PAT DS350C

TROUBLESHOOTING MANUAL

P/N 031-300-190-020

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NOTE:

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PAT shall not be liable for errors contained in this manual nor for incidental or consequential damages related to the furnishing and the use of this book.

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1 General Information

The PAT Load Moment Indicator [1] (LMI) DS 350 C has been designed to provide the crane operator with essential information indispensable for the operation of the crane within the preset design parameters.

Using various sensing devices, the PAT Load Moment Indicator monitors various crane functions and provides the operator with a continuous reading of the crane's performance data. The readings continuously change as the crane moves through the motions needed to make the lift.

The Load Moment Indicator provides the operator with information about length and angle of the boom, jib height, radius, nominal load and the total load lifted by the crane.

As soon as the crane reaches an unauthorised operating state, the Load Moment Indicator DS 350 C warns the crane operator by means of an audible alarm and a signal lamp and the cut-off of all movements that could aggravate the condition of the crane.

1) Load Moment: generally, it is the product of a force and its moment arm, specifically the product of load and load radius. Is used to determine the lifting capacity of the crane.

2 Important Notes

The PAT Load Moment Indicator PAT DS 350 C is an operational aid warning the crane operator of an imminent overload or an approaching overhoist condition in order to prevent possible damages of equipment and injury of persons.

The system cannot, and shall not, be a substitute for the good judgement or experience respectively of the crane operator or of the application of working methods in the utilisation of a crane which are proven to be safe.

The crane operator is solely responsible for the safe operation of the crane. He must observe and obey all warnings and instructions displayed.

Prior to operating a crane the operator must carefully and thoroughly read and understand the information in this manual to make sure that he knows the operation and limitations of the LMI and the crane.

Proper functioning depends on proper daily inspection and observance of the operating instructions set forth in this manual. Please confer chapter 5 of this manual.

Warning

The display (1) can only assist the crane operator if the LMI is correctly adjusted and the correct load chart and operating code for the respective operating configuration have been selected. In order to prevent damages of the equipment and serious or fatal injuries of persons the correct adjustment of the LMI has to be guaranteed before starting the crane work.

3 System description

The PAT DS 350 C load moment indicator consists of a central microprocessor unit, operator's console, a length/angle sensor, pressure transducers and anti two-block switches.

The system operates according to the principle of reference/actual comparison. The actual values resulting from the force or pressure measurement are compared to the reference data stored in the central processor memory and evaluated in the microprocessor. When reaching the limits an overload warning signal is generated at the operator's console. Simultaneously, the dangerous crane movements such as hoist up, telescope out and boom down are cut-off.

The crane-specific data, i.e. load chart, boom weights, centers of gravity and dimensions are stored in the memory boards of the central unit. These data represent the reference values for the calculation of the operating conditions.

Boom length and boom angle are registered by the length/angle sensor installed inside of the cable reel mounted on the lateral side of the boom. The boom length is measured by the length sensor rope which also serves for the transmission of the anti two-block switch signal.

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

3.1 System Function

The PAT Load Moment Indicator (LMI) PAT DS350C has an operator's prompting simplifying the work with the crane and the LMI. After starting the engine the system executes an automatic test of the LMI-System, the lamps and the audible signals. In case of an error the respective error code is displayed on the console.

After the automatic test the crane operator has to select the operating mode corresponding to the operating condition of the crane. Then, the system is ready for operation.

3.2 Operator's console

The console has two functions:

- input of current crane configuration by the operator
- display of important data, information and instructions

Figure 1 illustrates the display and control elements of the console.

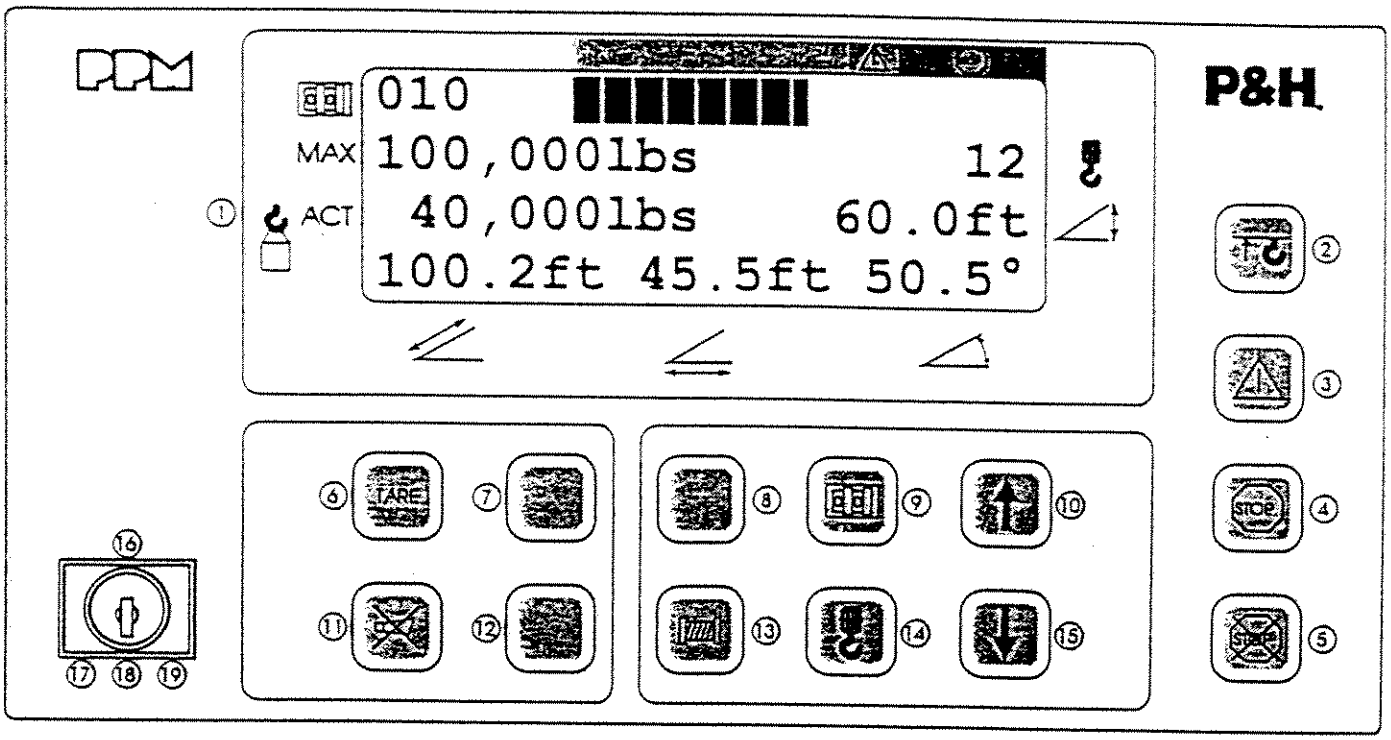
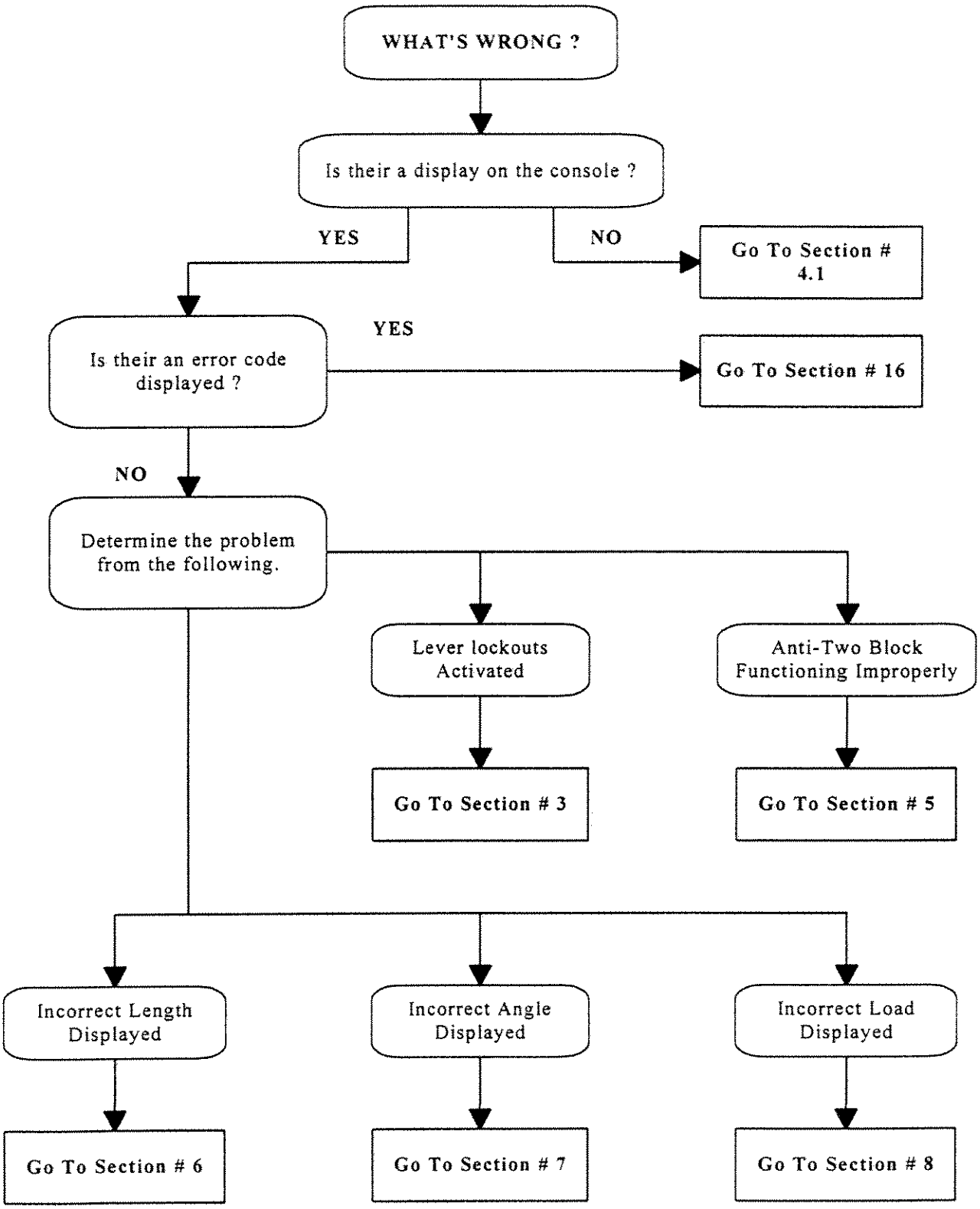


Fig. 1 Operator's console

1. Display
2. Anti Two-Block alarm light
3. Load moment pre-warning light
4. Overload alarm light
5. Warning light "By-passing"
6. Button "Tare"
7. Without function
8. Without function
9. Button "Operating Modes"
10. Button "Counting upwards"
11. Button "Horn off"
12. Without function
13. Button "Hoist Selection"
14. Button "Reevings"
15. Button "Counting downwards"
16. Key switch for by-passing
17. By-pass Anti 2-Block lockout
18. Normal operation
19. By-pass LMI lockout

1.1 GENERAL FLOW CHART



2.0 DEFINITIONS

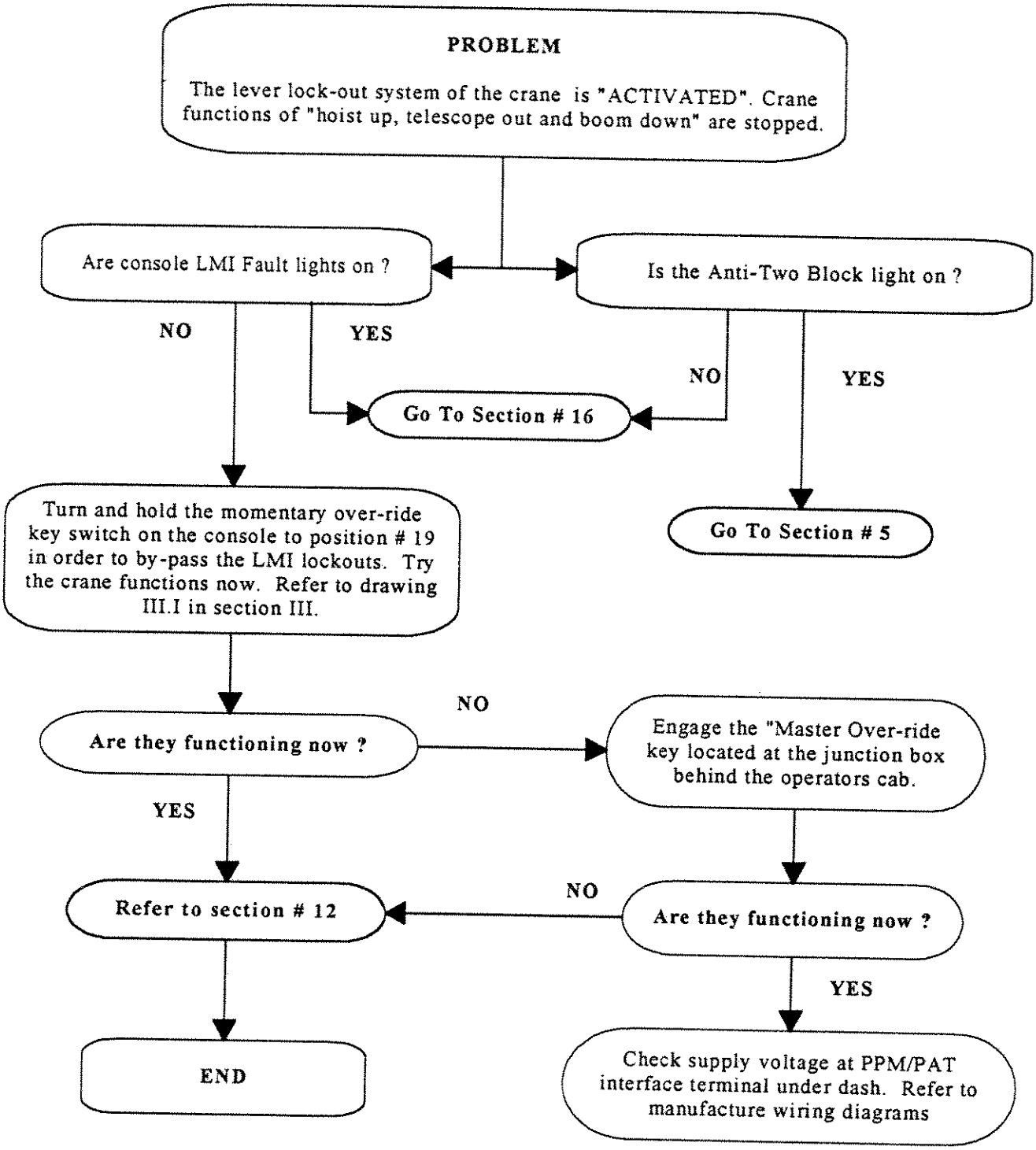
1. **Pressure Transducer**: The pressure transducer transforms hydraulic pressure into an electric analogue voltage signal. Two pressure transducers are connected, one to the rod side of the lift cylinder and one to piston side of the lift cylinder. The pressure transducer is connected to the junction box with a four conductor double shielded cable.
The power supply voltage is +5 and -5 volts.
The output signal is 0.000V at 0 pressure, and 1.0V at maximum pressure (4410psi)

2. **The Length-Angle Transducer**: The length-angle sensor (LWG) is a combination of two sensors located in the cable reel housing, fitted at the base section of boom. They continuously measure the length and angle of the main boom.
A reeling drum drives a potentiometer, which is the length transducer. Part of the length transducer is the length cable, a two conductor cable (core and shield) securely fixed to the boom head. It is connected through a receptacle to the anti-two block switch located also on the boom head. On the opposite end it is connected to a slip ring assembly in the cable reel.
The angle transducer is a pendulum driven potentiometer located in the cable reel housing. The angle transducer is fitted in a small enclosure filled with oil.
The power supply to both transducers is a common +5V.
The output signal for the length transducer is +.500MV completely retracted, and +4.5V at 10 turns of the potentiometer.
The output signal for the angle transducer is +3.125V at 0 degrees, and +1.875V at 90 degrees

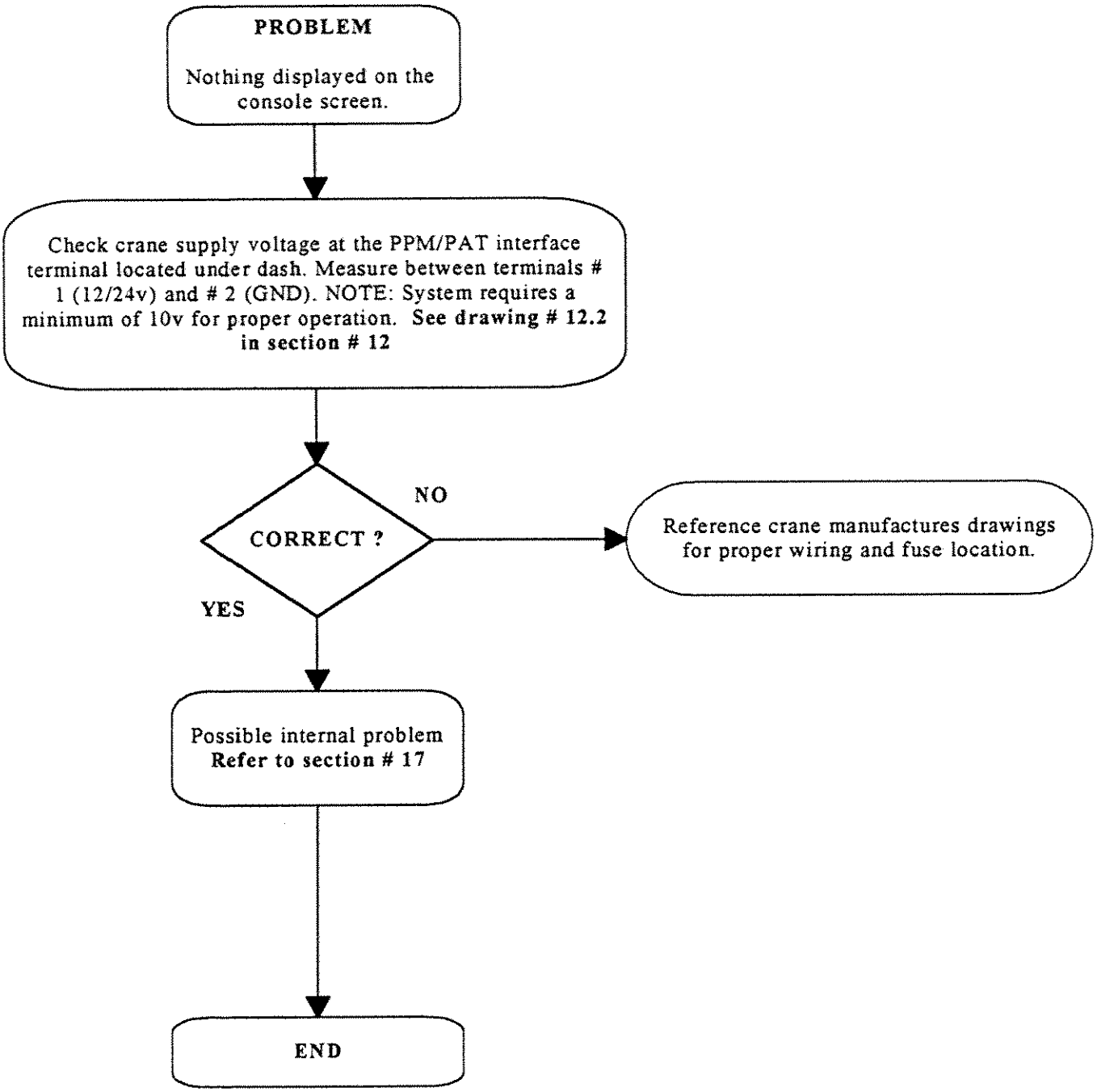
3. **Anti-Two Block Switch**: The anti two-block switch stops the movement of hoisting up, telescoping out and boom down functions when the hook block comes in contact with the anti-two block weight. In working conditions the switch is closed when the hook block contacts the weight the switch opens. The switch transmits a 4.7k signal when in a closed position. The weight at the anti-two block switch keeps the switch closed until the hook block strikes it.

4. **Console**: The console serves two purposes. One, it serves as a complete processing center for all sensors located on the machine. Two it provides a display of all pertinent information within the LMI. All geometrical information, boom length, boom angle, radius and tip height is continuously displayed. It also provides the actual load and the maximum load permitted by the load chart. The bar graph provides a continuos display of percentage of total permissible moment. Furthermore it has an alarm horn and a warning light for overload, and a prewarning light when 90% of total permissible moment has been achieved. It has on operating mode selection switch enabling the operator to select various crane configurations. It has a reeving selection switch allowing the operator to select proper parts of line. It also has a warning light for anti-two block conditions and an override key switch for overload and anti-two block conditions.

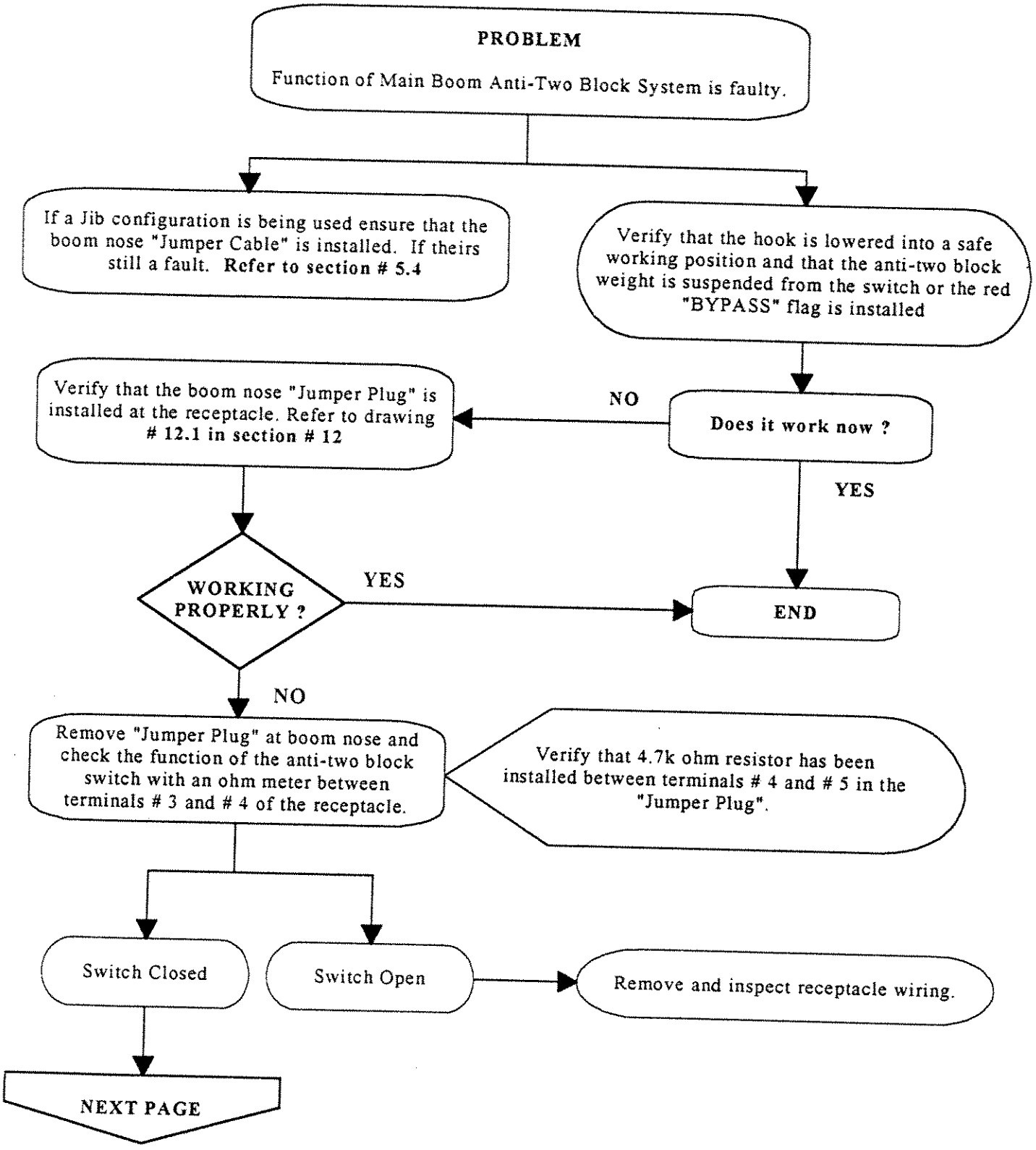
3.1 LEVER LOCKOUTS ACTIVATED



4.1 BLANK CONSOLE DISPLAY



5.1 ANTI-TWO BLOCK PROBLEM



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5.2 ANTI-TWO BLOCK PROBLEM

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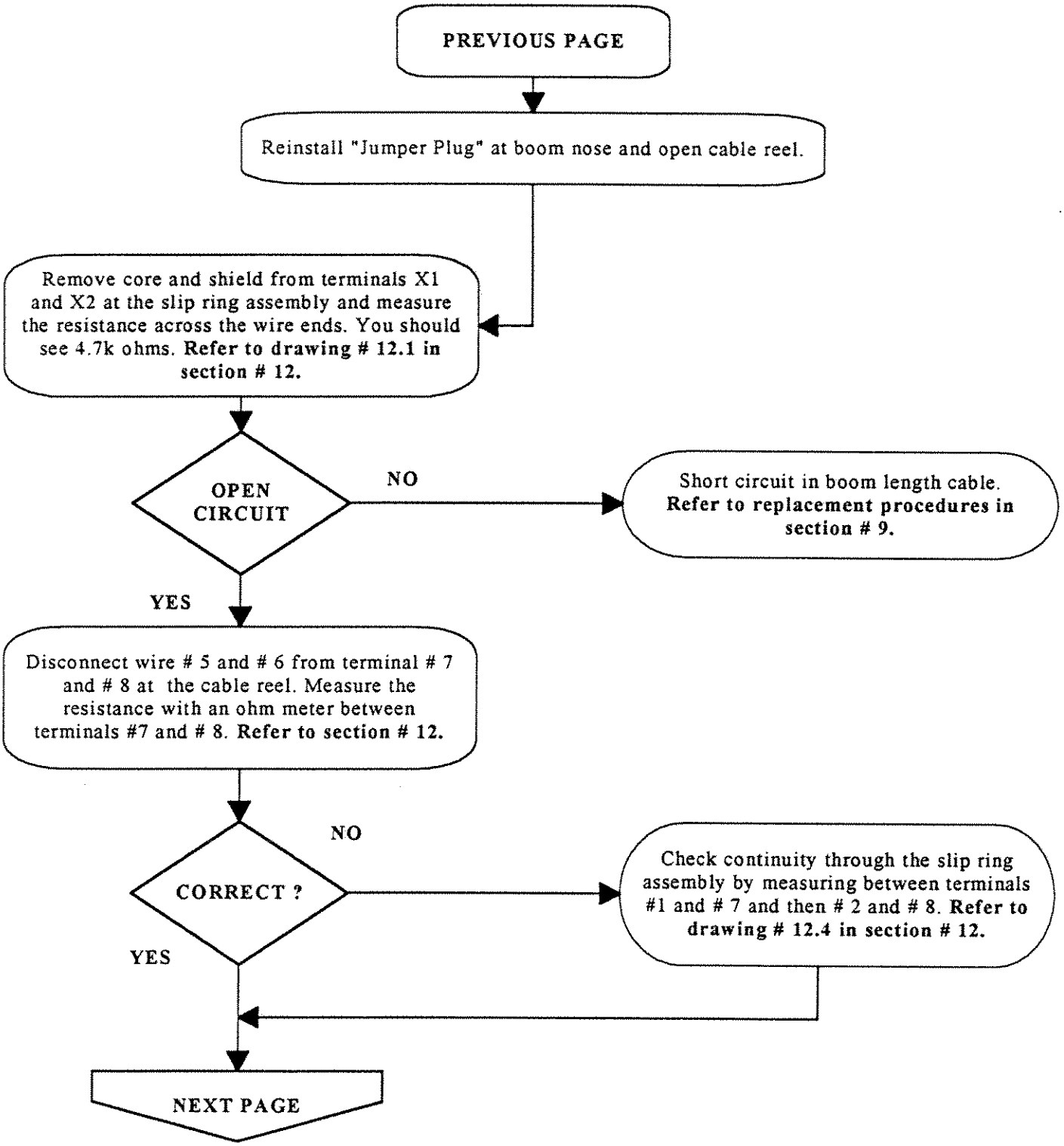

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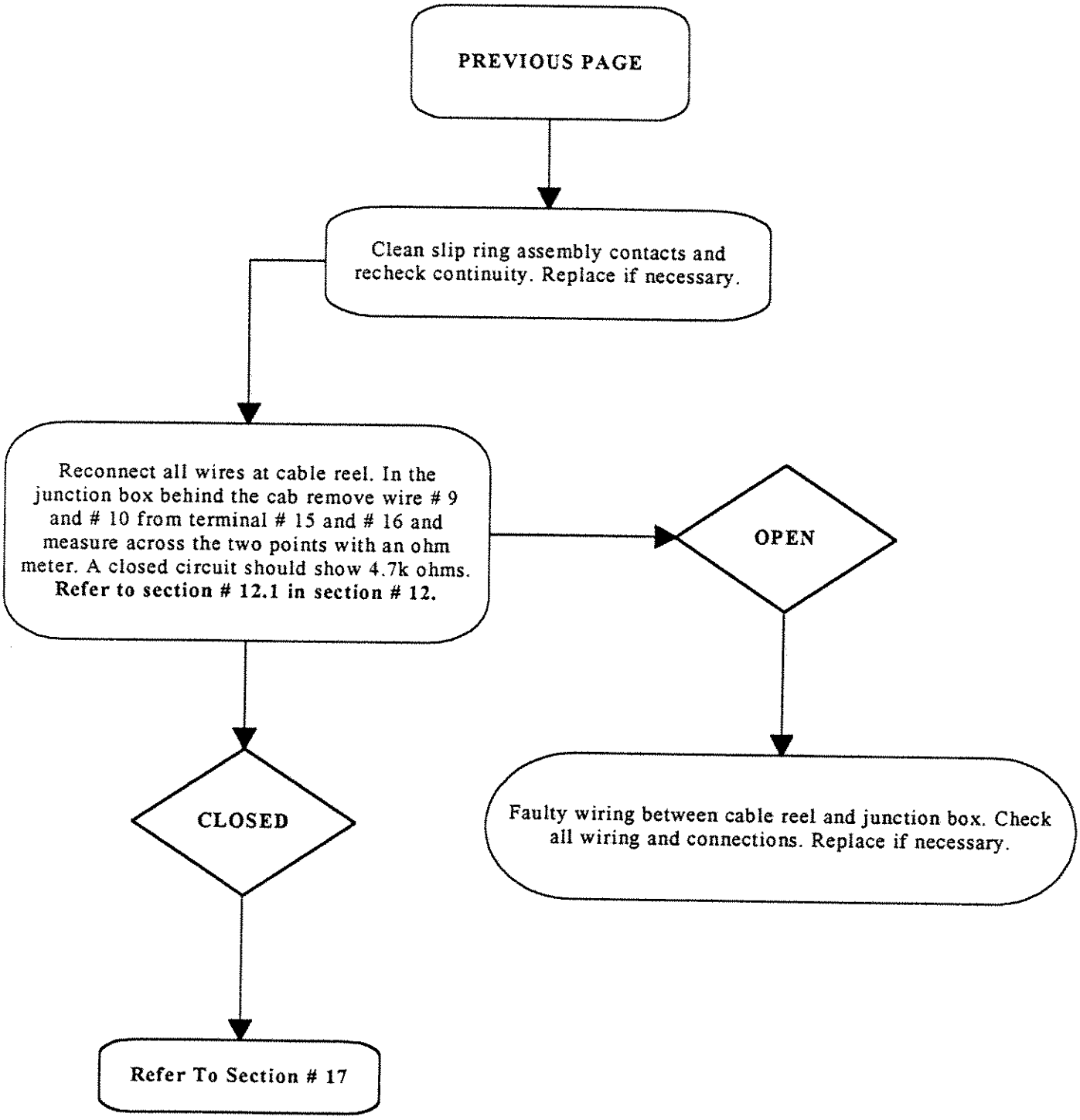
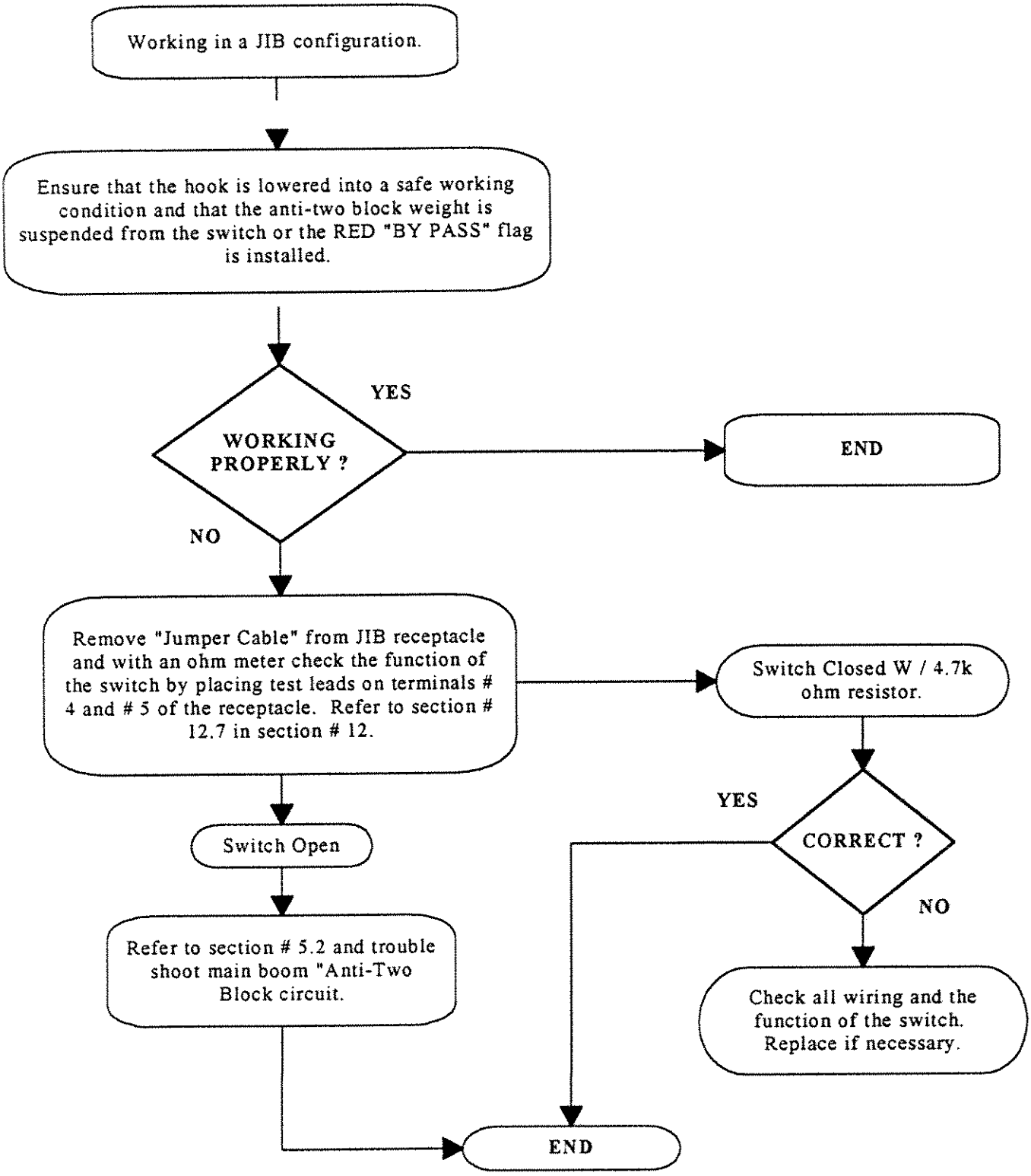
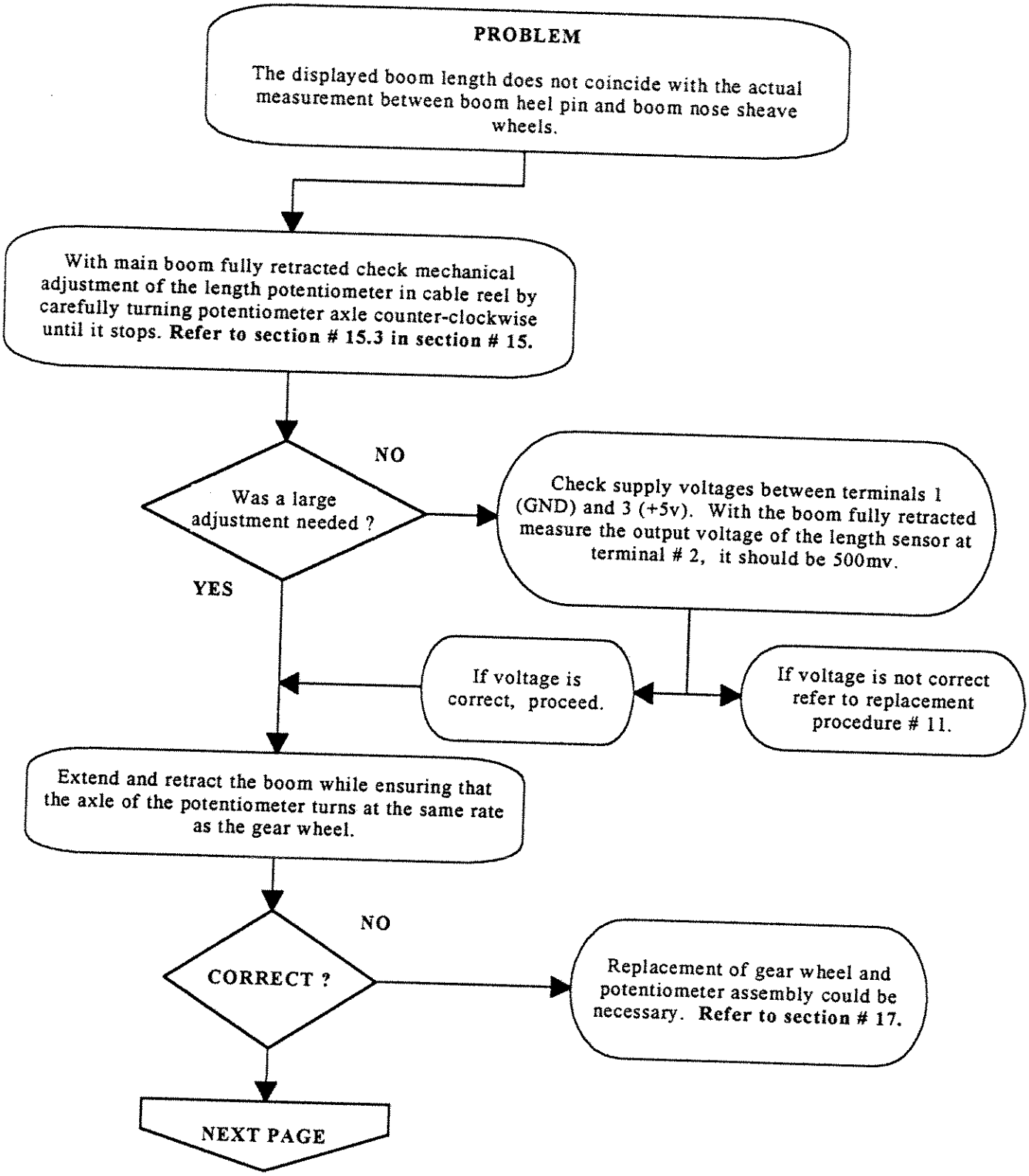
5.3 ANTI-TWO BLOCK PROBLEM



5.4 ANTI-TWO BLOCK PROBLEM



6.1 LENGTH INDICATION PROBLEM



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6.2 LENGTH INDICATION PROBLEM

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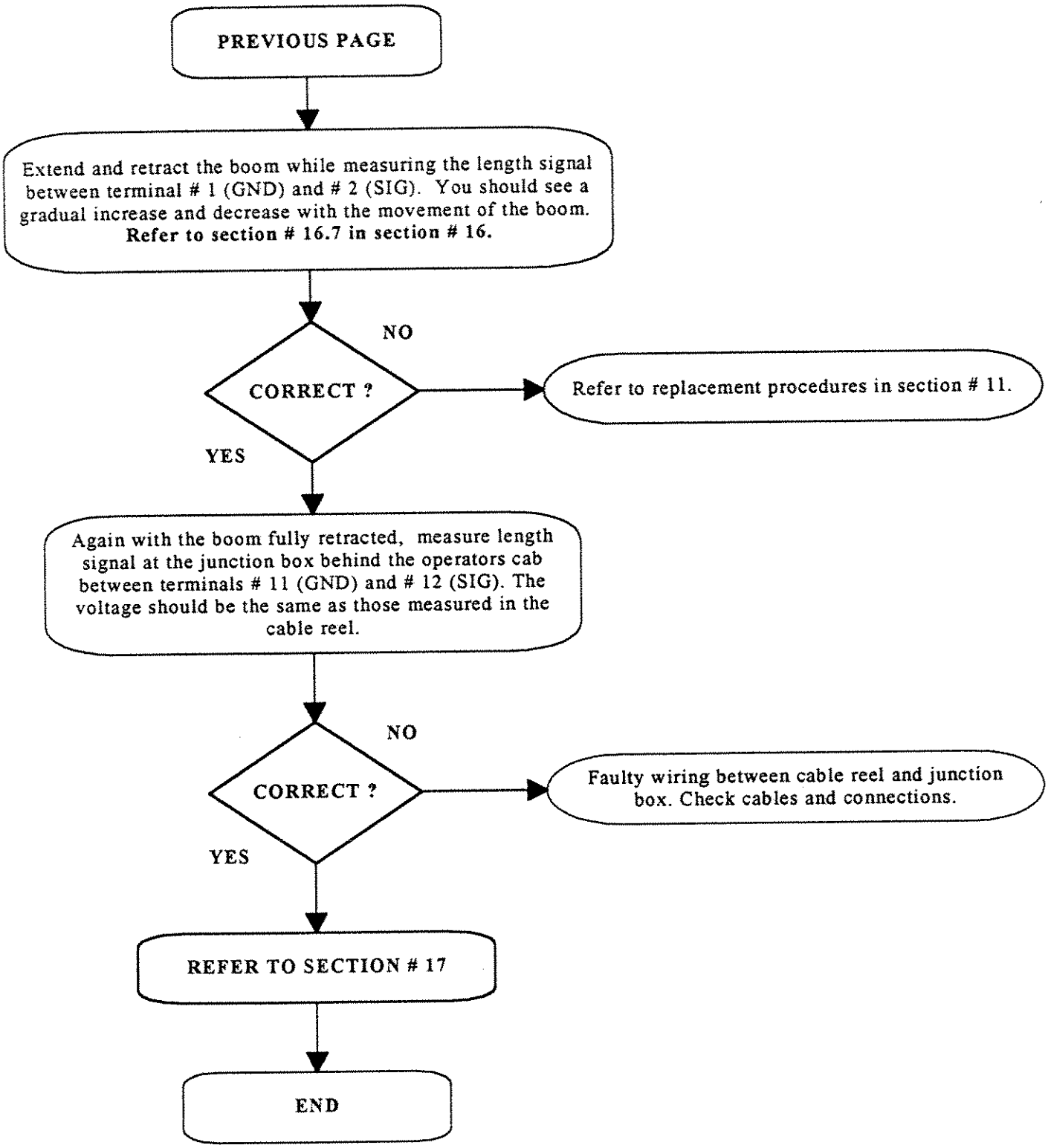
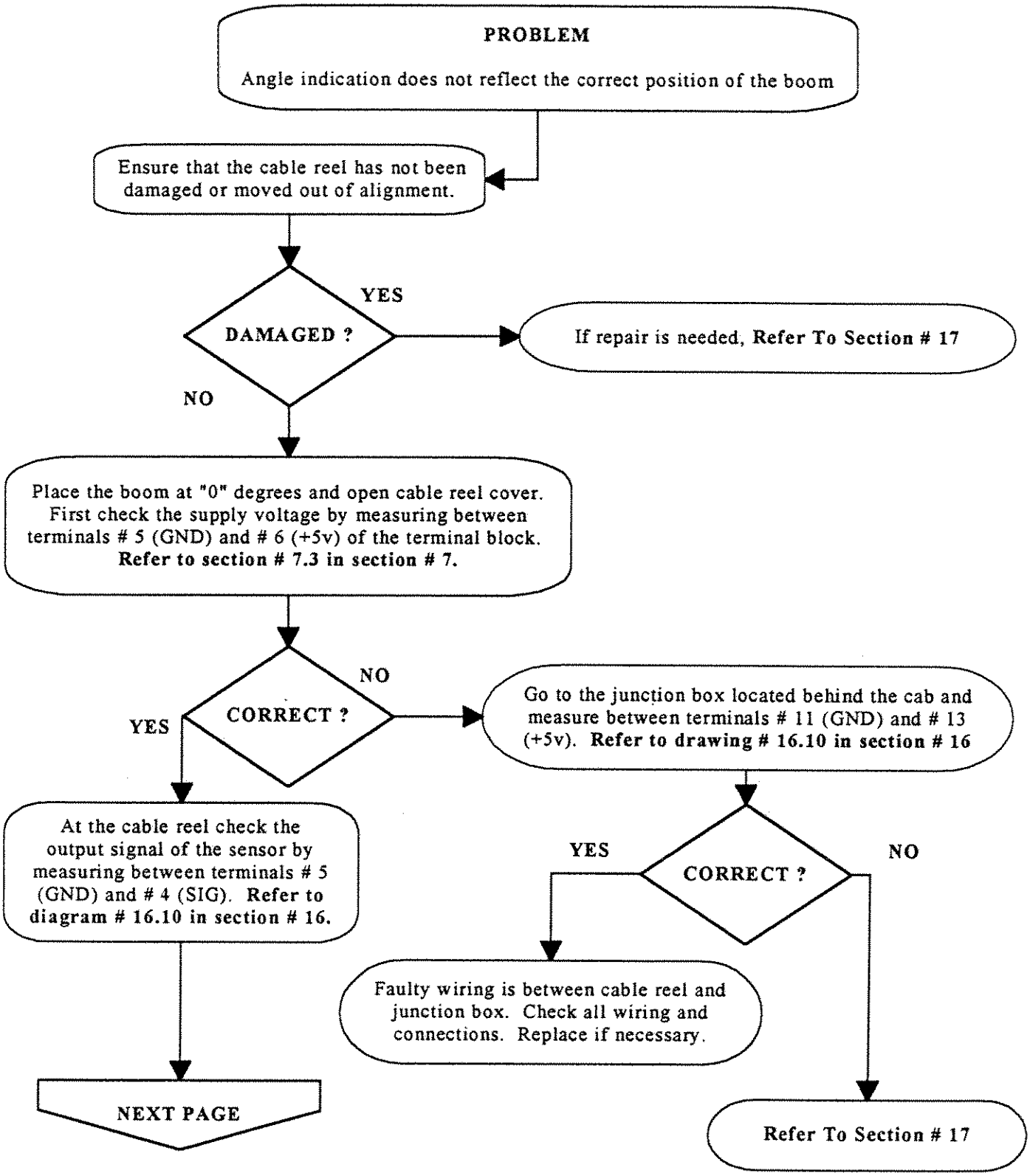


7.1 ANGLE INDICATION PROBLEM



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7 .2 ANGLE INDICATION PROBLEM

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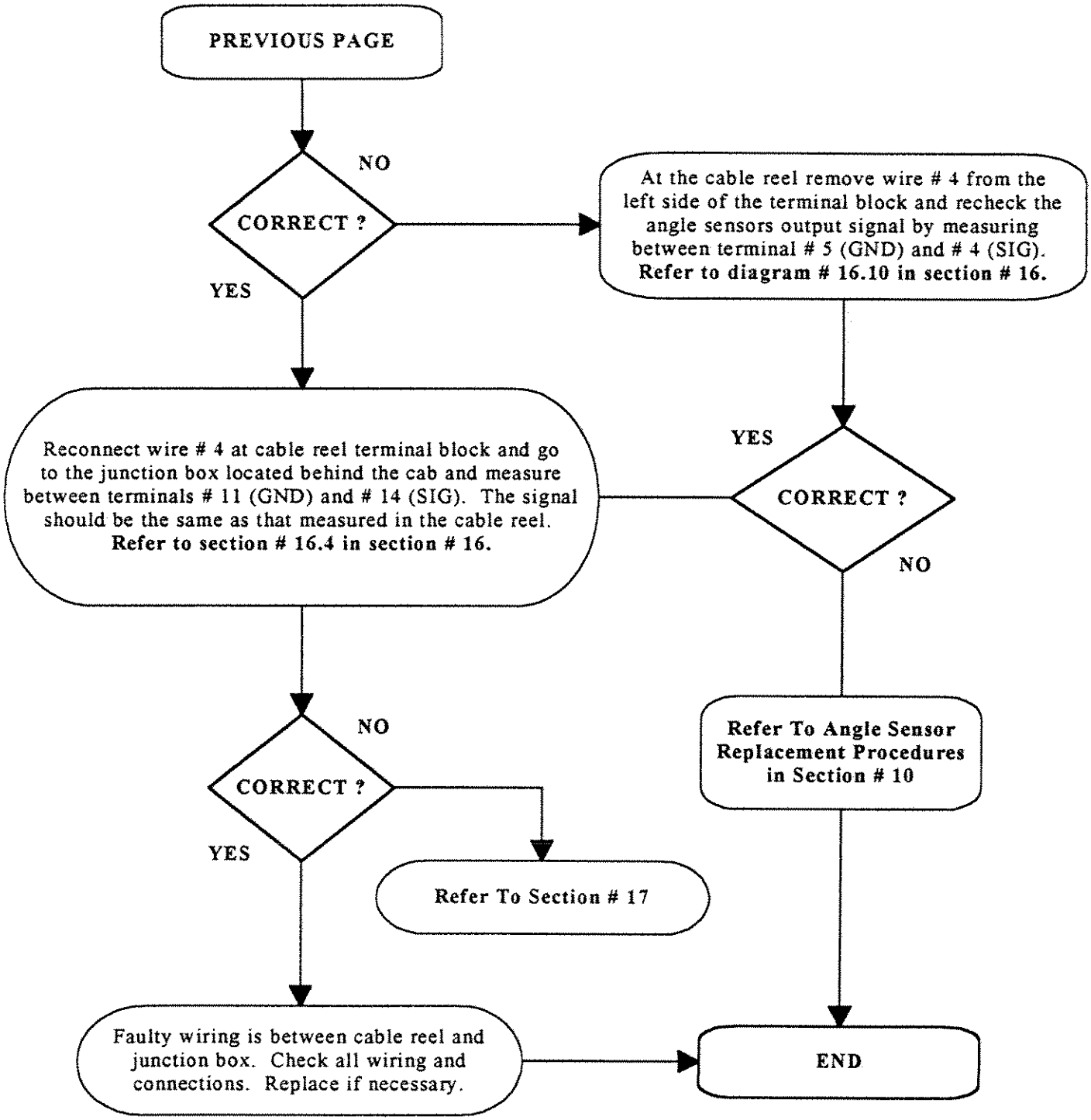


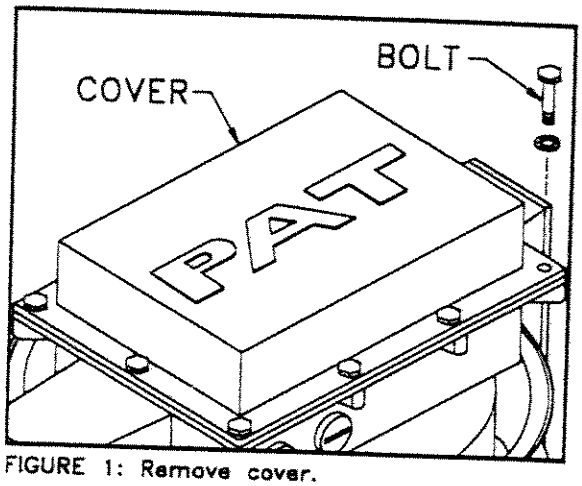


FIGURE 1: Remove cover.

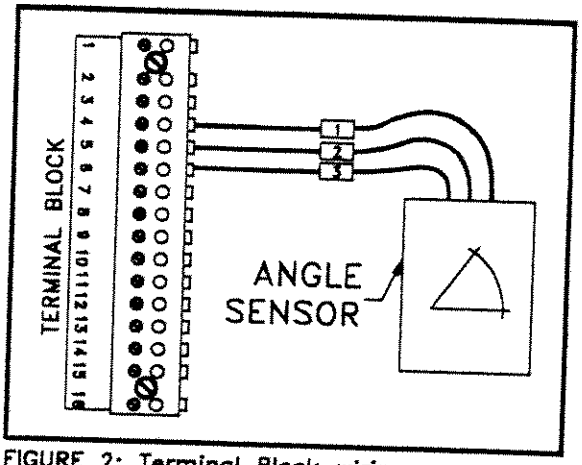


FIGURE 2: Terminal Block wiring.

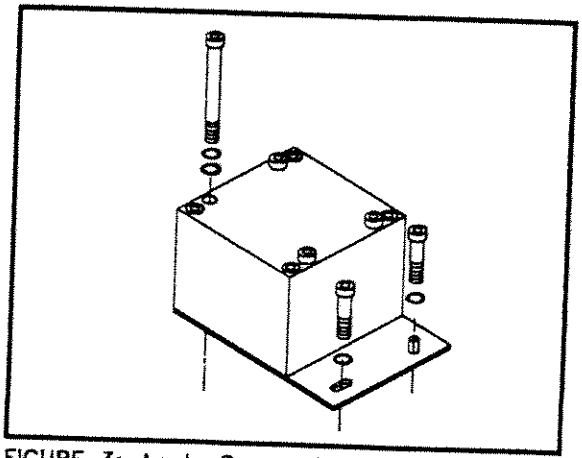
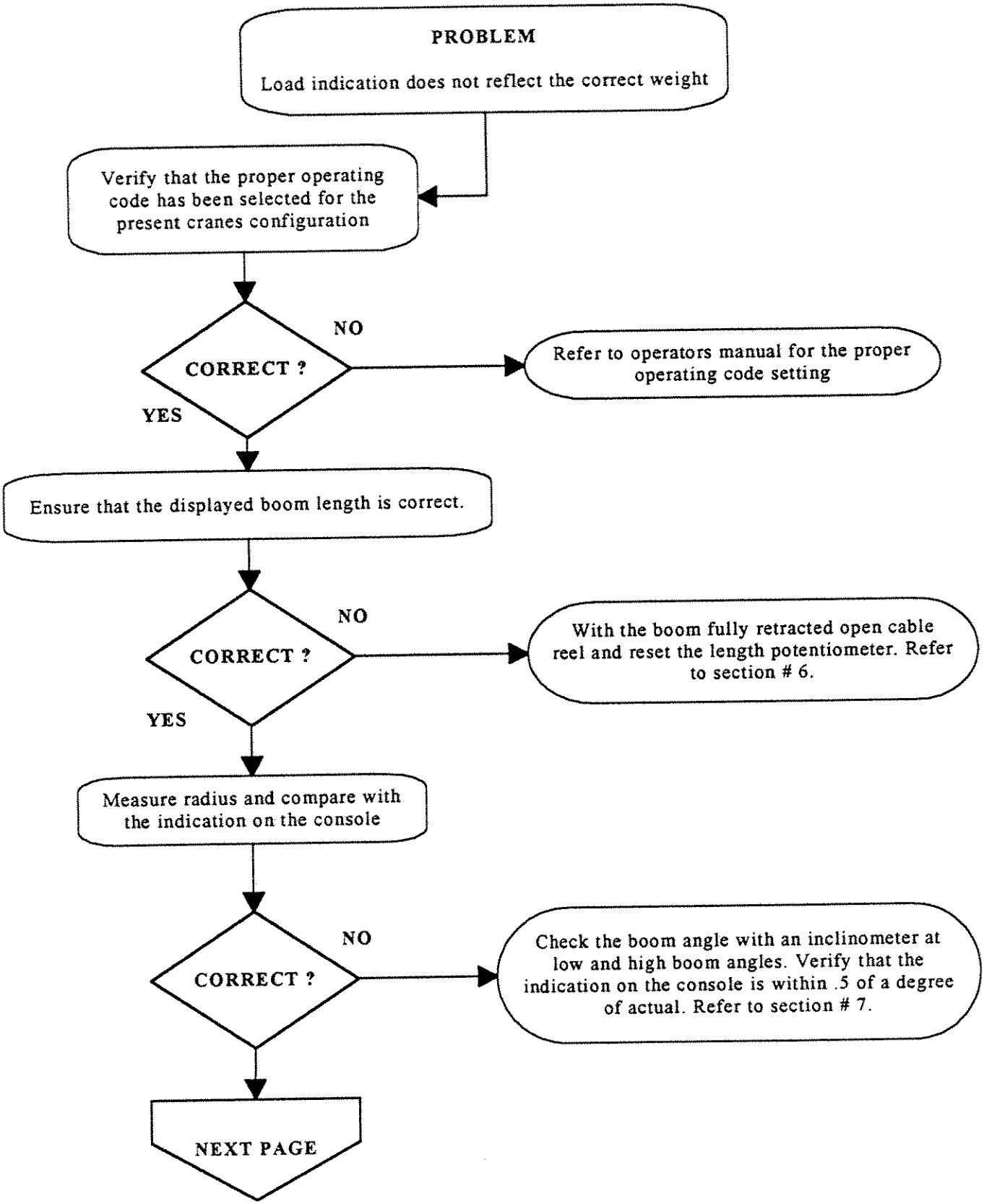
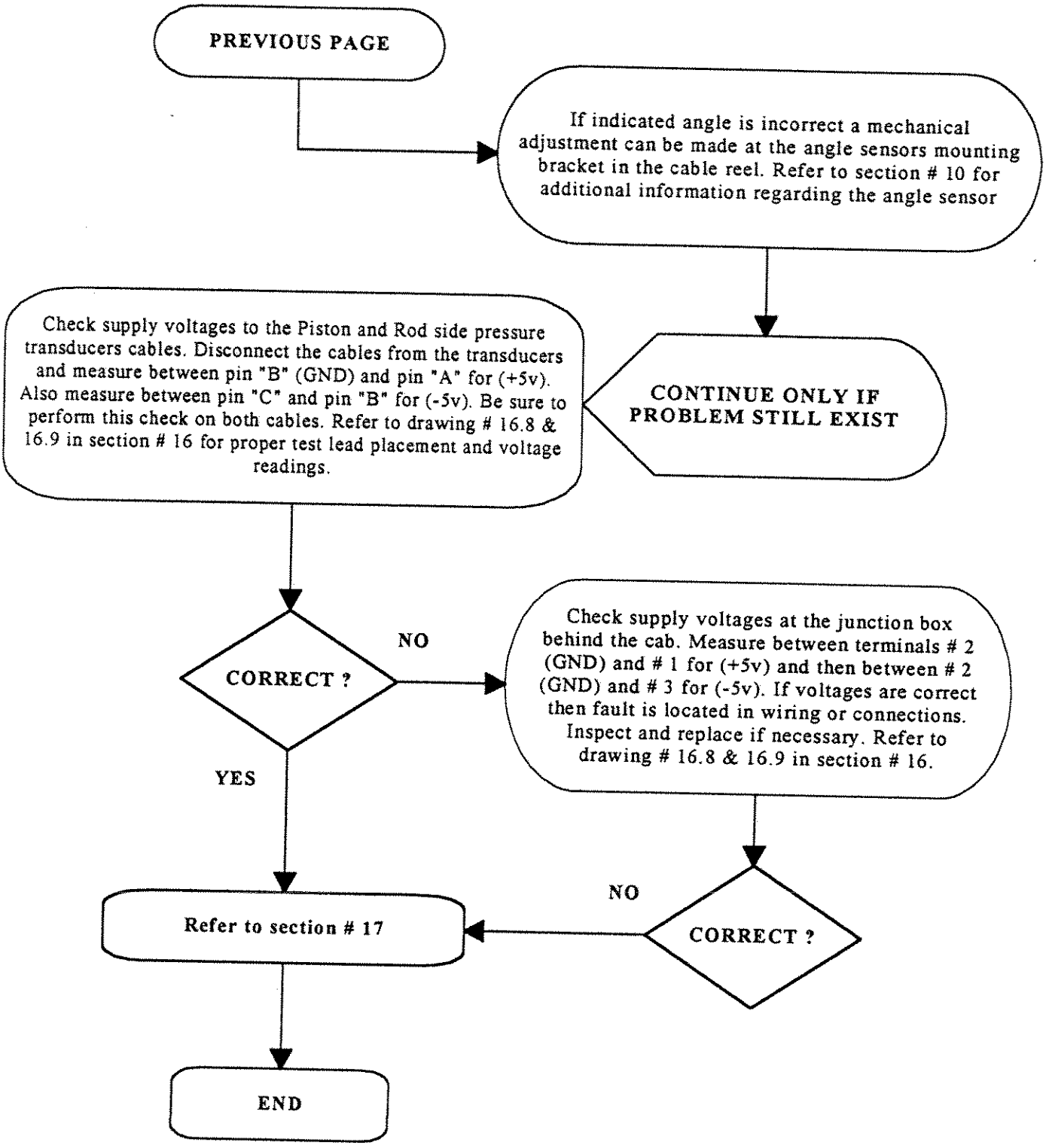


FIGURE 3: Angle Sensor breakout.

8.1 LOAD INDICATION PROBLEM



8.2 LOAD INDICATION PROBLEM



9 LENGTH CABLE REPLACEMENT PROCEDURE

STEP	ACTION
1.	Remove damaged cable from the reel.
2.	Using a 10mm socket or wrench open the reel cover and disconnect all wiring from the left side of the terminal block. Loosen and remove the strain relief with the cable from the bottom of the reel.
3.	Remove the reel from its mounting brackets.
4.	Disconnect the wire ends on terminals X1 and X2 at the slip-ring assembly.
5.	On the back side of the reel remove the strain relief at center axle of the drum and pull the remaining cable out of the reel.
6.	At the boom nose remove the remaining cable from the anchor poll and receptacle.
7.	Start installing the new cable at the reel by pulling it through the hole and pipe on the side of the reel. Install a new strain relief and feed approximately one foot of cable through the center axle to the slip ring.
8.	Dismantle the cable near the slip ring and reconnect the shield to terminal X1 (Shield must be covered with shrink wrap or electrical tape) and center core to terminal X2 (Core has a protective covering that needs to be removed a 1/4" at the end for proper contact with wire end).
9.	Install cable reel back to the boom mounts. By turning the drum clockwise continue to load the remaining cable.
10.	Set cable reel pretension by turning the drum counter-clockwise 5 to 8 turns.
11.	Reconnect cable at the anchor poll and boom nose receptacle.

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9 LENGTH CABLE REPLACEMENT PROCEDURE

Continued from previous page

STEP	ACTION

12. With the boom fully retracted reset the length potentiometer by carefully turning the axle at the gear wheel counter-clockwise until it stops. Check to see that the length, angle and radius display correctly. Verify that the Anti-Two Block works properly.

13. Minor adjustments to the mounting bolts may be needed to ensure proper spooling and angle indication. (Uneven layers can cause improper length indication)

Suggested Equipment For This Task:

1. 10mm socket or wrench
2. Small flat tip screw driver
3. Wire strippers
4. Side cutters
5. Needle nose pliers
6. Electrical tape / plastic tie straps

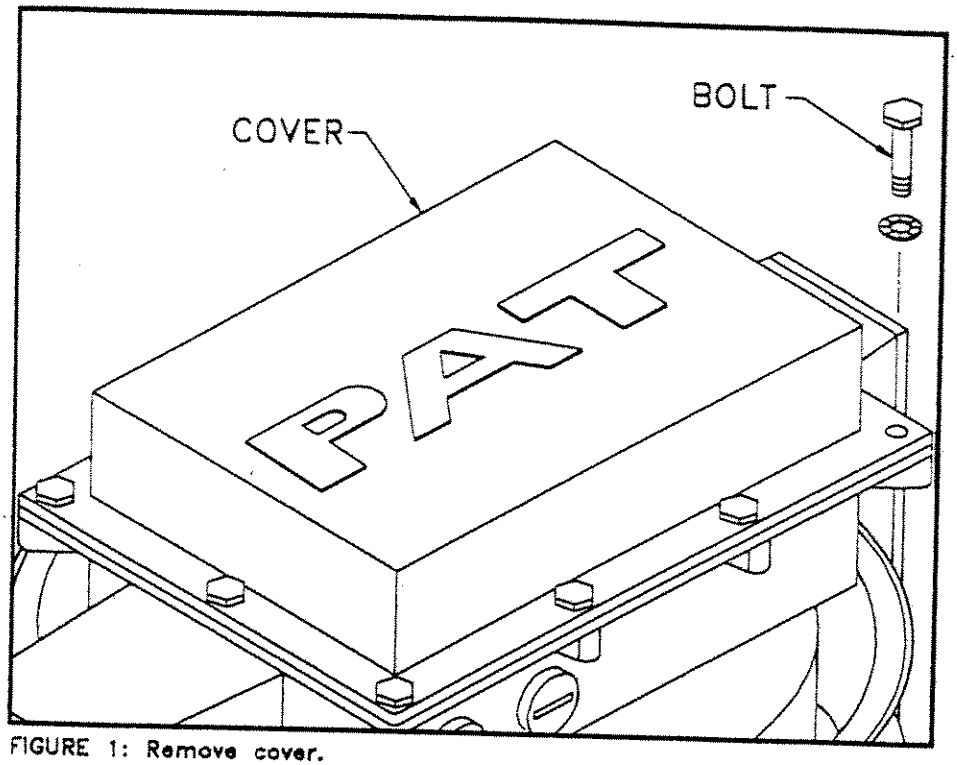

FIGURE 1: Remove cover.

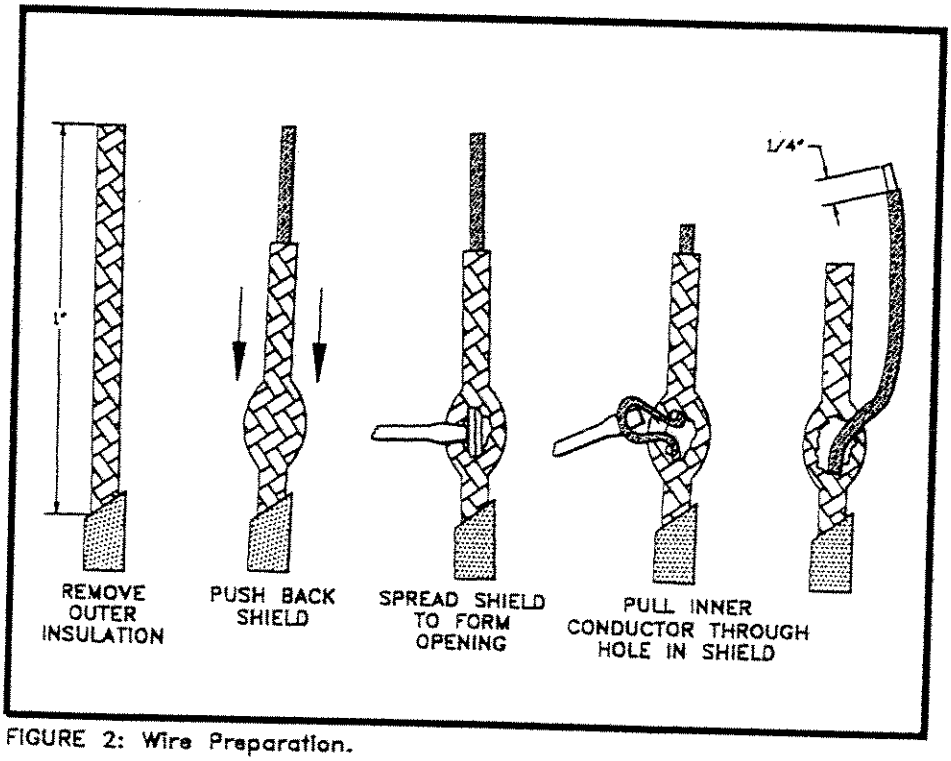

FIGURE 2: Wire Preparation.

10 ANGLE SENSOR REPLACEMENT PROCEDURE

STEP	ACTION
1.	Using a 10mm socket or wrench open cable reel cover. Refer to figure # 1 in section # 10.3.
2.	Desolder wires # 4, 5 and 6 from their same corresponding numbers on the right side of the terminal block. Refer to figure # 2 in section # 10.3.
3.	Remove any plastic tie straps that may be securing the wires.
4.	Using a 5mm allen wrench remove both bottom bolts from the angle sensor bracket. Take hold of the sensor and remove the top left bolt which extends through the sensor to the cable reel housing. Refer to figure # 3 in section # 10.3.
5.	Install new sensor with previously removed bolts. (Thread damage could occur if bolts are over tightened. Care should also be taken to ensure that the wires extending from the rear of the sensor do not get pinched during this process).
6.	Feed wiring around center axle to the terminal strip and secure with plastic tie straps to avoid any possible contact with gear assembly.
7.	Resolder the new wires to the terminal strip. Wires are numbered 4, 5, 6, and are to be attached to the same terminal numbers on the right side of the terminal block.
8.	Turn the system on and check angle indication at the console display.
9.	With an inclinometer measure the boom angle and compare with console indication.
10.	If actual and indicated angle indications are not the same make adjustments to the angle sensor bracket by loosening the three bolts that secure it and rotating the assembly left or right. (Indication should be with in a tolerance of plus or minus 5 tenths of a degree).
11.	Reinstall cable reel cover. (Thread damage can occur if cover bolts are over tightened).

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10 ANGLE SENSOR REPLACEMENT PROCEDURE

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STEP	ACTION
12.	If angle indication is still not correct refer to section # 16.1.

Suggested Equipment For This Task:

1. 10mm socket or wrench
2. 5mm allen wrench
3. Small flat tip screw driver
4. Soldering iron
5. Inclinometer

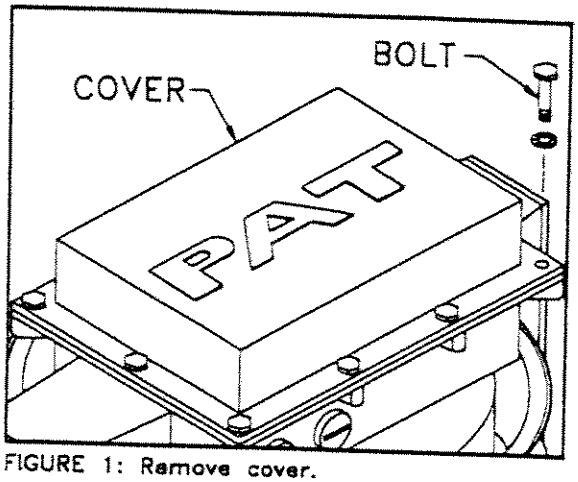

FIGURE 1: Remove cover.

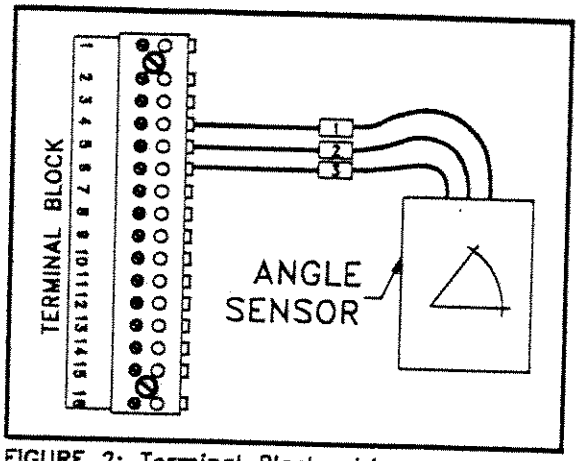

FIGURE 2: Terminal Block wiring.

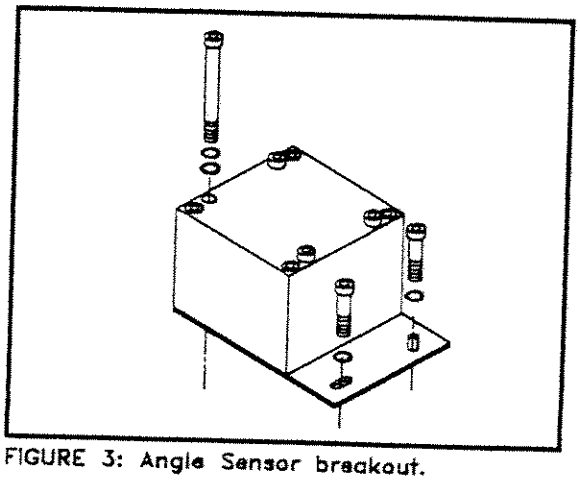

FIGURE 3: Angle Sensor breakout.

11 LENGTH POTENTIOMETER REPLACEMENT PROCEDURE

STEP	ACTION
1.	With a 10mm socket or wrench remove cable reel face cover. See figure # 1 in section # 11.3.
2.	Using a phillips screw driver, remove the retainer bracket which secures the gear wheel. Refer to figure # 2 in section # 11.3.
3.	Remove the gear wheel from the potentiometer axle by pulling it straight out with your fingers. Refer to figure # 3 in section # 11.3.
4.	At the slip ring assembly, remove the wire ends from terminals # 1 and # 2.
5.	Now remove the retainer ring at the center of the slip ring assembly. (This will allow you to remove both sides of the slip ring from the axle). Refer to figure # 4 in section # 11.3.
6.	With a phillips screw driver, remove the four screws that secure the mounting plate. Refer to figure # 3 in section # 11.3.
7.	Using a soldiering iron, remove wires # 1, 2 and 3 from the same corresponding terminal block numbers. (These wires are the last thing holding the assembly in place). Refer to figure # 5 in section # 11.3.
8.	Install the new length potentiometer assembly by securing the mounting plate with the four phillips screws. (Ensure that the grounding wire is also reconnected at the lower right mounting screw).
9.	Resolder wires # 1, 2 and 3 to the same corresponding pins at the terminal block. (Be sure that wires are secured in a way that they cannot become caught in the gear wheel). Refer to figure # 5 in section #11.3.
10.	Install gear wheel onto potentiometer axle. (Care should be taken when aligning the drive gear and potentiometer axle. Damage to the clutch assembly or gear wheels can lead to an incorrect length indication). Refer to figure # 3 in section # 11.3.

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11 LENGTH POTENTIOMETER REPLACEMENT PROCEDURE

Continued from previous page.

STEP	ACTION
11.	Secure the gear wheel retainer bracket with the remaining two phillips screws.
12.	Feed length cable wires through both top and bottom slip ring assembly while aligning bottom slip ring stop post with hole located in length potentiometer mounting bracket. Refer to figure # 4 in section # 11.3.
13.	Reconnect core to terminal # 1 and shield to terminal # 2 on the top slip ring contacts. Refer to figure # 6 in section # 11.3.
14.	With the boom fully retracted, use a small screw driver and turn potentiometer center axle screw counter clock wise until it stops. This is the zero point setting. Refer to figure # 5 in section # 11.3.
15.	Verify that the console displays the proper length indication.
16.	Boom length should be measured from the boom heel pin to the boom nose center sheave wheel pin.
17.	If length indication is not correct refer to section # 17.

Suggested Equipment For This Task:

1. 10mm socket or wrench
2. Small flat tip screw driver
3. Small phillips head screw driver
4. Digital multimeter
5. Retainer ring pliers
6. Soldering iron
7. Needle nose pliers

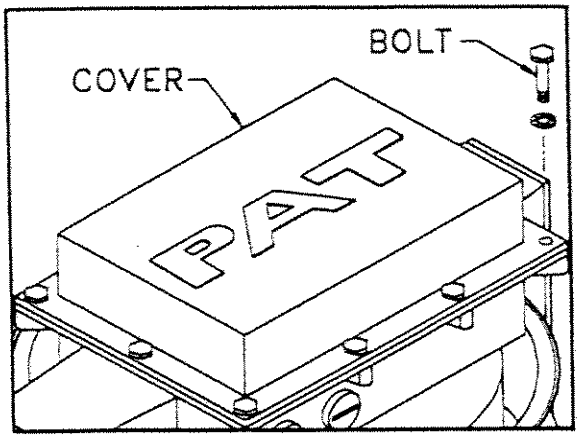


FIGURE 1: Remove cover.

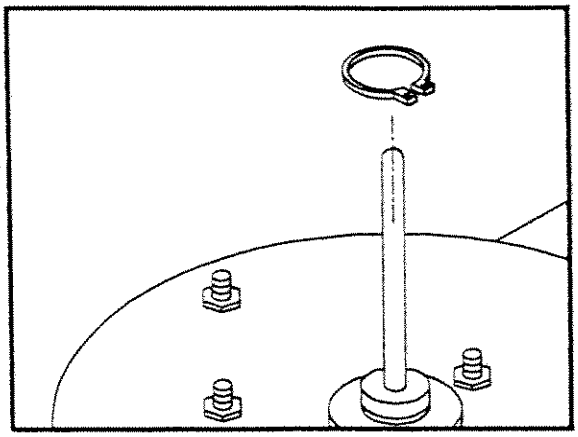


FIGURE 4: Snap-Ring.

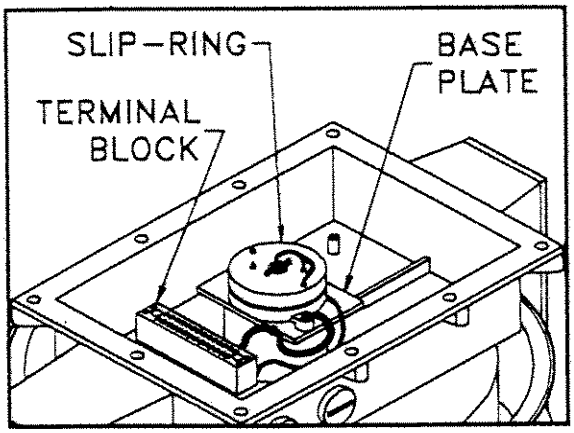


FIGURE 2: Locate the various components, of the Cable Reel.

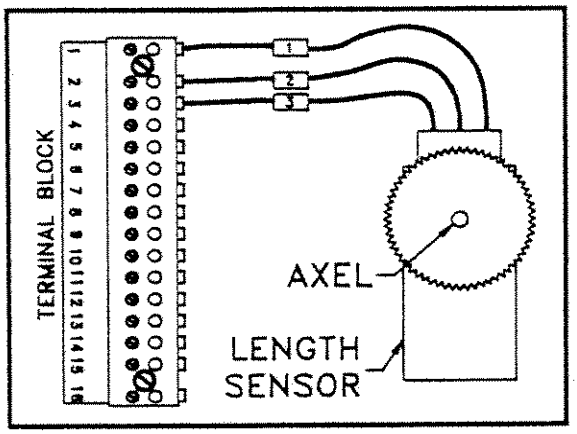


FIGURE 5: Terminal Block wiring.

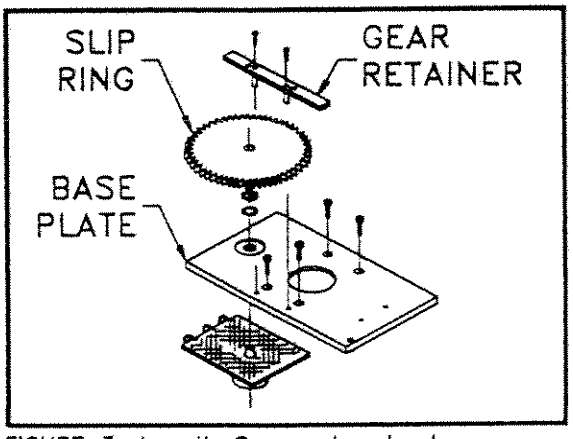


FIGURE 3: Length Sensor breakout.

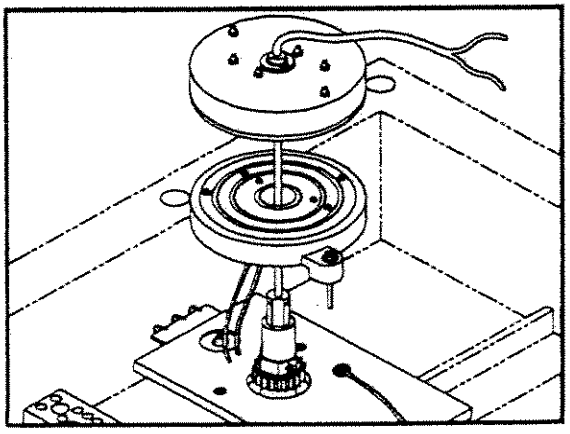
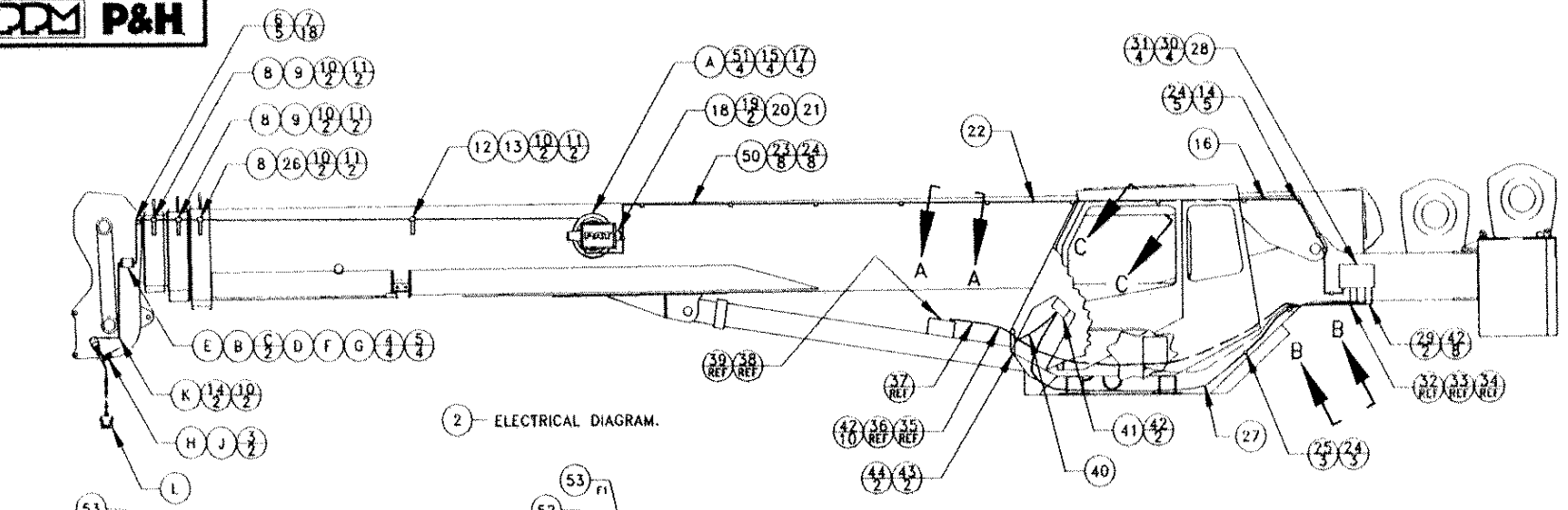
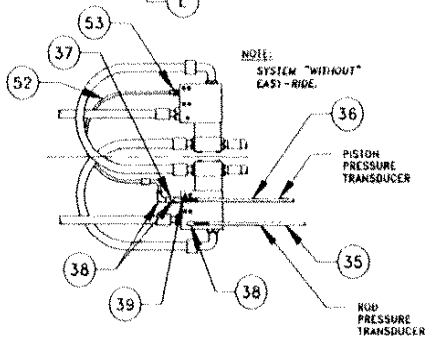


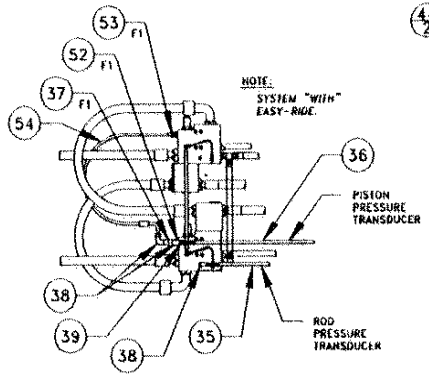
FIGURE 6: Slip-Ring bracket.

P&H

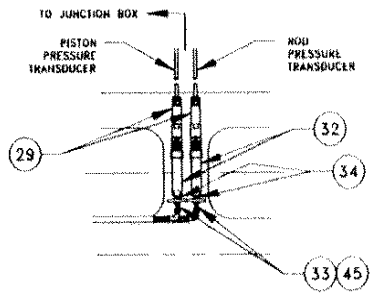




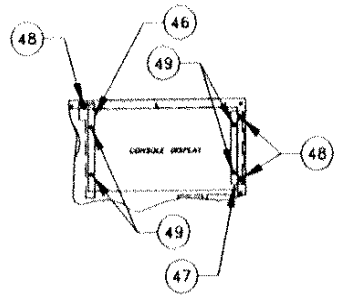
VIEW A–A
SCALE: NTS



VIEW A–A
SCALE: NTS



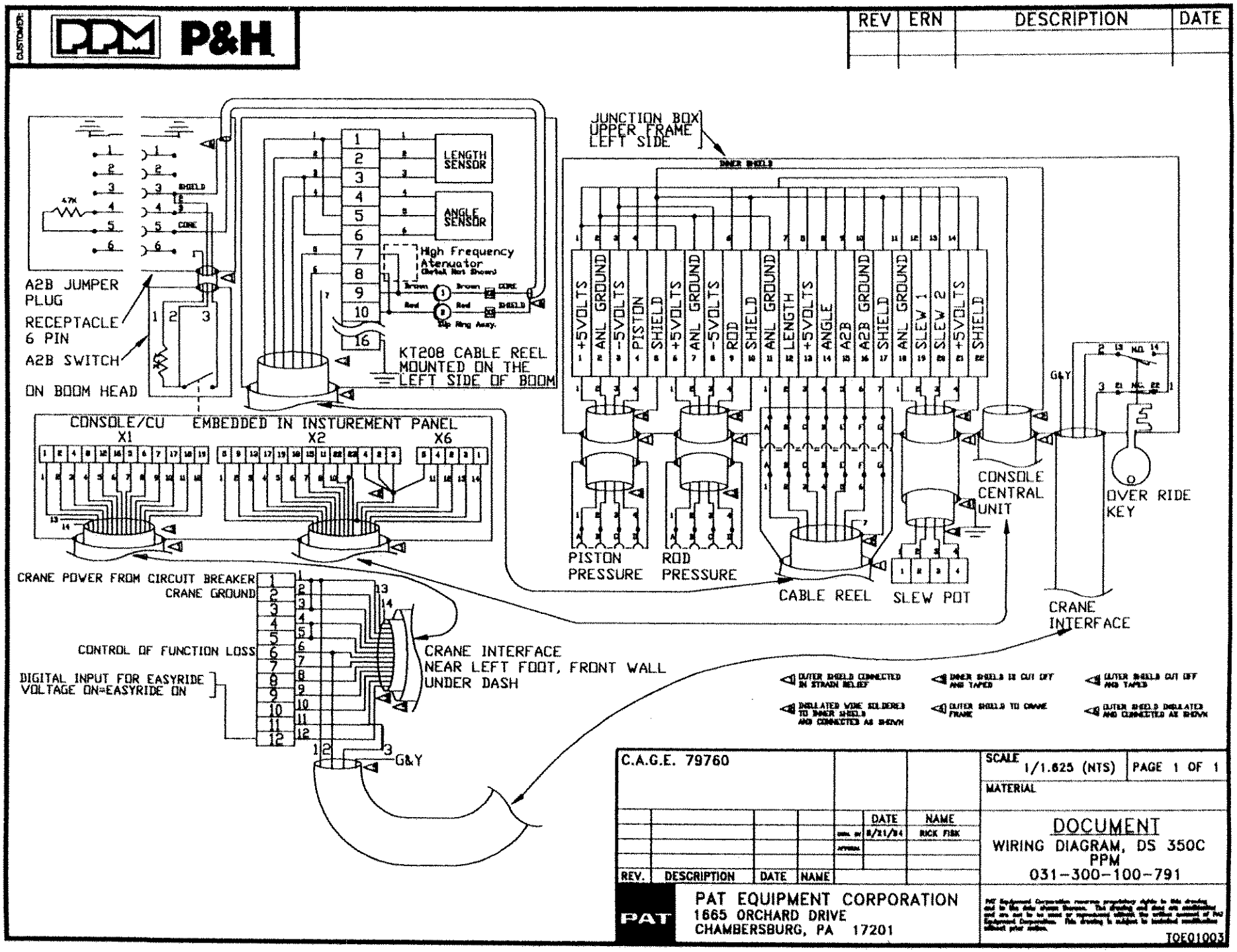
VIEW B–B
SCALE: NTS



VIEW C–C
SCALE: NTS

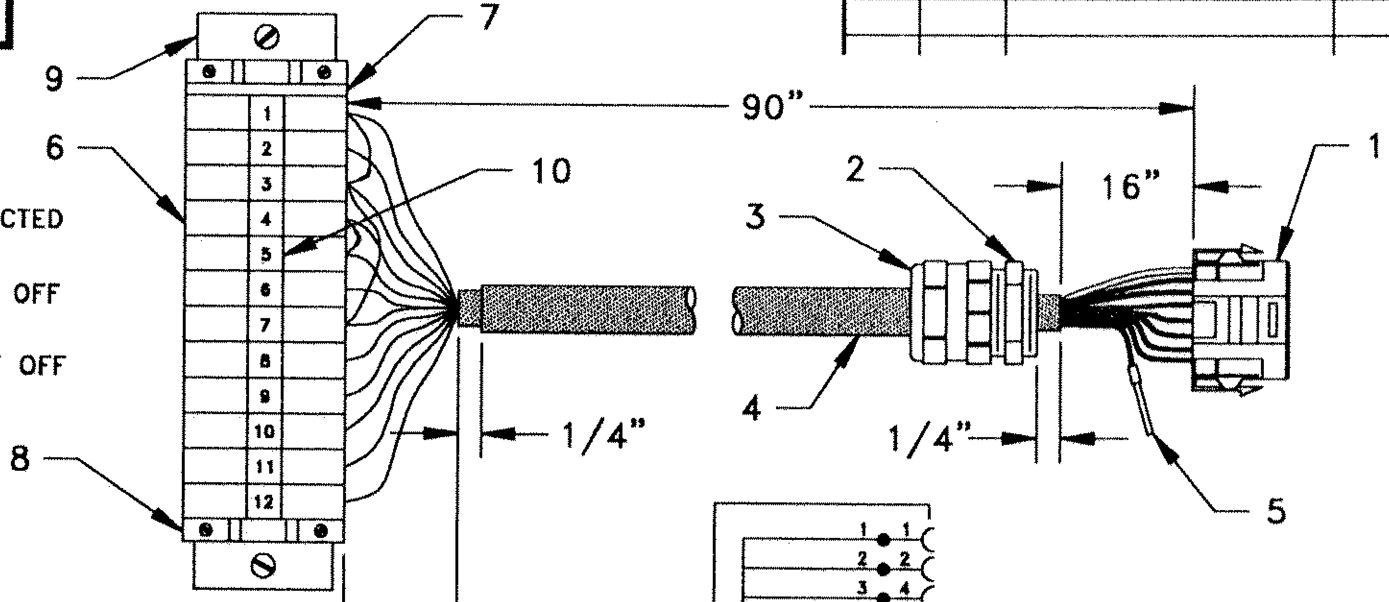
ITEM	PART NUMBER	DESCRIPTION	QTY
A	068-208-060-013	CABLE REEL LWG208 - 2 CONDUCTOR	1
B	021-441-090-908	STRAIN RELIEF, PG 9, WHITE GROM	1
C	000-214-251-609	REDUCER, PG 16 TO PG 9	2
D	000-301-025-062	INSERT, 6 PIN FEMALE	1
E	000-301-022-298	RECEPTACLE, 6 PIN	1
F	021-441-090-709	STRAIN RELIEF, PG 9, BLACK INSERT	1
G	031-300-100-812	PLUG, A2B, DUMMY PLUG, 6 PIN, W/4.7K	1
H	031-002-060-011	SWITCH, A2B WITH CRIMP	1
J	031-300-100-722	SWITCH ACCY., A2B FLAG ASS'Y.	1
K	031-300-100-110	ELECTRICAL, CONDUIT, 1/4", BLACK, FLEX (PER FOOT)	4'
L	003-100-210-012	WEIGHT & CHAIN, A2B WITH SHACKLE	1

C.A.G.E. 79760							SCALE 1/1 (NTS)	PAGE 1 OF 2
					DATE	NAME	MATERIAL	
				DRN	6/6/94	RE	INSTALLATION SYSTEM CNT 500	
REV.	DESCRIPTION	DATE	NAME					
PAT	PAT-EQUIPMENT CORPORATION 1665 ORCHARD DRIVE CHAMBERSBURG, PA 17201							SYS1N500



CUSTOMER: PPM P&H

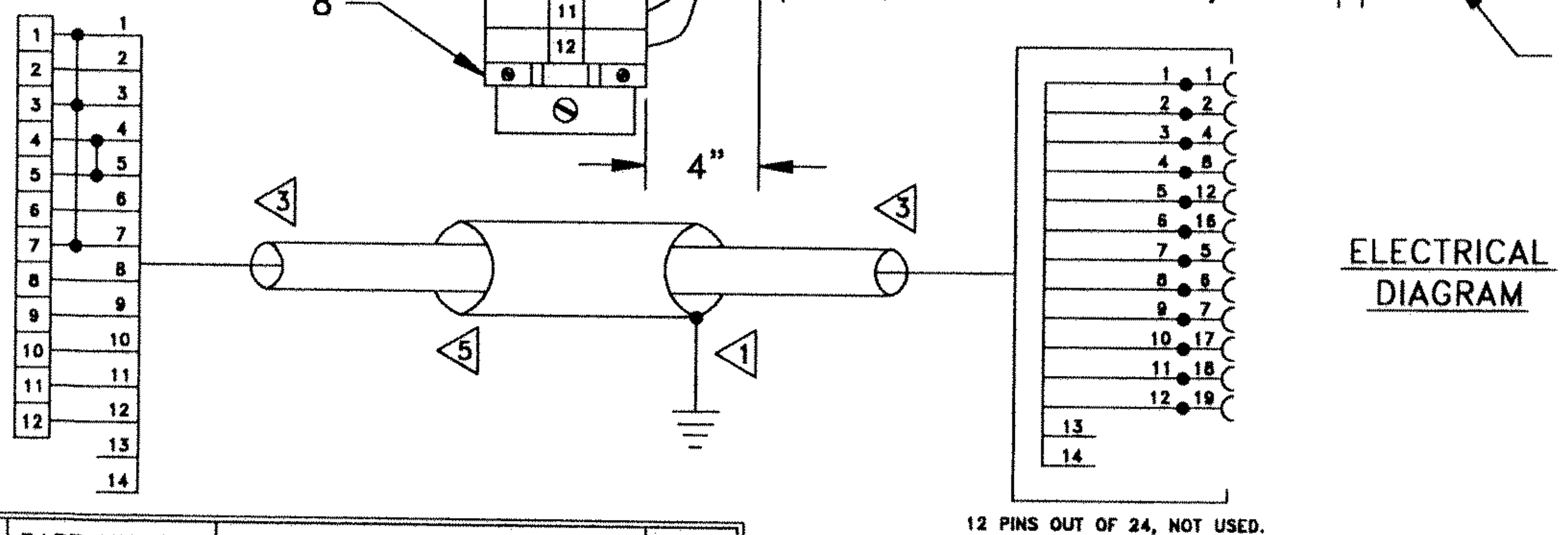
REV	ERN	DESCRIPTION	DATE



◁1 OUTER SHIELD CONNECTED IN STRAIN RELIEF.

◁3 INNER SHIELD IS CUT OFF AND TAPED.

◁5 OUTER SHIELD IS CUT OFF AND TAPED.



ITEM	PART NUMBER	DESCRIPTION	QTY
1	000-301-402-422	24 PIN PLUG, WEIDMULLR, RSV1.6, #141800	1
2	000-214-210-016	LOCK NUT, PG 16	1
3	021-441-161-216	STRAIN RELIEF, PG 16, 12-15mm, GRAY+WHITE INSERT	1
4	031-300-100-141	CABLE, 14 COND. D.S. (PER FOOT)	8'
5	000-301-409-221	PIN SOCKET, WEIDMULLER, #142290	12
6	031-300-100-686	TERMINAL STRIP ACCY, BLOCK, AKZ4	12
7	031-300-100-687	TERMINAL STRIP ACCY, END PLATE, AKZ4	1
8	031-300-100-688	TERMINAL STRIP ACCY, END BRACKET, EW15	2
9	031-300-100-795	TERMINAL STRIP ACCY, RAIL, MTG, TS 15	1
10	031-300-100-693	TERMINAL STRIP ACCY, MARKING TAGS 1-50, 6mm BLOCK, VERTICAL, 4687.6 WEIDMULLER	1

C.A.G.E. 79760

REV.	DESCRIPTION	DATE	NAME		DATE	NAME
				DRN. BY	6/16/94	BLK
				APPRVD.		

SCALE 1/2 — PAGE 1 OF 1

MATERIAL

CABLE ASSEMBLY

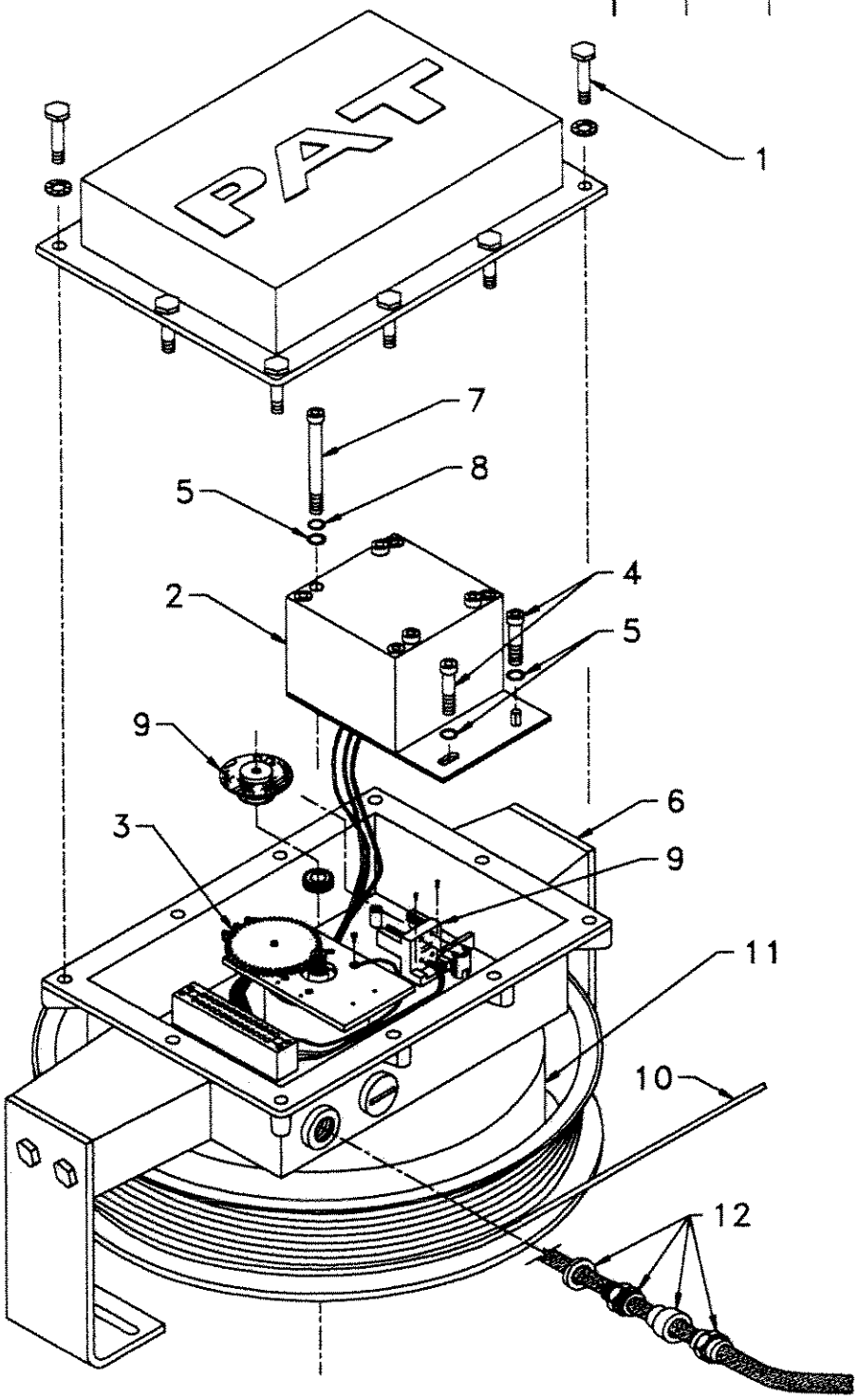
14 COND. D.S., 24 PIN
WEIDMULLER PLUG, 90", PPM
031-300-100-793

PAT

PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

CAC00010

REV	ERN	DESCRIPTION	DATE



C.A.G.E. 79760						
					DATE	NAME
				ORIG. BY	8/27/94	RLE
				APPROV.		
REV.	DESCRIPTION	DATE	NAME			

SCALE 1/6 | PAGE 1 OF 2

MATERIAL

CABLE REEL ASS'Y

2-CONDUCTOR
LWG 208
068-208-060-013

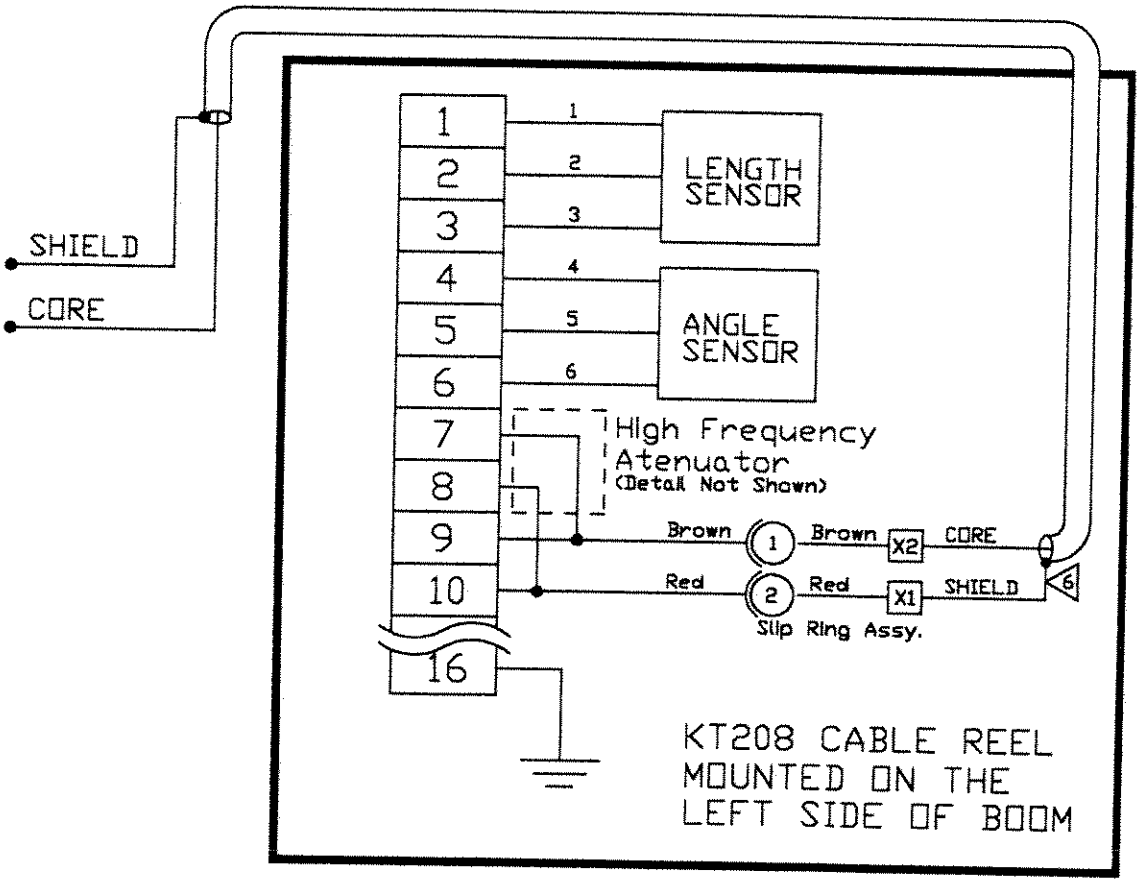
CUSTOMER: P&H

PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

RMC1K208

ITEM	PART NUMBER	DESCRIPTION	QTY
1	068-000-110-031	CABLE REEL ACCY. SCREW/CAPTIVE	10
2	064-103-060-002	SENSOR, ANGLE WG 103	1
3	006-710-006-002	SENSOR, LENGTH TRANSDUCER LGE 100	1
4	002-050-208-012	SCREW, M8 X 12 HEX SOCKET CAP (FOR ANGLE SENSOR)	2
5	000-207-010-064	WASHER, FLAT 8mm	3
6	006-820-006-002	CABLE REEL, KT 200, STANDARD	1
7	031-300-100-358	SCREW, 8mm X 1 X 110	1
8	000-208-040-064	WASHER, LOCK, 8mm	1
9	068-000-110-013	SLIP-RING, 2 CONDUCTOR	1
10	000-673-020-002	CABLE, LENGTH SENSOR, 1 CORE WITH SCREEN (PER FOOT)	139'
11	068-000-110-010	SPRING PACK W/HOUSING, KT 200	1
12	021-441-161-213	STRAIN RELIEF, PG 13.5, 12-15mm GRAY+WHITE INSERT	1

REV	ERN	DESCRIPTION	DATE



ELECTRICAL DIAGRAM

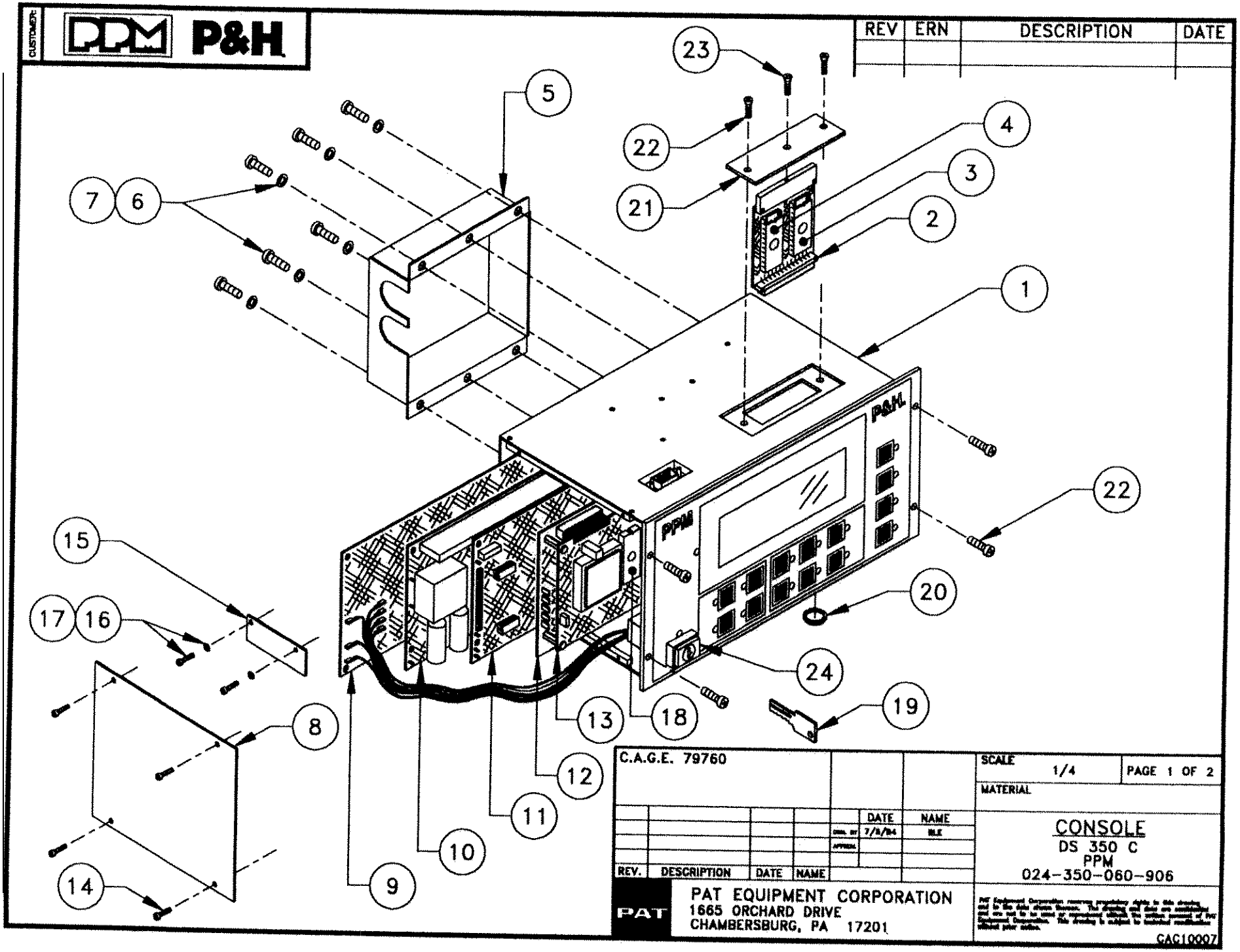
⑥ OUTER SHIELD INSULATED AND CONNECTED AS SHOWN.

C.A.G.E. 79760						SCALE 1/1 (NTS)	PAGE 2 OF 2
						MATERIAL	
					DATE	NAME	
				ORIG. BY	6/27/94	RLE	
				APPROVAL			
REV.	DESCRIPTION	DATE	NAME			CABLE REEL 2-CONDUCTOR LWG 208 068-208-060-013	

CUSTOMER: PPM P&H

PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

BMC2K208

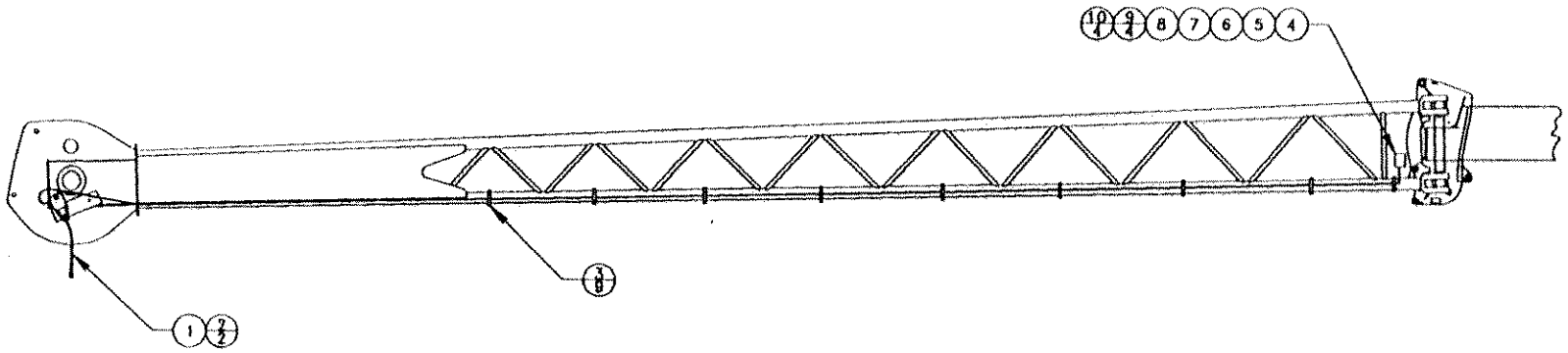


Engineering Bill Date : 12/08/94 17:15:55 F/N:CAC20007

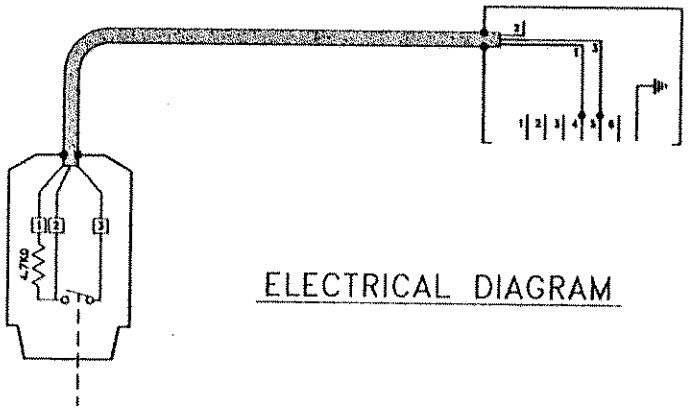
Number	:CAC20007
Title	:B.O.M. FOR CONSOLE DS 350 C
Model	:ALL MODELS
Revision	:
ECO Number	:
Date of Last ECO	:
Basic List No	:
Similar To	:
Drawn By	:ROD EAVES
Checked By	:
Approved By	:RICK FISK (PAT)
Revised By	:
Tree Number	:

ITEM	PART NUMBER	DESCRIPTION	MAT'L	WGT	QTY
1	024-000-100-078	HOUSING, CONSOLE/CU, DS350C			1
2	024-351-300-010	BOARD, DS350C, DATA PROM MODUL			1
3					
4					
5	024-000-100-080	HOUSING, DS350C, BACK COVER,- FOR STRAIN RELIEF & TERM. MTG.			1
6					
7					
8	024-000-050-223	COVER, DS350C, SIDE PANEL FOR CIRCUIT BOARD ACCESS			1
9	024-351-300-103	BOARD, DS350C CONNECTION, 8- DIGITAL INPUTS, 3+1+1 RELAYS			1
10	024-351-300-040	BOARD, DS350C POWER SUPPLY			1
11	024-351-300-063	BOARD, DS350C ANALOG			1
12	024-351-300-001	BOARD, DS350C PROCESSOR			1
13	024-351-300-002	BOARD, DS350C CPU			1
14	000-205-270-308	SCREW, 3mm X 8mm, FLATHEAD			4
15	024-000-050-226	RETAINING PLATE, BOARDS			1
16	000-205-370-308	SCREW, 3mm X 8mm			2
17	000-208-030-030	WASHER, 3mm			2
18					
19	050-350-100-001	KEY, DS350G & DS350C CONSOLE			1
20	050-350-110-049	ALARM, BUZZER, DS150 & DS350C			1
21	024-000-050-174	COVER, DS350C, PANEL TO ACCESS DATA PROM MODULE			1
22	000-205-270-308	SCREW, 3mm X 8mm, FLATHEAD			2
23	000-205-270-312	SCREW, 3mm X 12mm, DS350C- DATA PROM COVER MTG.			1
24	050-350-110-213	SWITCH, KEY, DS350C CONSOLE/CU			1

P&H



SWINGAWAY JIB



ELECTRICAL DIAGRAM

C.A.G.E. 78760						SCALE 1/1 (NTS)	PAGE 1 OF 2
						MATERIAL	
					DATE 4/15/04	NAME MJ	A2B INSTALLATION FOR BOOM EXTENSION OPTION KIT
REV.	DESCRIPTION	DATE	NAME				
PAT	PAT EQUIPMENT CORPORATION 1685 ORCHARD DRIVE CHAMBERSBURG, PA 17201						

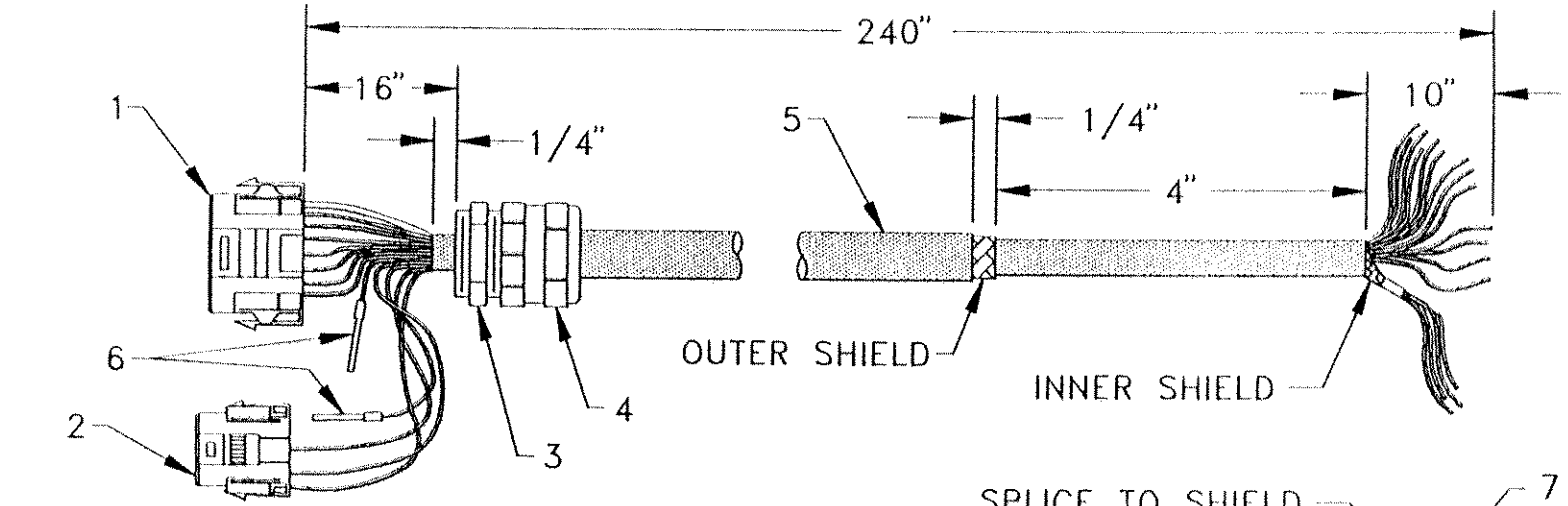
Engineering Bill Date : 08/18/94 13:00:00 F/N:JII24000

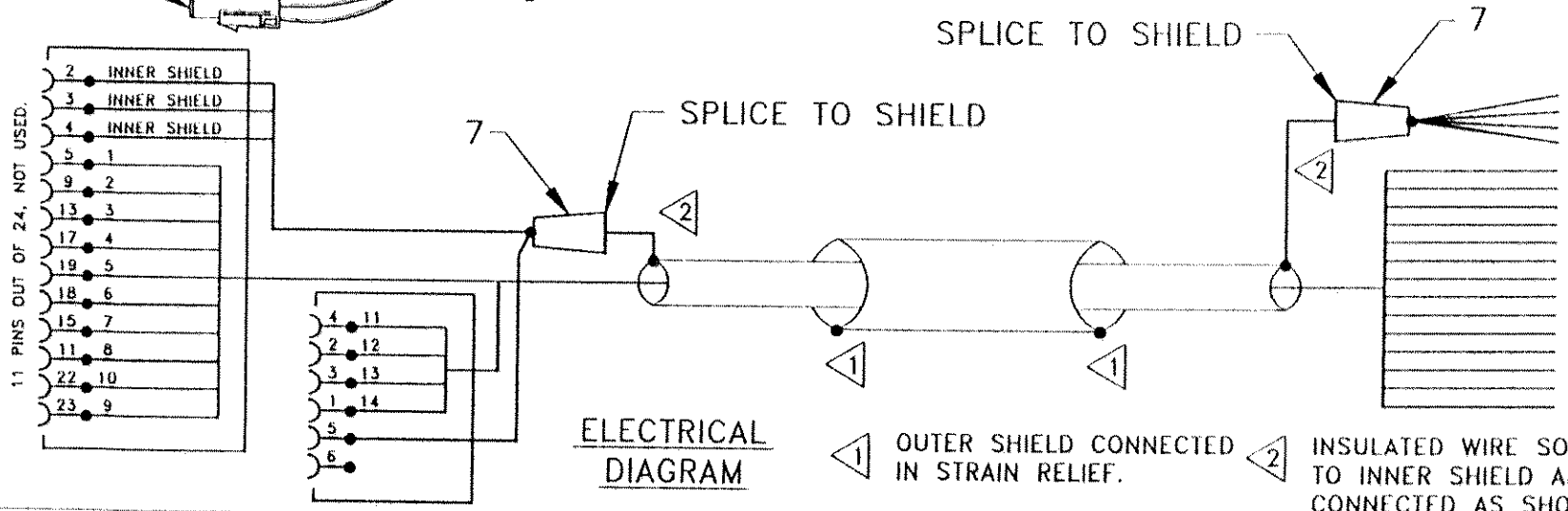
Number	:JII24000
Title	:B.O.M. FOR SWINGAWAY JIB
Model	:CN 180, VARIOUS
Revision	:
ECO Number	:
Date of Last ECO	:
Basic List No	:
Similar To	:
Drawn By	:ROD EAVES
Checked By	:
Approved By	:RICK FISK (PAT)
Revised By	:
Tree Number	:

ITEM	PART NUMBER	DESCRIPTION	MAT'L	WGT	QTY
1	031-002-060-017	A2B SWITCH, 40' CABLE			1
2	0830V032	5/16-18 X 1 1/2 S.H.C.S.			2
3	32Z890D122	TIE WRAP			9
4	3287Z30	RECEPTACLE, 6 PIN			1
5	3287Z32	6 POSITION, PIN INSERT			1
6	3287Z24	REDUCER, PG 16-9			1
7	3287Z26	STRAIN RELIEF, PG 9, 4-6mm-YELLOW			1
8	3287Z29	HOLE PLUG, PG 16			1
9	0862V094	SCREW, 10-24 X 3/8 R.H.M.S.			4
10	3643V007	#10 LOCK WASHER			4

CUSTOMER: P&H

REV	ERN	DESCRIPTION	DATE





ELECTRICAL DIAGRAM

1 OUTER SHIELD CONNECTED IN STRAIN RELIEF.

2 INSULATED WIRE SOLDERED TO INNER SHIELD AND CONNECTED AS SHOWN.

ITEM	PART NUMBER	DESCRIPTION	QTY
1	000-301-402-422	24 PIN PLUG, WEIDMULLR, RSV1.6, #141800	1
2	000-301-400-622	6 PIN PLUG, WEIDMULLER, RSV1.6, #141400	1
3	000-214-210-016	LOCK NUT, PG 16	1
4	021-441-161-216	STRAIN RELIEF, PG 16, 12-15mm, GRAY+WHITE INSERT	1
5	031-300-100-141	CABLE, 14 COND. D.S. (PER FOOT)	20'
6	000-301-409-221	PIN SOCKET, WEIDMULLER, #142290	18
7	-	10-12 SPLICE CONNECTOR	2

C.A.G.E. 79760

					DATE	NAME
				DRAWN	6/15/94	RLE
				APPROV	8/9/94	M.O.O.
1	ADDED SPLICE/LENGTH	3/6/95	RLE			
REV.	DESCRIPTION	DATE	NAME			

PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

SCALE 1/2 | PAGE 1 OF 1

MATERIAL

CABLE ASSEMBLY

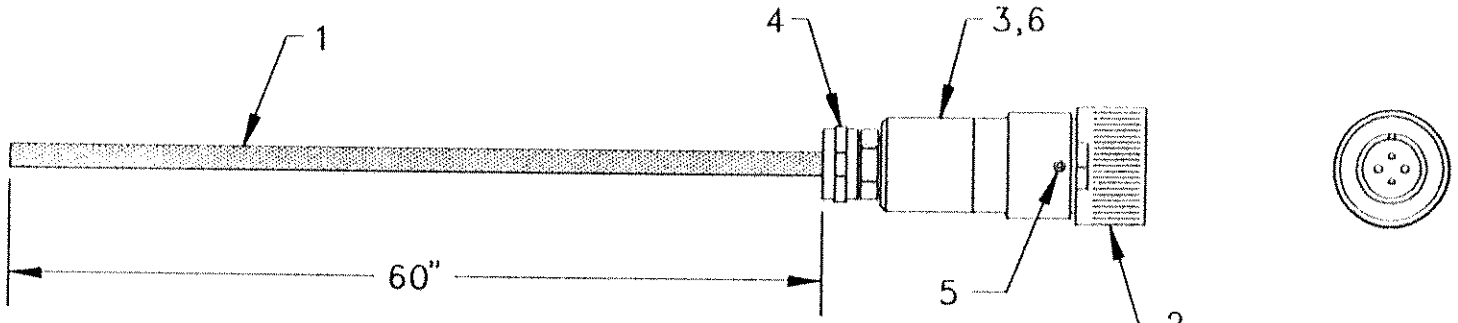
14 COND. D.S., 24 PIN WEIDMULLER PLUG, 240", PPM
031-300-100-794

UFCOJB02

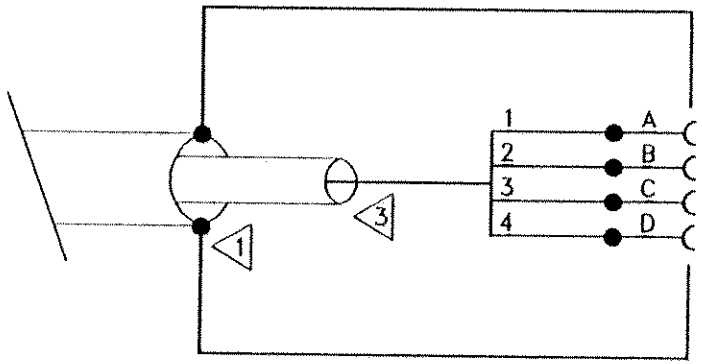
CUSTOMER

PPM P&H

REV	ERN	DESCRIPTION	DATE



ELECTRICAL DIAGRAM



NOTE:

AFTER SOLDERING CONDUCTORS AND INSTALLING SHRINK TUBE, APPLY NON-CONDUCTIVE GREASE, FOR MOISTURE DISPLACEMENT.

ITEM	PART NUMBER	DESCRIPTION	QTY
1	031-300-100-145	CABLE, 4 X 0.5 D.S. (PER FOOT)	5'
2	031-010-100-197	CONNECTOR, CANNON 4 PIN 16-09S FEMALE MS3106F16S-09S	1
3	031-010-100-219	CONNECTOR ACCY, HOUSING PG 11 CONN 16	1
4	021-441-090-711	STRAIN RELIEF, PG 11, 5.5-9mm BLK+WHT	1
5	000-211-010-303	HARDWARE, SET SCREW, 3X3mm, CONNECTOR HOUSING	1
6	020-903-200-200	HARDWARE, O-RING CONNECTOR HOUSING (20X2mm) (INSIDE HOUSING)	1

<1> OUTER SHIELD CONNECTED IN STRAIN RELIEF.

<3> INNER SHIELD IS CUT OFF AND TAPED.

C.A.G.E. 79760

REV.	DESCRIPTION	DATE	NAME
1	ADDED NOTE&ITEMS 5,6	2/8/05	RLE

	DATE	NAME
DRWN. BY	6/15/04	RLE
APPROV.	6/8/04	MOO

PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

SCALE 1/2 | PAGE 1 OF 1

MATERIAL

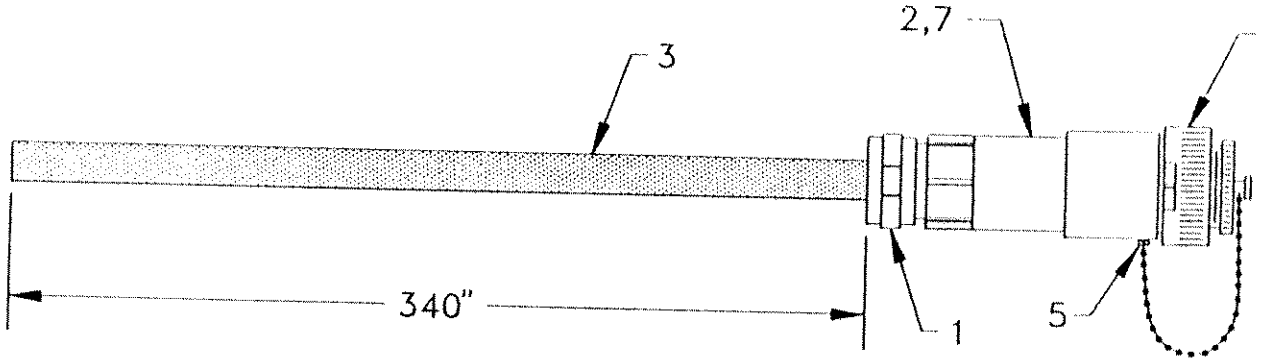
CABLE ASSEMBLY

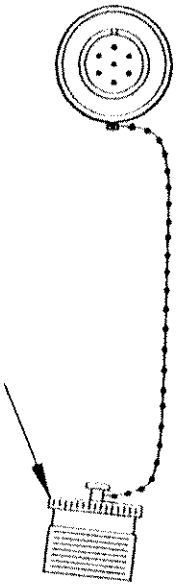
4 COND. D.S., 4 PIN FEMALE CANNON, 60", PPM
031-300-100-915

UFC00405

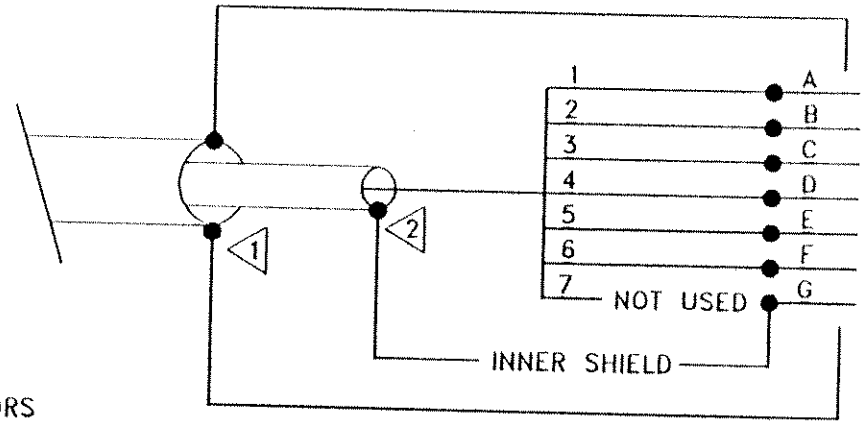
CUSTOMER: PPM P&H

REV	ERN	DESCRIPTION	DATE





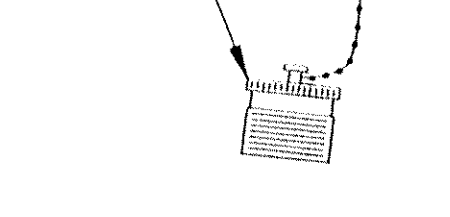
ELECTRICAL DIAGRAM



NOTE:

AFTER SOLDERING CONDUCTORS AND INSTALLING SHRINK TUBE, APPLY NON-CONDUCTIVE GREASE, FOR MOISTURE DISPLACEMENT.

ITEM	PART NUMBER	DESCRIPTION	QTY
1	021-441-131-011	STRAIN RELIEF, PG 11, 8mm, RED+WHITE INSERT	1
2	031-010-100-219	CONNECTOR ACCY, HOUSING PG 11 CONN 16	1
3	031-300-100-148	CABLE, 7 X 0.5 D.S. (PER FOOT)	29"
4	123-429-900-400	CONNECTOR ACCY, CAP & CHAIN, #16 CABLE END	1
5	031-300-100-447	SCREW, SLOTTED 3mm X 5mm, MACHINE	1
6	031-300-100-517	CONNECTOR, CANNON 7 PIN 16-01P PLUG MALE MS3106F16S-01P	1
7	020-903-200-200	HARDWARE, O-RING CONNECTOR HOUSING (20X2mm) (INSIDE HOUSING)	1



C.A.G.E. 79760

REV.	DESCRIPTION	DATE	NAME
1	ADDED NOTE & ITEM 7	2/8/85	RLE

	DATE	NAME
DRWN BY	6/14/84	RLE
APPROV.	MDO	8/8/84

SCALE 1/2 | PAGE 1 OF 1

MATERIAL

CABLE ASSEMBLY

7 COND. D.S., 7 PIN MALE CANNON PLUG, 340", PPM
031-300-100-797

PAT

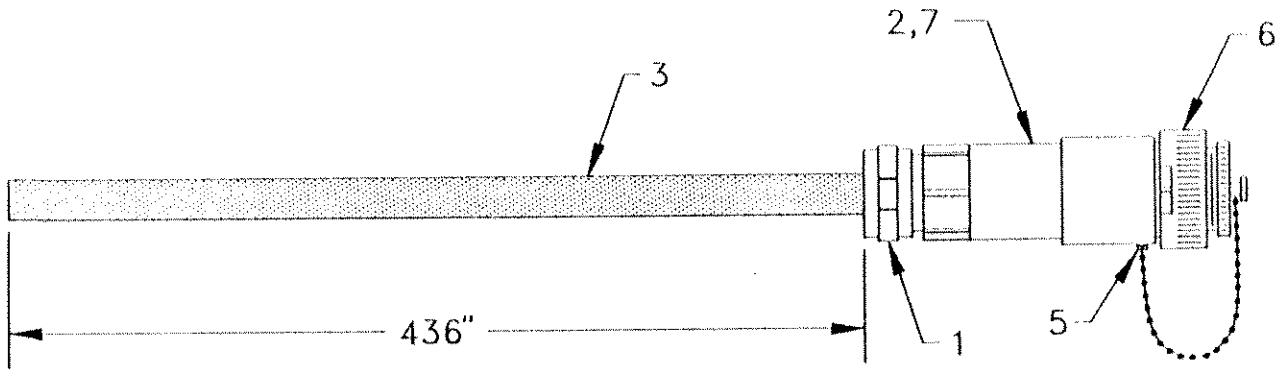
PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

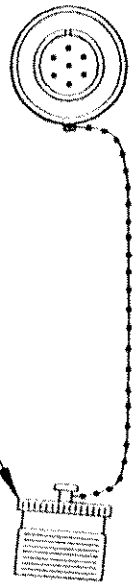
UFC00728

CUSTOMER

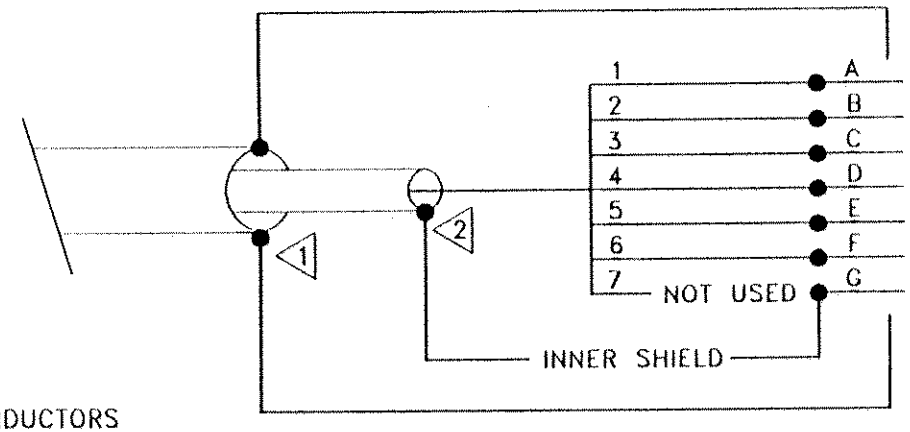
PPM P&H

REV	ERN	DESCRIPTION	DATE





ELECTRICAL DIAGRAM



NOTE:

AFTER SOLDERING CONDUCTORS AND INSTALLING SHRINK TUBE, APPLY NON-CONDUCTIVE GREASE, FOR MOISTURE DISPLACEMENT.

1. OUTER SHIELD CONNECTED IN STRAIN RELIEF.
2. INSULATED WIRE SOLDERED TO INNER SHIELD AND CONNECTED AS SHOWN.

ITEM	PART NUMBER	DESCRIPTION	QTY
1	021-441-131-011	STRAIN RELIEF, PG 11, 8mm, RED+WHITE INSERT	1
2	031-010-100-219	CONNECTOR ACCY, HOUSING PG 11 CONN 16	1
3	031-300-100-148	CABLE, 7 X 0.5 D.S. (PER FOOT)	37'
4	123-429-900-400	CONNECTOR ACCY, CAP & CHAIN, #16 CABLE END	1
5	031-300-100-447	SCREW, SLOTTED 3mm X 5mm, MACHINE	1
6	031-300-100-517	CONNECTOR, CANNON 7 PIN 16-01P PLUG MALE MS3106F16S-01P	1
7	020-903-200-200	HARDWARE, O-RING CONNECTOR HOUSING (20X2mm) (INSIDE HOUSING)	1

C.A.G.E. 79760

DRAFT

	DATE	NAME
DRAWN	12/20/94	RLE
APPROV		

REV. | DESCRIPTION | DATE | NAME

PAT

PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

SCALE 1/2 | PAGE 1 OF 1

MATERIAL

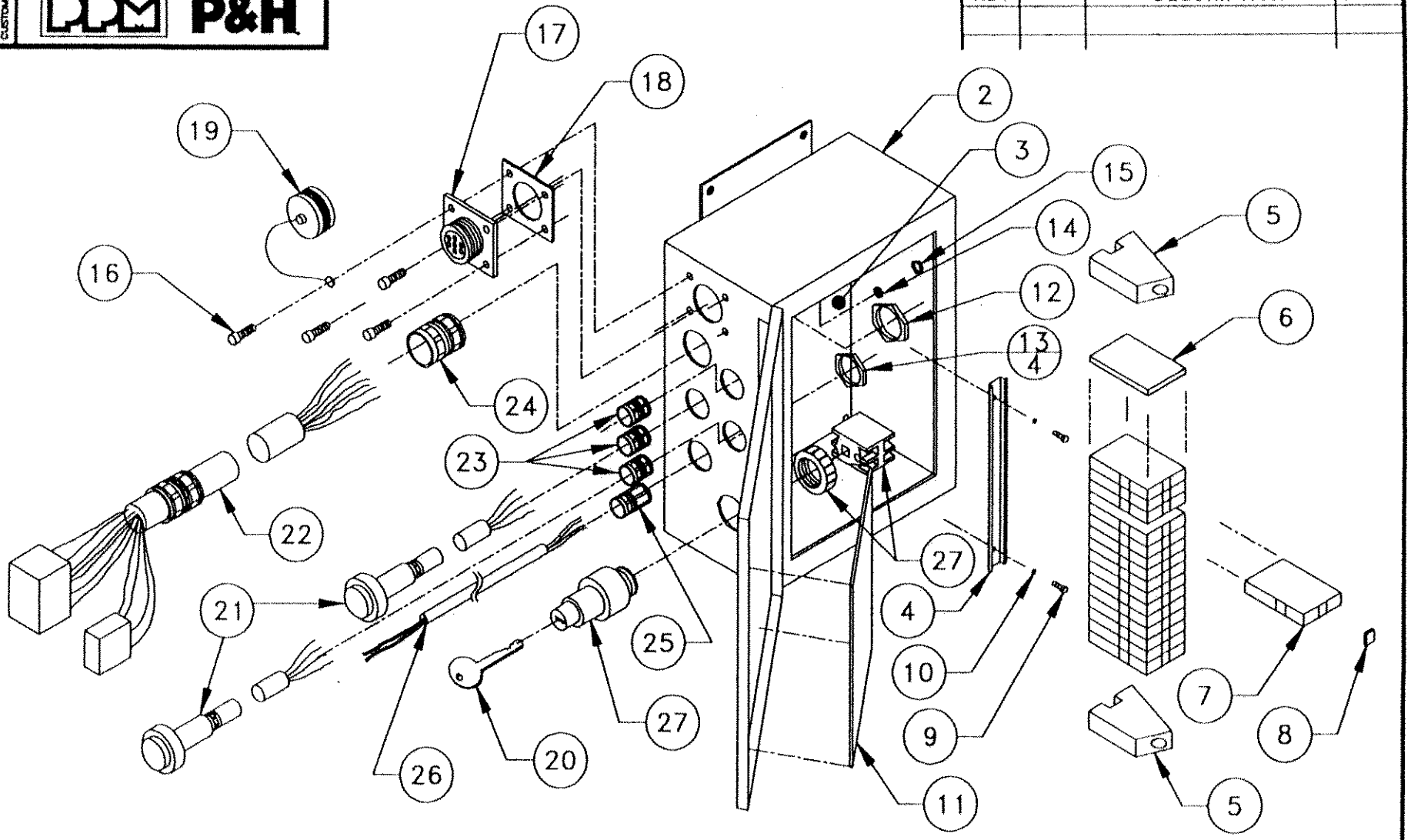
CABLE ASSEMBLY

7 COND. D.S., 7 PIN MALE CANNON PLUG, 436", PPM
031-300-100-927

UFC00737

CUSTOMER: PPM P&H

REV	ERN	DESCRIPTION	DATE



C.A.G.E. 79760

REV.	DESCRIPTION	DATE	NAME

	DATE	NAME
DRWN BY	8/17/94	BLE
APPROV		

PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

SCALE 1/4 (NTS) | PAGE 1 OF 2

MATERIAL

JUNCTION BOX ASS'Y

HOFFMAN 8X6X3.5 ENCLOSURE
PPM
031-300-100-792

UFA1JBOX

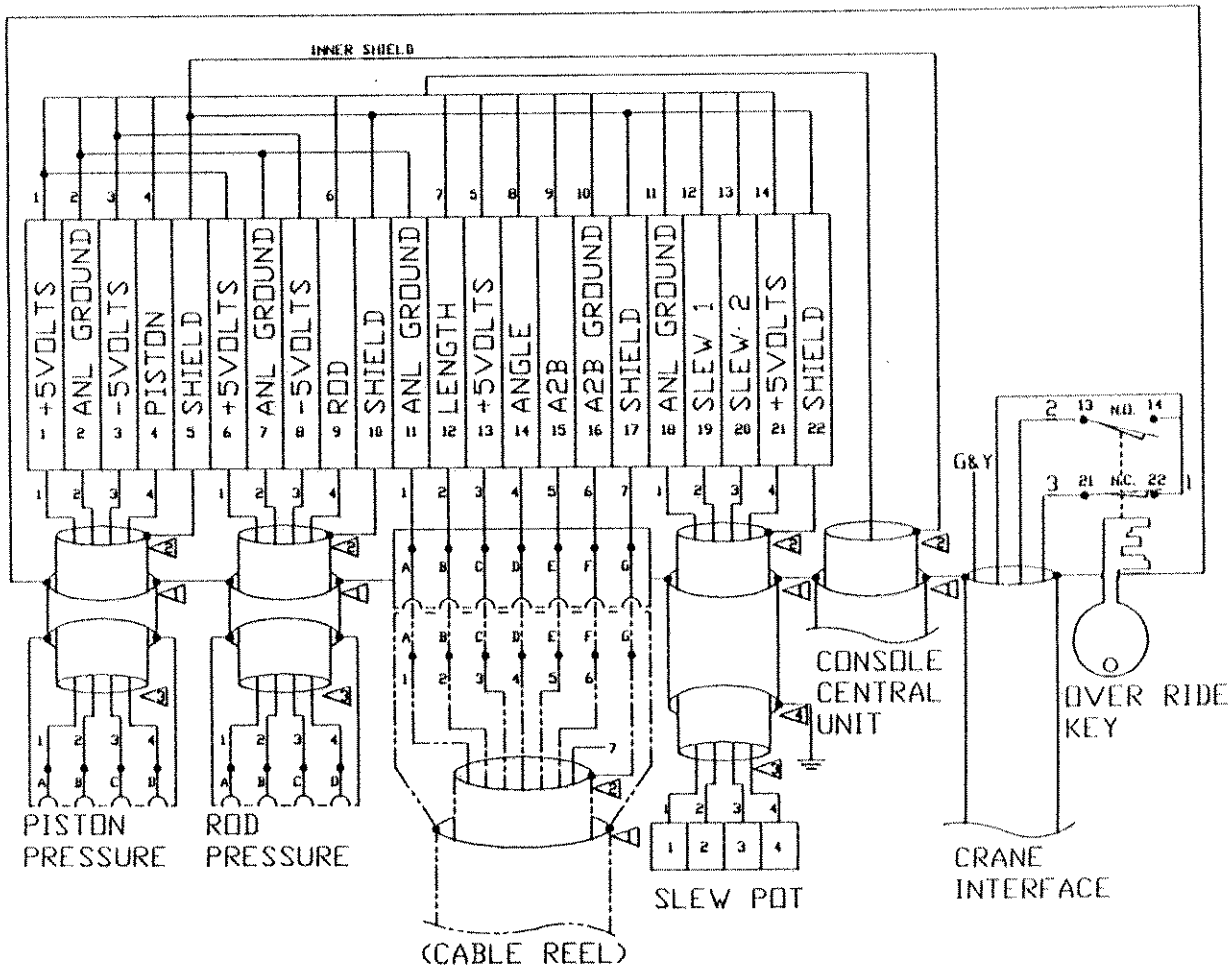
Engineering Bill Date : 06/22/94 08:48:55 F/N:UFB0JBOX

Number	:UFB0JBOX
Title	:B.O.M. FOR JUNCTION BOX
Model	:
Revision	:
ECO Number	:
Date of Last ECO	:
Basic List No	:
Similar To	:
Drawn By	:ROD EAVES
Checked By	:
Approved By	:RICK FISK (PAT)
Revised By	:
Tree Number	:

ITEM	PART NUMBER	DESCRIPTION	MAT'L	WGT	QTY
1	031-300-100-800	WIRING DIAGRAM, J.B. ASS'Y.			-
2	031-300-100-787	JUNCTION BOX ASS'Y., U.F.			1
3	031-300-100-788	ASS'Y., PANEL, 6 3/4 X 4 7/8			1
4	031-300-100-786	ASS'Y., TERMINAL RAIL 6 1/8			.510
5	031-300-100-688	TERM. STRIP ACCY., END BLOCK			2
6	031-300-100-687	TERM. STRIP ACCY., END PLATE			1
7	031-300-100-686	TERM. STRIP ACCY., BLOCK, AK			22
8	031-300-100-799	MARKING TAPE 1-50 (HORIZ.)			1
9	123-429-909-730	SCREW, #8-32 X 1/2", PHILLIPS			2
10	031-300-100-801	WASHER, LOCK, #8			2
11	031-300-100-798	DECAL, WIRING DIAGRAM, UF, JB			1
12	000-214-210-016	NUT, PG 16			1
13	000-214-210-011	NUT, PG 11			4
14	031-300-100-175	WASHER, LOCK, #4			4
15	031-300-100-176	NUT, #4-40 HEX			4
16	123-429-910-630	SCREW, #4-40 X 3/4", PHILLIPS			4
17	031-300-100-796	CONNECTOR ASS'Y.,7 PIN FEMALE			1
18	031-300-100-173	CONNECTOR ACCY., GASKET #16			1
19	031-300-100-024	CONNECTOR ACCY., COVER, DUST			1
20	050-000-060-001	KEY, SET, A2B & C.U. KEYSET			1
21	031-300-100-915	CABLE ASS'Y., PRESS. TRANS. 5'			2
22	031-300-100-794	CABLE ASS'Y., 14 COND., 24 PIN			1
23	021-441-110-811	STRAIN RELIEF, PG 11, 6mm			3
24	021-441-161-216	STRAIN RELIEF, PG 16, 12-15mm			1
25	021-441-131-011	STRAIN RELIEF, PG 11			1
26	031-300-100-146	CABLE, 4 X 1.5 S.S.(PER FOOT)			19'
27	003-051-910-002	SWITCH ASS'Y. W/KEY & CONTACT			1

CUSTOMER: P&H

REV	ERN	DESCRIPTION	DATE



△1 OUTER SHIELD CONNECTED IN STRAIN RELIEF

△2 INSULATED WIRE SOLDERED TO INNER SHIELD AND CONNECTED AS SHOWN

△3 INNER SHIELD IS CUT OFF AND TAPED

△4 OUTER SHIELD TO CRANE FRAME

C.A.G.E. 79760

DRAFT

REV.	DESCRIPTION	DATE	NAME

	DATE	NAME
DRAWN	6/20/84	RICK FISK
APPROV.		

PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

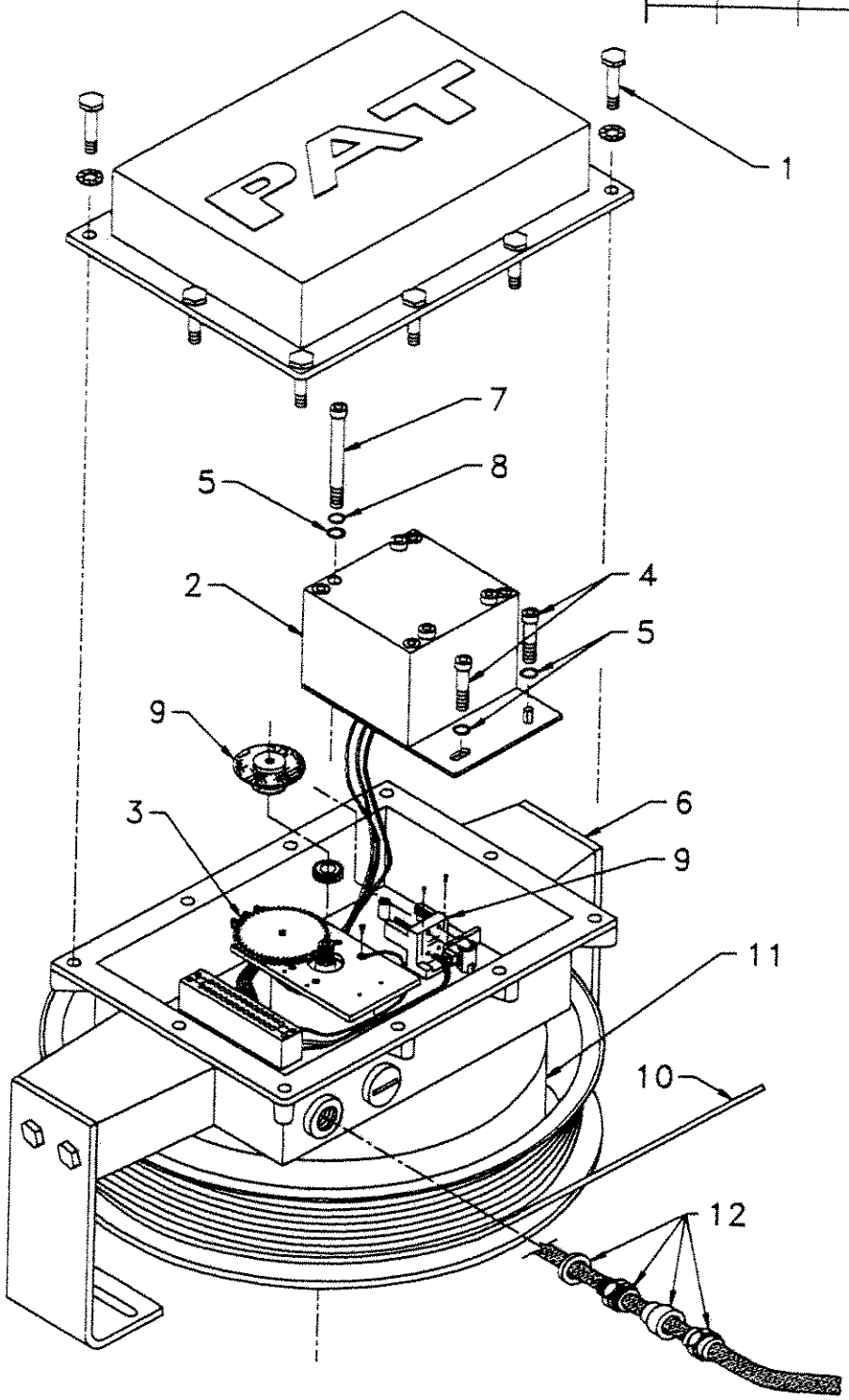
SCALE 1/1.25 | PAGE 1 OF 1

MATERIAL

DOCUMENT
ELECTRICAL DIAGRAM
JUNCTION BOX ASS'Y, PPM
031-300-100-800

UFE0JB04

REV	ERN	DESCRIPTION	DATE



C.A.G.E. 79760						SCALE 1/6	PAGE 1 OF 2
						MATERIAL	
					DATE	NAME	
				ORIG. BY	6/27/94	RLE	CABLE REEL ASS'Y
				APPROV.			2-CONDUCTOR
REV.	DESCRIPTION	DATE	NAME				LWG 208
							068-208-060-013

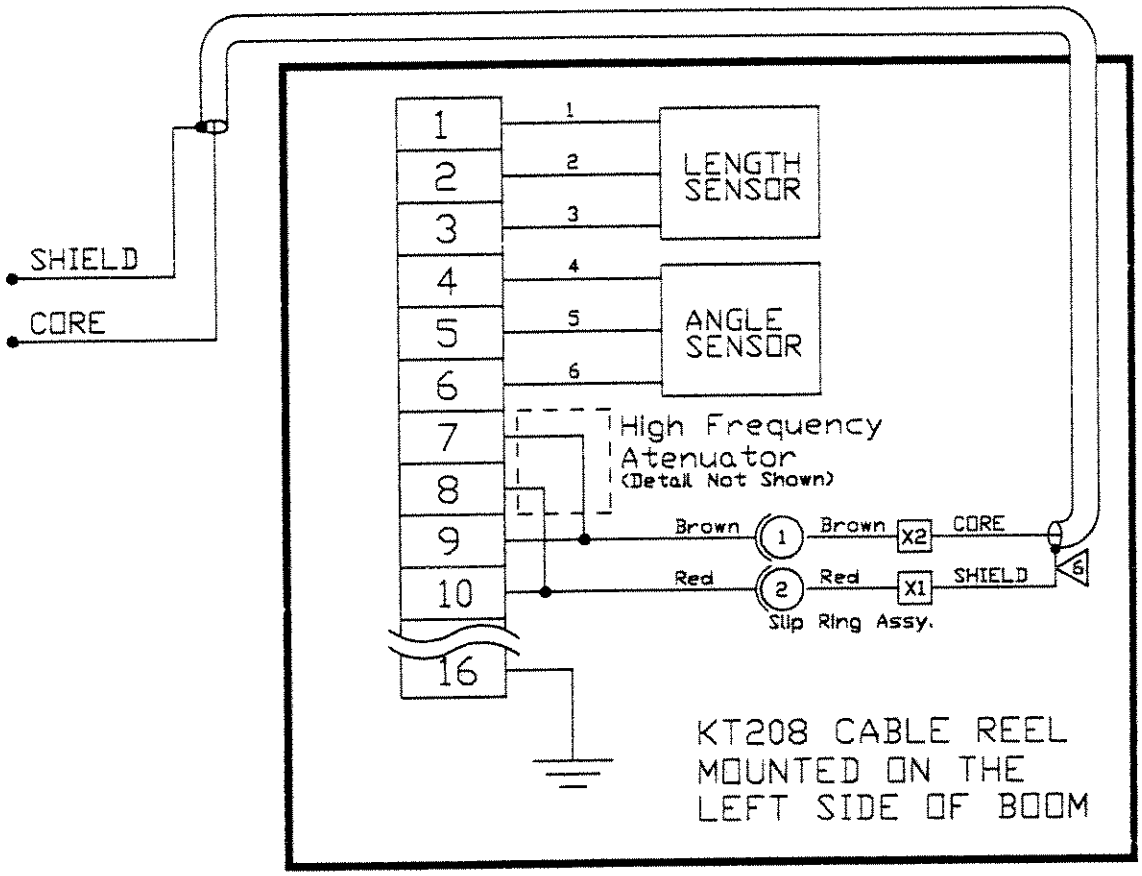
CUSTOMER: PPM P&H

PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

RMC1K208

REV	ERN	DESCRIPTION	DATE

ITEM	PART NUMBER	DESCRIPTION	QTY
1	068-000-110-031	CABLE REEL ACCY. SCREW/CAPTIVE	10
2	064-103-060-002	SENSOR, ANGLE WG 103	1
3	006-710-008-002	SENSOR, LENGTH TRANSDUCER LGE 100	1
4	002-050-208-012	SCREW, M6 X 12 HEX SOCKET CAP (FOR ANGLE SENSOR)	2
5	000-207-010-084	WASHER, FLAT 6mm	3
6	006-820-006-002	CABLE REEL, KT 200, STANDARD	1
7	031-300-100-358	SCREW, 6mm X 1 X 110	1
8	000-208-040-084	WASHER, LOCK, 8mm	1
9	068-000-110-013	SLIP-RING, 2 CONDUCTOR	1
10	000-673-020-002	CABLE, LENGTH SENSOR, 1 CORE WITH SCREEN (PER FOOT)	139'
11	068-000-110-010	SPRING PACK W/HOUSING, KT 200	1
12	021-441-161-213	STRAIN RELIEF, PG 13.5, 12-15mm GRAY+WHITE INSERT	1



ELECTRICAL DIAGRAM

6 OUTER SHIELD INSULATED AND CONNECTED AS SHOWN.

C.A.G.E. 79760

SCALE 1/1 (NTS) | PAGE 2 OF 2

MATERIAL

REV.	DESCRIPTION	DATE	NAME
		5/27/94	RLE

CABLE REEL
2-CONDUCTOR
LWG 208
068-208-060-013

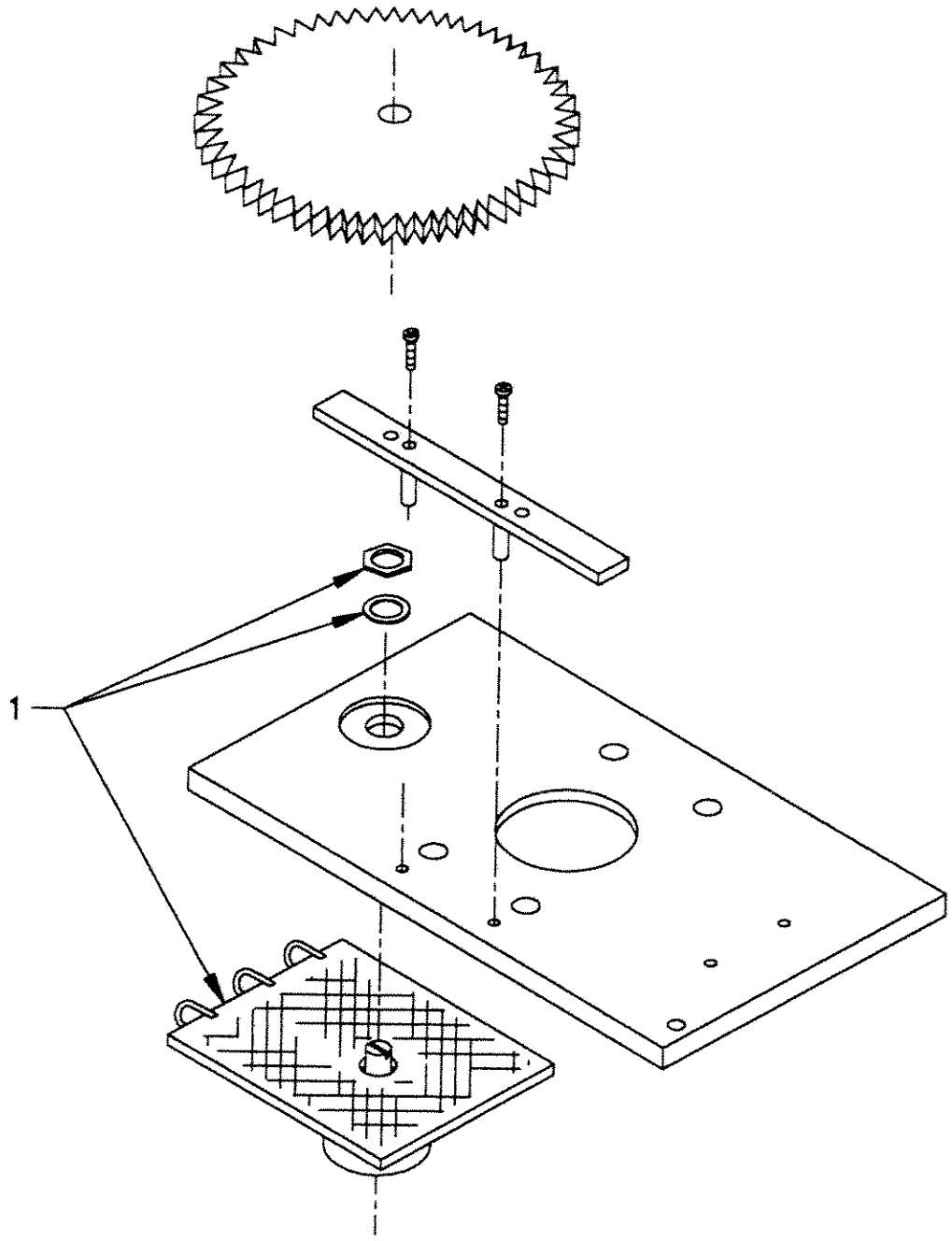
CUSTOMER: P&H

PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

RMC2K208

ITEM	PART NUMBER	DESCRIPTION	QTY
1	068-000-110-037	SENSOR, LENGTH POT. (PRINTED CIRCUIT BOARD+POTENTIOMETER)	1

REV	ERN	DESCRIPTION	DATE



C.A.G.E. 79760

SCALE 1/1.5 PAGE 1 OF 1

MATERIAL

REV.	DESCRIPTION	DATE	NAME
		DRWN BY 7/12/94	BLE
		APPROVAL	

CUSTOMER: PDM P&H

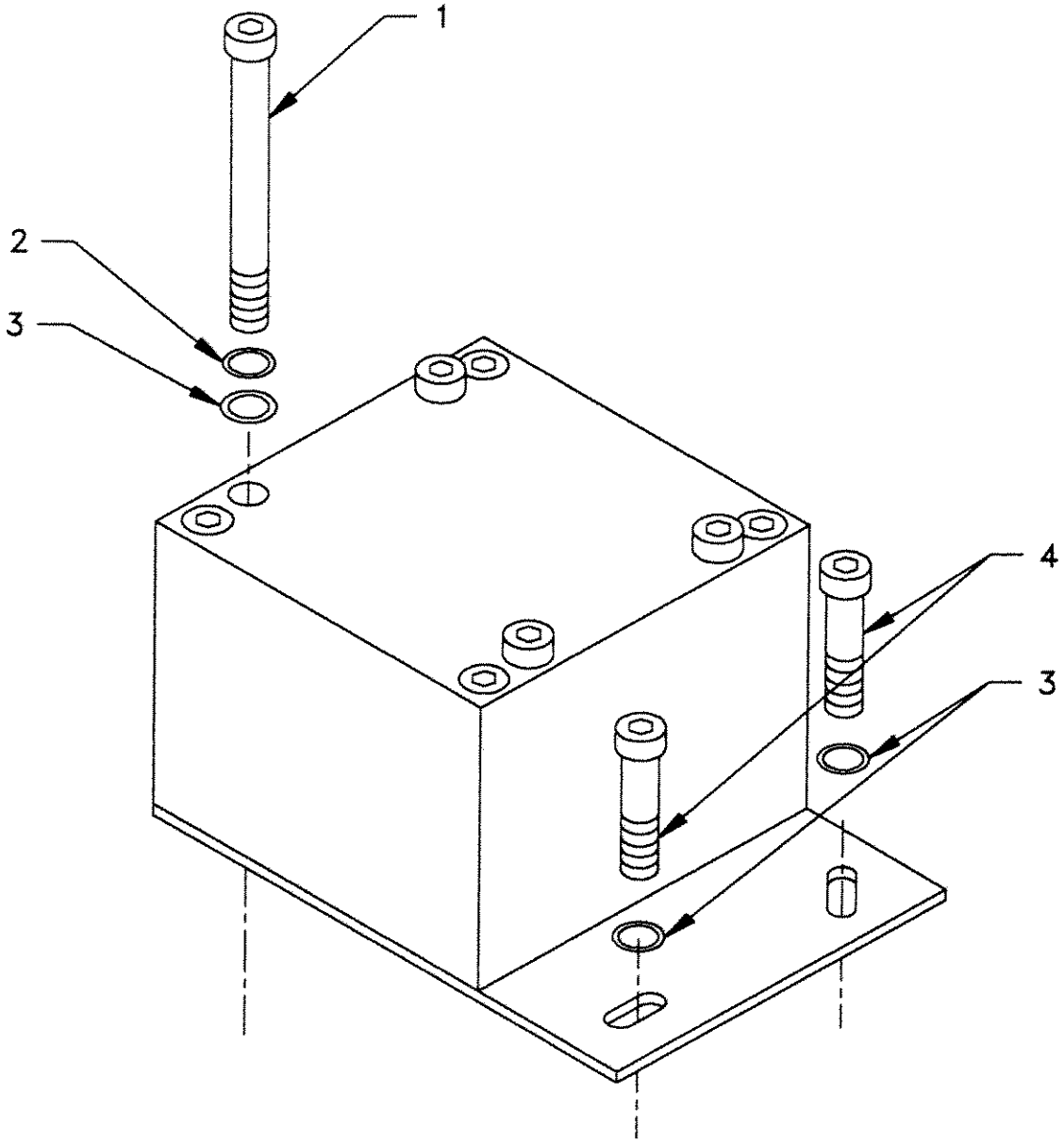
PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

SENSOR
LENGTH TRANSDUCER
LGE 100
006-710-006-002

BMC02010

REV	ERN	DESCRIPTION	DATE

ITEM	PART NUMBER	DESCRIPTION	QTY
1	031-300-100-358	SCREW, 6mm X 1 X 110	1
2	000-208-040-084	WASHER, LOCK, 8mm	1
3	000-207-010-064	WASHER, FLAT, 8mm	3
4	002-050-208-012	SCREW, M8 X 12 HEX SOCKET CAP (FOR ANGLE SENSOR)	2



C.A.G.E. 79760

SCALE 1/2 | PAGE 1 OF 1

MATERIAL

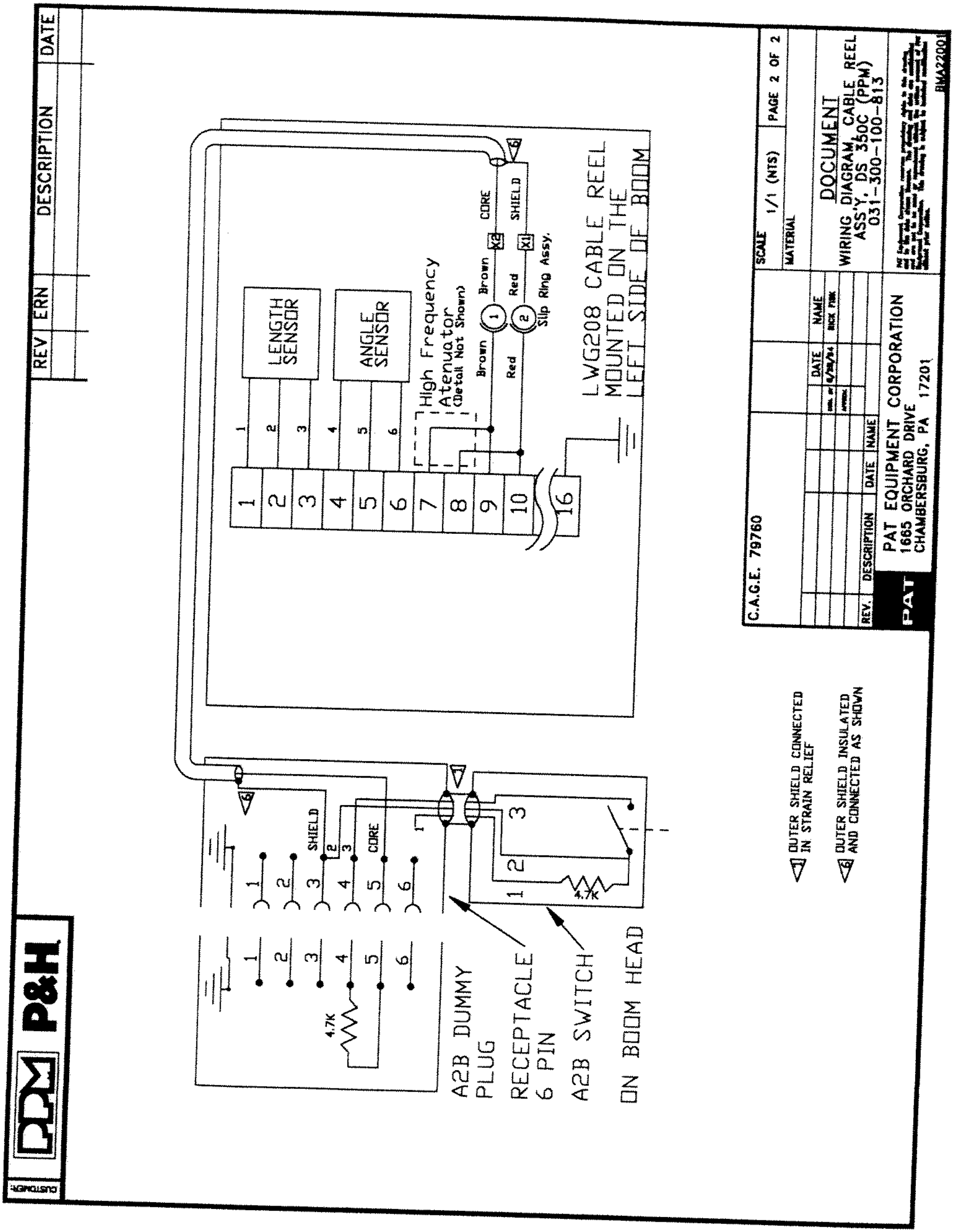
REV.	DESCRIPTION	DATE	NAME
		DRAWN	DATE 7/13/94 NAME RLE
		APPROVAL	

SENSOR
ANGLE
WG 203
006-420-306-001

CUSTOMER: PDM P&H

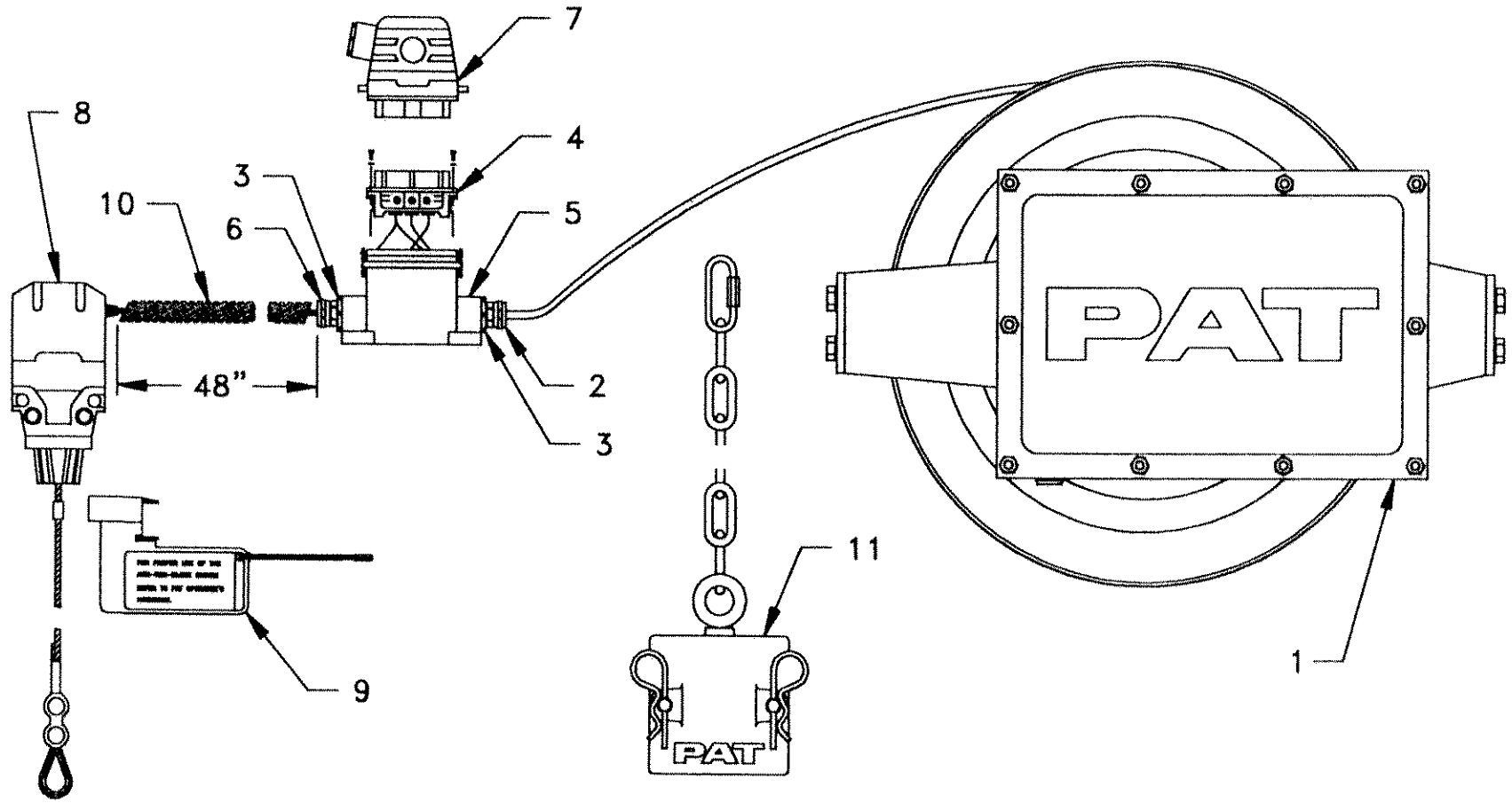
PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

BMC02011


REV
ERN
DESCRIPTION
DATE
CUSTOMER:
P&H
LENGTH SENSOR
ANGLE SENSOR
High Frequency Atenuator (Detail Not Shown)
Brown
Red
Slip Ring Assy.
CORE
SHIELD
X2
X1
LWG208 CABLE REEL MOUNTED ON THE LEFT SIDE OF BOOM
4.7K
A2B DUMMY PLUG
RECEPTACLE 6 PIN
A2B SWITCH
ON BOOM HEAD
OUTER SHIELD CONNECTED IN STRAIN RELIEF
OUTER SHIELD INSULATED AND CONNECTED AS SHOWN
C.A.G.E. 79760
SCALE 1/1 (NTS)
PAGE 2 OF 2
MATERIAL
DOCUMENT
WIRING DIAGRAM, CABLE REEL ASS'Y, DS 350C (PPM)
031-300-100-813
PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 172201
PAT
REV.
DESCRIPTION
DATE
NAME
BMA22001

CUSTOMER: PPM P&H

REV	ERN	DESCRIPTION	DATE



ITEM	PART NUMBER	DESCRIPTION	QTY
1	068-208-060-013	CABLE REEL LWG208 - 2 CONDUCTOR	1
2	021-441-090-909	STRAIN RELIEF, PG 9, WHITE GROM	1
3	000-214-261-609	REDUCER, PG 16 TO PG 9	2
4	000-301-025-062	INSERT, 6 PIN FEMALE	1
5	000-301-022-296	RECEPTACLE, 6 PIN	1
6	021-441-060-409	STRAIN RELIEF, PG 9, YELLOW INSERT	1
7	031-300-100-812	PLUG, A2B, DUMMY PLUG, 6 PIN, W/4.7K	1
8	031-002-060-011	SWITCH, A2B WITH CRIMP	1
9	031-300-100-722	SWITCH ACCY., A2B FLAG ASS'Y.	1
10	031-300-100-110	ELECTRICAL, CONDUIT, 1/4", BLACK, FLEX (PER FOOT)	4'
11	003-100-210-012	WEIGHT & CHAIN, A2B WITH SHACKLE	1

C.A.G.E. 79760

REV.	DESCRIPTION	DATE	NAME
		DRN. BY 6/27/14	BLE
		APPROV.	

PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

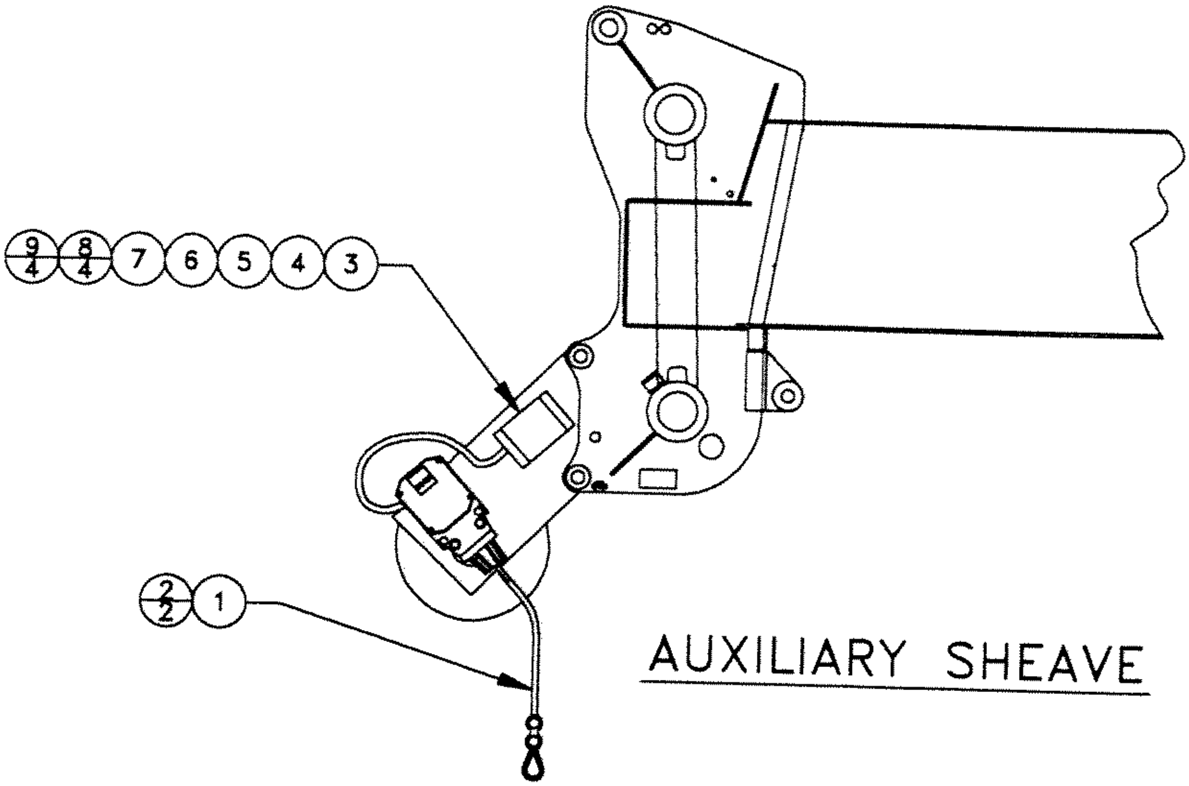
SCALE 1/5 | PAGE 1 OF 2

MATERIAL

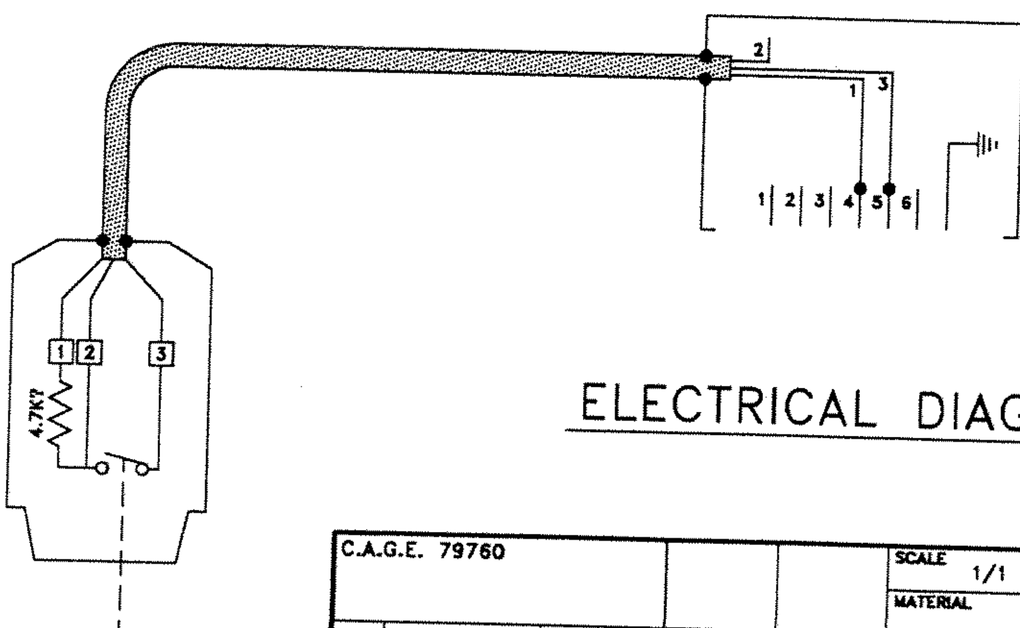
# CABLE REEL ASS'Y
LWG 208, 2-CONDUCTOR
W/WEIGHT & CHAIN, PPM
031-300-100-814

BMA12001

REV	ERN	DESCRIPTION	DATE



AUXILIARY SHEAVE



ELECTRICAL DIAGRAM

C.A.G.E. 79760

REV.	DESCRIPTION	DATE	NAME		DATE	NAME
					6/18/94	

SCALE 1/1 (NTS)

PAGE 1 OF 2

MATERIAL

A2B INSTALLATION
FOR BOOM EXTENSION
OPTION KIT

CUSTOMER: PPM P&H

PAT

PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

JII14005

Engineering Bill Date : 08/18/94 17:00:00 F/N:JII24005

Number	:JII24005
Title	:B.O.M. FOR AUXILIARY SHEAVE
Model	:VARIOUS
Revision	:
ECO Number	:
Date of Last ECO	:
Basic List No	:
Similar To	:
Drawn By	:ROD EAVES
Checked By	:
Approved By	:RICK FISK (PAT)
Revised By	:
Tree Number	:

ITEM	PART NUMBER	DESCRIPTION	MAT'L	WGT	QTY
1	031-002-060-011	A2B SWITCH, 5' CABLE			1
2	0830V032	5/16-18 X 1 1/2 S.H.C.S.			2
3	3287Z30	RECEPTACLE, 6 PIN			1
4	3287Z32	6 POSITION, PIN INSERT			1
5	3287Z24	REDUCER, PG 16-9			1
6	3287Z26	STRAIN RELIEF, PG 9, 4-6mm-YELLOW			1
7	3287Z29	HOLE PLUG, PG 16			1
8	0862V094	10-24 X 3/8 R.H.M.S.			4
9	3643V007	#10 LOCK WASHER			4

16 Troubleshooting

General information

In case of a system malfunction, a code to identify the error source will be shown on the display.

The code numbers listed in the malfunctions table identify various malfunctions that might occur in the LMI system. In the malfunctions table each error will be explained and the steps to be taken for their correction will be described.

Malfunctions within the microprocessor have to be repaired by factory-trained specialist only. Please inform the competent service organisation in case of errors of this kind.

Operating faults

Malfunctions of the LMI-system caused by exceeding preset areas or operating faults of the crane operator are indicated and explained on the LCD display. These code numbers could be E01, E02, E03, E04, E05 and E6. Normally, the operator can repair these faults by himself.

Malfunctions table

Error code	Error	Cause	Elimination
E01: MIN. RADIUS	Fallen below the radius range or angle range exceeded.	Fallen below the minimum radius or exceeding 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 preset in the load chart.
E02: MAX. RADIUS	Maximum radius exceeded or fallen below the angle range.	The maximum radius was exceeded 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 an angle preset in the load chart.
E04: ERROR OPERAT. MODE	Incorrect setting of operating mode	a) The selected operating mode is locked. b) The selected operating mode is not included in the TLK-EPROM	a) Set the operating mode in accordance with the assignment to the operating condition. b) Check the programmation in the TLK-EPROM

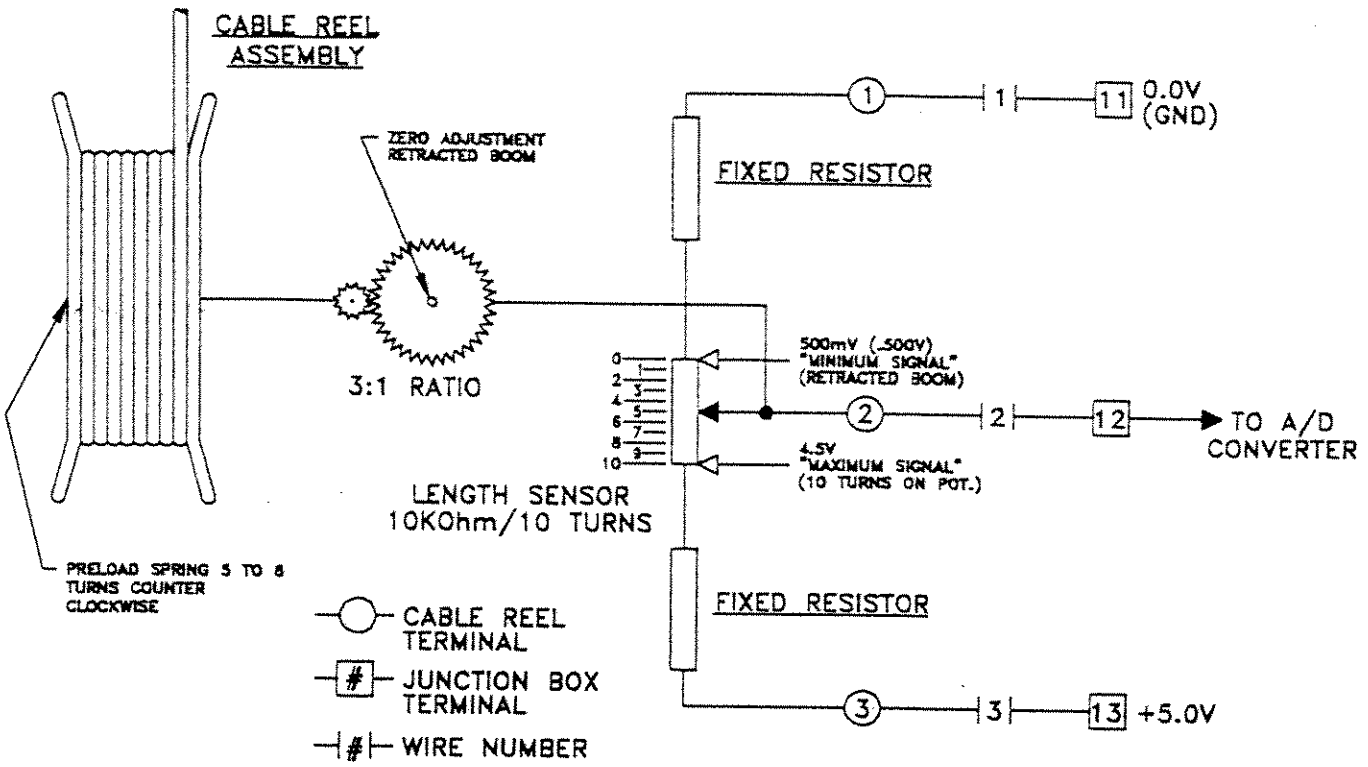
E05: PROHIBITED LENGTH	Prohibited length range	a.) Boom has been extended too far or not enough, e.g. if operation is only admitted up to a certain boom length or for load charts of jibs with the boom having to be extended to a certain length.	a.) Retract or extend boom to the correct length.
		b.) The length sensor adjustment was modified, e.g. rope slid off the length sensor reel.	b.) Retract the boom. Check the prestress of the cable reel (the rope has to be under traction). Open the length sensor and carefully turn the length pot counterclockwise to the detent by use of a screwdriver.
		c.) Clutch between length sensor pot and drive is defective	c.) Completely replace the clutch with the drive wheel and adjust length sensor pot as described at b.)
		d.) Failure of the -5V-supply for the analog part of the LMI-main board.	d.) Check -5V-voltage. If there is no voltage or break down at a charge of 50 ohm approximately, exchange main board.
		e.) Cable between the central unit and the length sensor defective or slack.	e.) Check cable as well as connector and exchange, if necessary.
		f.) Length potentiometer defective.	f.) Replace length potentiometer.
E07: ERROR OVERLOAD RELAY	No acknowledgement from the overload relay.	Overload relay is caught, defective or is not being driven.	Replace relay. If this replacement is not satisfactory, the connection board has to be replaced, too.
E08: ERROR A2B RELAY	No acknowledgement of the anti two-block switch relay.	A2B-relay is caught, defective or is not being driven.	Replace relay. If this replacement is not satisfactory, the connection board has to be replaced, too.
E11: ERROR MB LENGTH MIN.	Fallen below limit for the measuring channel "Length telescopic boom".	a.) Cable between length sensor and central unit defective, not connected or water in the connectors.	a.) Check cable and connector as well and replace, if necessary.
		b.) Length sensor pot defective.	b.) Replace length sensor potentiometer.
		c.) Electronic board in the measuring channel defective.	c.) Replace main board or analog board.

E12: ERROR PR. PISTON MIN	Fallen below lower limit value for the measuring channel "pressure transducer piston side"	a.) Cable leading from the central unit to the pressure transducers defective or water in the connectors. b.) Pressure transducer defective. c.) Electronic board in the measuring channel defective.	a.) Check cable and connector as well and replace, if necessary. b.) Replace pressure transducer. c.) Replace CPU or analog board.
E13: ERROR PR. ROD MIN.	Fallen below lower limit value for the measuring channel "pressure transducer rod side".	a.) Cable leading from the central unit to the pressure transducers defective or water in the connector. b.) Pressure transducer defective. c.) Electronic board in the measuring channel defective.	a.) Check cable and connectors as well and replace, if necessary. b.) Replace pressure transducer. c.) Replace CPU or analog board.
E15: ERROR MIN. ANGLE	Fallen below lower limit value for the measuring channel "angle main boom".	a.) Cable leading from the central unit to the length/angle sensor defective, loose or water in the connectors. b.) Angle sensor defective. c.) Electronic board in the measuring channel defective.	a.) Check cable as well as connectors and replace, if necessary. b.) Replace angle sensor. c.) Replace CPU or analog board.
E19: ERROR REF. VOLT. MIN.	Reference voltage defective.	a.) The total of the supply and the reference voltages is less than 2.7V. b.) A/D converter defective.	a.) Check supply voltages. b.) Replace analog board.
E1A: ERR. MIN. SLEW. ANG. A	Fallen below lower limit value for the measuring channel "slewing angle A"	a) Cable leading from the central unit to the slewing angle sensor defective, loose or water in the connectors. b) Slewing angle sensor defective. c.) Electronic board in the measuring channel defective.	a.) Check cable and connector as well and replace, if necessary. b) Replace slewing angle sensor c.) Replace CPU or analog board.
E1B: ERR. MIN. SLEW. ANG. B	Fallen below lower limit value for the measuring channel "slewing angle B"	cf. Error 1A	cf. Error 1A
E20: NO REF. VOLTAGE	No analog voltages	a.) The input voltages are too small. b.) The voltage converter is defective.	a.) Check crane voltage. b.) Replace power supply board.

E21: ERROR MB LENGTH MAX.	Upper limit value for measuring channel "length telescopic boom" exceeded.	a.) Cable leading from the central unit to the length/angle sensor defective, not connected or water in the connectors.	a.) Check cable and connectors as well and replace, if necessary.
		b.) Length sensor pot defective.	b.) Replace length sensor pot.
		c.) Electronic board in the measuring channel defective.	c.) Replace CPU or analog board.
E22: ERROR PRES. PISTON MAX.	Upper limit value for the measuring channel "pressure transducer piston side" exceeded.	a.) Cable leading from the central unit to the pressure transducers defective, not connected or water in the connectors.	a.) Check cable as well as connectors and replace, if necessary.
		b.) Pressure transducer defective.	b.) Replace pressure transducer.
		c.) Electronic board in the measuring channel defective.	c.) Replace CPU or analog board.
E23: ERROR PRES. ROD MAX.	Upper limit value for the measuring channel "pressure transducer rod side" exceeded.	a.) Cable leading from the central unit to the pressure transducers defective, not connected or water in the connectors.	a.) Check cable and connectors as well and replace, if necessary.
		b.) Pressure transducer defective	b.) Replace pressure transducer
		c.) Electronic board in the measuring channel defective.	c.) Replace CPU or analog board.
E25: ERROR MAX. ANGLE	Upper limit value for the measuring channel "angle main boom" exceeded.	a.) Cable leading from the central unit to the length-angle sensor defective, loose or water in the connectors.	a.) Check cable and connectors as well and replace, if necessary.
		b.) Angle sensor defective	b.) Replace angle sensor.
		c.) Electronic board in the measuring channel defective.	c.) Replace CPU or analog board.
E29: ERROR REF. VOLT. MAX.	Reference voltage defective.	a.) The total of the supply and the reference voltages is more than 3.3V	a.) Check supply voltages.
		b.) A/D converter defective.	b.) Replace analog board.
E2A: ERR. MAX. SLEW. ANG. A	Upper limit value for the measuring channel "slewing angle A" exceeded.	a) Cable leading from the central unit to the slewing angle sensor defective, loose or water in the connectors.	a.) Check cable and connector as well and replace, if necessary.
		b) Slewing angle sensor defective.	b) Replace slewing angle sensor
		c.) Electronic board in the measuring channel defective.	c.) Replace CPU or analog board.

E2B: ERR. MAX. SLEW. ANG. B	Upper limit value for the measuring channel "slewing angle B" exceeded.	cf. Error 2A	cf. Error 2A
E31: ERROR SYSTEM EPROM	Error in the system program.		Replace system program PROM
E38: WRONG SYST.-PROM DAT	Wrong system program in the LMI.	The system program in the LMI does not correspond to the programmings in the data EPROM 1.	Replace EPROM 1 of the system program.
E39: WRONG SYST.-PROM TLK	Wrong system program in the LMI.	The system program in the LMI does not correspond to the programming of the data EPROM 2.	Replace EPROM 2 of the system program.
E41: ERROR INTERNAL RAM	Error in the internal RAM.		- Replace RAM - Replace CPU-board.
E42: ERROR EXTERNAL RAM 1	Error in the first part of the external RAM.		- Replace CMOS-RAM - Replace CPU-board.
E43: ERROR EXTERNAL RAM 2	Error in the second part of the external RAM.		- Replace CMOS-RAM - Replace CPU-board.
E45: ERROR RED. A/D CONVERTER	Redundancy error in the A/D conversion.	The A/D converter of the processor board and the redundant A/D converter in the CPU provide divergent results.	Replace CPU board.
E46: ERROR EXT. A/D CONVERTER	Error in the A/D converter uPD 7004	The A/D converter uPD 7004 of the CPU board does not provide an EOC signal	Replace CPU board.
E51: ERROR DATA EPROM	Errors in the crane data EPROM or in the EEPROM.	No valid data in the crane data EEPROM. Memory module incorrectly by-passed. Defective crane data PROM.	Load crane data EEPROM with valid data. Bridge memory module for the respective memory type. Re-place crane data EEPROM.
E52: ERR. LOAD CH. EPROM	Error in the load chart PROM.	Load chart PROM defective.	Restart LMI. Replace crane data PROM.
E56: ERROR EEPROM	Error in the crane data EEPROM.	Crane data EEPROM defective. Memory module incorrectly by-passed.	By-pass memory module according to memory type. Replace crane data EEPROM.
E57: ERROR SER. D.-EEPROM	Error in the serial crane data EEPROM.	No valid data on the serial crane data EEPROM. Memory module defective.	Write data on to the serial crane data EEPROM by means of the test program, then, restart the LMI. Load serial crane data EEPROM with valid data. Replace memory module.
E58: ERROR SER. AN.-EEPROM	Error in serial analog board EEPROM	No valid data in the serial analog board EEPROM. Analog board defective.	Write data onto the serial analog board EEPROM by means of the test program, then restart the LMI. Replace analog board.

E71: ERROR RELAY K1	Incorrect acknowledgement of the 1. relay on the analog board.	1. relay or main board or connection board defective.	Replace 1. relay, main board or connection board.
E72: ERROR RELAY K2	Incorrect acknowledgement of the 2. relay on the analog board.	2. relay or main board or connection board defective.	Replace 2. relay, main board or connection board.
E73: ERROR RELAY K3	Incorrect acknowledgement of the 3. relay on the analog board.	3. relay or main board or connection board defective.	Replace 3. relay, main board or connection board.
E74: ERROR RELAY K4	Incorrect acknowledgement of the 4. relay on the analog board.	4. relay or main board or connection board defective.	Replace 4. relay, main board or connection board.
E80: ERROR SLEWING ANG:	The measuring channels "slewing angle A" and "slewing angle B have no distance of 90 deg.	a) Cable leading from the central unit to the slewing angle sensor defective, loose or water in the connectors. b) Slewing angle sensor defective. c.) Electronic board in the measuring channel defective.	a.) Check cable and connector as well and replace, if necessary. b) Replace slewing angle sensor c.) Replace CPU or analog board.
E81: ERROR CANT	Maximally admitted cant of the crane was exceeded.	Maximally admitted cant of the crane exceeded because of outriggers not having been correctly placed.	Check outriggers and modify their position, if necessary
E82: ERROR OUTRIGGER.	Error at outriggers	At least one of the four outriggers is not completely extended or not fully set onto the ground.	Completely extend the outriggers and/or correctly set the cylinders onto the ground.
E83: ERROR TELECOMBINATION	Error when telescoping	Combination of the boom elements does not correspond to the prescriptions.	Correct the combination of the boom elements.
E84: ERROR OPERAT. MODE	Error in operating mode	The selected operating mode is not includet in the DATA-(E)EPROM.	Check the programmation in the DATA-(E)EPROM.
E86: ERROR TELE PERCENT	Prohibited length range	cf. Error 05	cf. Error 05



P.A.T. DS 350C LMI
MAIN BOOM LENGTH SIGNAL VOLTAGE

No. of Turns on Cable Reel	No. of Turns on Length Poteniometer	"INPUT" Signal at Terminal #12 in Junction Box
0	0	0.50V
3	1	0.90V
6	2	1.30V
9	3	1.70V
12	4	2.10V
15	5	2.50V
18	6	2.90V
21	7	3.30V
24	8	3.70V
27	9	4.10V
30	10	4.50V

C.A.G.E. 79760

SCALE 1/1 PAGE 1 OF 1

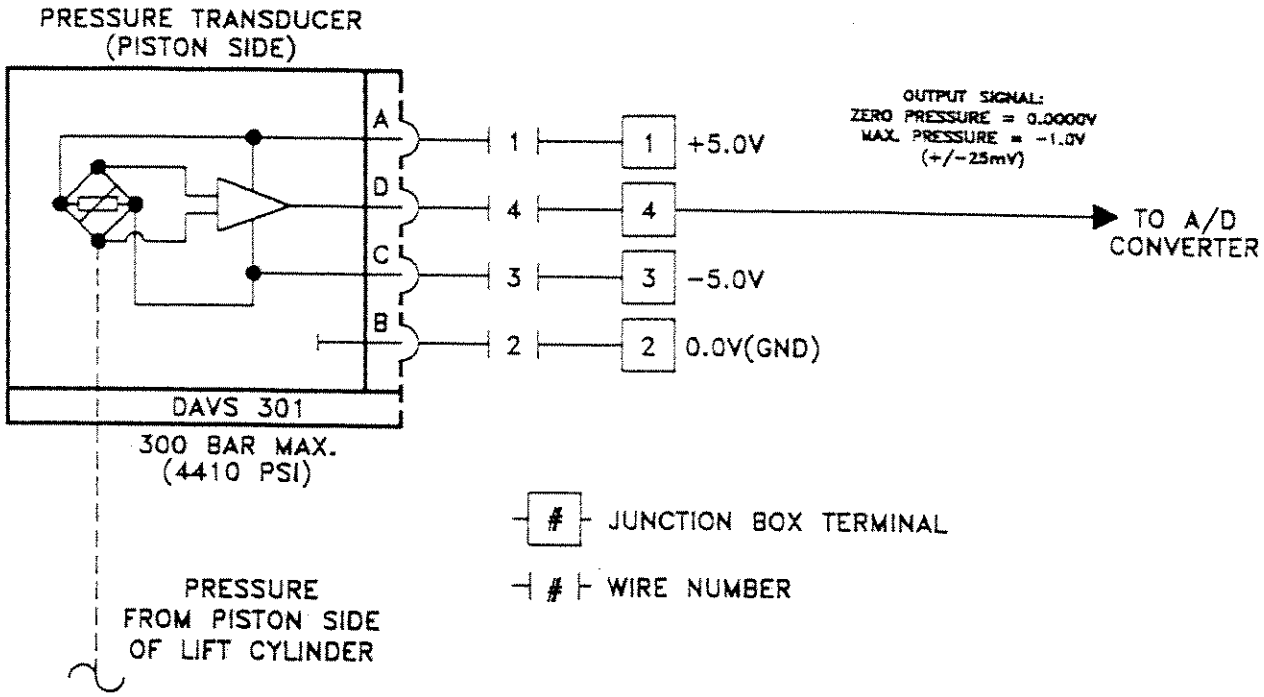
MATERIAL

REV.	DESCRIPTION	DATE	NAME
		DATE	NAME
		4/7/96	RLE

PAT DS 350C LMI
BOOM LENGTH MEASURING CHANNEL CHANNEL #1

PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

PPM38-01

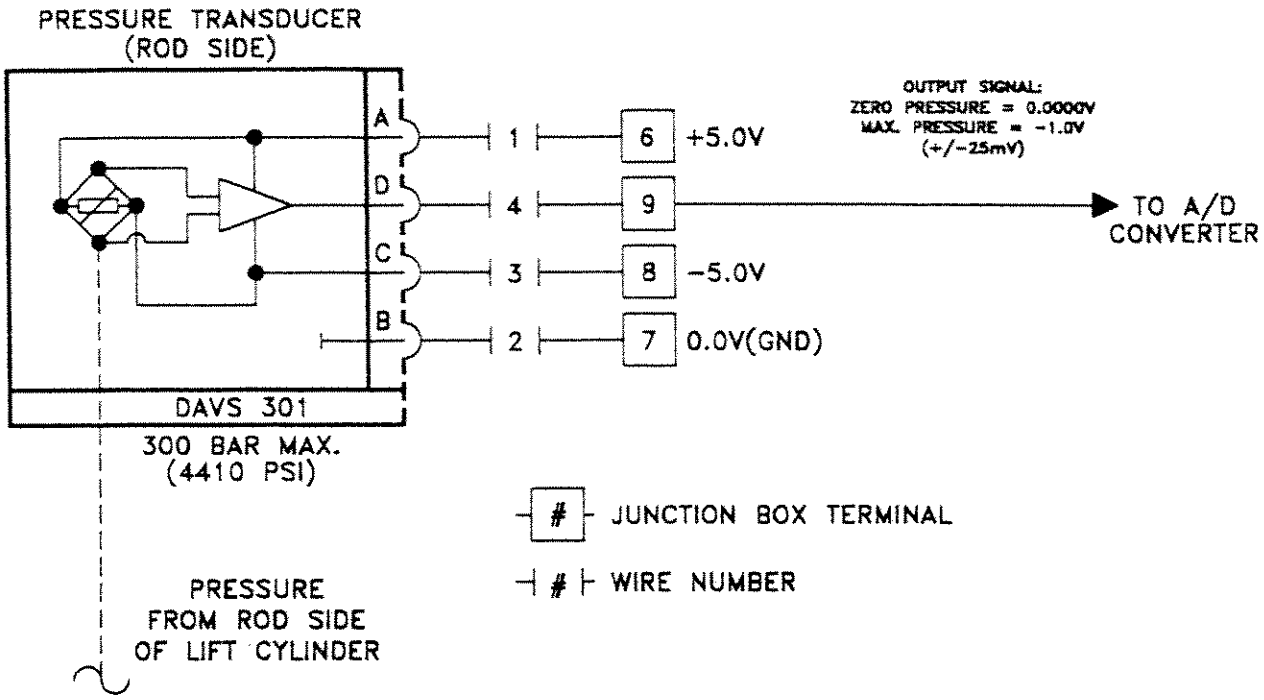


P.A.T. DS 350C LMI
PISTON PRESSURE TRANSDUCER SIGNAL VOLTAGE

Pressure / Bar	"INPUT" Signal at Terminal #4 in Junction Box
0	0.0V*
50	−0.16V
100	−0.33V
150	−0.50V
200	−0.66V
250	−0.83V
300	−1.0V

* Zero Point (no pressure) Input Signal should be less than 25mV.

C.A.G.E. 79760		SCALE 1/1	PAGE 1 OF 1
		MATERIAL	
	DATE / NAME	PAT DS 350C LMI	
	4/10/98	PISTON PRESSURE MEASURING CHANNEL CHANNEL #2	
REV. / DESCRIPTION / DATE / NAME			
PAT EQUIPMENT CORPORATION 1665 ORCHARD DRIVE CHAMBERSBURG, PA 17201		PPM38-03	



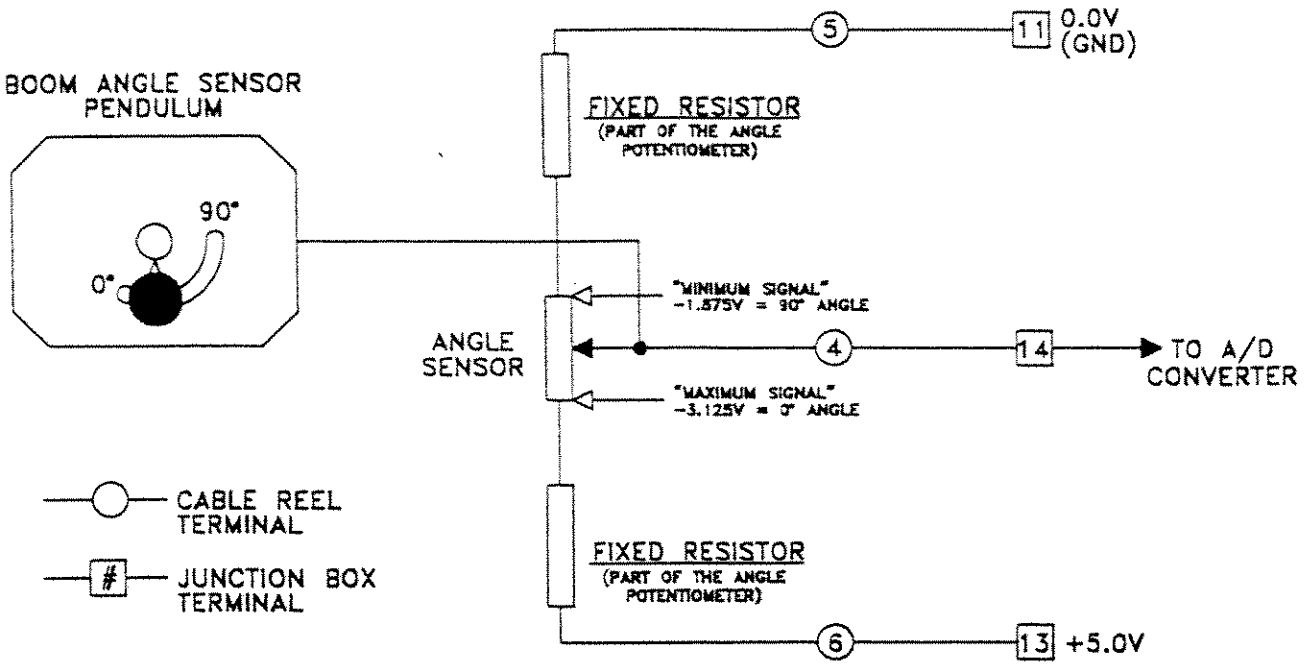
P.A.T. DS 350C LMI
ROD PRESSURE TRANSDUCER SIGNAL VOLTAGE

Pressure / Bar	"INPUT" Signal at Terminal #9 in Junction Box
0	0.0V*
50	−0.16V
100	−0.33V
150	−0.50V
200	−0.66V
250	−0.83V
300	−1.0V

* Zero Point (no pressure) Input Signal should be less than 25mV.

C.A.G.E. 79760		SCALE 1/1	PAGE 1 OF 1
		MATERIAL	
REV.	DESCRIPTION	DATE	NAME
		DRN. BY 4/10/96	RLE
		APPROV.	
PAT	PAT EQUIPMENT CORPORATION 1665 ORCHARD DRIVE CHAMBERSBURG, PA 17201	PAT DS 350C LMI ROD PRESSURE MEASURING CHANNEL CHANNEL #3	

PPM38-04



P.A.T. DS 350C LMI
BOOM ANGLE SIGNAL VOLTAGE

Actual Boom Angle	"INPUT" Signal at Terminal #14 in Junction Box
90°	1.87
85°	1.93
80°	2.00
75°	2.07
70°	2.14
65°	2.21
60°	2.28
55°	2.35
50°	2.41
45°	2.49

P.A.T. DS 350C LMI
BOOM ANGLE SIGNAL VOLTAGE

Actual Boom Angle	"INPUT" Signal at Terminal #14 in Junction Box
40°	2.56
35°	2.63
30°	2.70
25°	2.77
20°	2.84
15°	2.91
10°	2.98
5°	3.05
0°	3.12

C.A.G.E. 79760

SCALE 1/1 | PAGE 1 OF 1

MATERIAL

REV.	DESCRIPTION	DATE	NAME
		DRWN BY	4/10/98 RLE
		APPROV.	

PAT DS 350C LMI
BOOM ANGLE
MEASURING CHANNEL
CHANNEL #5

PAT EQUIPMENT CORPORATION
1665 ORCHARD DRIVE
CHAMBERSBURG, PA 17201

PPM38-02

17.0 CONTACTING PAT SERVICE DEPARTMENT

CONTACT PAT EQUIPMENT SERVICE DEPARTMENT

Monday thru Friday 8:00 am - 5:00 pm est.

OFFICE - 717 - 263 - 7655

FAX - 717 - 263 - 7845