bus cable for continuity and cross-check for short circuit.

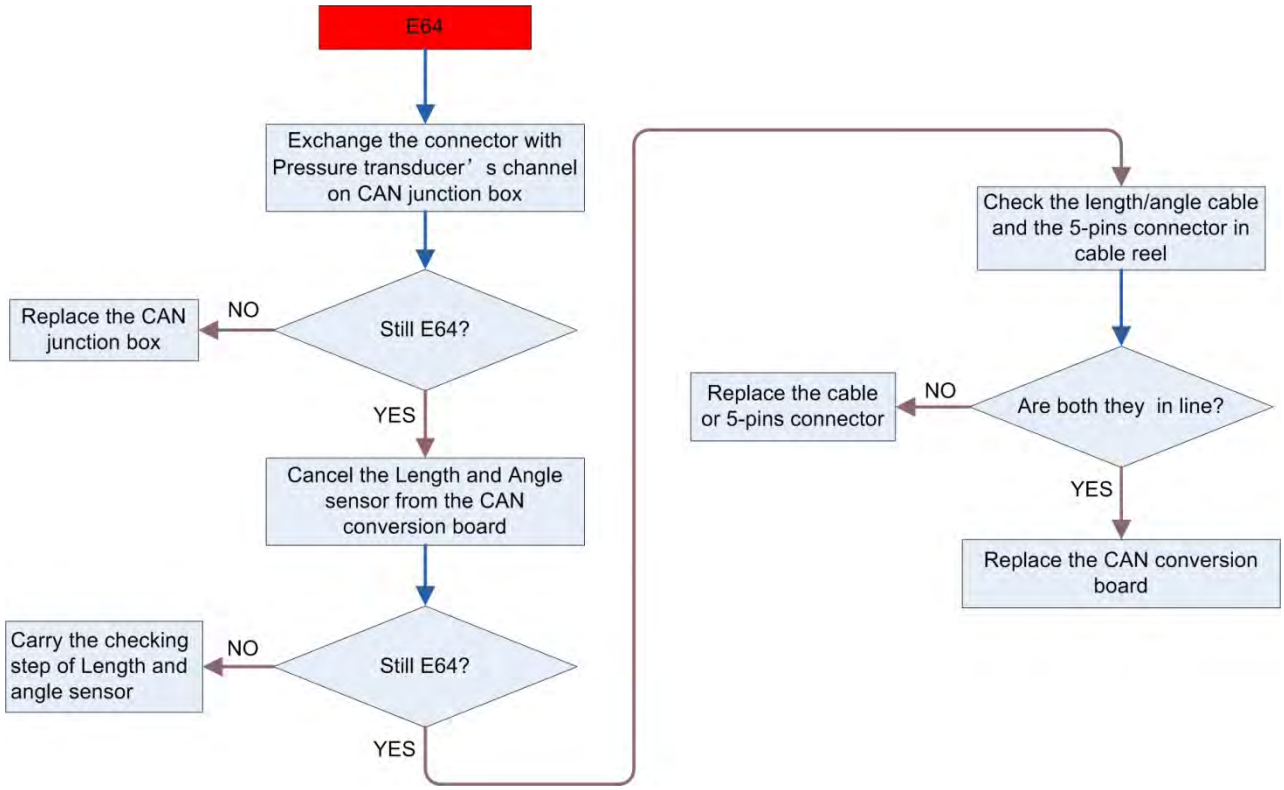
If the continuity check fails, the cable must be replaced. If the cable appears to be fine, check the connector at the cable reel. You can verify that power is being supplied to the sensor by testing the CAN connectors per the pin layout (see E61). Replace the connector if this check fails.

If the connector checks properly, the board in the cable reel might be defective.



CAN Bus electronics in cable reel.

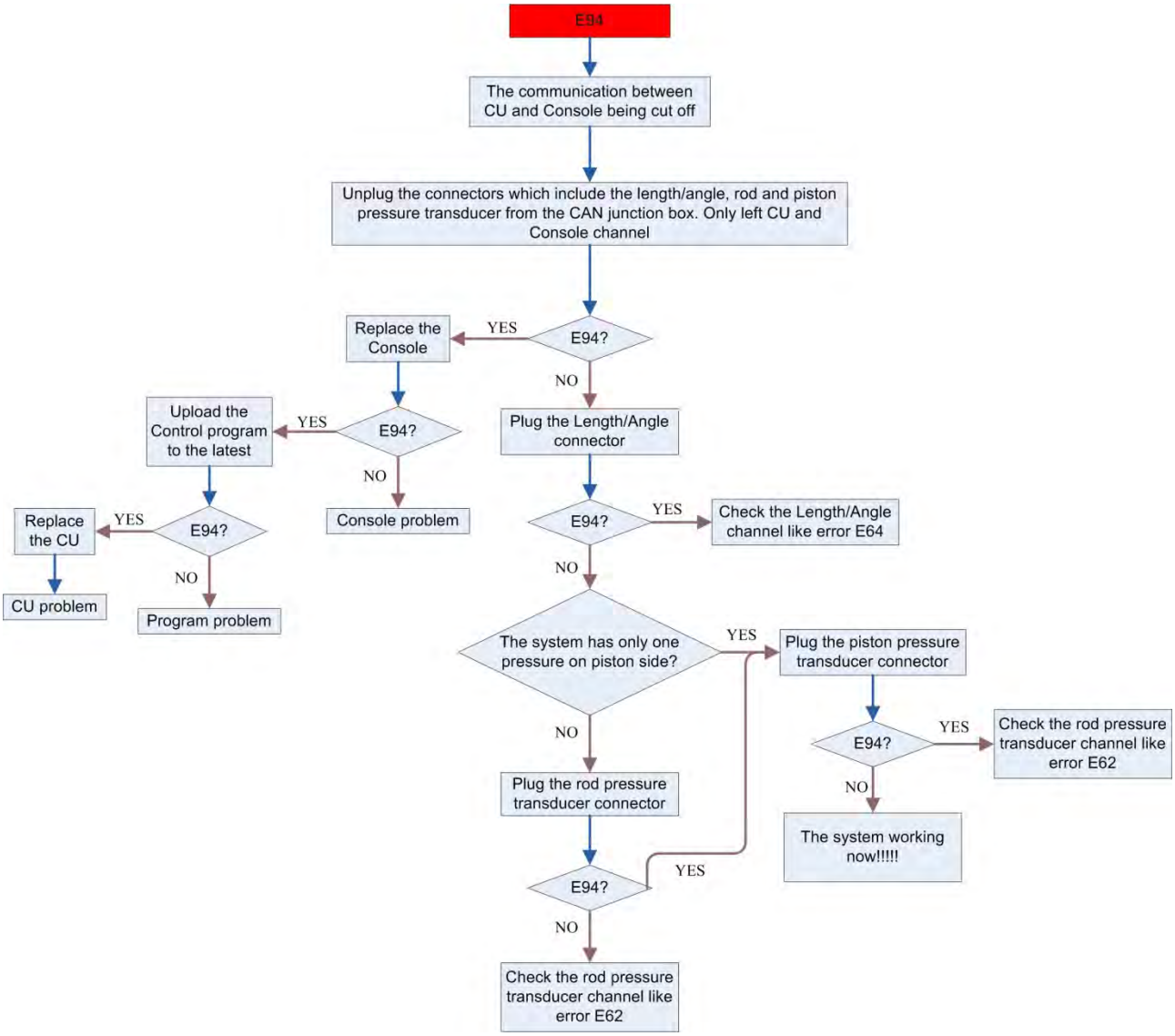
X1 Pin	CAN
1	CAN_SHLD
2	CAN +UB
3	CAN GND
4	CAN_H
5	CAN_L



4.10.5 E94

The HC4900's CU sends a message per second to test the communication between the CU and console. If the console cannot receive the message on time, it will show an E94 error, but be advised that several problems cause the console not to receive the message on time.

- Short circuit between CAN_H and CAN_L
- CAN device's communication disturb



5 SYSTEM COMMUNICATION CABLE

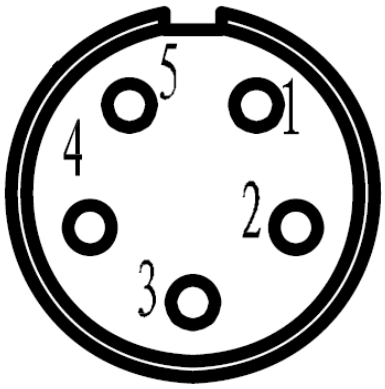
The communication cables of the system include:

- The communication cable of central unit-CAN junction box
- The communication cable of the console,
- The pressure transducer cable
- The cable of the length/angle sensor

The lead line color of the cable is uniform: brown, white, blue, black, gray. The soldering method between lead line and the tie-in of the lead line is also uniform：

1. Brown Shield
2. White CAN_V+
3. Blue CAN_GND
4. Black CAN_H
5. Gray CAN_L

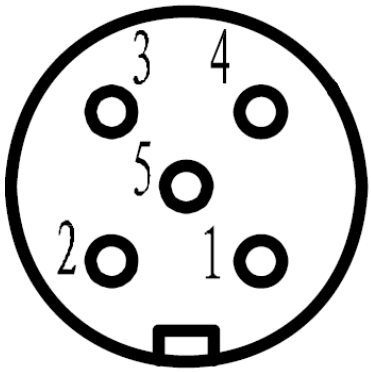
5.1 THE COMMUNICATION CABLE OF CONSOLE



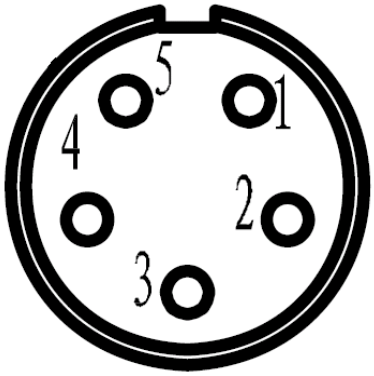
One side of the cable is connected to the CAN junction box, and the other side is connected to the console.

CAN Junction Box Terminal

5.2 THE PRESSURE TRANSDUCER CABLE

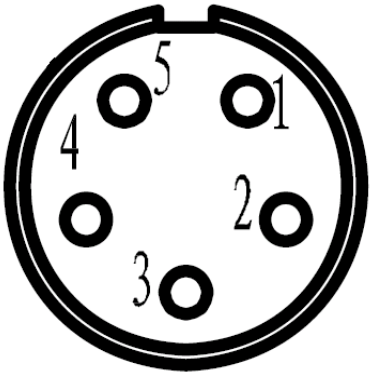


Pressure transducer terminal

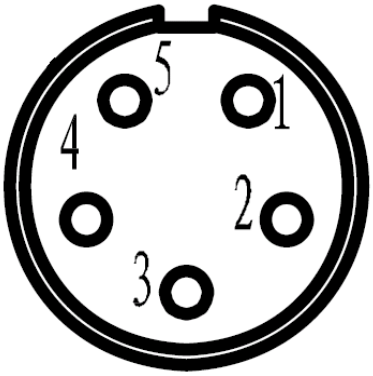


CAN junction box terminal

5.3 THE LENGTH/ANGLE SENSOR CABLE



Cable Reel Terminal

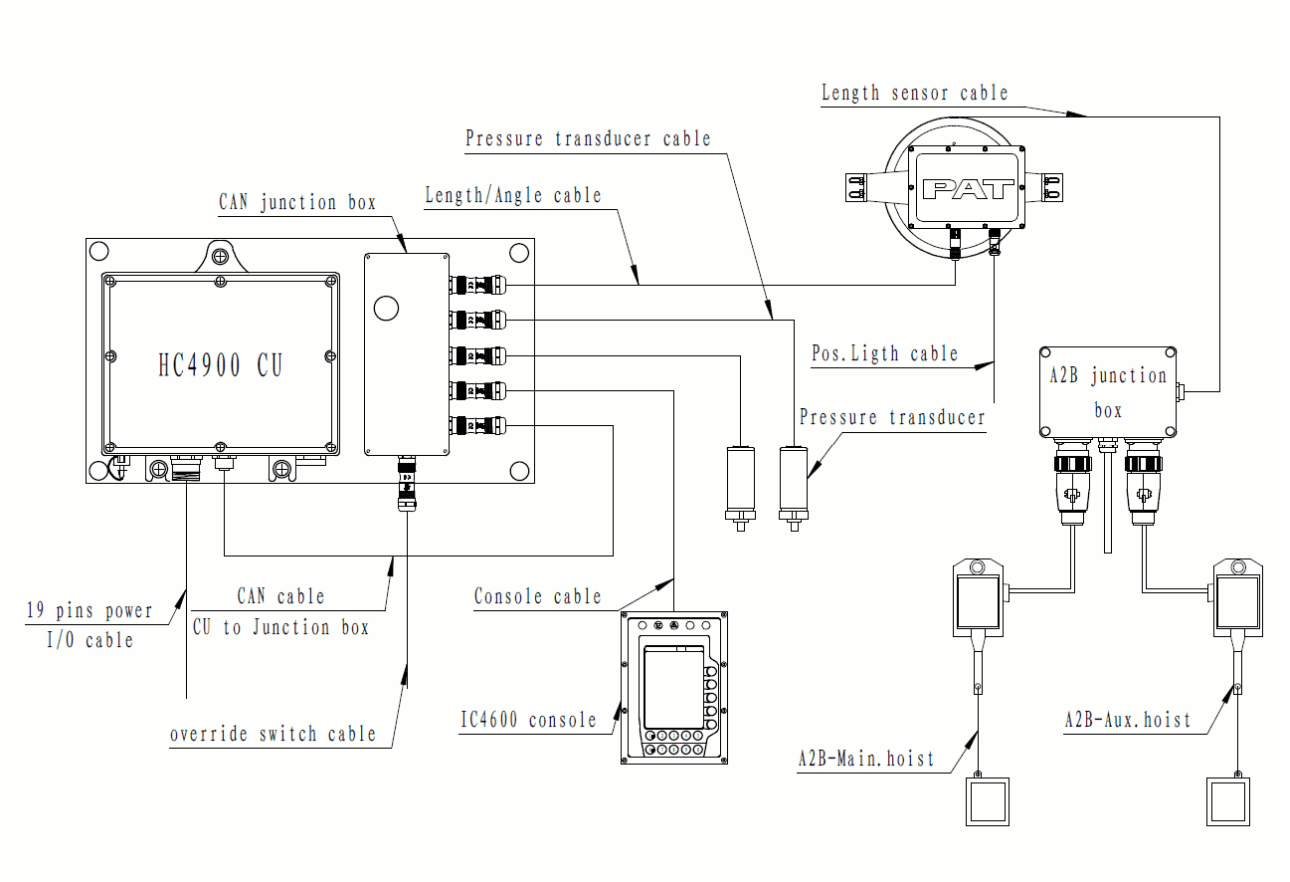


CAN Junction box terminal

The pins soldered on the both terminals of length/angle cable are the same.

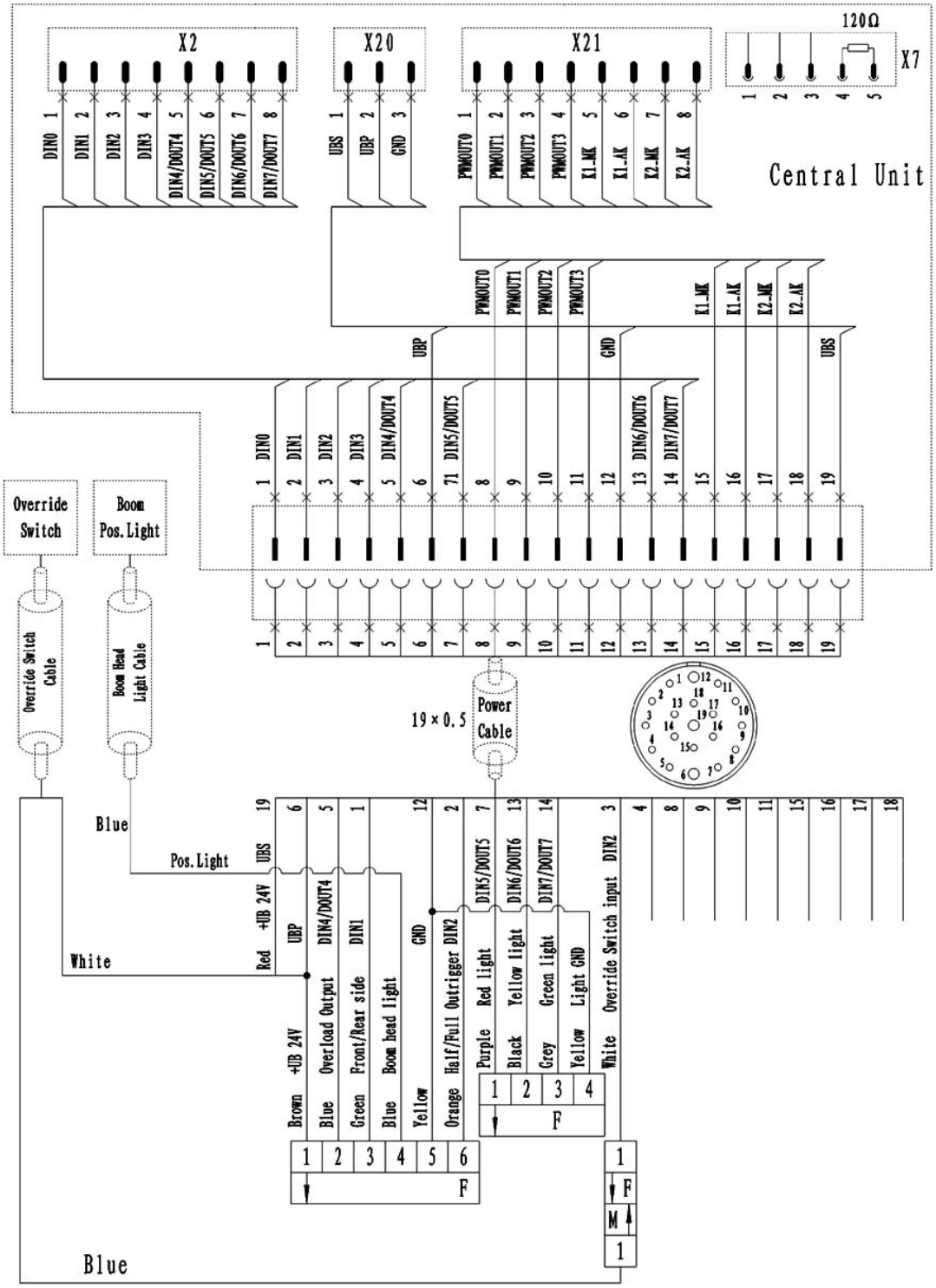
6 DRAWINGS

6.1 SYSTEM TOPOLOGY DIAGRAM

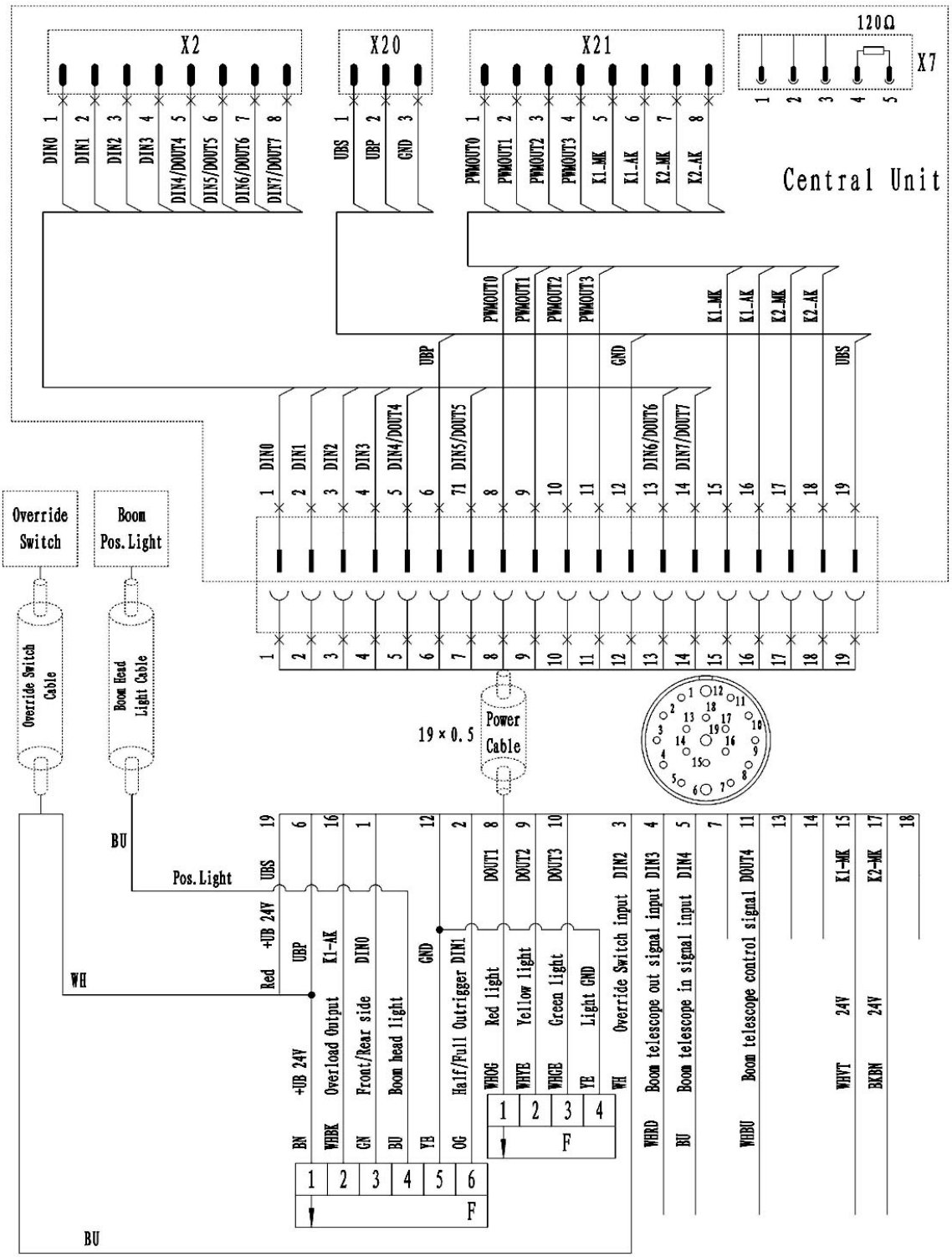


6.2 CENTRAL UNIT TO CRANE WIRING DIAGRAM

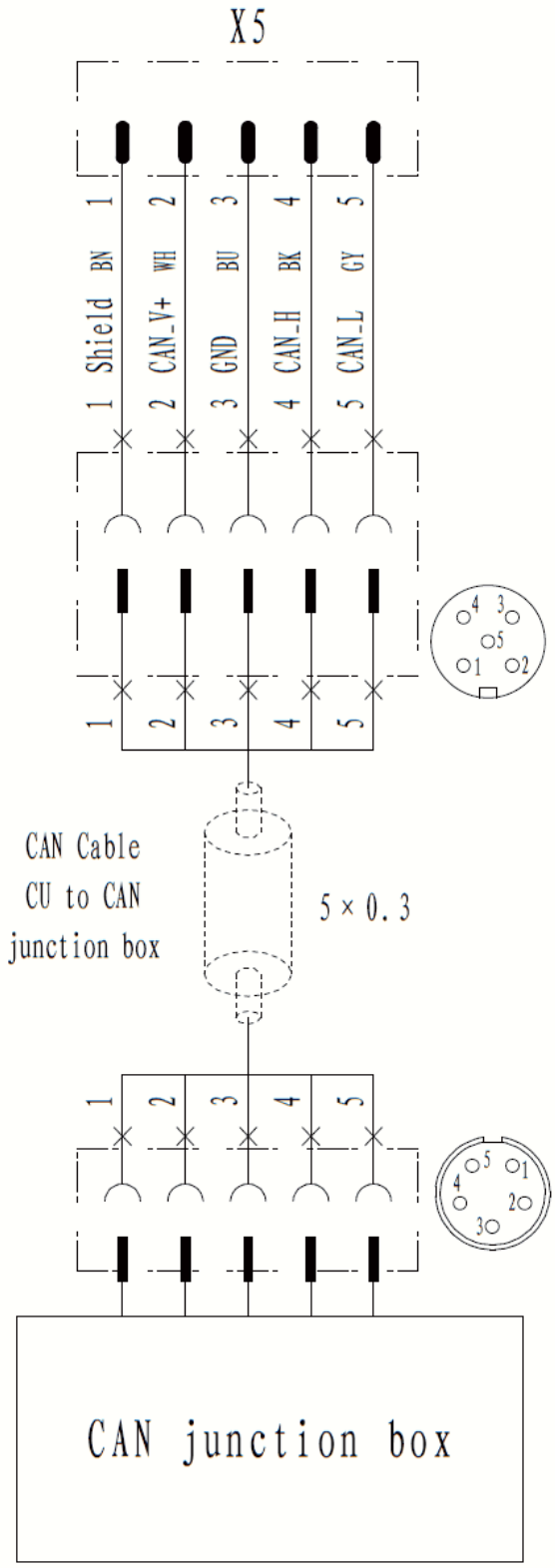
6.2.1 Earlier version



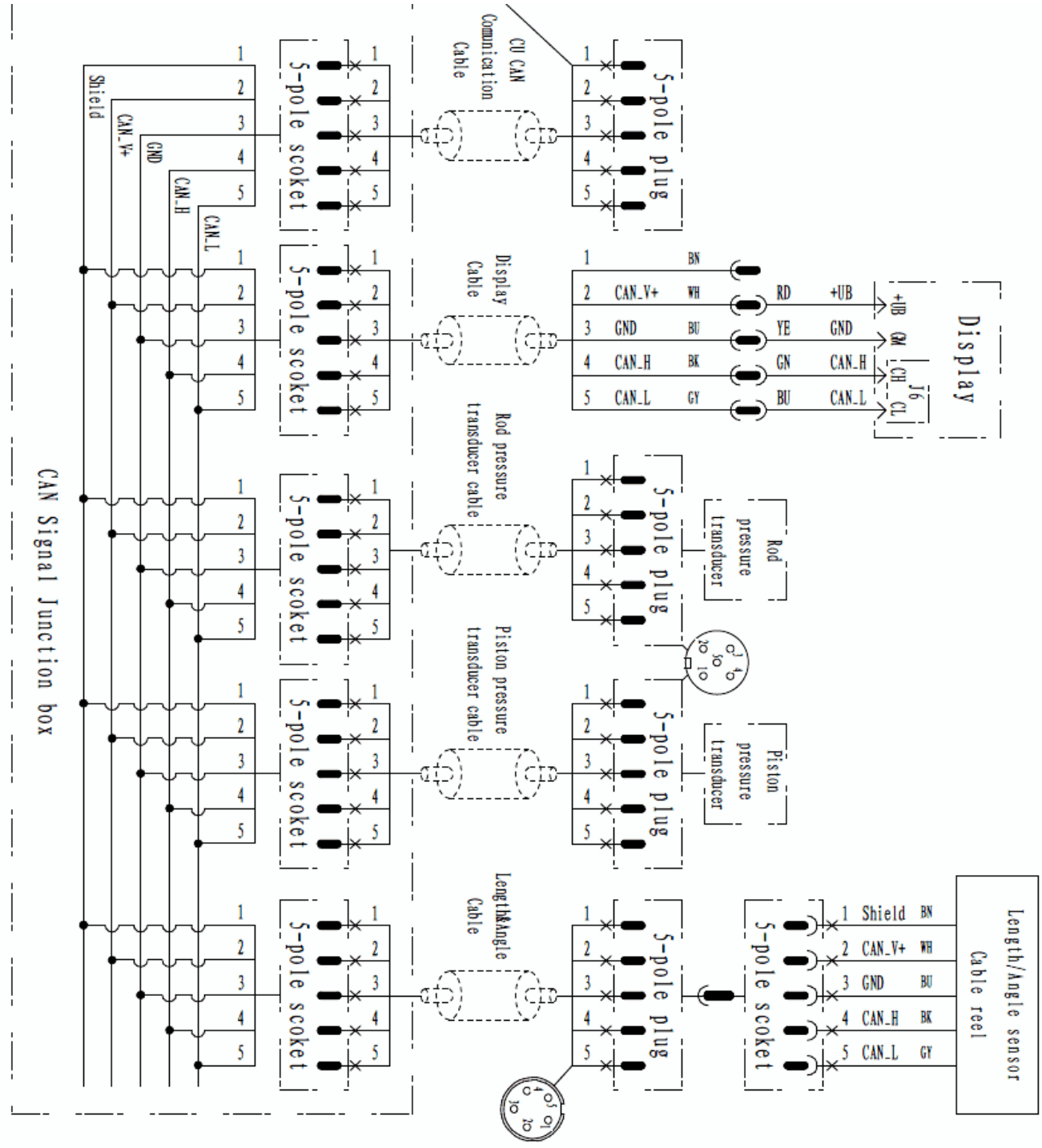
6.2.2 The latest version



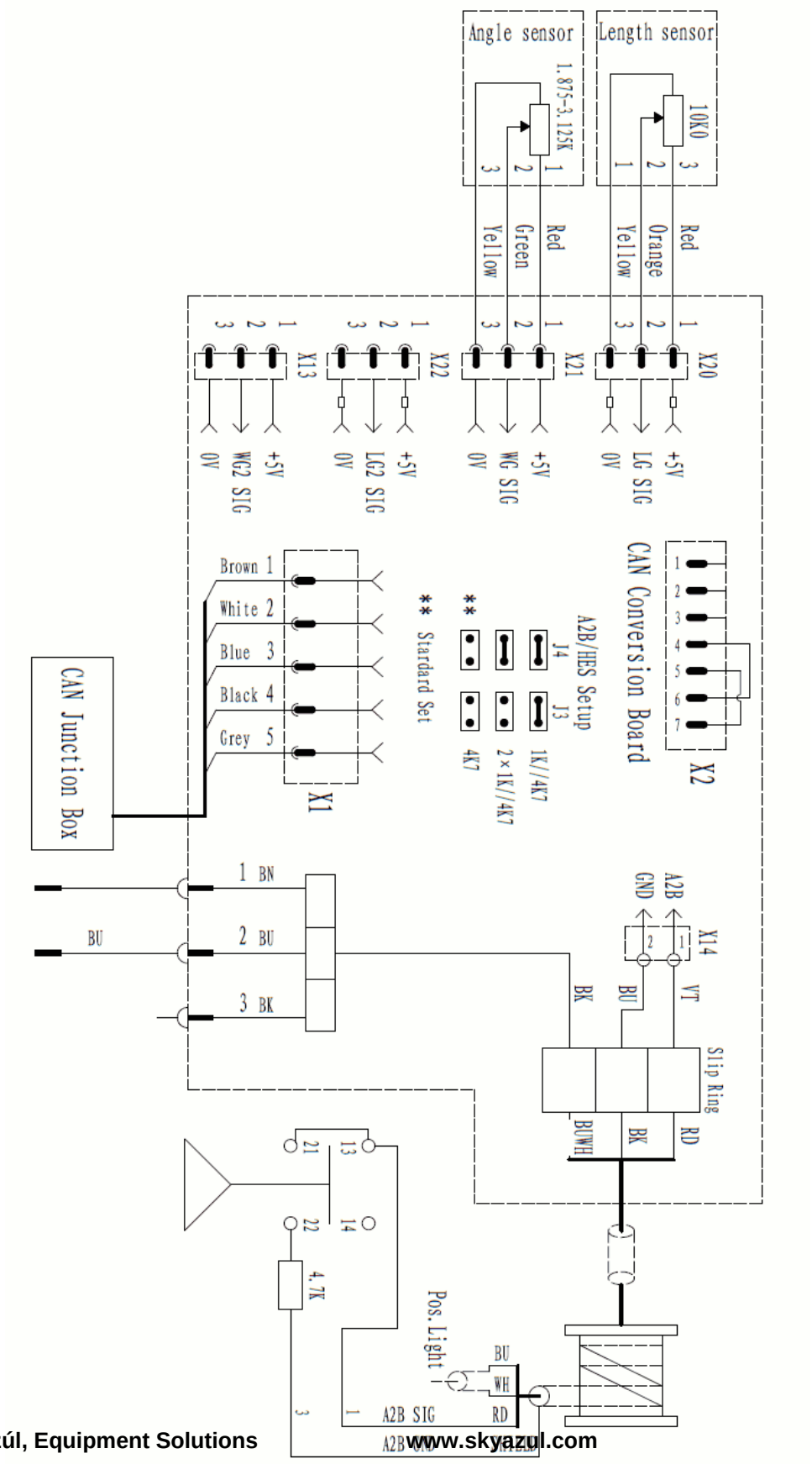
6.3 CENTRAL UNIT TO CAN JUNCTION BOX WIRING DIAGRAM



6.4 CAN JUNCTION BOX TO OTHER SENSORS WIRING DIAGRAM

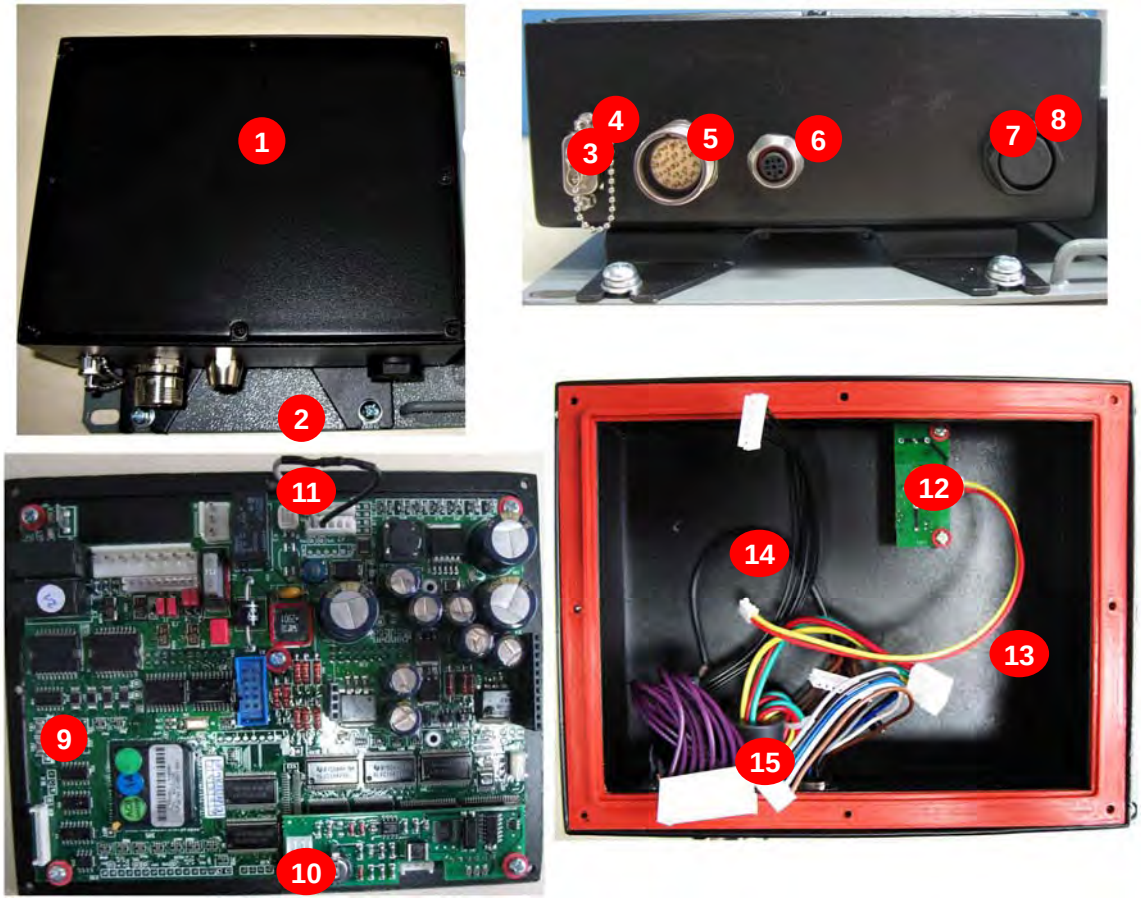


6.5 CABLE REEL WIRING DIAGRAM



7 SPARE PART LISTINGS

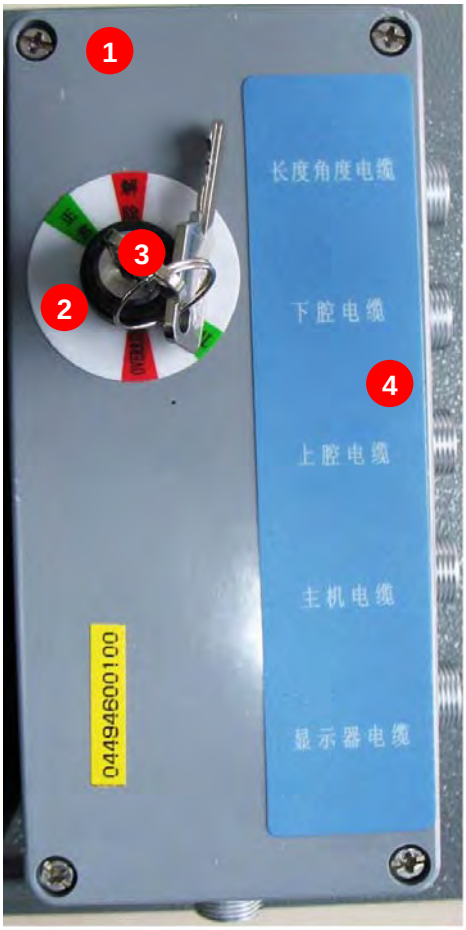
7.1 CENTRAL UNIT, HC4900 PART NO. 01490000100



NO.	PART NO.	QTY	DESCRIPTION
1	01490050200	1	Central unit cover
2	04494600900	1	Central unit and CAN junction box back board
3	08221003300	1	RS232 socket (with wirings)
4	08221003600	1	Protection cover of RS232 socket
5	01490021000	1	19-pin socket (with wirings)
6	08221003100	1	5-pin CAN communication socket (with wirings)
7	08221003400	1	Breathing valve's plug
8	08221003500	1	Breathing valve's socket
9	08221002600	1	Mother board
10	08221002800	1	RTC module
11	01490020700	1	120Ω terminal resistance jumper
12	08221002700	1	Battery circuit board

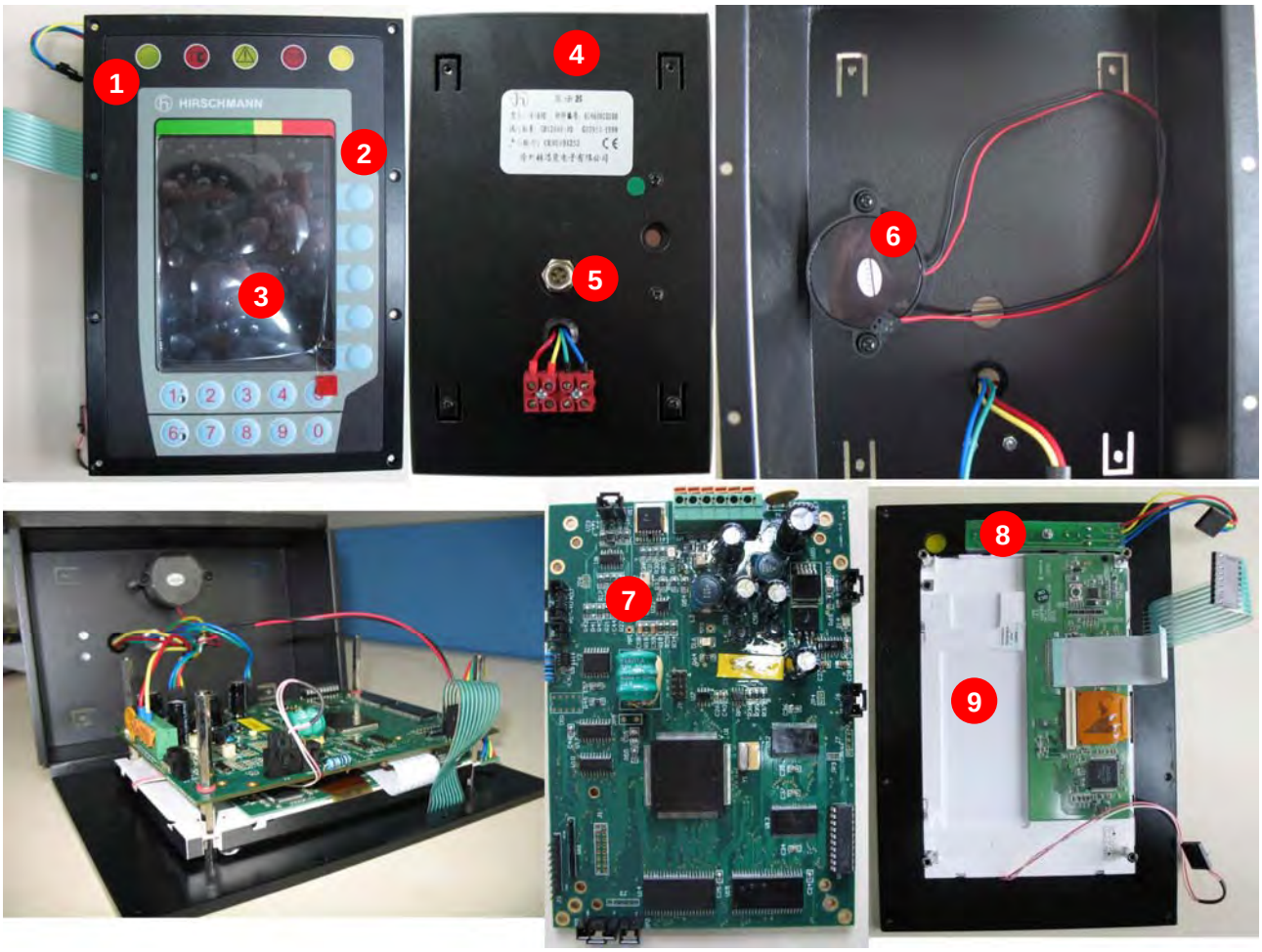
13	01490020300	1	Battery cable
14	01490020400	1	CU ground cable
15	08062300300	1	Magnet

7.2 CAN JUNCTION BOX, PART NO. 04494600100



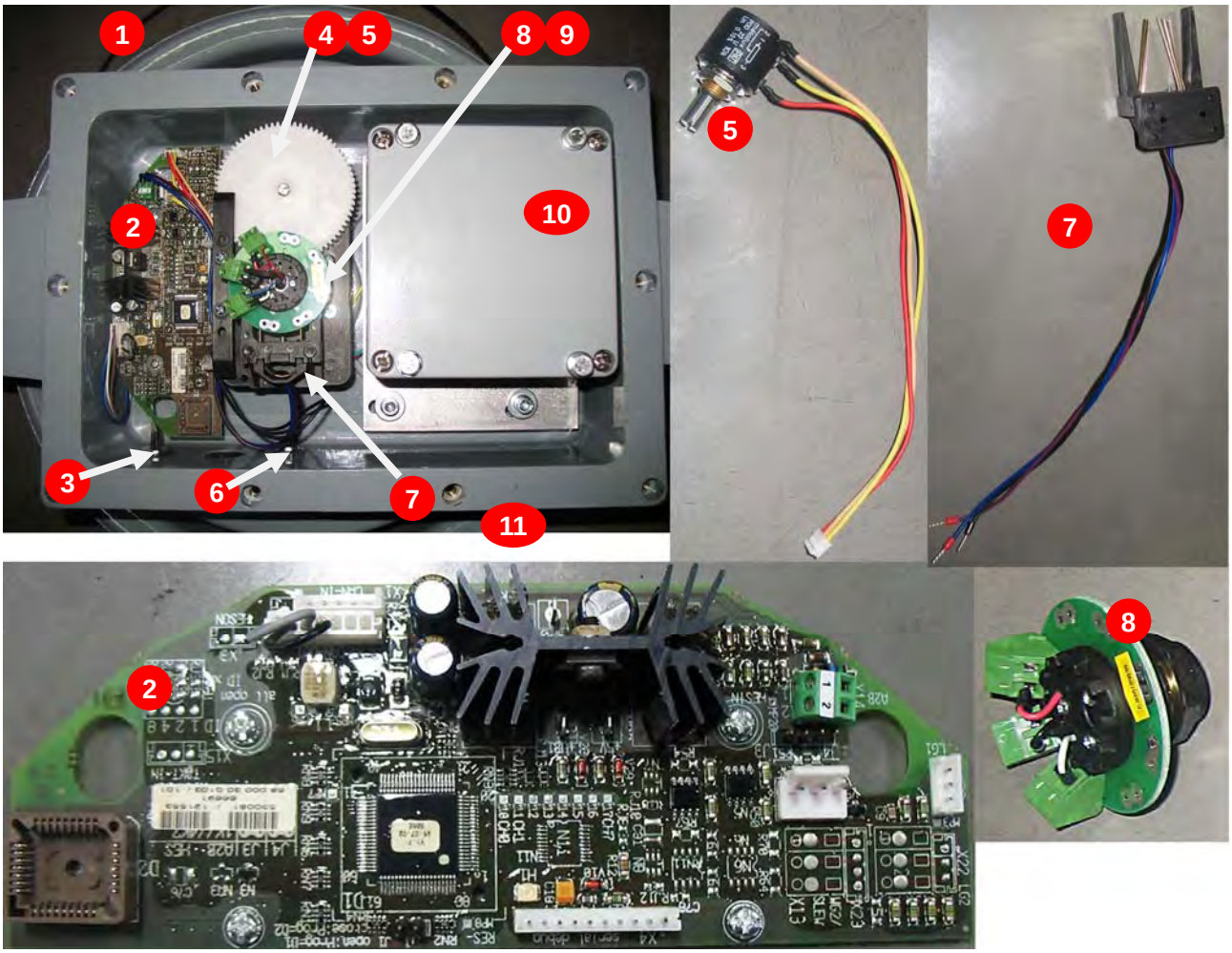
NO.	PART NO.	QTY	DESCRIPTION
1	08221003800	1	Box cover
2	04494650500	1	Override switch indicating panel
3	08081001500	1	Override switch
4	04494650600	1	Junction box indicating panel
5	04494620100	1	Junction circuit-board
6	04494620500	1	5-pin override switch socket (with wirings)

7.3 IC4600 DISPLAY, PART NO. 02460000200



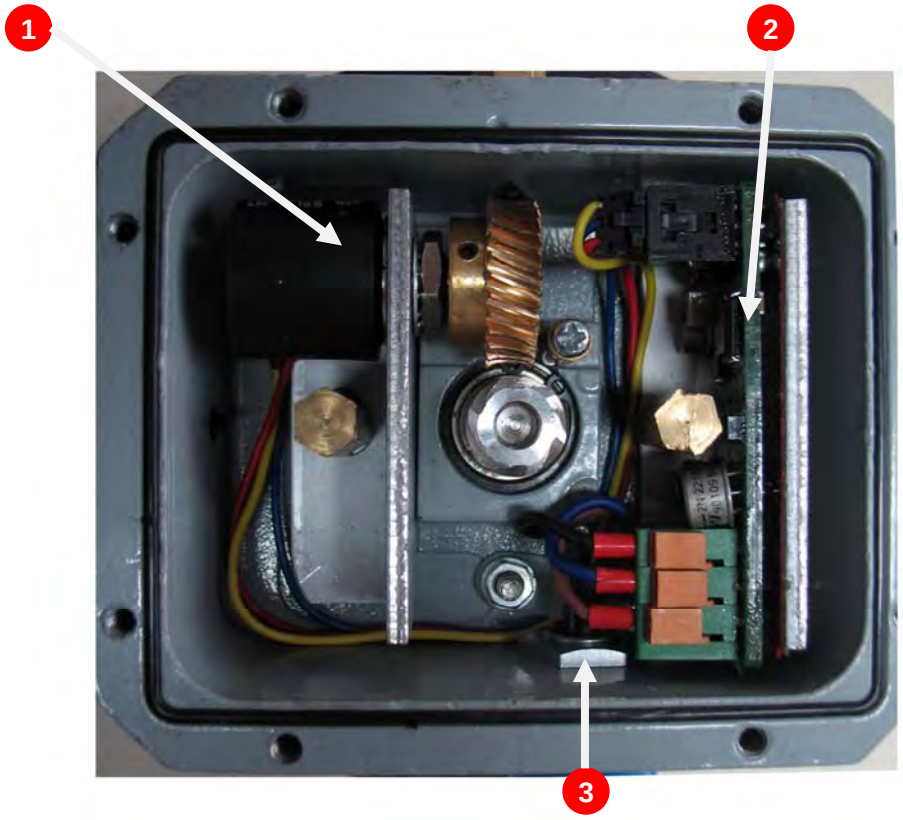
NO.	PART NO.	QTY	DESCRIPTION
1	02360050600	1	IC4600 display's front cover
2	02360050500	1	IC4600 panel switch (with pressable keys)
3	02360050700	1	Plexiglass display
4	02360120700	1	Display's back housing
5	02360120800	1	RS232 communicate port (with wirings)
6	02460020700	1	Buzzer
7	02460020200	1	Display's mother board
8	02460020400	1	Warning light circuit board
9	08061101100	1	LCD screen

7.4 LENGTH/ANGLE SENSOR, PART NO. 03520802000



NO.	PART NO.	QTY	DESCRIPTION
1	08084003600	45m	Length sensor cable
2	08221002900	1	CAN conversion board
3	04494620400	1	Connector 5-pole wirings
4	03520850300	1	Gear wheel (75)
5	03520820100	1	Length sensor potentiometer
6	03520821000	1	Connector 3-pole wirings
7	08089000400	3	Electronic brush
8	03520820300	1	Slip ring assembly 3 conductor
9	03520850700	1	Gear wheel (25)
10	03510300600	1	Angle sensor
11	03520851800	2	Spring roll

7.5 LENGTH SENSOR (LG105), PART NO. 03510500300



NO.	PART NO.	QTY	DESCRIPTION
1	03510520400	1	Length sensor
2	03510520500	1	Signal conversion board
3	01390020800	1	Connector 3-pole wirings

7.6 SYSTEM CABLES

NO.	PART NO.	QTY	DESCRIPTION
1	04494601000	1	Cable of the light on the tip of the boom
2	04494601600	1	Cable of override switch(from CAN junction box)
3	04494602100	1	Cable of power and I/O
4	04494601100	1	Cable of Length/Angle sensor(from CAN junction box)
5	04494600500	1	Cable from CU to CAN junction box
6	04494600600	1 or 2	Cable of pressure transducer(from CAN junction box)
7	04494600300	1	Cable of display (from CAN junction box to console)

7.7 PRESSURE TRANSDUCER

NO.	PART NO.	QTY	DESCRIPTION
1	08221003900	1	Piston side
2	08221003000	1	Rod side

8 BASIC ADJUSTMENT FOR SENSORS

Retract the boom to the shortest boom length and boom down until the boom angle is about 0° measured by electronic level.

8.1 Set Zero Point of length sensor

Use a flat screwdriver to adjust the displayed boom length to the same as the actual boom length，turning counter clockwise will decrease the length and turning clockwise will increase the length, the error must not exceed ±0.1m.

8.2 Set Zero Point of Angle sensor

Use a wrench or socket (10mm) and a allen wrench (5mm) to adjust the position of the Angle sensor (see position 1 on the picture below). Turning counter clockwise will decrease the angle and turning clockwise will increase the angle. Adjust the displayed angle to the same value measured by the angle device, and the error must not exceed ±0.2°.

Extend the boom to about 3m, measuring the distance between the rotary center of the hook center (which is actually the actual radius) and compare it with the displayed radius. If the error is lower than ±0.1m, zero point of angle sensor must be corrected by online computer; if the error is above ±0.1m, the boom must retract to about 0°, adjust installed position of angle device.

9 ERROR CODE

Error Code	Error	Cause	Elimination
E01	Boom below radius range or angle range exceeded	• Boom is below the minimum radius or has exceeded the maximum angle specified in the respective load chart due to raising the boom too high	• Lower the boom to a radius or angle specified in the load chart.
E02	Radius range exceeded or fallen below angle range	• Exceeded the maximum radius or fallen below the minimum angle specified in the respective load chart due to lowering the boom too low	• Raise the boom to a radius or angle specified in the load chart.
E03	Non-permitted slewing zone (no load area)	• The load is outside of the permitted slewing zone.	• Slew to a permitted area
E04	Operating mode not acknowledged or non permitted slewing zone	• A non existing operating mode has been selected	• Set the correct operating mode for the configuration in question
		• The boom is in a non-permitted slewing zone	• Slew the boom to a permitted area.
E05	Prohibited length range	• Boom has been extended either too far or not far enough, e.g. if it is prohibited to go beyond a certain maximum boom length or with load curves for jibs where the main boom has to be extended to a certain length	• Extend/retract boom to the correct length
		• Length sensor adjustment has changed, e.g. the cable slid off the length sensor reel.	• Retract boom. Check the pre-stress of the cable reel (cable must be taut). Open the length sensor and carefully turn the length sensor pot counterclockwise until the detent by means of a screw driver

Error Code	Error	Cause	Elimination
		• Clutch between length sensor pot and drive is defective	• Replace the complete clutch including drive wheel and adjust length sensor pot as described above
E06	Radius range exceeded or fallen below angle range with luffing jib operation	• Maximum radius as specified in the load chart has exceeded or fallen below the minimum angle due to lowering the luffing jib too far	• Luff the jib to a radius or angle specified in the load chart.
E11	Fallen below lower limit value for measuring channel "length main boom"	• Length potentiometer is defective • PDB variable for analog value not supported	• Replace length potentiometer • Setup of correct PDB variable for analog value in DGA6.i.3
		• Electronic component in the measuring channel is defective	• Replace sensor unit
E12	Fallen below the lower limit value in the measuring channel "pressure piston side"	• Pressure transducer is defective. • PDB variable for analog value not supported	• Replace pressure transducer • Setup of correct PDB variable for analog value in DGA6.i.3
		• Electronic component in the measuring channel is defective.	• Replace sensor unit
E13	Fallen below lower limit value in the measuring channel "pressure rod side"	• refer to E12	• refer to E12
E14	Fallen below lower limit value in measuring channel "force"	• Force transducer defective • Electronic component in the measuring channel is defective.	• Replace force transducer • Replace sensor unit
E15	Fallen below lower limit value in measuring channel "angle main boom"	• Angle potentiometer defective • PDB variable for analog value not supported	• Replace angle sensor • Setup of correct PDB variable for analog value in DGA6.i.3
		• Electronic component in the measuring channel is defective.	• Replace sensor unit

Error Code	Error	Cause	Elimination
E21	Upper limit value in measuring channel "main boom length" has been exceeded.	• refer to E11	• refer to E11
E22	Upper limit value in measuring channel "pressure piston side" has been exceeded	• refer to E12	• refer to E12
E23	Upper limit value in measuring channel "pressure rod side" has been exceeded.	• refer to E12	• refer to E12
E24	Upper limit value in measuring channel "force" has been exceeded.	• refer to E14	• refer to E14
E25	Upper limit value in measuring channel "main boom angle" has been exceeded.	• refer to E15	• refer to E15
E31	Error in the system program	• The system program file is defective. • Flash-EPROM is defective	• Upload valid system software • Replace central unit
E32	Error in the power supply	• +UB System not present at the system start • +UB System not present at the system finish • Contact problems at +UB switch off/on	• +UB System and +UB Power must be wired separately: +UB System connected direct with the crane battery. +UB Power for switch on/off • +UB switch off/on again
E37	Error in the logical program flow	• System program file is defective • Flash-EPROM is defective	• Upload valid system software • Replace central unit
E38	System program and crane data file do not match.	• The system program in the LMI does not match the programming in the crane data file	• Upload valid system program file or the valid crane data file
E39	System program and load chart file do not match	• The system program in the LMI and the programming in the load chart file do not match.	• Upload valid system program file or the valid load chart file

Error Code	Error	Cause	Elimination
E43	Error in the write/read memory, (RAM)	• Write/read memory (RAM) or central unit is defective.	• Replace central unit
E47	Error in the monitored write/ read memory. The CRC verification of the monitored write/read memory provides an incoherent result	• The CRC sign of the monitored write/read memory is wrong • The buffer battery is decharged (< 2V at 1kOhm). • Central unit is defective.	• Restart the LMI • Replace buffer battery on the central unit. • Replace central unit
E51	Error in the crane data file	• No valid data in the crane data file. • Flash-EPROM is defective	• Upload valid crane data file • Replace central unit
E52	Error in load chart file.	• No valid data in the load chart file • Flash-EPROM is defective	• Upload valid load chart file • Replace central unit
E56	Error in crane data file.	• No valid data in the crane data file during calibration. • Flash-EPROM is defective	• Restore or upload valid crane data file • Replace central unit
E57	Error in serial crane data file.	• Calibration data file does not contain valid data. • Flash-EPROM is defective	• Upload calibration data file by changing data (OM, limits) and save • Replace central unit
E61	Error in the CAN Bus data transfer for all CAN units	• CAN Bus cable between the central unit and the sensor unit is defective or not connected.	• Check the connection between the central unit and the sensor units
		• CAN Bus port in the central unit is defective	• Replace the central unit
		• Short circuit in a CAN Bus cable	• Replace CAN Bus cable
E62	Error in the CAN bus data transfer of the pressure transducer sensor unit	• Cable between the central unit and the sensor unit is defective.	• Check the cable to the sensor unit
		• CAN bus port in the central unit is defective	• Replace the central unit
		• CAN bus port in the sensor unit is defective	• Replace the sensor unit
		• Sensor unit is defective	• Replace the sensor unit
E63	Error in the CAN Bus pressure transducer sensor unit	• The analog values of the sensor unit are invalid	• Replace the sensor unit

Error Code	Error	Cause	Elimination
E64	Error in the CAN Bus data transfer of the length/angle sensor unit	• See E62	• See E62
E65	Error in the CAN bus length/angle sensor unit	• See E63	• See E63
E66	Error in the can bus data transfer of the 2nd length/angle sensor unit	• See E62	• See E62
E67	Error in the CAN Bus of the 2nd length/angle sensor unit	• See E63	• See E63
E84	Wrong rigging condition.	• The selected rigging condition is not contained in the crane data file.	• Select another rigging condition • Check the programming in the crane data file.
E85	Error in the radius determination	• The computed radius is too small (negative deflection)	• Check the programming in the crane data file.
E89	Operating mode switchover with load.	• The operating mode on the console has been switched over with the boom loaded.	• Select operating mode without load on the boom
E98	LMI watchdog activated	• LMI processing time limit has been exceeded	• Reset system • Connect PC terminal and watch error messages
EAB	Short circuit in the A2B switch circuit (not with radio A2B)	• Short circuit in the A2B switch • Short circuit in the cable to the A2B switch	• Replace A2B switch • Replace cable to the A2B switch
EAC	A2B switch circuit disconnected (not with radio A2B)	• Disconnected cable in the A2B switch • Disconnected cable to the A2B switch	• Connect or replace cable in the A2B switch • Connect or replace cable to the A2B switch
EAD	No valid A2B switch status	• Sensor wrong function • CAN Bus delay	• Replace A2B switch • Replace cable to the A2B switch
EDB	Datalogger setup error	• Setup of the datalogger is cleared (ser. crane data file or battery buffered RAM)	• Transfer data and setup datalogger again

Error Code	Error	Cause	Elimination
EDC	Datalogger watchdog activated	• Datalogger processing time limit exceeded	• Reset system • Connect PC terminal and watch error messages
EDD	Battery empty	• Battery check detected a low voltage of the battery	• Change battery, after this setup of RTC
EDE	Record lost	• Not possible to save data because other task saves data at the same time	• Message disappears after a few seconds
EDF	Flash block full	• Not possible to save any more data	• Message disappears after a few seconds
EFD	SLI Watchdog extra time	• A function needs more than 0.5 sec, e.g. Flash PROM write	• Message disappears after a few seconds

10 TROUBLESHOOTING MOISTURE

The Hirschmann LMI contains electronic components in various locations, such as the central unit, sensors, junction boxes, etc. These internal components cannot be designed to withstand exposure to moisture over a long period of time. For this reason, the housings of the components are water protected according to IP 65. If you find water or moisture inside any of the housings, the source of 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

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

10.1 WATER INGRESS

There are different reasons for water ingress. It is possible to find 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 LMI system are water protected to IP 65. This means protection against the environment, such as rain. However, using a spray cleaner at short distances can 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 should be equally tight to ensure that the enclosure is protected from. If there are screws missing, replace them. If there are not any screws missing, check the tightness. If any screws are loose, loosen all of the 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.

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.

5) Loose Strain Reliefs

The strain relief allows cabling to enter the box without allowing water to enter it. The strain relief has to be correctly tightened in order to do this. Check the tightness by taking the external cable in one hand and carefully trying to turn it. If the internal wires turn with the outer cable, the strain relief is loose. Order 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 a 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.

10.2 CONDENSATION

In a climate with high humidity and rapidly changing temperatures, condensation can occur inside any enclosure. Typically, the larger the volume of the box, the more likely condensation will occur. 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, which is what prevents the trapped air from exiting the box. There are two ways to handle condensation:

- If the volume is very small, a desiccant bag might be able to soak up the air’s humidity.
- If the effect is more severe, the only way to get rid of this effect is to give the box the ability to breathe without sacrificing its water tightness. Contact a SkyAzul representative for breathing elements that can be added to the box and will help to reduce the effects of humid climates.

www.skyazul.com

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