www.hirschmann.com

HIRSCHMANN

PAT

DS350G BCS
(5-SECT. BOOM)

SERVICE MANUAL (TMS/TTS870, RT865BXL)

NOTICE

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

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

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

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

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

MANUAL REVISIONS

REV	DATE	NAME	DESCRIPTION
C	08/18/03	CSH	ECN 03-095
D	02/16/06	SB	ECN 06-013

TABLE OF CONTENTS

1. General Information

The DS 350 load moment indicator (LMI) with boom control extension is designed to aid the crane operator through the crane operations. The DS 350 with boom control extension is not, and shall not, be a substitute for good operator judgment, experience and use of accepted safe crane operating procedure.

2. Reference Material

Parts & Installation Manual:

Crane Model	*PAT- Part number*	*Grove- Part number*
TMS/ TTS 870	031-300-150-662	9-333-103129
RT 865 BXL	031-300-150-659	9-333-103206

Operator's Handbook:

PAT - Part number
50\350\19_1319e.doc

3. Warnings

The DS 350 load moment indicator (LMI) with boom control extension is an operational aid that warns the crane operator when he approaches an overload condition, a two block condition and an out of boom sequence condition. The boom control extension controls the sequence of the boom during operation. It still remains the operator's responsibility to verify the operation and to select the correct mode during crane operations.

The manual mode is a rigging mode. Lifting loads with manual mode programmed is prohibited.

Should an out of sequence condition occur, the crane operator is responsible to select manual mode to return the sections into sequence before continuing the lift.

The responsibility for 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 provided by the crane and load moment indicator manufacturer.

Proper functioning depends upon proper daily inspection and observance of the operating instructions provided with the crane and load moment indicator.

4. Service and Maintenance

Daily maintenance of the load moment indicator consists of inspecting:

1. The electrical wiring connecting the various parts of the system.
   If electrical wiring is damaged, it shall be replaced immediately.

2. If the insulation is worn on the length sensor cable or cable guides are damaged, these parts shall be replaced.

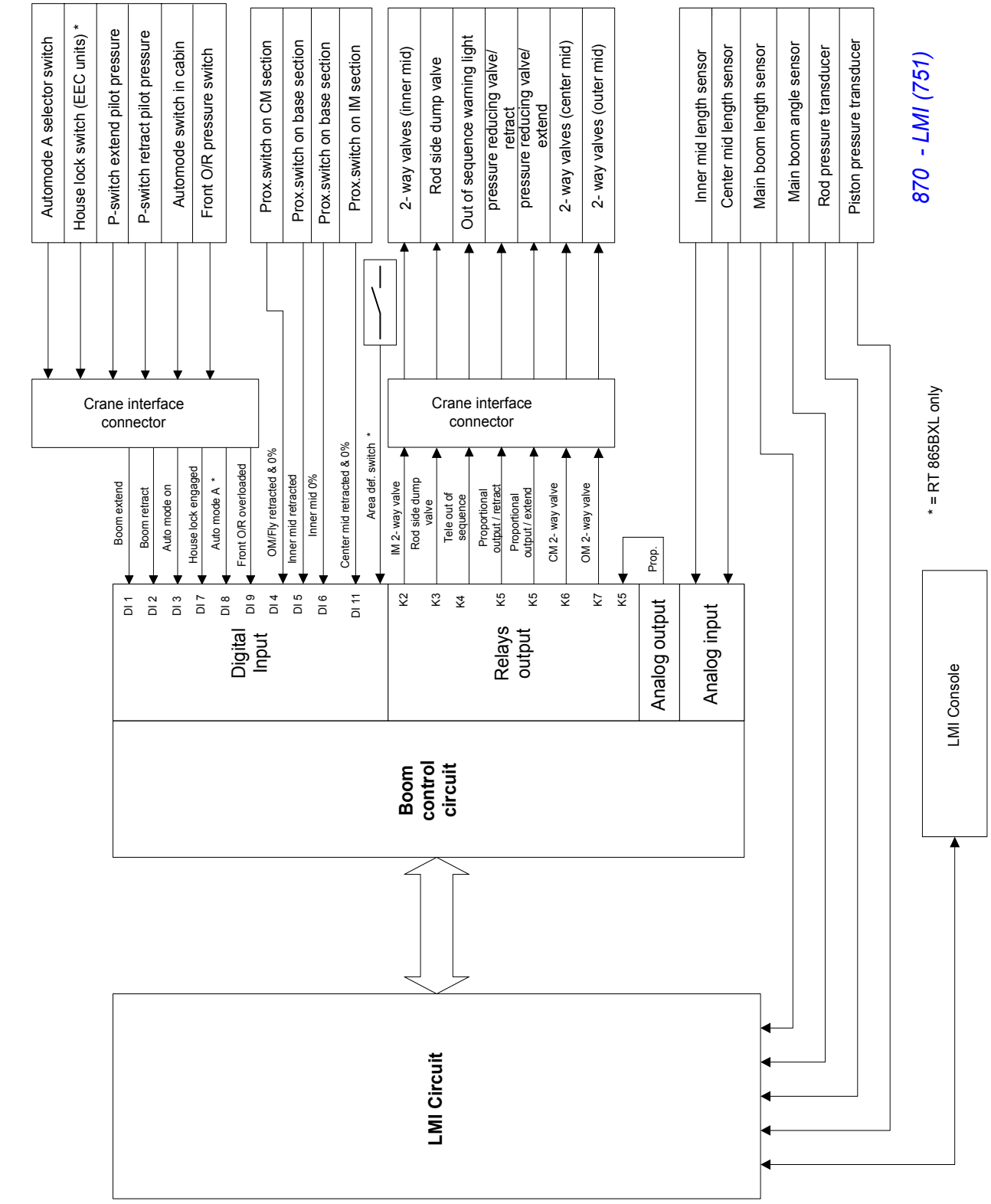
3. Check the anti two-block limit switches for freedom of movement.

4. The cable reel shall be under tension to operate properly.

5. Check the pressure transducers at the hoist cylinder(s) and the connecting hoses for oil leakage.

Other than correcting the problems identified in the Malfunctions Table and replacing faulty mechanical parts and cables, no other repairs shall be performed by non expert personnel.

5. Boom Control Interface



Drawing 1.

Auto mode / Manual mode:
The operator selects auto mode or manual mode using the rocker switch in the dash board. Auto mode is the working mode and manual mode is used for rigging or sequencing purpose only.

Pilot pressure switch signal / Analog output signal:
Two pressure switches in the pilot pressure circuit are used to distinguish between boom extend or boom retract. The two circuits are wired through the crane interface connector into the DS 350 G central unit.

When the operator extends the boom, the pressure switch signal at central unit terminal A101-X1/38 changes from 0V to +24V. The boom control logic allows electrical current to flow to the extend pressure reducing valve coil. The minimum current equals 0 mA with the control in neutral position. The maximum current output equals 800 mA.
To measure the coil current while extending, remove wire #20from central unit terminal A101-X1/63. Connect the Amp-meter in series with wire #20 to terminal X1/63.

When the operator retracts the boom, the pressure switch signal at central unit terminal A101-X1/40 changes from 0V to +24V. The boom control logic allows electrical current to flow to the retract pressure reducing valve coil. The minimum current equals 0 mA with the control in neutral position. The maximum current output equals 800 mA.
To measure the coil current while retracting, remove wire #21 from central unit terminal A101-X1/64. Connect the Amp-meter in series with wire #21 to terminal X1/64.

Length sensors:
Three length sensors are mounted to the boom base section to measure the overall length, the inner mid section length and the center mid section length. The software utilizes the signals to calculate the outer mid and fly section length.

Disengage the boom stop to retract the boom completely.

With retracted main boom the overall boom length signal is -500 mV (A101-X1/10). Use the test pin MP 15 (AGND) or terminal A101-X1/8 (AGND) for reference ground. Disengage the boom stop to retract the boom completely.

With retracted main boom the inner mid section length signal is -500 mV (A101-X1/24). Use the test pin MP 15 (AGND) or terminal A101-X1/8 (AGND) for reference ground.

With retracted main boom the center mid section length signal is -500 mV (A101-X1/73). Use the test pin MP 15 (AGND) or terminal A101-X1/8 (AGND) for reference ground.

Keep the cable on the length transducer drum spooled properly. A poorly spooled cable may causes the boom to become out of sequence. If the boom becomes out of sequence, select manual mode and correct the length by operating individual sections. Once the sections are sequenced again the operator may return to the automode. Refer to section 9.1 for boom components installation and set up.

Inner mid retract and % reset switch:
The reset- proximity switch on the base section provides a (+24V) signal to central unit terminal A 104 X1/80 when the inner mid section is retracted against the boom stop. The signal resets the inner mid percentage to 1%.

The retract- proximity switch on the base section provides a (+24V) signal to central unit terminal A 104 X1/78 when the inner mid section is fully retracted (disengage the boom stop).

Center mid retract and % reset switch:
The proximity switch on the inner mid section provides a (+24V) signal to central unit terminal A 114 X1/9 when the center mid section is fully retracted. The signal resets the center mid percentage to 0%.

Refer to Parts & Installation Manual and follow the installation instructions for switch and target adjustment.

Outer mid/ fly retract and % reset switch:
The proximity switch on the center mid section provides a (+24V) signal to central unit terminal A 114 X1/76 when the outer mid and fly section is fully retracted. The signal resets the outer mid/ fly percentage to 0%.

Refer to Parts & Installation Manual and follow the installation instructions for switch and target adjustment.

System inputs:

DI #	Description	Central Unit Terminal	Signal (DI=on)
1 MB	Pressure switch - boom extend GND	A104 - X1/38 A104 - X1/37	+24V 0V
2 MB	Pressure switch -boom retract GND	A104 - X1/40 A104 - X1/39	+24V 0V
3 MB	Automode switched on GND	A104 - X1/42 A104 - X1/41	+24V 0V
4 MB	Outer mid/ fly retract and % switch GND	A104 - X1/76 A104 - X1/75	+24V 0V
5 MB	Inner mid retract switch GND	A104 - X1/78 A104 - X1/77	+24V 0V
6 MB	Inner mid % reset switch GND	A104 - X1/80 A104 - X1/79	+24V 0V
1 EX	House lock engaged (RT 865 BXL-- Europe) * GND	A114 - X1/1 A114 - X1/2	+24V 0V
2 EX	Automode A = on; Automode B = off * GND	A114 - X1/3 A114 - X1/4	+24V 0V
3 EX	+ Ub (24V) Front outrigger overload (GND)	A114 - X1/5 A114 - X1/6	+24V 0V
4 EX	Area def. switch (RT 865 BXL) * GND	A114 - X1/7 A114 - X1/8	+24V 0V
5 EX	Center mid retract and % reset switch GND	A114 - X1/9 A114 - X1/10	+24V 0V

Note: MB = main board ** = RT 865 BXL only*
EX = extension board

Output for two- way valves:

A pair of two- way valves controls the oil to each tele- cylinder. The relay output K2, K6, K7 operates the pair of two- way valves in automode. The valve need to be de-energized to operate the particular cylinder. The valves for the sections that are not selected are powered to prevent movement of the other cylinders.

Mode	Relay K2 [V]	IM 2 way valves	Relay K6 [V]	CM 2 way valves	Relay K7 [V]	OM 2 way valves
	A104-X1/54		A104-X1/66		A104-X1/69	
Auto IM	0	0	24	1	24	1
Auto CM	24	1	0	0	24	1
Auto OM	24	1	24	1	0	0
Manual IM	0	0 *	0	1 *	0	1 *
Manual CM	0	1 *	0	0 *	0	1 *
Manual OM	0	1 *	0	1 *	0	0 *
Error (Auto)	24	1	24	1	24	1
Neutral (Auto)	24	1	24	1	24	1

*Note: * = powered directly from the section selector switch in the cabin.*

Relay outputs:

Relay	Fuse	Description	Central Unit Terminal	Signal
K1	F2	not used not used		
K2	F3	Inner mid two way- valves GND	A104 - X1/54 A104 - X1/3	+24V 0V
K3	F4	Rod side dump valve GND	A104 - X1/57 A104 - X1/3	+24V 0V
K4	F5	Tele out of sequence - Warning light in cabin GND	A104 - X1/61 A104 - X1/3	+24V 0V
K5 K5 K5	F6	Signal from analog output board Directs the analog signal to the extend valve Directs the analog signal to the retract valve	A104 - X1/62 A104 - X1/63 A104 - X1/64	0-800mA 0-800mA 0-800mA
K6 K6	F7	Center mid two way- valves GND	A104 - X1/66 A104 - X1/3	+24V 0V
K7	F8	Outer mid two way- valves GND	A104 - X1/69 A104 - X1/3	+ 24V 0V
K8	none	Internal LMI use (overload, error)	A104 - X1/44	+ 24V
K9	none	Internal LMI use (A2B)	A104 - X1/46	+ 24V
K10	external	Motion cut (Bosch relay)	A104 - X1/48	+ 24V

Rod side dump valve:

Relay K3 controls the rod side dump valve. The valve dumps the rod side pressure when the controller is in neutral position and during the time the section stops while changing over to another section.

Controller	Relay K3 A101 x1/ 57
Extend on	0V
Retract on	0V
Neutral	+24V
Retracted/ retract on	+24V

6. Boom Sequence

Main Boom:

Mode	IM %	CM %	OM %	FLY %
Auto B	0	0	0	0
Auto B	50	0	0	0
Auto B	50	50	0	0
Auto B	75	50	0	0
Auto B	75	75	0	0
Auto B	100	75	0	0
Auto B	100	100	0	0
Auto B	100	100	100	100

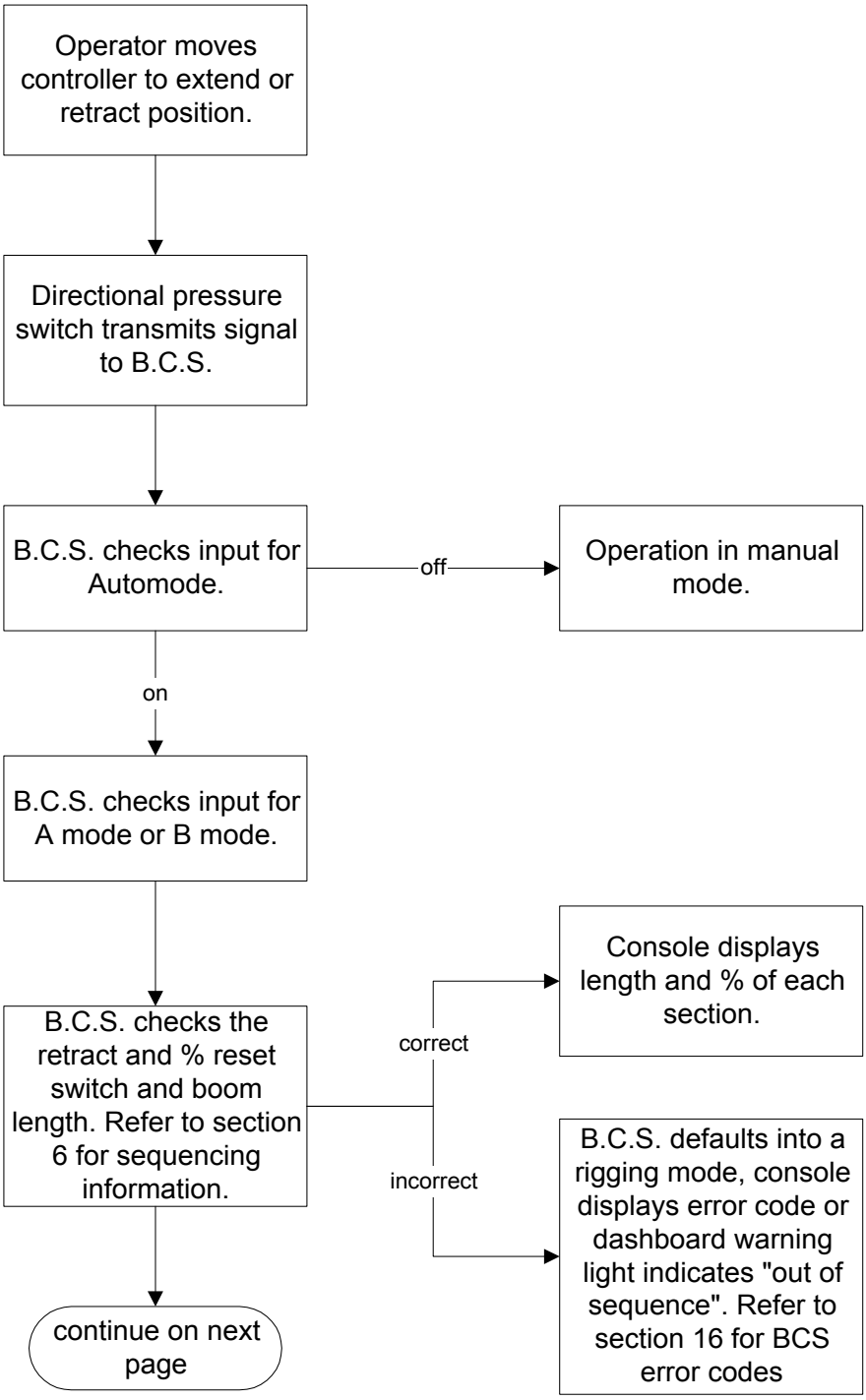
Mode	IM %	CM %	OM %	FLY %
Auto A *	0	0	0	0
Auto A *	0	100	0	0
Auto A *	0	100	100	100
Auto A *	100	100	100	100

*= Mode A not available on RT 865 BXL

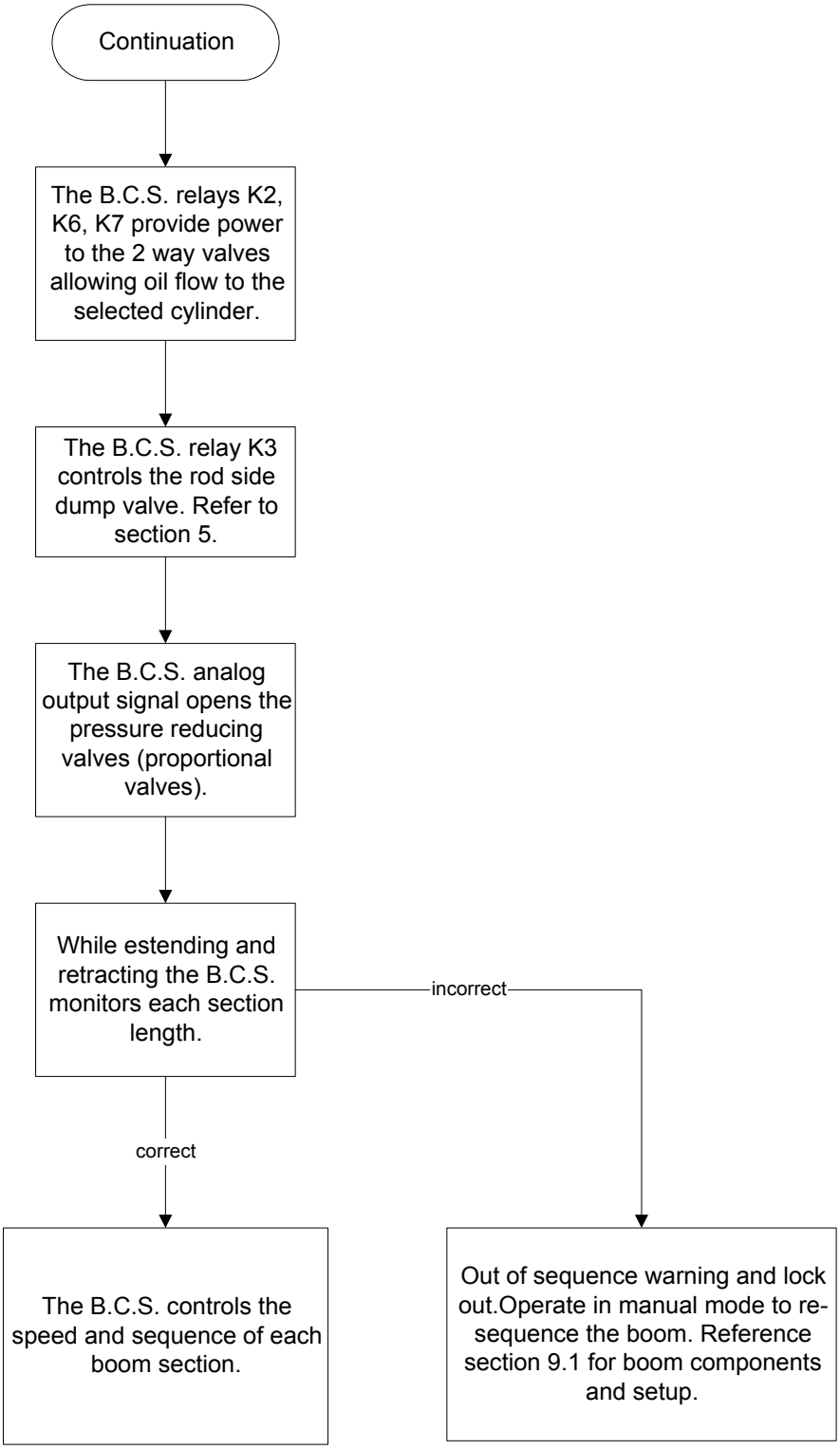
Extensions:

Mode	IM %	CM %	OM %	FLY %
Auto	0	0	0	0
Auto	100	0	0	0
Auto	100	100	0	0
Auto	100	100	100	100

7. Boom Control Flow

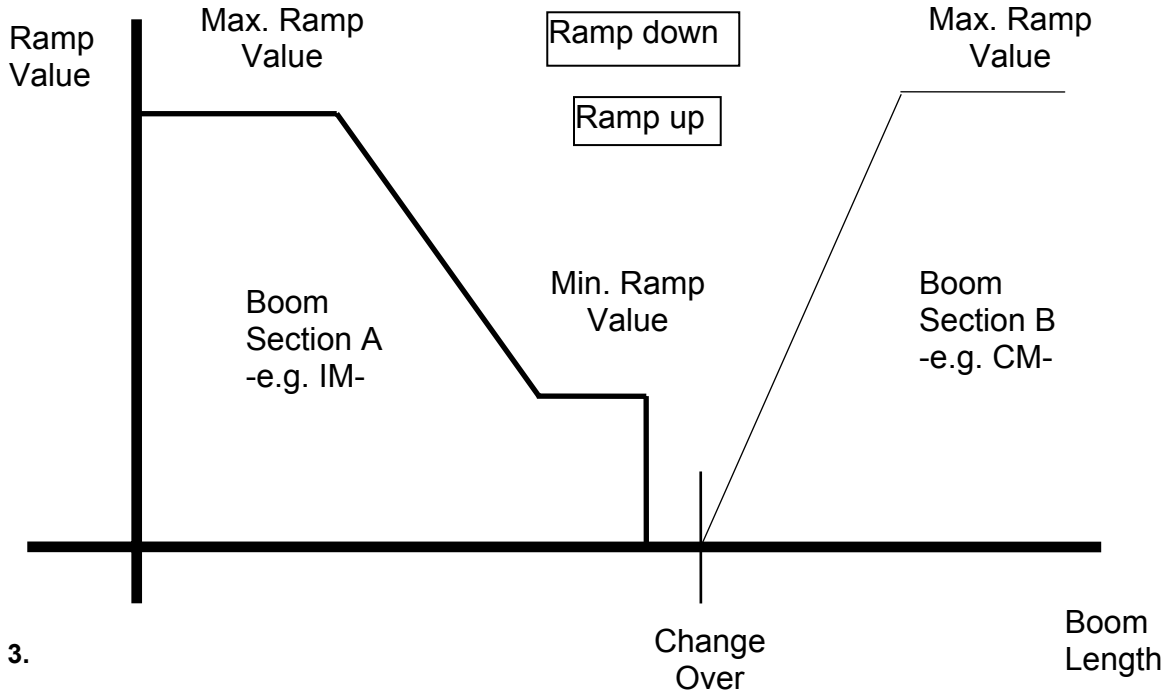


Drawing 2a.


Continuation
The B.C.S. relays K2, K6, K7 provide power to the 2 way valves allowing oil flow to the selected cylinder.
The B.C.S. relay K3 controls the rod side dump valve. Refer to section 5.
The B.C.S. analog output signal opens the pressure reducing valves (proportional valves).
While estending and retracting the B.C.S. monitors each section length.
incorrect
correct
The B.C.S. controls the speed and sequence of each boom section.
Out of sequence warning and lock out.Operate in manual mode to re-sequence the boom. Reference section 9.1 for boom components and setup.

Drawing 2b.

8. Ramping

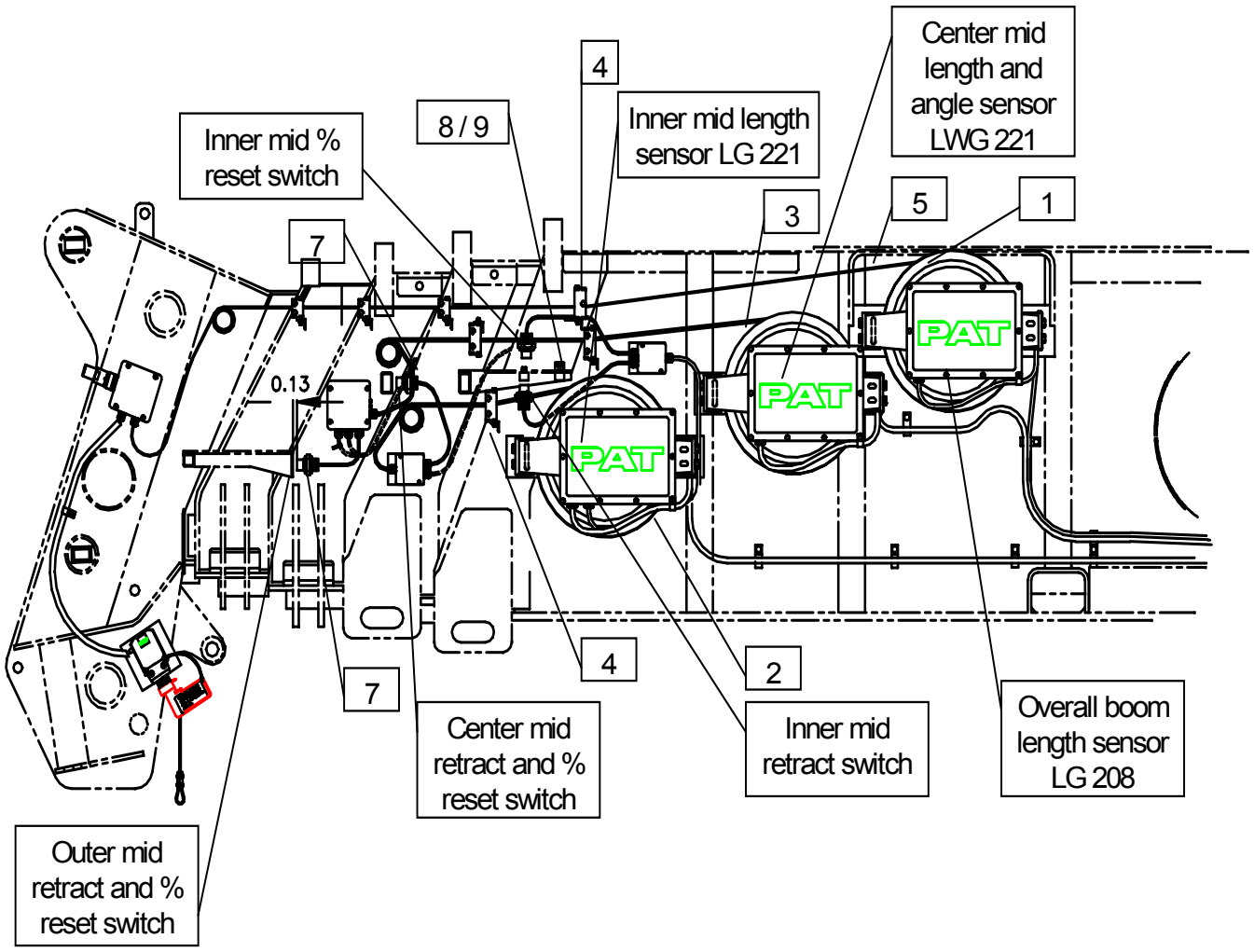


Drawing 3.

Ramp value: A hex value in the software which determines the output current to the proportional valve.
Max. ramp value: The maximum hex value (hex 255) equals to 800 mA valve (pressure reducing valve). This current is required to open the valve for maximum tele speed.
Min. ramp value: The minimum hex value that is required to move a section in the ramping area. These values may differ for each ramping area.
Change over: The previous section comes to a complete stop and the next section ramps up (accelerates speed).

IM: Inner Mid Section
CM: Center Mid Section
OM/Fly: Outer Mid Section & Fly

9.1 DS 350 G - Boom Components and Setup



Drawing 4.

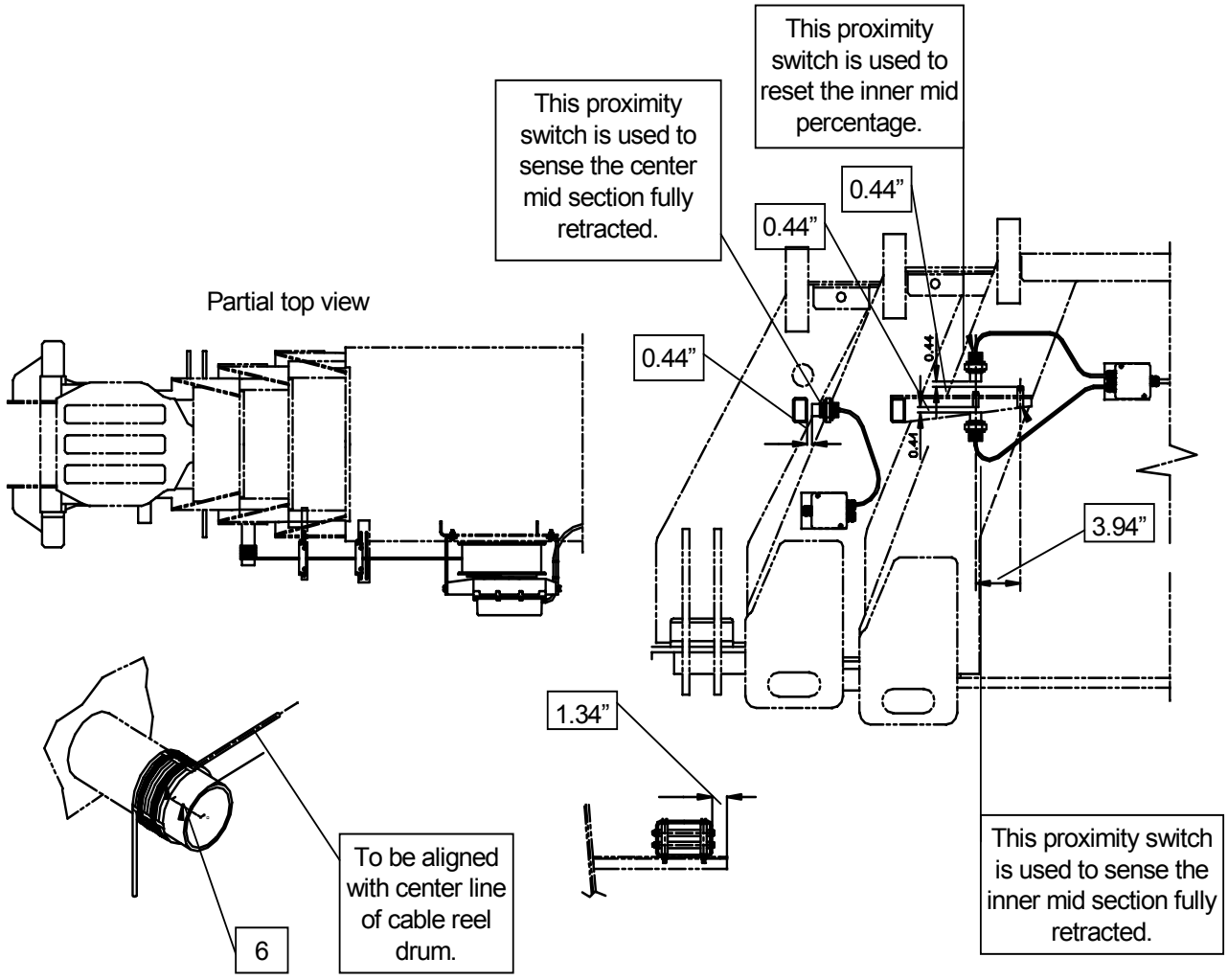
1. Pre-tension the cable reel spring by rotating drum (16) revolution counterclockwise. If replacing the LG 208 un-spool the length cable and secure to bushing on the boom nose as noted in the installation drawing. Zero the length potentiometer as described on page 18.
2. Pre-tension the cable reel spring by rotating drum (35) revolution counterclockwise. If replacing the LG 221 un-spool the length cable and secure to bushing on the boom nose as noted in the installation drawing. Zero the length potentiometer as described on page 18.
3. Pre-tension the cable reel spring by rotating drum (30) revolution counterclockwise. If replacing the LWG 221 un-spool the length cable and secure to bushing on the boom nose as noted in the installation drawing. Zero the length potentiometer as described on page 18.
4. Run cable through the cable guides. Remove 1/4-20 nuts on bottom of cable guide, insert cable guide screws through existing angle bracket and secure in place with 1/4-20 nuts removed previously.
5. Center line of cable must be aligned with center line of cable drum. See partial top view.

1. Place tie wrap, 120 degree apart around the bushing. Wrap cable (8-10) revolutions over the tie wraps starting from the outside and working inward. Allow ample cable to reach the junction box. Secure with (2) additional tie wraps. See page 17.

2. Check proximity switch installation (0.44 inch from target) when boom sections are fully retracted.

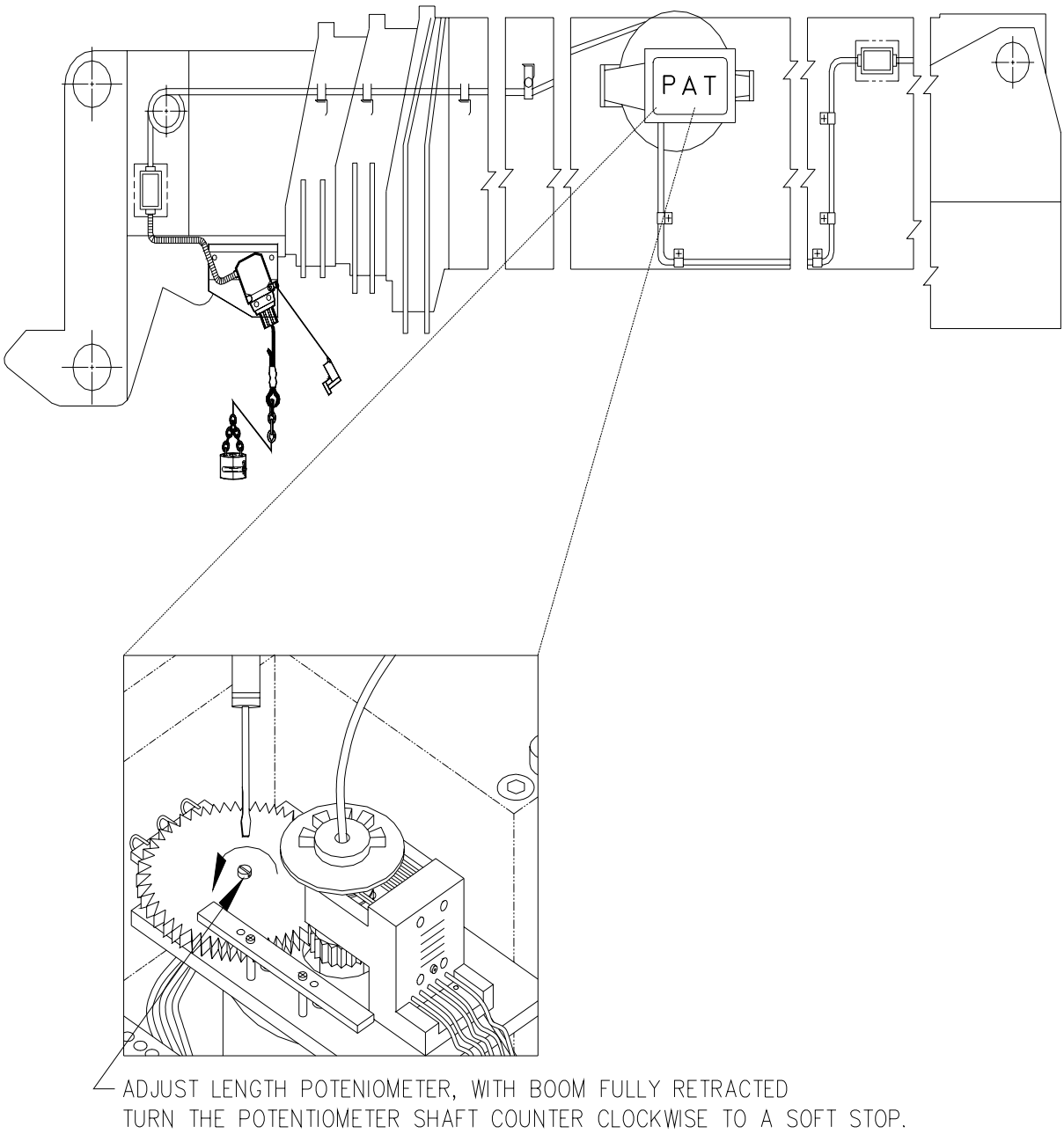
3. This target is only installed if the boom is equipped with a boom extension stop block.

4. Check this proximity switch installation (0.13 inch from target) when boom sections are fully retracted.



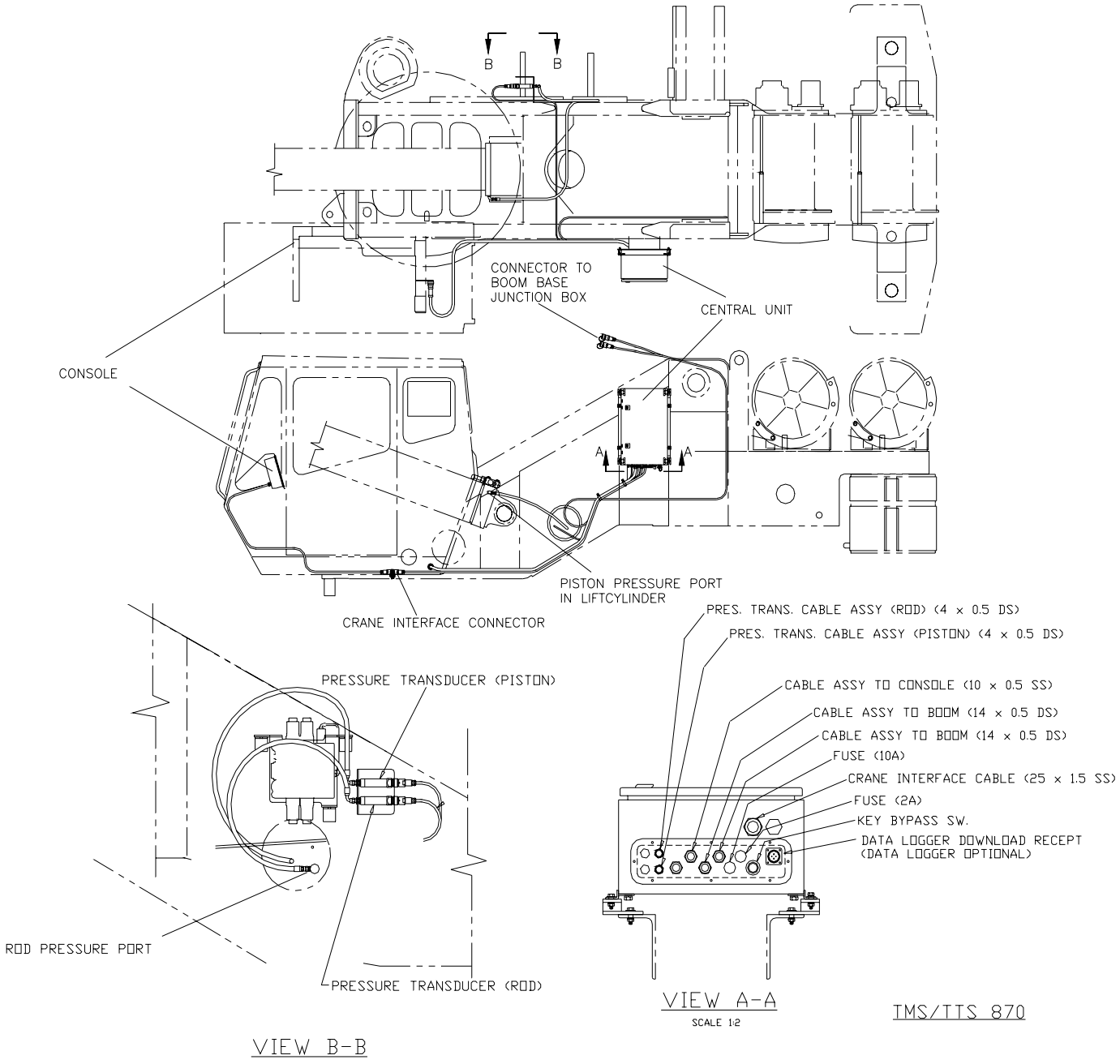
Drawing 5.

9.2 Length Transducer Adjustment



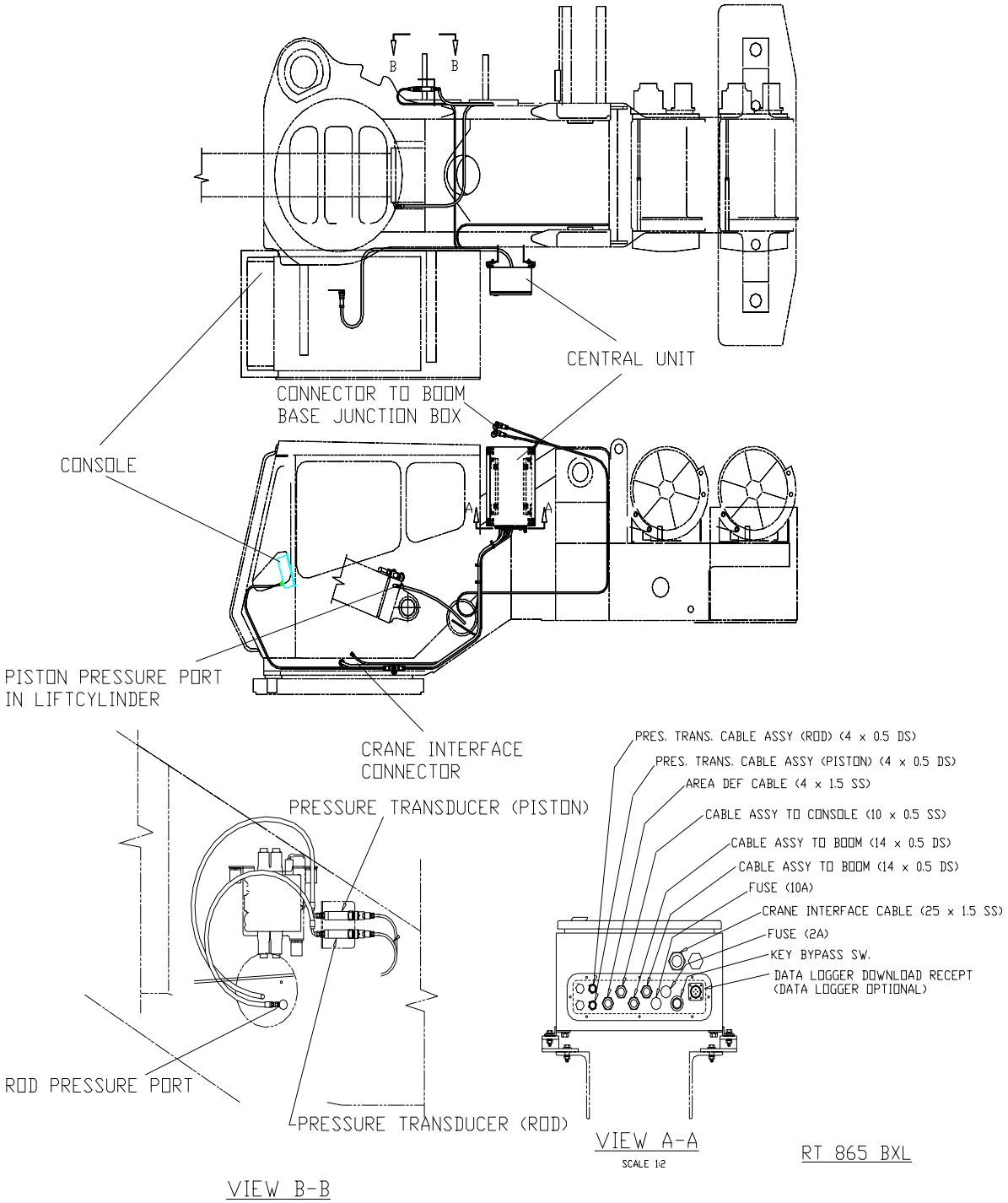
Drawing 6.

9.3 DS 350 G Superstructure Components - TMS/TTS 870



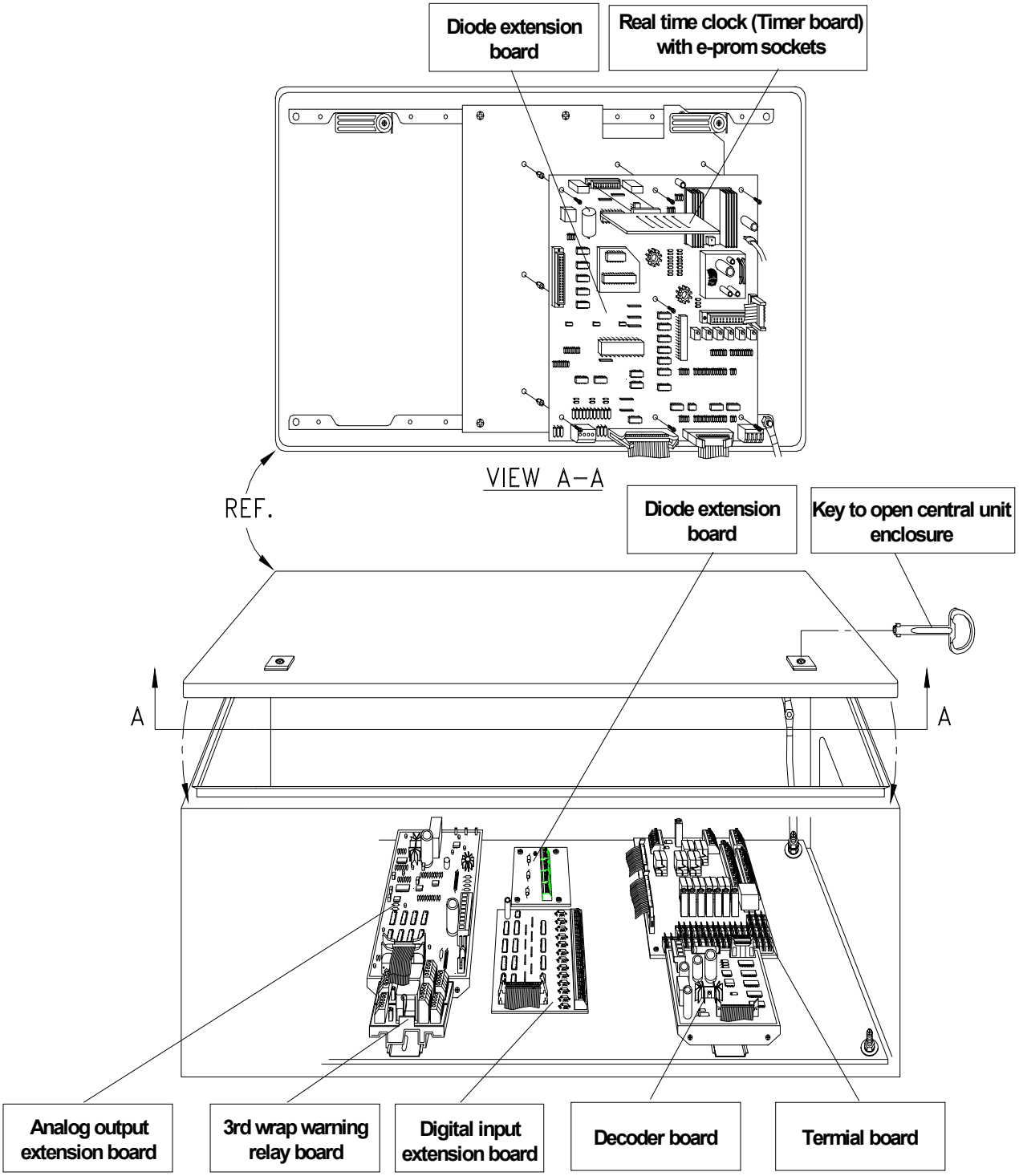
Drawing 7.

9.4 DS 350 G Superstructure Components - RT 865 BXL



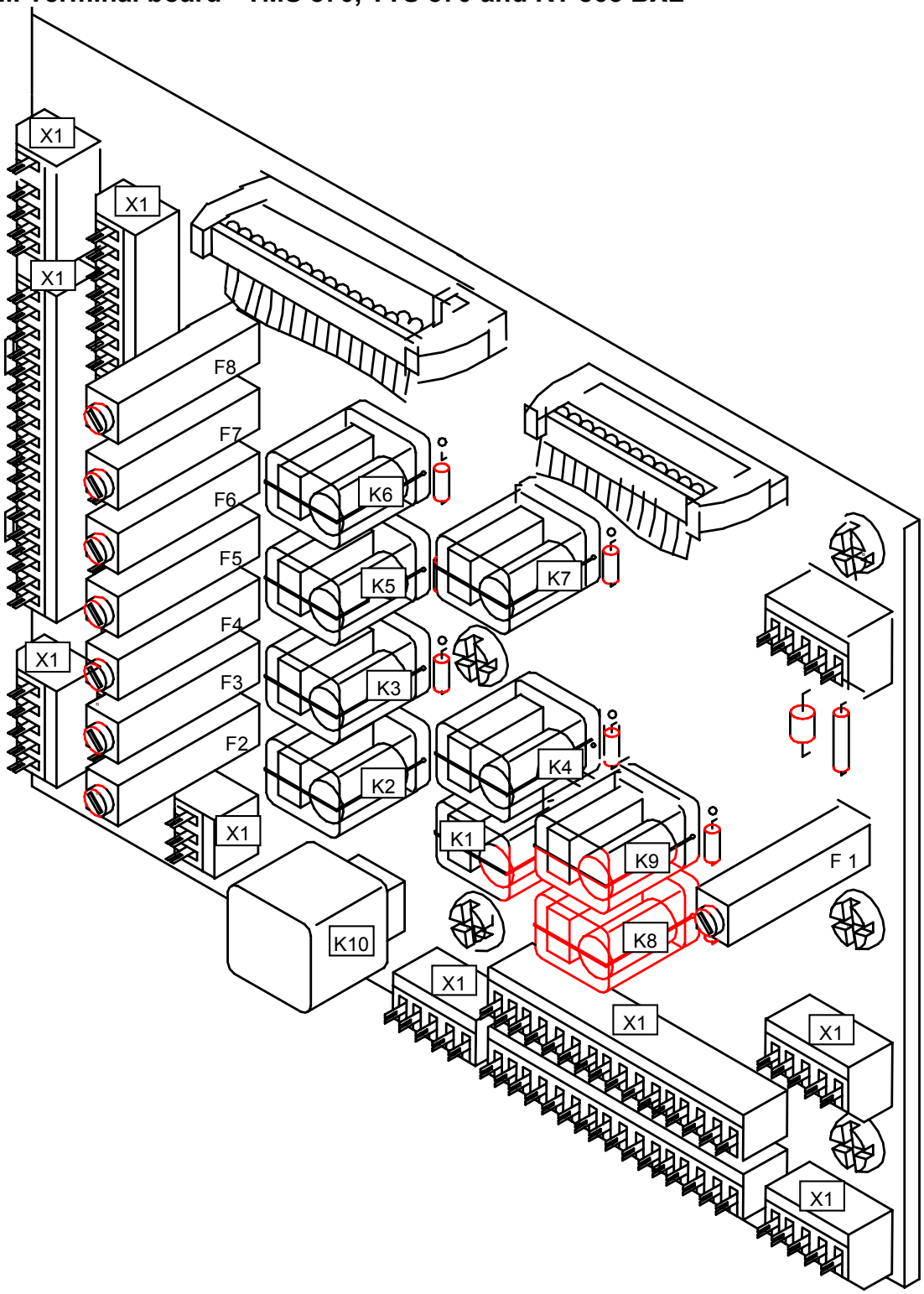
Drawing 8.

10.1 DS 350 G LMI central unit (751) - TMS/TTS 870 & RT 865 BXL



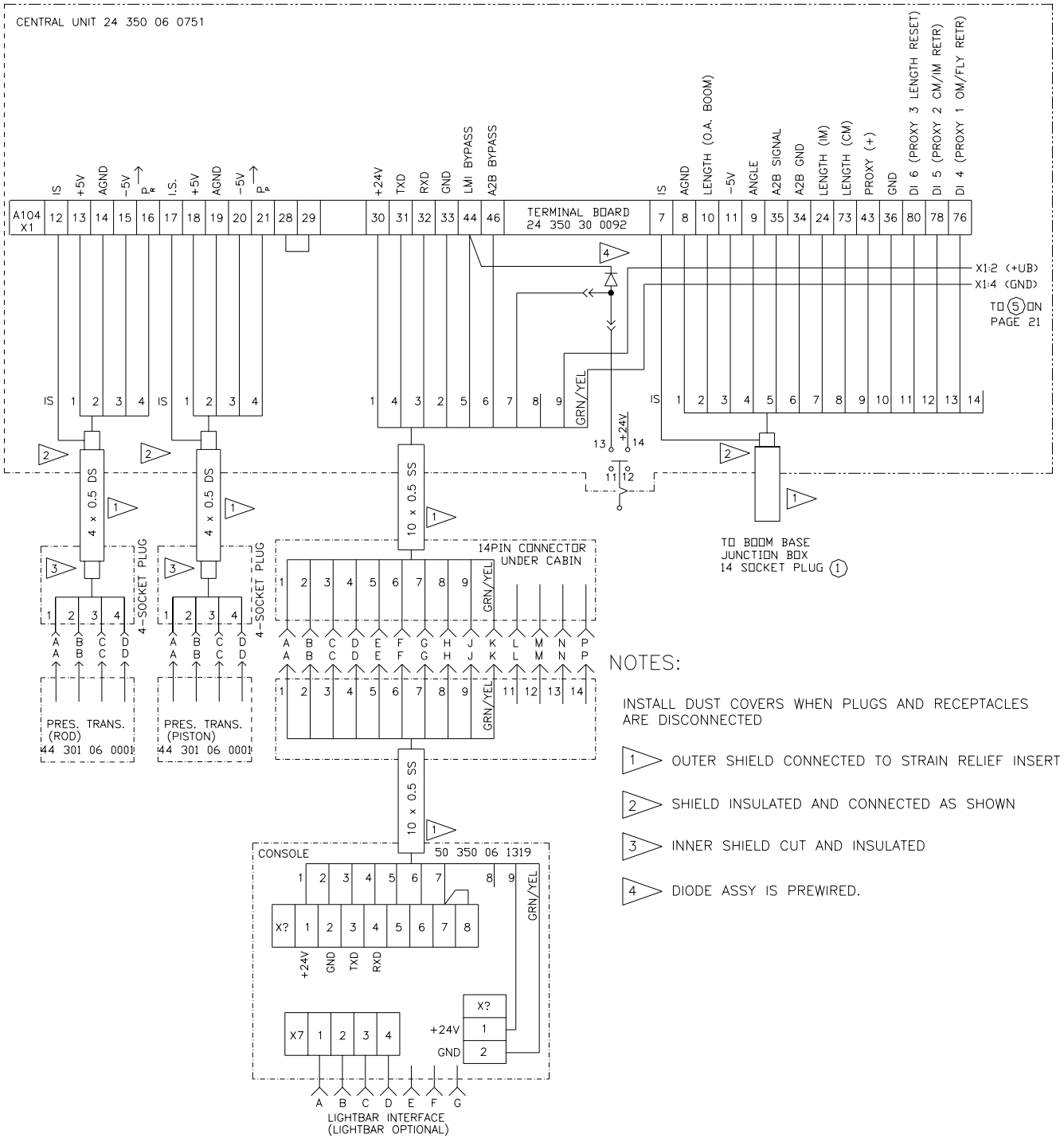
Drawing 9.

10.2 LMI Terminal board - TMS 870, TTS 870 and RT 865 BXL



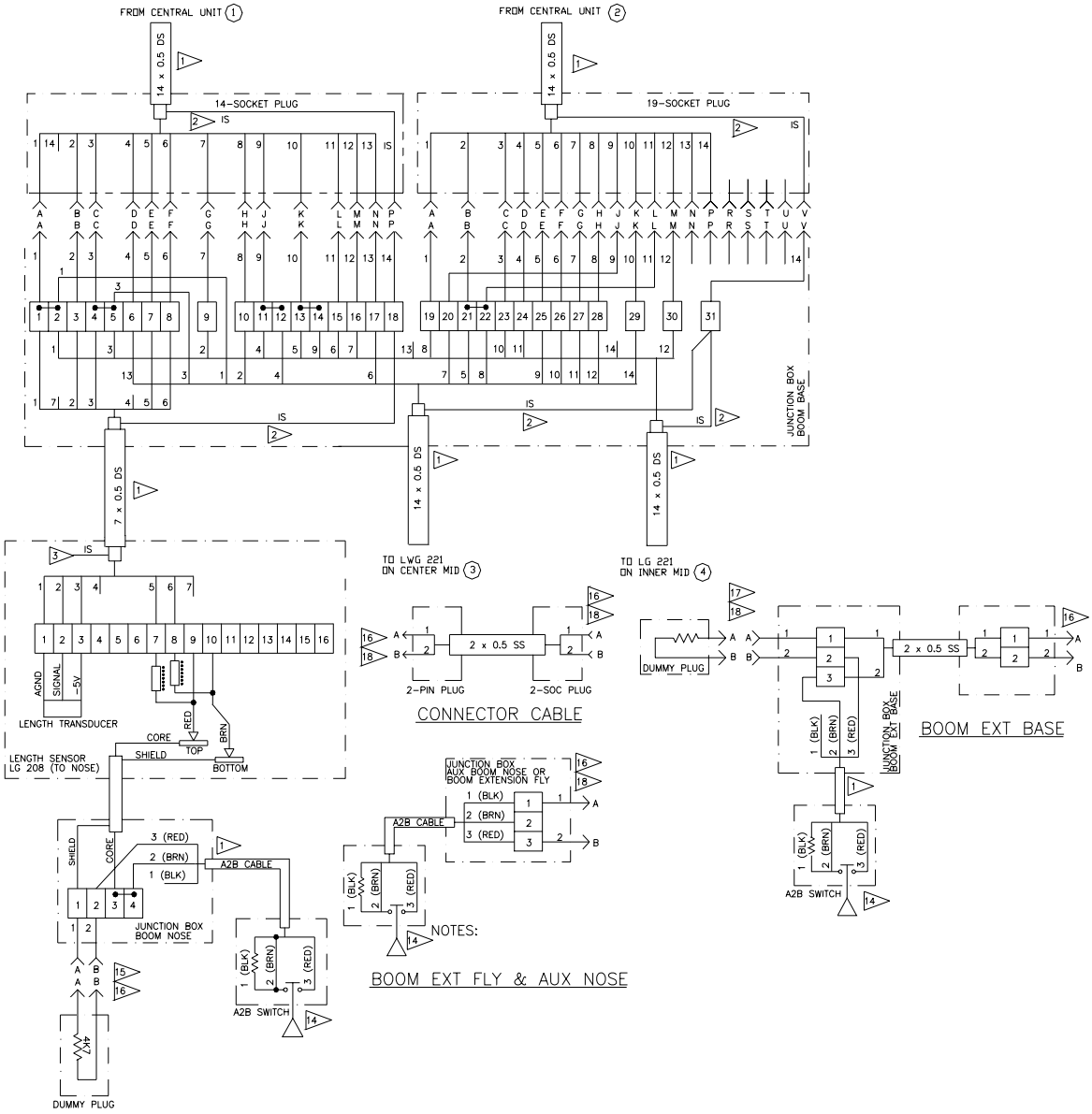
Drawing 10.

11.1 Wiring Schematic - TMS 870/ TTS 870



Drawing 11.1

11.1 Wiring Schematic - TMS 870/ TTS 870



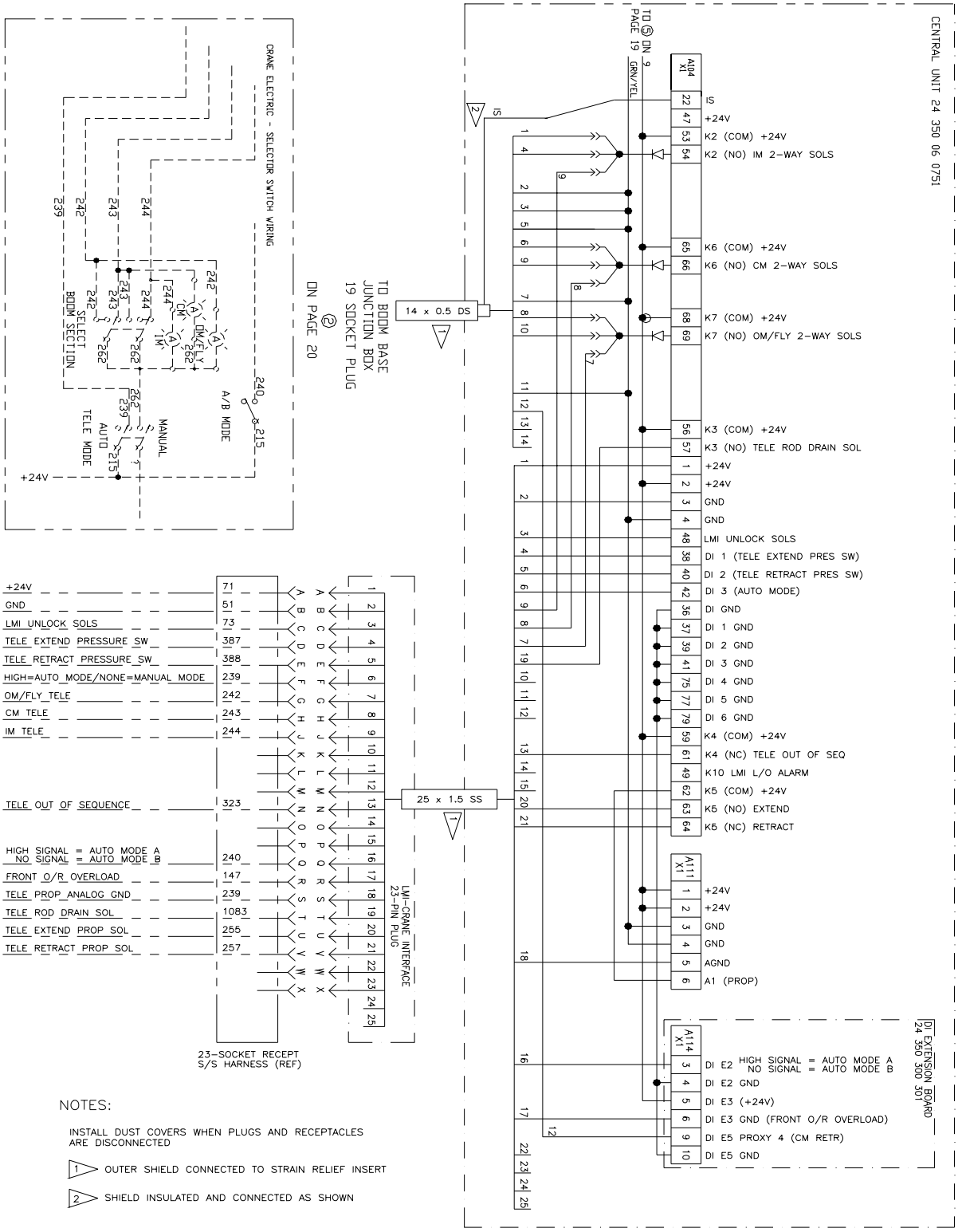
NOTES:

INSTALL DUST COVERS WHEN PLUGS AND RECEPTACLES ARE DISCONNECTED

1. OUTER SHIELD CONNECTED TO STRAIN RELIEF INSERT
2. SHIELD INSULATED AND CONNECTED AS SHOWN
3. INNER SHIELD CUT AND INSULATED
4. DIODE ASSY IS PREWIRED.
5. SEE GROVE BOOM ASSEMBLY DRAWING FOR WIRING CONNECTION OF THE 2-WAY SOLENIOD VALVES
13. RELAY AND DIODE ASSY ARE PREWIRED
14. A2B SWITCH IS PREWIRED & POTTED
15. WHEN BOOM EXT OR AUX NOSE IS NOT USED, INSTALL DUMMY PLUG INTO RECEPT ON BOOM NOSE JUNCTION BOX
16. WHEN BOOM EXT OR AUX BOOM NOSE IS USED, INSTALL CONNECTOR CABLE FROM RECEPT ON BOOM NOSE JUNCTION BOX TO RECEPT ON BOOM EXT OR AUX NOSE JUNCTION BOX
17. WHEN BOOM EXT BASE IS USED WITHOUT FLY, INSTALL DUMMY PLUG INTO RECEPT ON BOOM EXT BASE JUNCTION BOX
18. WHEN BOOM EXT FLY IS USED, INSTALL 2nd CONNECTOR CABLE FROM RECEPT ON BOOM EXT BASE JUNCTION BOX TO RECEPT ON BOOM EXT FLY JUNCTION BOX

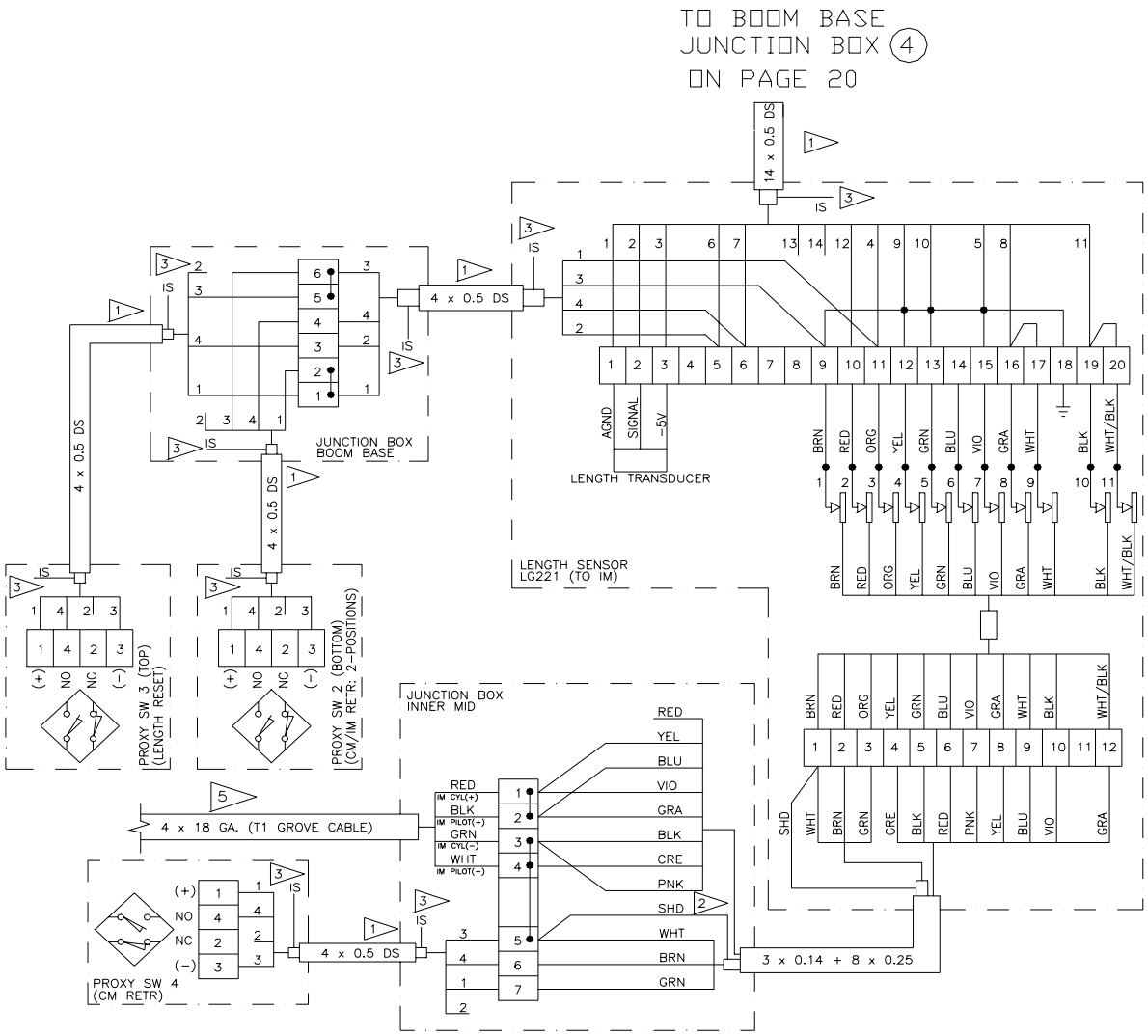
Drawing 11.2

11.1 Wiring Schematic - TMS 870/ TTS 870



Drawing 11.3

11.1 Wiring Schematic - TMS 870/ TTS 870



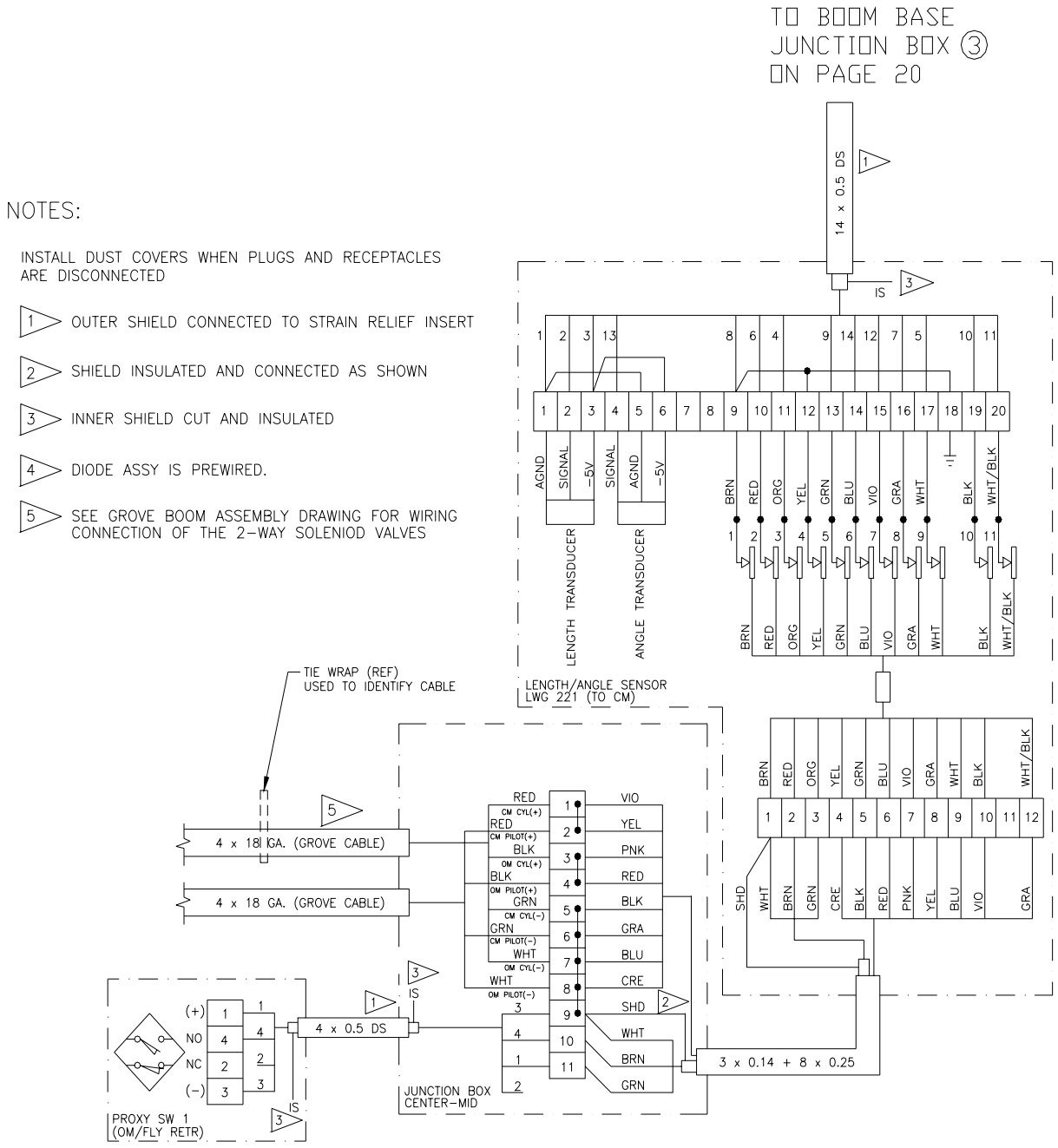
NOTES:

INSTALL DUST COVERS WHEN PLUGS AND RECEPTACLES ARE DISCONNECTED

1. OUTER SHIELD CONNECTED TO STRAIN RELIEF INSERT
2. SHIELD INSULATED AND CONNECTED AS SHOWN
3. INNER SHIELD CUT AND INSULATED
4. DIODE ASSY IS PREWIRED.
5. SEE GROVE BOOM ASSEMBLY DRAWING FOR WIRING CONNECTION OF THE 2-WAY SOLENIOD VALVES

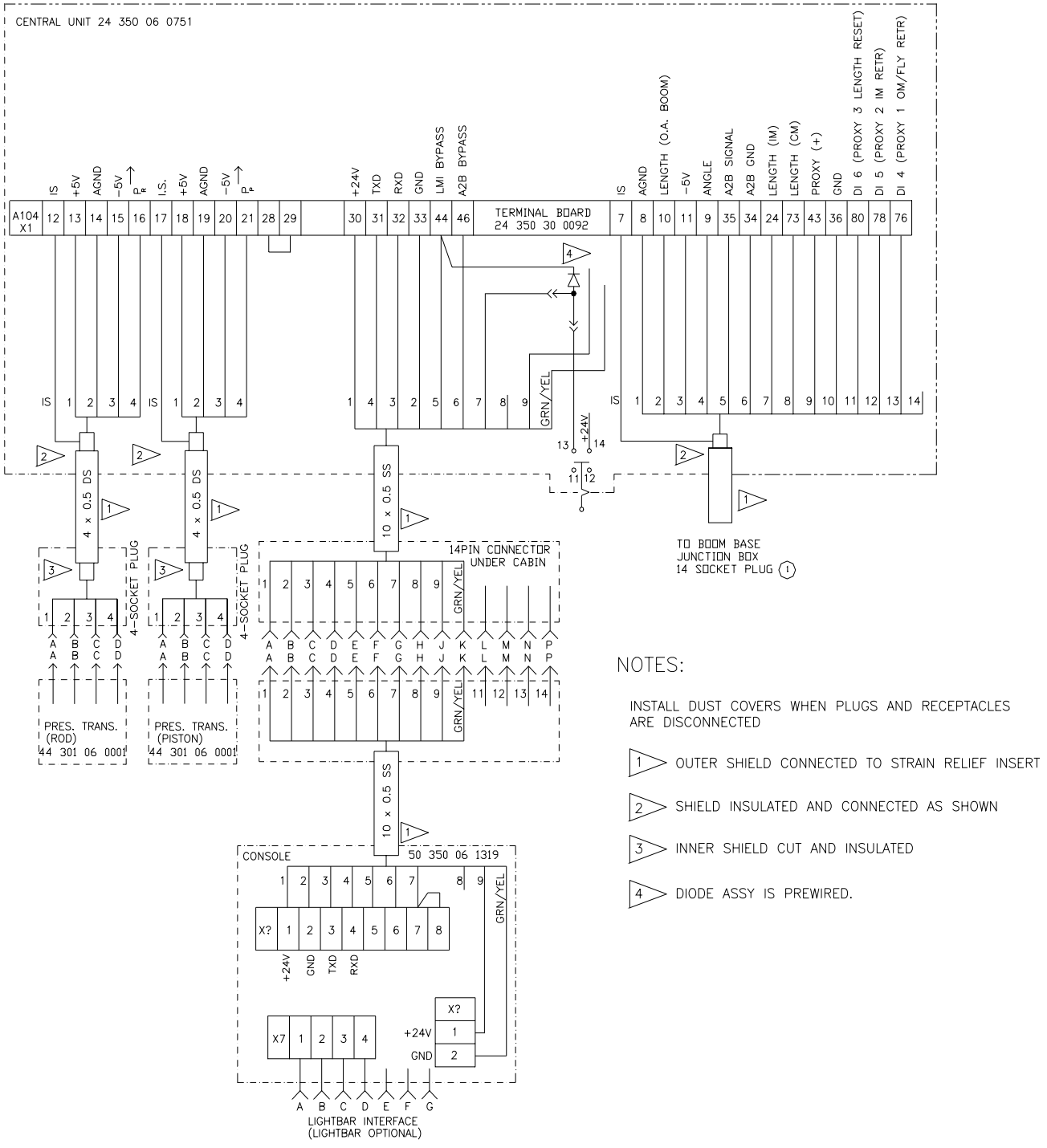
Drawing 11.4

11.1 Wiring Schematic - TMS 870/ TTS 870



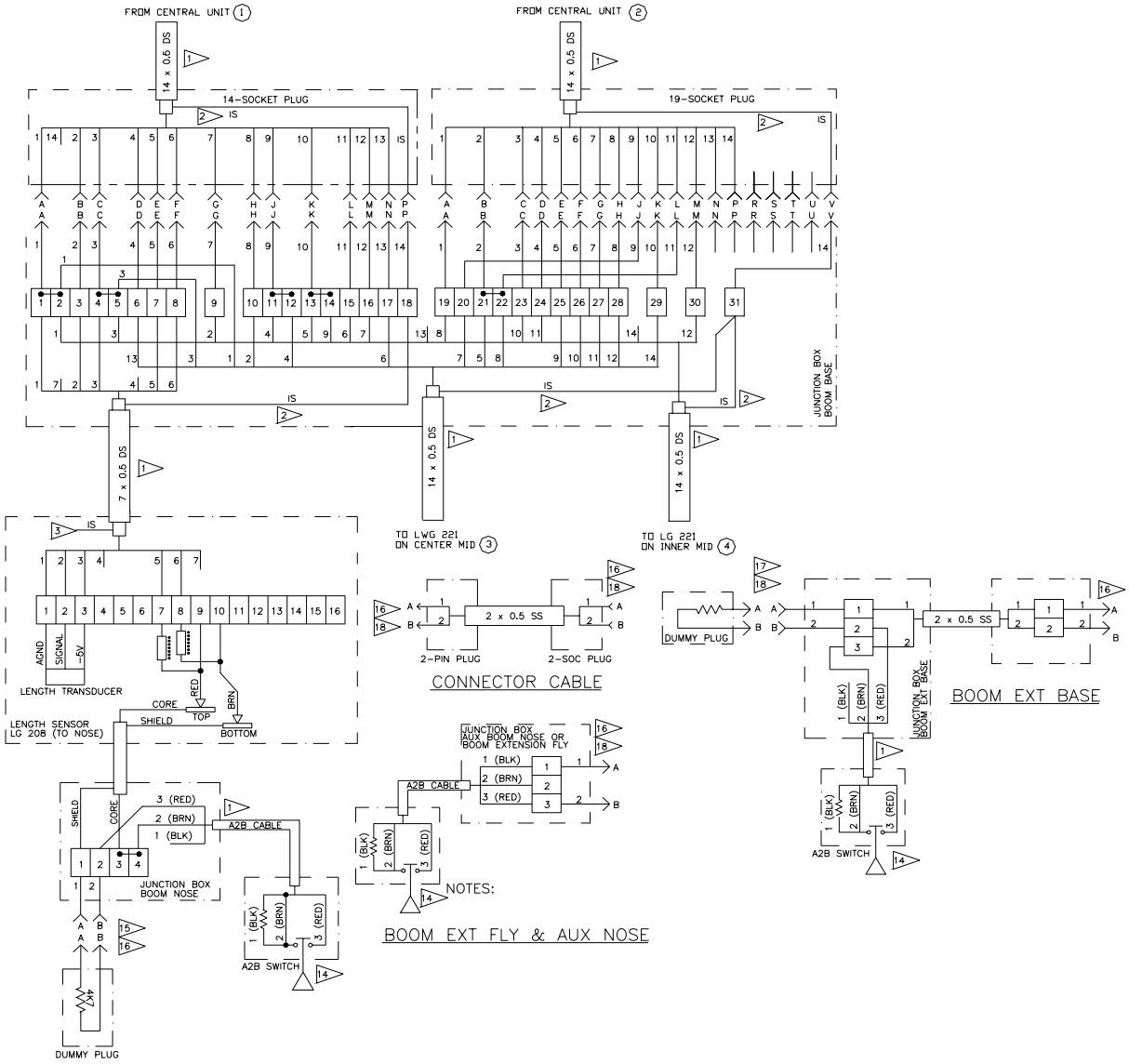
Drawing 11.5

11.2 Wiring Schematic - RT 865 BXL



Drawing 12.1

11.2 Wiring Schematic - RT 865 BXL



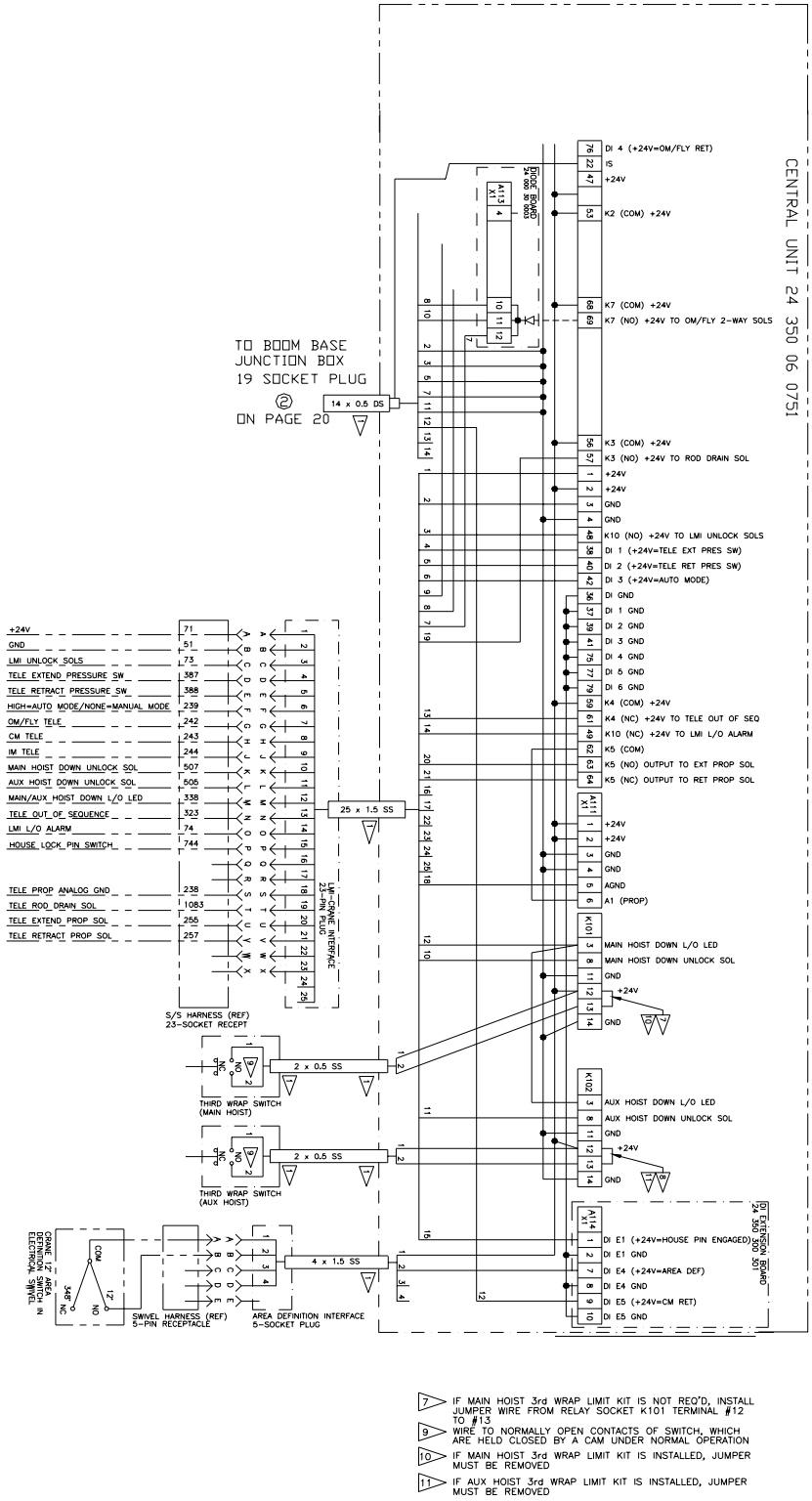
NOTES:

INSTALL DUST COVERS WHEN PLUGS AND RECEPTACLES ARE DISCONNECTED

1. OUTER SHIELD CONNECTED TO STRAIN RELIEF INSERT
2. SHIELD INSULATED AND CONNECTED AS SHOWN
3. INNER SHIELD CUT AND INSULATED
4. DIODE ASSY IS PREWIRED.
5. SEE GROVE BOOM ASSEMBLY DRAWING FOR WIRING CONNECTION OF THE 2-WAY SOLENIOD VALVES
13. RELAY AND DIODE ASSY ARE PREWIRED
14. A2B SWITCH IS PREWIRED & POTTED
15. WHEN BOOM EXT OR AUX NOSE IS NOT USED, INSTALL DUMMY PLUG INTO RECEPT ON BOOM NOSE JUNCTION BOX
16. WHEN BOOM EXT OR AUX BOOM NOSE IS USED, INSTALL CONNECTOR CABLE FROM RECEPT ON BOOM NOSE JUNCTION BOX TO RECEPT ON BOOM EXT OR AUX NOSE JUNCTION BOX
17. WHEN BOOM EXT BASE IS USED WITHOUT FLY, INSTALL DUMMY PLUG INTO RECEPT ON BOOM EXT BASE JUNCTION BOX
18. WHEN BOOM EXT FLY IS USED, INSTALL 2nd CONNECTOR CABLE FROM RECEPT ON BOOM EXT BASE JUNCTION BOX TO RECEPT ON BOOM EXT FLY JUNCTION BOX

Drawing 12.2

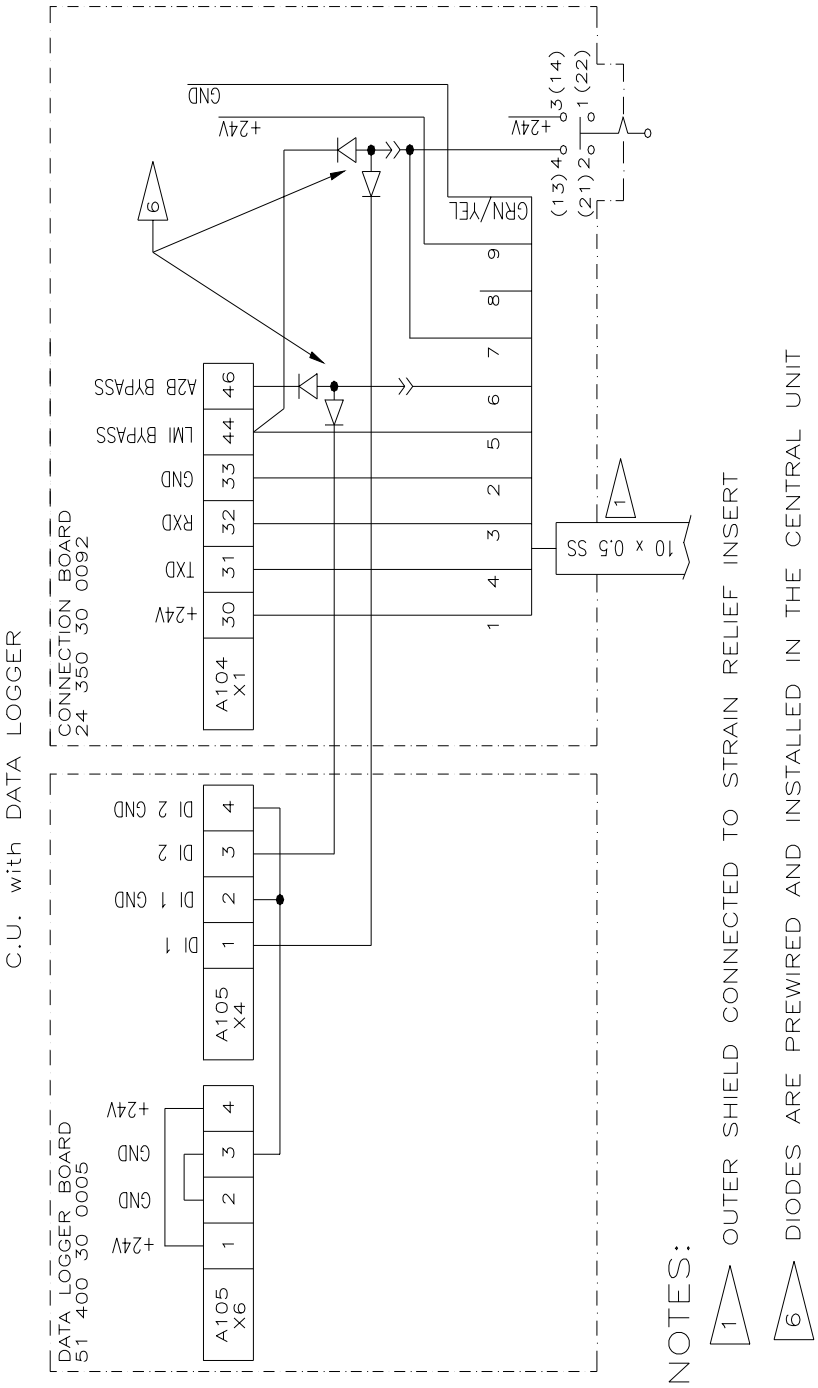
11.2 Wiring Schematic - RT 865 BXL



Drawing 12.3

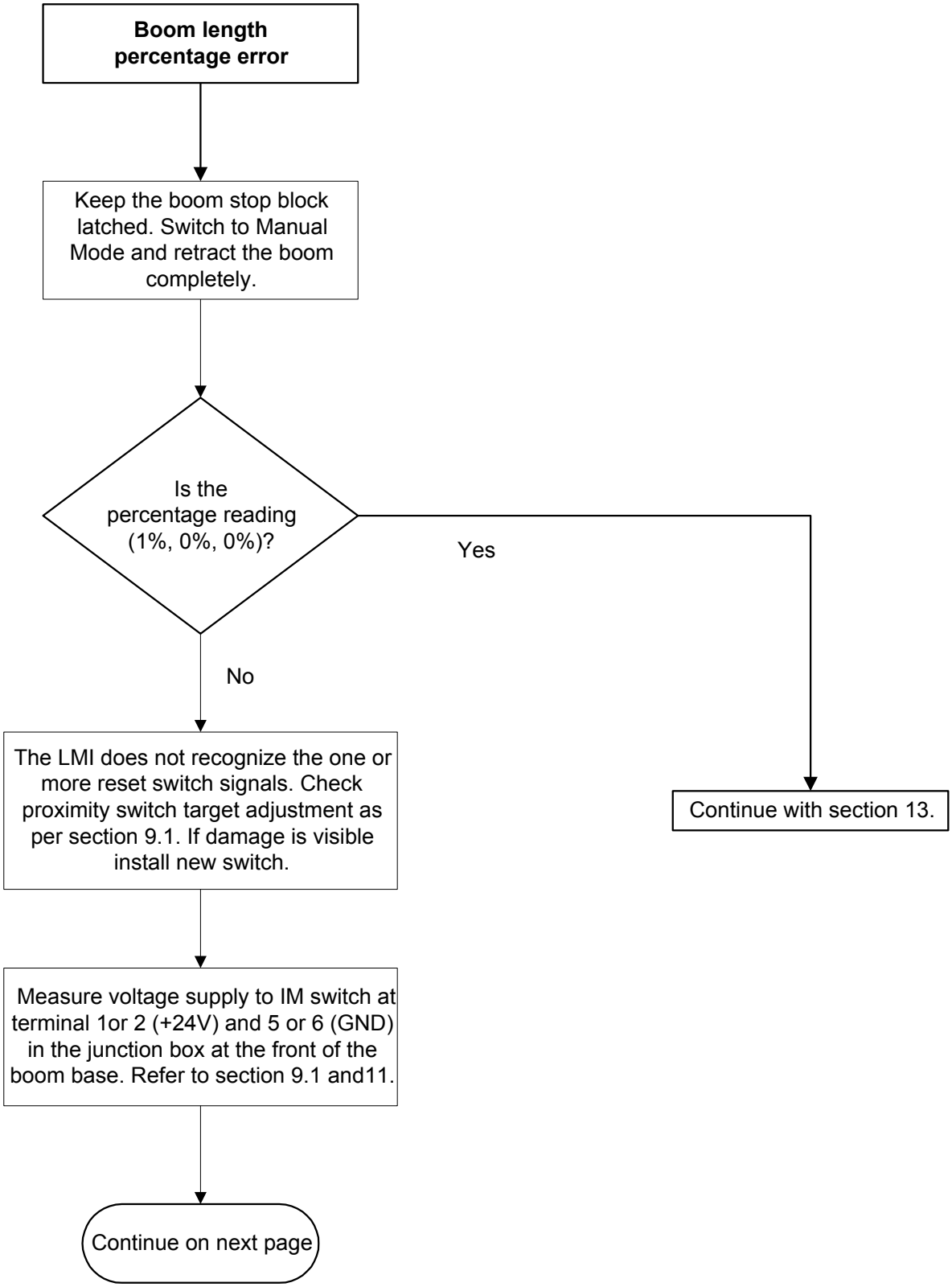
11.2 Wiring Schematic - RT 865 BXL

Optional Data Logger Connection

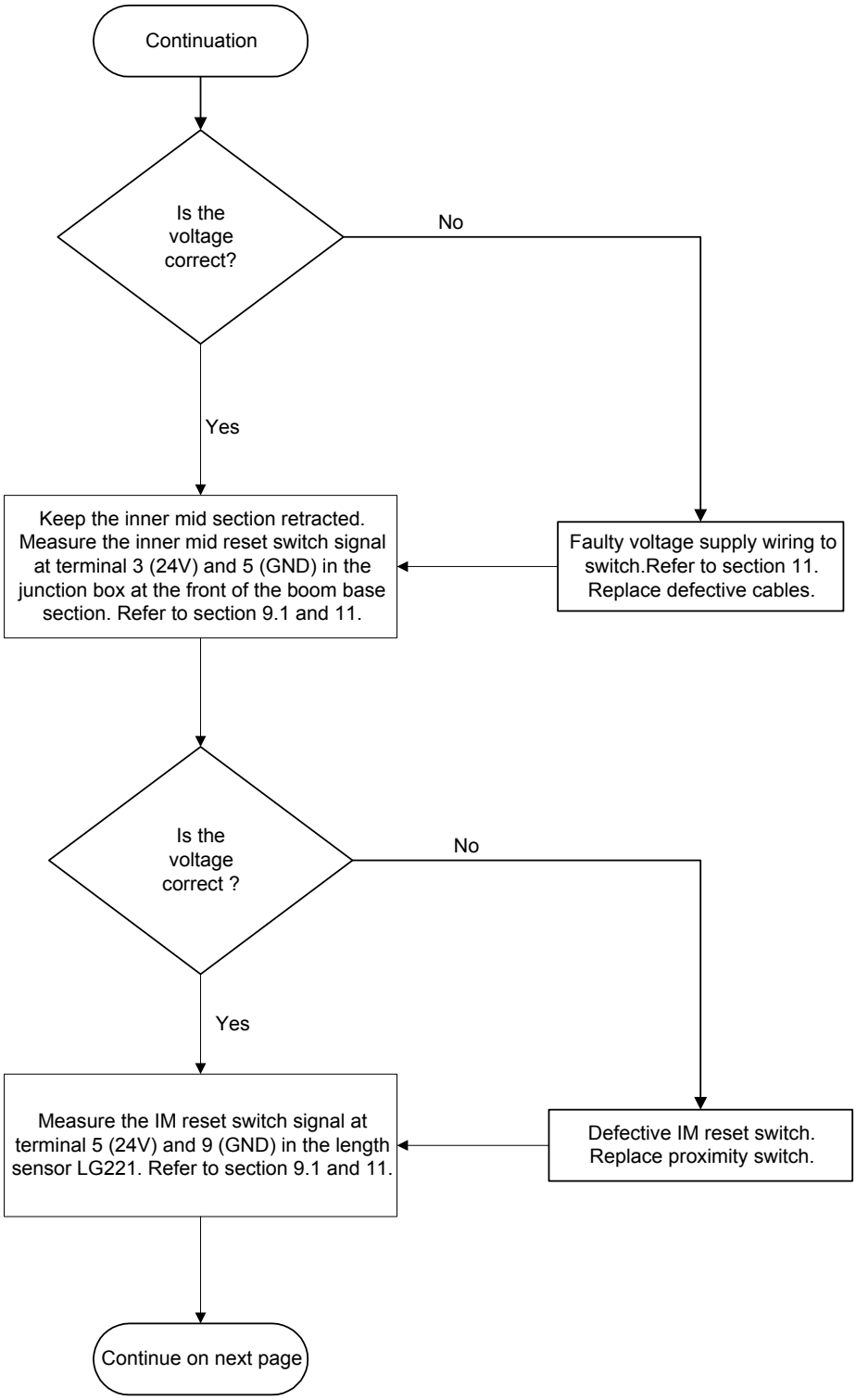


Drawing 12.4

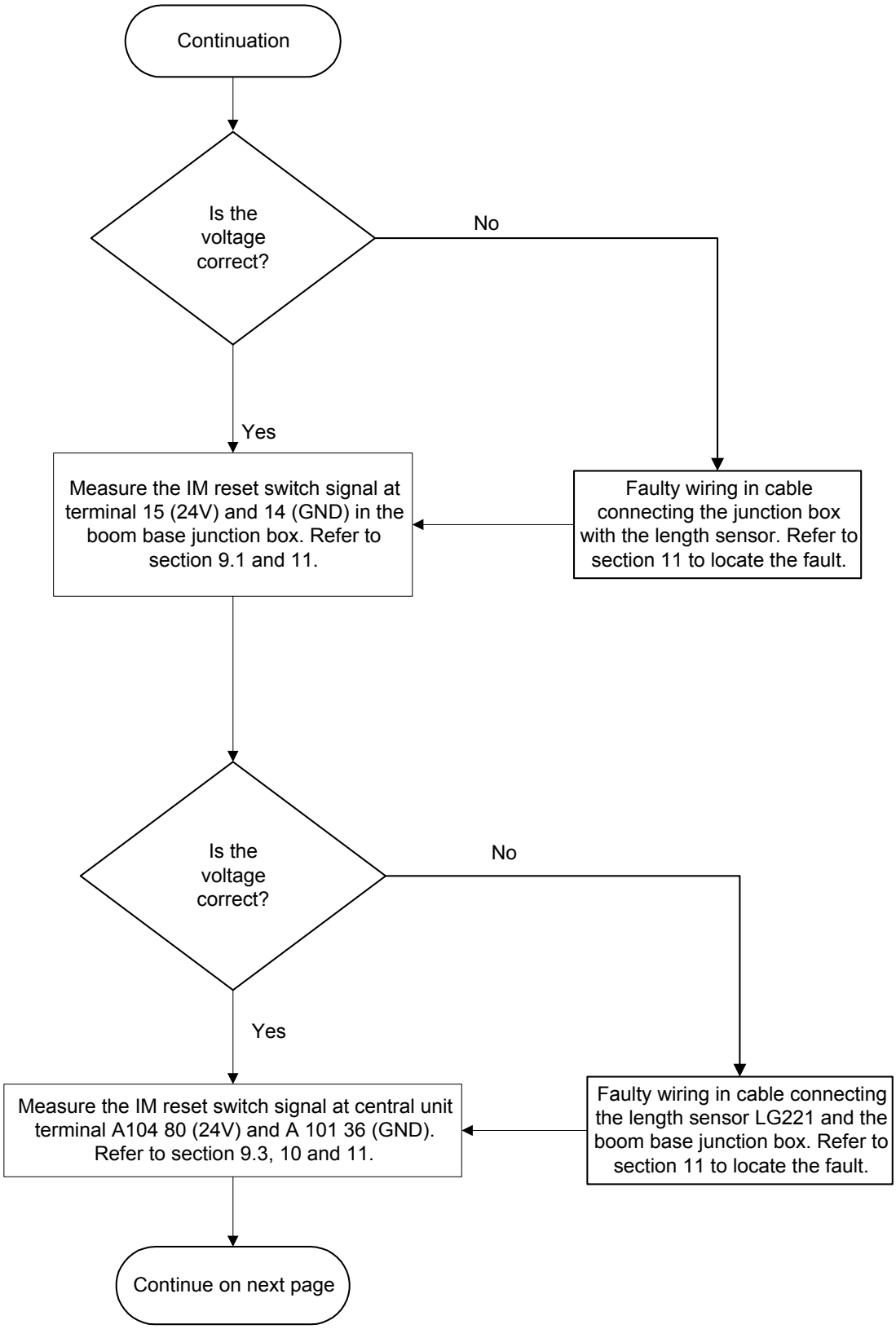
12. Boom Length Percentage Error



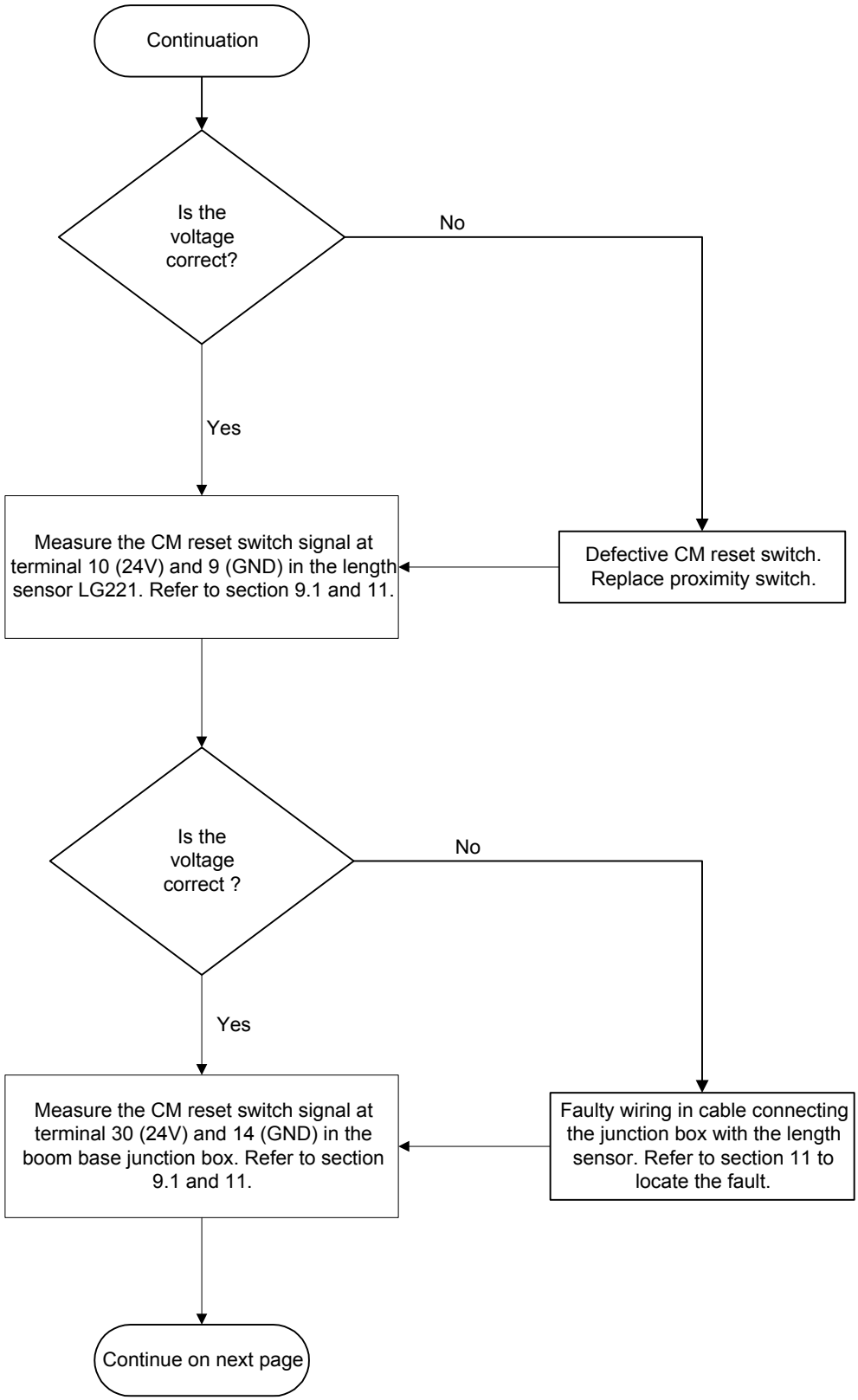
12. Continuation



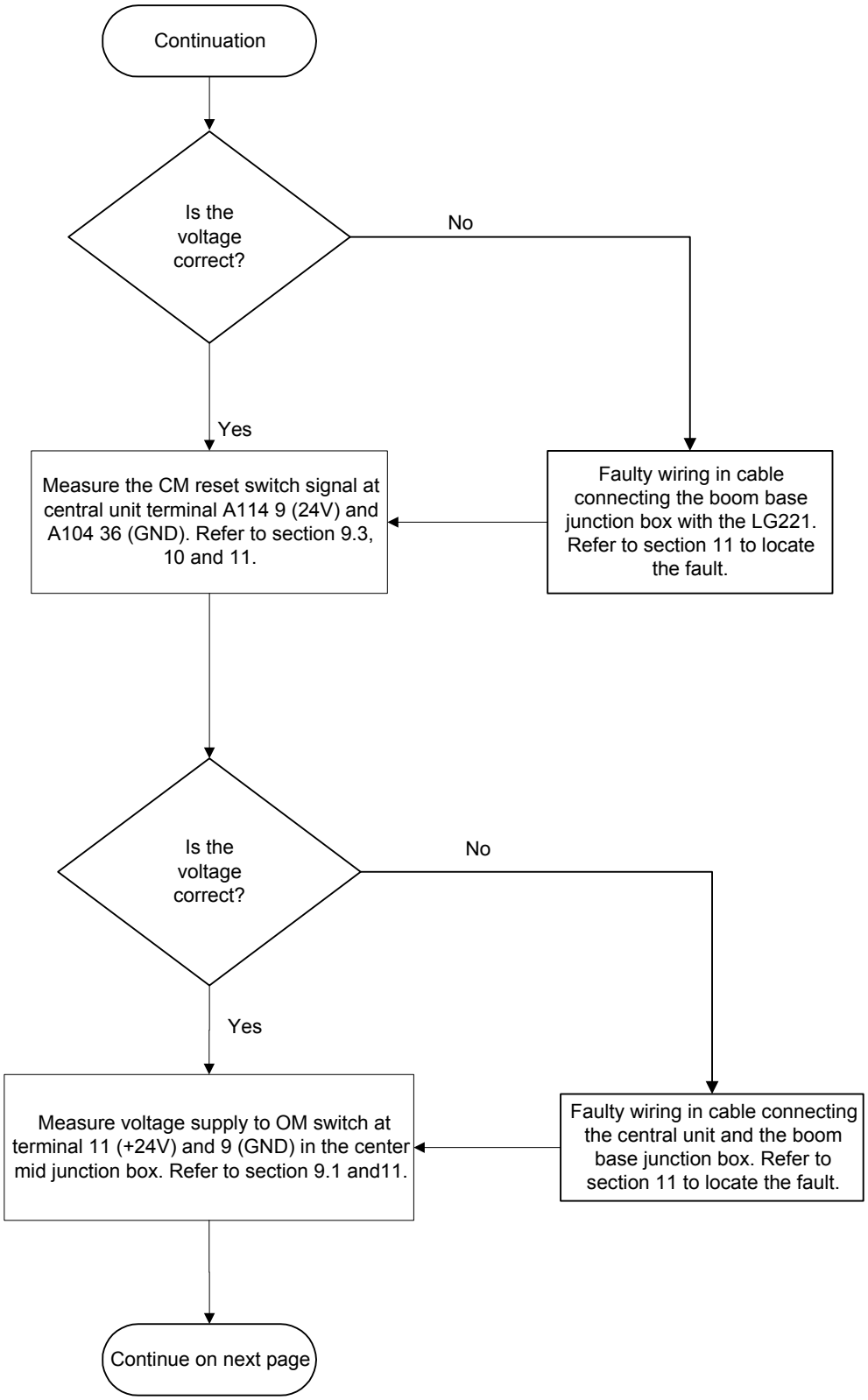
12. Continuation



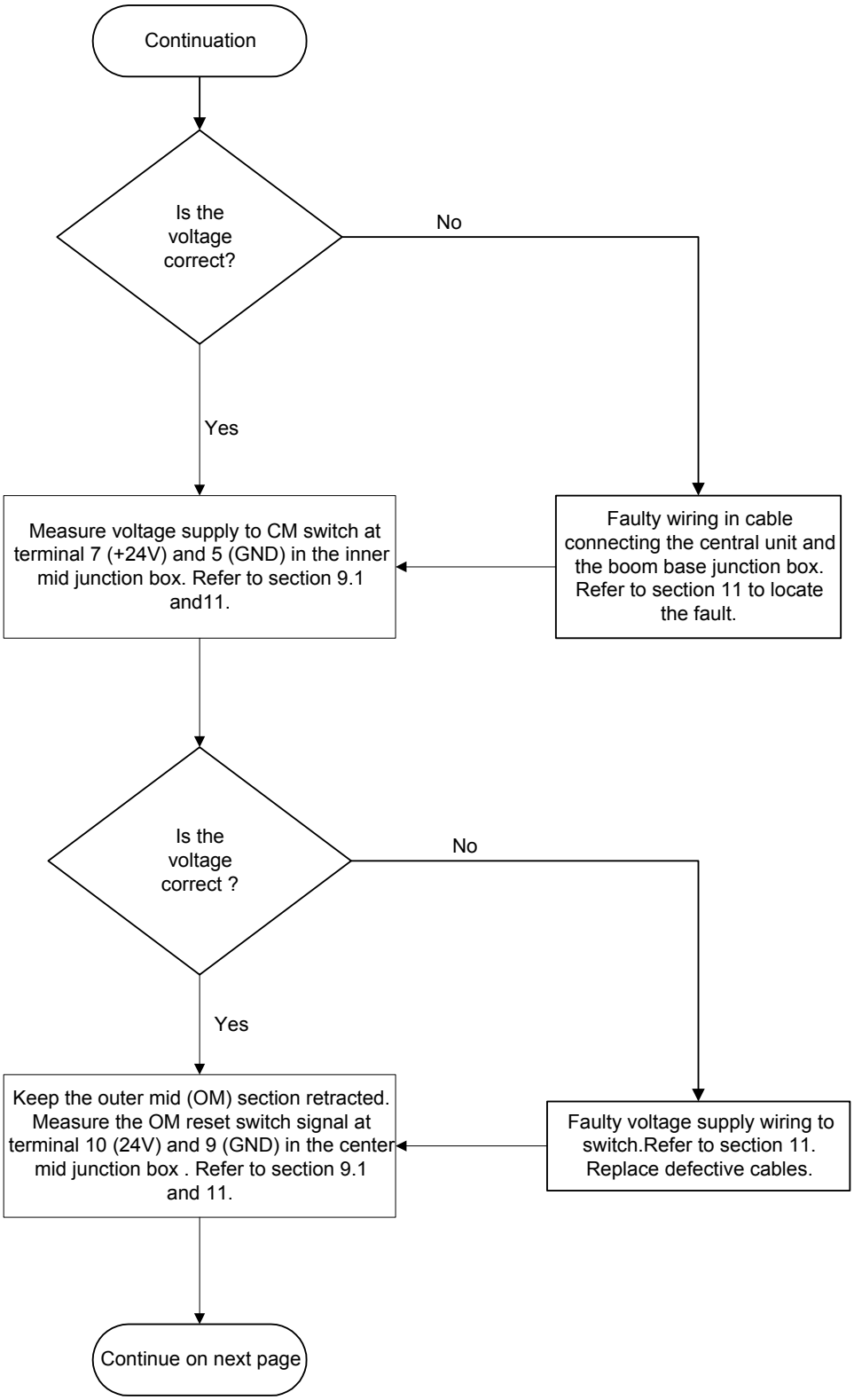
12. Continuation



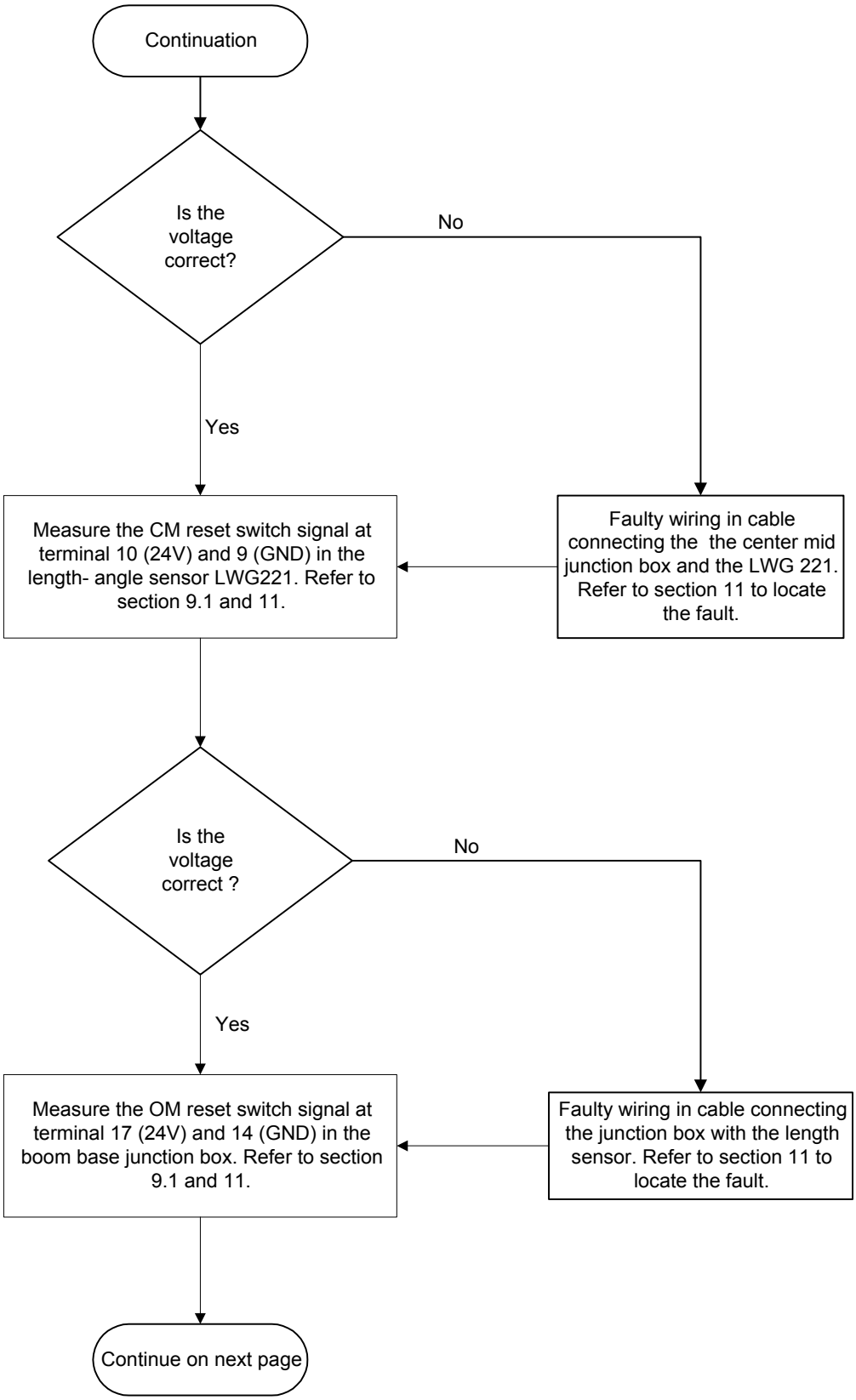
12. Continuation



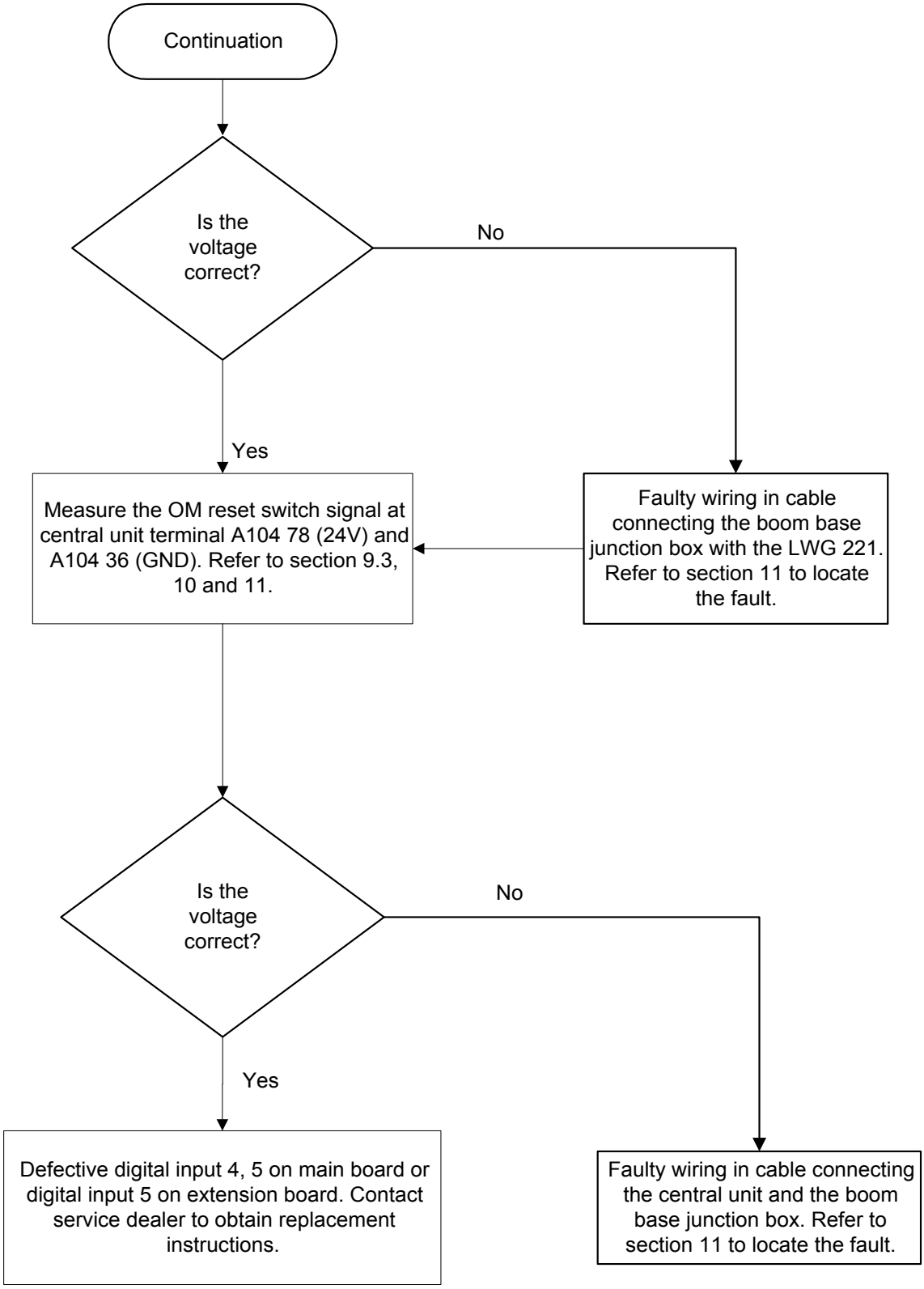
12. Continuation



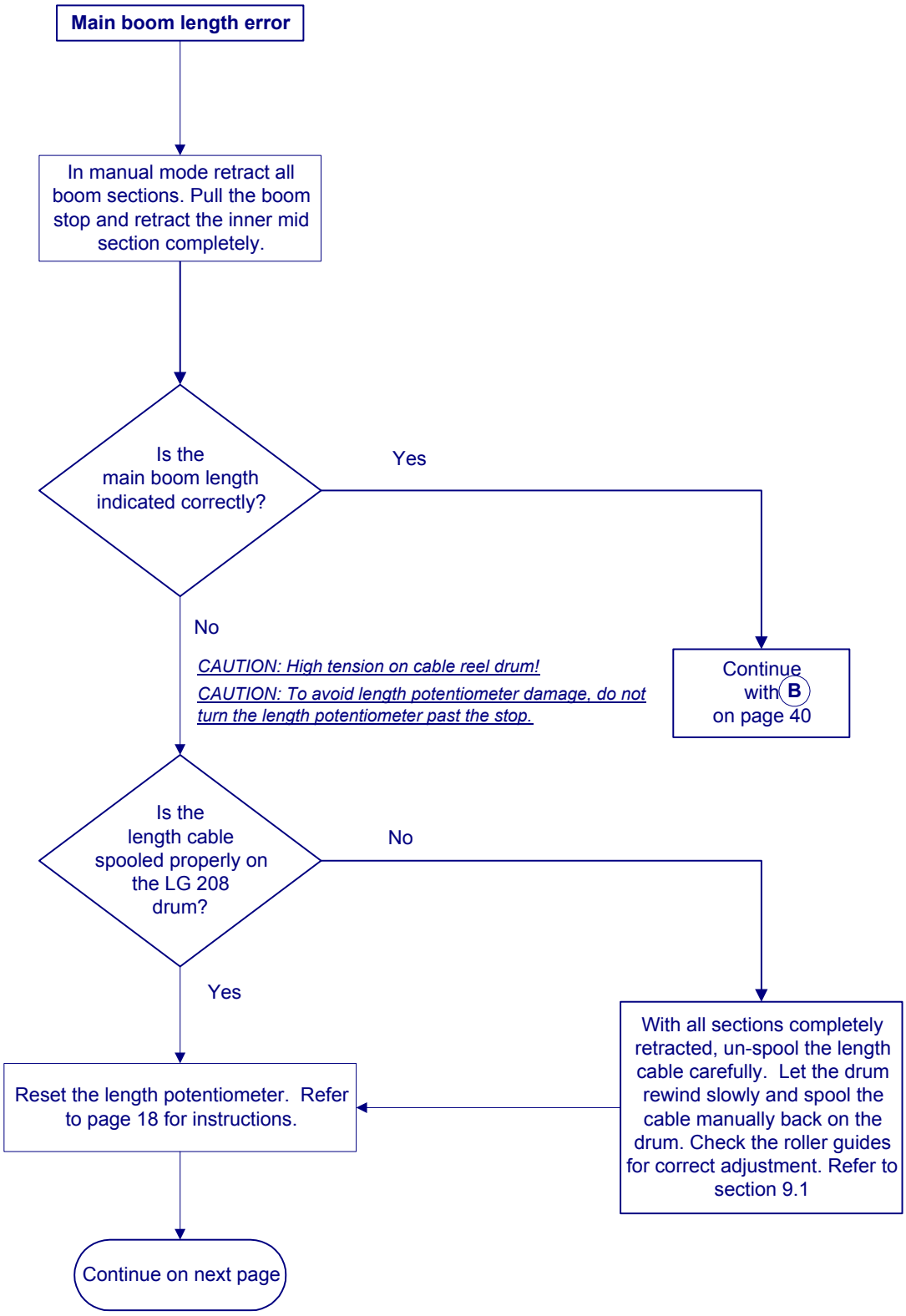
12. Continuation



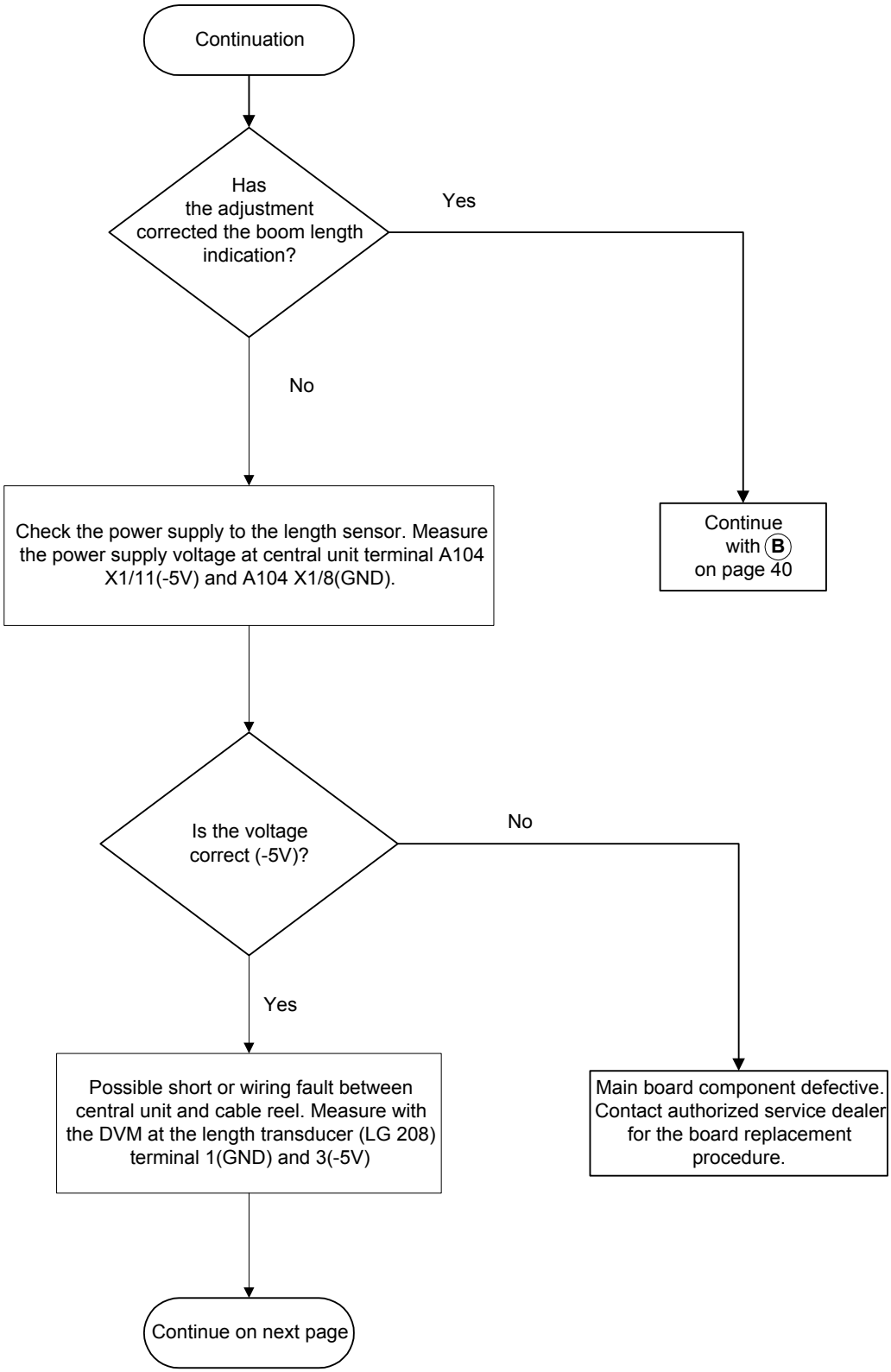
12. Continuation



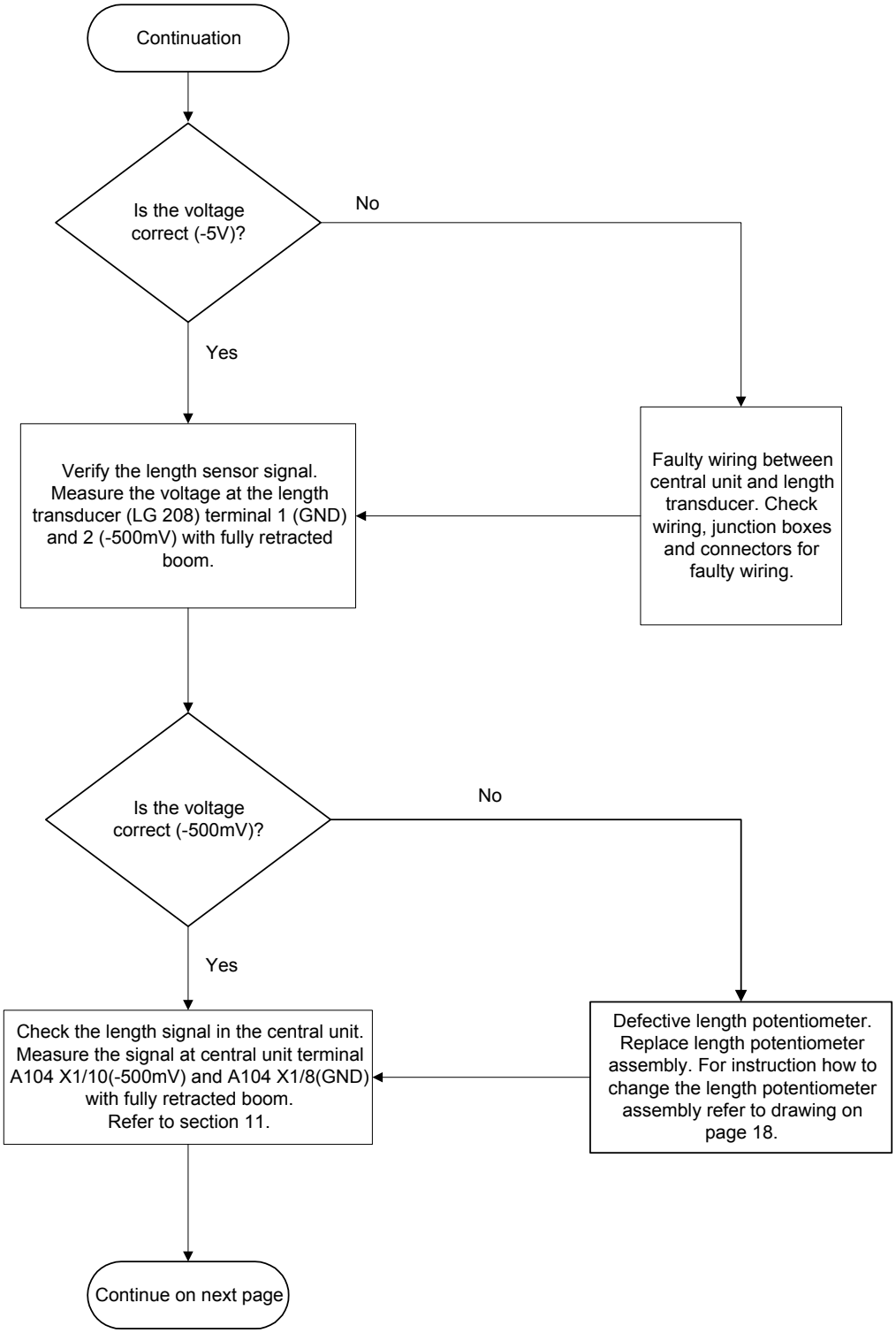
13. Main Boom Length Error



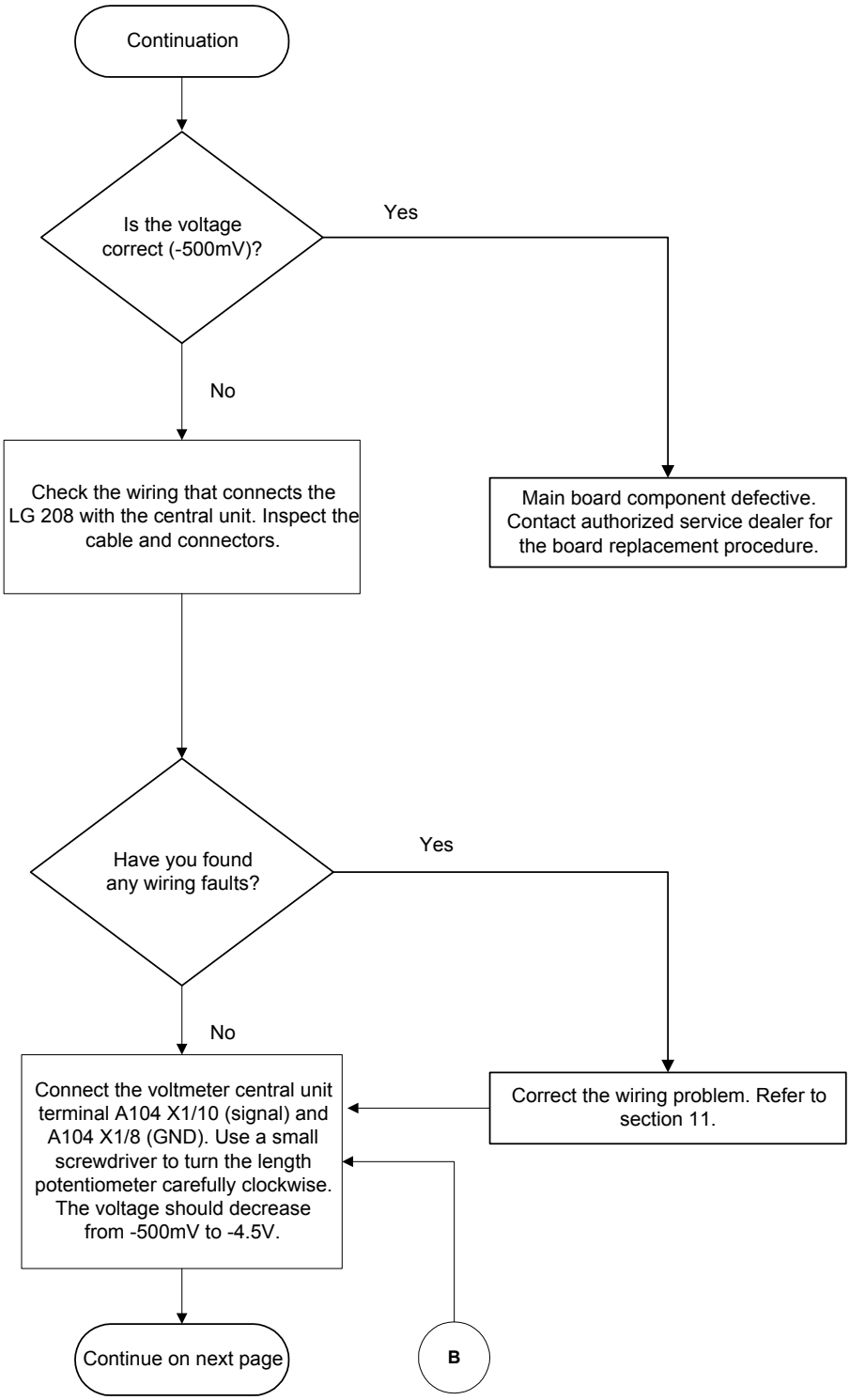
13. Continuation



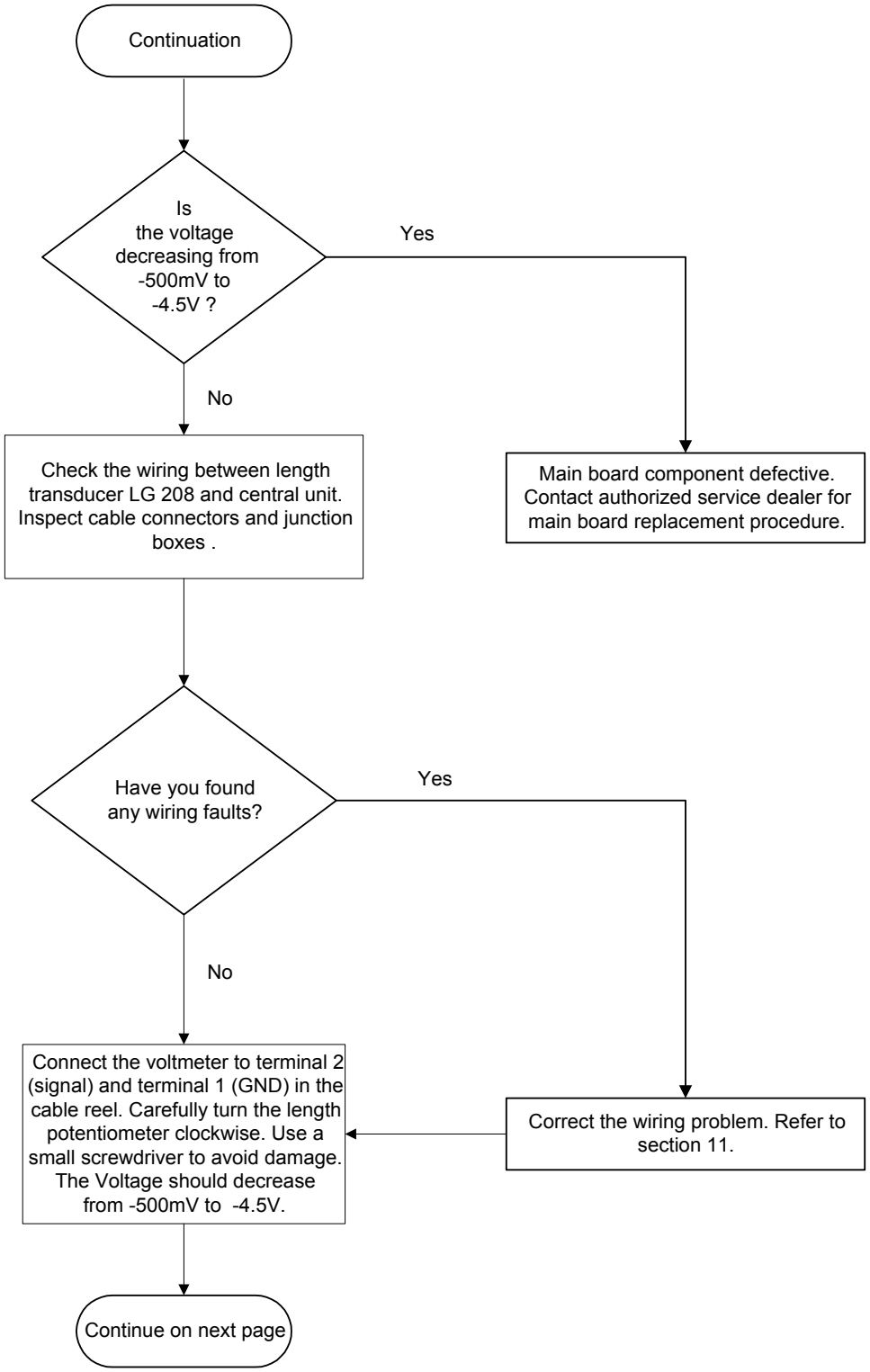
13. Continuation



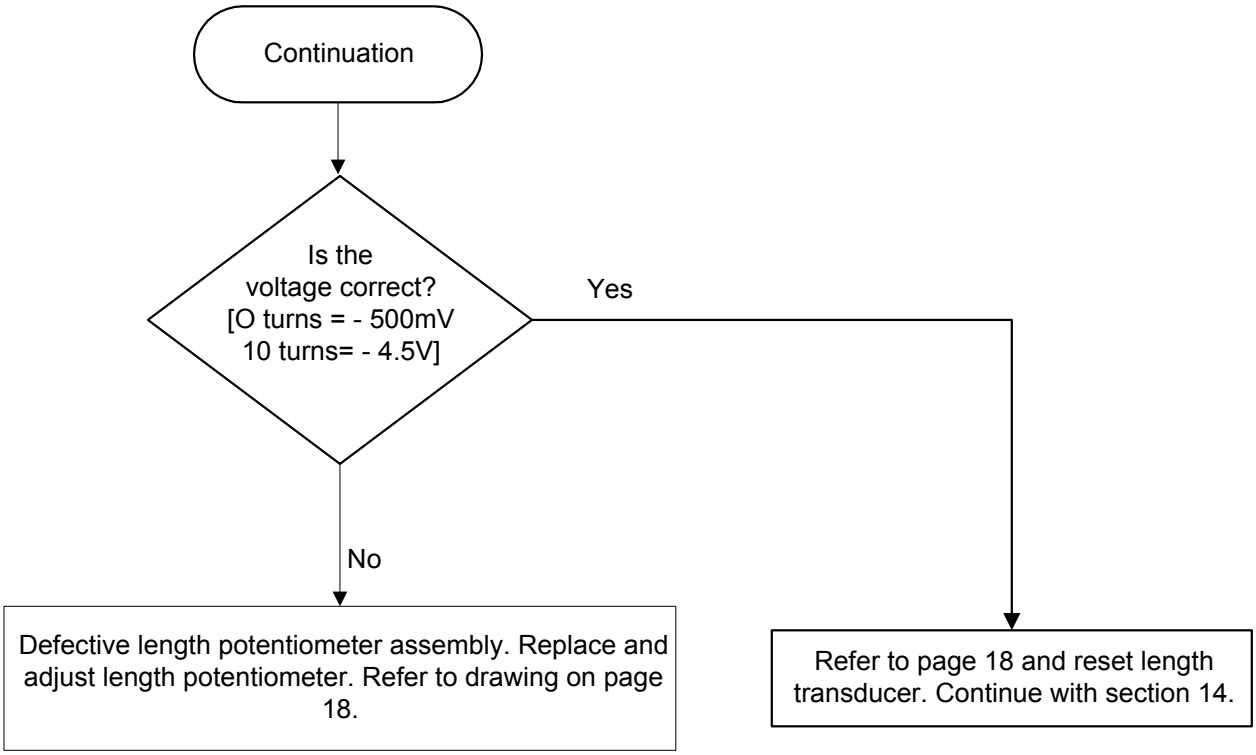
13. Continuation



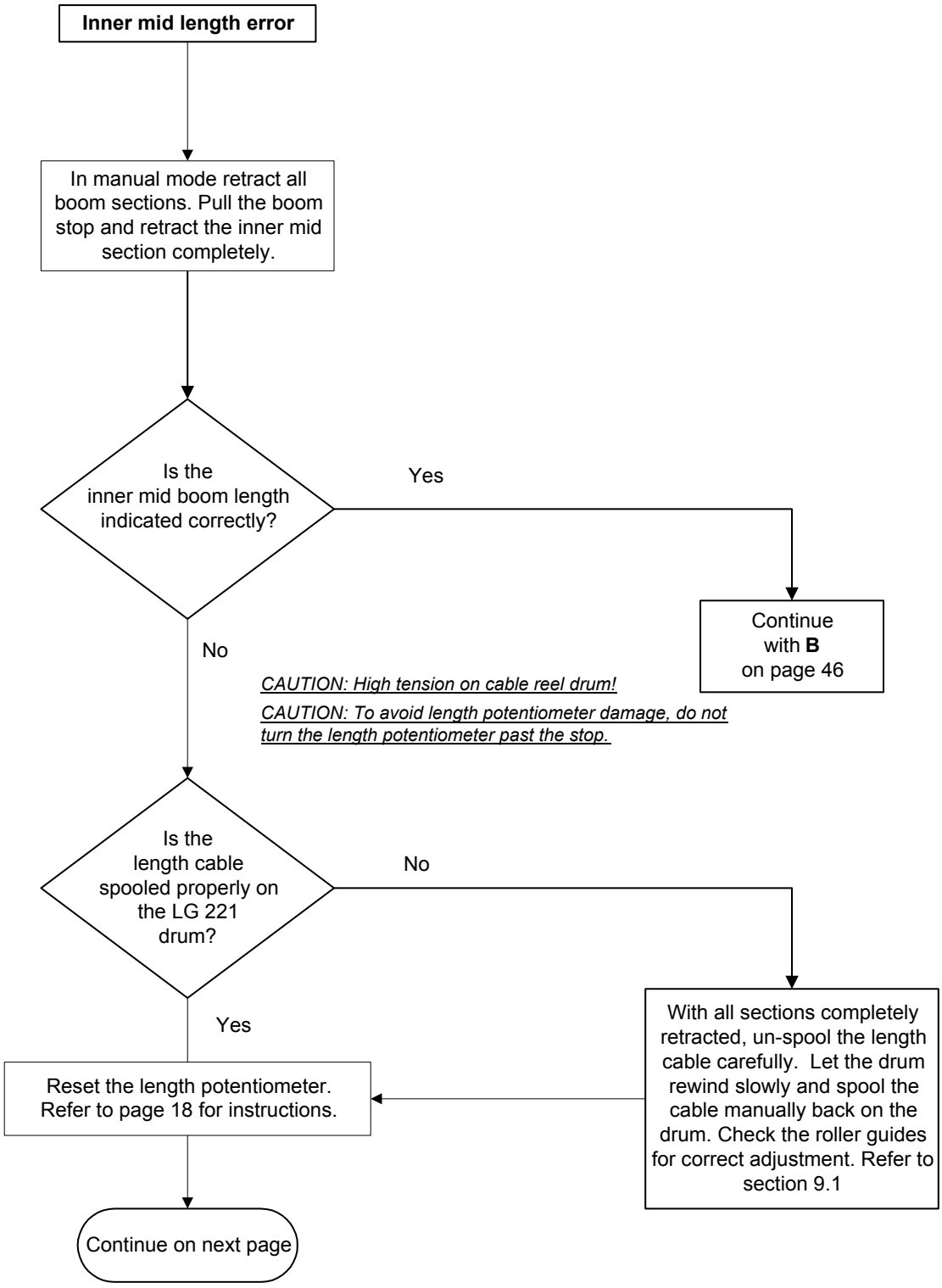
13. Continuation



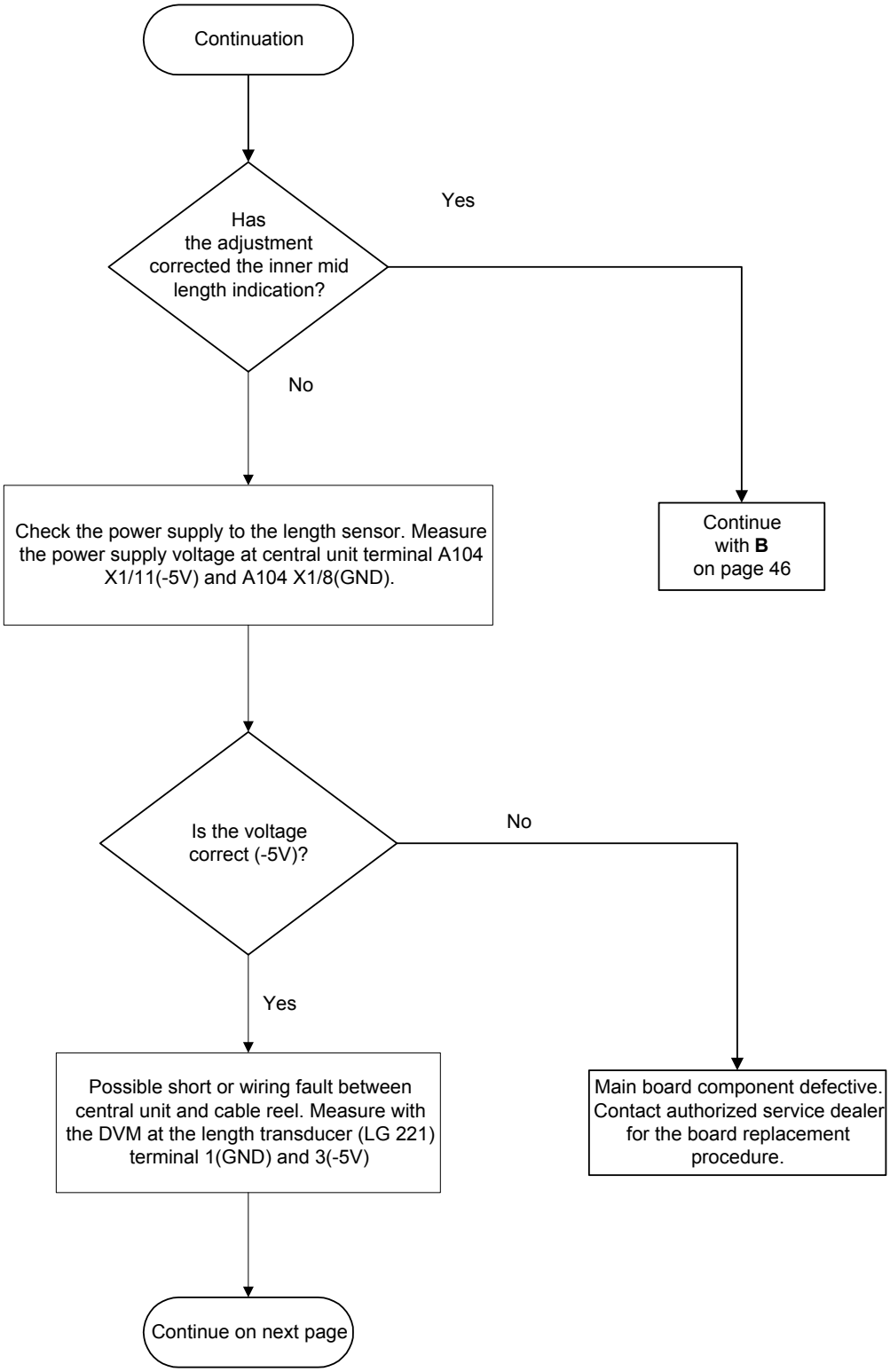
13. Continuation



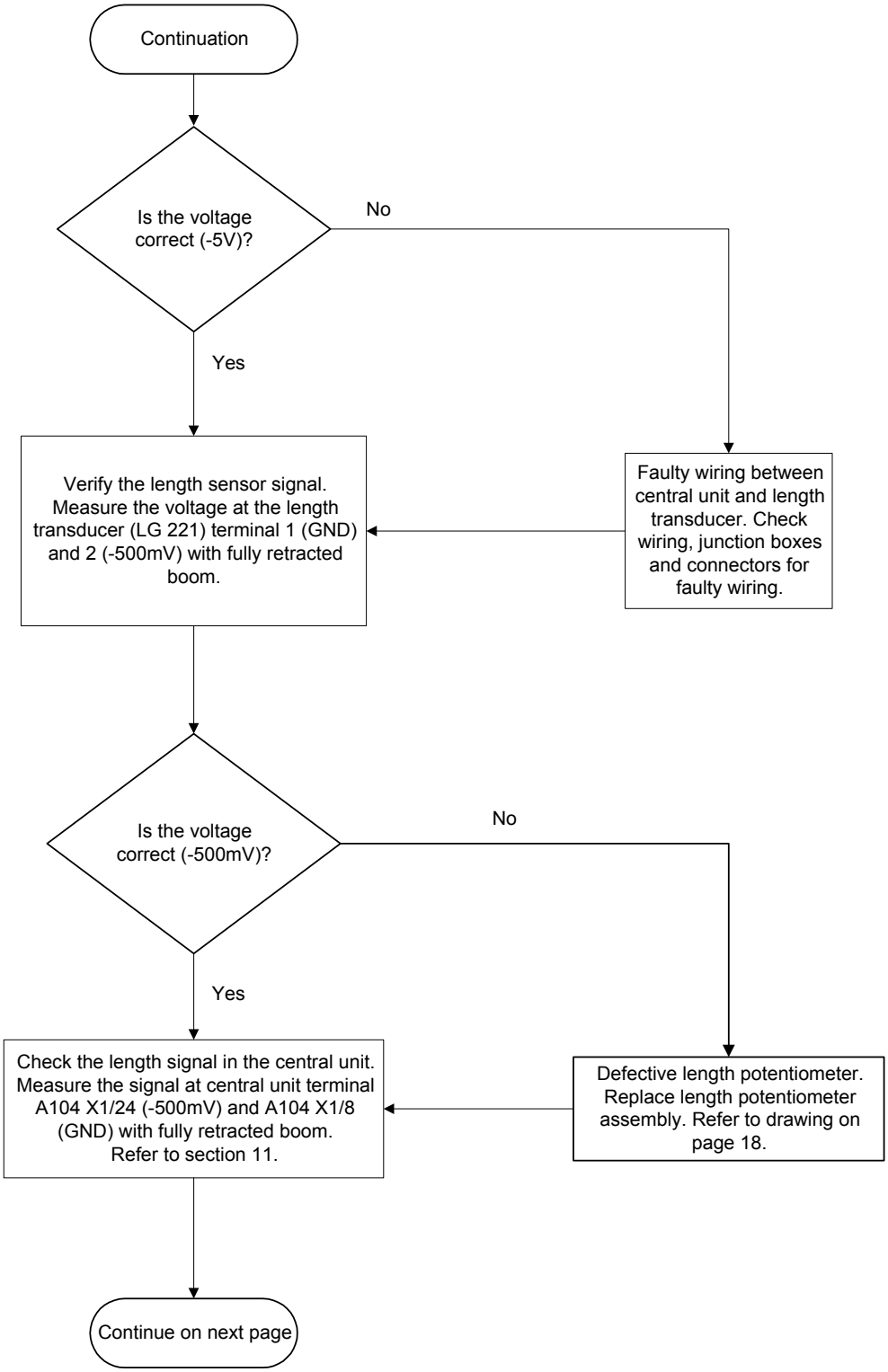
14. Inner Mid Length Error



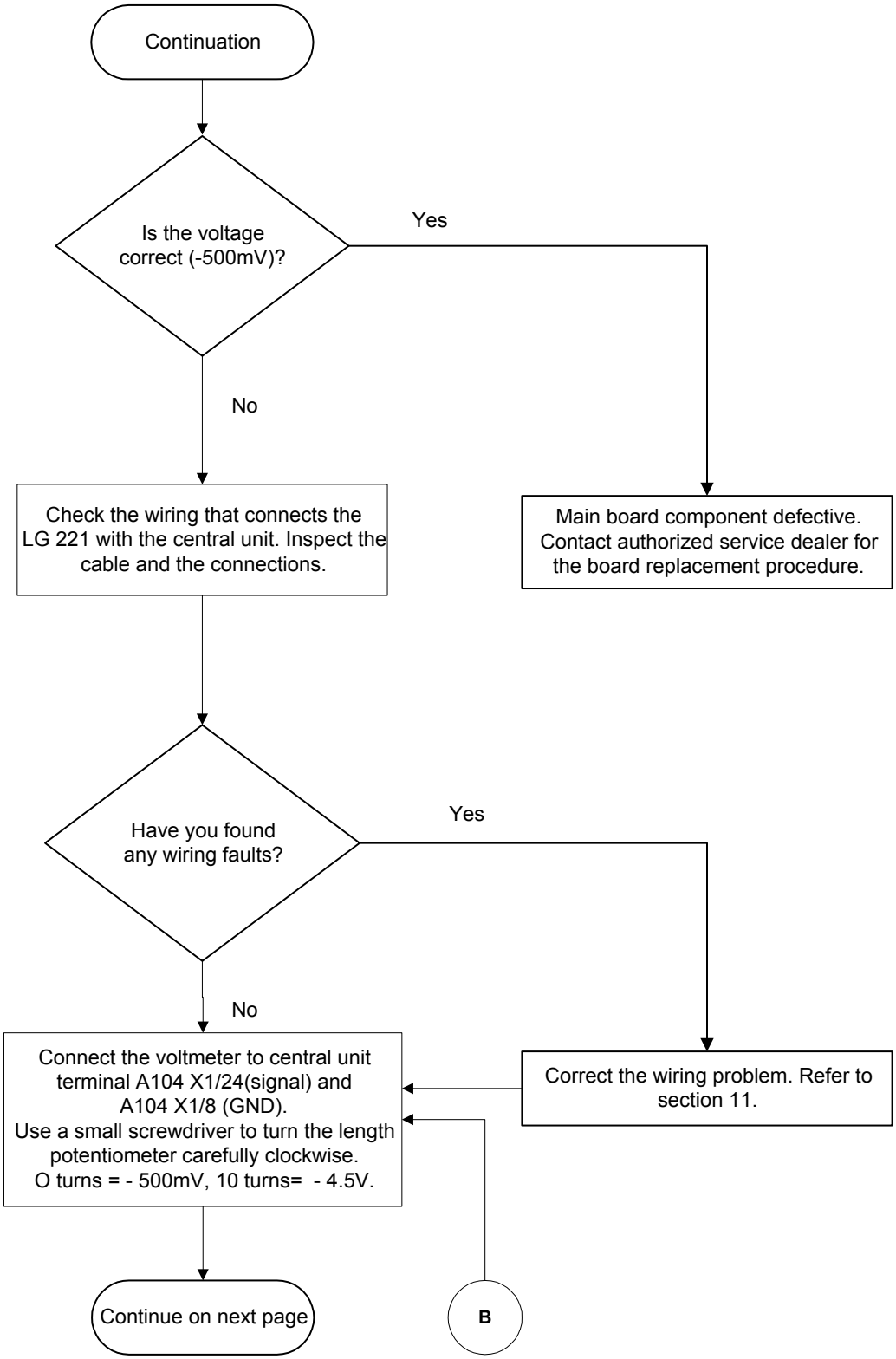
14. Continuation



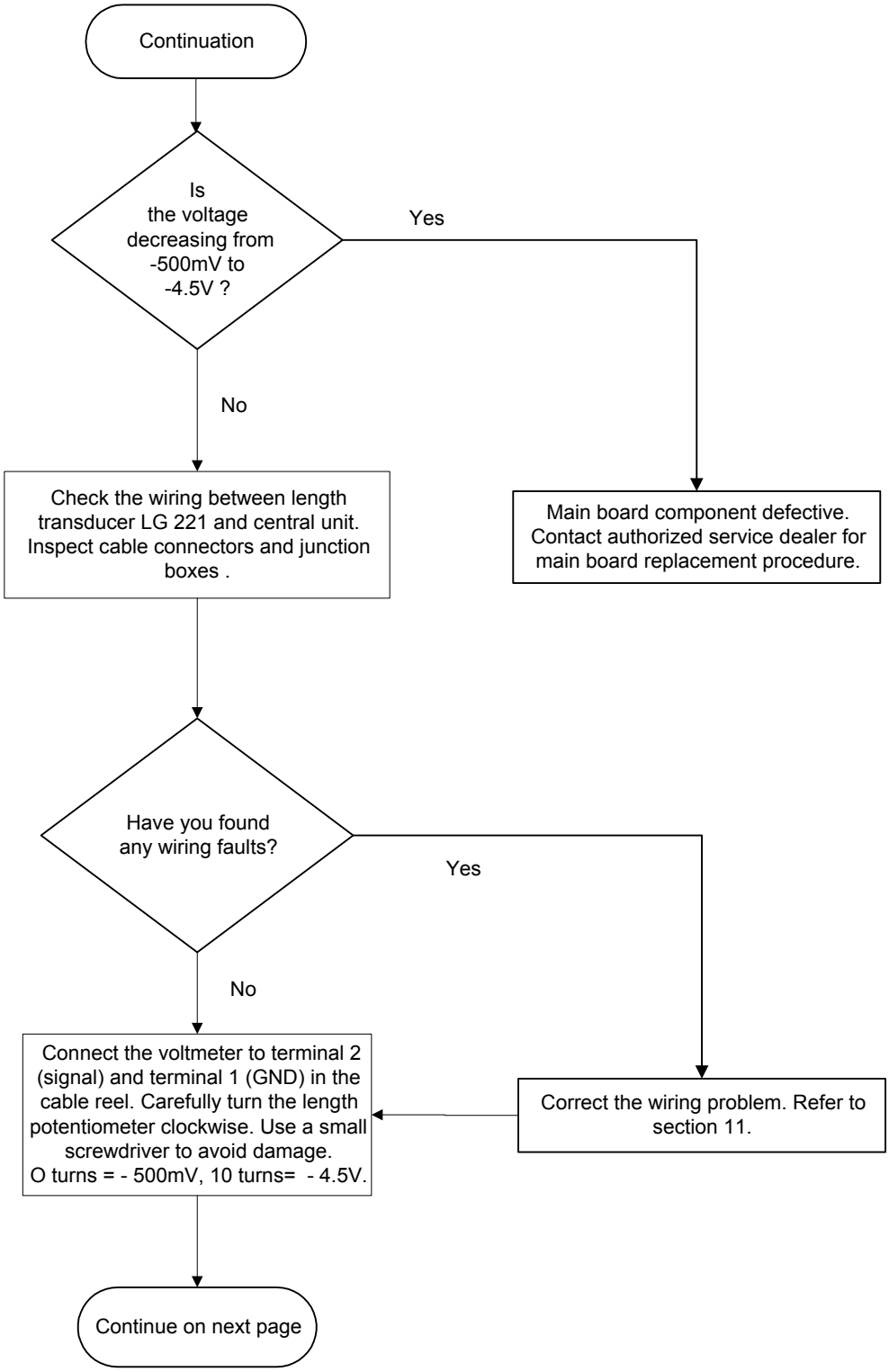
14. Continuation



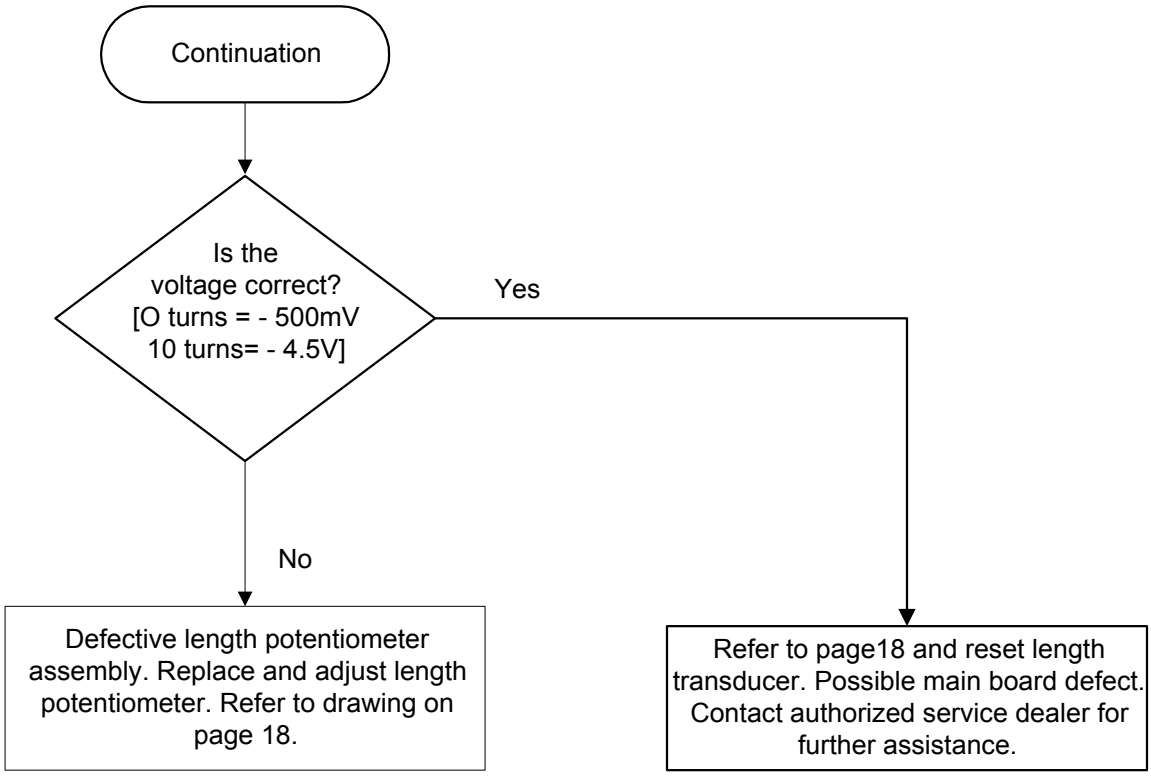
14. Continuation



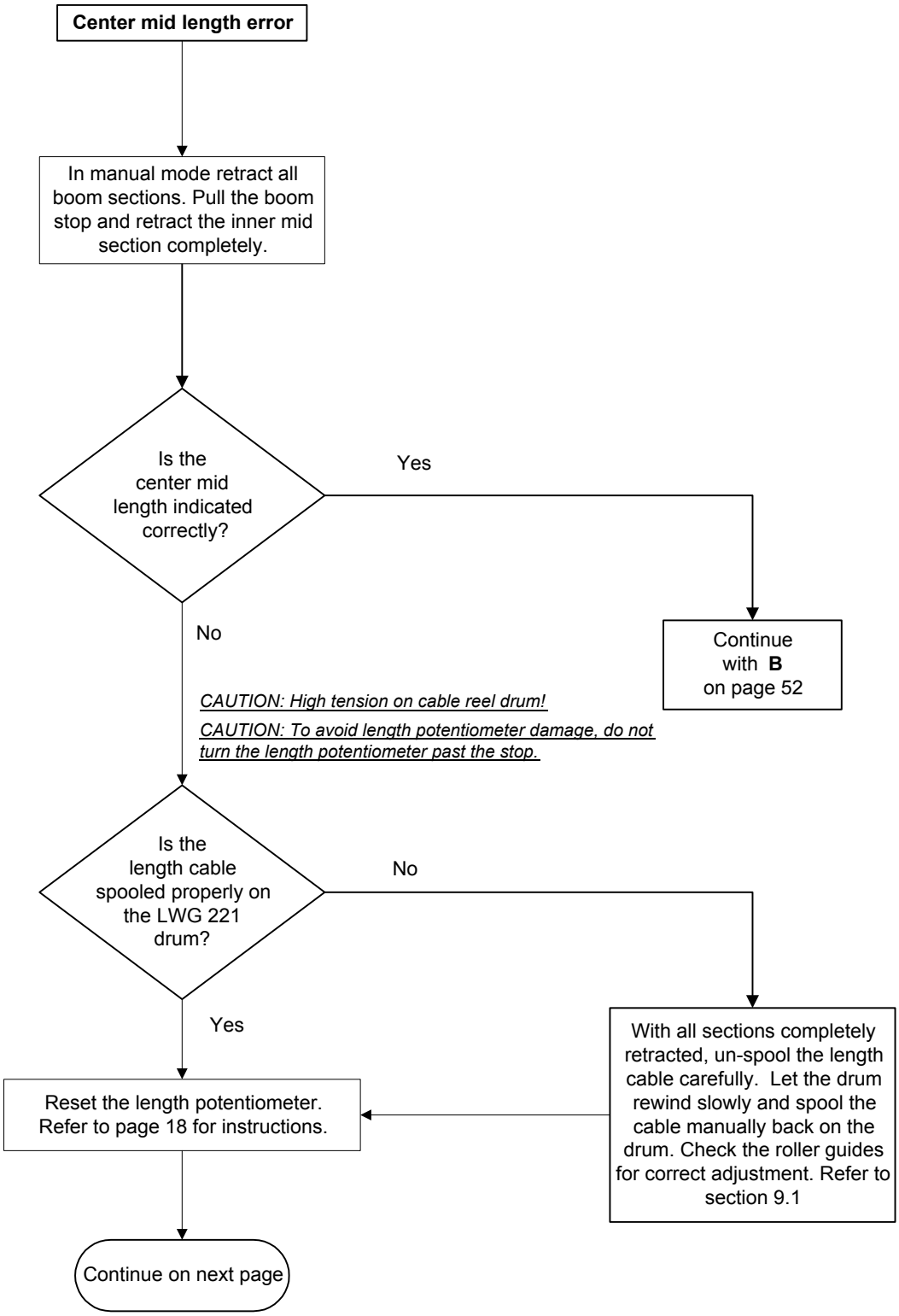
14. Continuation



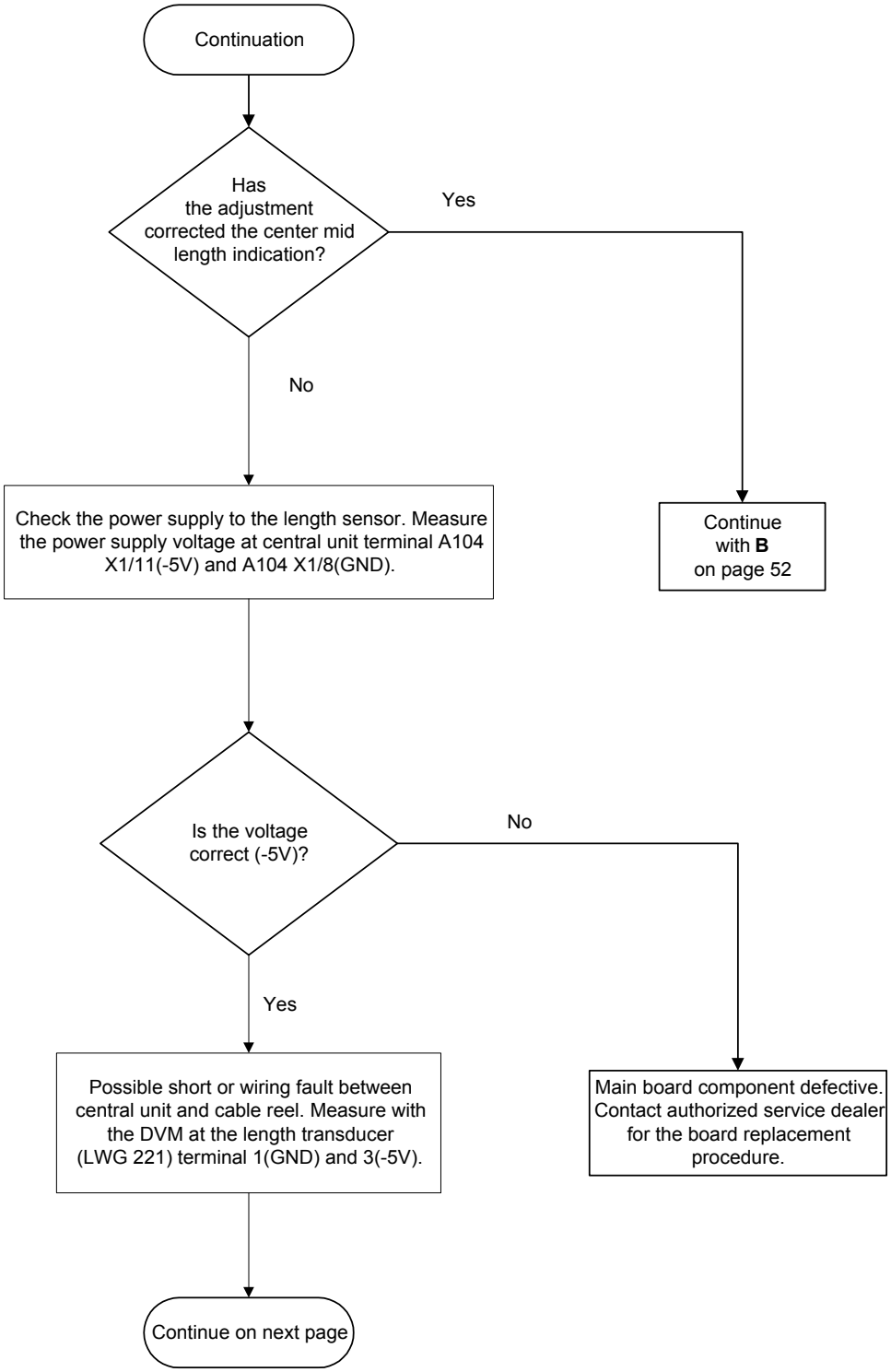
14. Continuation



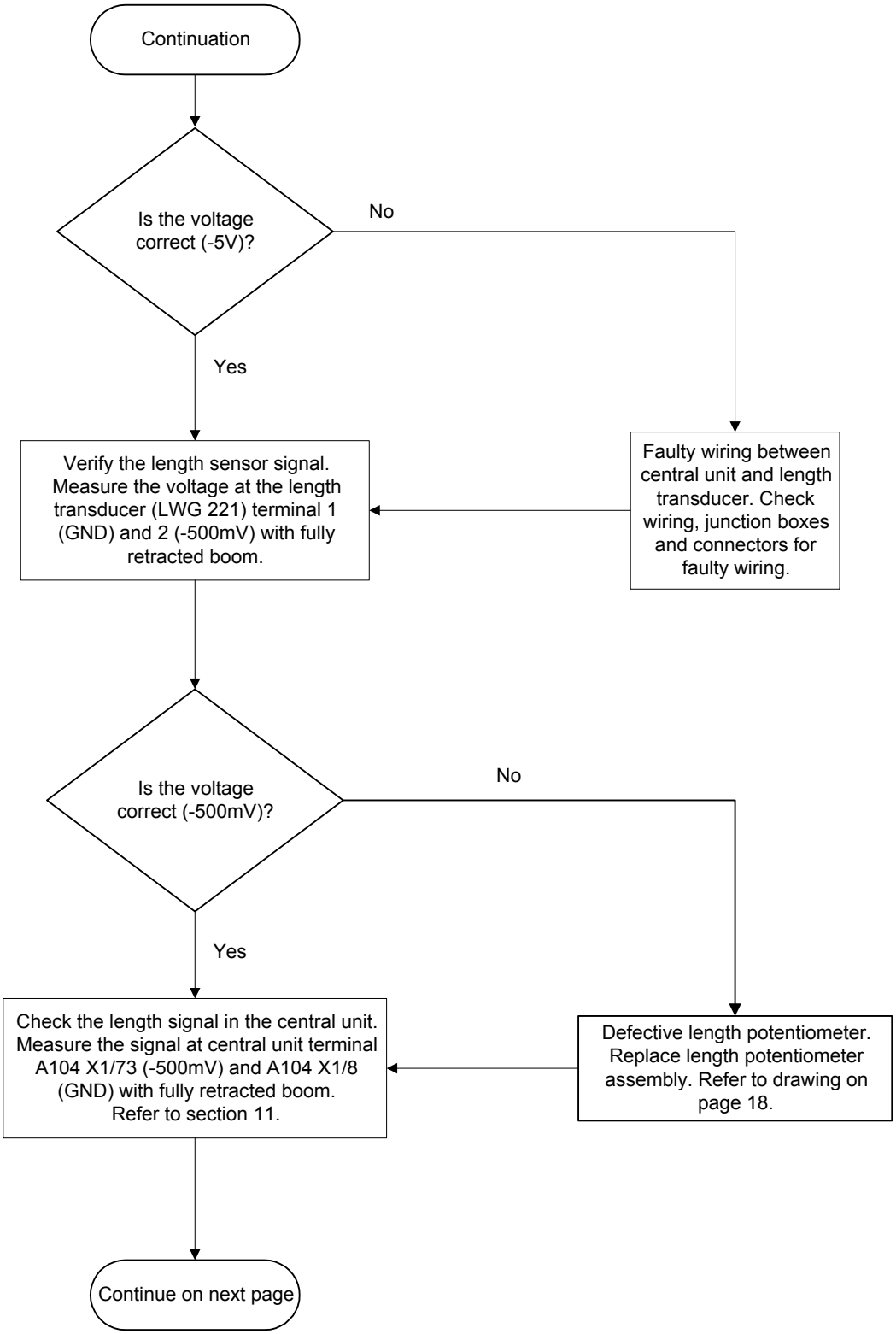
15. Center Mid Length Error



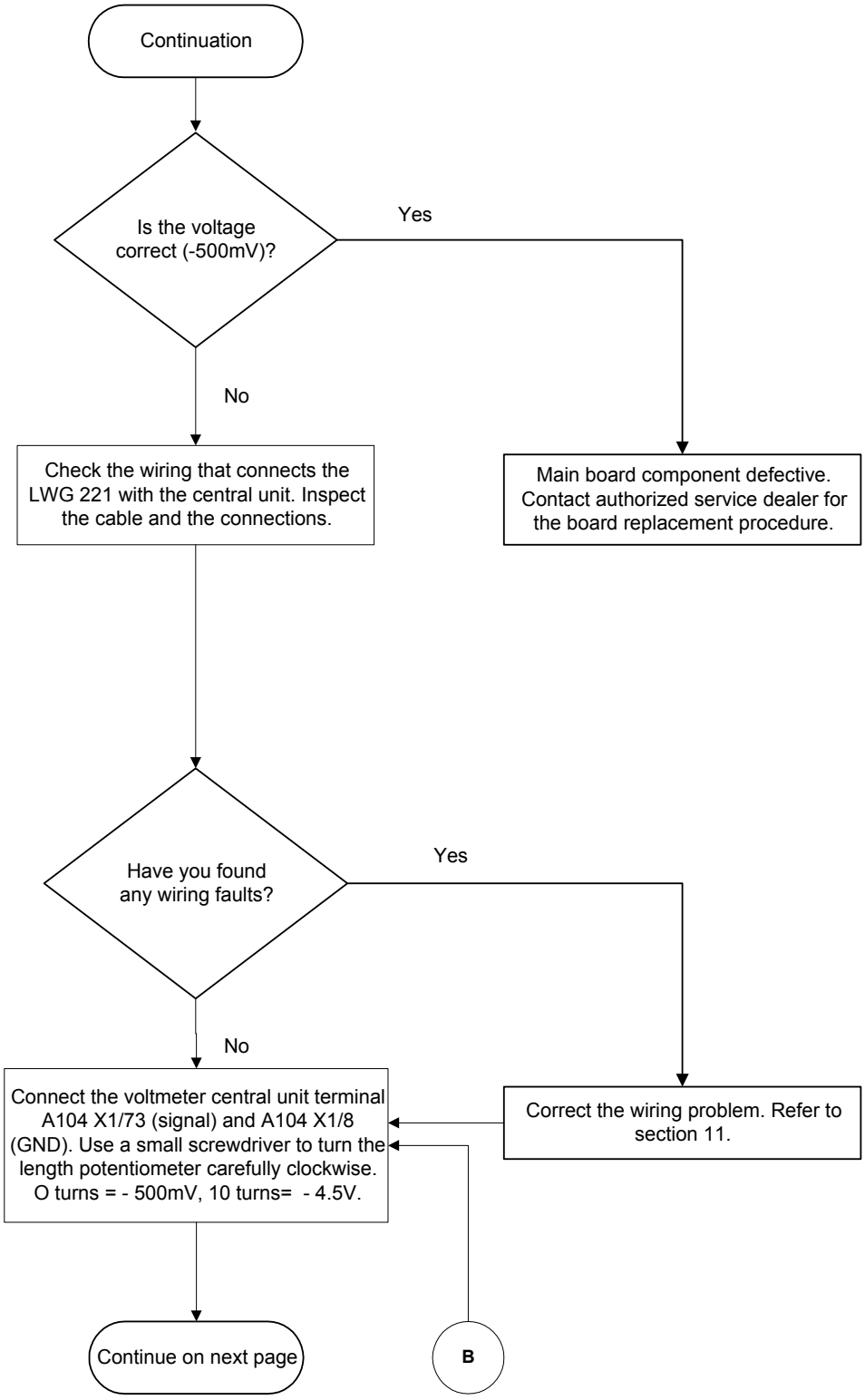
15. Continuation



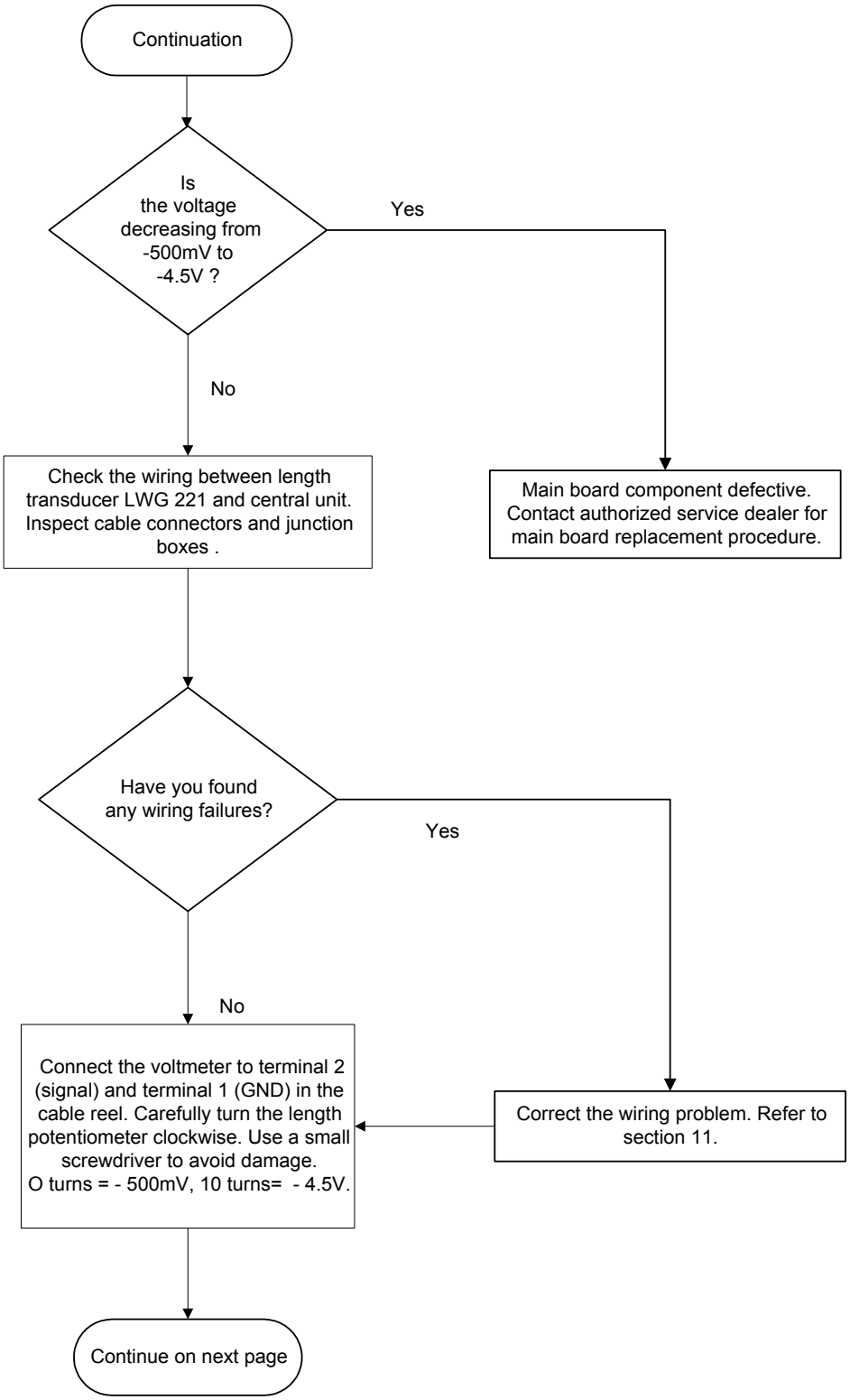
15. Continuation



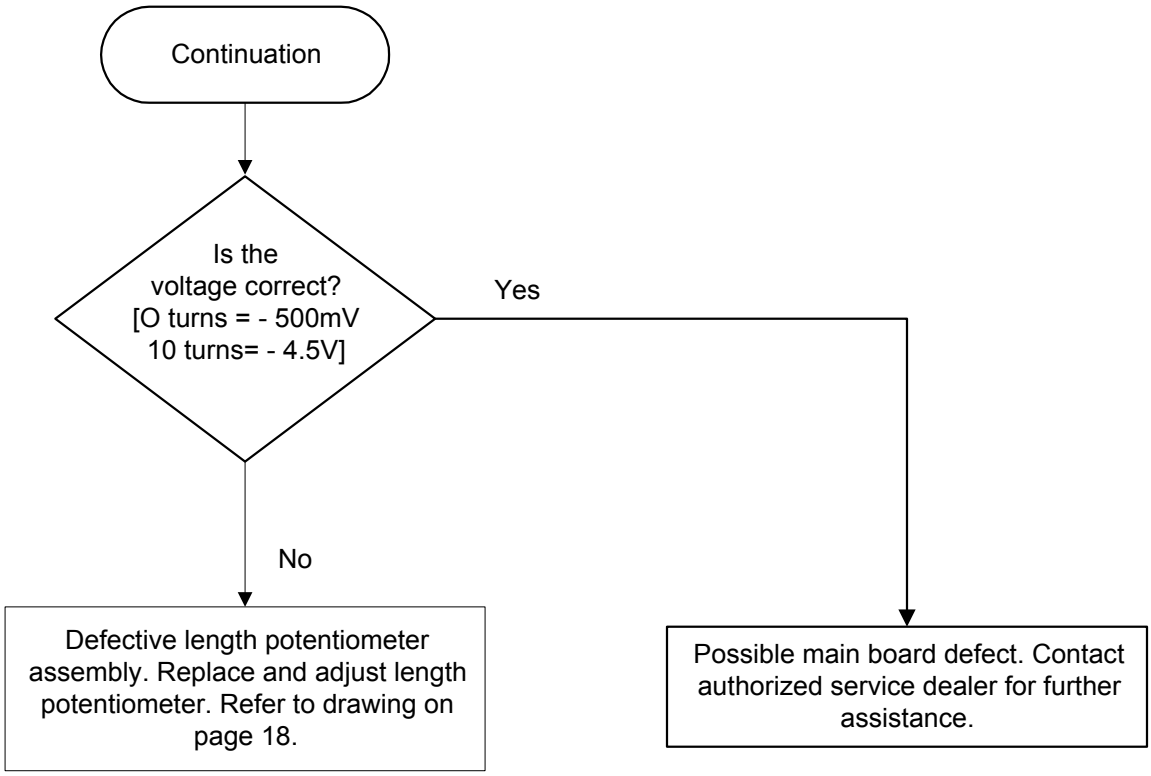
15. Continuation



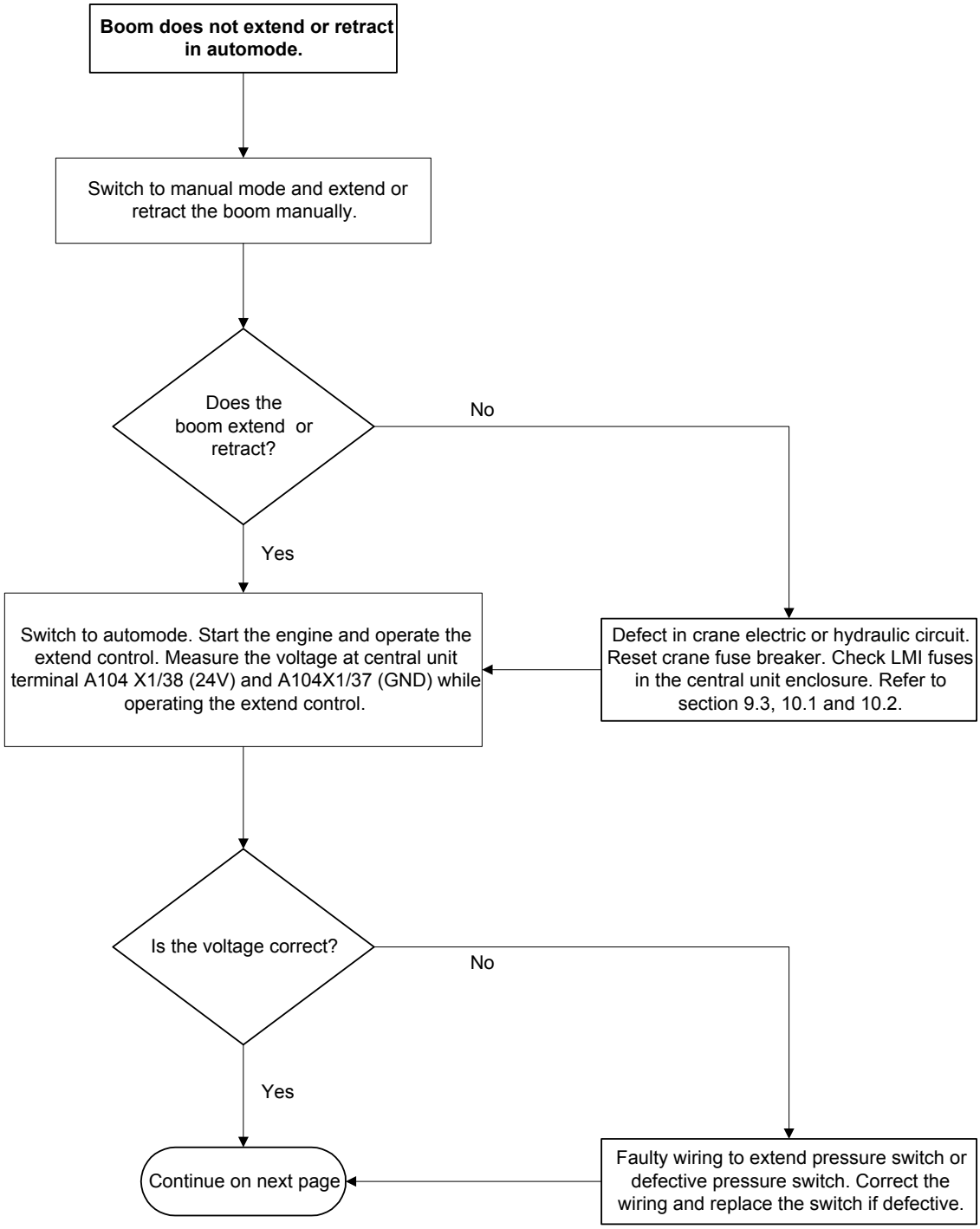
15. Continuation



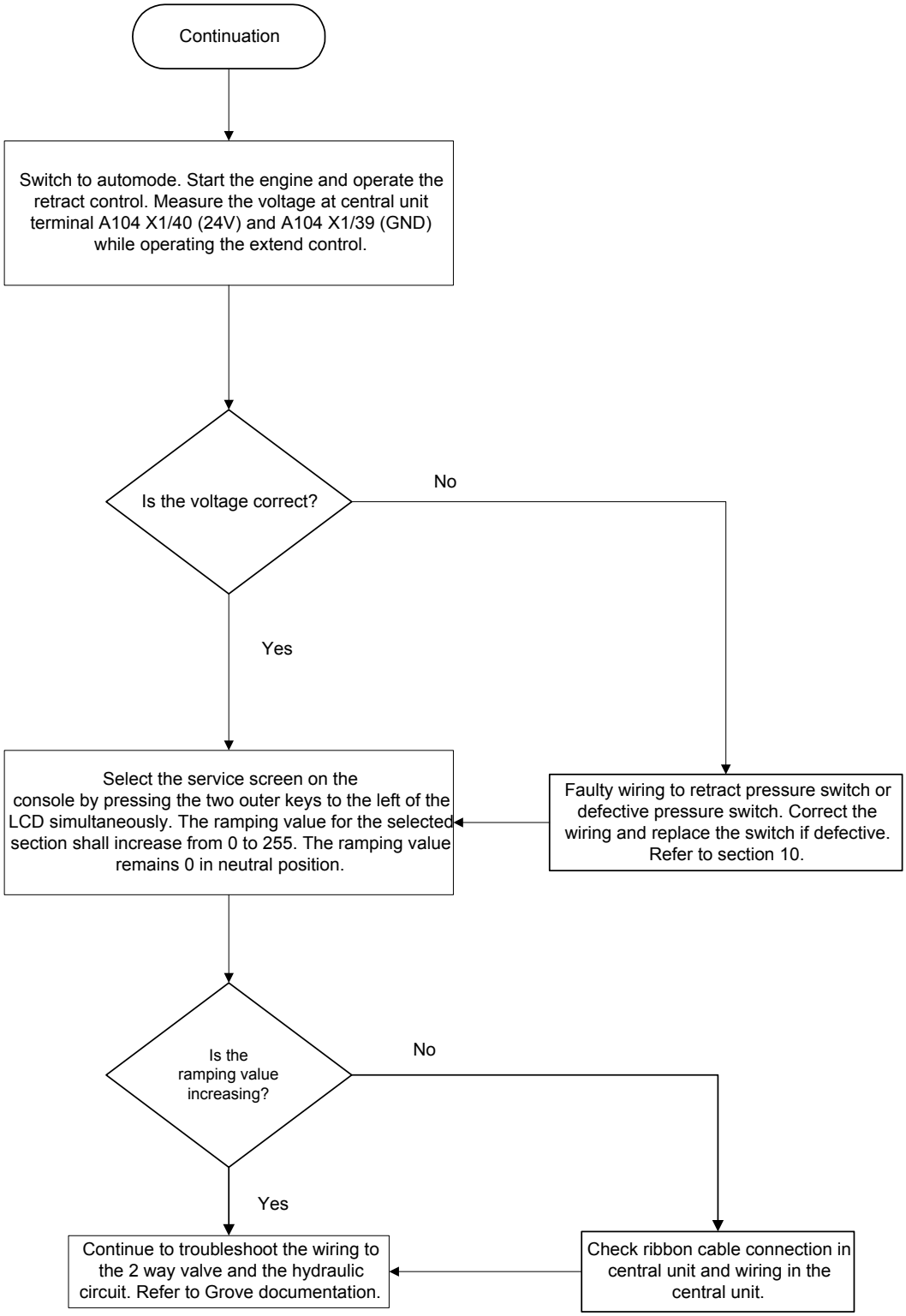
15. Continuation



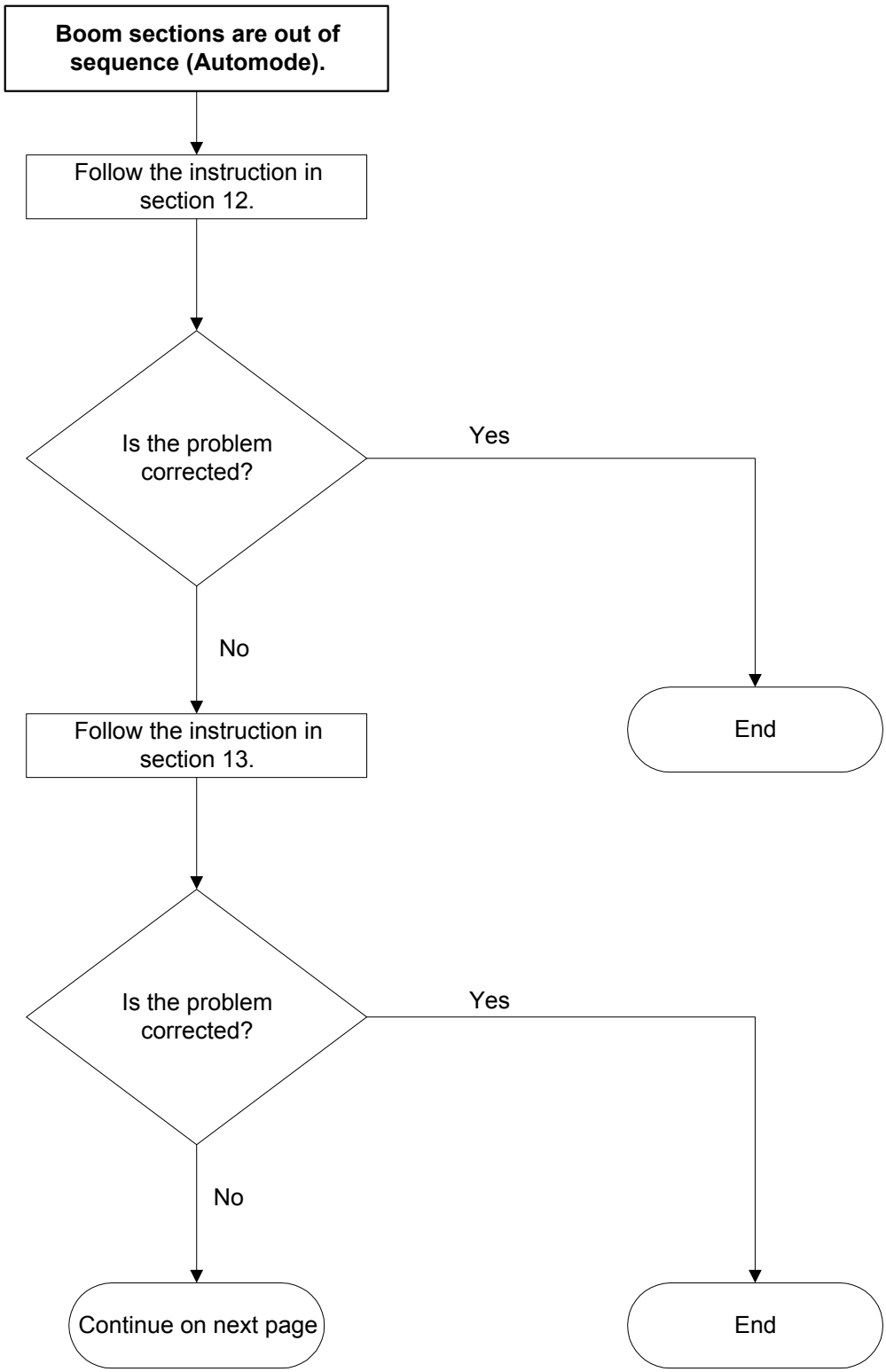
16. No Extend or Retract Function in Automode



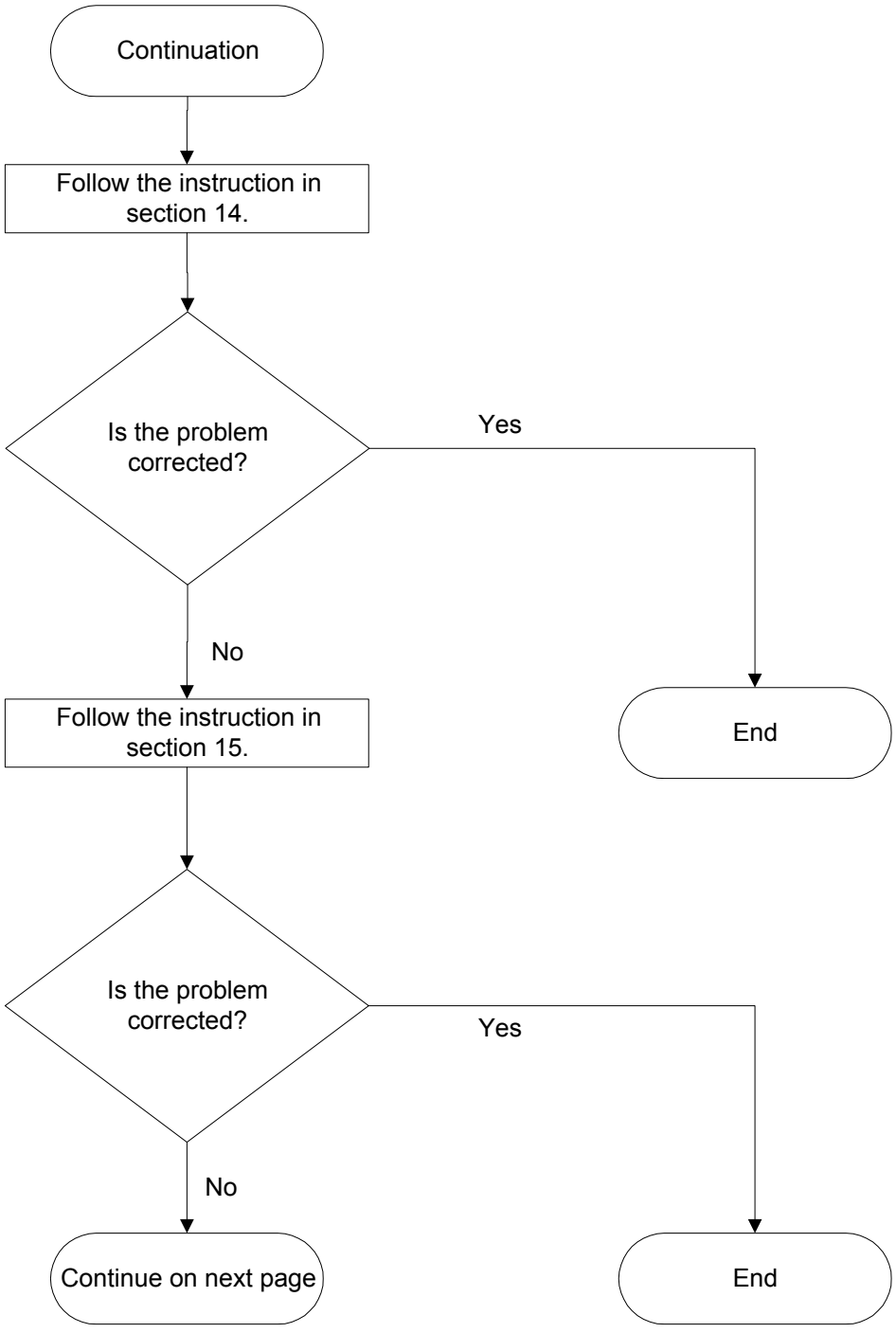
16. Continuation



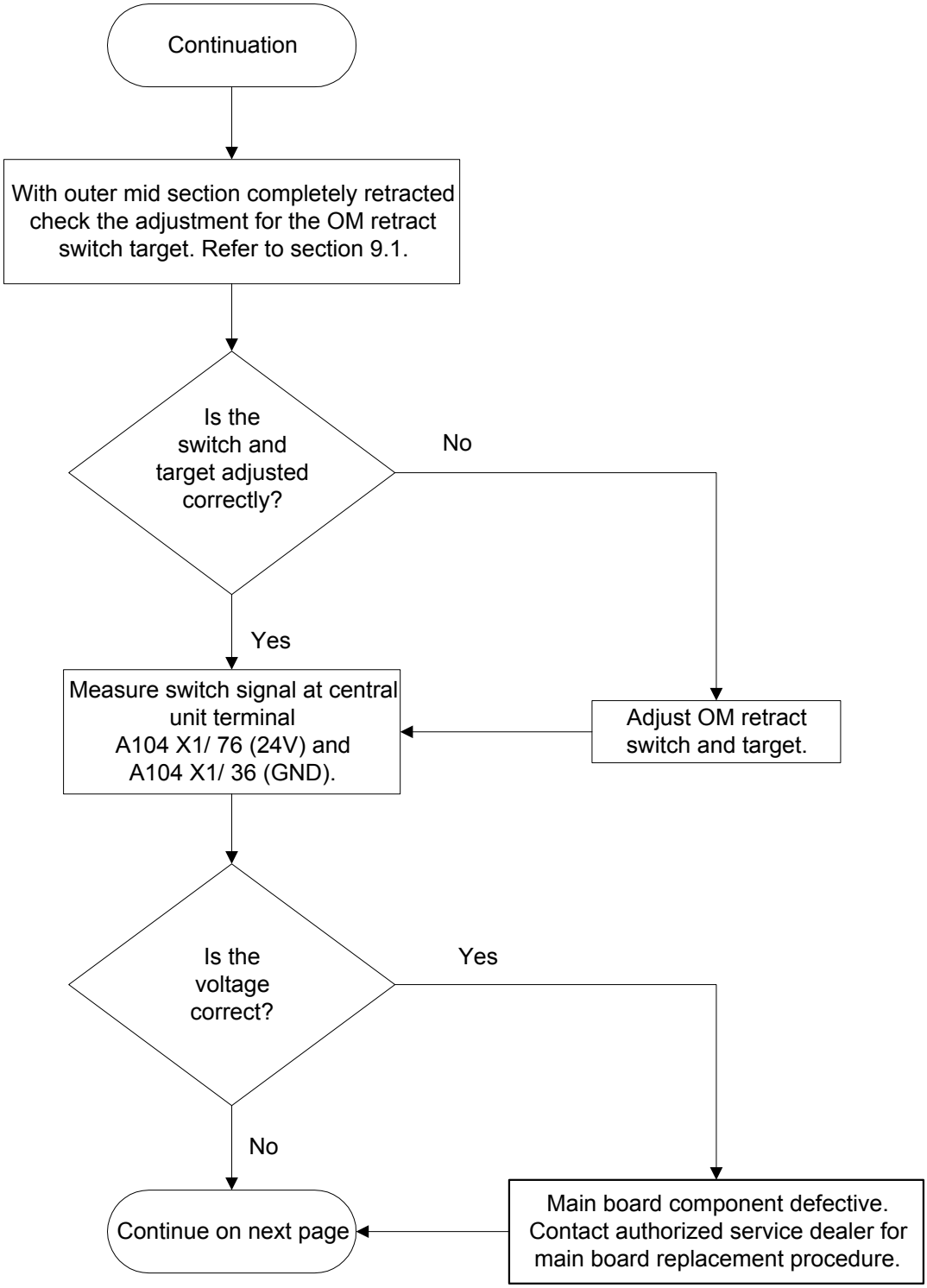
17. Out of Sequence Warning



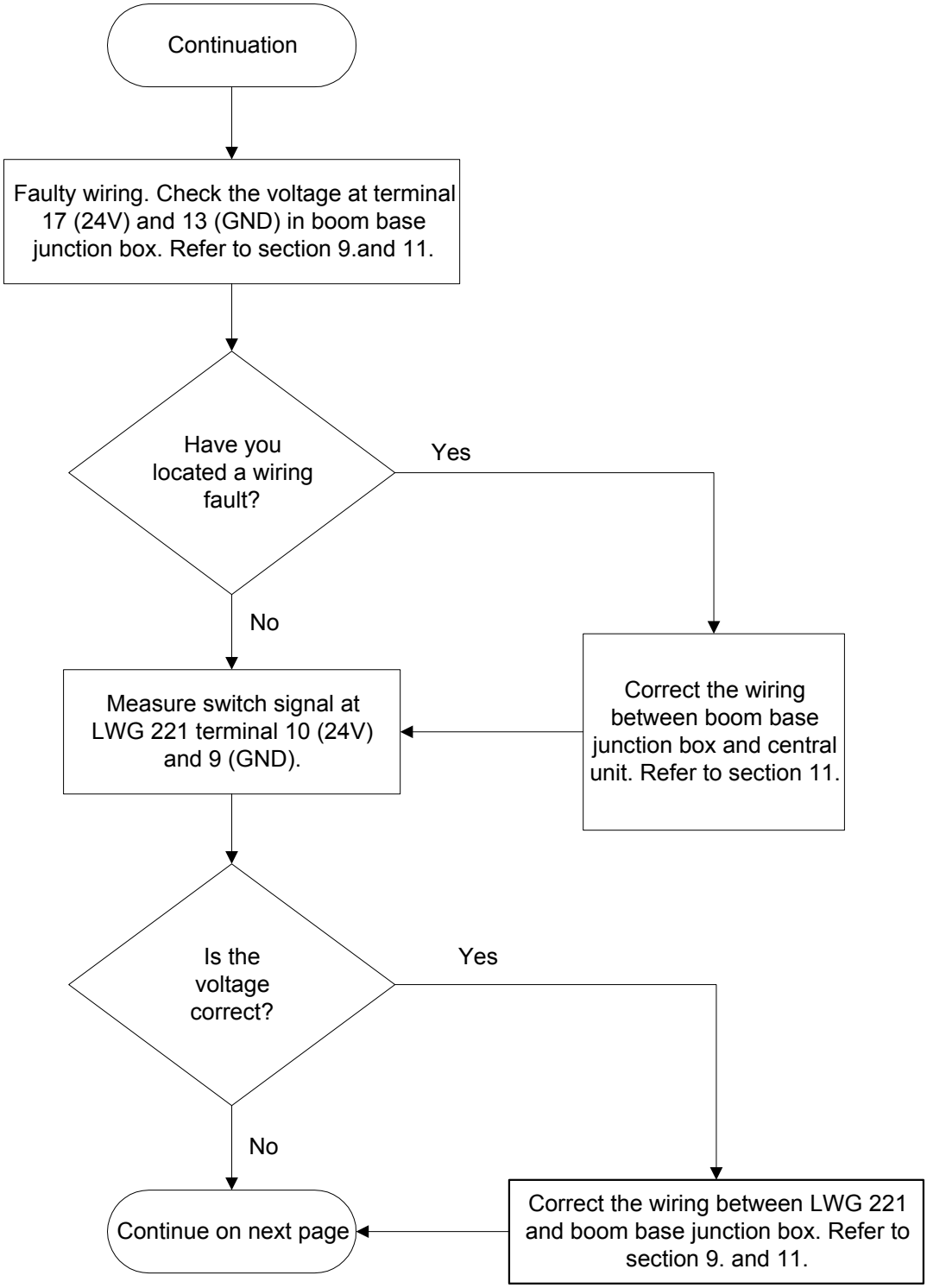
17. Continuation



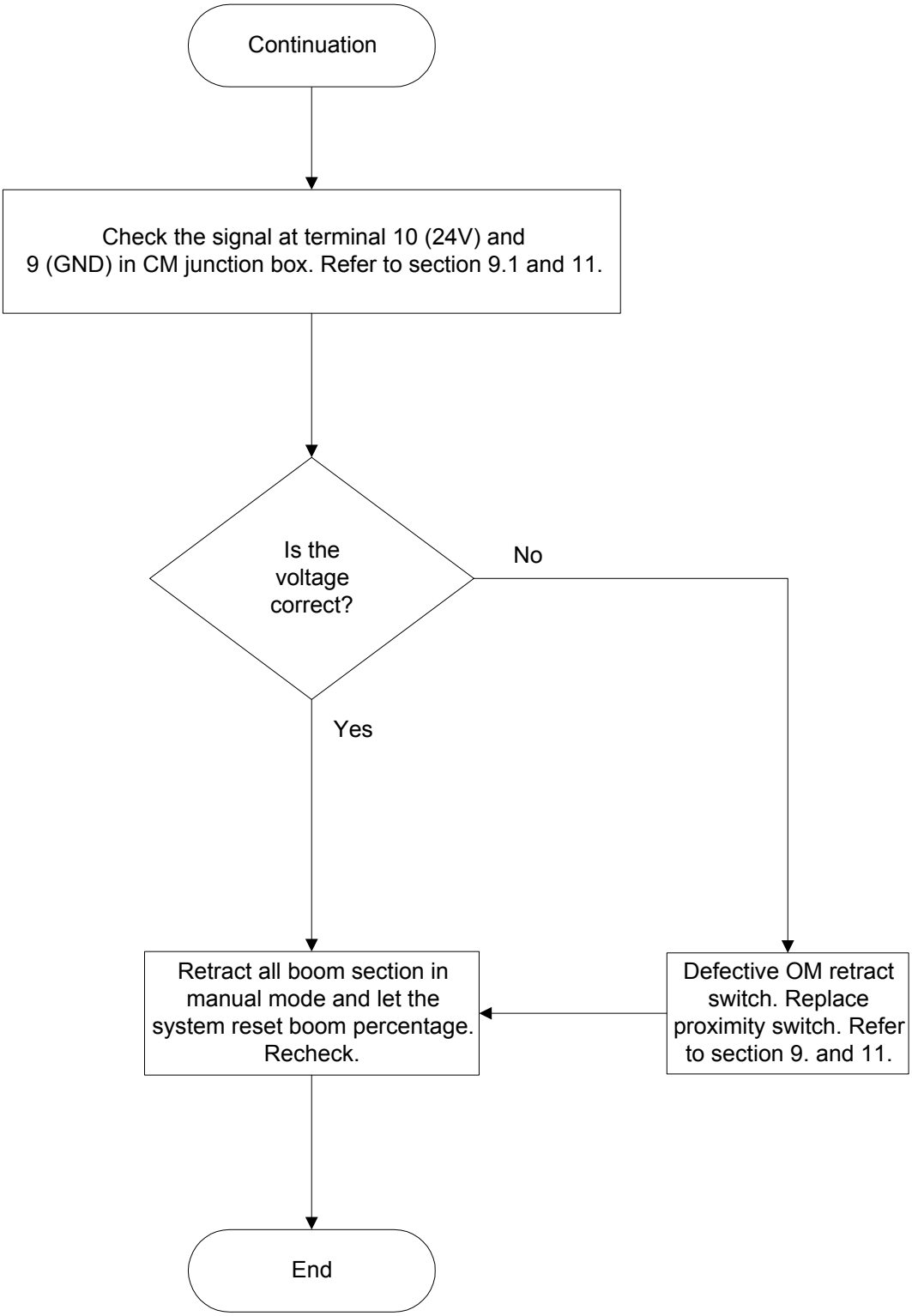
17. Continuation



17. Continuation



17. Continuation



18 Error Codes

Error Code	Error	Cause	Elimination
E01	Fallen below radius range or angle range exceeded	• Fallen below the minimum radius or gone past the maximum angle specified in the respective load chart due to luffing up the boom too far	• Luff down the boom to a radius or angle specified in the load chart.
E02	Radius range exceeded or fallen below angle range	• Gone past the maximum radius or fallen below the minimum angle specified in the respective load chart due to luffing down the boom too far	• Luff up the boom to a radius or angle specified in the load chart.
E03	Non-permitted slewing zone (no load area)	• The slewing zone with load is not permitted	• Slew to 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 operating state 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 prestress 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
		• Clutch between length sensor pot and drive is defective	• Replace the complete clutch including drive wheel and adjust length sensor pot as described above
		• Failure of +5V supply of analog part of analog board	• Check +5 V supply. Exchange main board in case of voltage failure or breakdown when loaded with 50 ohms approx.
		• Cable between central unit and length sensor is defective or disconnected.	• Check cable and plugs, replace, if need be.
		• Defective length potentiometer	• Replace length potentiometer.

Error Code	Error	Cause	Elimination
E06	Radius range exceeded or fallen below angle range with luffing jib operation	• Maximum radius as specified in the load chart exceeded or fallen below minimum angle due to luffing down the luffing jib too far	• Luff the jib to a radius or angle specified in the load chart.
E07	Faulty acknowledgment of the overload relay on the connection board. The relay should be energized, the 2nd contact however is indicated to be off, or the 2nd contact is indicated to be on while the relay should be de-energized.	• Overload relay or connection board are defective • Processor board defective	• Replace connection board • Replace processor board.
E08	No acknowledgment from the anti-two-block relay	• refer to E07	• refer to E07
E10	Error in the length measurement	• With the boom retracted, the signal "main boom length" differs by more than 2 % from the programmed value for the basic length • With the boom retracted, the signal "length Tele I (+II)" differs by more than 2 % from the reference value 0	• Check length sensor of the main boom • Check length sensor 2.

Error Code	Error	Cause	Elimination
E11	Fallen below lower limit value for measuring channel "length main boom"	• Cable between central unit and length sensor is defective or disconnected. Water inside the plug of the length/angle sensor • Length potentiometer is defective • Electronic component in the measuring channel is defective	• Check cable as well as plugs, replace, if need be. • Replace length potentiometer • Replace LMI main board or processor board.
E12	Fallen below the lower limit value in the measuring channel "pressure piston side"	• Cable between the central unit and pressure transducers defective or water inside the plugs • Pressure transducer is defective. • Electronic component in the measuring channel is defective.	• Check cable as well as plugs, replace, if need be. • Replace pressure transducer • Replace LMI main board or processor board.
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"	• Cable between the central unit and pressure transducers defective or water inside the plugs • Force transducer defective • Electronic component in the measuring channel is defective.	• Check cable as well as plugs, replace, if need be. • Replace force transducer • Replace LMI main board or processor board.
E15	Fallen below lower limit value in measuring channel "angle main boom"	• Cable between central unit and the length/angle sensor defective or loose. Water inside the plug of the length/angle sensor. • Angle potentiometer defective • Electronic component in the measuring channel defective.	• Check cable as well as plugs, replace, if need be. • Replace angle sensor • Replace LMI main board or processor board.

Error Code	Error	Cause	Elimination
E16	Fallen below lower limit value in measuring channel "angle 2"	• Cable between the central unit and the angle sensor defective or loose. Water inside the plug of the angle sensor. • Angle potentiometer defective • Electronic component in the measuring channel defective.	• Check cable as well as plugs, replace, if need be. • Replace angle sensor • Replace LMI main board or processor board.
E17	Fallen below lower limit value "length telescope I (+II)"	• Cable between the central unit to the length sensor defective or loose. Water inside the length sensor plug. • Length potentiometer defective • Electronic component in the measuring channel defective	• Check cable as well as plugs, replace, if need be. • Replace length sensor. • Replace LMI main board or processor board.
E18	Front outrigger overloaded	• Front outrigger overloaded	•
E19	Reference and/or supply voltage defective	• The supply voltage is falsified by one of the sensors (DAV, LWG) • Electronic component is defective • A/D converter defective.	• Check the voltages on the LMI main board (AGND = MP0). Check sensors, plugs and cable, replace, if need be. • Replace LMI main board • Replace LMI main board
E1A	Fallen below lower limit value in measuring channel "slewing angle 1".	• Cable between the central unit and the slewing angle sensor defective or loose. Water inside the plug of the angle sensor • Slewing angle potentiometer is defective • Electronic component in the measuring channel defective	• Check cable as well as plugs, replace, if need be. • Replace slewing angle sensor • Replace LMI main board or processor board.
E1B	Fallen below lower limit value in measuring channel "slewing angle 2"	• refer to E1A	• refer to E1A

Error Code	Error	Cause	Elimination
E1D	Fallen below lower limit value "length telescope 3"	• Cable between the central unit to the length sensor defective or loose. Water inside the length sensor plug. • Length potentiometer defective • Electronic component in the measuring channel defective	• Check cable as well as plugs, replace, if need be. • Replace length sensor. • Replace LMI main board or processor board.
E1E	Fallen below lower limit value in measuring channel "boom head angle"	• Cable between the central unit and the angle sensor defective or loose. Water inside the plug of the angle sensor. • Angle potentiometer defective • Electronic component in the measuring channel defective.	• Check cable as well as plugs, replace, if need be. • Replace angle sensor • Replace LMI main board or processor board.
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

Error Code	Error	Cause	Elimination
E26	Upper limit value in measuring channel "angle 2" has been exceeded.	• refer to E16	• refer to E16
E27	Upper limit value in measuring channel "length telescope I (+II) has been exceeded.	• refer to E17	• refer to E17
E29	Reference and/or supply voltage defective.	• refer to E19	• refer to E19
E2A	Upper limit value in measuring channel "slewing angle 1" has been exceeded	• refer to E1A	• refer to E1A
E2B	Upper limit value in measuring channel "slewing angle 2" has been exceeded	• refer to E1A	• refer to E1A
E2D	Upper limit value in measuring channel "length telescope 3 has been exceeded.	• refer to E1D	• refer to E1D
E2E	Upper limit value in measuring channel " boom head angle" has been exceeded.	• refer to E1E	• refer to E1E
E31	Error in the system program	• The system program PROM is defective.	• Replace system program PROM (PROM No. 0)
E38	System program and data EPROM do not match.	• The system program in the LMI does not match to the programming in the data EPROM	• Replace the system program PROM or the data EPROM (PROM No. 1)

Error Code	Error	Cause	Elimination
E39	System program and TLK EPROM do not match	• The system program in the LMI and the programming in the TLK EPROM do not match.	• Replace system program PROM or TLK EPROM (PROM No. 2).
E41	Error in the internal write/read memory (RAM) of the computer component 80C537	• Computer component 80C537 defective • CPU module defective • Processor board defective.	• Replace computer component 80C537. • Replace CPU module. • Replace processor board with CPU module.
E42	Error in the external write/read memory, 1st part (RAM)	• Write/read memory (CMOS RAM) or processor board defective.	• Replace processor board with CPU module.
E43	Error in the external write/read memory, 2nd part (RAM)	• refer to E42	• refer to E42
E45	Redundancy error in the A/D conversion	• The A/D converter on the processing board and the redundant A/D converter in the CPU 80C537 provide different results.	• Replace processor board.
E46	Error in the A/D converter uPD 7004 of the processor board.	• No acknowledgment of the A/D converter uPD 7004	• Replace processor board.
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). • Processor board defective.	• Restart the LMI • Replace buffer battery on the LMI main board • Replace processor board.

Error Code	Error	Cause	Elimination
E48	Cyclic RAM test: error in the internal write/read memory (RAM) of the computer component 80C537	• Computer component 80C537 defective • CPU module defective • Processor board defective.	• Replace computer component 80C537. • Replace CPU module • Replace processor board with CPU module.
E51	Error in the crane data EPROM or EEPROM.	• No valid data in the crane data EEPROM. • Memory module wrongly bridged. • Crane data EPROM defective	• Load crane data EEPROM containing valid data. • Bridge memory module acc. to memory type • Replace crane data EPROM
E52	Error in load chart PROM.	• Memory module wrongly bridged. • Load chart EPROM defective.	• Bridge memory module acc. to memory type. • Replace load chart EPROM
E56	Error in crane data EEPROM.	• Memory module wrongly bridged. • Crane data EEPROM defective	• Bridge memory module acc. to memory type • Replace crane data EEPROM
E57	Error in serial crane data EEPROM.	• Serial crane data EEPROM does not contain valid data. • Memory module defective	• Write data on the serial crane data EEPROM (by means of test program or on-line function), then restart the LMI • Replace memory module.
E58	Error in the serial analog data EEPROM.	• No valid data in the serial analog data EEPROM. • LMI main board defective.	• Write data on the serial analog data EEPROM by means of the test program, then, restart the LMI • Replace LMI main board.

Error Code	Error	Cause	Elimination
E60	The number of the selected EPROM base and the programmed value are not identical	• Load chart EPROM defective	• Replace load chart EPROM
		• Base number not programmed	• Program the correct base number (1 for base 1, 2 for base 2)
		• Load chart EPROM wrongly programmed	• Check base programming in the load chart EPROM.
E61	Error in the boom control extension.	• Cable between the central unit and the boom control extension defective.	• Check the cable to the boom control extension
		• Profibus adapter in the central unit defektiv	• Replace the profibus adapter
		• Profibus adapter in the Boom control extension defective	• Replace the profibus adapter
E62	Error digital inputs 1 - 8 in the boom control extension.	• Module for digital inputs in the Boom control extension defective	• Replace the module for the digital inputs
		• Boom control extension defective	• Replace the boom control extension
E63	Error digital inputs 9 - 16 in the boom control extension.	• Module for digital inputs in the Boom control extension defective	• Replace the module for the digital inputs
		• Boom control extension defective	• Replace the boom control extension
E64	Error analog output 1 in the boom control extension.	• Module for analog output 1 in the Boom control extension defective	• Replace the module for the analog output 1
		• Boom control extension defective	• Replace the boom control extension
E65	Error analog output 2 in the boom control extension.	• Module for analog output 2 in the Boom control extension defective	• Replace the module for the analog output 2
		• Boom control extension defective	• Replace the boom control extension

Error Code	Error	Cause	Elimination
E66	Error analog outputs in the boom control extension.	• Module for analog outputs in the Boom control extension defective • Boom control extension defective	• Replace the module for the analog outputs • Replace the boom control extension
E70	Error relay outputs in the boom control extension.	• Module for relay outputs in the Boom control extension defective • Boom control extension defective	• Replace the module for the relay outputs • Replace the boom control extension
E71	Faulty acknowledgment of relay K1 on the connection board	• Relay K1 or connection board defective.	• Replace connection board.
	Relay should be energized but the 2nd contact is signaled to be off or the 2nd contact is signaled to be on whereas the relay should be de-energized.	• LMI main board is defective	• Replace LMI main board.
E72 **...** **E77**	Faulty acknowledgment of relays K2...K7 on the connection board.	• refer to E71	• refer to E71
E81	Too large difference of the boom angles at tip and base boom.	• The angle as to the horizontal on the boom head exceeds the main boom angle by more than 5 degrees.	• Check angle sensor on the boom head. • Check angle sensor on the base boom.
E83	Center Mid not fully extended	• The Center Mid is not on ist fully extended position while the OM/Fly is not completly retracted	• Extend the Center Mid • Retract the OM/Fly • Check the OM/Fly switch (digital input 4)
E84	Wrong rigging condition.	• The selected rigging condition is not contained in the data EPROM.	• Select another rigging condition • Check the programming in the data EPROM.

Error Code	Error	Cause	Elimination
E85	Error in the radius determination	• The computed radius is too small (negative deflection)	• Check the programming in the data EPROM. • Check the length measurement system.
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
E91	No data transmission form the console to the central unit	• 24 V supply of the console is interrupted • Interruption or accidental ground in the line between console electronics and central unit • Transmitter/receiver module is defective	• Check 24 V at terminal X1 of the console electronics • Check the connection console electronics - central unit. In case of an accidental ground, the transmitter module of the console electronics might be damaged. Therefore, replaces the console electronics. • Exchange console electronics or LMI main board resp.
E92	Error in the data transmission from console to central unit	• Loose connection in the line between console electronics and central unit • Transmitter/receiver module is defective	• Check the connection between console electronics and central unit • Exchange console electronics or LMI main board resp.
E93	Error in the data transmission from the central unit to the console	• refer to E92	• refer to E92
E94	No data transmission from the central unit to the console	• Interruption or accidental ground in the line central unit - console • 5 V supply of the computer in the central unit is missing • 5 V supply is too low • Transmitter/receiver module is defective • Computer module is defective	• Check line to the console (in case of accidental ground, replace console electronics, too). • Check connection to the power unit • Exchange the LMI main board • Replace console electronics or LMI main board • Replace processor board.

Error Code	Error	Cause	Elimination
E94 cont'		• Electro-magnetic interferences (e.g. when switching contactors or valves)	• Eliminate the source of interferences by inverse diodes or varistors.
E95	Error in the console EPROM	• The console EPROM is defective.	• Replace the console EPROM
E96	Error in the internal RAM of the console.	• The CPU of the console is defective. • The console main board is defective.	• Replace the CPU of the console • Replace the console main board.
E97	Error in the external RAM of the console	• The external RAM of the console is defective. • The console main board is defective.	• Replace the external RAM of the console. • Replace the console main board.
EAB	Short circuit in the A2B switch circuit	• Short circuit in the A2B switch • Short circuit in the cable to the A2B switch	• Replace A2B switch • Replace cable to the A2B switch

Note:
If an error message is displayed which is not contained in above list, please contact the Hirschmann Service Department.