



**ANGLE-LENGTH-RADIUS-LOAD
INDICATOR SYSTEM**

EI65

**TROUBLESHOOTING
HANDBOOK**

Link-Belt

Construction Equipment

LATTICE BOOM CRANES

NOTICE

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1. GENERAL INFORMATION

The purpose of this troubleshooting handbook is to provide additional information to assist a service or maintenance person in identifying malfunctions or system problems with the PAT System. A digital voltmeter and regular maintenance and service tools will be required to troubleshoot the system. Note: Knowledge of how to use a digital voltmeter is assumed.

REFERENCE:

Operator's and Calibration Handbook PAT 031-300-190-015

SYSTEM MALFUNCTION:

MB 115.0	J1 85.0	☰
J2 50.0	0J 15.0	E71

In case of a malfunction of the system, an error code which identifies the system malfunction will be displayed in the reeving portion of the display. The error codes are listed in Section 4, Error Codes. The table identify various faults that can occur with the EI65, explain each fault, and describe the action which shall be taken to correct the fault.

Faults within the electronic microprocessor shall be repaired by factory trained service personnel. When these faults occur, contact your authorized dealer or service organization.

SYSTEM PROBLEMS:

If the operator identifies a possible problem in the system, perform the pre-operation inspection in the Operator's Handbook 031-300-190-015 to define the problem. Use the following drawings to identify the problem.

SYSTEM DESCRIPTION:

The PAT Length-Angle-Radius-Load Indicator System EI65 has been designed to provide the crane operator with the essential information required to enable the machine to be used within its design parameters. The EI65 System indicates the length and angle of the boom, tip height, working radius and the total weight being lifted by the crane. Using the various sensors and the limits set by the operator, the EI65 System warns the crane operator of certain approaching hazardous conditions which could occur during the operation of his crane.

WARNING

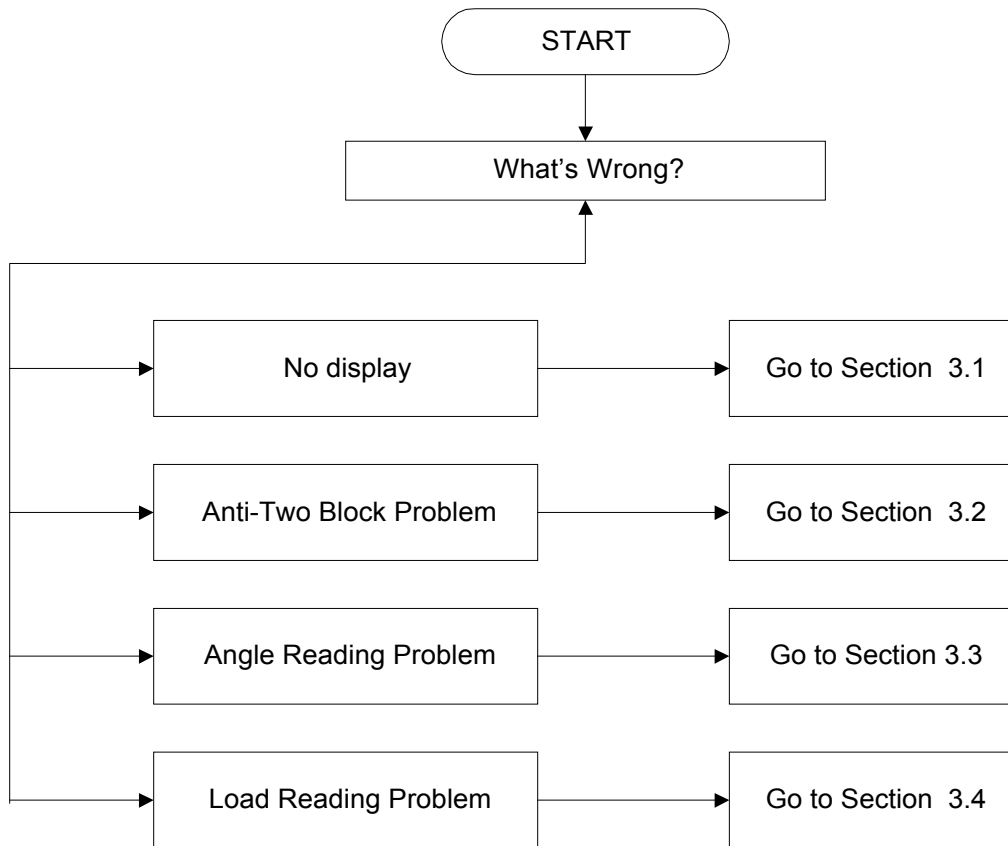
Always refer to operational instructions and load charts provided by the crane manufacturer for specific crane operation and load limits.

2. WARNINGS

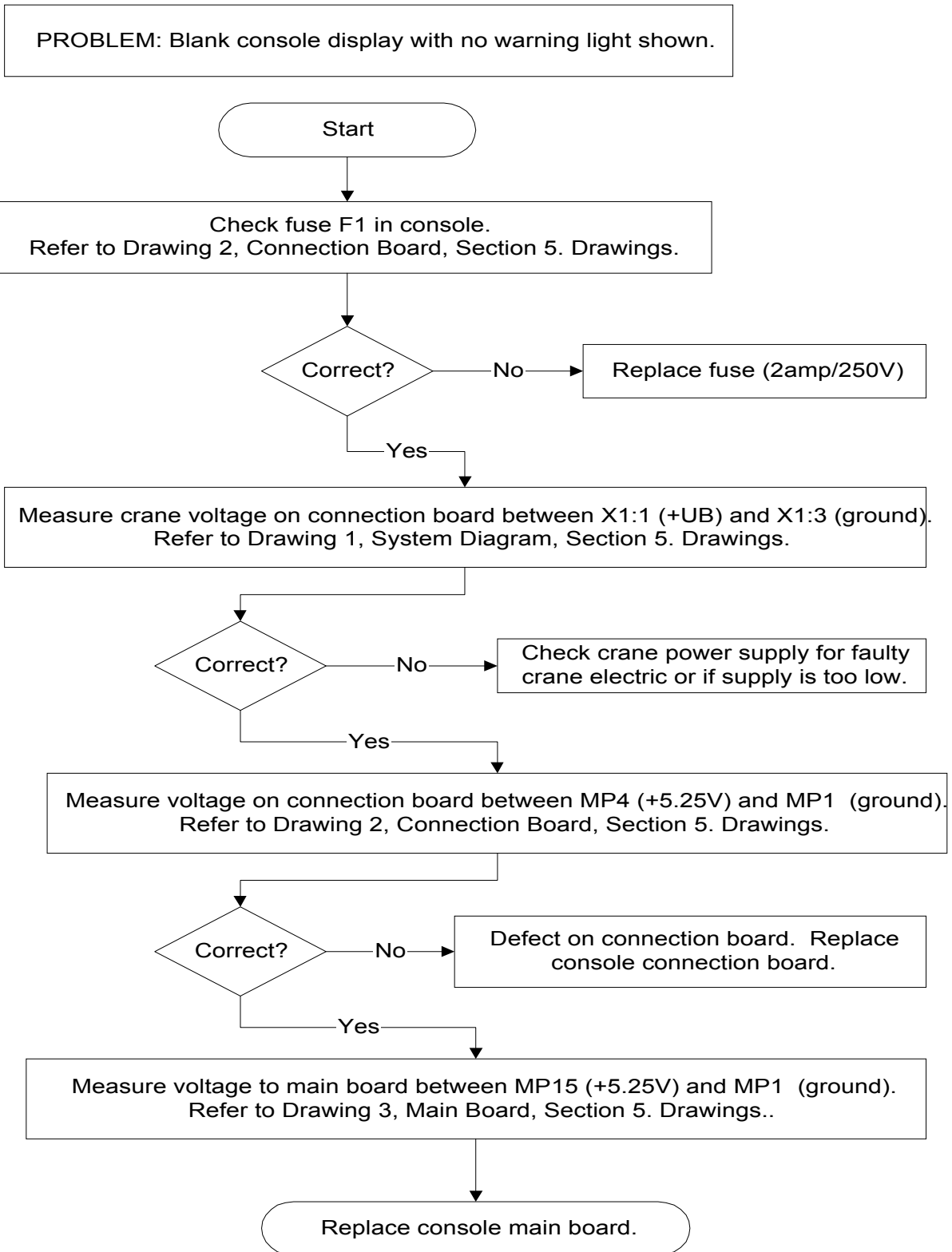
- The EI65 is an operational aid which warns a crane operator of certain approaching hazardous conditions which could cause damage to equipment and personnel.
- The device is not, and shall not be, a substitute for good operator judgment, experience and use of accepted safe crane operating procedures.
- The responsibility for the safe operation of the crane 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 the operator's handbook to ensure that he/she knows the operation and limitations of the indicating system and crane.

3. TROUBLESHOOTING FLOW CHARTS

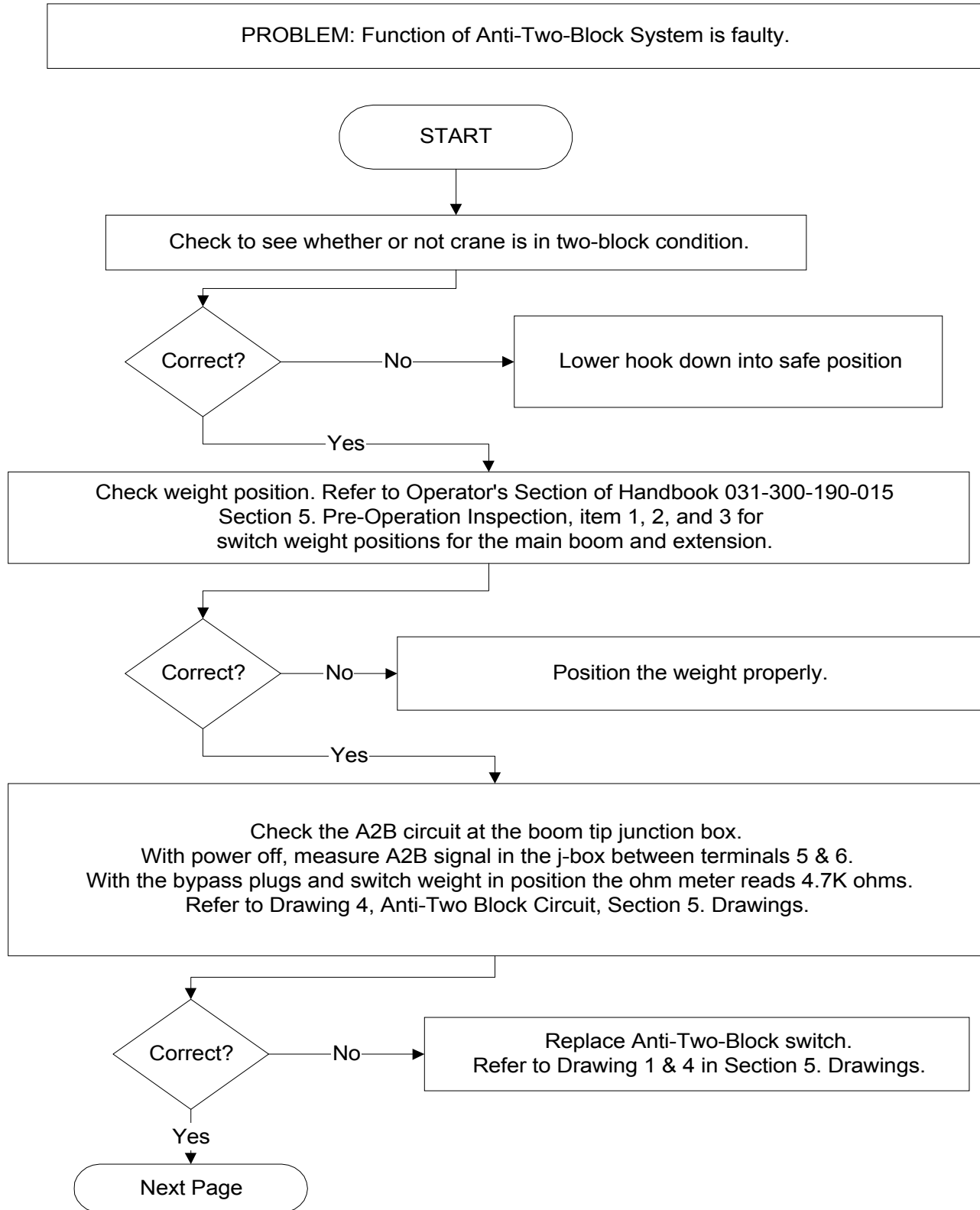
This section explains how to handle a problem that may arise with the EI65, PAT Load Indicator System. The procedures are easy to follow and are given in flowcharts on the following pages. Start with the general flowchart below which will guide you to one of the detailed flowcharts shown in this section. Section 5 contains the necessary drawings needed for troubleshooting.



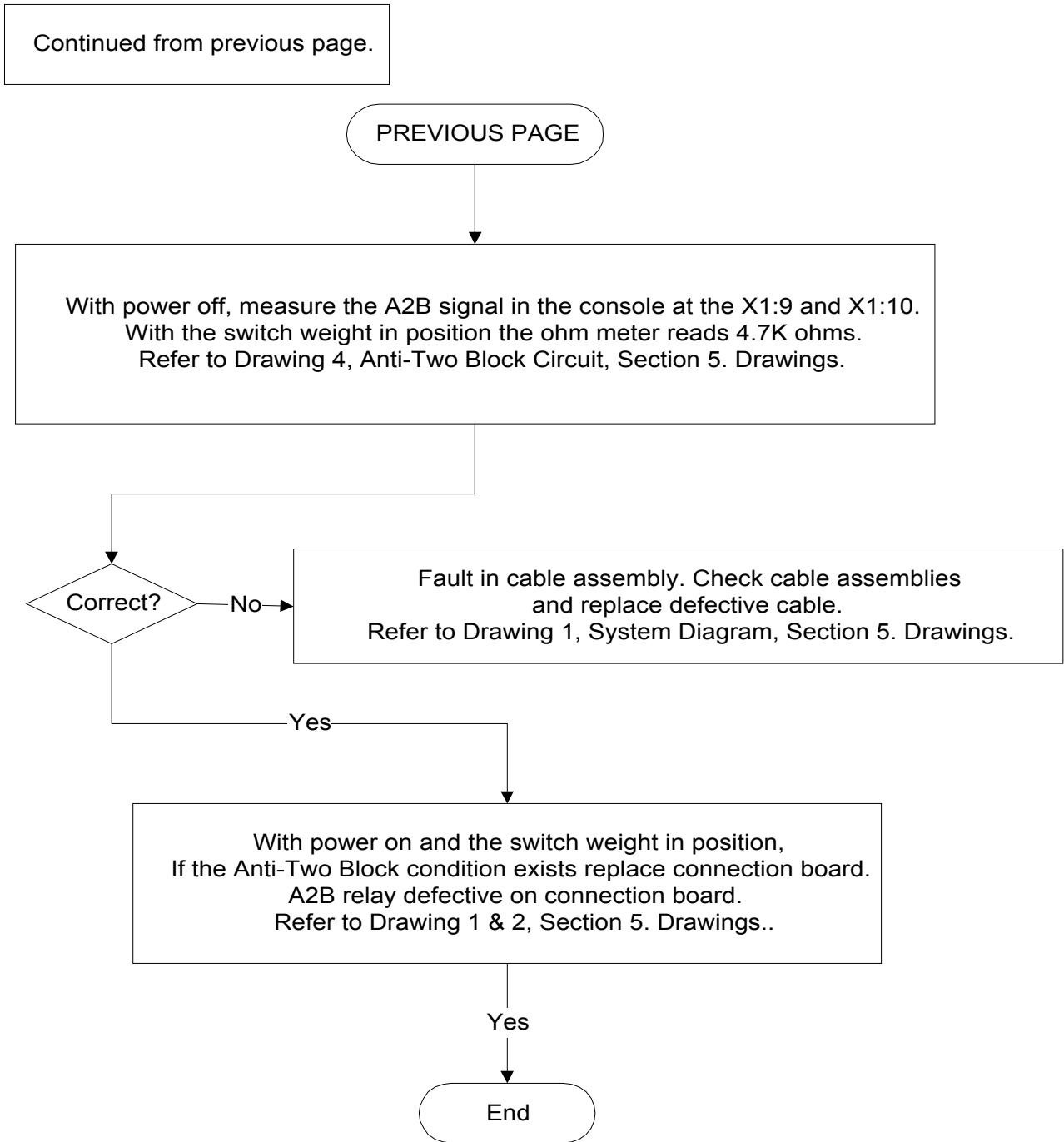
3.1 NO DISPLAY



3.2 ANTI TWO BLOCK PROBLEM

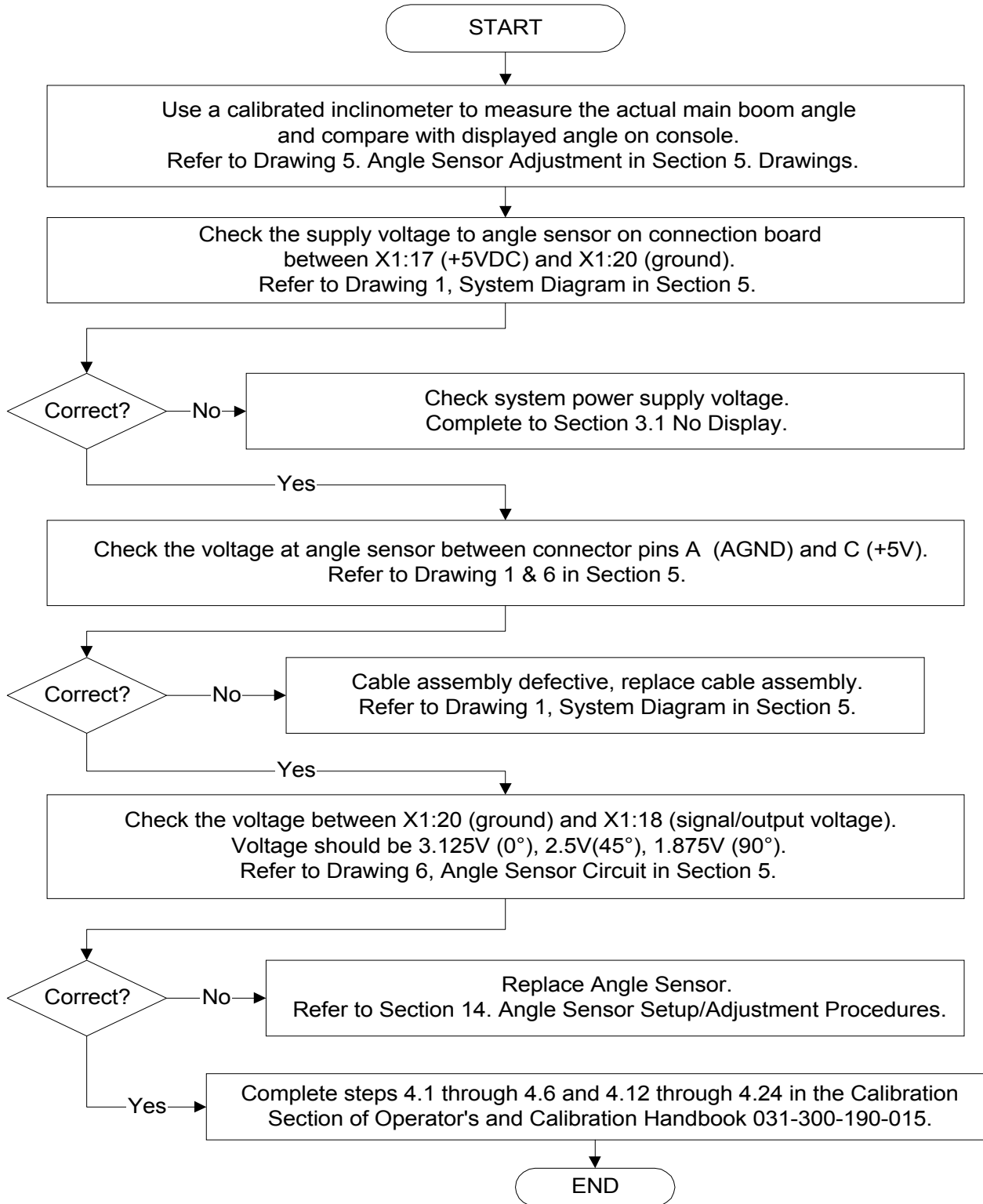


3.2 ANTI TWO BLOCK PROBLEM - continued



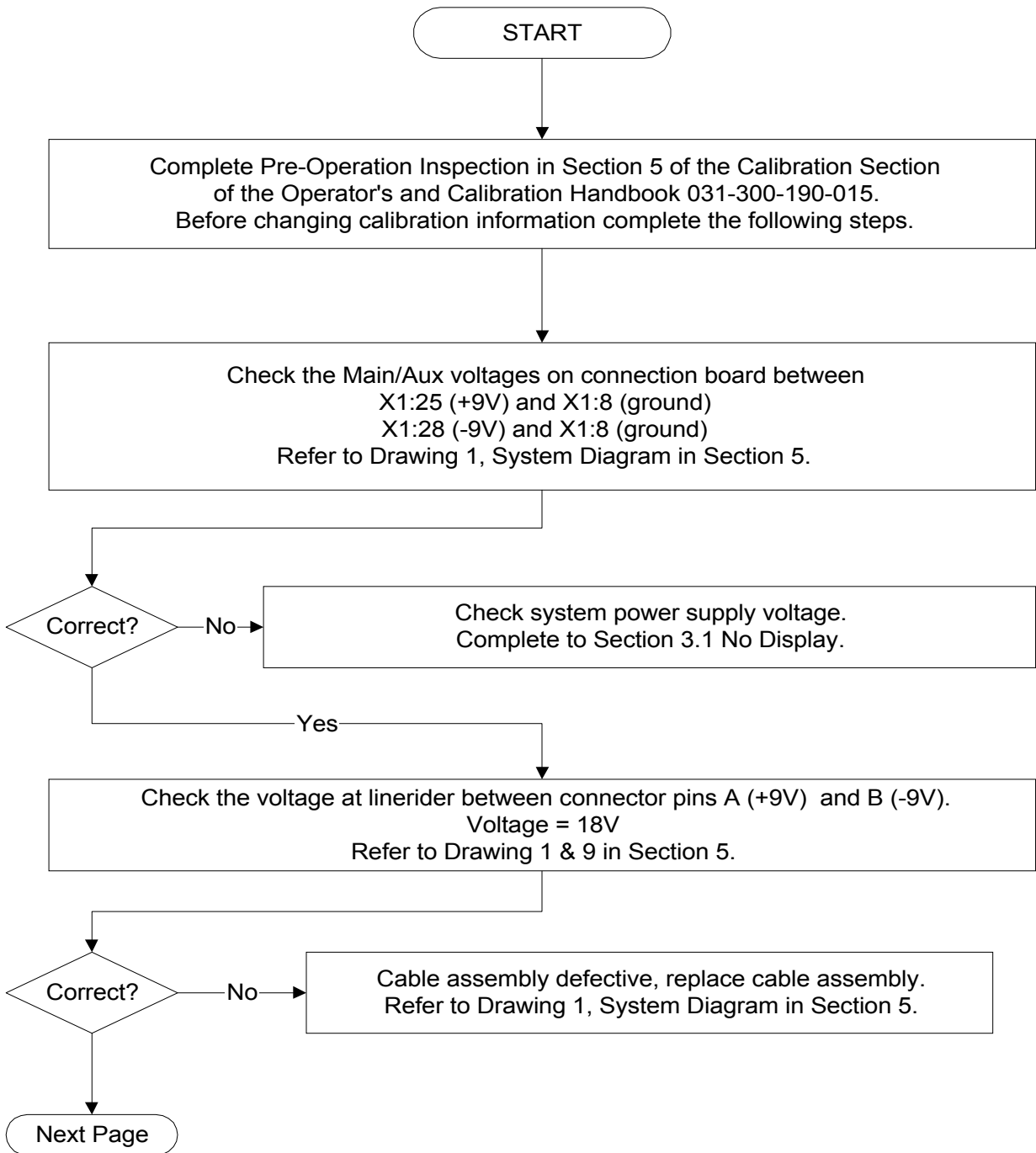
3.3 ANGLE READING PROBLEM

PROBLEM: Displayed Angle Incorrect. Actual measured angle is different from displayed angle.

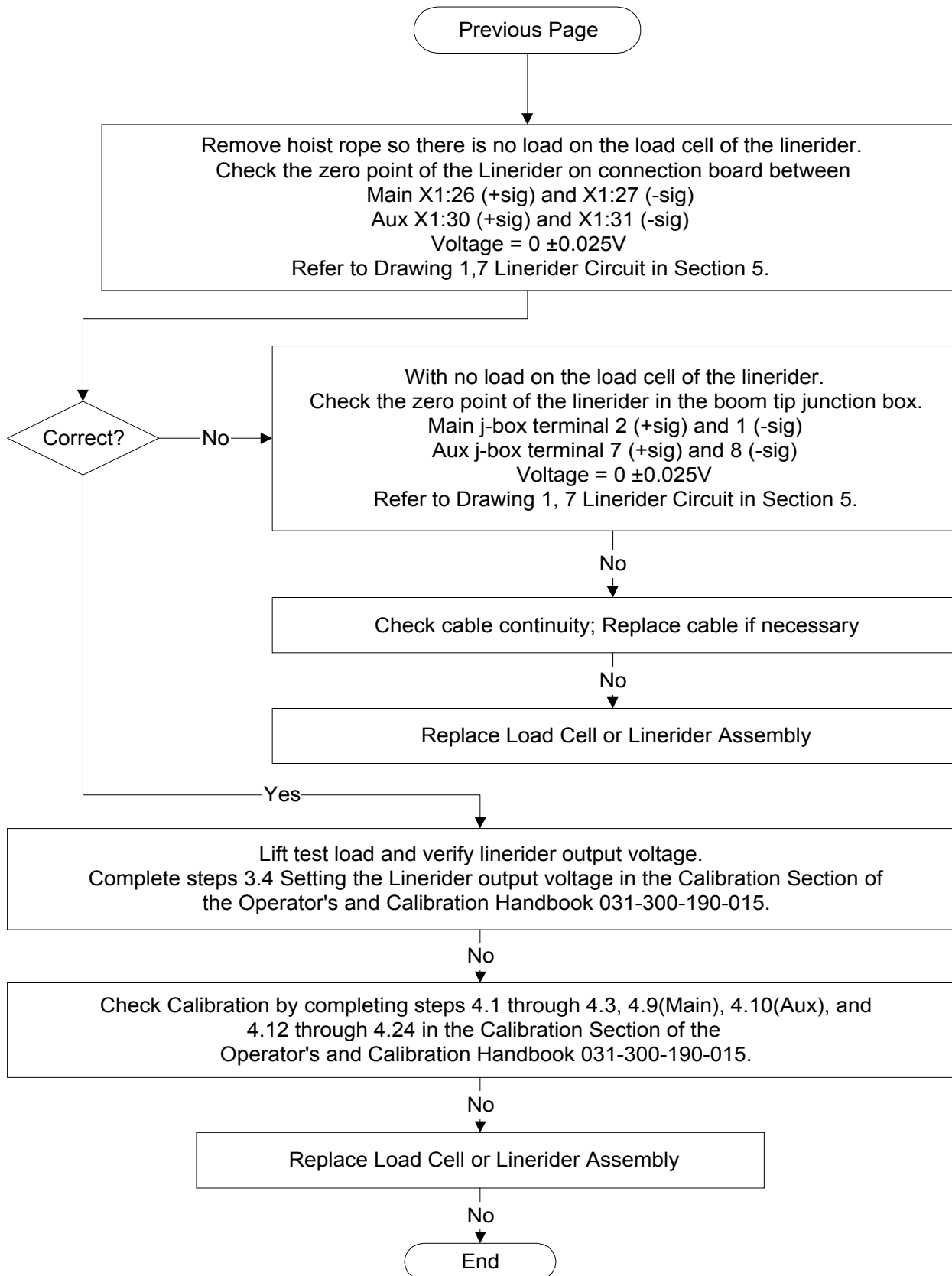


3.4 LOAD READING PROBLEM

PROBLEM: Displayed Load is out of tolerance. The displayed load should be equal to or 10% greater than the actual load.



3.4 LOAD READING PROBLEM - continued



4. ERROR CODE TABLE

Error code	Reason	Action
11	Operating data in the buffered RAM	Turn on the system again and adjust operating data
21	Crane parameters in the serial EPROM incorrect	Re-calibrate the system
31	Wrong EPROM programming or EPROM defective	Exchange EPROM
51	Short circuit min layer device term 11&12	Check minimum layer device
52	Cable break min layer device term 11&12	Check minimum layer device
53	Short circuit A2B -switch - 2 term 13&14	Check anti-two block system
54	Cable break A2B -switch - 2 term 13&14	Check anti-two block system
55	Short circuit A2B -switch - 1 term 9&10	Check anti-two block system
56	Cable break A2B -switch - 1 term 9&10	Check anti-two block system
•61	Load on the main hoist hook too big	Reduce load on main hoist
•63	Load on the auxiliary hoist hook too big	Reduce load on aux. hoist
•71	Limit Length - Main - Boom - Max.	Decrease length limit
•72	Limit Length - Main - Boom - Min.	Increase length limit
•73	Limit WG - Main - Boom - Max.	Decrease main boom angle
•74	Limit WG - Main - Boom - Min.	Increase main boom angle
•75	Limit Boom height - Max.	Decrease main boom angle
•76	Limit Boom height - Min.	Increase main boom angle
•77	Limit Working radius - Max.	Increase main boom angle
•78	Limit Working radius - Min.	Decrease main boom angle
81	ADC-Measuring value KMD1 too big	Check zero point in linerider
82	ADC-Measuring value KMD1 too low	Check zero point in linerider
83	ADC-Measuring value KMD2 too big	Check zero point in linerider
84	ADC-Measuring value KMD2 too low	Check zero point in linerider
93	ADC-Measuring value WG1 too big	Check main angle sensor circuit
94	ADC-Measuring value WG1 too low	Check main angle sensor circuit
95	ADC-Measuring value WG2 too big	Check luffing angle sensor circuit
96	ADC-Measuring value WG2 too low	Check luffing angle sensor circuit

- Limit set by the operator refer to Operator's Handbook, Section 4.3. Activating and Setting Preset Limits

5. SYSTEM DRAWINGS

The PAT EI65 System drawings in this section are provided as reference material for the troubleshooting flow charts. Use the drawings in conjunction with the flow charts to help understand the operation of the EI65 system.

Drawing List:

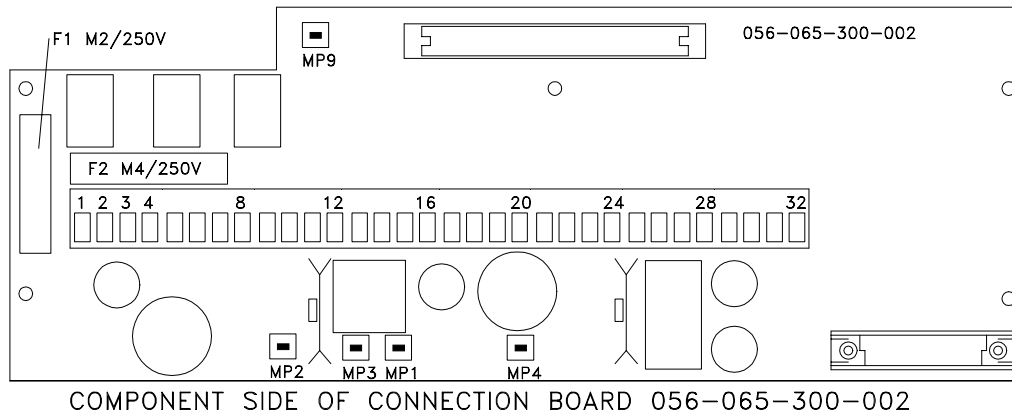
1. System Diagram
2. Connection Board Layout
3. Main Board Layout
4. Anti-Two Block Circuit
5. Angle Sensor Adjustment
6. Angle Sensor Circuit
7. Linerider Circuit

Refer to the Operator's Handbook for basic component layout on the crane and console drawing. The EI65 console connection board has the following terminal designations.

Connection Board 056-065-300-002 Designations:

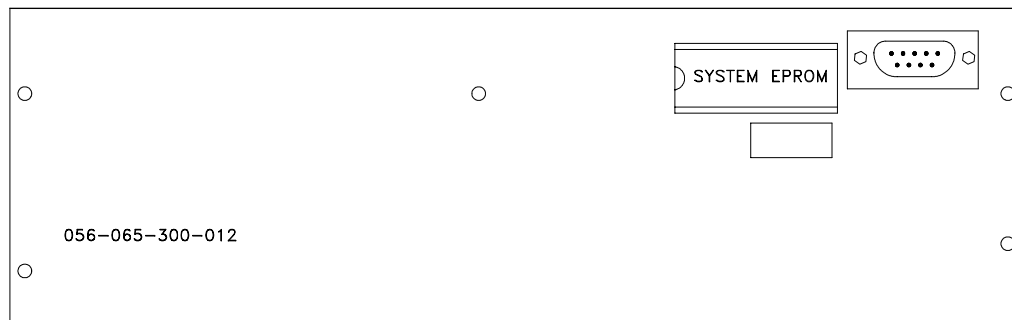
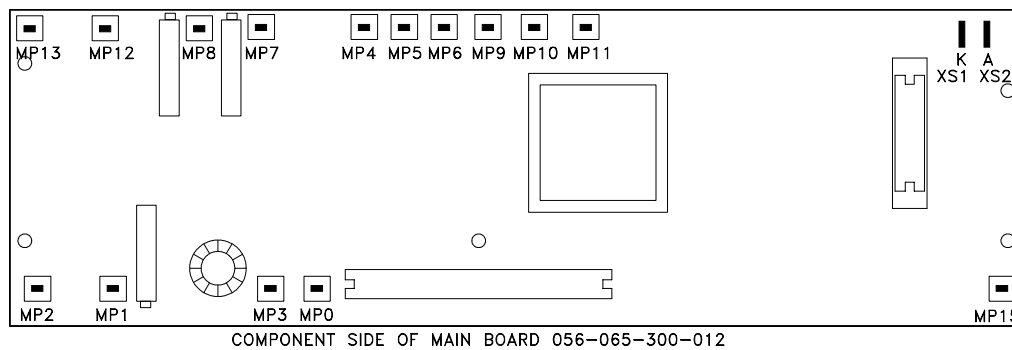
1	+ Battery	17	+5VDC
2	+ Battery	18	Main Boom angle input
3	- Battery	19	Main Boom Length input
4	- Battery	20	Analog Ground
5	Load Limit output	21	+5VDC
6	A2B Relay output 2	22	Jib Angle input
7	A2B Relay output 1	23	Analog Ground
8	Peripheral ground	24	Analog Ground
9	A2B 1 input	25	+9VDC
10	A2B Ground	26	KMD1 +Signal input
11	A2B 2 input	27	KMD1 -Signal input
12	A2B Ground	28	-9VDC
13	3rd Wrap Switch input	29	+9VDC
14	3rd Wrap Switch ground	30	KMD2 +Signal input
15	Digital input 1	31	KMD2 -Signal input
16	Digital input 2	32	-9VDC

5. DRAWING 2. CONNECTION BOARD LAYOUT



MP1 = GND
 MP2 = 5.6V
 MP3 = 5.6V
 MP4 = 5.25V

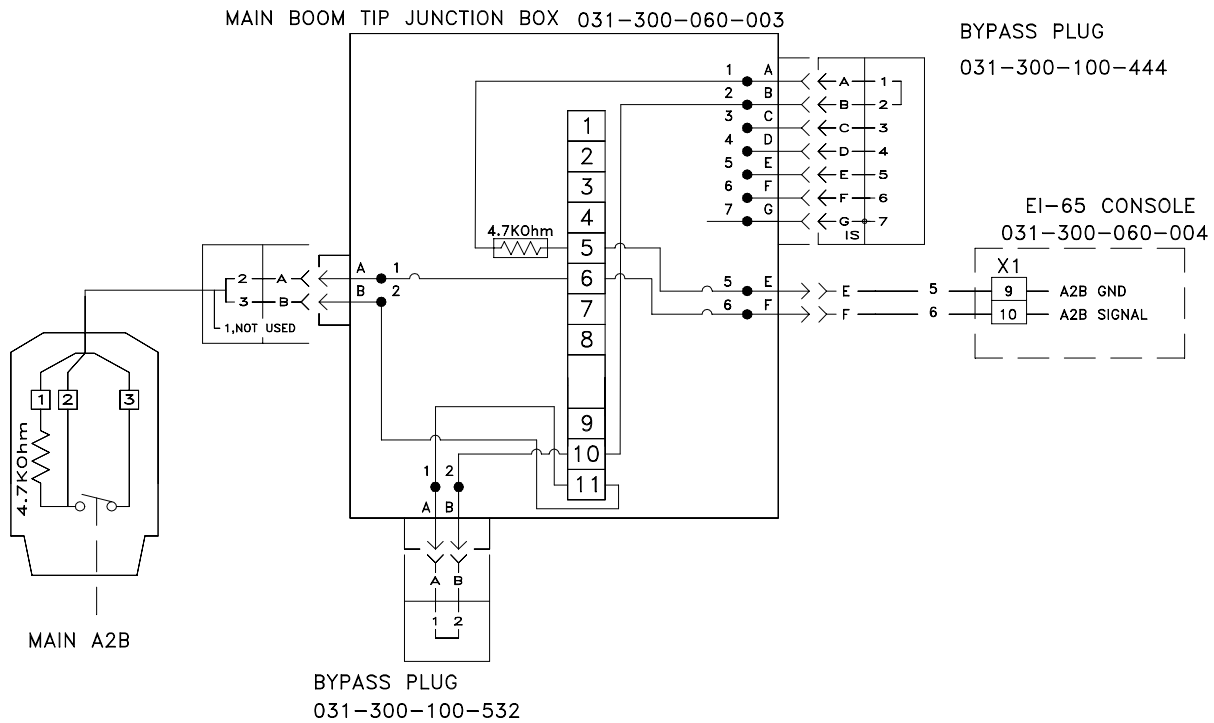
5. DRAWING 3. MAIN BOARD LAYOUT



MP0 = GND
 MP1 = AGND
 MP2 = +5.0V
 MP3 = +5.0V
 MP4 = SIGNAL NOT USED
 MP5 = SIGNAL, ANGLE 2
 MP6 = SIGNAL, ANGLE 1
 MP7 = SIGNAL, KMD1

MP8 = SIGNAL, KMD2
 MP9 = AN5 REFERENCE VOLATGE
 MP10 = AN6 REFERENCE VOLTAGE
 MP11 = AN7 REFERENCE VOLTAGE
 MP12 = -0.5V
 MP13 = +5.0V
 MP15 = 5.25V

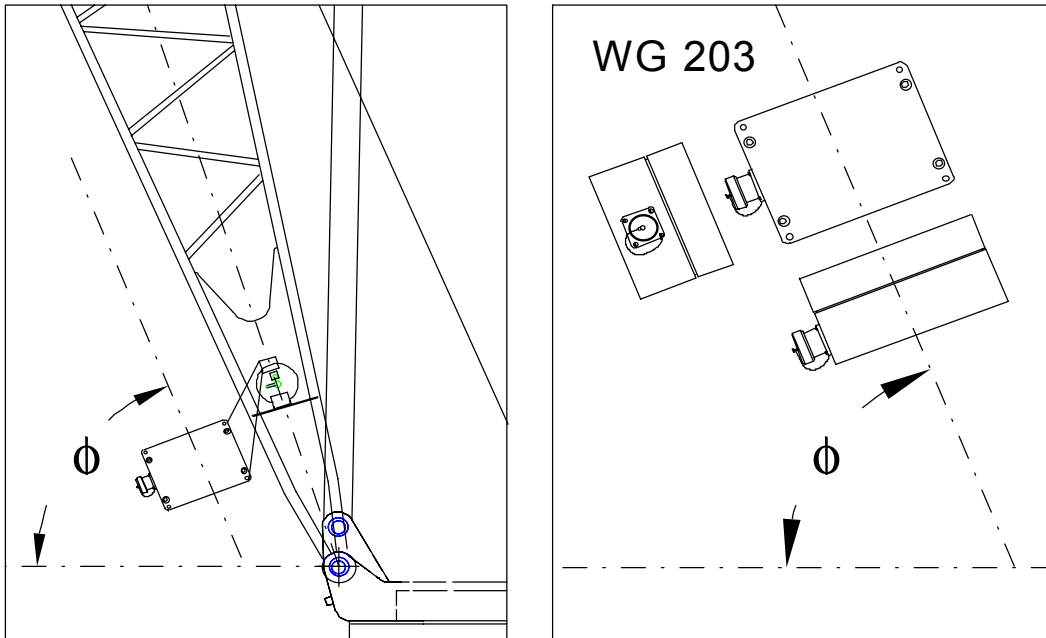
5. DRAWING 4. ANTI-TWO BLOCK CIRCUIT



The anti-two block circuit can connect three A2B switches in series. The signal is divided by a 4.7KΩ resistor; therefore, a resistance can be measured 4.7KΩ between:

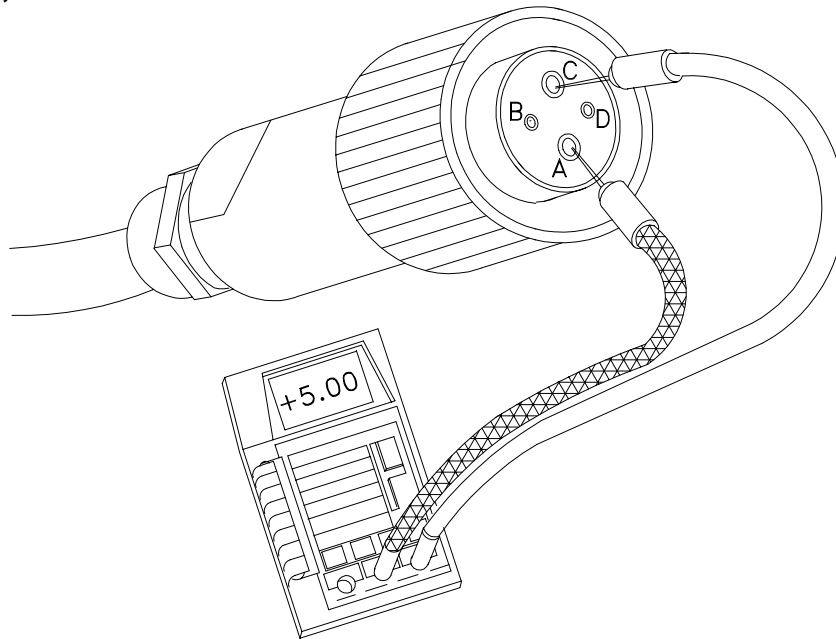
- console terminal X1:9 and 10
- junction box terminal 5 and 6
- the three receptacle connection 1(A) and 2(B) in the junction box.

5. DRAWING 5, ANGLE SENSOR ADJUSTMENT



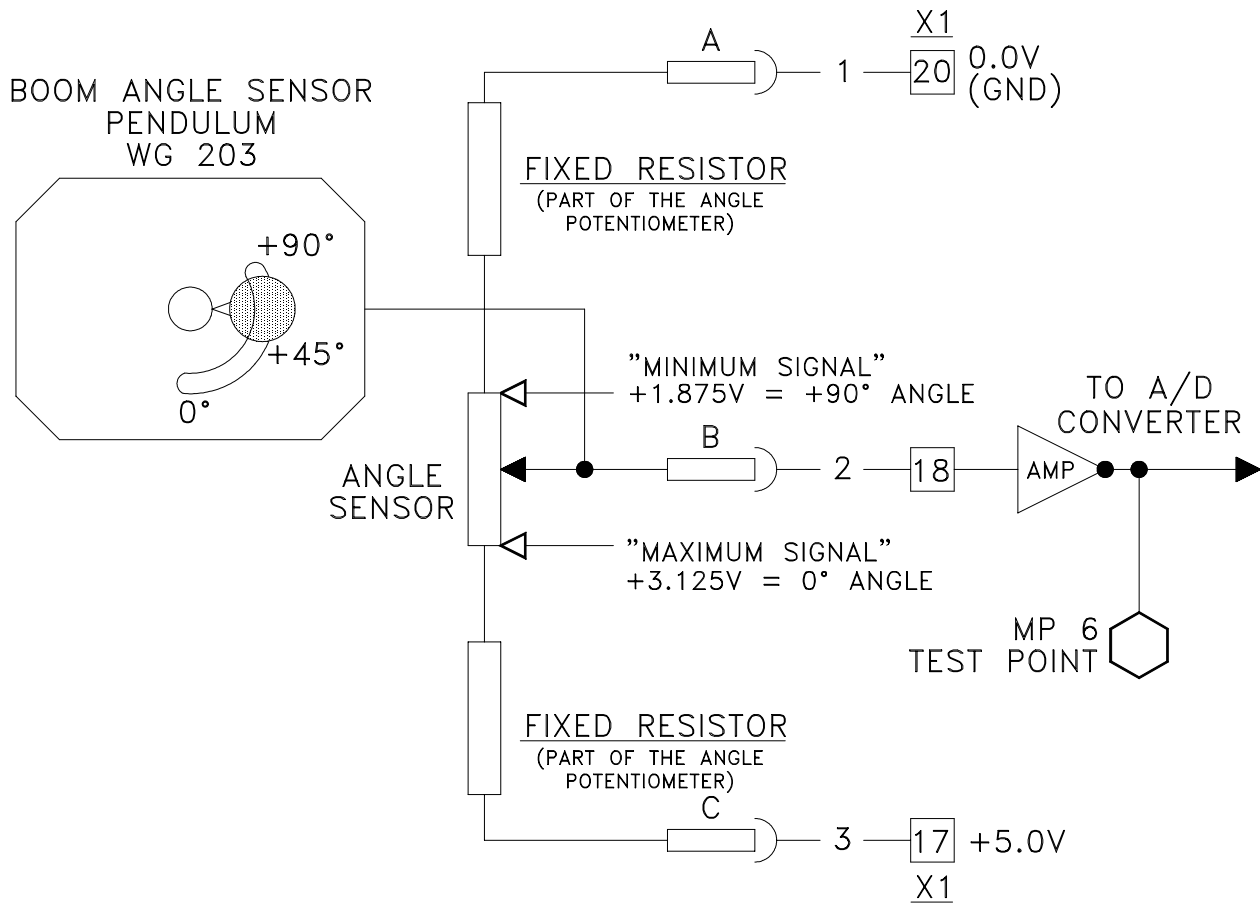
The angle ϕ shown above needs to be within $+0, -0.4$ of the actual angle of the boom. Check boom angle at base/heel section only. After adjustment, compare the actual boom angle with the displayed angle at about 0° , 30° and 60° . To comply with the SAE J375 standards the displayed angle must be $+0.0^\circ$ to -2.0° of the actual angle.

5. DRAWING 6, ANGLE SENSOR SUPPLY VOLTAGE



The supply voltage can be checked directly at the cannon connection. Using a digital volt meter measure between pins A and C, (A=GND, C= +5V). If this voltage is not correct refer to the system wiring diagram and verify all cable connections. You may need to start at the main board and check the supply voltages at their proper measuring points.

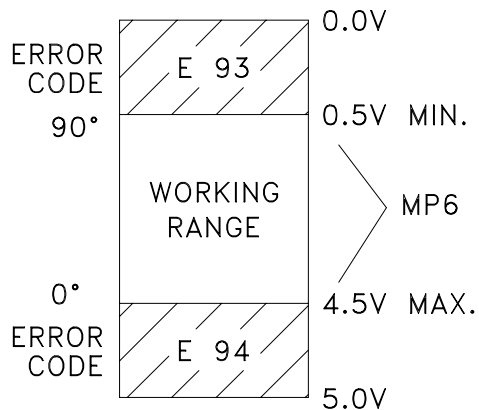
5. DRAWING 7, ANGLE SENSOR CIRCUIT



NOTE: MINIMUM AND MAXIMUM VOLTAGES ARE MEASURED ON THE TERMINAL BOARD X1-18 TO 20.

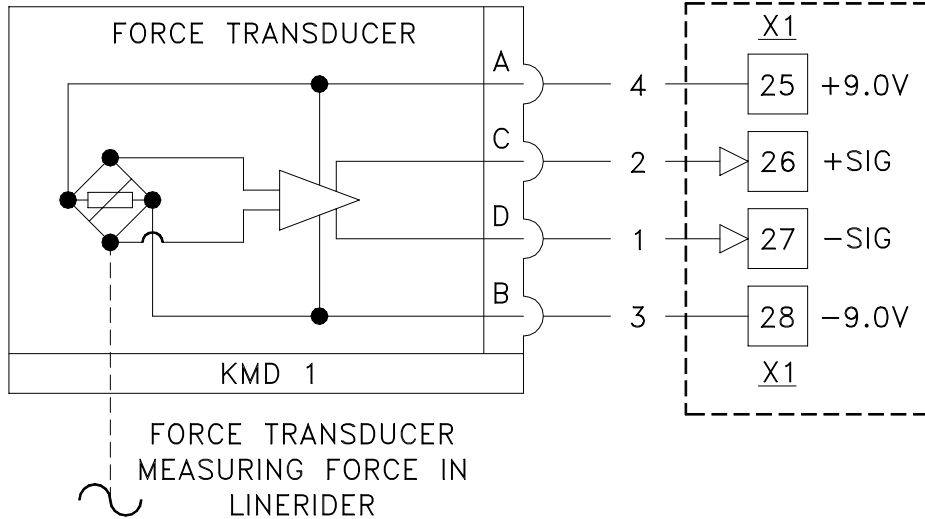
"MINIMUM SIGNAL"
+1.875V = +90° ANGLE

"MAXIMUM SIGNAL"
+3.125V = 0° ANGLE

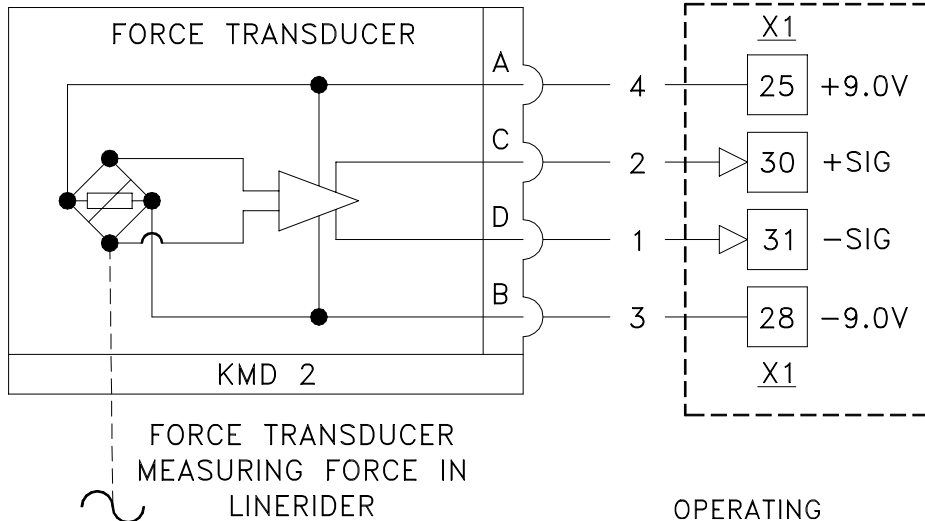


5. DRAWING 8, LINERIDER CIRCUIT

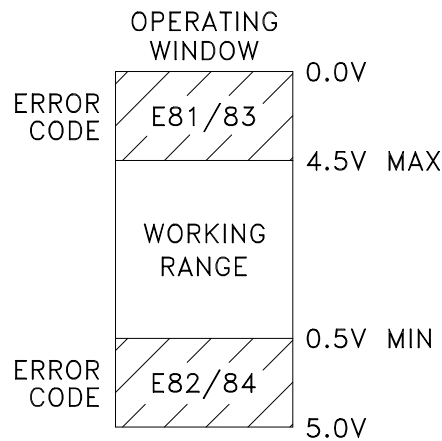
MAIN LINERIDER



AUXILIARY LINERIDER

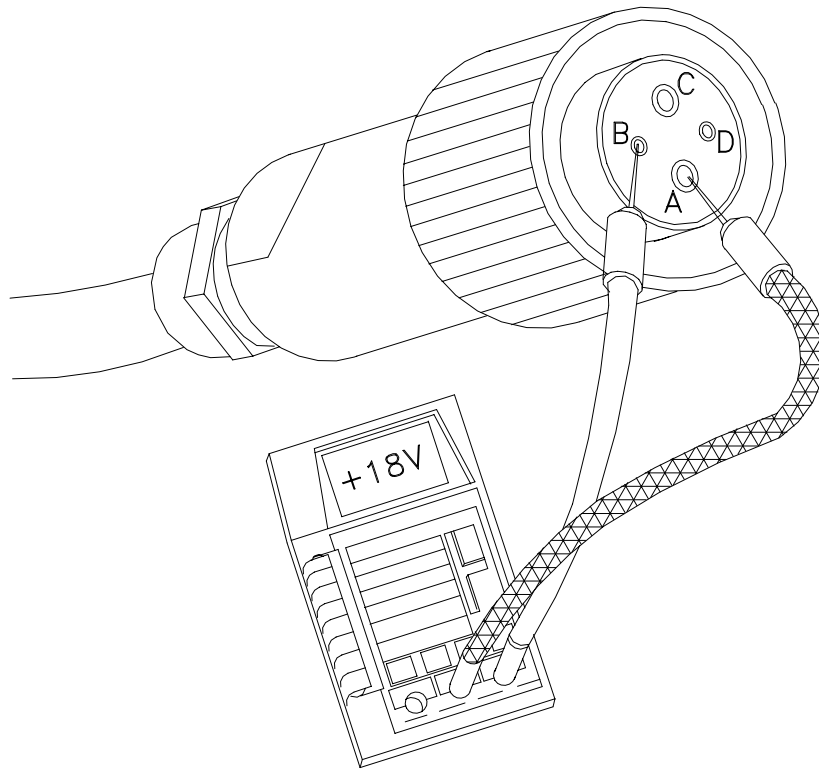


DIFFERENTIAL OUTPUT SIGNAL
 MAIN LINERIDER X1-26 & 27
 AUX LINERIDER X1-30 & 31
 ZERO FORCE = 0.0V ±25mV
 MAX. RATED FORCE = 2.5V



5. DRAWING 9, LINERIDER SUPPLY VOLTAGES

The supply voltage can be checked directly at the cannon connection. Using a digital volt meter measure between pins A and B, (A= +9v) + (B= -9v) = 18volts. If this voltage is not correct refer to the system wiring diagram and verify all cable connections. You may need to start at the console and check the supply voltages at their proper measuring points.



HANDBOOK REVISIONS

REV	DATE	NAME	DESCRIPTION
-	10/19/98	CSH	EI65 Troubleshooting handbook created.
A	01/25/98	CSH	Pg 13 - Add both sides of main board and measuring point Pg 15 - Chg. drawing 6 +5 volts