PAT

TROUBLESHOOTING MANUAL

DS350G
Load Moment Indicator

O.E.M. WARRANTY POLICY

PAT Equipment Corporation provides a complete 1 year warranty covering both parts and labor for defects in materials or workmanship under normal operating conditions. PAT Equipment would agree to use the Pettibone in-service date of record as the starting date of the warranty.

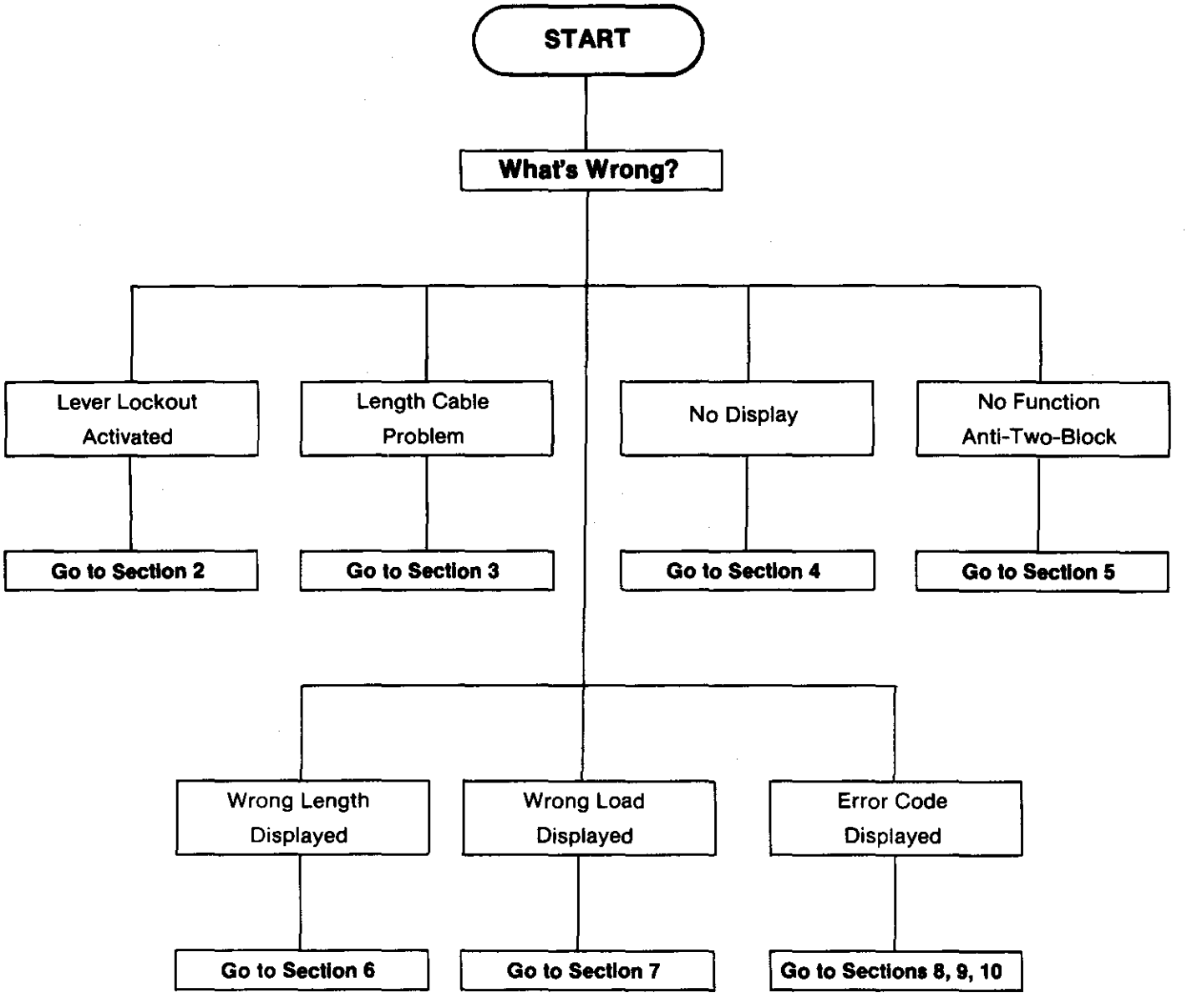
PAT Equipment will offer complete training of Pettibone service personnel and dealers' technicians to allow complete and comprehensive service support through the existing service support network of Pettibone if elected. PAT technicians would always be available for full service coverage.

Upon receipt of a warranty claim, Pettibone would forward this along with the failed parts for evaluation. Upon verification PAT Equipment would credit Pettibone for the cost of the part as well as any reasonable labor required to diagnose and correct the problem at $30.00/hr. In the event that a PAT technician was required to resolve the problem, all costs would be covered by PAT Equipment and a complete report submitted to the Pettibone service department.

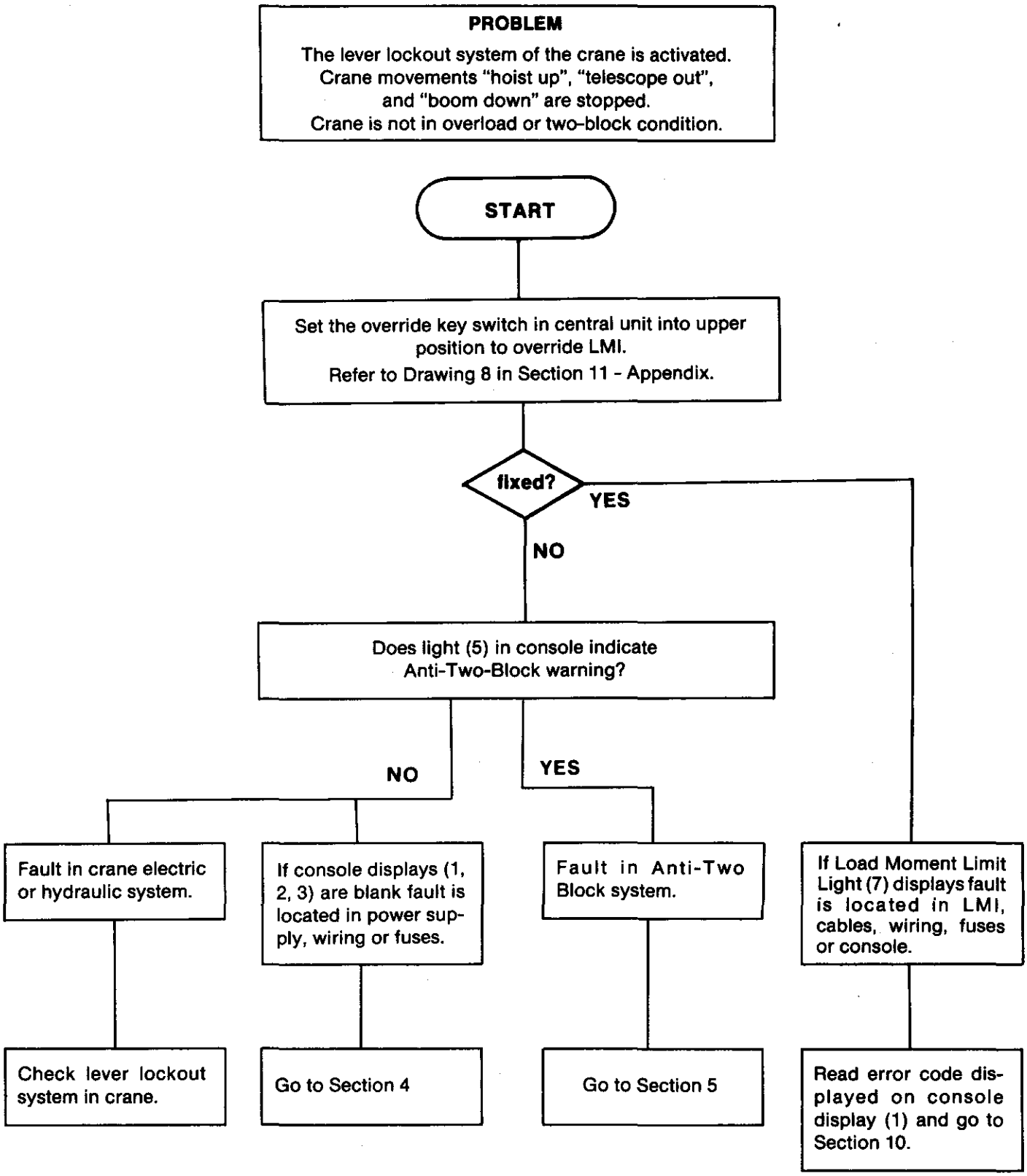
From an operational standpoint, warranty service can be handled in any way that best suits the needs of Pettibone.

PAT DS350G
Load Moment Indicator
Troubleshooting Manual

This section explains how to handle a problem that may arise with the PAT Load Moment Indicator System - PAT DS350G. 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 more detailed flowcharts shown in Sections 2 through 10.



2 LEVER LOCKOUT ACTIVATED

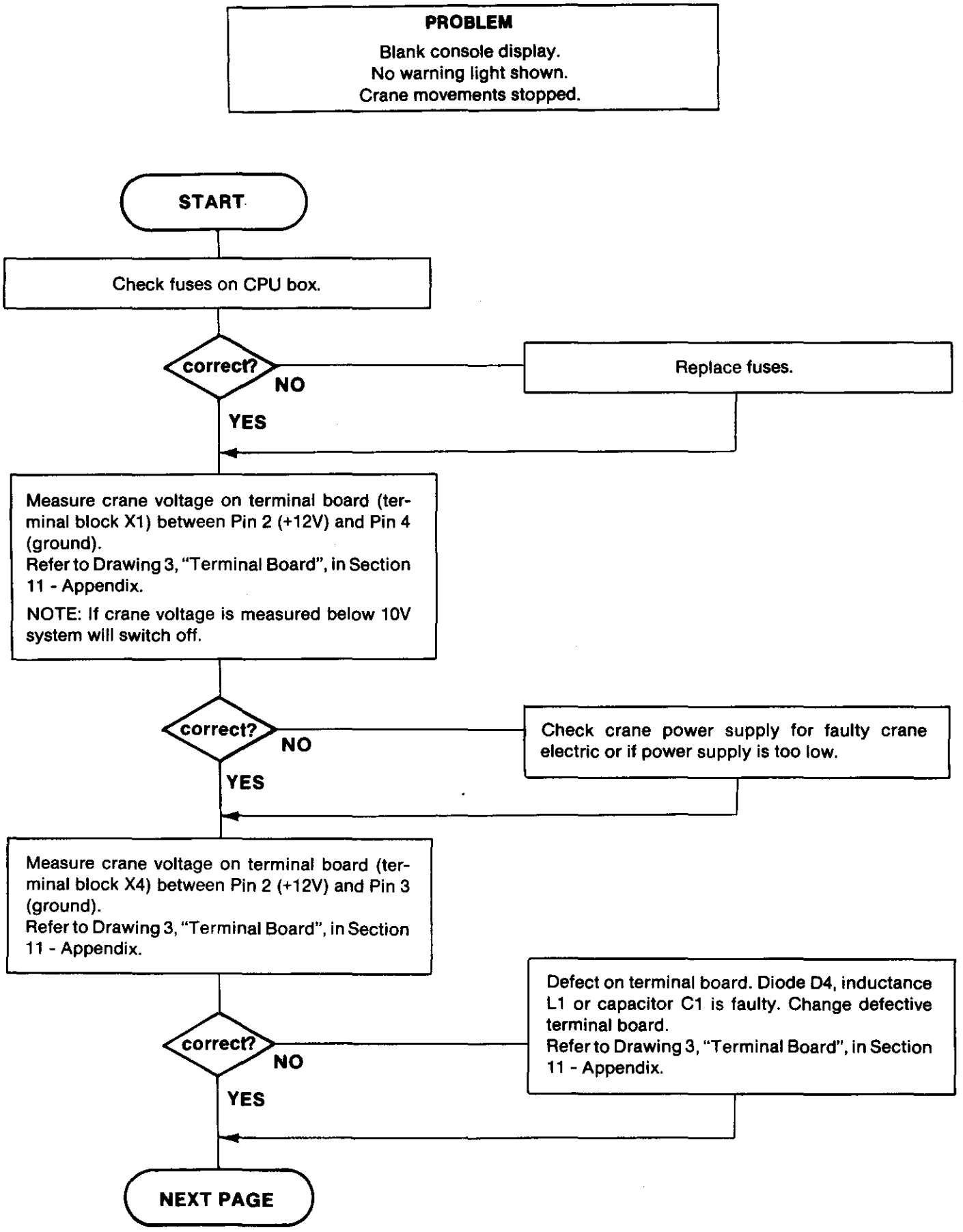


For numbers shown in parentheses ( ) refer to the Operator's Manual.

PROBLEM

Damaged or broken length cable.

STEP	ACTION
1	Cut old cable at cable drum.
2	Open cable reel cover and disconnect wiring from terminal block. Pull 7-conductor cable out of strain relief.
3	Remove cable reel from mounting brackets.
4	Remove damaged length cable, which is mounted to the slip rings in the cable reel, from Terminal 17 and 18. Refer to Drawing 1 in Section 11 - Appendix.
5	Turn the cable reel and open the strain relief attached to the axle in the center of the drum. Pull existing length cable out of the cable reel.
6	Disconnect damaged length cable from Anti-Two-Block switch receptacle at the boom nose.
7	Pull new length cable through the hole, pipe and strain relief and push it through the axle of the reeling drum. Tighten strain relief to ensure sealing.
8	Dismantle length cable near slip ring and reconnect shield to terminal No. 18 and center to No. 17. Refer to Drawing 1 in Section 11 - Appendix.
9	Remount cable reel to the boom. Turn reeling drum clockwise to get rest of new cable onto the drum.
10	Set preload on cable reel by turning the drum counter-clockwise 5 to 8 turns.
11	Reconnect new cable to Terminal No. 1 (center) and ground terminal (shield) of receptacle at the boom nose. Refer to Drawing 2 in Section 11 - Appendix.
12	Reset length potentiometer in length angle transducer (screw is located in center of white gear); with boom fully retracted, turn potentiometer carefully counter-clockwise until it stops. Check function of Anti-Two-Block switch. Recheck length and angle display. Refer to Drawing 6 in Section 11 - Appendix.


PROBLEM
Blank console display.
No warning light shown.
Crane movements stopped.
START
Check fuses on CPU box.
correct?
NO
Replace fuses.
YES
Measure crane voltage on terminal board (terminal block X1) between Pin 2 (+12V) and Pin 4 (ground).
Refer to Drawing 3, "Terminal Board", in Section 11 - Appendix.
NOTE: If crane voltage is measured below 10V system will switch off.
correct?
NO
Check crane power supply for faulty crane electric or if power supply is too low.
YES
Measure crane voltage on terminal board (terminal block X4) between Pin 2 (+12V) and Pin 3 (ground).
Refer to Drawing 3, "Terminal Board", in Section 11 - Appendix.
correct?
NO
Defect on terminal board. Diode D4, inductance L1 or capacitor C1 is faulty. Change defective terminal board.
Refer to Drawing 3, "Terminal Board", in Section 11 - Appendix.
YES
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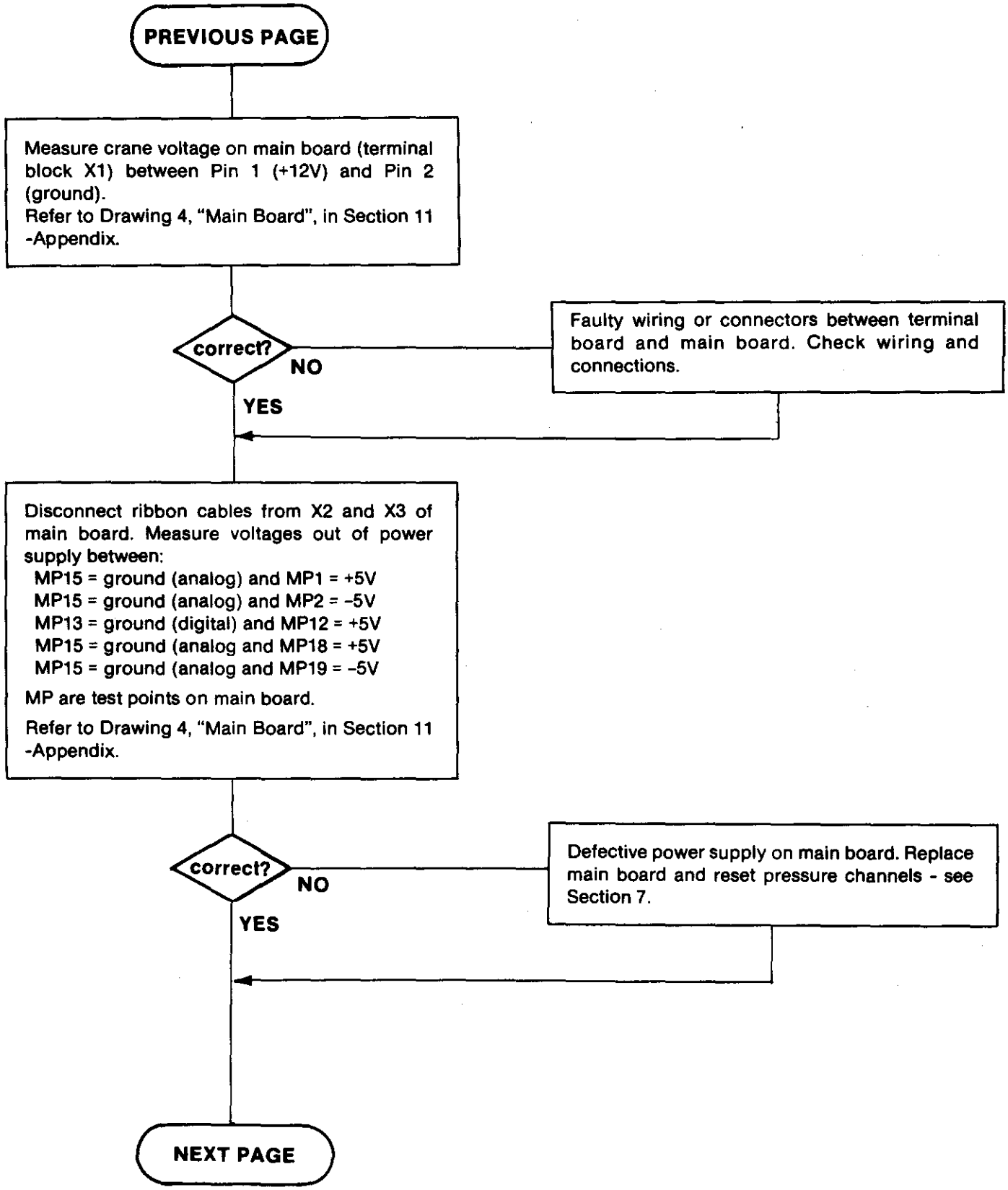

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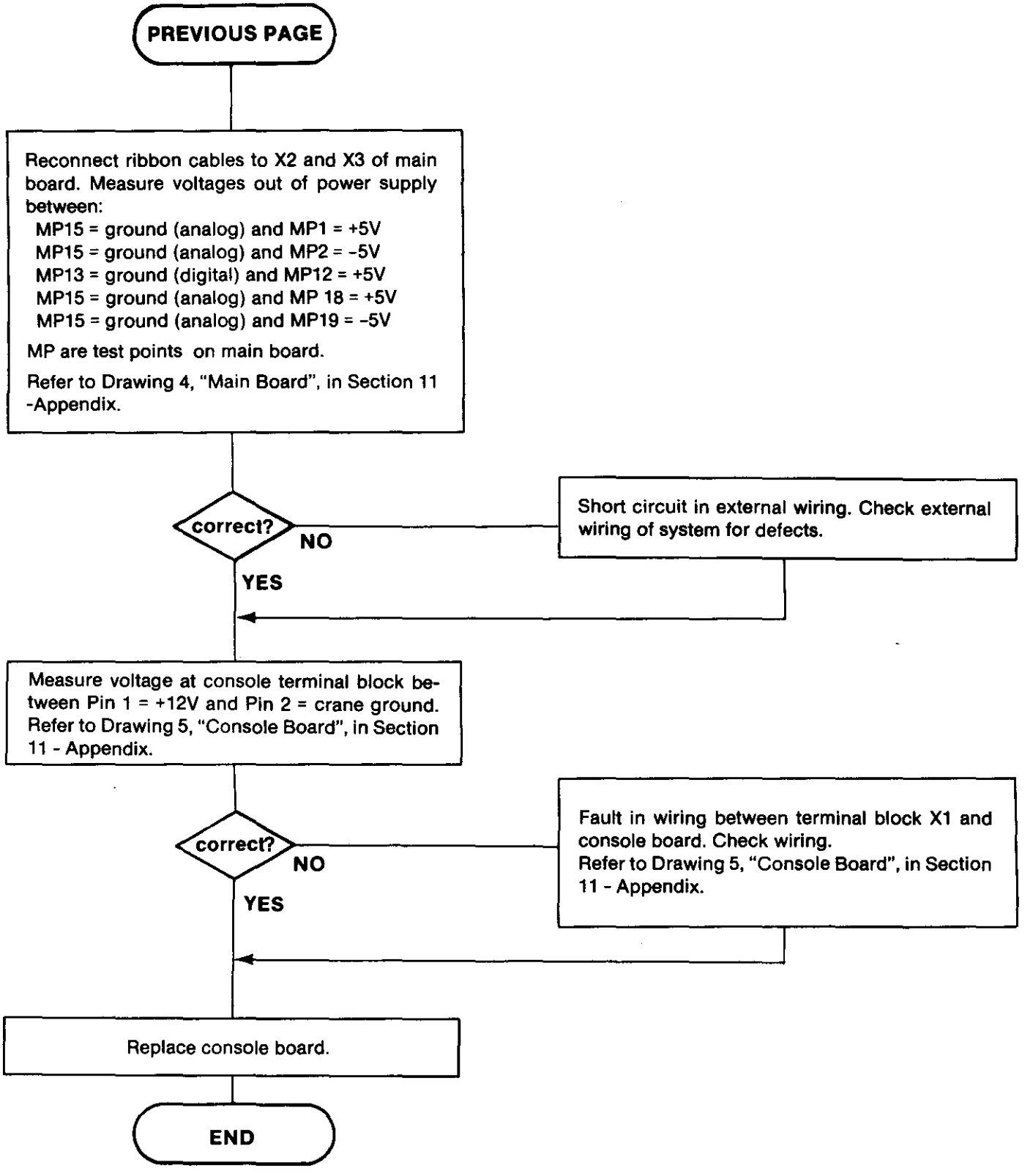

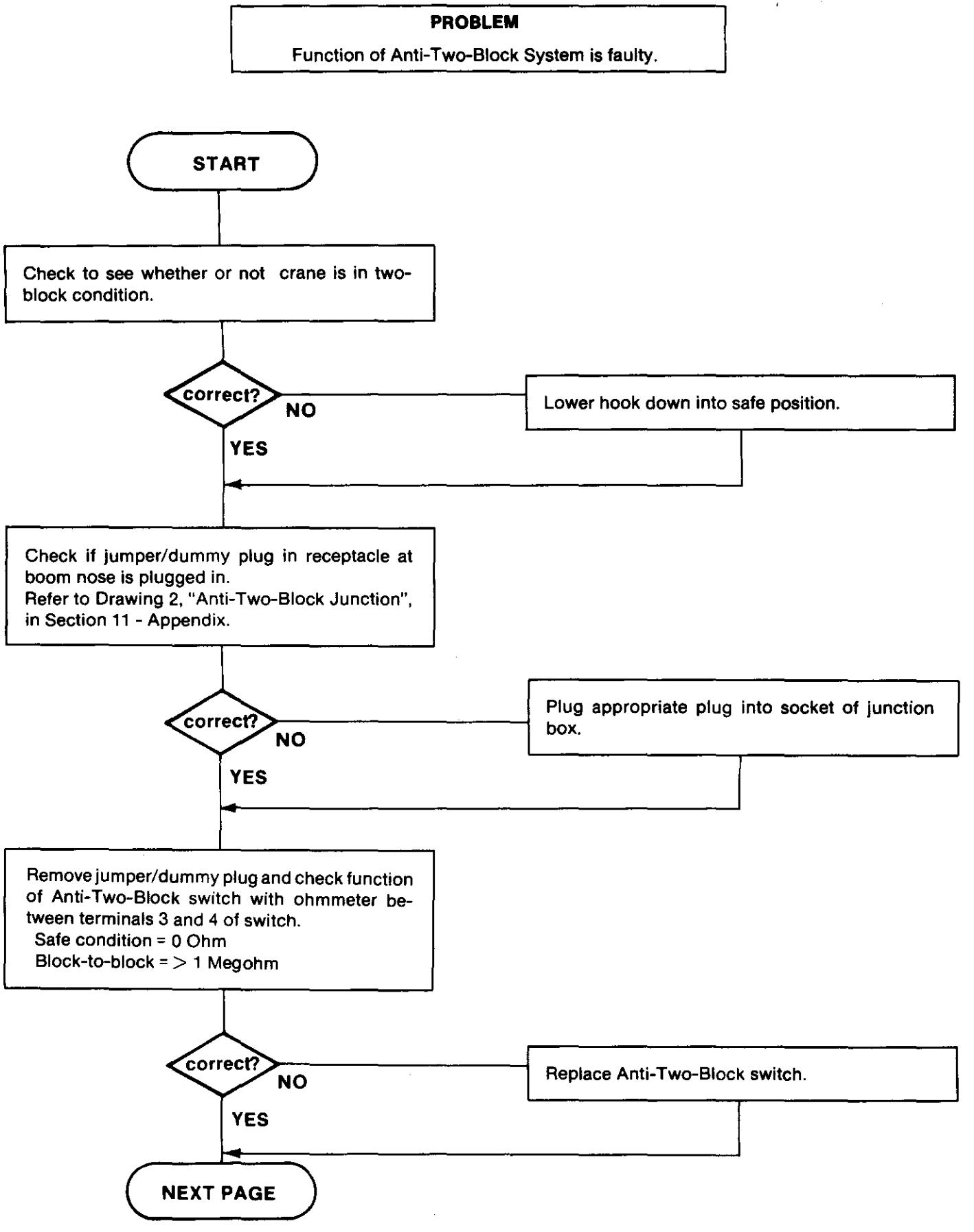
PROBLEM
Function of Anti-Two-Block System is faulty.
START
Check to see whether or not crane is in two-block condition.
correct?
NO
Lower hook down into safe position.
YES
Check if jumper/dummy plug in receptacle at boom nose is plugged in.
Refer to Drawing 2, "Anti-Two-Block Junction", in Section 11 - Appendix.
correct?
NO
Plug appropriate plug into socket of junction box.
YES
Remove jumper/dummy plug and check function of Anti-Two-Block switch with ohmmeter between terminals 3 and 4 of switch.
Safe condition = 0 Ohm
Block-to-block = > 1 Megohm
correct?
NO
Replace Anti-Two-Block switch.
YES
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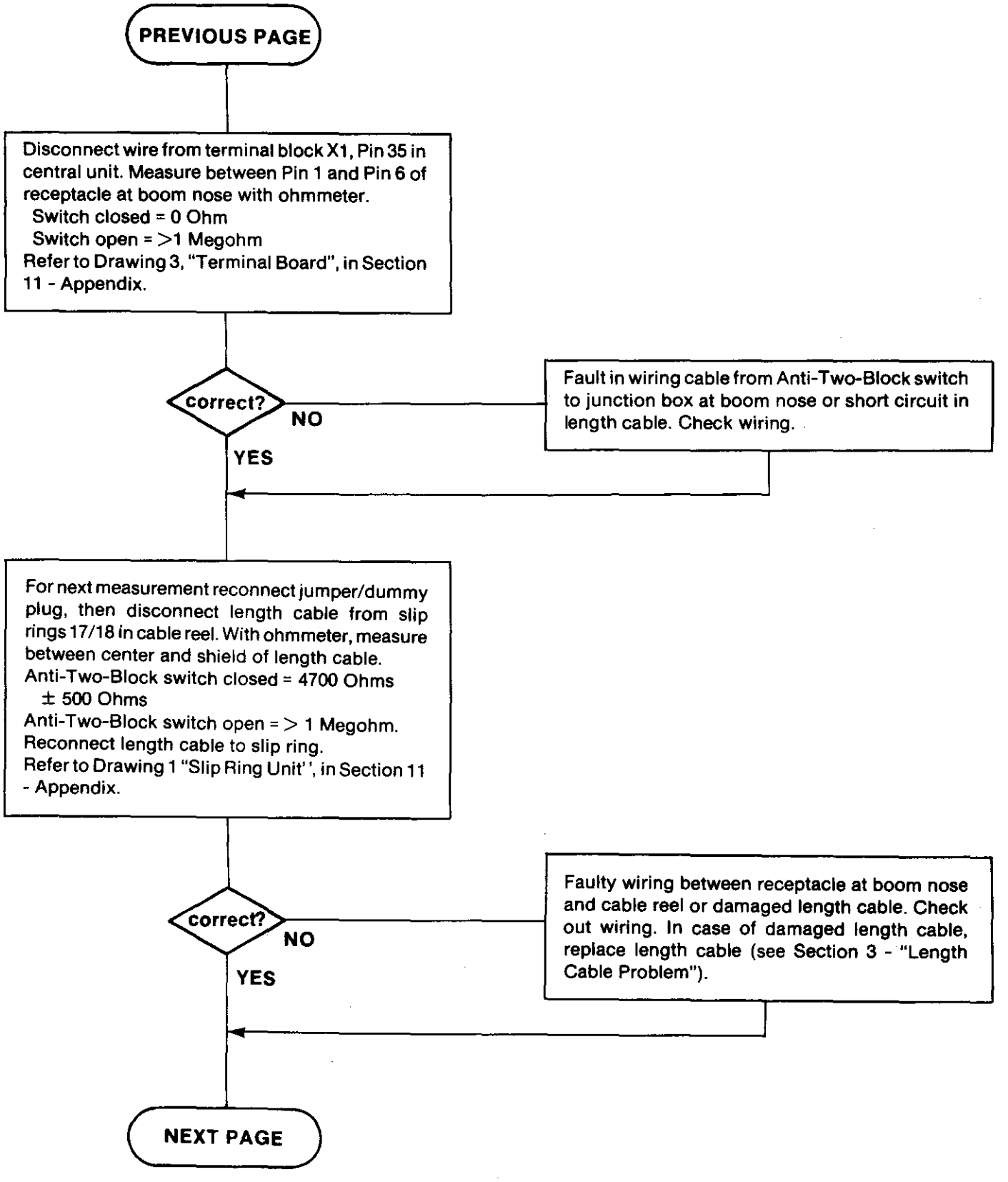

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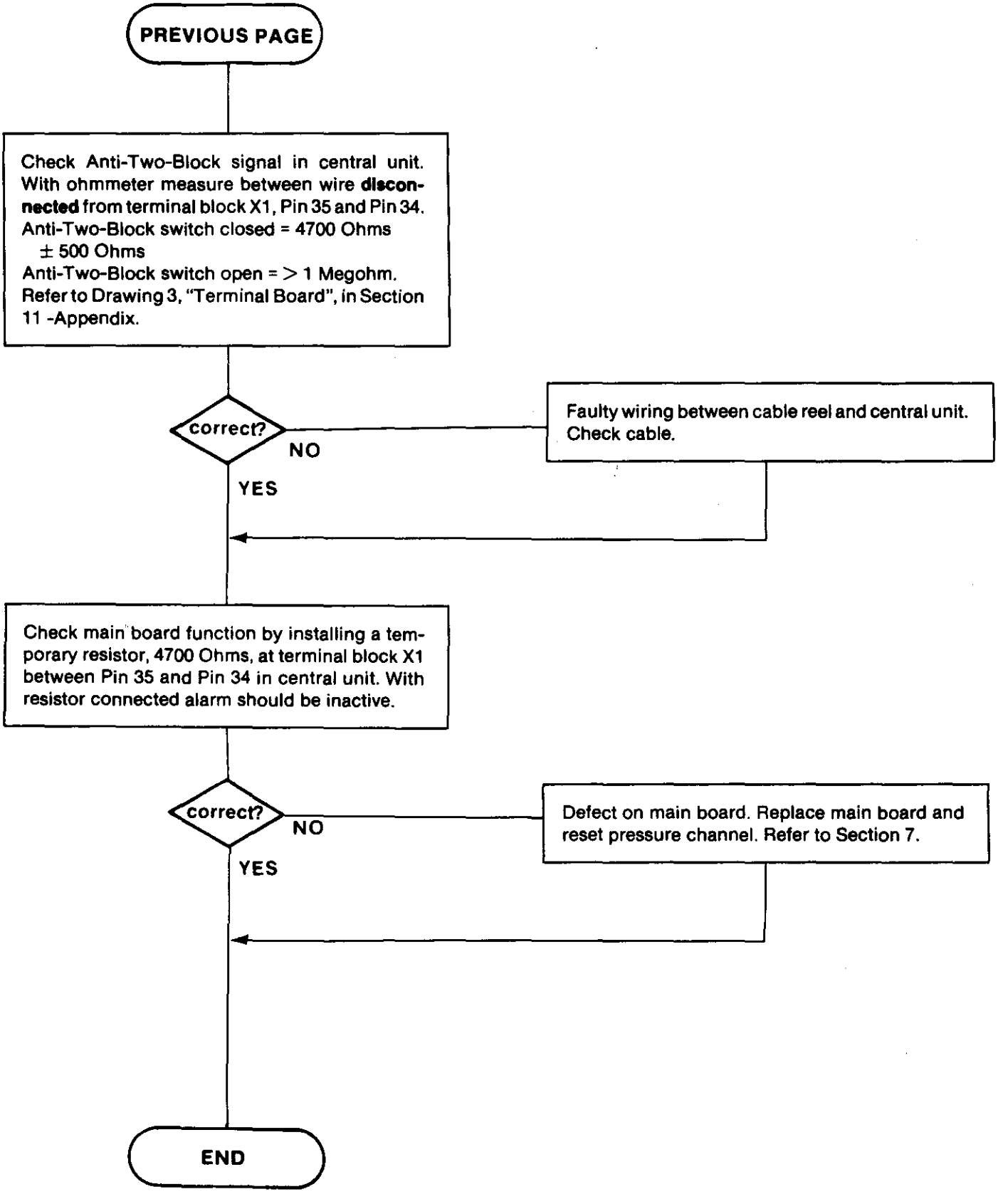

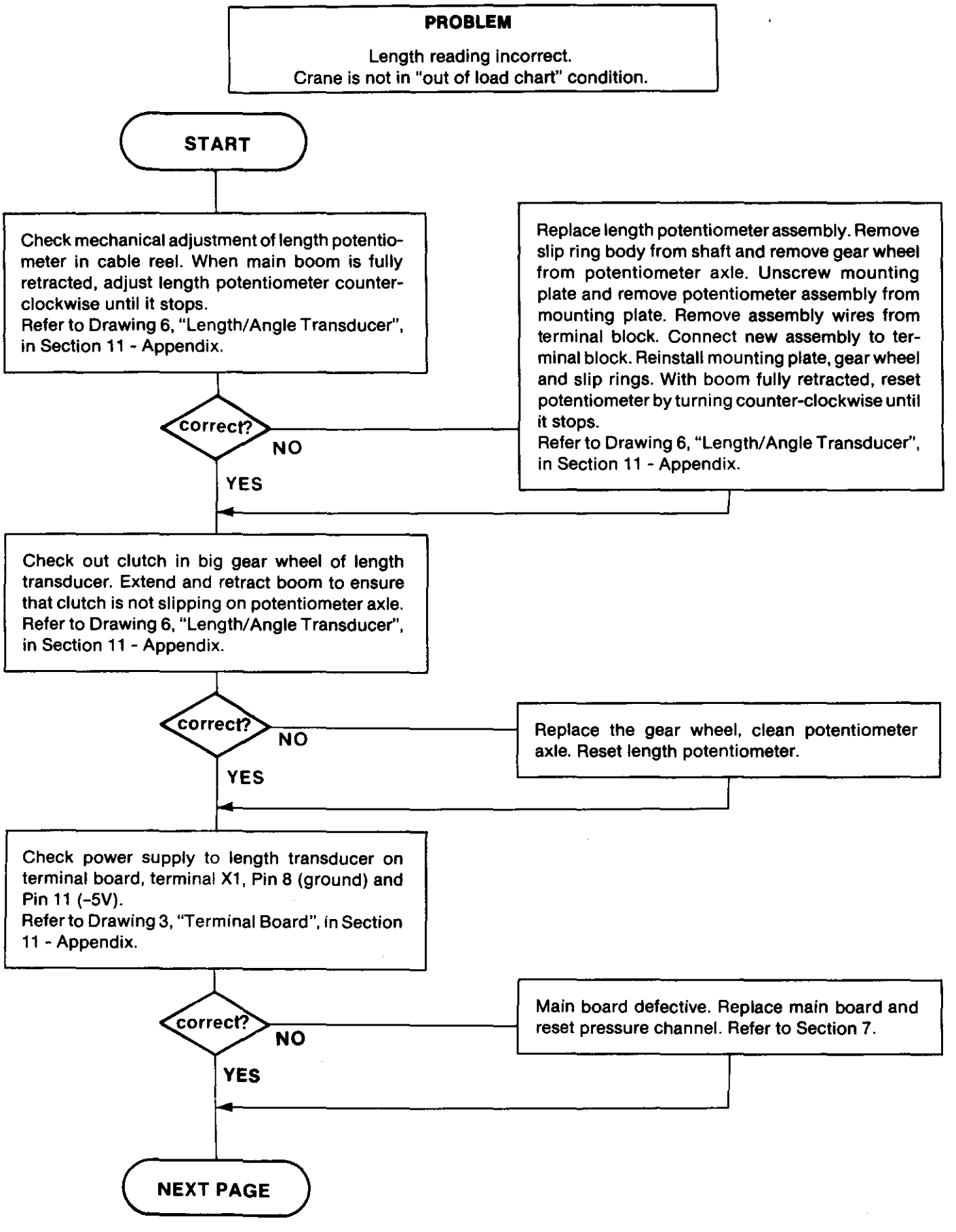
PROBLEM
Length reading incorrect.
Crane is not in "out of load chart" condition.
START
Check mechanical adjustment of length potentiometer in cable reel. When main boom is fully retracted, adjust length potentiometer counter-clockwise until it stops.
Refer to Drawing 6, "Length/Angle Transducer", in Section 11 - Appendix.
correct?
NO
YES
Replace length potentiometer assembly. Remove slip ring body from shaft and remove gear wheel from potentiometer axle. Unscrew mounting plate and remove potentiometer assembly from mounting plate. Remove assembly wires from terminal block. Connect new assembly to terminal block. Reinstall mounting plate, gear wheel and slip rings. With boom fully retracted, reset potentiometer by turning counter-clockwise until it stops.
Refer to Drawing 6, "Length/Angle Transducer", in Section 11 - Appendix.
Check out clutch in big gear wheel of length transducer. Extend and retract boom to ensure that clutch is not slipping on potentiometer axle.
Refer to Drawing 6, "Length/Angle Transducer", in Section 11 - Appendix.
correct?
NO
YES
Replace the gear wheel, clean potentiometer axle. Reset length potentiometer.
Check power supply to length transducer on terminal board, terminal X1, Pin 8 (ground) and Pin 11 (-5V).
Refer to Drawing 3, "Terminal Board", in Section 11 - Appendix.
correct?
NO
YES
Main board defective. Replace main board and reset pressure channel. Refer to Section 7.
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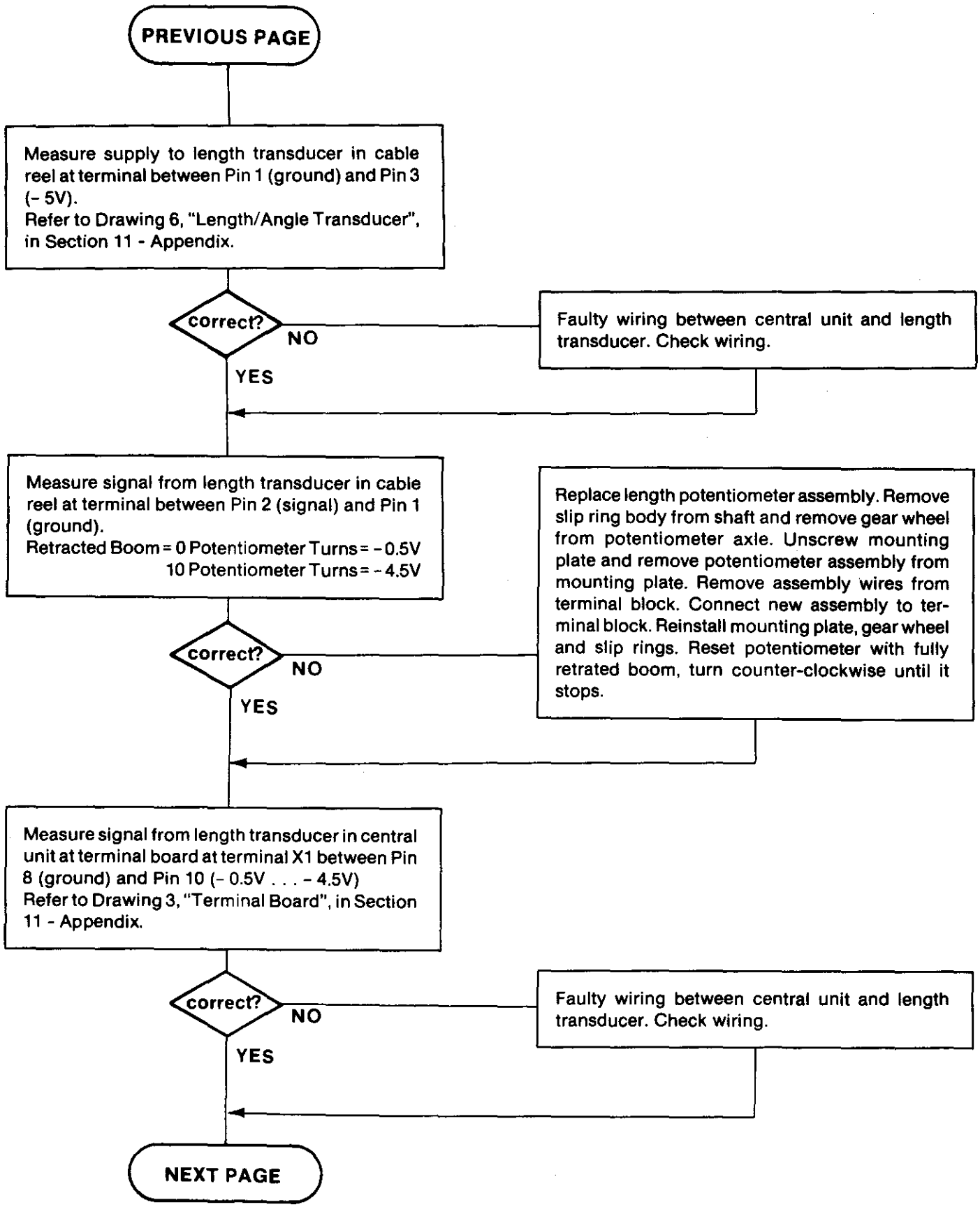

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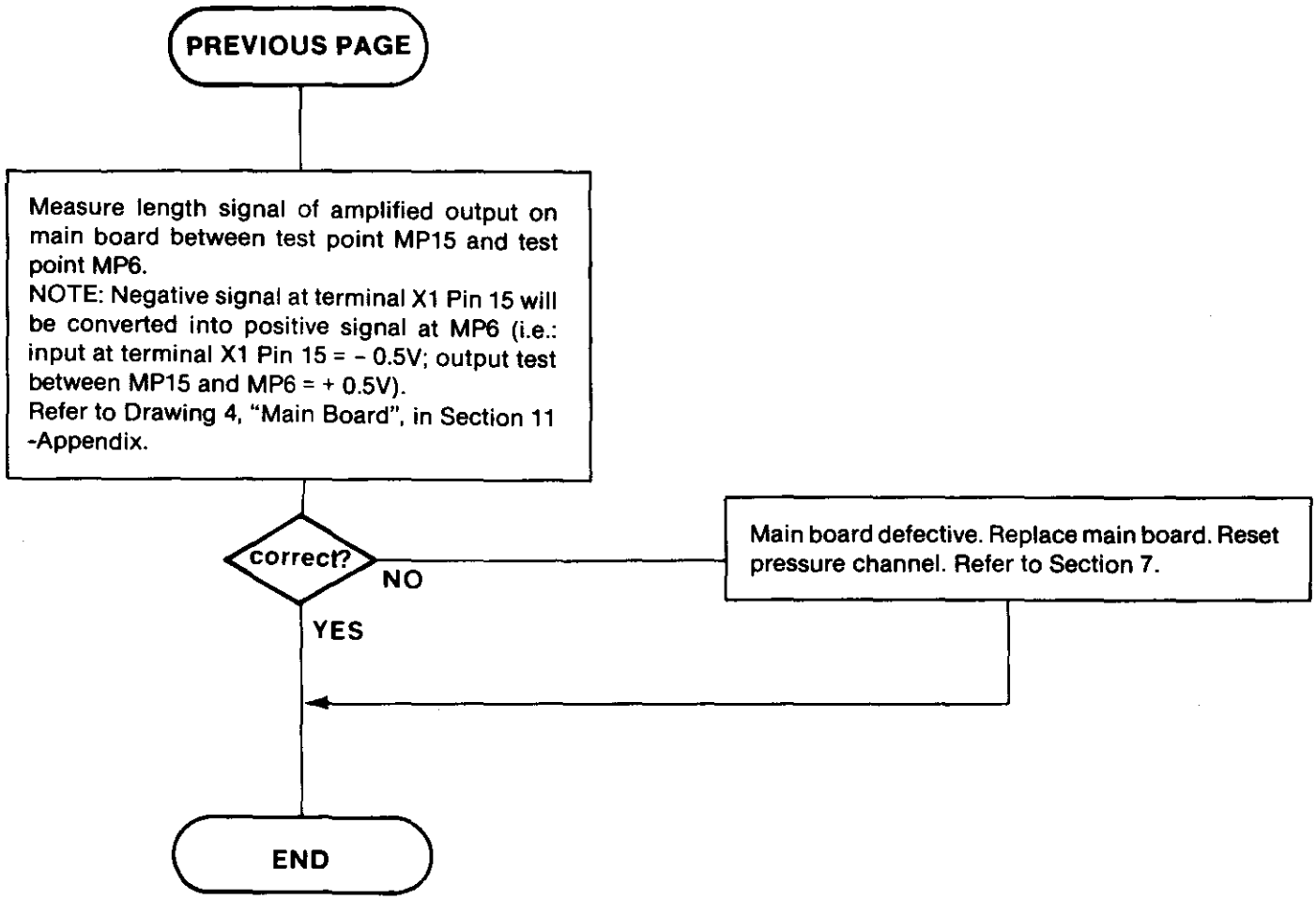

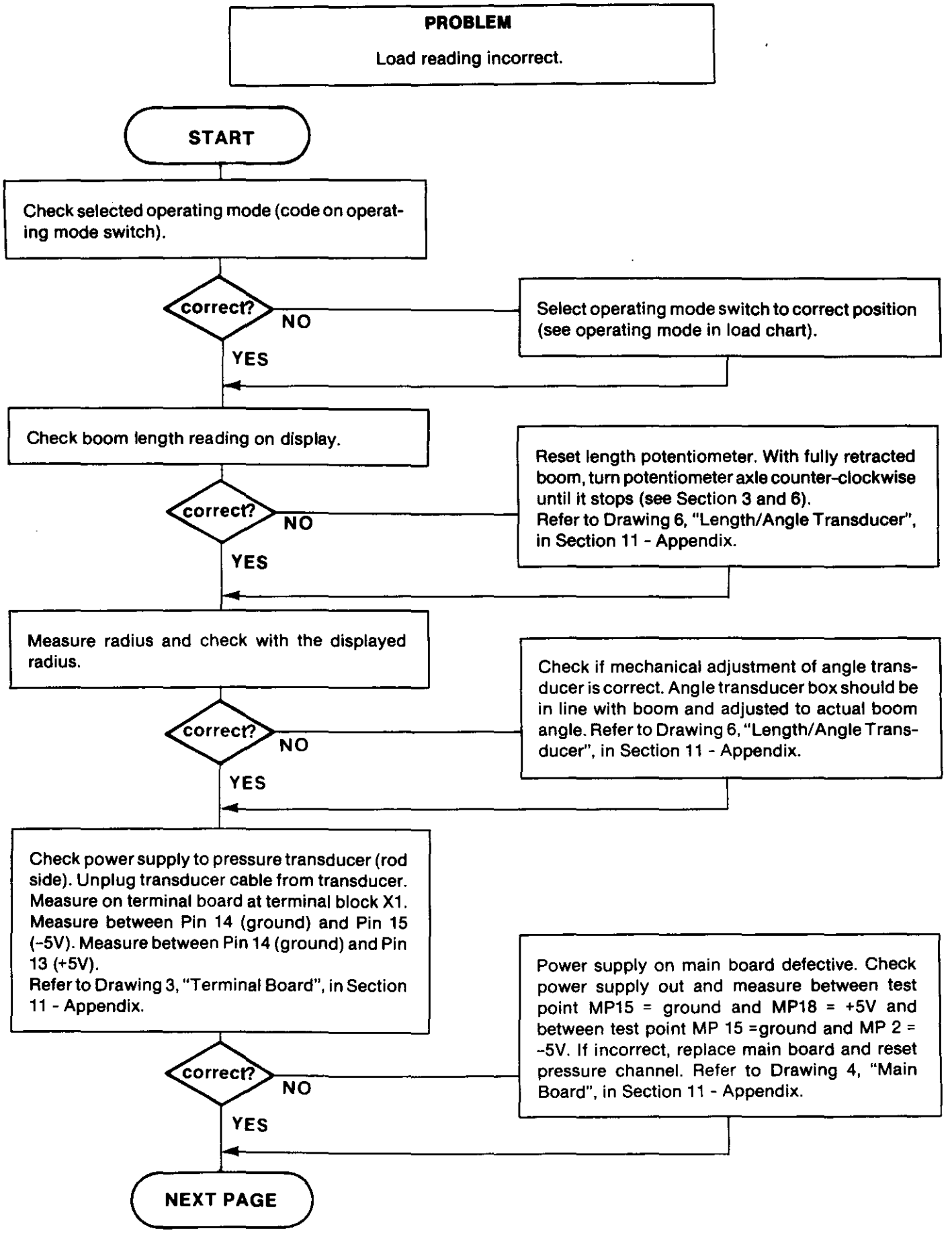
PROBLEM
Load reading incorrect.
START
Check selected operating mode (code on operating mode switch).
correct?
NO
Select operating mode switch to correct position (see operating mode in load chart).
YES
Check boom length reading on display.
correct?
NO
Reset length potentiometer. With fully retracted boom, turn potentiometer axle counter-clockwise until it stops (see Section 3 and 6).
Refer to Drawing 6, "Length/Angle Transducer", in Section 11 - Appendix.
YES
Measure radius and check with the displayed radius.
correct?
NO
Check if mechanical adjustment of angle transducer is correct. Angle transducer box should be in line with boom and adjusted to actual boom angle. Refer to Drawing 6, "Length/Angle Transducer", in Section 11 - Appendix.
YES
Check power supply to pressure transducer (rod side). Unplug transducer cable from transducer. Measure on terminal board at terminal block X1. Measure between Pin 14 (ground) and Pin 15 (-5V). Measure between Pin 14 (ground) and Pin 13 (+5V).
Refer to Drawing 3, "Terminal Board", in Section 11 - Appendix.
correct?
NO
Power supply on main board defective. Check power supply out and measure between test point MP15 = ground and MP18 = +5V and between test point MP 15 =ground and MP 2 = -5V. If incorrect, replace main board and reset pressure channel. Refer to Drawing 4, "Main Board", in Section 11 - Appendix.
YES
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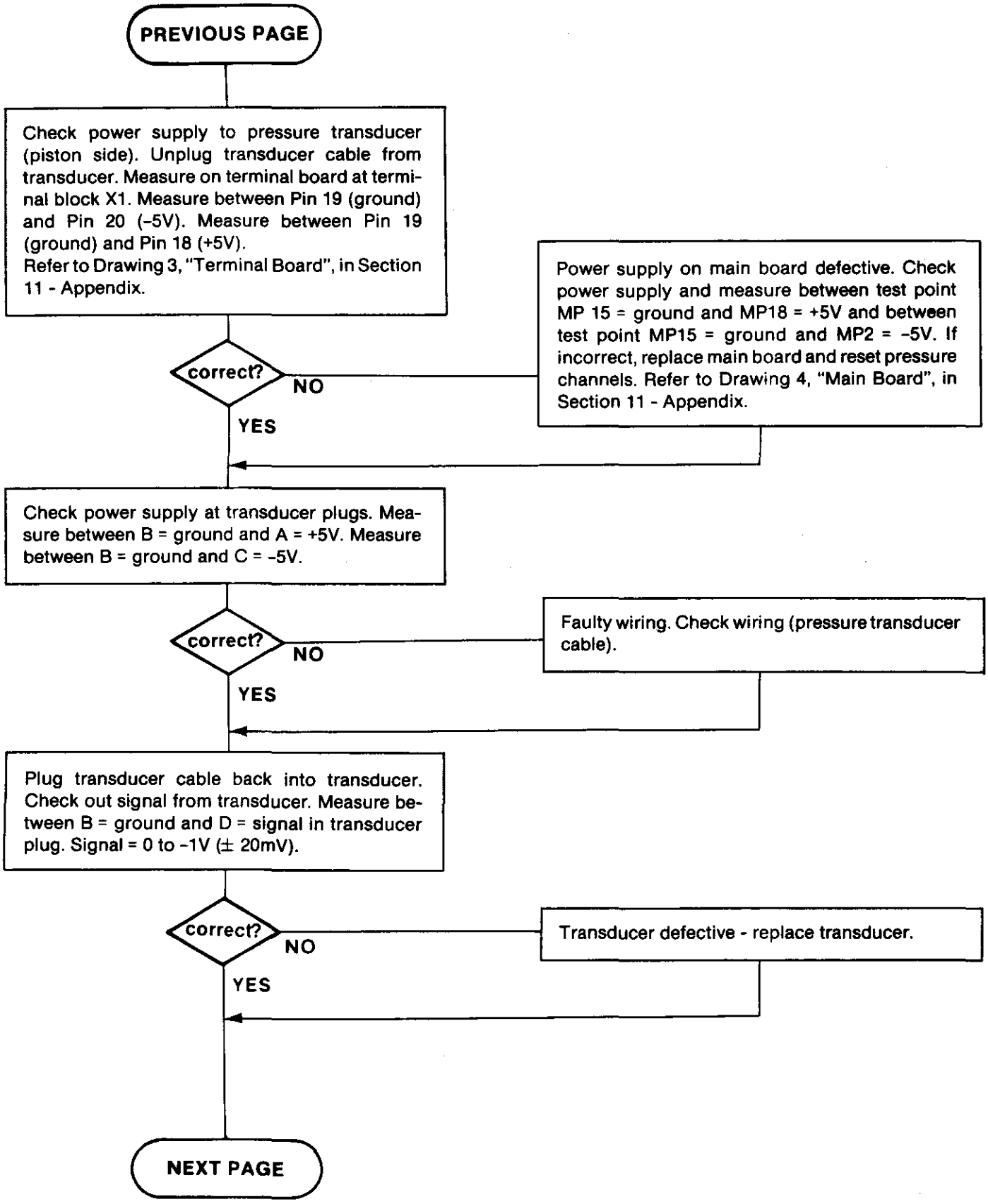

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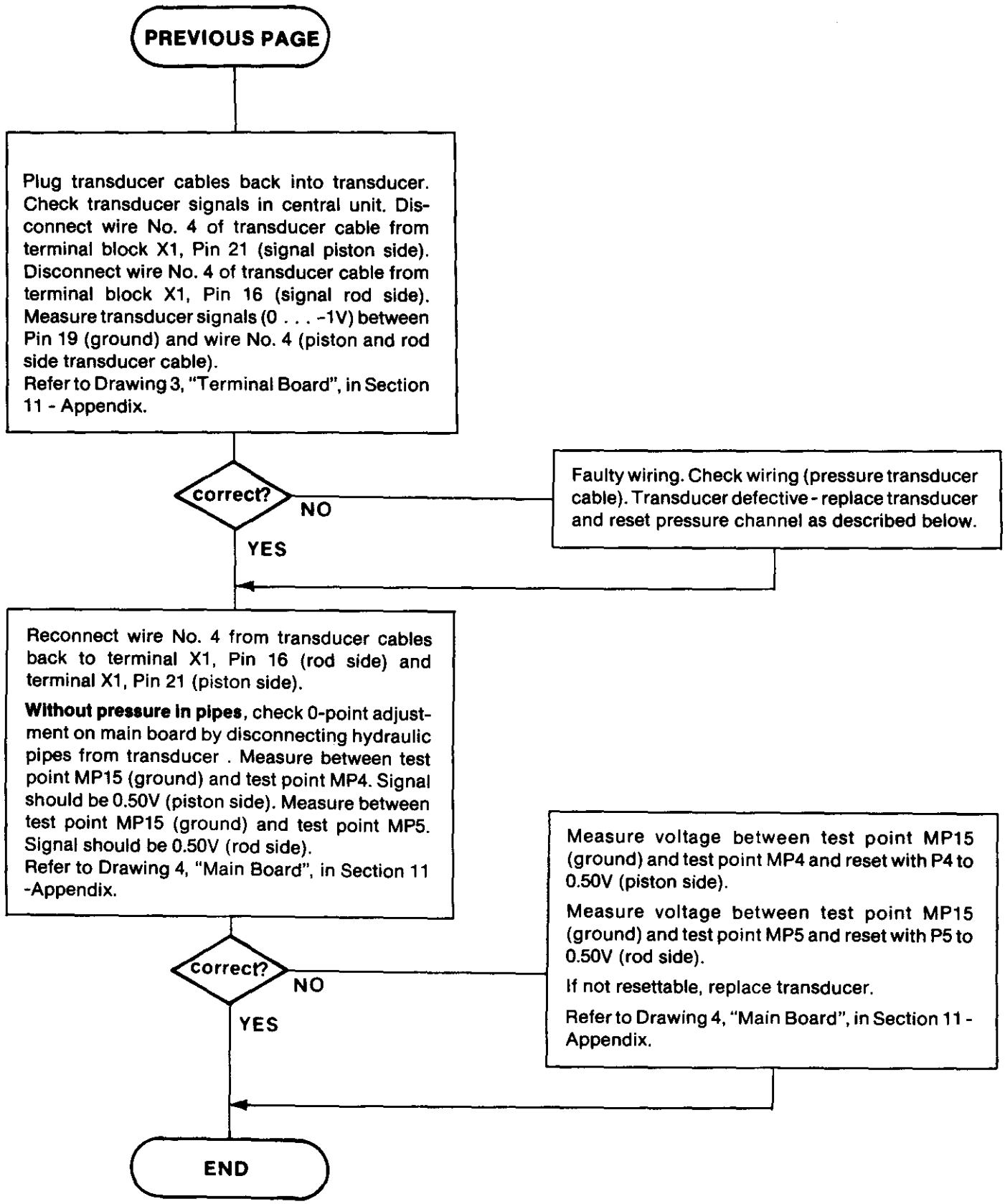
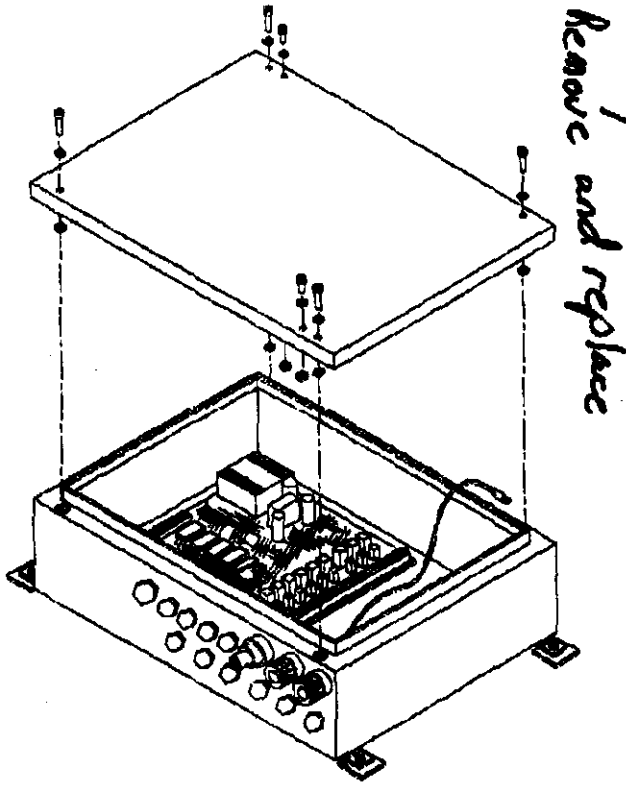
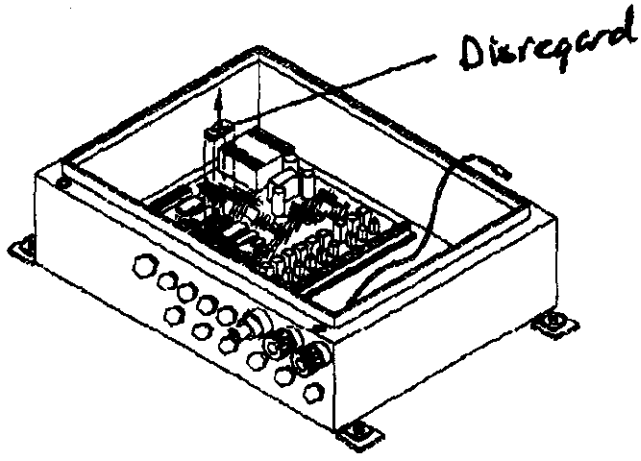


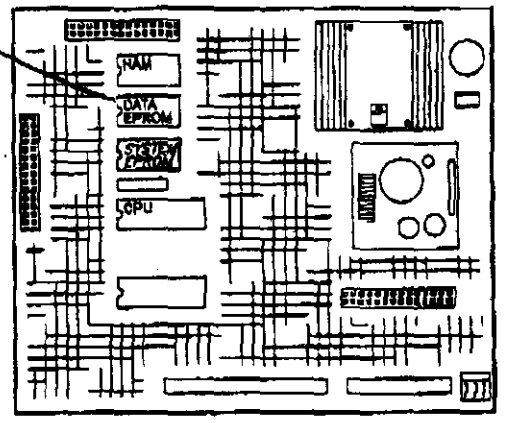
REV	ERN	DESCRIPTION	DATE



1. Remove cover, from central unit.

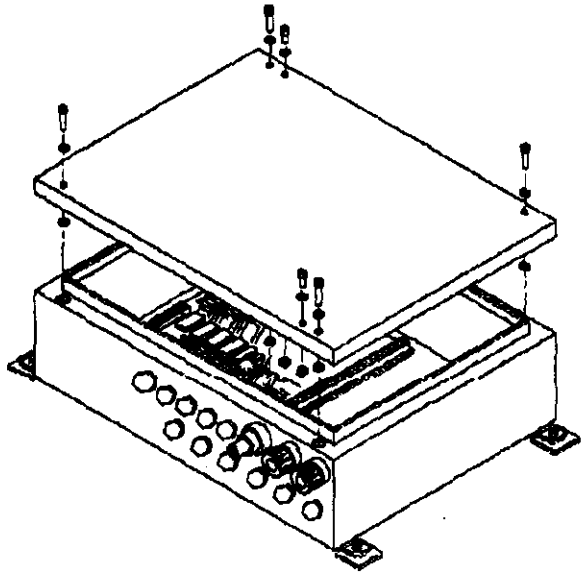


2. CAUTION: Discharge any static electricity, from your body, before handling the EPROM. The EPROM could be damaged, if this procedure, is not followed. Remove the old [redacted] EPROM, from the main board. Be careful to pull the EPROM out, without bending the legs. Refer to drawing above.



3. Carefully align the new EPROM, with the socket and push the EPROM, into the socket. Be careful not to bend any of the legs. Refer to drawing.

NOTE: The correct orientation, of the EPROM, is determinned, by the notch, on the end, of the EPROM. The new EPROM should be placed, in the direction, of the other chips, on the board.



4. Reinstall cover and tighten screws, making sure the rubber gasket, is positioned correctly, to prevent any moisture, from entering the central unit.

C.A.G.E. 79760

REV.	DESCRIPTION	DATE	NAME

	DATE	NAME
ENG. APP.	4/28/97	RLE
APPVD.		

SCALE NTS | PAGE 1 OF 1

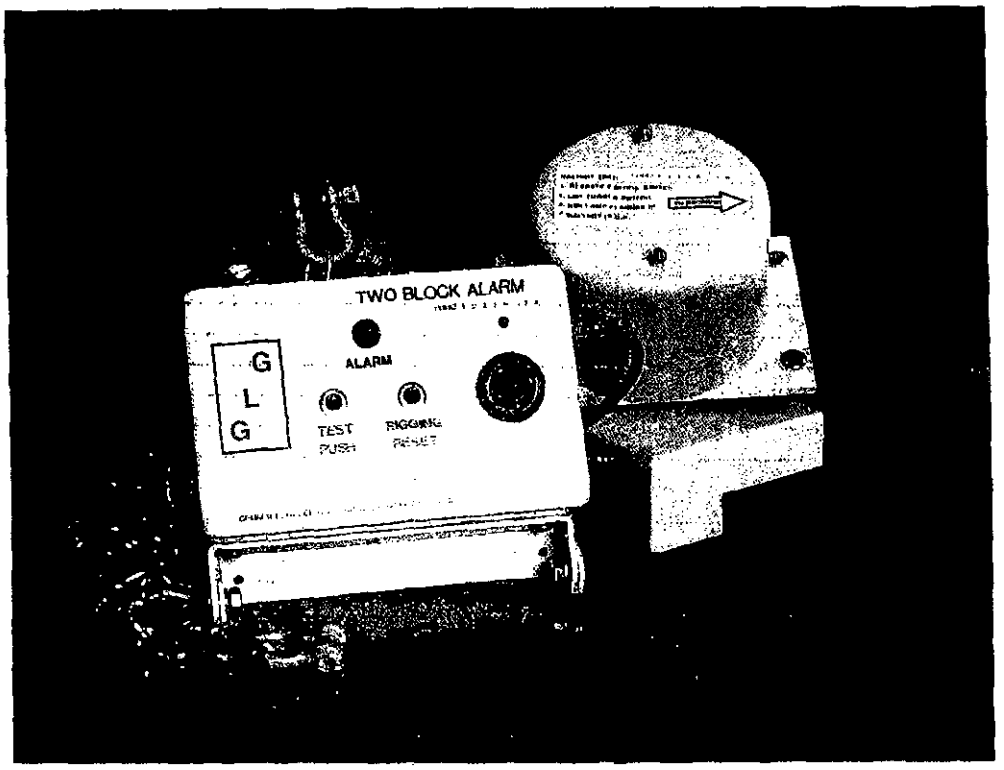
MATERIAL

DS 350
SYSTEM EPROM INSTALLATION

PAT EQUIPMENT CORPORATION
1865 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

F00015-5

RADIO ANTI TWO BLOCK ALARM
MODEL BB-550



RECEIVER CONTROL PANEL

SYSTEM FEATURES:

- Boom head transmitter radios coded two block signal to cab.
- 200 digitally coded signals allow many cranes on one site.
- Space age batteries and circuitry for exceptionally long life.
- Batteries field replaceable with common hand tools.
- Built-in battery test.
- No cables, sliprings, or cables to boom head required.
- Jib and rooster head switches do not require extra transmitters.
- Simultaneous protection of main and whip lines with one transmitter.
- All parts completely sealed against rain and moisture.
- 10 ampere motion-cut output for optional motion-cut solenoids.
- Transmitter, switch and receiver installed in one hour or less.
- Radio link anti two block system patented.

- **Excellent Serviceability.** We take pride in our service - it's the best reason to buy our products Working with our people over the phone, your mechanic can use simple, built-in diagnostics onboard the system to locate the cause of almost any difficulty during one phone call. If your mechanic can't fix it, our repair, parts and service department are available.

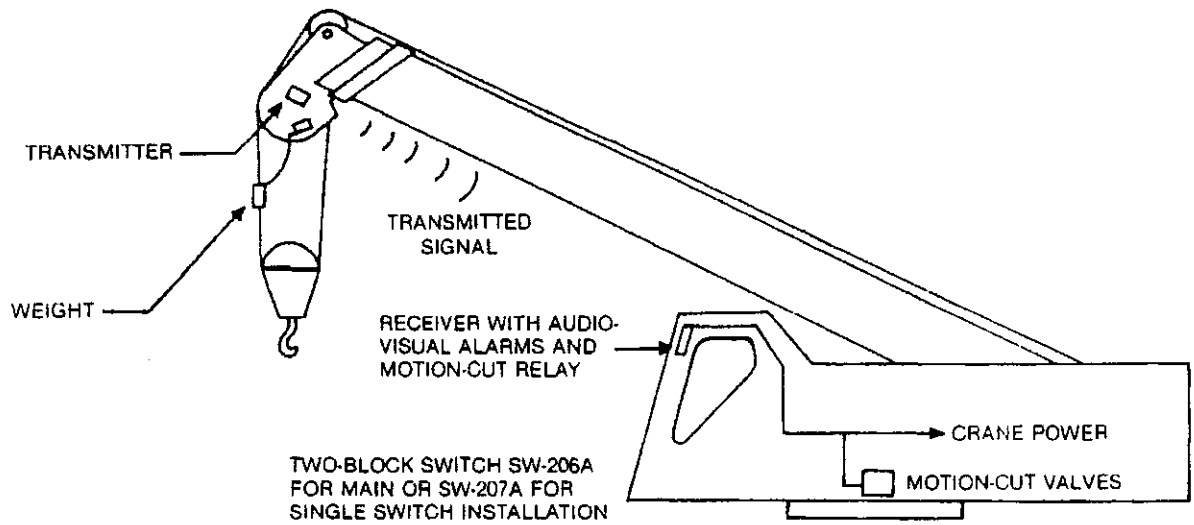
GREER COMPANY
1918 E. Glenwood Place
Santa Ana, California 92705

(714) 259-9702
fax (714) 259-7626

SPECIFICATIONS:

TRANSMITTER FEATURES:

* Sealed against all weather conditions
* Transmits pulsing signal for more commanding alarm
* Sends unique coded signal which trips only its own receiver
* Automatic shut off after 2 plus minutes in two-block to save the battery
* Miniature toggle switch lights LED to show battery charge
* Battery field-replaceable without loss of weather seals



RECEIVER FEATURES:

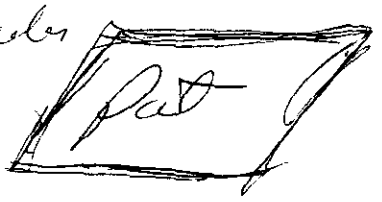
* Automatically releases motion-cut when alarm stops
* Holding rigging switch overrides motion-cut during alarm
* Test switch checks alarm lamp, horn, and motion-cut
* Case only 5 in. x 7 in. x 2 in.

SWITCH FEATURES:

* Gravity operated, no springs to break
* Electrical components completely weather-sealed
* Can be connected together for multiple switch operation

40 CWR 2 to 3 weeks

18 wheeler



Benson Arizona

281 - 745 - 0847
888 495 9238

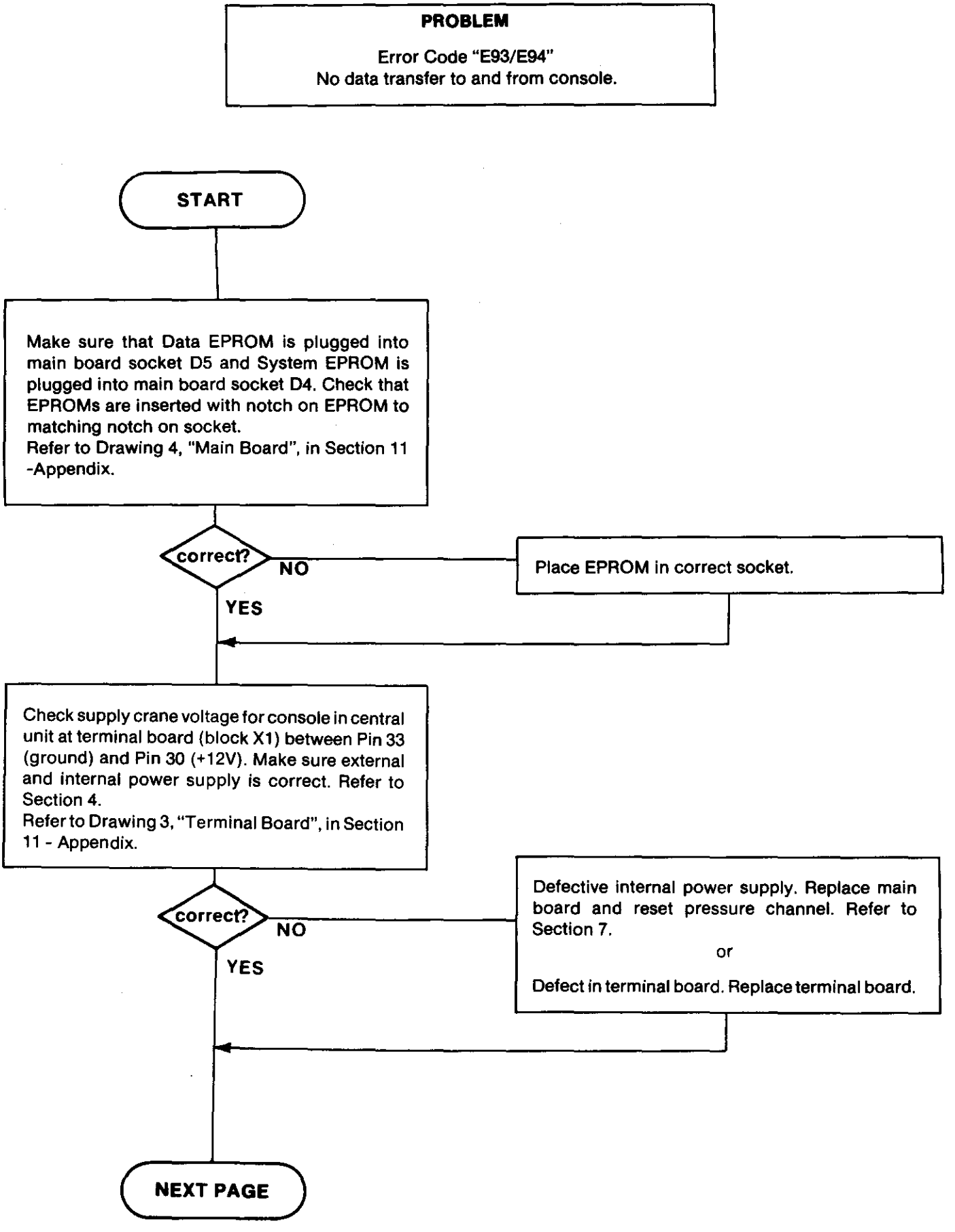
619
298
2354

SAUL

Keith Dayley

ANTI TWO BLOCK SWITCH
LL-3858-59

6697


PROBLEM
Error Code "E93/E94"
No data transfer to and from console.
START
Make sure that Data EPROM is plugged into main board socket D5 and System EPROM is plugged into main board socket D4. Check that EPROMs are inserted with notch on EPROM to matching notch on socket.
Refer to Drawing 4, "Main Board", in Section 11 -Appendix.
correct?
NO
Place EPROM in correct socket.
YES
Check supply crane voltage for console in central unit at terminal board (block X1) between Pin 33 (ground) and Pin 30 (+12V). Make sure external and internal power supply is correct. Refer to Section 4.
Refer to Drawing 3, "Terminal Board", in Section 11 - Appendix.
correct?
NO
Defective internal power supply. Replace main board and reset pressure channel. Refer to Section 7.
or
Defect in terminal board. Replace terminal board.
YES
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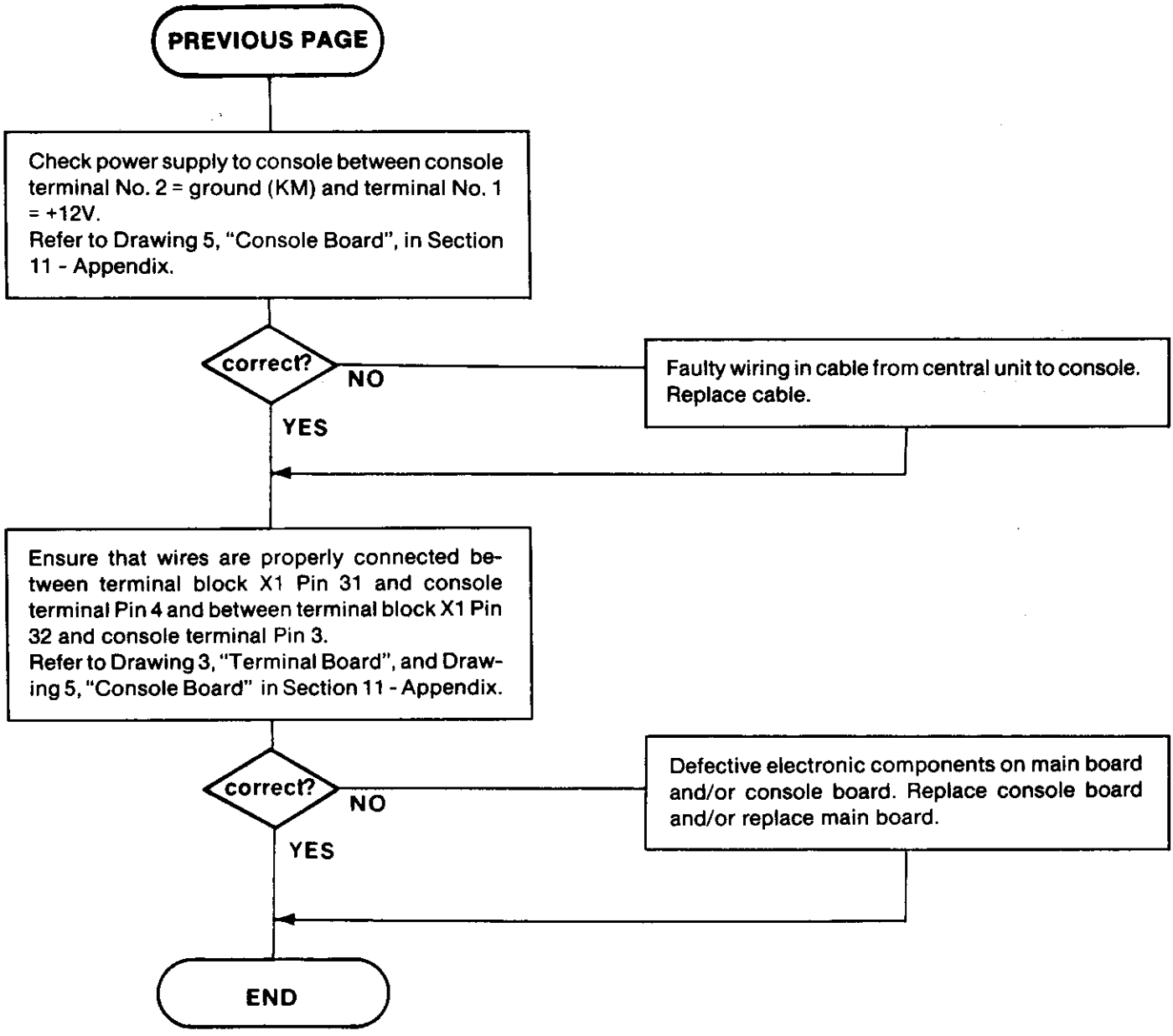
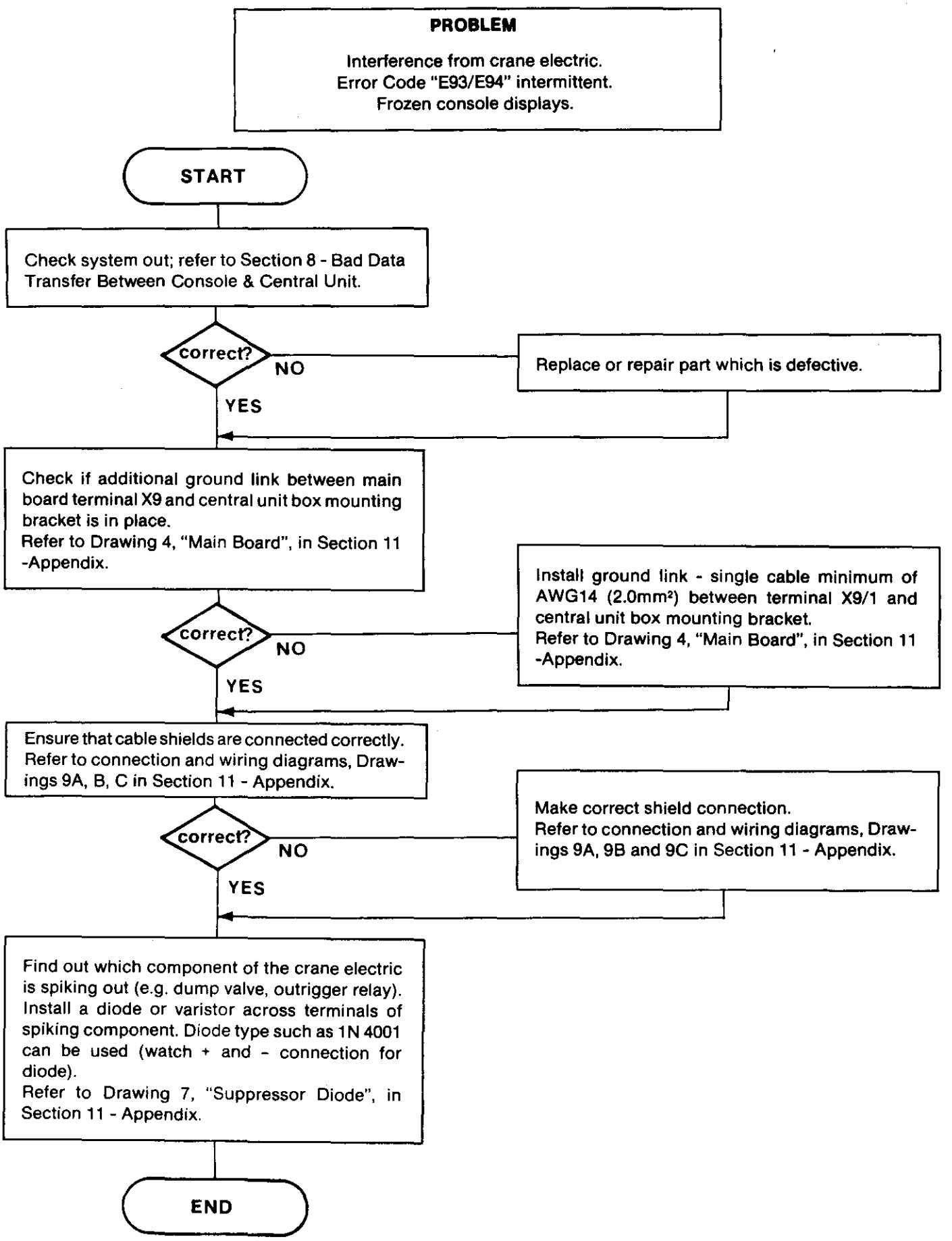



PROBLEM
Interference from crane electric.
Error Code "E93/E94" intermittent.
Frozen console displays.
START
Check system out; refer to Section 8 - Bad Data Transfer Between Console & Central Unit.
correct?
NO
Replace or repair part which is defective.
YES
Check if additional ground link between main board terminal X9 and central unit box mounting bracket is in place.
Refer to Drawing 4, "Main Board", in Section 11 -Appendix.
correct?
NO
Install ground link - single cable minimum of AWG14 (2.0mm²) between terminal X9/1 and central unit box mounting bracket.
Refer to Drawing 4, "Main Board", in Section 11 -Appendix.
YES
Ensure that cable shields are connected correctly.
Refer to connection and wiring diagrams, Drawings 9A, B, C in Section 11 - Appendix.
correct?
NO
Make correct shield connection.
Refer to connection and wiring diagrams, Drawings 9A, 9B and 9C in Section 11 - Appendix.
YES
Find out which component of the crane electric is spiking out (e.g. dump valve, outrigger relay).
Install a diode or varistor across terminals of spiking component. Diode type such as 1N 4001 can be used (watch + and - connection for diode).
Refer to Drawing 7, "Suppressor Diode", in Section 11 - Appendix.
END

PROBLEM

Error code displayed.
Lever lockout activated.
Warning lights on.

ERROR DISPLAY	ERROR	CAUSE	ACTION
E 01	Below radius or above angle range	Fallen below the minimum radius or above the angle given in the load chart due to raising the boom too far.	Lower boom back to a radius or angle given in the load chart.
E 02	Beyond radius or below angle range	The maximum radius or minimum angle given in the load chart was exceeded due to lowering the boom too far.	Raise boom back to a radius or angle given in the load chart.
E 03	Prohibited slewing range (no load area)	Slewring range prohibited with load.	Slew back into admissible range.
E 04	Operating mode not available	Operating mode switch in the console set incorrectly. Operating mode is not permissible with actual crane configuration.	Set operating mode switch correctly to the code assigned to the operating mode of the crane.
E 05	Length range not permitted	Boom was telescoped too far or not far enough.	Telescope boom to correct length given in the load chart.
		Length sensor adjustment changed; i.e. length sensor cable slid off the cable drum.	See Section No. 6
E 06	Fallen below angle range with luffing jib operation.	Fallen below the minimum jib angle specified in the respective load chart due to luffing out the jib too far.	Luff in the jib to a radius or angle specified in the load chart.
E 07	No acknowledgement signal from overload relay (K1).	Overload relay is stuck, defective or not being selected.	Replace relay. See Section No. 4.
E 08	No acknowledgement signal from Anti-Two-Block switch relay (K2).	Anti-Two-Block switch relay is defective or not being selected.	Replace relay. See Section No. 5.

ERROR DISPLAY	ERROR	CAUSE	ACTION
E 11	Fallen below lower limiting value for the measuring channel "length".	Cable from central unit to length sensor defective.	Check cable. Replace if necessary. See Section No. 6.
		Length potentiometer defective.	Replace and reset length potentiometer. See Section 6.
		Electronic component in the measuring channel defective on main board.	Replace main board and reset pressure channels. See Section No. 7
E 12	Fallen below lower limiting value for the measuring channel "pressure piston side".	Cable from central unit to the pressure transducer defective, loose or water in the plug.	Check cable as well as plug. Replace if necessary. See Section No. 7.
		Pressure transducer on piston side defective.	Replace pressure transducer and reset pressure channel. See Section No. 7.
		Electronic component in the measuring channel defective on main board.	Replace main board and reset pressure channels. See Section No. 7.
E 13	Fallen below lower limiting value for the measuring channel "pressure rod side".	Cable from central unit to the pressure transducer defective, loose or water in in the plug.	Check cable as well as plug. Replace if necessary. See Section No. 7.
		Pressure transducer on rod side defective.	Replace pressure transducer and reset pressure channel. See Section No. 7.
		Electronic component in the measuring channel defective on main board.	Replace main board and reset pressure channels. See Section No. 7.
E 14	Fallen below upper limit value in measuring channel "Force".	Cable from central unit to force measuring point defective or water inside the plugs.	Check cable as well as plugs, replace if need be.
		Force transducer defective.	Replace force transducer.
		Electronic component in the measuring channel defective.	Replace main board and reset pressure channels. See Section No. 7.

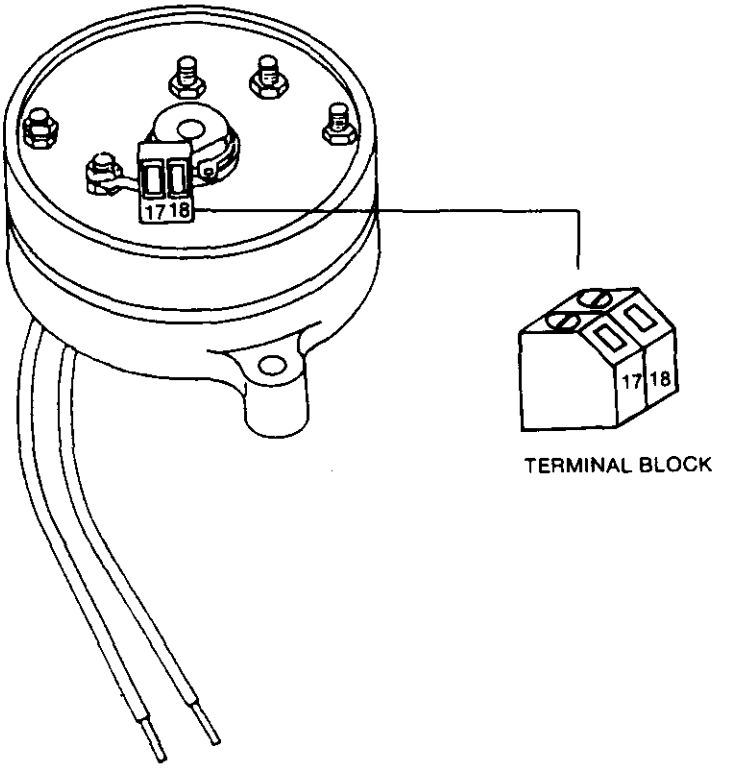
ERROR DISPLAY	ERROR	CAUSE	ACTION
E 15	Fallen below lower limiting value for the measuring channel "angle main boom".	Cable from central unit to the length/angle sensor defective or loose.	Check cable. Replace if necessary. See Section No. 6
		Angle sensor defective.	Replace angle sensor. and reset adjustment.
		Electronic component in the measuring channel defective.	Replace main board and reset pressure channels. See Section No. 7.
E 16	Fallen below lower limit value for measuring channel "Luffing Jib Angle".	Cable from central unit to angle sensor defective or disconnected or water inside the plug.	Check cable as well as plug, replace if need be.
		Angle sensor defective.	Replace angle sensor.
		Electronic component in the measuring channel defective.	Replace main board and reset pressure channels. See Section No. 7.
E 19	Error in the reference voltage.	Electronic component on the main board defective.	Replace main board and reset pressure channels. See Section No. 7.
E 21	Upper limiting value for the measuring channel "length" exceeded.	Cable from central unit to the length/angle sensor defective or loose.	Check cable. Replace if necessary. See Section No. 6.
		Length potentiometer defective.	Replace and reset length potentiometer.
		Electronic component in the measuring channel defective on main board.	Replace main board and reset pressure channels. See Section No. 7.
E 22	Upper limiting value for the measuring channel "pressure piston side" exceeded.	Cable from central unit to the pressure transducer defective, loose or water in the plug.	Check cable as well as plug. Replace if necessary. See Section No. 7.
		Pressure transducer on piston side defective.	Replace pressure transducer and reset pressure channels. See Section No. 7.
		Electronic component in the measuring channel defective on main board.	Replace main board and reset pressure channels. See Section No. 7.

ERROR DISPLAY	ERROR	CAUSE	ACTION
E 23	Upper limiting value for the measuring channel "pressure rod side" exceeded.	Cable from central unit to the pressure transducer defective, loose or water in the plug.	Check cable as well as plug. Replace if necessary. See Section No. 7.
		Pressure transducer on rod side defective.	Replace pressure transducer and reset pressure channels. See Section No. 7.
		Electronic component in the measuring channel defective. on main board.	Replace main board and reset pressure channels. See Section No. 7.
E 24	Upper limit value in measuring channel "Force" exceeded.	Cable between central unit and force measuring point defective or water inside the plug.	Check cable as well as plug, replace if need be.
		Force sensor defective.	Replace force sensor.
		Electronic component in the measuring channel defective.	Replace main board and reset pressure channels. See Section No. 7.
E 25	Upper limiting value for the measuring channel "angle main boom" exceeded.	Cable from central unit to the length/angle sensor defective or loose.	Check cable. Replace if necessary. See Section No. 6.
		Angle sensor defective.	Replace angle sensor and reset mechanical adjustment.
		Electronic component in the measuring channel defective on main board.	Replace main board and reset pressure channels. See Section No. 7.
E 26	Upper limit value for measuring channel "Luffing Jib Angle" exceeded.	See Error E 16.	See Error E 16.
E 29	Error in the reference voltage.	Electronic component on the main board defective.	Replace main board and reset pressure channels. See Section No. 7.
E 31	Error in system program.	EPROM with system program defective.	Replace EPROM with system program.

ERROR DISPLAY	ERROR	CAUSE	ACTION
E 38	Incorrect system program.	CPU is equipped with an incorrect version of system program.	Equip main board with correct version of system EPROM.
E 41	Error in the external RAM.	RAM in the CPU on the main board defective.	Replace CPU Chip No. 80C31. Replace main board and reset pressure channels. See Section No. 7.
E 42	Error in the external write/ read memory (RAM).	Internal defect in digital part of CPU.	Exchange write/read memory (CMOS-RAM). Replace main board and reset pressure channels. See Section No. 7.
E 45	Error in internal communications.	Defective electronic component.	Replace main board and reset pressure channels. See Section 7.
E 47	Malfunction in the monitored write/read memory.	Internal defect in in digital part of CPU	Replace main board and reset pressure channels. See Section No. 7.
E 51	Error in data memory.	Data EPROM on the main board defective.	Replace Data EPROM. Make sure BR3 on the main board is installed. See Drawing 4 in Section 11.
E 91	No data transmission from console to central unit. (See Section 8 and 9)	12V supply of console interrupted.	Check 12V at terminal X1 of console electronics.
		Interruption or accidental ground in the line from console electronics to central unit.	Check the connection between console electronics and central unit. If you find an accidental ground, the transmitter module in the console electronics can be damaged. You should, therefore, replace the console electronics.
		Transmitter/receiver module defective.	Replace console electronics or main board respectively.

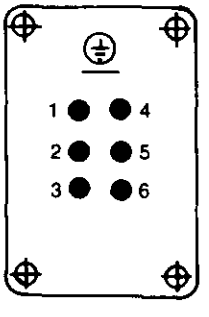
ERROR DISPLAY	ERROR	CAUSE	ACTION
E 92	Error in the data transmission from console to central unit. (See Section 8 and 9)	Defective data line from console electronics to central unit.	Check the connection between console electronics and central unit.
		Transmitter/receiver module defective.	Replace console electronics or main board respectively.
E 93	Error in the data transmission from central unit to console. (See Section 8 and 9)	Defective contact in the line from central unit to console.	Check the line to the console.
		Transmitter/receiver module defective.	Replace console electronics or main board respectively.
E 94	No data transmission from central unit to console. (See Section 8 and 9)	Interruption or accidental ground in the data line from central unit to console.	Check the line to the console (in case of accidental ground also replace console electronics).
		5V supply for the computer in the central unit is missing.	Check the connection to the power supply.
		5V supply voltage too low.	Replace power supply module.
		Transmitter/receiver module defective.	Replace console electronics or main board respectively.
		Data EPROM defective.	Check data PROM.
		Computer module defective.	Replace main board.
		Electromagnetic interferences (e.g. when switching contactors or valves).	Eliminate interference source by inverse diodes or varistors.

Drawing 1 - SLIP RING UNIT

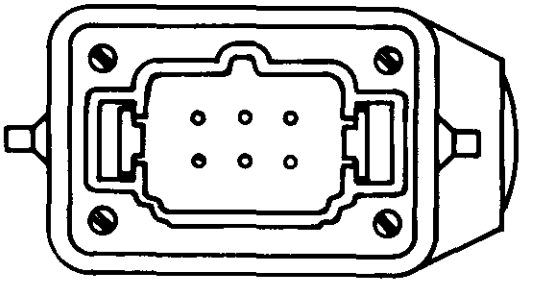


TERMINAL BLOCK

Drawing 2 - ANTI-TWO-BLOCK JUNCTION

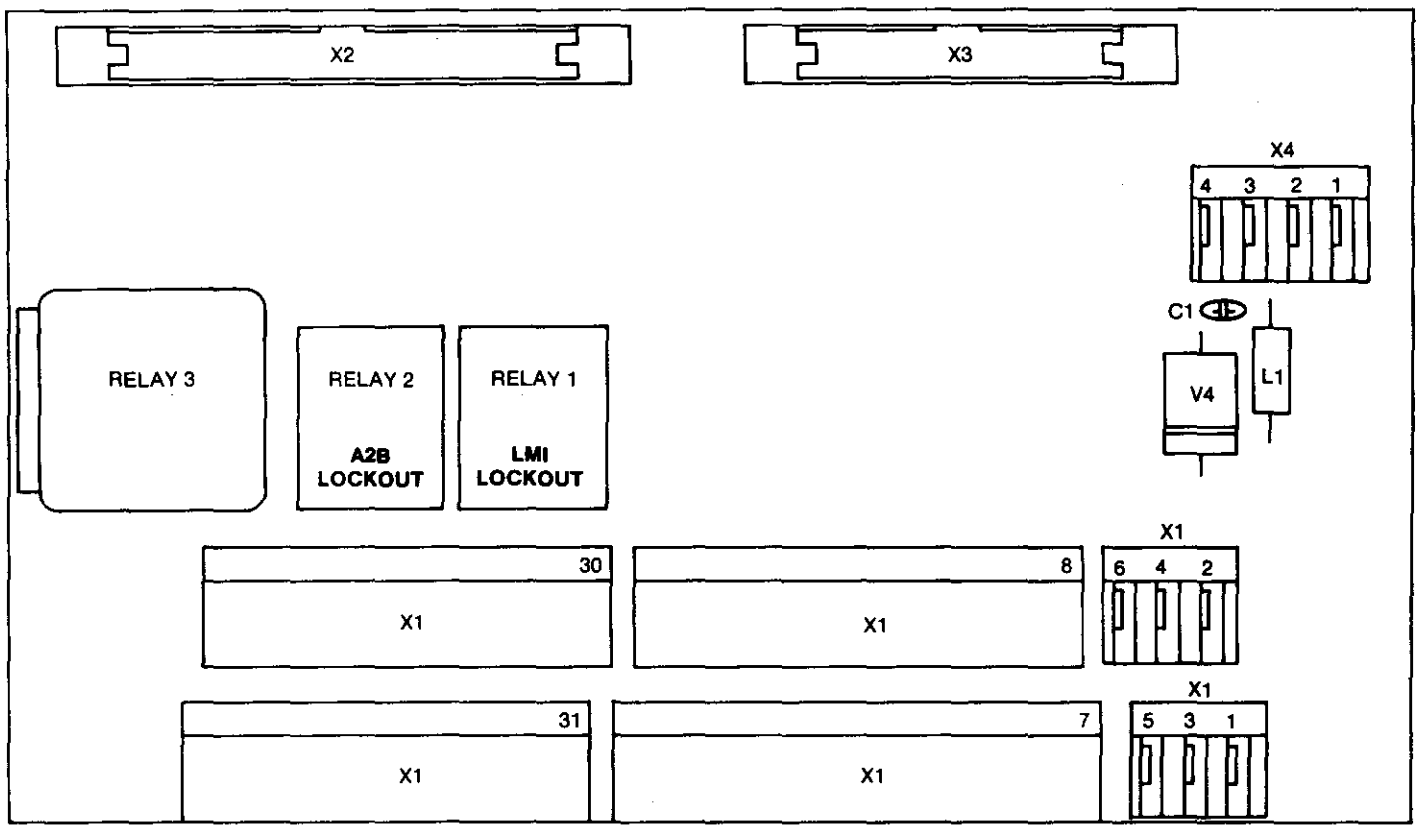


PINS IN JUNCTION BOX
(View From Cable Side)

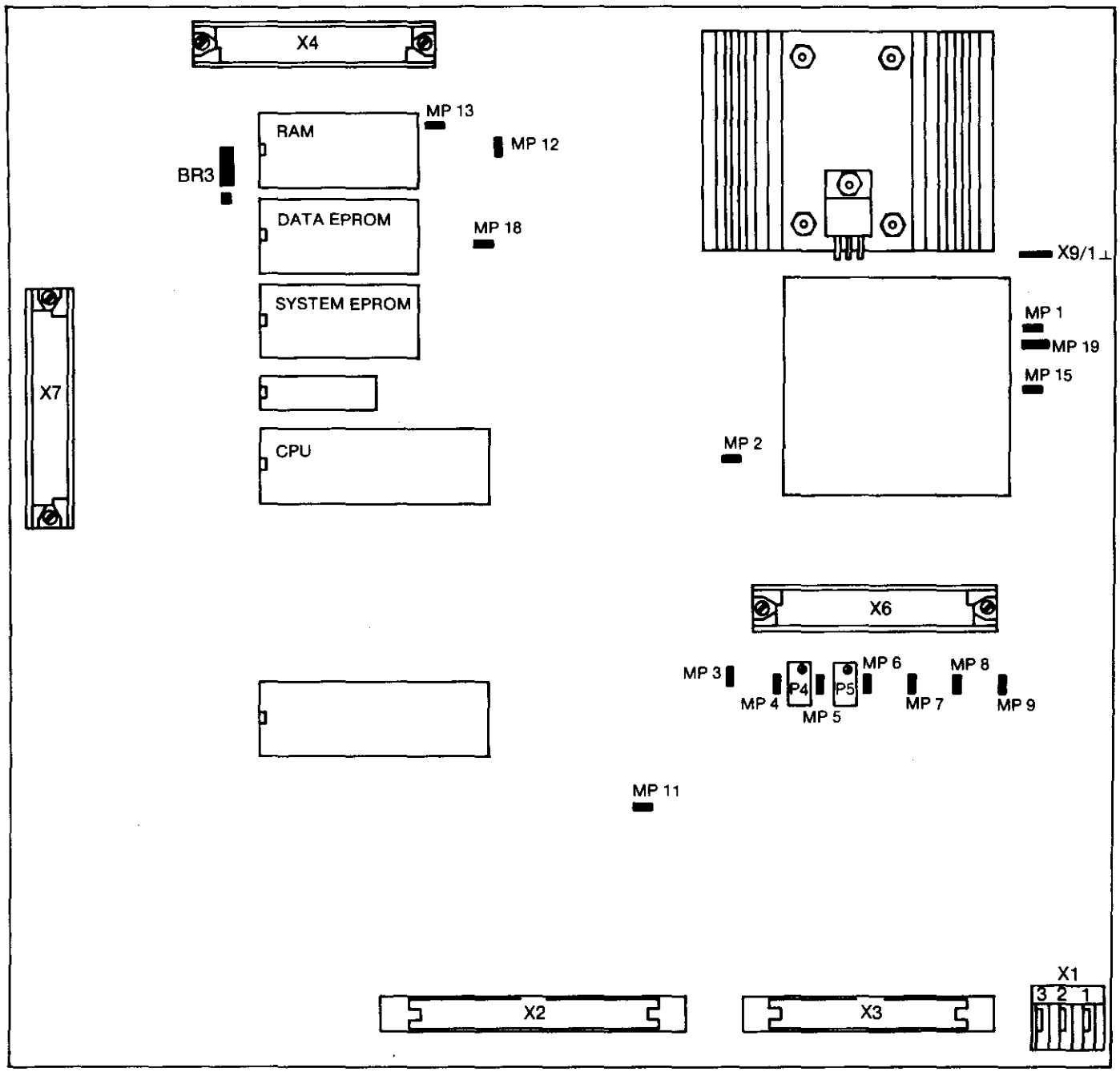


DUMMY PLUG WITH RESISTOR 4700 OHM
BETWEEN PIN 1 AND GROUND PIN

Drawing 3 - TERMINAL BOARD



Drawing 4 - MAIN BOARD



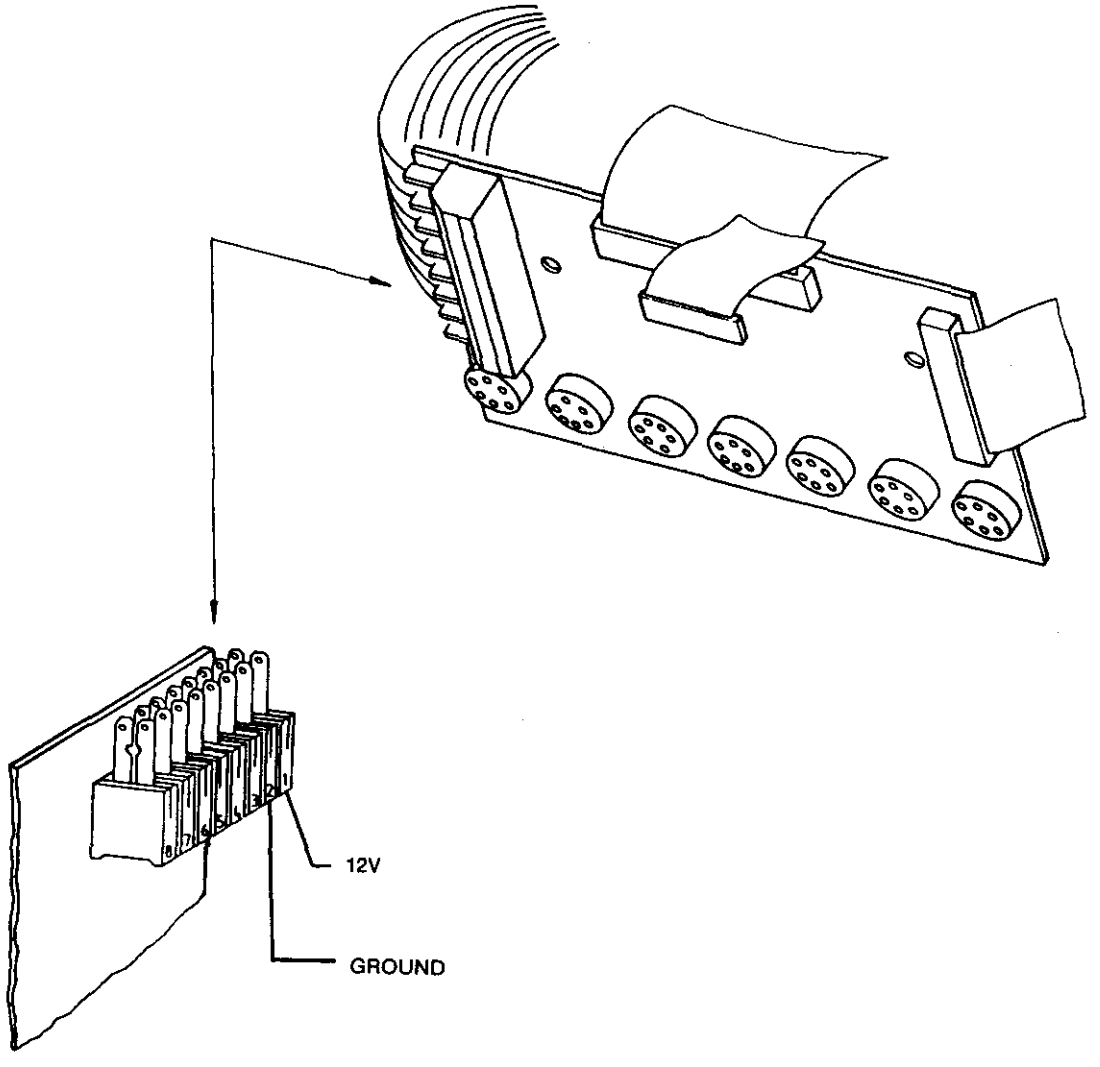
Power Supply Test Points

MP 1 = + 5V
MP 2 = - 5V
MP 11 = Ground
MP 12 = + 5V
MP 13 = Digital Ground
MP 15 = Analog Ground
MP 19 = - 5V

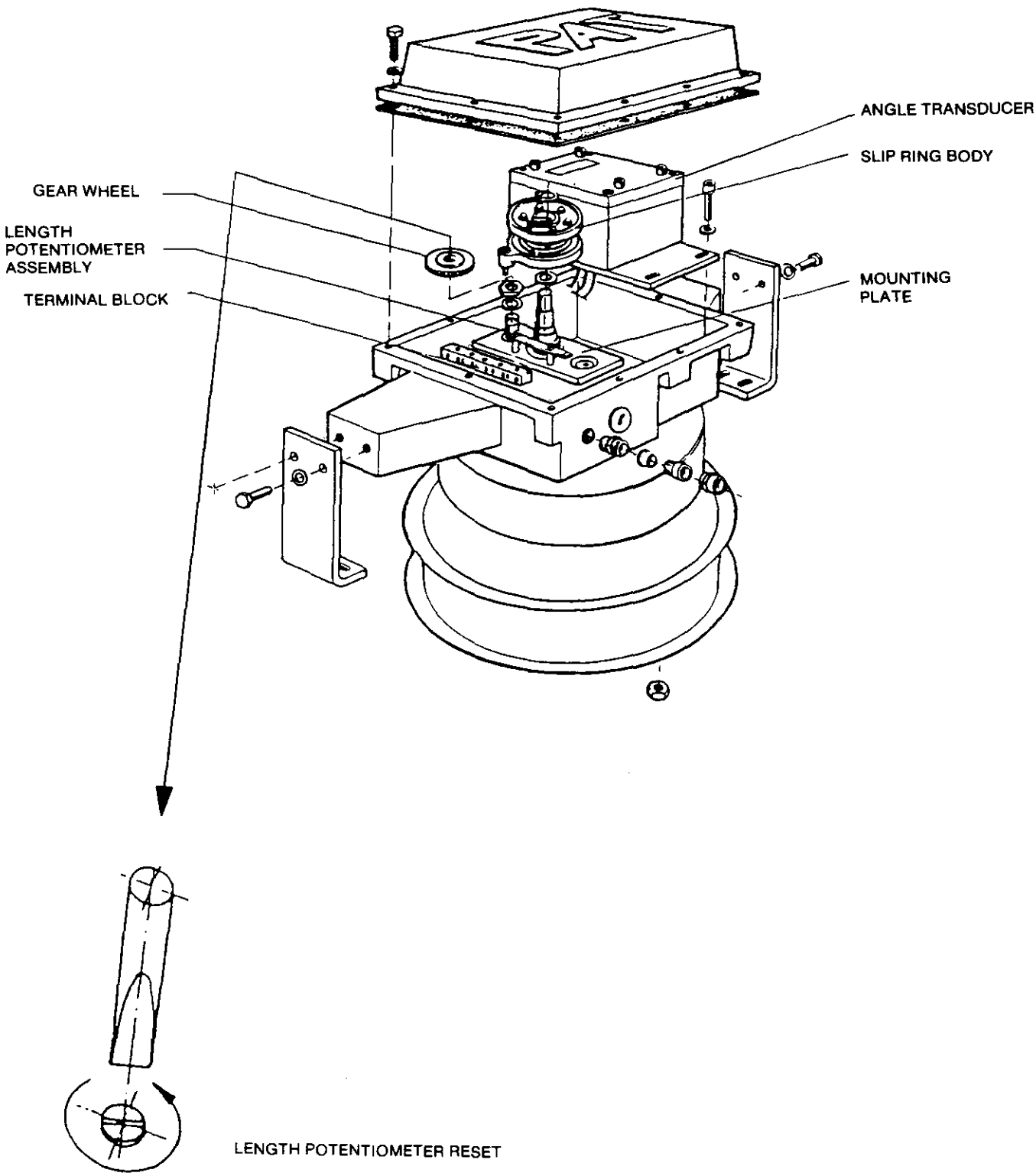
Analog Measuring Channels/Test Points

Ch. 1 Boom Length — MP 6/P6 - Do Not Adjust
Ch. 2 Piston Pressure — MP 4/P4
Ch. 3 Rod Pressure — MP 5/P5
Ch. 4 Force Transducer — MP 3/P3 - Do Not Adjust
Ch. 5 Boom Angle — MP 8/P8 - Do Not Adjust
Ch. 6 Jib Angle — MP 9/P9 - Do Not Adjust

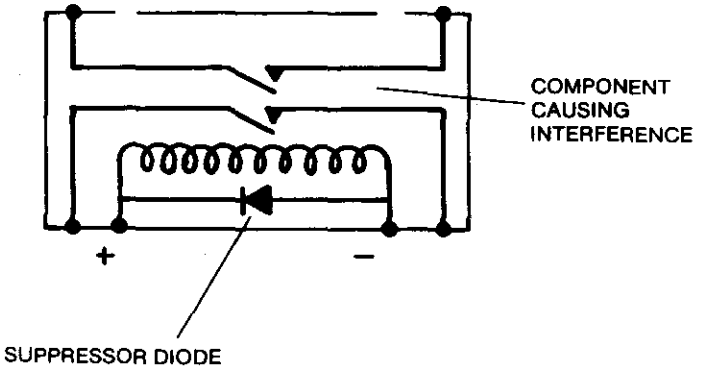
Drawing 5 - CONSOLE BOARD



Drawing 6 - LENGTH/ANGLE TRANSDUCER

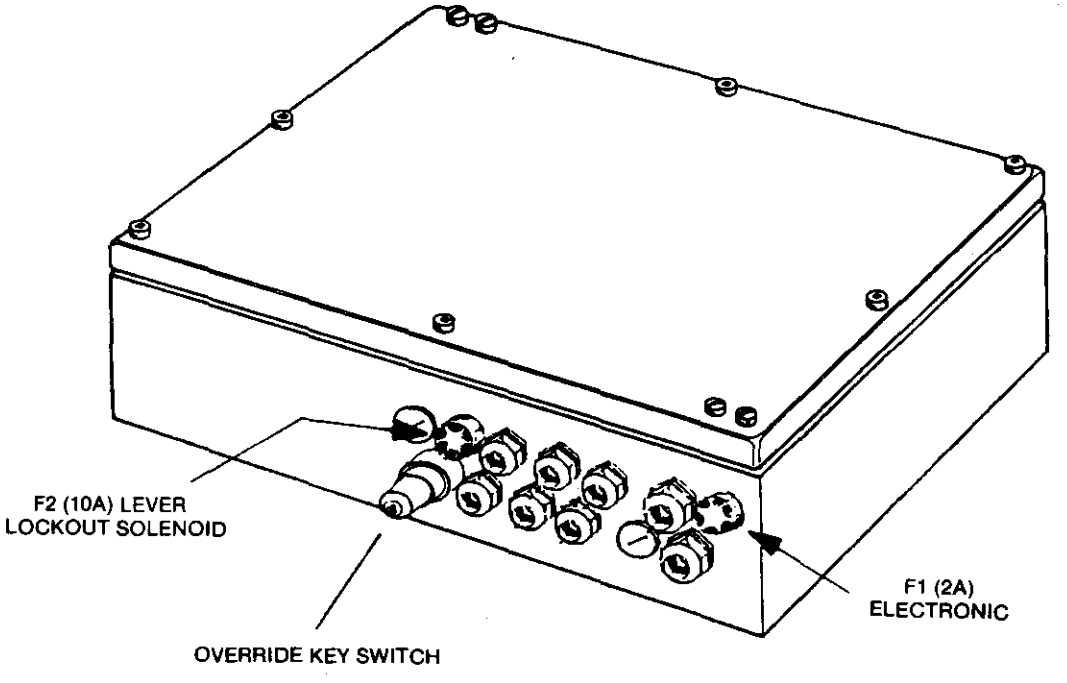


Drawing 7 - SUPPRESSOR DIODE

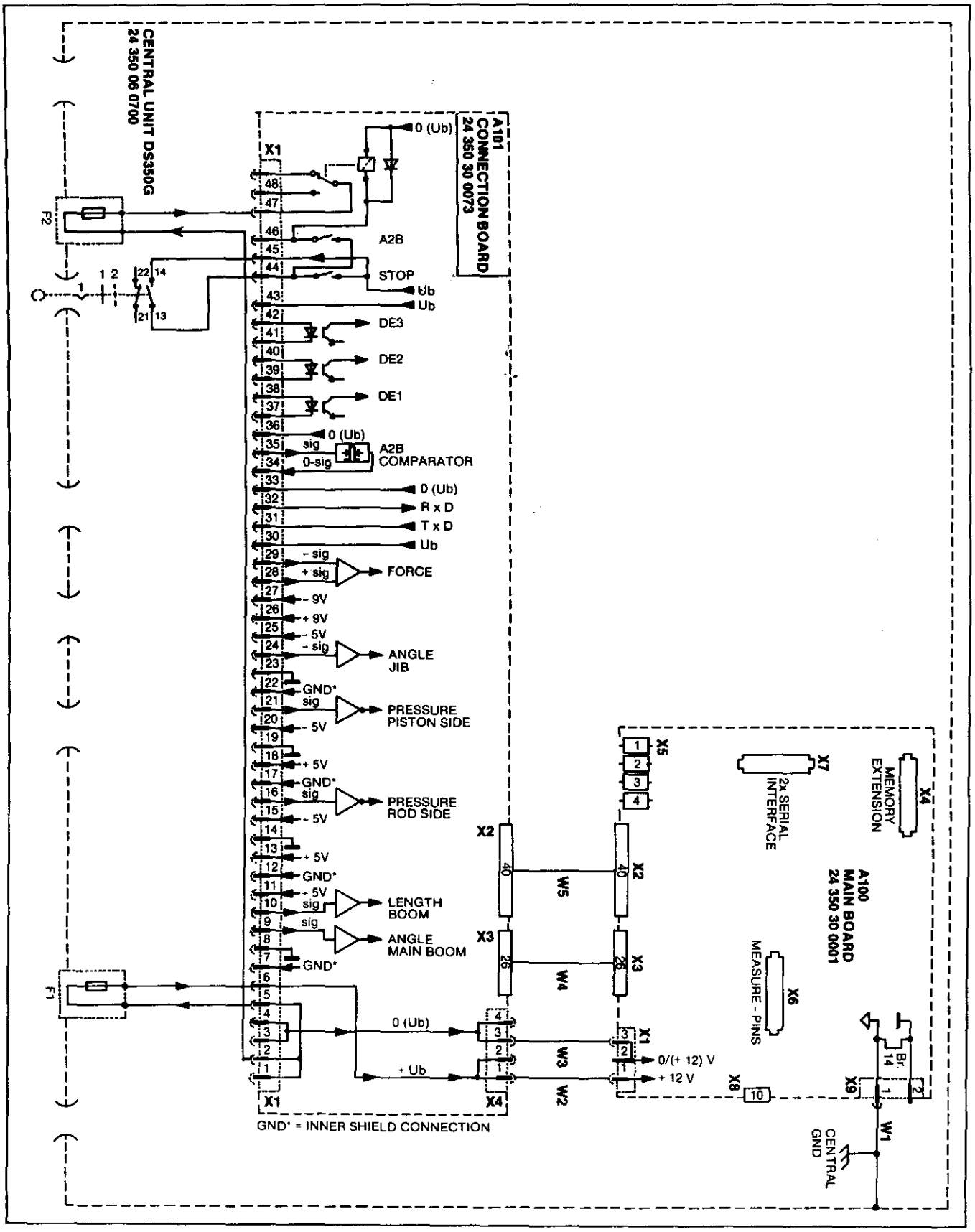


CAUTION: Make sure that + and – diode connections are made as shown to ensure proper polarity.

Drawing 8 - CENTRAL UNIT BOX

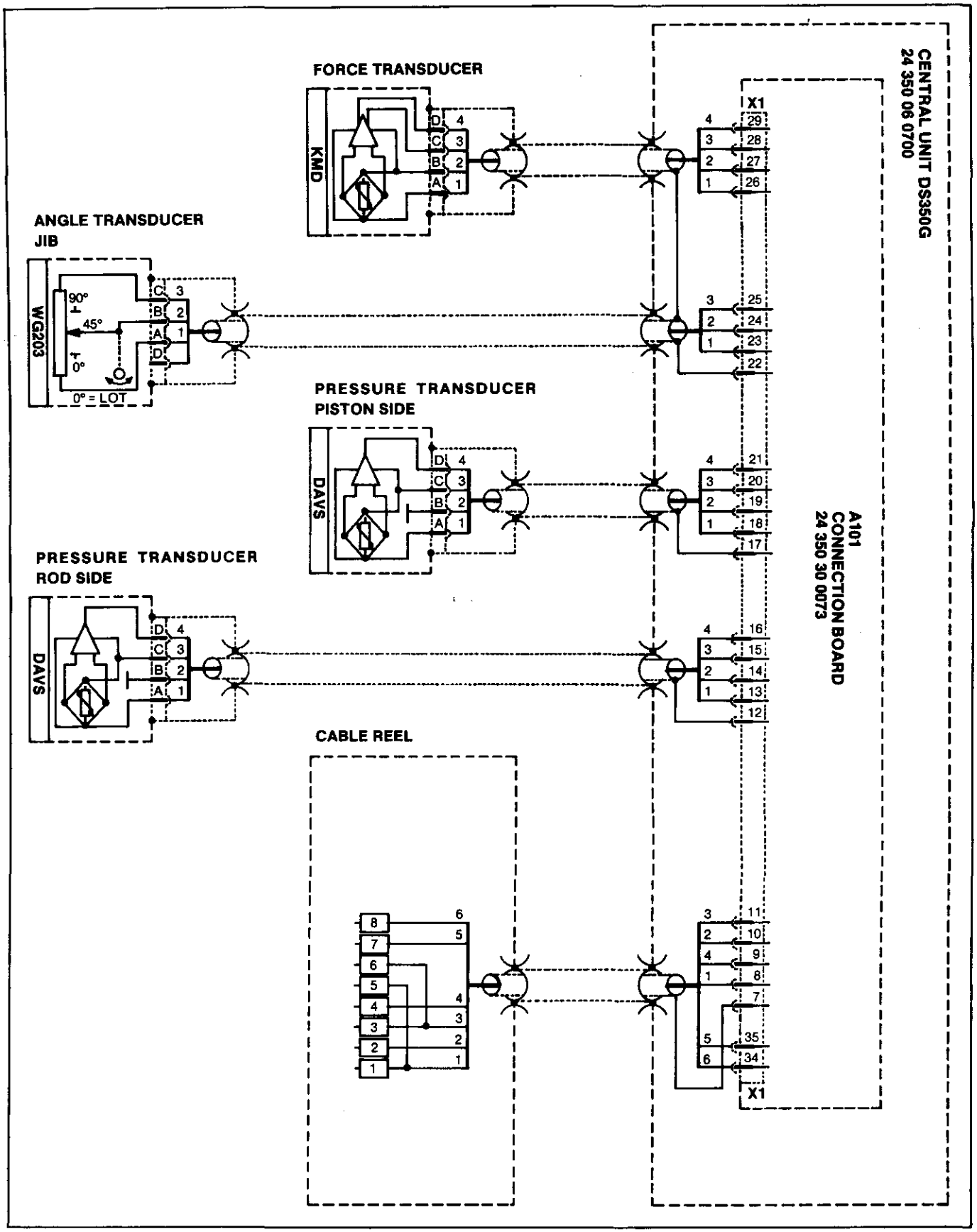


Drawing 9A - WIRING DIAGRAM



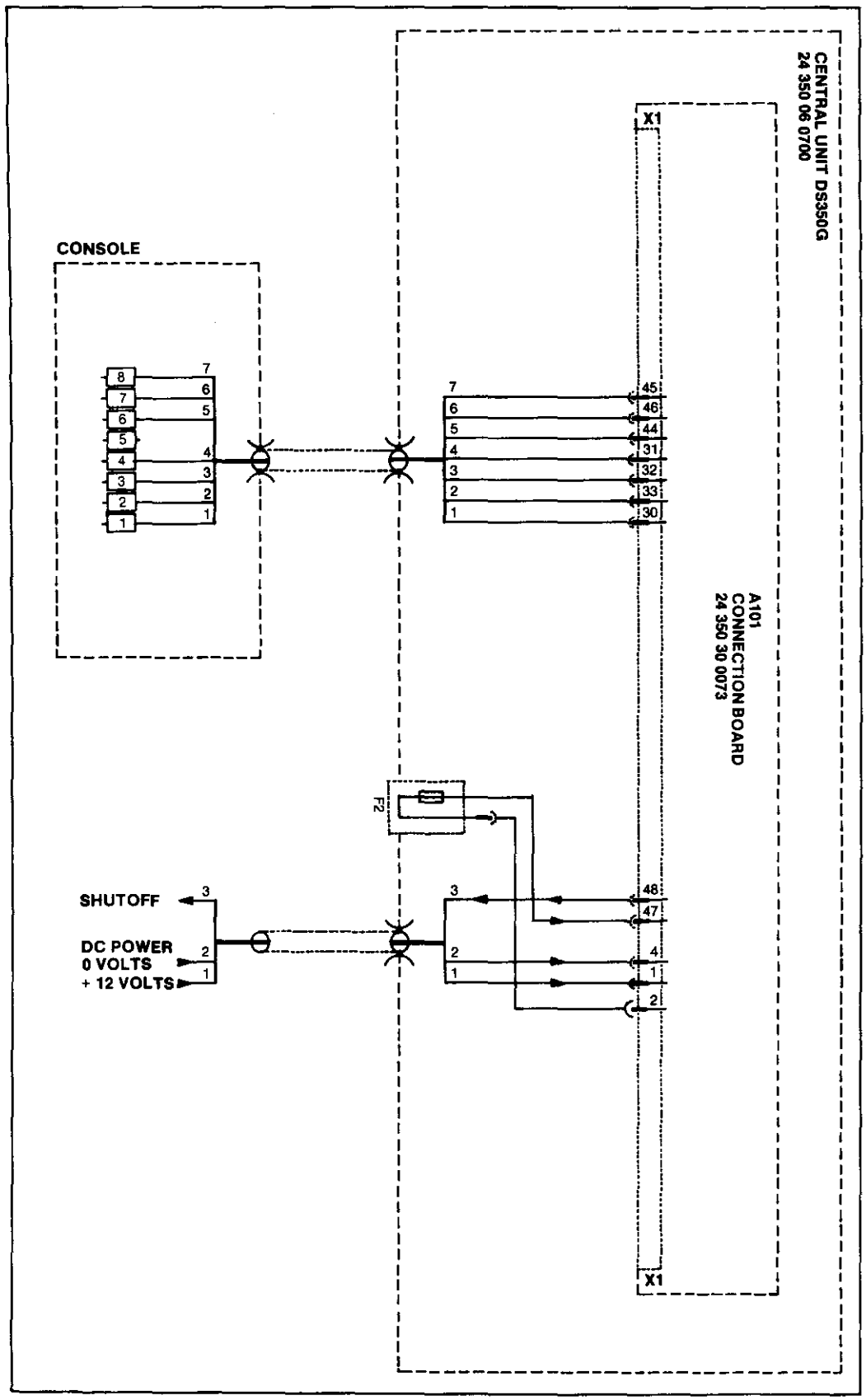
NOTE: This diagram may differ from the actual wiring of the system supplied. Consult the Parts & Installation Manual for your particular crane model for a detailed wiring diagram.

Drawing 9B - WIRING DIAGRAM



NOTE: This diagram may differ from the actual wiring of the system supplied. Consult the Parts & Installation Manual for your particular crane model for a detailed wiring diagram.

Drawing 9C - WIRING DIAGRAM



NOTE: This diagram may differ from the actual wiring of the system supplied. Consult the Parts & Installation Manual for your particular crane model for a detailed wiring diagram.