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RK450

-SHOP MANUAL

-S5ET0002E④

-S5ET2502E①

-16. ELECTRIC SYSTEM

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SHOP MANUAL

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KOBELCO

SHOP MANUAL RK450

— ELECTRIC SYSTEM —

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KOBE STEEL, LTD.

PREFACE

In order to simplify the electrical connection between the reovolving upper and the carrier, a central processing unit is used for the electrical system of this machine. This book concerns mainly that central processing unit. For the electrical system of the overload prevention device, see the separate shop manual "Load Safety Device."

Applicable Models	Applicable Machines	Notes	Applicable Models	Applicable Machines	Notes
RK450	ET-2002~				

Revision Number	Date of Issue	Remarks
1st Edition	SEP., 1990	S5ET2502E Ⓥ
2nd Edition	FEB., 1991	S5ET2502E ① Ⓡ

1. OUTLINE OF ELECTRICAL SYSTEM

1.1 GENERAL

Fig. 1-1 shows the entire electrical system.

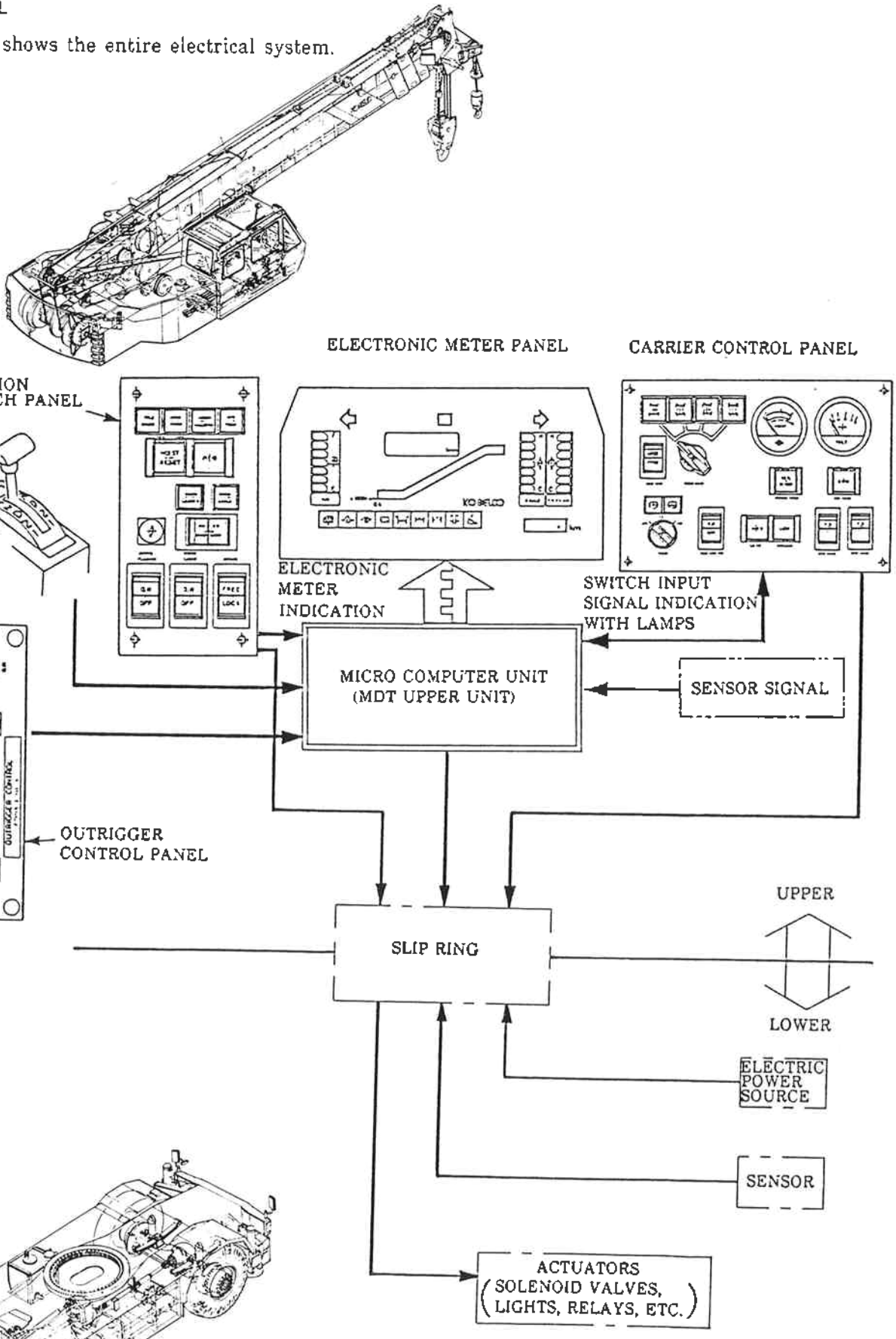


Fig. 1-1

The electrical system of this machine is largely divided into the controls and indicators on the revolving upper and the drive system on the lower carrier.

(1) The electrical system of this machine is composed of the following systems for the use.

① Engine control system
② Travel control system
③ Crane control system
(including load safety device)
(including multiplex data transmission device.)
④ Accessory control system

And, two kinds of micro computer units are installed to control the above ① and ② systems.

(2) The revolving upper is provided mainly with the switch controls and condition indicators or the crane operating devices, and the lower carrier is provided with the electrical (electronic) devices such as the travel drive system and sensors.

The electrical (electronic) circuits, which connect the upper and lower electrical devices, are connected through the slip ring shown in Fig. 1-7.

(3) In Table 1-1, the electrical system is classified into the respective system circuit in the respect of the use or transmission method, and the numbers (SP..) of the relative connecting slip rings are arranged.

1. Electrical power earth (ground) system circuit.
2. General transmission system circuit.
3. Multiplex data transmission (MDT) system circuit.
4. Emergency system circuit.

Table 1-1 System Circuits and Connecting Slip Rings

System	Circuit	Connecting slip ring
1. Power (source) and earth	① Power (directly connected to battery)	SP6, 9
	② Power (conected when key sw. in ON)	SP7, 8, 20
	③ Battery earth (E)	SP16
2. General transmission	① Engine start operation	SP15
	② Engine stop operation	SP12
	③ Parking brake operation	SP4
	④ Aux. brake operation	SP18
	⑤ Parking light operation	SP14
	⑥ Lower Outrigger stowing operation signal (feed back to M/L)	SP13
	⑦ Pilot unloading operation	–
	⑧ Winch unloading operation (RK450)	–
	⑨ Outrigger judging signal of M/L	SP19
3. Multiplex data transmission	① PTO operation ② Outrigger operation ③ Transmission shift operation (manual and automatic) ④ High/low operation ⑤ 2WD/4WD operation ⑥ Axle lock/free operation ⑦ Rear steering lock on/off operation ⑧ Steering mode operation ⑨ Reverse steering operation	SP1 · SP2 · SP3
3. Multiplex data transmission (continued)	⑩ Exhaust brake operation ⑪ Engine idle up operation ⑫ Engine air heater operation ⑬ Winch inching operation ⑭ Variable pump delivery regulation ⑮ Various sen sing operation ⑯ Electronic meter indication ⑰ Automatic T/M shift operation ⑱ Automatic T/C lock-up operation ⑲ Steering joining operation (RK250II) ⑳ Max. speed regulation ㉑ Turn signal and hazard operation ㉒ Headlight operation Tail light, clearance light and ㉓ license number light operation shift operation ㉔ Emergency shunt operation Self starting motor operation	SP1 · SP2 · SP3
	1. Forward (FR) shift signal 2. Reverse (RE) shift signal 3. 2nd spee shift signal Automatically operate for CPU trouble.	SP15 SP10 SP11 SP14
	4. Emergency steering operation	SP17
	5. Emergency direct connecting cable operation	–
	6. Emergency PTO operation	–

1.2 GENERAL WIRING SCHEMATIC

(1) WHOOLD CIRCUIT SCHEMATIC (1/2~2/2)

NOTE

1. EARTH SYMBOLS ARE SHOWN AS RIGHT DESCRIPTION: $\frac{E_0}{(\frac{1}{\pm})}$: BODY EARTH, E_1 $(\perp)$: SIGNAL EARTH, E $(\ominus)$: BATTERY EARTH
2. THE WIRES BETWEEN MDT LOWER UNIT AND SP1,SP2,SP3,BETWEEN MDT LOWER UNIT AND ENGINE RPM SENSOR SHALL BE USED WITH MVVS 1.25sq 3C
3. THE WIRES BETWEEN FUEL SENSOR,ENGINE WATER TEMPERATURE SENSOR, TORQUE CONVERTER OIL TEMPERATURE SENSOR AND MDT LOWER UNIT SHALL BE USED WITH TWIST PAIR 1.25sq

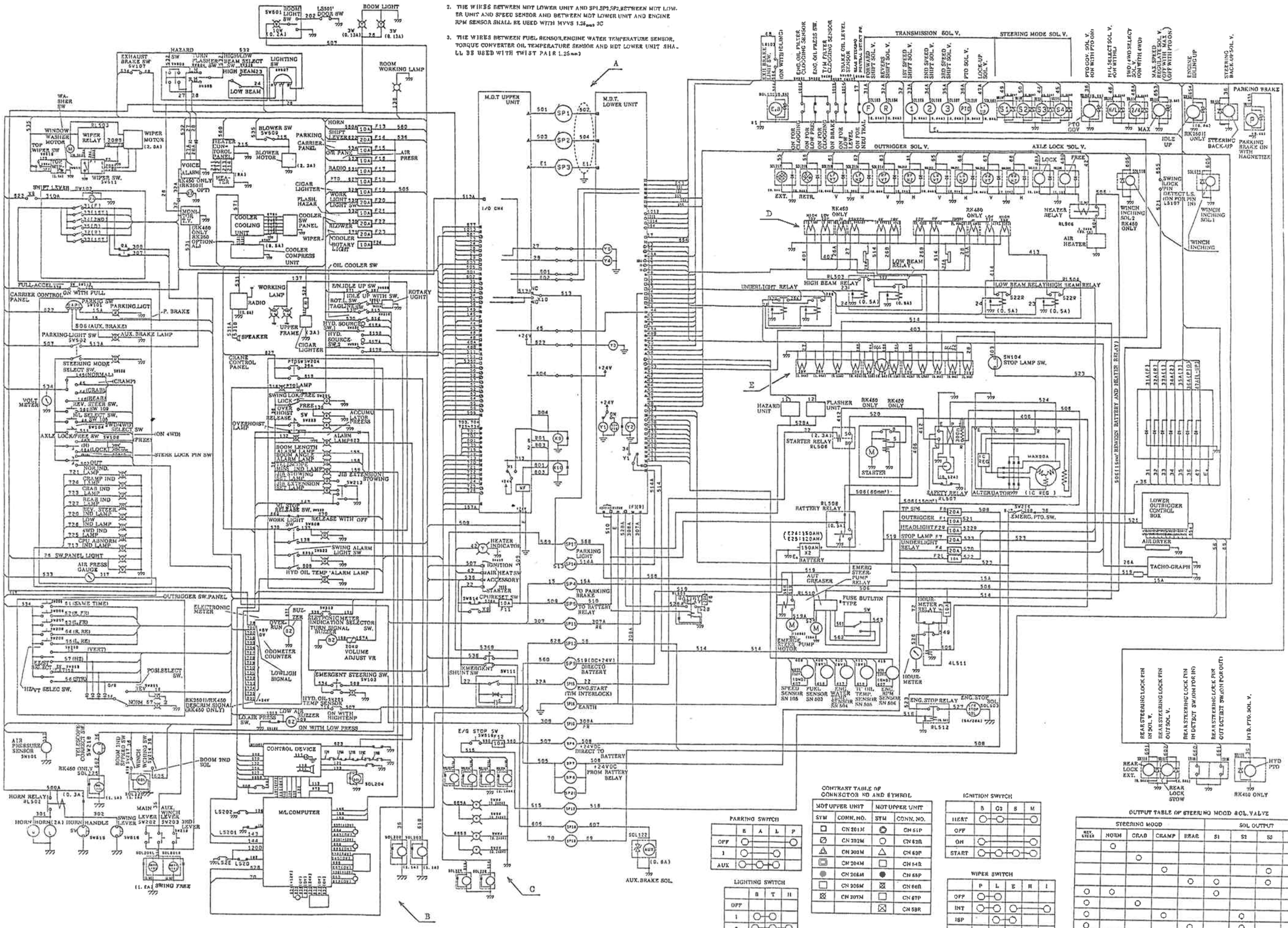
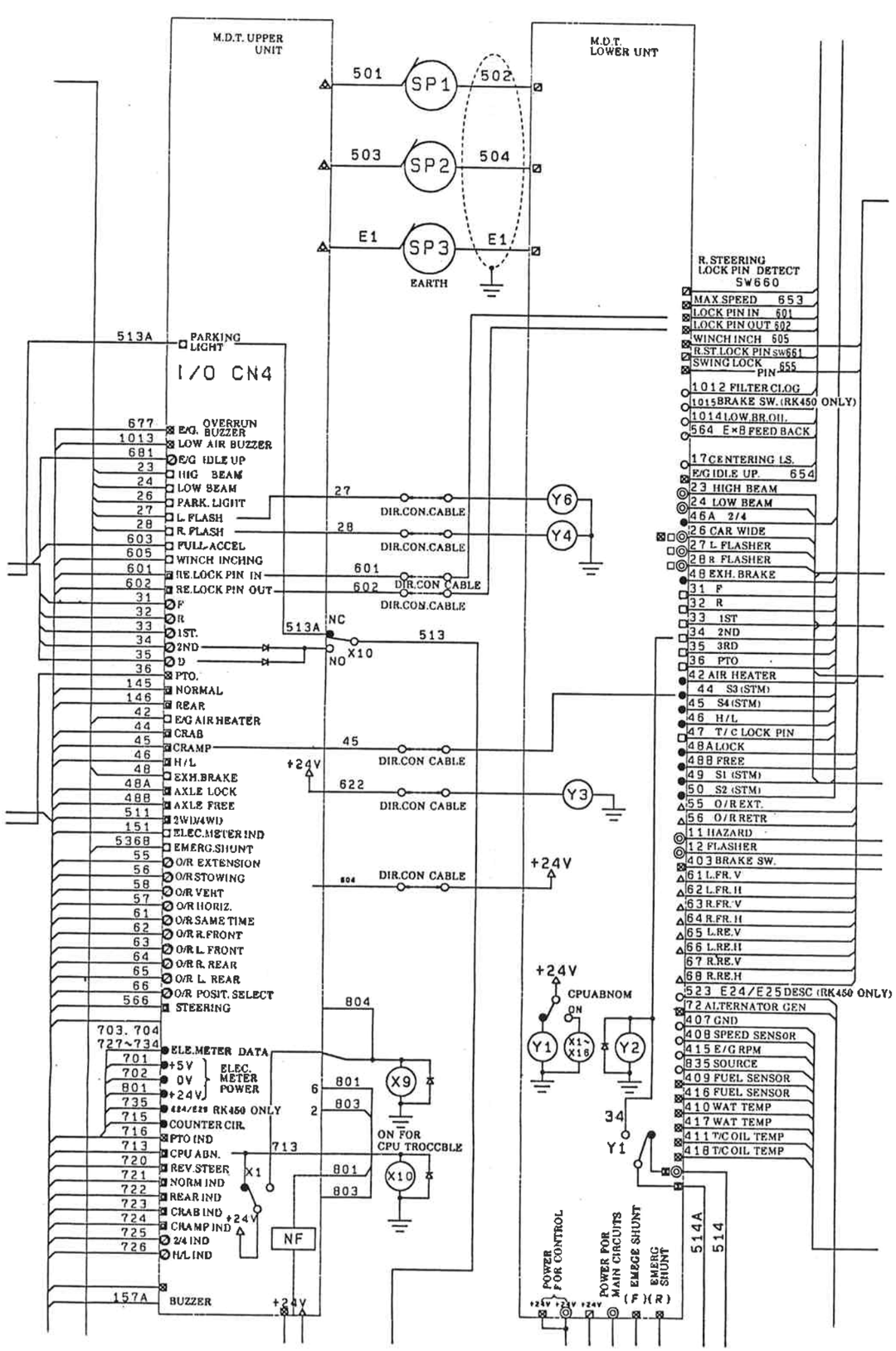
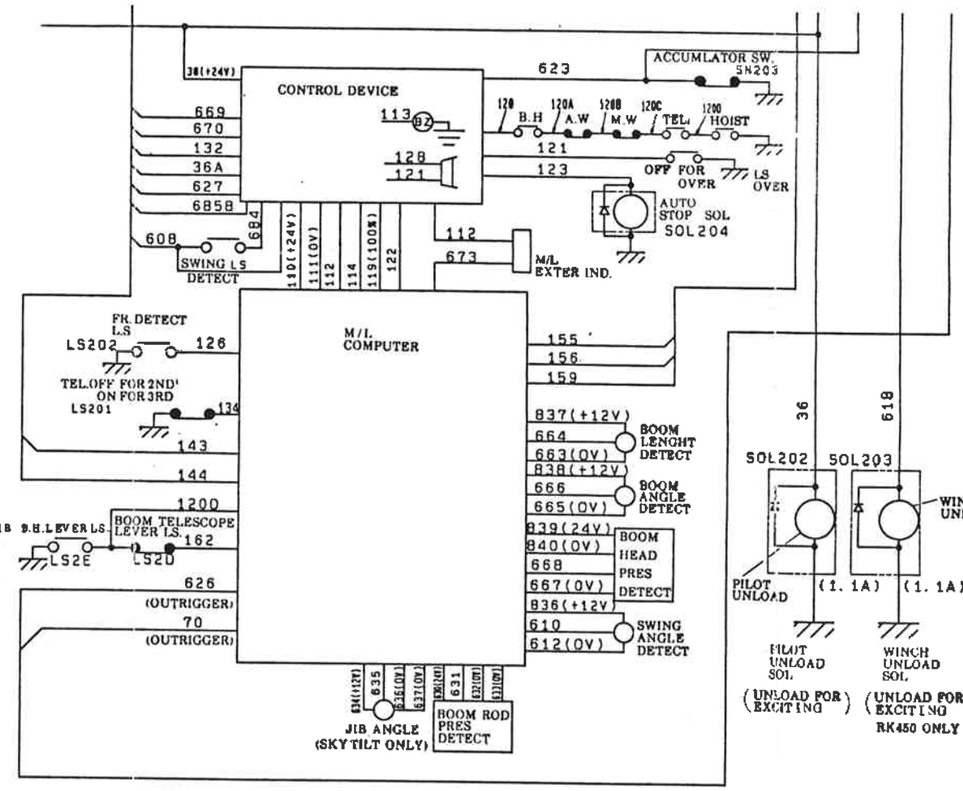


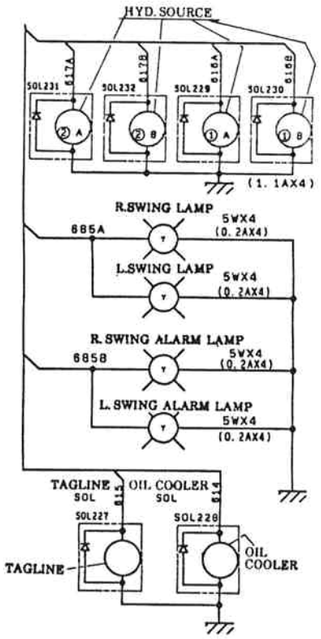
Fig. 1-2 Whole Circuit Schematic (1/2)



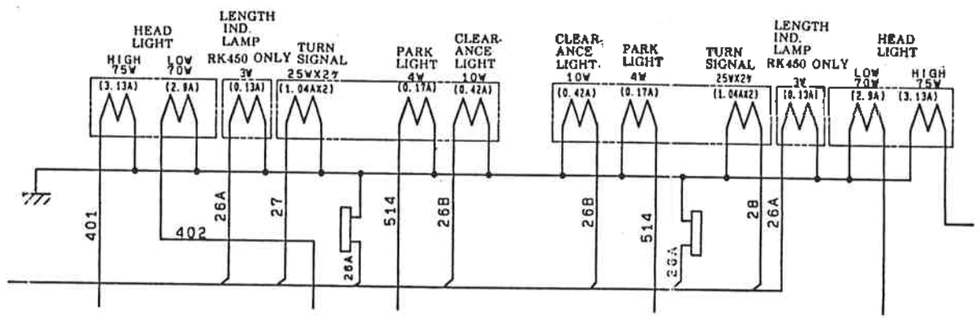
VIEW A



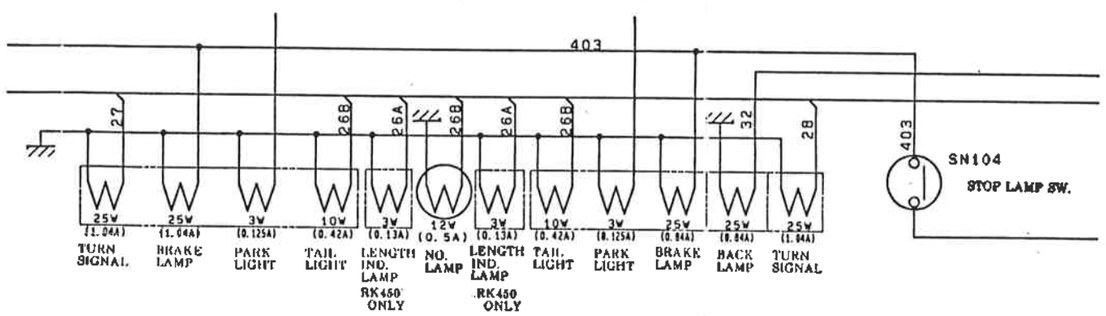
VIEW B



VIEW C



VIEW D



VIEW E

Fig. 1-2 Whole Circuit Schematic (2/2)

(2) CONTROL DEVICE CIRCUIT SCHEMATIC

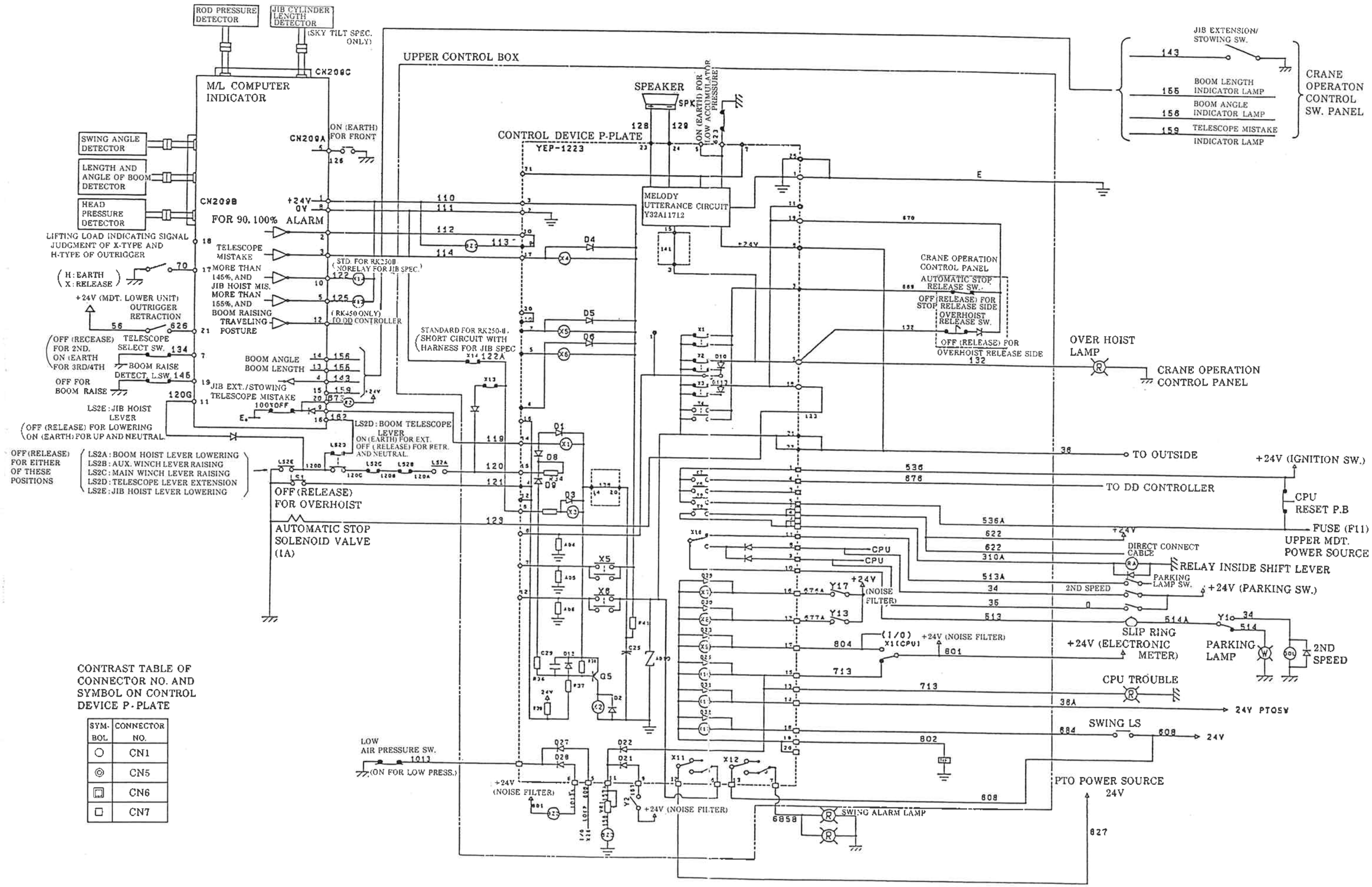


Fig. 1-3 Control Device Circuit Schematic

(3) LOWER OUTRIGGER CONTROL PANEL

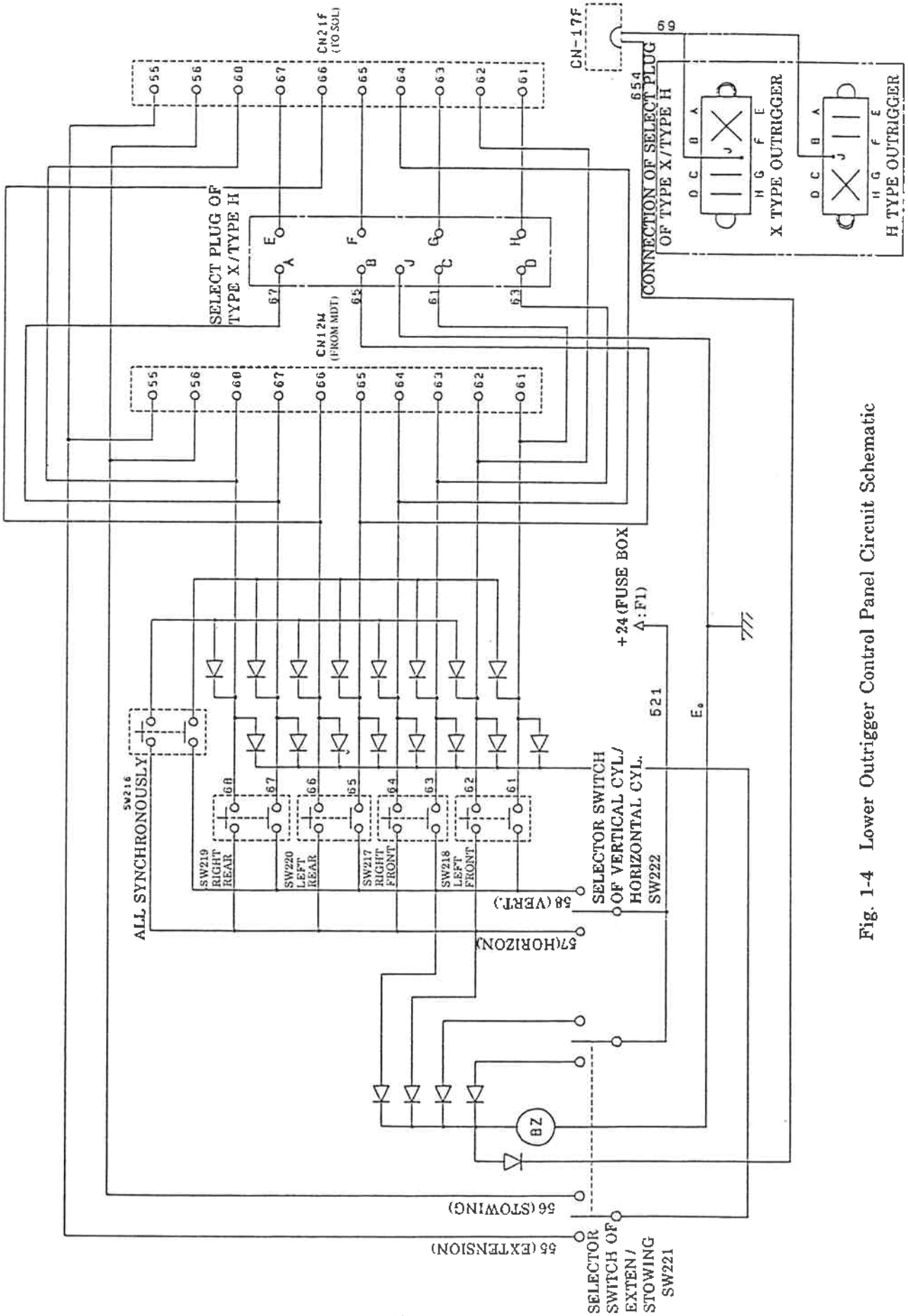


Fig. 1-4 Lower Outrigger Control Panel Circuit Schematic

(4) EMERGENCY SHUNT CIRCUIT

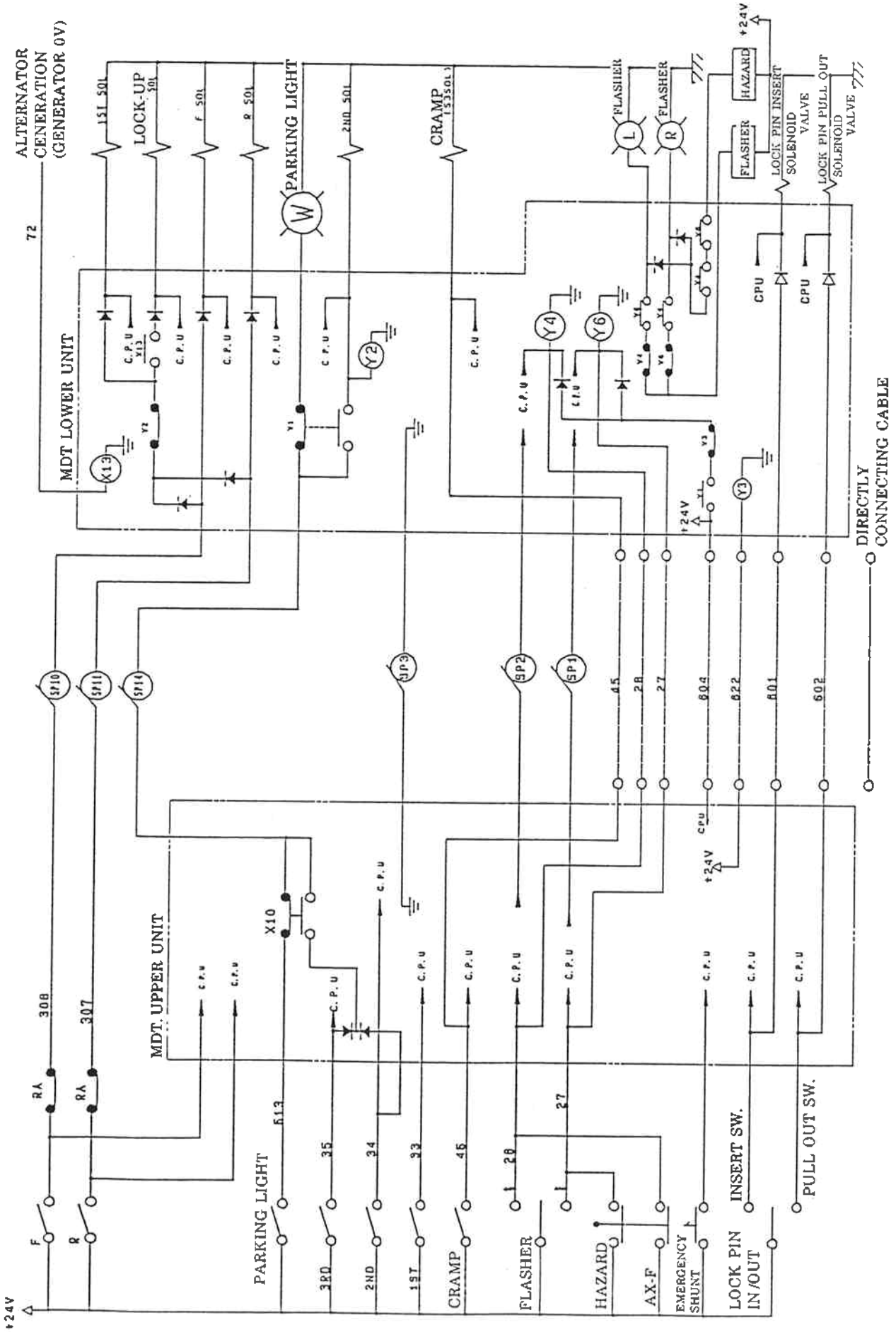
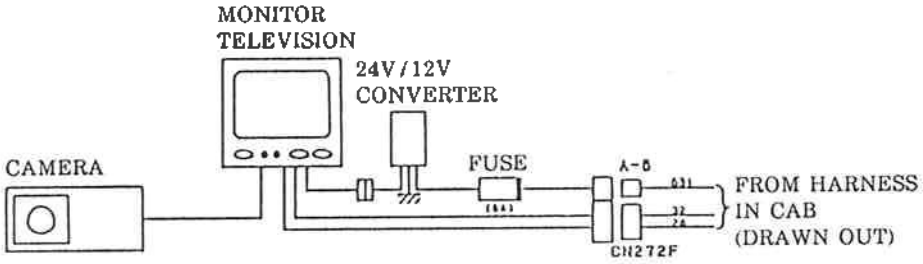


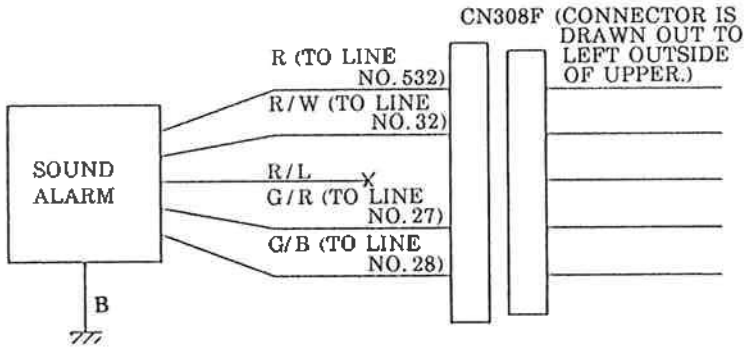
Fig. 1-5 Emergency Shunt Circuit



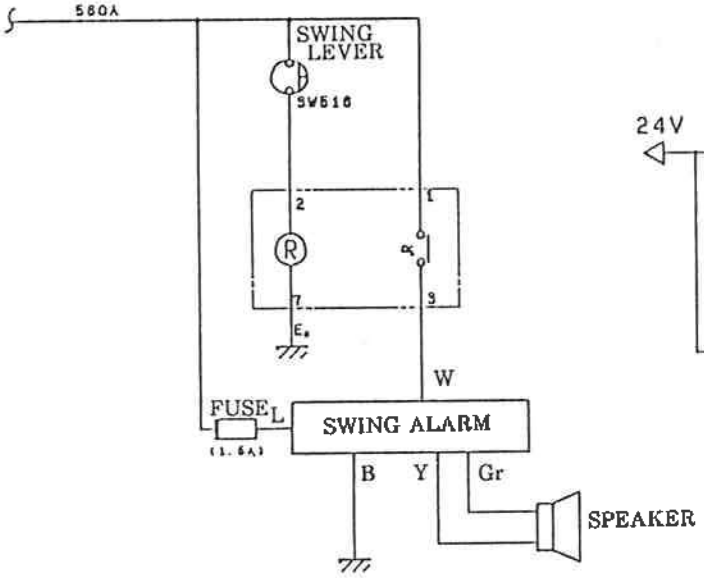
TELEVISION CAMERA CIRCUIT (OPTIONAL)

WIRE COLOR SYMBOLS

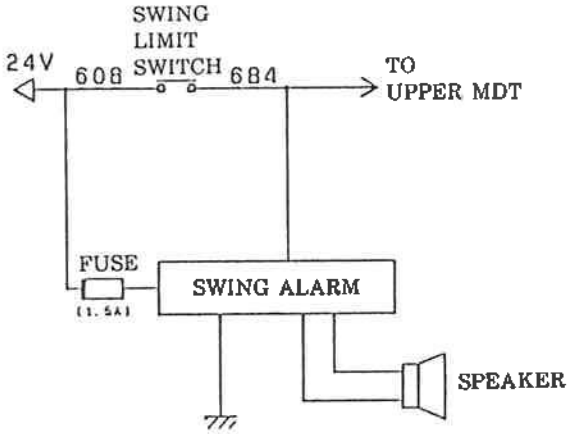
W ··· WHITE	L ··· BLUE
B ··· BLACK	G ··· GREEN
R ··· RED	Gr ··· GRAY
Y ··· YELLOW	



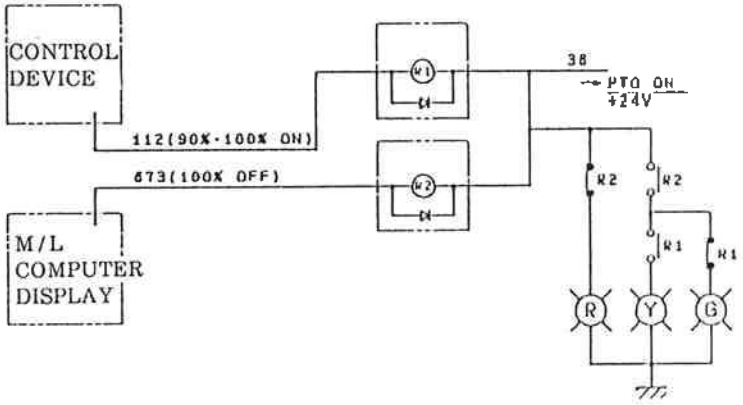
SOUND ALARM CIRCUIT (OPTIONAL)



BUTTON TYPE SWING TURN ALARM CIRCUIT (OPT.)

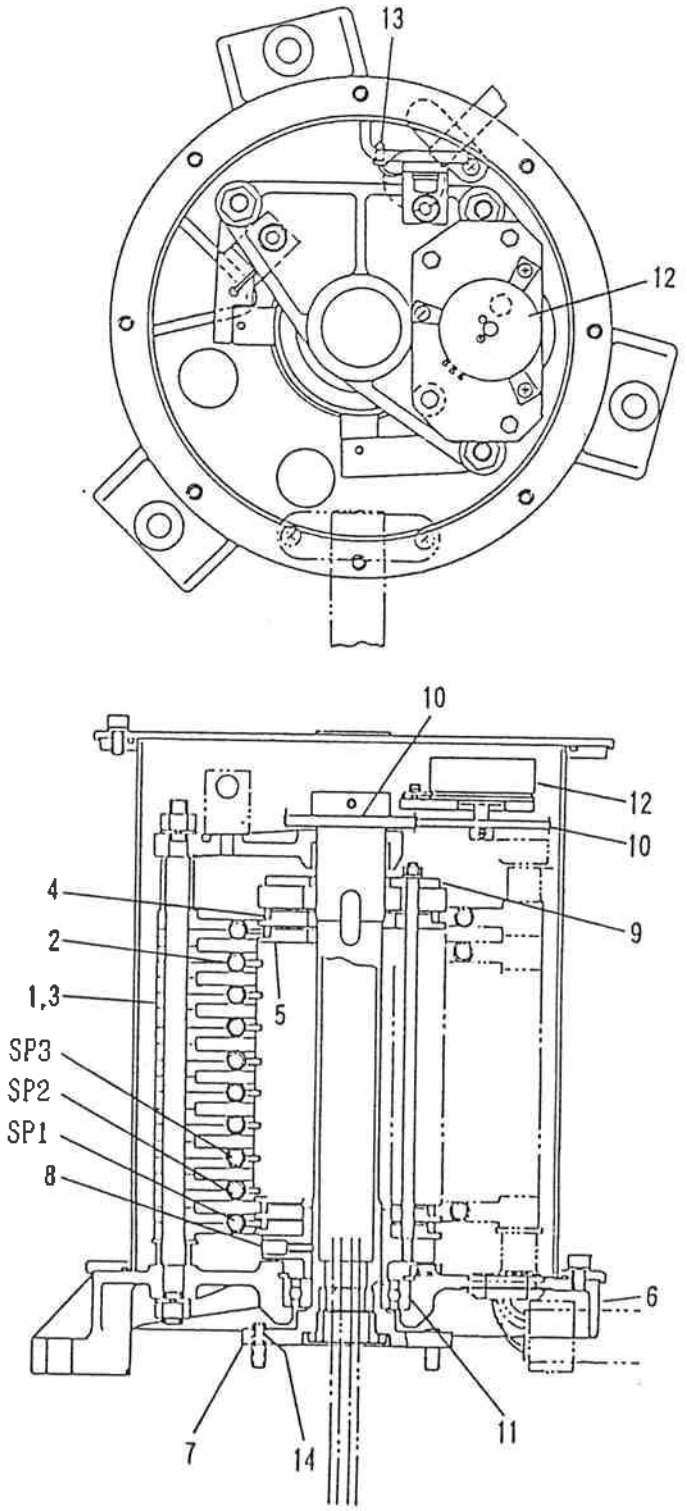


LEVER TYPE SWING TURN ALARM CIRCUIT (OPTIONAL)



OVERLOAD EXTERNAL INDICATOR LAMP CIRCUIT (OPTIONAL)

Fig. 1-6 Optional Circuit Schematic



1. BRUSH HOLDER
2. SPRING
3. BRUSH
4. RING
5. HUB
6. BASE
7. ROTOR
8. RETAINER
9. STOPPER
10. GEAR
11. BEARING
12. POTENTIOMETER
13. TERMINAL
14. SPRING PIN

Fig. 1-7 Slip Ring Assembly

NOTE : The ring number of the slip ring shown in the general electrical circuit schematic starts from No.1 of the lowest ring.

1.4 WIRE HARNESS

(1) UPPER

NOTE
WIRE COLOR SYMBOLS

W ··· White
B ··· Black
R ··· Red
Y ··· Yellow
L ··· Blue
Br ··· Brown
G ··· Green
O ··· Orange
Gr ··· Gray
P ··· Pink

Wire No.	Wire Color	Function	Wire kind & size
15	R.W	Parking SW. → SP-4	AV1.25sq
15	R.W	〃 → Shift lever	〃
22	Br.W	Key SW. ← Emergent shunt SW.	〃
22	Br.W	Emergent shunt SW. → Shift lever	〃
22A	R.B	Shift lever → SP-15	〃
22A	R.B.	〃 ← Emergent shunt SW.	〃
23	Y.W	(Hi beam) comb. SW. → M.D.T.	AV0.85sq
24	Y.G	(Lo beam) comb. SW. → 〃	〃
26	R.G	Light SW. → 〃	〃
26	R.G	M.D.T. ← Boom point	〃
26	R.G	Light SW. → Moni. camera	〃
26	R.G	〃 → Press. goge light	〃
27	L	(L. Winker) comb. SW. → M.D.T.	〃
27	L	M.D.T. → Sound alarm	〃
28	Y	(R. winker) comb. SW. → M.D.T.	〃
28	Y	M.D.T. → Sound alarm	〃
31	L	Shift lever (F) → M. D. T.	〃
32	G.B	Shift lever (R) → 〃	〃
32	G.B	〃 → Monitor camera	〃
32	G.B	M.D.T. → Back buzzer	〃
33	L.R	Shift lever (1st) → M.D.T.	〃
34	Br	Shift lever (2nd) → 〃	〃
35	W.L	Shift lever (D) → 〃	〃
120G	Y.W	Jib hoist L.S → M/L	〃
36	Y.L	Control device → Hyd. power SW.	〃
36	Y.L	〃 → Pilot unload sol. SW.	〃
36	Y.L	〃 → Tele. length correct SW.	AV0.85sq
36	Y.L	〃 → Winch inching, swing free SW.	AV1.25sq
36	Y.L	〃 → Crane OK monitor	〃
36A	R	PTO SW. → Control device	AV0.85sq
42	Y.L	Key SW. ← M.D.T.	〃
48	G.L	Exhaust br. SW. → 〃	〃
55	O.W	O/R cont. pan (exten) → 〃	〃
56	O	〃 (Stow.) → 〃	〃
57	R.B	〃 (Hori) → 〃	〃
58	R.W	〃 (Vert) → 〃	〃
61	R.W	〃 (All) → 〃	〃
62	L.W	〃 (R. fr.) → 〃	〃
63	R.Gr	〃 (L. fr.) → 〃	〃
64	R.Y	〃 (R. rear) → 〃	〃
65	L.G	〃 (L. rear) → 〃	〃
66	L.Y	〃 (position shift) → 〃	〃
70	Y	Slip ring → M/L	〃
110	L	Control device → 〃	AV1.25sq
110	L	Control device → Alarm Sensor relay (155%)	AV0.85sq

Wire No.	Wire Color	Function	Wire kind & size
110	L	Control device → Alarm Sensor relay (145%)	AV0.85sq
111	L.W	〃 ← N/L(E)	AV1.25sq
111	L.W	〃 → DD controller (E)	〃
111	L.W	〃 → Alarm sensor relay (145%)	〃
112	L.B	〃 → M/L (90, 100%)	AV0.85sq
112	L.B	〃 → Pre-notice outside indi.	〃
114	Br.W	〃 → M/L (Tele. mistake)	〃
119	L.R	〃 ← M/L (Stop signal)	〃
120	L.B	〃 → Boom lever (B.H.L.S.)	〃
120	L.B	〃 → Alarm sensor relay	〃
120D	Y	M/L ← Jib hoist L.S.	〃
120F	Y.B	Control device → Alarm Sensor relay	〃
121	G.Y	〃 → Overhoist L.S	〃
122	R.B	Alarm sensor reday (145%) → M/L (145%)	〃
122A	R.B	Contraol device → Alarm Sensor relay(155%)	〃
122A	R.B	〃 → Alarm Sensor relay(145%)	〃
123	G.R	〃 → Stop sol.v.	〃
125	G.R	M/L → Alarm Sensor relay	〃
126	W.G	Contraol device → Fr. lift area L.SW.	〃
132	R	〃 → Overhoist lamp	〃
132	R	〃 → Overhoist release SW.	〃
134	W	M/L → Tele. shift L. SW	〃
136	Br.W	Swing free SW. → Swing free sol. v.	〃
136	Br.W	〃 → 〃	〃
137	W.L	Work light SW. → Cab top Work light	AV1.25sq
137	W.L	〃 → work light	〃
138	L	〃 → Boom work light	〃
143	O.W	Jib exten/ stow SW. → M/L	AV0.85sq
151	W.L	Elec. meter indi. select → M.D.T.	〃
155	G.R	M/L → (Ext/stow lamp length) OK moni	〃
156	G.Y	〃 → 〃	〃
159	G.W	〃 → (Tele. mistake lamp) OK moni	〃
162	O	〃 → Telescope SW.	〃
202	B.W	Room light → Door SW.	AV1.25sq
208	L.R	Front wiper SW. → Front wiper relay	〃
208A	R.W	〃 → 〃	〃
208B	Y.L	Front wiper motor ← 〃	〃
208H	L.W	〃 ← Fr. wiper SW.(H)	〃
208L	L	〃 ← Fr. wiper SW.(L)	〃
209	L.Y	Fr. wiper SW. (wind. wash) ← Fr. wiper relay	〃
209	L.Y	〃 ← Wind wash motor	〃
302	P	Horn relay ← Horn SW.	〃
302	P	〃 → 〃	〃
307	R.Y	Shift lever (RA) → SP-11	〃
308	R.L	Shift lever (RA) → SP-10	〃

Wire No.	Wire Color	Function	Wire kind & size
310A	Br. R	M.D.T.×2 (1st) ← Shift lever RA relay	AV1.25sq
505	R. L	SP-7 → Fuses F19, F20	AV2sg
505	R. L	SP-8 → Fuses F21, F22	〃
505	R. L	SP-20 → 〃	〃
507	P. L	SP-6 → Room light	AV1.25sq
507	P. L	SP-6 → Hydr. oil temp SW.	〃
507	P. L	SP-6 → Park. light SW.	〃
507	P. L	SP-6 → Key SW.	〃
509	Y.W	SP-5 → Fuse F11	AV2sg
509	Y.W	Fuse F11 → M.D.T.	AV1.25sq
513	R.W	M.D.T. ← SP-14	〃
513A	G.W	〃 ← Park linght SW.	〃
515	L.W	Engine stop SW. → SP-12	〃
517	W.R	Aip press. gauge → Air press. sensor	AV0.85sq
529	W.R	Fuse F19 → Cigar lighter (R1)	AV1.25sq
530	R.L	Fuse F20 → Work light SW.	AV2sg
530	R.L	Fuse box F19 → Oil cooler SW. Tagline SW.	AV1.25sq
531	G	Fuse F17 → Radio	〃
531	G	〃 → Monitor comera	〃
532	R.Y	Fuse F21 → Combination SW.	AV2sg
532	R.Y	〃 → 〃	AV1.25sq
532	R.Y	〃 → Sound alarm	AV0.85sq
533	G.W	Fuse F16 → Air press gauge	AV1.25sq
534	W.Y	Fuse F15 → Combination SW.	〃
534	W.Y	〃 → O/R control panel	〃
534	W.Y	Emerg. steer pump SW. → Fuse F15	〃
534	W.Y	Accel. SW. ← 〃	〃
534	W.Y	Fuse F15 → DD. SW. current	〃
534	W.Y	〃 → SW. panel	〃
535	W.Y	Fuse F22 → Wiper relay	〃
535	R.B	〃 → Wiper motor	〃
535	R.B	Fuse box F22 → Wiper relay	〃
535	R.B	〃 → Window washer	〃
535	R.B	Fuse F22 → Blower SW. sky light wip. SW.	〃
536	R.W	Key SW. → Emerge shunt SW.	〃
536	R.W	〃 → Speed/tacho select. SW.	〃
536	R.W	〃 → M.D.T.(×2)	〃
536	R.W	〃 → Fuse box	〃
536	R.W	〃 → CPU reset SW.	〃
536A	Gr	F11 ← 〃	〃
536A	Gr	F11 → M.D.T.(×2)	〃
536B	R.Y	Emerg. shunt SW. ← Key SW.	〃
550	W.B	Fuse F12 → Engine stop SW.	〃
560	R	SP-9 → Heater control panel	〃
560	R	〃 → Fuse F13	〃

Wire No.	Wire Color	Function	Wire kind & size
560A	Gr	Fuse F13 → Horn relay	AV1.25sq
569	Y.R	Emerg. steer pump SW. → SP-17	〃
571	R.W	Fuse box F23 → Rotary lamp SW.	AV2sg
571	R.W	〃 → Cooler	〃
603	L.W	Accel. SW. ← M.D.T.	AV0.85sq
605	L.Y	Winch inching SW. → 〃	〃
606	L.W	Aux. park. SW. → SP-8	〃
608	R	Swing alarm SW. → Control device	〃
608	R	〃 → Swing alarm lamp	〃
610	R.Y	M/L ← Swing angle sensor (output)	AV1.25sq
612	B	〃 ← 〃 (E)	〃
622	G.Y	Fuse F14 → M.D.T.	〃
622	G.Y	〃 → Parking SW.	〃
623	O.W	Contr. device (accum. press. watch) → Accumulator press SW.	〃
623	O.W	Accumulator watch lamp → 〃	AV0.85sq
626	Br.W	SP-13 → M/L (O/R retra. sign)	AV1.25sq
627	G.R	Fuse F18 → PTO SW.	〃
627	G.R	〃 → Control device	〃
627	G.R	〃 → DD contr. power	〃
630	R.W	M/L → Press. detect (rod side)	〃
631	G	〃 → 〃 (signal)	〃
632	B.W	〃 → 〃 (E)	〃
633	B	〃 → Press. detect (E for signal)	〃
634	R.Y	〃 → Jib angle indi. (power)	〃
635	R.L	〃 → 〃 (signal)	〃
636	B.W	〃 → 〃 (E)	〃
637	B	〃 → 〃 (signal)	〃
663	B	〃 → Length meter (E)	〃
664	O	〃 ← 〃 (out put)	〃
665	B	〃 → Angle meter (E)	〃
666	R.L	〃 ← 〃 (out put)	〃
667	B	〃 → Press. detect. (E)	〃
667	B	〃 → DD controller	〃
668	G.L	M/L ← 〃 (output)	〃
668	G.L	DD controller ← 〃	〃
669	Y	Control device → Overload stop release SW.	AV0.85sq
670	R.G	〃 → 〃	〃
673	G.L	M/L → External alarm indi.	〃
676	Y	M.D.T. → Dynamic damper	AV1.25sq
677	R.W	〃 → Eng. overrun buzzer	AV0.85sq
678	R.Y	Boom 2nd speed SW. → Boom 2nd speed sol.	〃
670i	G	Cooler cooling unit → Cooler compress unit	AV1.25sq
679k	L	〃 → 〃	〃
681	G.W	M.D.T. ← Eng. idle up SW.	〃
682	O	Telescope correct SW. → Telescope correct sol.	〃

Wire No.	Wire Color	Function	Wire kind & size
684	Y.G	L & R. Swing lever SW. → Control device	AV1.25sq
685A	L.R	Swing alarm SW. → Swing alarm lomp (up, low)	〃
685B	G.W	Control device → 〃 (mid-up, mid-lo)	〃
714	W.Y	Hydr. oil temp alarm lamp ← Hydr. oil temp sensor	〃
716	Y.R	M.D.T. → PTO lamp (OK monitor)	〃
836	W	M/L → Swing angle sensor (12V)	AV1.25sq
837	Br	〃 → Length meter (+12V)	〃
838	R	〃 → Angle meter (+12V)	〃
839	R.W	〃 → Press detect (24V)	〃
839	R.W	Press detect (24V) → 〃	〃
839A	R.W	〃 → press. detect.	〃
840	R.W	M/L → 〃 (E)	〃
1013	Y.B	M.D.T. → Low air press. SW.	AV0.85sq
677	R.W	〃 → DD controller	〃
E0	B	Body earth ← Wiper relay	AV1.25sq
E0	B	Combination switch → Body earth	〃
E0	B	Body earth ← Eng. overrun buzzer	〃
E0	B	Key SW. body earth → 〃	〃
E0	B	Switch panel → 〃	〃
E0	B	DD SW. earth → 〃	〃
E0	B	Shift lever → 〃	〃
E0	B	O/R contr. panel → 〃	〃
E0	B	Horn switch → 〃	〃
E0	B	Emerg. shunt SW. → 〃	〃
E0	B	OK monitor → 〃	〃
E0	B	Cooling unit → 〃	〃
E0	B	Boom hoist L. SW. →	〃
618	L	PTO SW. → Winch unload switch	〃
618	L	〃 → DD controller	〃
690	Y.R	DD controller ← DD raise SW.	AV1.25sq
691	Y.B	〃 ← DD lower SW.	〃
692	L.W	〃 ← DD OFF lamp	〃
693	L.B	〃 ← DD on lamp	〃
694	Y.G	M/L ← DD controller (Travel post sign)	〃
310A	W	M.D.T. → Shift lever	〃
E0	B	Shift lever → Body earth	〃
E0	B	〃 → 〃	〃
145	R	Boom hoist L. SW. → M/L	〃
122A	R.B	Control device → Earth	〃
27A	L.B	M.D.T. → Sound alarm	〃
28A	Y.B	〃 → 〃	〃
32A	G	M.D.T. → Back buzzer	〃

(2) LOWER

NOTE
WIRE COLOR SYMBOL

W ··· White
B ··· Black
R ··· Red
Y ··· Yellow
L ··· Blue
Br ··· Brown
G ··· Green
O ··· Orange
Gr ··· Gray
P ··· Pink

Wire No.	Wire Color	Function	Wire kind & size
15A	G.W	SP-4 → Parking brake	AV1.25sq
17	Y.L	M.D.T. → Centering L.SW.	〃
22	R.B	SP-15 → Starting relay	〃
26B	Y	Clearance light relay → Tail lamp Number lamp	〃
26B	Y	〃 → Clearance light	〃
26	G.Y	M.D.T. → Under light relay	〃
26A	L	Under light relay → Under light	〃
26A	L	〃 → Tachograph under light	〃
26A	L	Tachograph ← Under light	〃
26A	L	Under light → Length meter indi. lamp	〃
27	G.R	M.D.T. → Left turn signal indi.	〃
28	G.R	〃 → Right turn signal indi.	AV1.25sq
31	L	〃 → Transmission FW	〃
32	L.R	〃 → 〃 RC	AV 2sq
32	L.R	Transmis-sionRC ← Back buzzer Back light	〃
33	L.B	M.D.T. → Transmisssion 1st	AV1.25sq
34	L.Y	〃 → 〃 2nd	〃
35	L.W	〃 → 〃 3rd	〃
36	Br.W	〃 → PTO	〃
36	Br.W	PTO sol. ← Fuse box (PTO SW.)	〃
36	Br.W	〃 → PTO governor sol.v.	〃
36	Br.W	M.D.T. → PTO sol. v.	〃
36	Br.W	〃 → 〃	〃
42	L.W	〃 → Air heater relay	〃
44	G.R	〃 → Steer. mode S3	〃
45	G.L	〃 → 〃 S4	〃
46	G.Y	〃 → H/L select valve	〃
46A	W.G	〃 → 2W/4WD select valve	〃
47	Br.R	〃 → T.C. lock-up	〃
48	Br	〃 → W brake L.SW.	〃
48A	G.W	〃 → Axle lock lock	〃
48B	G	〃 → Axle lock free	〃
49	G.W	〃 → Steer mode S1	〃
50	G.B	〃 → 〃 S2	〃
55	O.W	M.D.T. → O/R control v. (extension)	〃
55	O.W	O/R contr. box → 〃 (extension)	〃
56	O	M.D.T. → 〃 (stowing)	〃
56	O	O/R contr. box → 〃 (stowing)	〃
56	O	O/R contr. box (stow) → SP-13	〃
61	R.B	M.D.T. → O/R contr. v. (L.Fr. vert.)	〃
61	R.B	O/R contr. box → 〃 (L. Fr. vert.)	〃
62	R.W	M.D.T. → 〃 (L. Fr. horiz.)	〃
62	R.W	O/R contr. box → 〃 (L. Fr. horiz.)	〃
63	L.B	M.D.T. → 〃 (R. Fr. vert.)	〃
63	L.B	O/R contr. box → 〃 (R. Fr. vert.)	〃

Wire No.	Wire Color	Function	Wire kind & size
64	L.W	M.D.T. → O/R contr. v. (R. Fr. horiz.)	AV1.25sq
64	L.W	O/R contr. box → 〃 (R. Fr. horiz.)	〃
65	R.G	M.D.T. → 〃 (L.Re. V)	〃
65	R.G	O/R contr. box → 〃 (L.Re. V)	〃
66	R.Y	M.D.T. → 〃 (L.Re. H)	〃
66	R.Y	O/R contr. box → 〃 (L.Re. H)	〃
67	L.G	M.D.T. → 〃 (R.Re. V)	〃
67	L.G	O/R contr. box → 〃 (R.Re. V)	〃
68	L.Y	M.D.T. → 〃 (R.Re. H)	〃
68	L.Y	O/R contr. box → 〃 (R.Re. H)	〃
69	Y	SP-19 → Outrigger judge	〃
72	Y.B	M.D.T. → Hr. meter relay	〃
307A	Y.R	〃 ← SP-11	〃
308A	Y.L	〃 ← SP-10	〃
403	G	Stop lamp SW. → M.D.T.	〃
403	G	〃 → Stop lamp	〃
406	W.L	Safety relay Hr meter relay → Alternator (L) terminal	〃
406	W.L	Alternator (L) terminal → 2nd speed diode	〃
412	B.Y	Safety relay ← Starter relay	〃
506	R	Battery relay → Air heater relay	AV15sq
506	W	Alternator (D) terminal → Fuse box	AV5sq
506	W.Y	Fuse box → SP-7	AV2sq
506	W.Y	〃 → SP-8	〃
506	W.Y	Fuse box → SP-20	AV2sq
506	W.Y	Alternator (R) terminal → Alternator (D) terminal	AV1.25sq
508	R.W	Fuse box F6 → SP-6	〃
510	R.W	SP-5 → Battery relay	〃
510	Y.W	SP-5 → M.D.T. and ACC relay	〃
510A	R	2nd speed diode → Battery relay	〃
514	Y.G	M.D.T. → Bear park. light	〃
514A	G	〃 ← SP-14	〃
516	B.G	SP-12 → Eng. stop relay	〃
519	W.B	Battery relay 1st (-) terminal → Fuse box	AV2sq
519	W.B	SP-9 ← Fuse box Tachograph	〃
519	W.B	SP-9 → Tachograph	AV1.25sq
521	R.Y	Fuse box F1 → O/R contr. box	〃
521	R.Y	〃 → Swing lock pin L.SW.	〃
521	R.Y	〃 → Axle lock pin SW.	〃
521	R.Y	Axle lock pin ext. sign SW. ← Fuse box F1	〃
522	R	Fuse box F2 → R. head light relay	〃
522R	R.G	〃 → 〃	〃
523	R.G	Fuse box F5 ← Stop lamp SW.	〃
523	R.G	M.D.T. → Relay unit	〃
523	R.G	Fuse box F7 → Eng. stop relay	〃
524	W	Alternator P terminal → Safety relay	〃

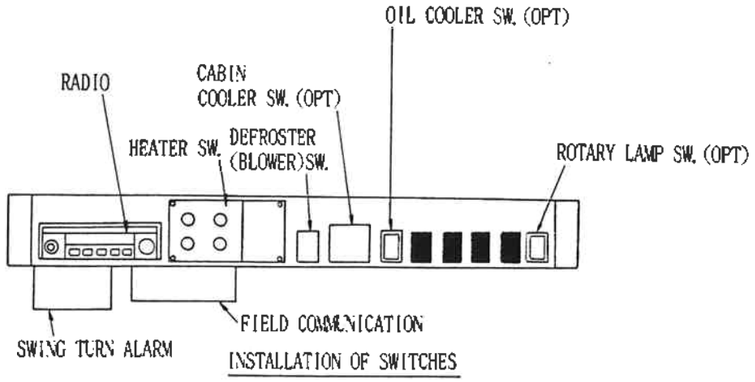
Wire No.	Wire Color	Function	Wire kind & size
526	Y	Hr. meter relay → Hourmeter	AV1.25sq
528	W.L	Fuse box F4 → Aux. battery relay	AV2sq
549	R.L	〃 F3 → Hr. meter relay Emerg. pump	AV1.25sq
564	Br.L	Aux. brake L.SW. → Exhaust brake sol. v.	〃
564	Br.L	M.D.T. ← Exhaust brake L.SW.	〃
568	R.Y	Sp-17 → Emerg. steer. pump	〃
570	Y.R	Fuse box F8 → Under light relay	〃
601	G.Y	M.D.T. → Lock pin ext. sol. v.	〃
602	G.R	〃 → Lock pin ret. sol. v.	〃
605	L.W	〃 → Winch inch. sol.v.	〃
605	L.W	〃 → Winch inch. sol.v.	〃
607	L.R	Sp-18 → Aux. brake sol. v.	〃
653	R.Y	M.D.T. → Max. speed rega. gov. sol.	〃
655	R.B	〃 → Swing lock pin L.SW.	〃
660	W.L	〃 → Lock pin in check SW.	〃
661	L.W	〃 → Lock pin in check SW.	〃
1014	Y	〃 → Brake oil low level sensor	〃
1015	W.L	〃 → Strong brake SW.	〃
1012	Y.R	〃 → T/M filter clog. sensor	〃
1012	Y.R	〃 → Low oil. low press. filter alarm	〃
407	B	〃 ← Speed sensor	① 3 color shield 1.25sq
408	W	〃 ← Speed sensor (output)	
835	R	〃 → Speed sensor	
E	SealF	〃 ← Speed sensor shield	
407	B	〃 ← Eng. R sensor	③ 3 color shield 1.25sq
415	W	〃 ← Eng. R sensor (output)	
835	R	〃 → Eng. R sensor	
E	SealF	〃 ← Tacho. sensor shield	
409	W	〃 → Fuel sensor	Twist pair ② 0.75sq
416	L	〃 ← 〃	
410	W	〃 → Eng. water temp. sensor	
417	W	〃 ← 〃	
411	W	〃 → T/C oil temp. sensor	twist pair ③ (0.75sq)
418	L	〃 ← 〃	
502	R	〃 ← SP-1	3color shied ③ 1.25sq
504	W	〃 ← SP-2	
E1	B	〃 ← SP-3	
E	SealF	〃 ← Slip ring	
E	B.W	〃 ← SP-16	AV 2sq
E	B.W	Battery ← 〃	〃
E0	B	Trans-mission → Body earth	AV1.25sq
E0	B	Centering limit SW. → 〃	〃
E0	B	Lock pin sol. v. → 〃	〃
E0	B	〃 → 〃	〃
E0	B	Axle lock pin in detect SW. → 〃	〃

Wire No.	Wire Color	Function	Wire kind & size
E0	B	Axle lock pin off detect SW. → Body earth	AV1.25sq
E0	B	M/L select → 〃	〃
E0	B	〃 → 〃	〃
E0	B	O/R contr. box ← 〃	〃
E0	B	Body earth ← Tachograph	
E0	B	〃 ← 〃	〃
E0	B	Hourmeter → Body earth	〃
506	W.Y	Auto-greaser controller ← Air heater relay	AV 2sq
561	O	〃 → Auto-greaser pump SW.	AV1.25sq
562	O.W	〃 ← 〃	〃
563	O.L	〃 ← 〃	〃
525	P	〃 → Auto-greaser pump	〃

2. ARRANGEMENT AND CONNECTION OF ELECTRICAL APPARATUS

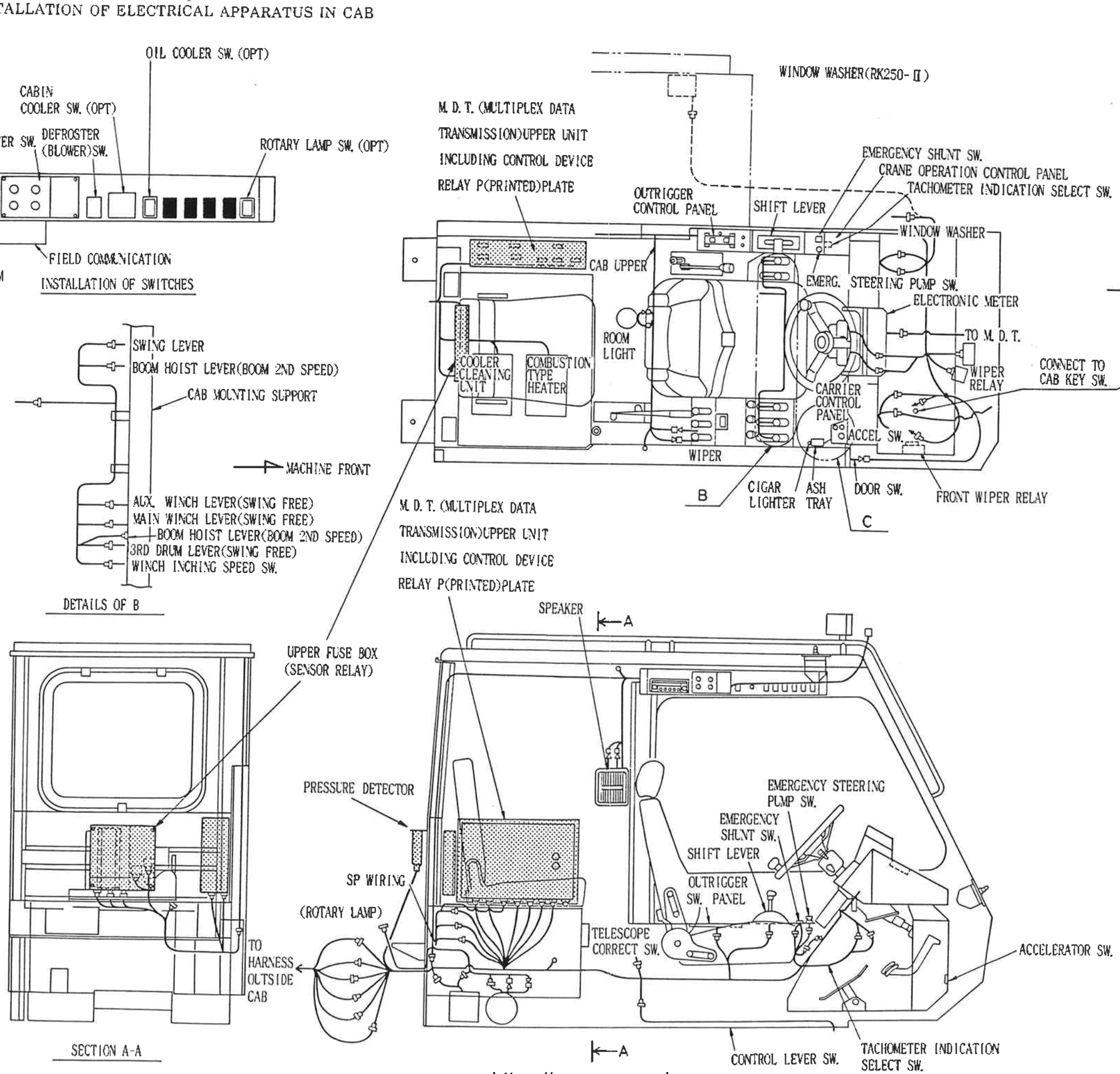
2.1 ARRANGEMENT OF ELECTRICAL APPARATUS

(1) INSTALLATION OF ELECTRICAL APPARATUS IN CAB

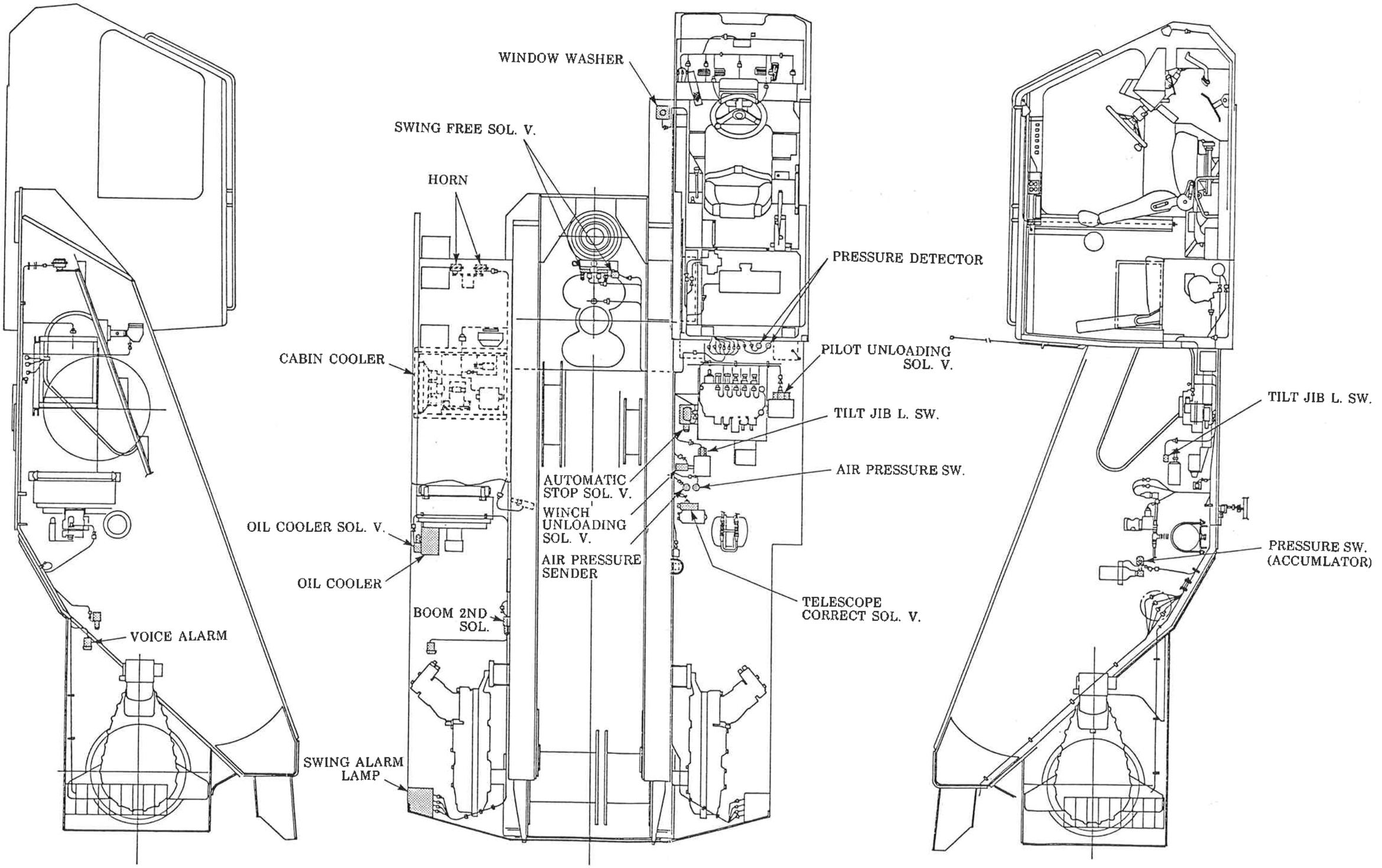


INSTALLATION OF SWITCHES

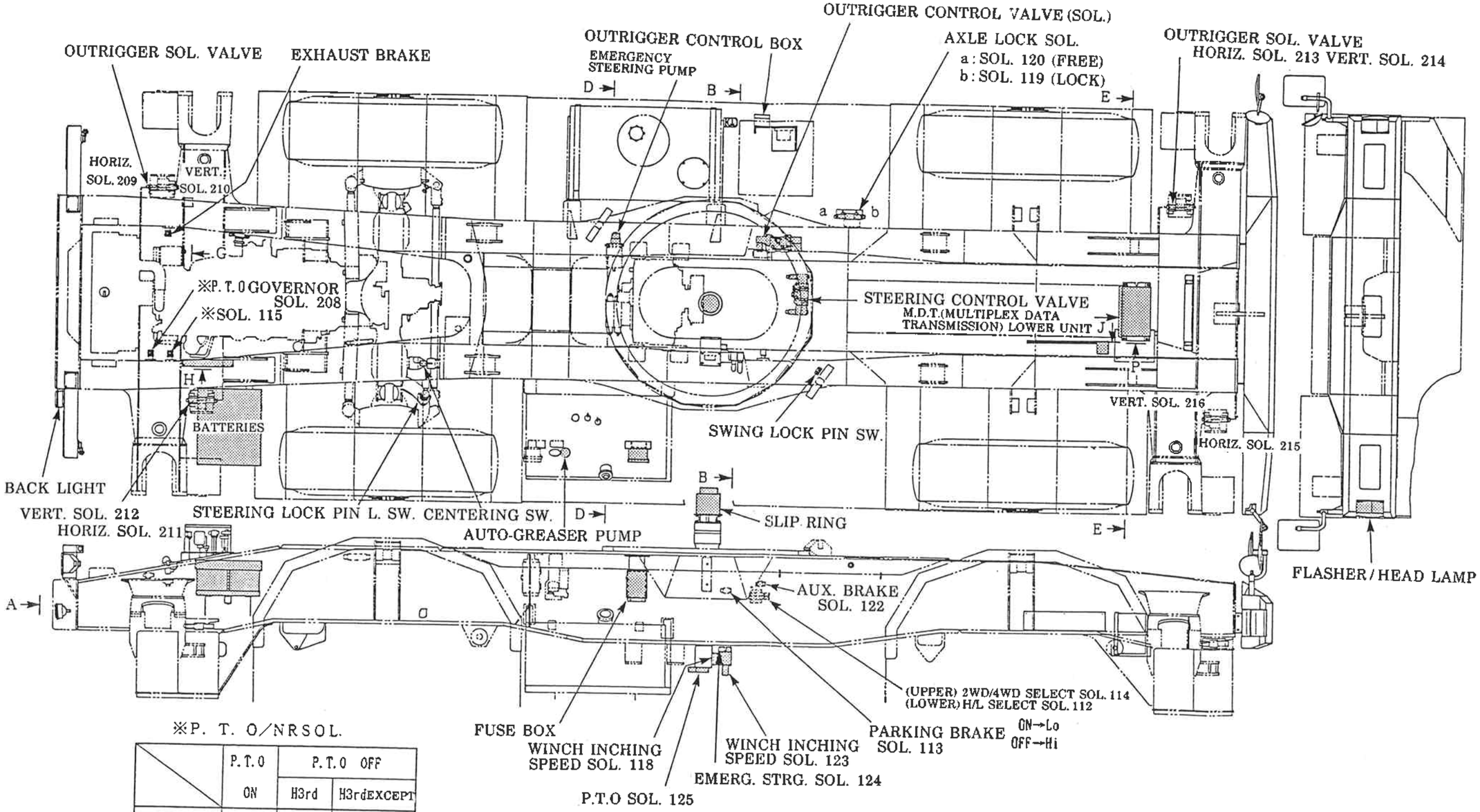
DETAILS OF B



SECTION A-A

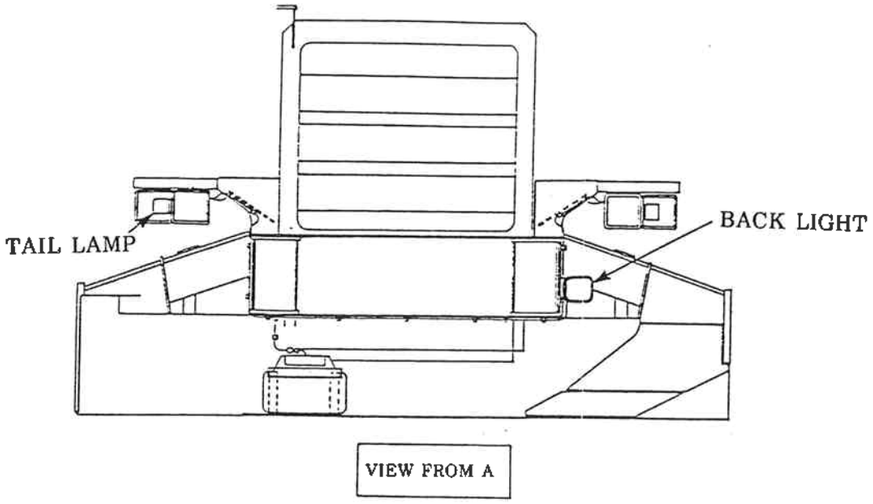


(3) INSTALLATION OF ELECTRICAL APPARATUS ON CARRIER (1/2)

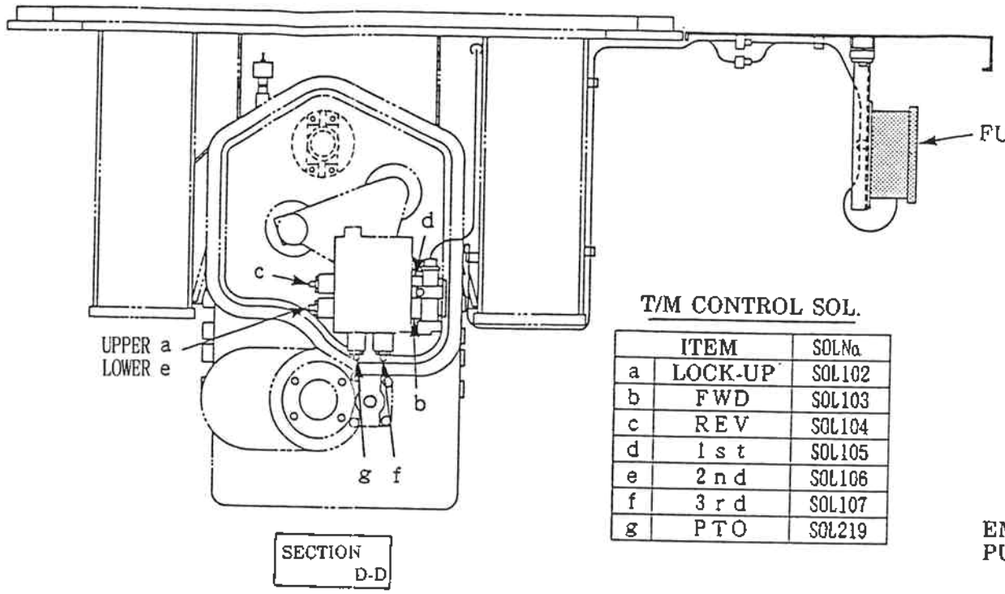


※P. T. O/NR SOL.

	P.T.O ON	P.T.O OFF	
		H3rd	H3rd EXCEPT
P.T.O SOL 208	○	×	×
NR SOL 115	×	×	○
ENGINE r.p.m.	1500	1800	Full 2200



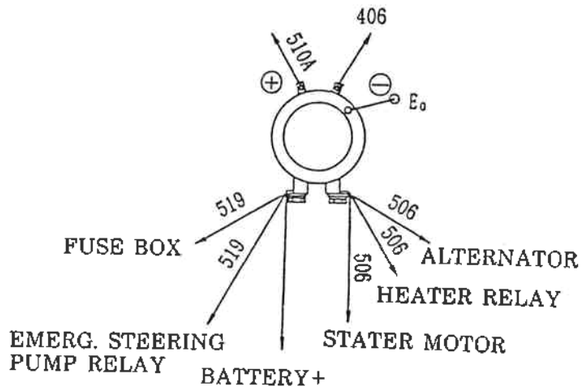
VIEW FROM A



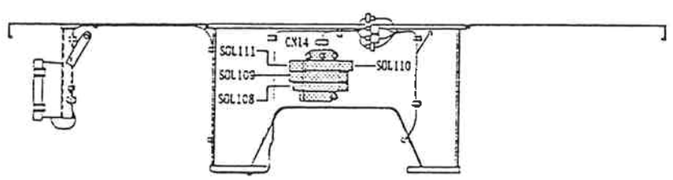
SECTION D-D

T/M CONTROL SOL.

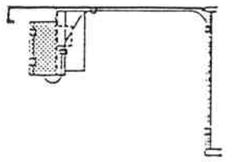
	ITEM	SOLNo.
a	LOCK-UP	SOL102
b	FWD	SOL103
c	REV	SOL104
d	1st	SOL105
e	2nd	SOL106
f	3rd	SOL107
g	PTO	SOL219



BATTERY RELAY



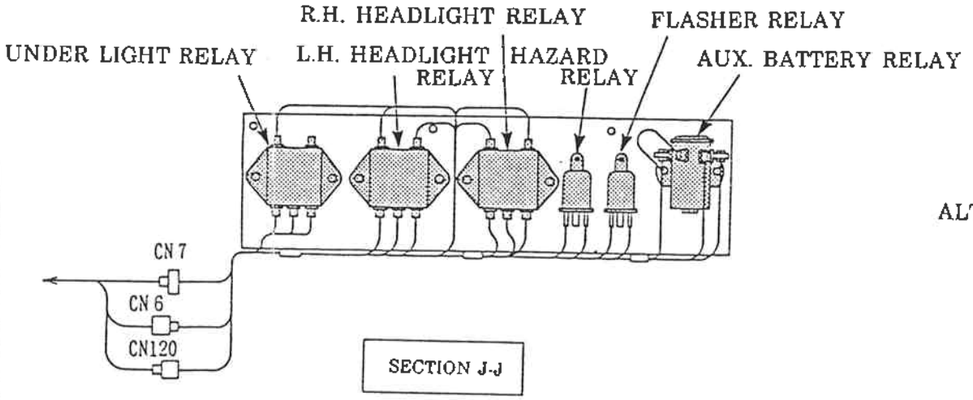
OUTRIGGER CONTROL BOX



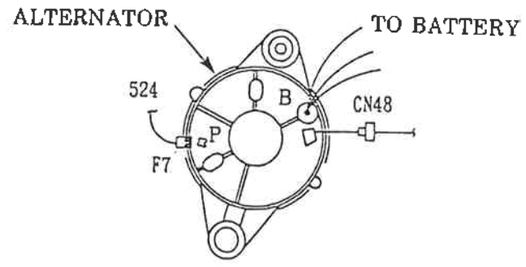
SECTION B-B

STEERING CONTROL VALVE

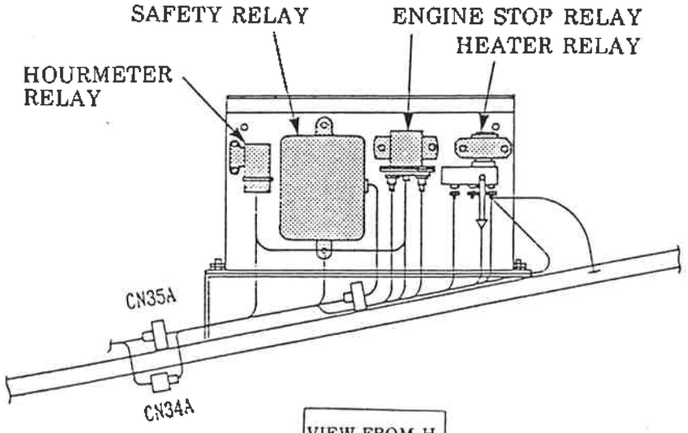
WIRE NO.	49	50	44	45
SOLNo. / MODE	SOL108 (SOL 1B)	SOL109 (SOL 2B)	SOL110 (SOL 3A)	SOL111 (SOL 3B)
FRONT 2 WHEEL				
CRAB				○
CRAMP			○	
2 WHEEL REVERSE	○			○
CRAMP REVERSE		○		○
REAR 2 WHEEL	○		○	
REAR 2 WHEEL REVERSE		○		



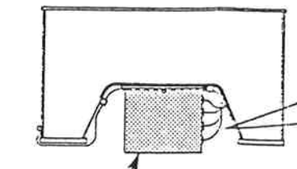
SECTION J-J



VIEW FROM G

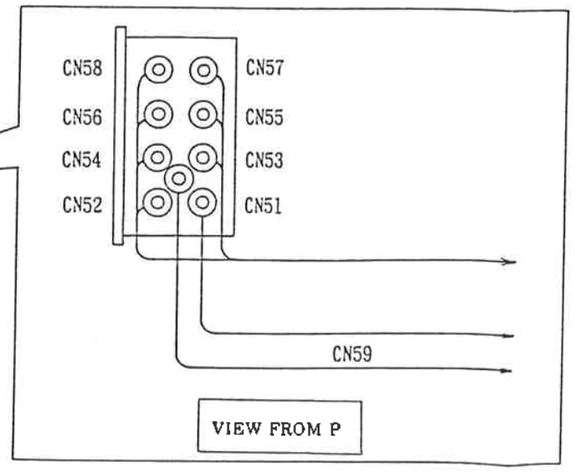


VIEW FROM H



MDT (MULTIPLEX DATA TRANSMISSION) LOWER UNIT

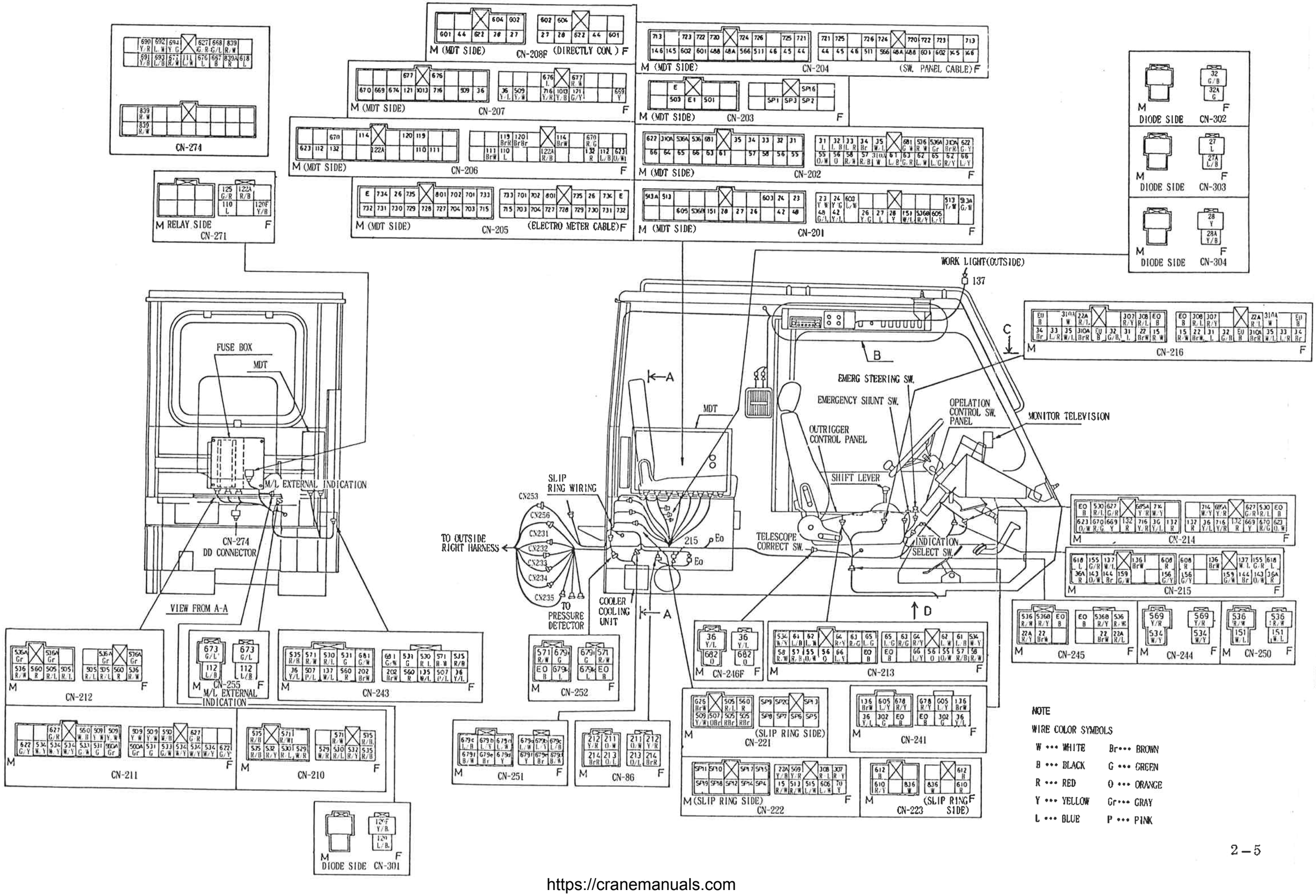
SECTION E-E



VIEW FROM P

2. 2 CONNECTION OF ELECTRICAL APPARATUS

(1) UPPER HARNESS CONNECTION IN CAB (1/2)

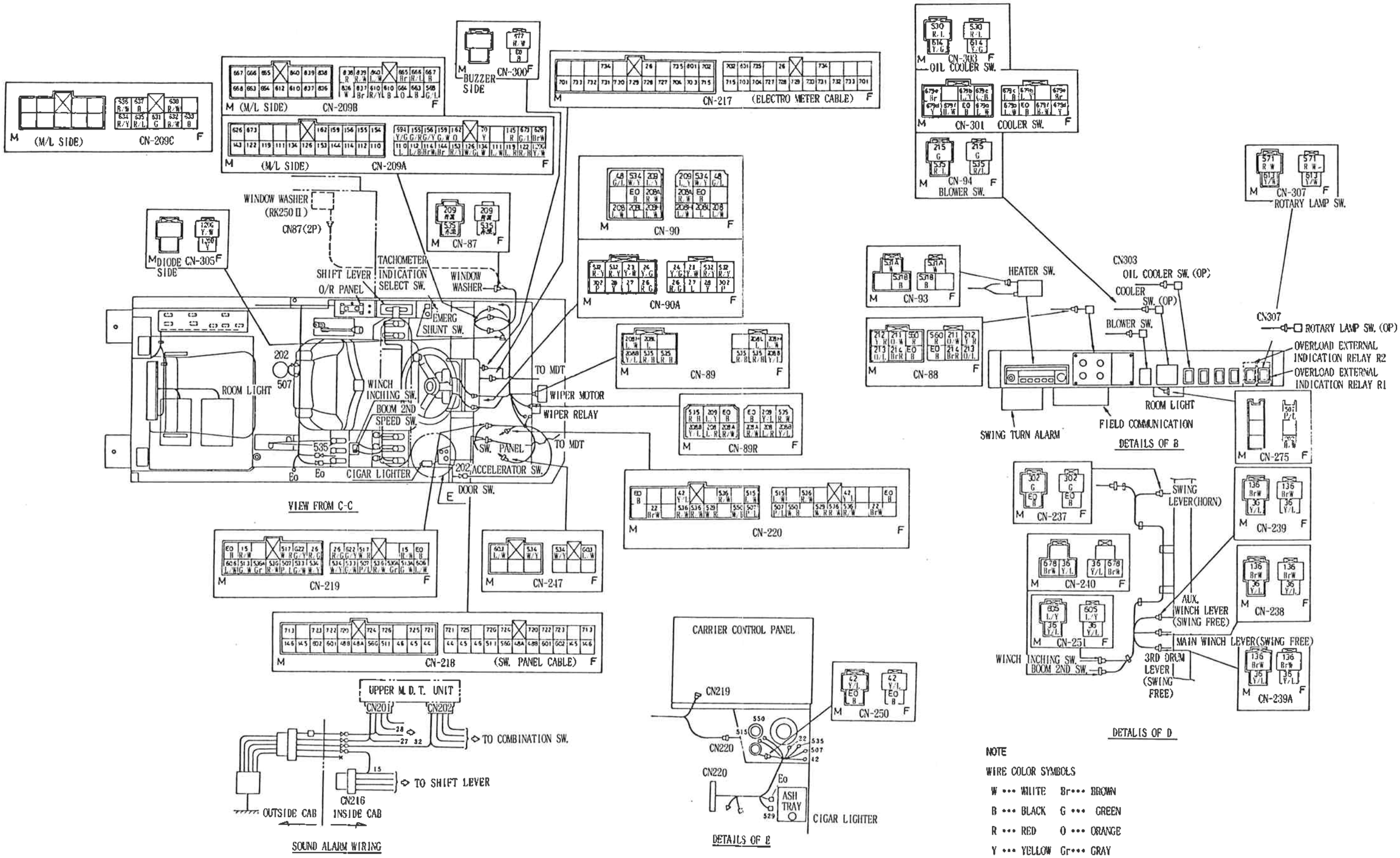


NOTE

WIRE COLOR SYMBOLS

W ••• WHITE	Br••• BROWN
B ••• BLACK	G ••• GREEN
R ••• RED	O ••• ORANGE
Y ••• YELLOW	Gr••• GRAY
L ••• BLUE	P ••• PINK

UPPER HARNESS CONNECTION IN CAB (2/2)

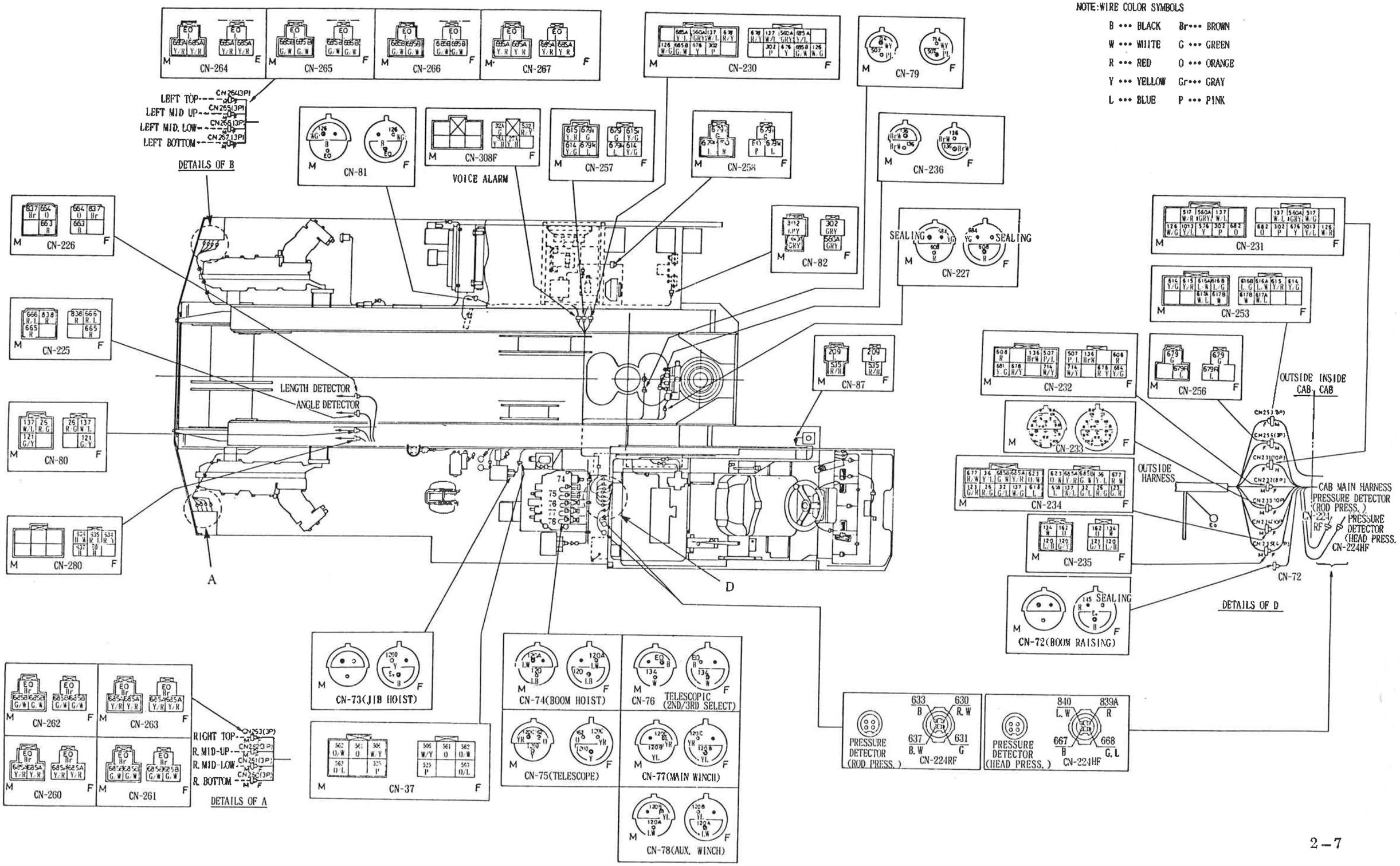


NOTE

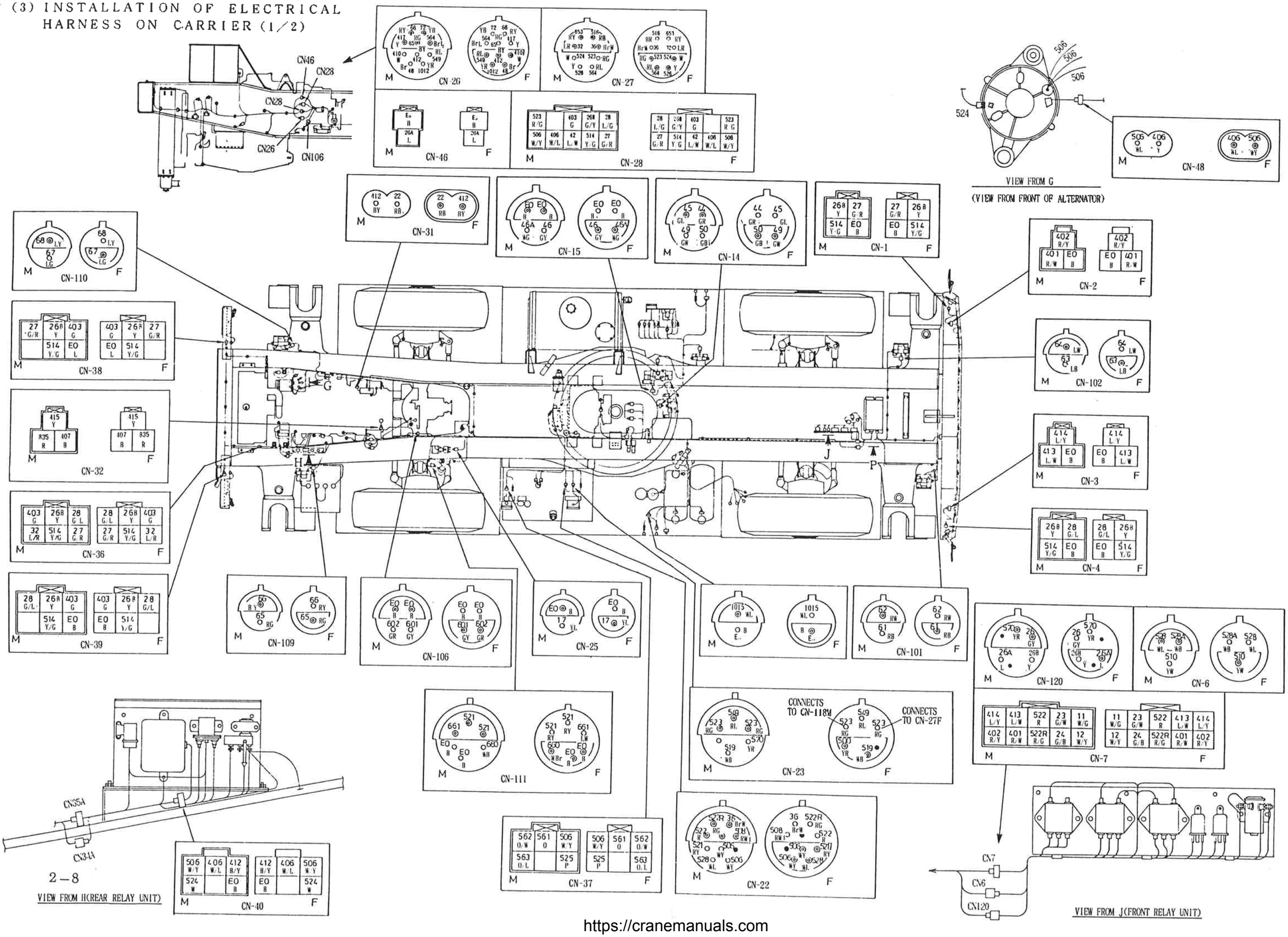
WIRE COLOR SYMBOLS

W ••• WHITE	Br••• BROWN
B ••• BLACK	G ••• GREEN
R ••• RED	O ••• ORANGE
Y ••• YELLOW	Gr••• GRAY
L ••• BLUE	P ••• PINK

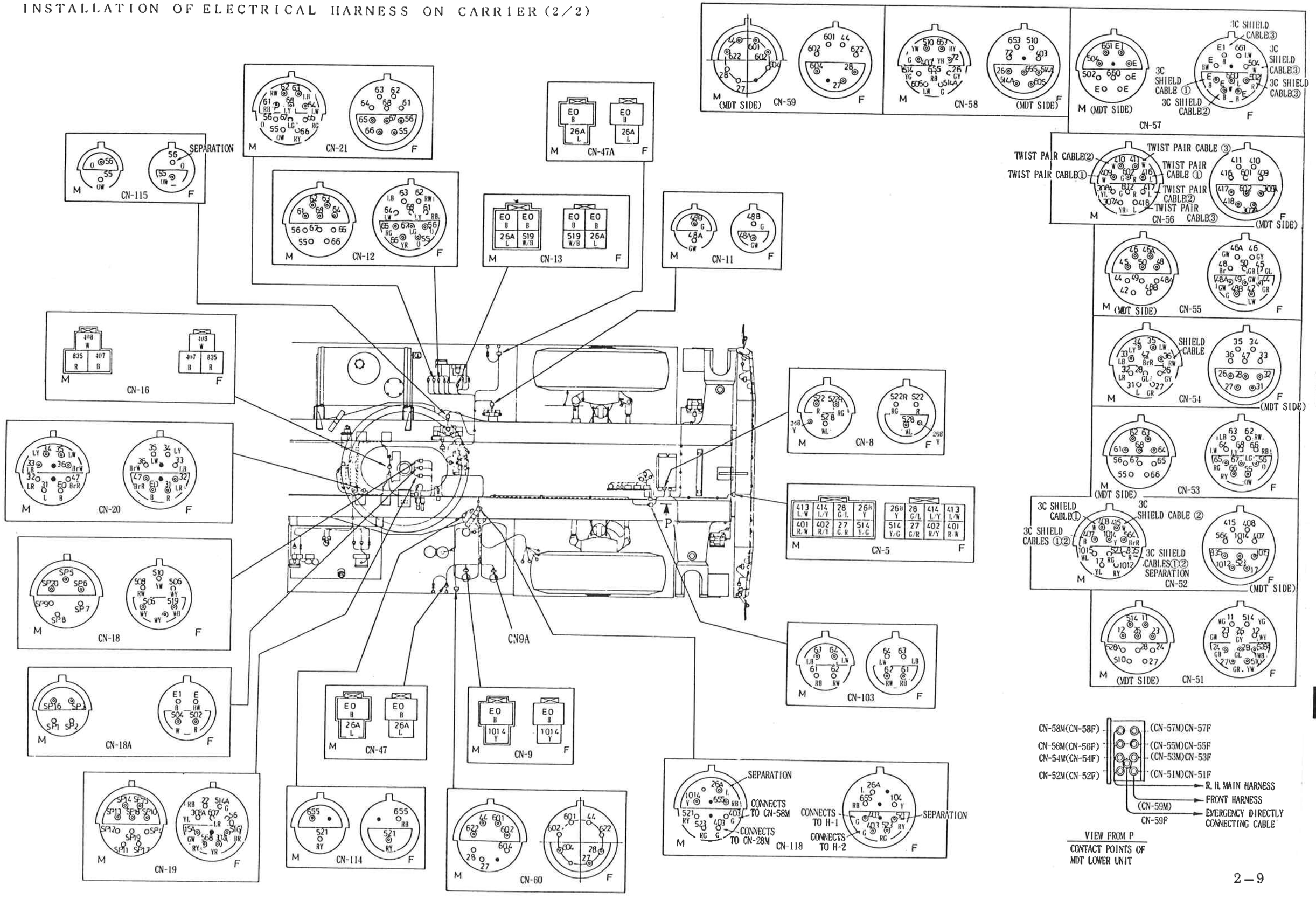
(2) UPPER HARNESS CONNECTION



(3) INSTALLATION OF ELECTRICAL HARNESS ON CARRIER (1/2)

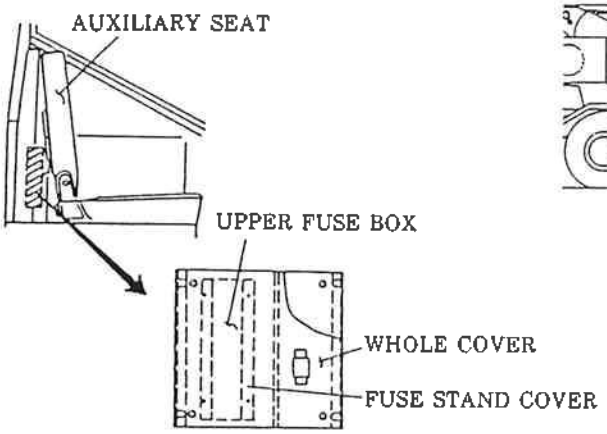


INSTALLATION OF ELECTRICAL HARNESS ON CARRIER (2/2)

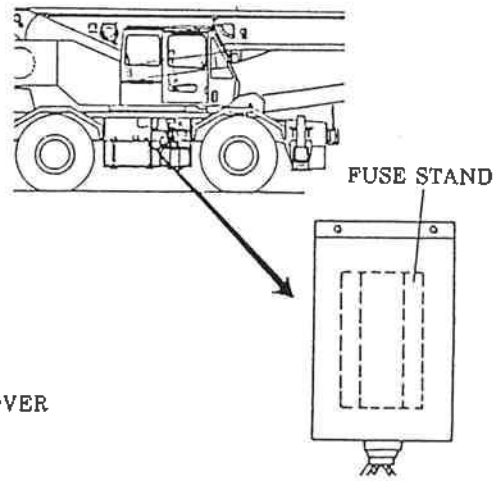


2.3 FUSES

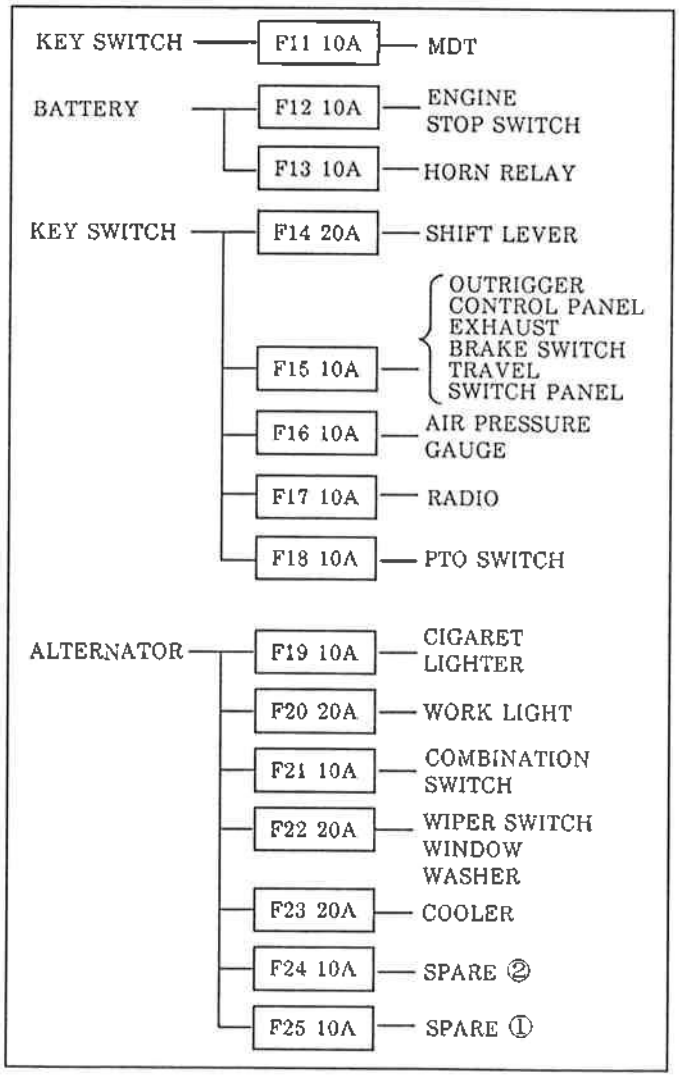
OPERATOR'S ROOM SIDE
(UPPER FUSE BOX)



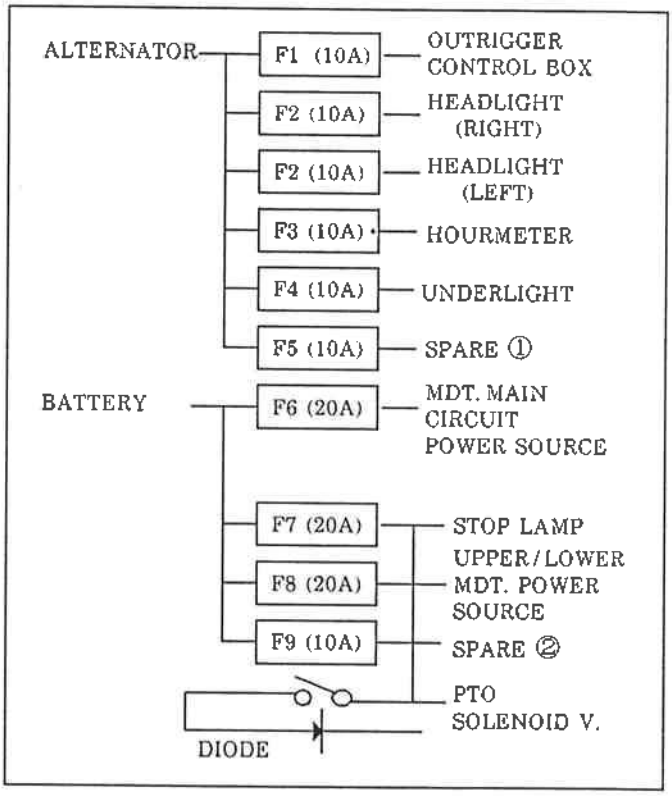
LOWER CARRIER SIDE
(LOWER FUSE BOX)



STICKER (BACK OF FUSE STAND COVER)



STICKER (BACK OF FUSE STAND COVER)

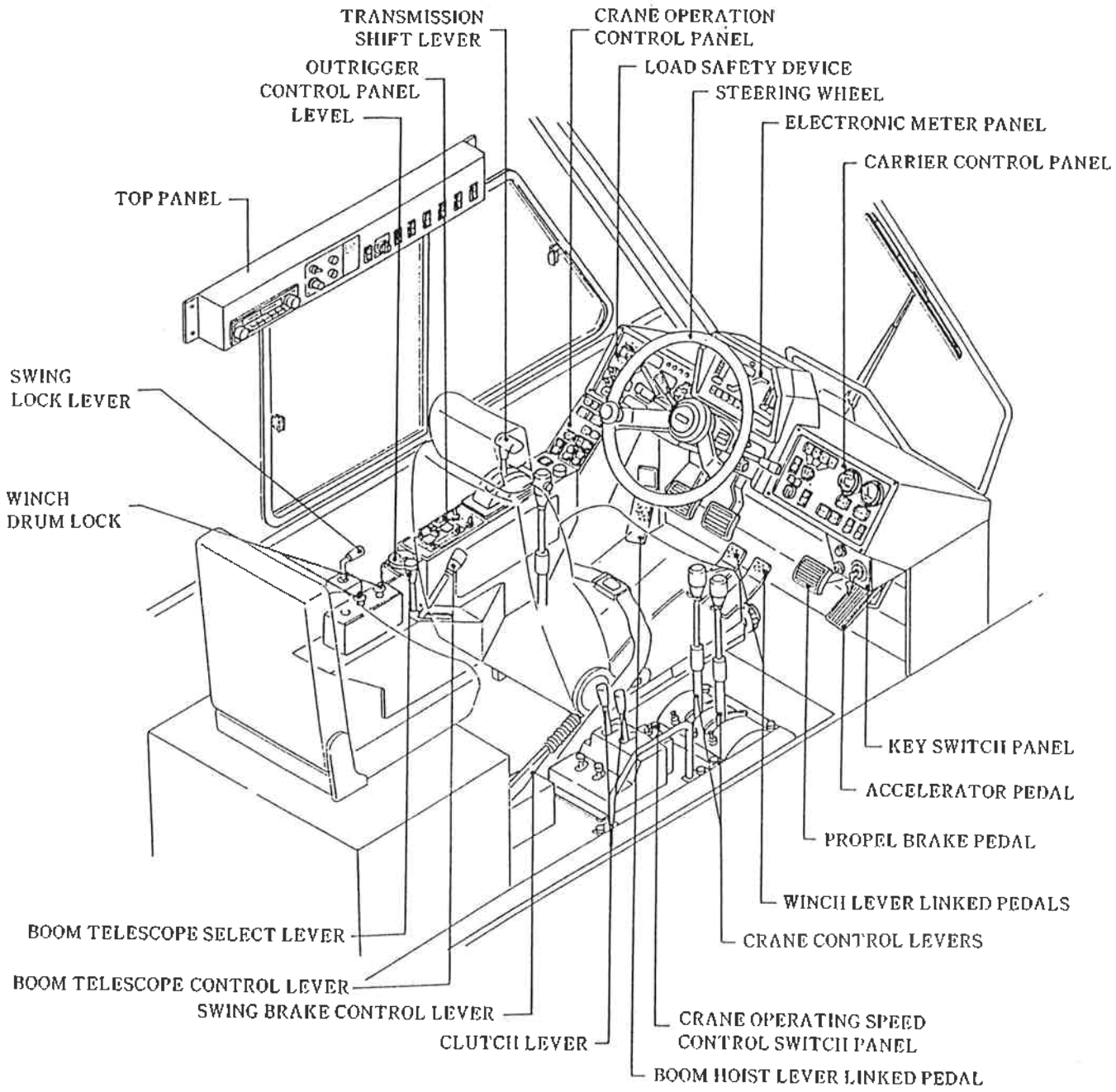


⇨ The fuses used in this machine are automotive fuses of 10 ampere and 20 ampere.

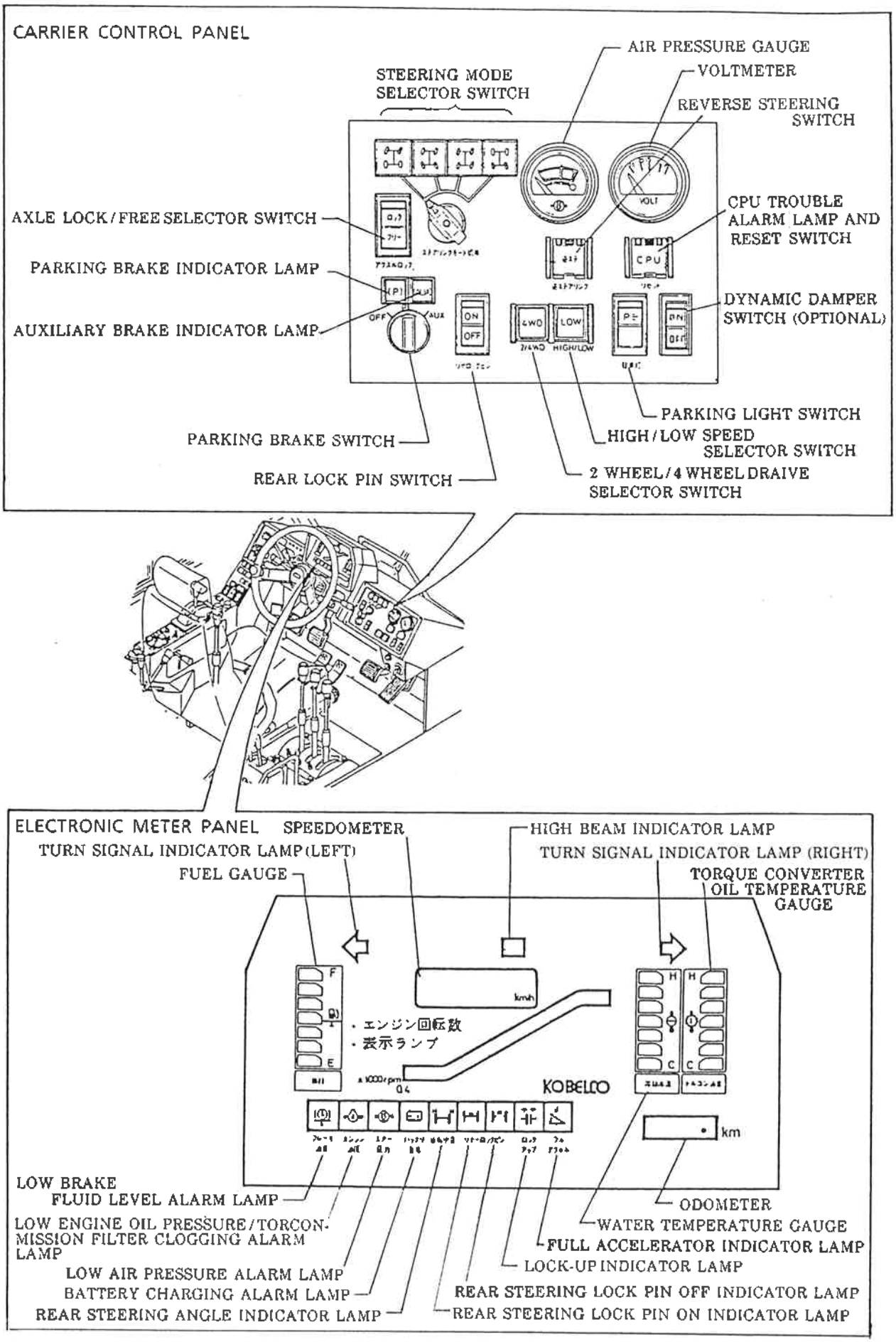
In the case that the same fuse is frequently burnt out, it is considered that the cause is not determined and not repaired. In such a case, absolutely do not the burnt fuse simply with a fuse over the specified capacity. This could burn even the wiring and electrical apparatus.

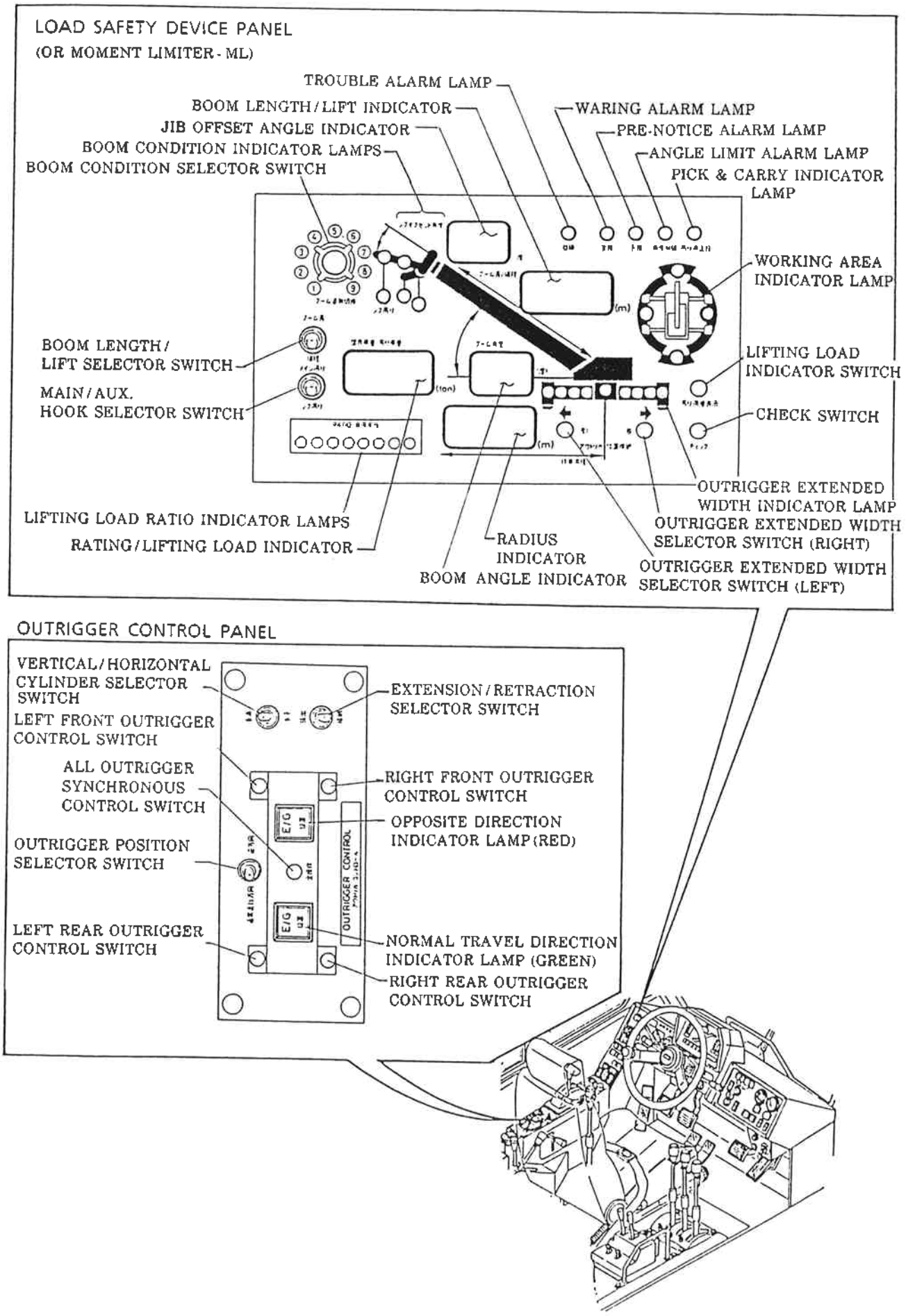
3. OPERATION OF ELECTRICAL APPARATUS

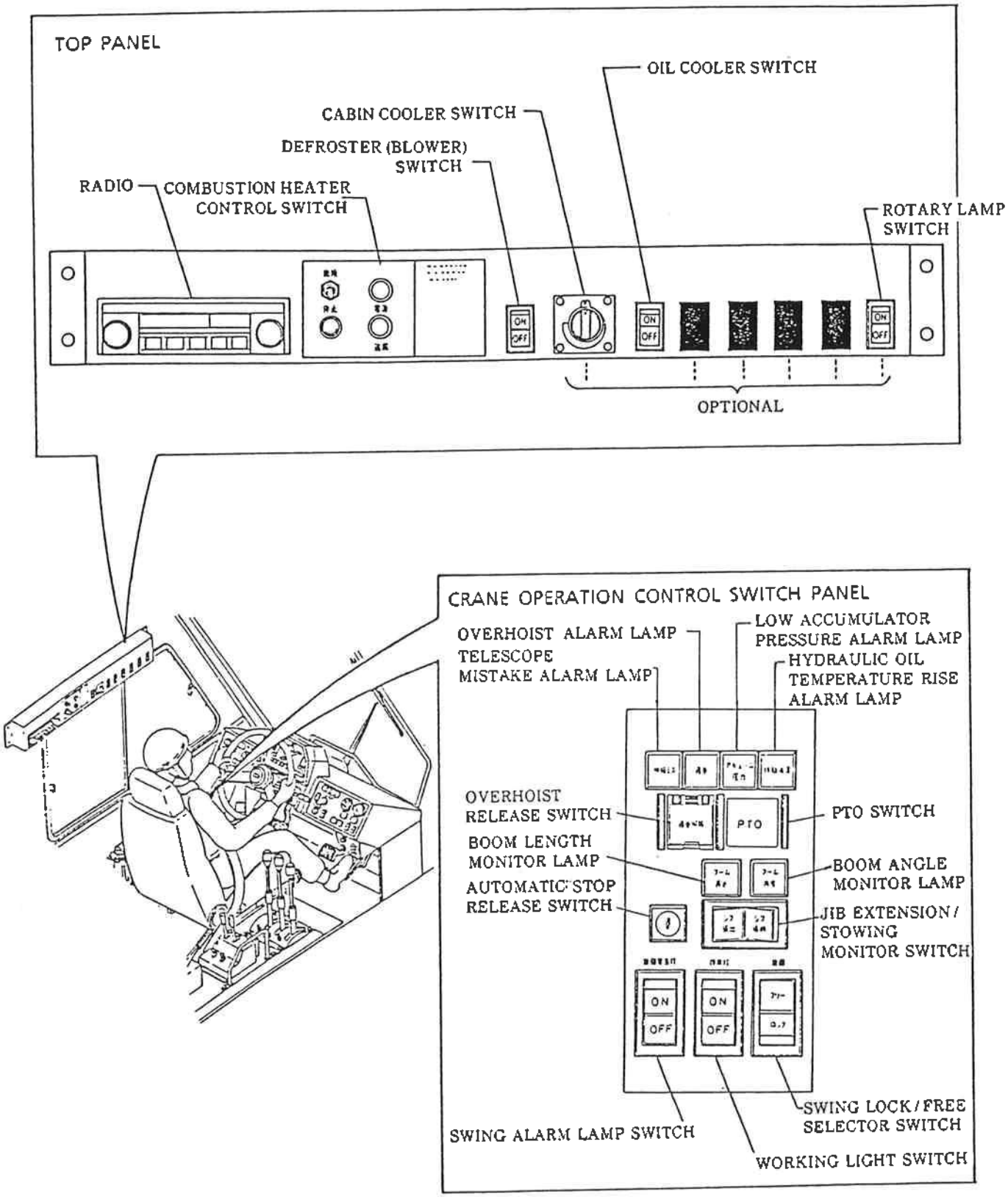
3.1 OUTLINES OF APPARATUS



☞ Arrangement of levers and pedals is changed according to specification.







4. MULTIPLEX DATA TRANSMISSION SYSTEM

4.1 MULTIPLX DATA TRANSMISSION (M.D.T) SYSTEM

(1) In the hydraulic truck crane the transmission and receipt of electrical signals between the upper and the lower are generally conducted through the slip rings.
Besides, in the case that the transmission and receipt of operation signals to the lower (carrier) and various sensor signals from the carrier are conducted in the rough terrain crane, transmitting each signal respectively through one slip ring requires massive slip rings.

Therefore, excluding the electric power source, earth and other basic circuits, most of signals are transmitted between the upper and the lower through electronic treatment with micro computers. That is, the system of combining and transmitting many digitalized signals as one digital signal through one slip ring (one transmitting line) is adopted. We call this system as Multiplex Data Transmission (M.D.T) System.
Fig. 4-1 is a block diagram showing this multiplex data transmission system.

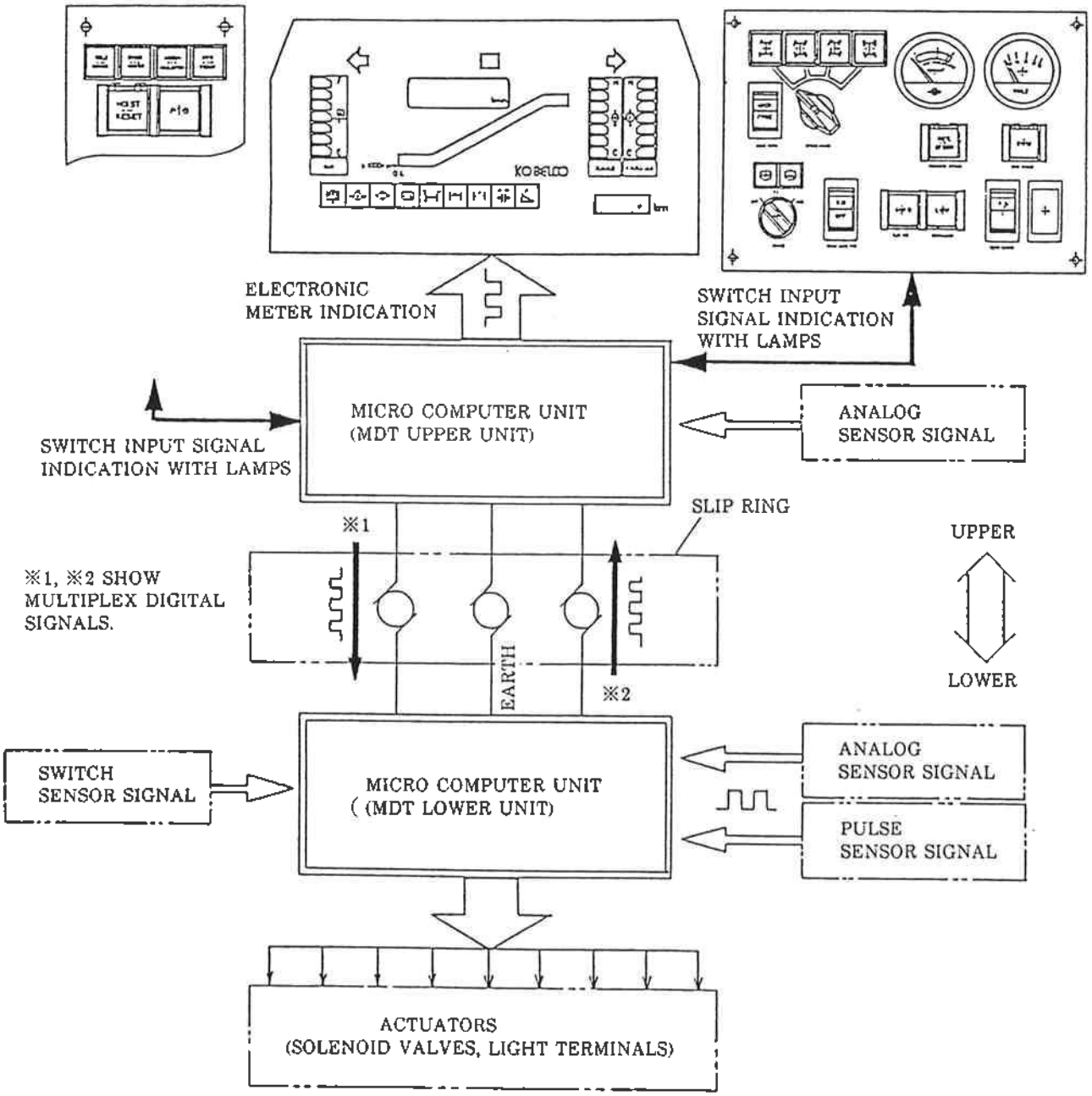


Fig. 4-1 Outlines of Multiplex Data Transmission System

(2) By adopting this multiplex data transmission system, the following measures also are available.

(A) Function of Interlock

- By input of one switch operation signal, combined output of more than two signals can be issued.
- Operation with condition is conducted, such as, when input of combined operation signal is operated, if this combination becomes the dangerous side as the operating condition, this signal is not issued to the lower side.

(B) Function of Error Check (Watch)

In this system, when abnormality (error) such as abnormal voltage of the electric power disconnection of the signal wire, or incongruousness of the signal and action, etc., the control section of the micro computer has functions to detect this abnormality, and to take measure to prevent the machine from wrong operation, and further of watching in order to indicate and warn occurrance of troubles.

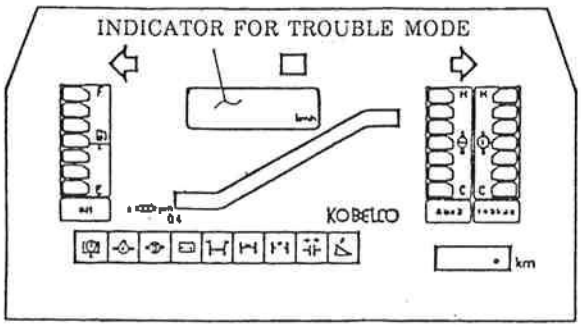
These functions are controlled by ROM (read-only-memory) which remembers the basic function and CPU (central processing unit) which computes and indicates execution.

By this, this machine is designed so that it does not run away even if electrical trouble would occur in this system.

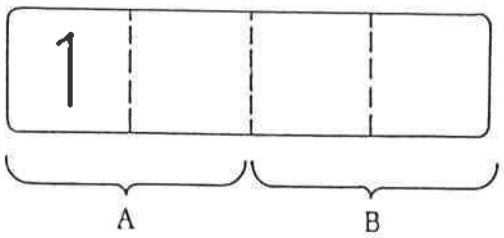
Further, this system has also function to indicate trouble code which will be a help to quick service follow for reference of troubleshooting when electrical trouble occurs.

Indicator Lamp and Reset Switch for CPU Trouble

Condition	Indicator lamp
CPU trouble	Lights up (red).
Normal	Does not light.



[Example of Indication for Trouble Mode]

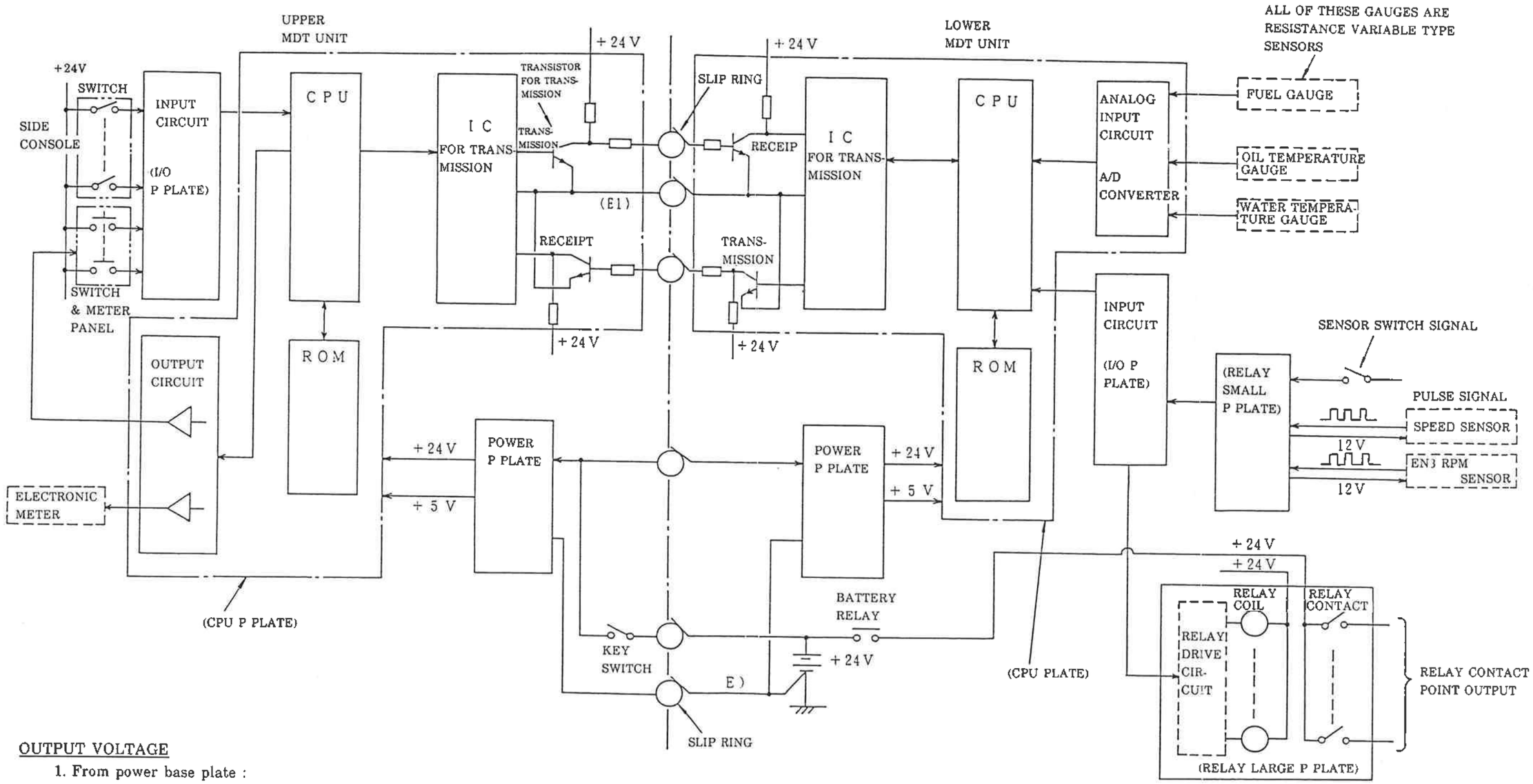


A ~ shows trouble of upper unit.
B ~ shows trouble of lower unit.

Fig. 4-2

4.2 ARRANGEMENT

(1) BLOCK DIAGRAM



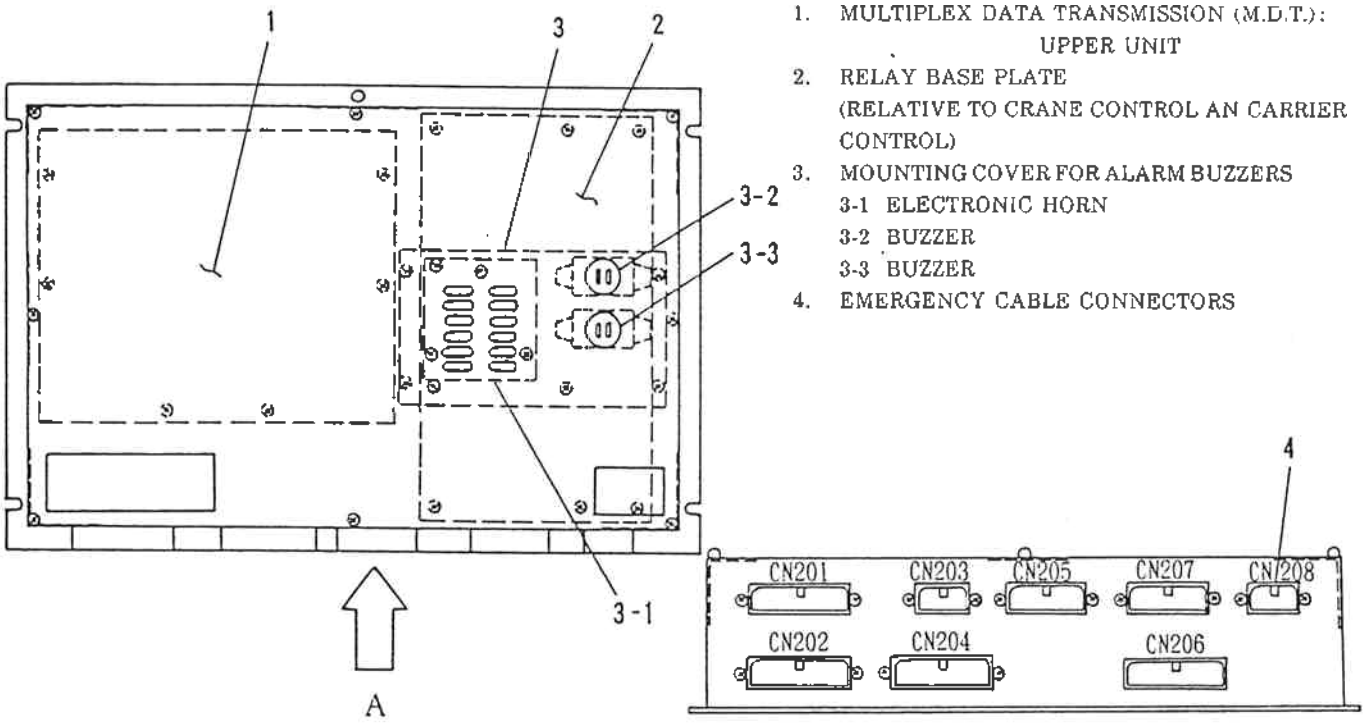
OUTPUT VOLTAGE

1. From power base plate :
   - +24V .... Action, relay and transmission.
   - +5V ..... Power for CPU control, bar indication relative to operation amplifier and analog sensors (fuel gauge, oil temperature gaug and water temperature gauge).
2. From R (small) base plate (lower CPU) :
   - +12V .... Power for pulse sensors (speed and engine rpm).

Fig. 4-3 Block Diagram of Transmission System

(2) UPPER MULTIPLEX DATA TRANSMISSION UNIT

1. Whole Construction



1. MULTIPLEX DATA TRANSMISSION (M.D.T.): UPPER UNIT
2. RELAY BASE PLATE (RELATIVE TO CRANE CONTROL AN CARRIER CONTROL)
3. MOUNTING COVER FOR ALARM BUZZERS
   3-1 ELECTRONIC HORN
   3-2 BUZZER
   3-3 BUZZER
4. EMERGENCY CABLE CONNECTORS

Fig. 4-4

2. Construction of Upper Unit

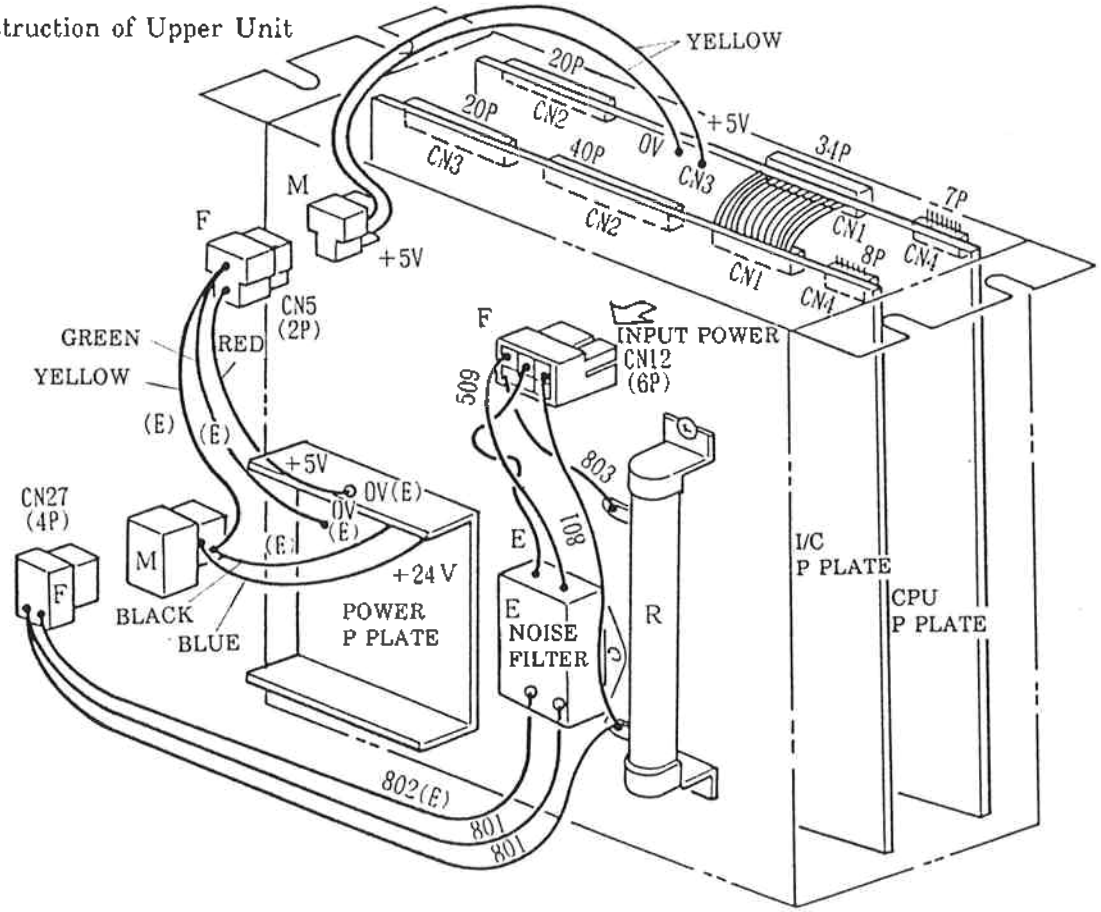
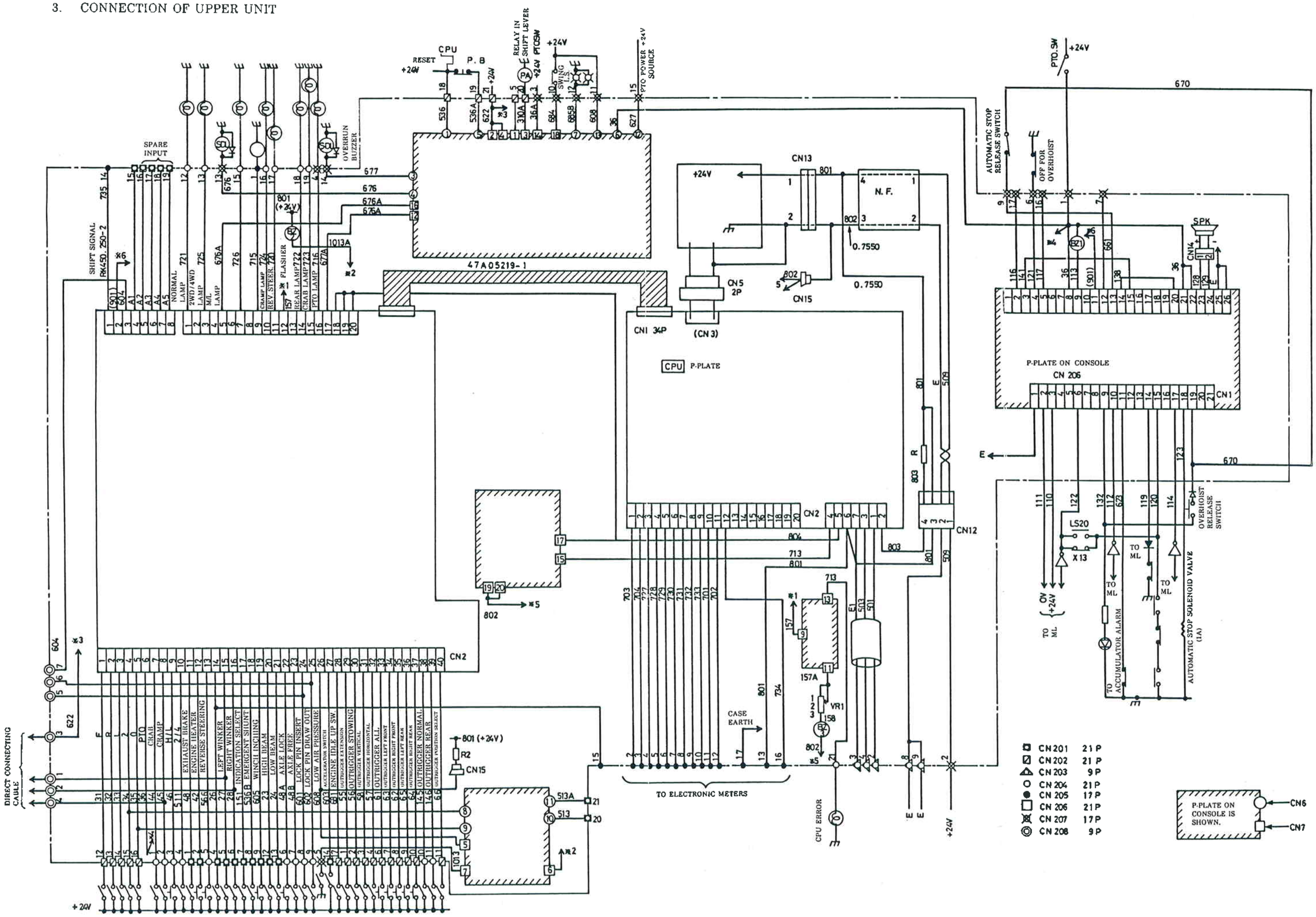


Fig. 4-5

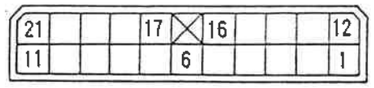
3. CONNECTION OF UPPER UNIT



4. Arrangement of Pins

CN201

Cap Housing 172517-1 White 21P AMP

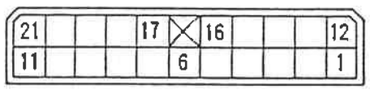


Plug Housing 172501-1 White 21P AMP

Pin No.	Wire No.	Specification
1	48	Exhaust brake
2	42	Engine heater
3		
4	26	Clearance light
5	27	Left winker
6	28	Right winker
7	151	Indication change
8	536B	Emergency shunt
9	605	Winch inching
10		
11		
12	23	High beam
13	24	Low beam
14	603	Accelerator SW.
15	A1	Spare input
16	A2	
17	A3	
18	A4	
19	A5	
20	513	Parking light (SP14)
21	513A	Parking light (SW)

CN202

Cap Housing 172517-1 White 21P AMP

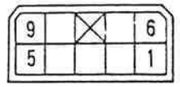


Plug Housing 172501-1 White 21P AMP

Pin No.	Wire No.	Specification
1	55	Outrigger extension
2	56	Outrigger retraction
3	58	Outrigger vertical
4	57	Outrigger horizontal
5		
6	61	Outrigger
7	63	Outrigger left front
8	62	Outrigger right front
9	65	Outrigger left rear
10	64	Outrigger right rear
11	66	Outrigger position selection
12	31	Shift F
13	32	Shift R
14	33	Shift L
15	34	Shift 2
16	35	Shift D
17	681	Engine idle up
18	536	Contact between Key SW. (×2 : 1st)
19	536A	Contact between ×2 : 2nd (F14)
20	310A	Contact between ×2 : 2nd shift lever
21	622	F6 (×2 : 1st)

CN203

Cap Housing 172513-1 White 9P AMP

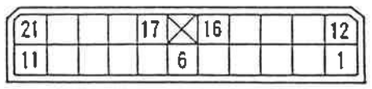


Plug Housing 172496-1 White 9P AMP

Pin No.	Wire No.	Specification
1		
2	501	
3	E1	
4	503	
5		
6		
7		
8	E	
9	E	

CN204

Cap Housing 172517-1 White 21P AMP

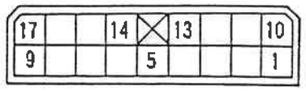


Plug Housing 172501-1 White 21P AMP

Pin No.	Wire No.	Specification
1	44	Crab
2	45	Cramp
3	46	H/L
4	511	2/4
5	566	Reverse steering
6	48A	Axle lock
7	48B	Axle free
8	601	Lock pin IN
9	602	Lock pin OUT
10	145	Outrigger normal
11	146	Outrigger rear
12	721	Normal lamp
13	725	2/4 lamp
14		
15	726	H/L lamp
16	724	Cramp lamp
17	720	Reverse steering lamp
18	722	Rear lamp
19	723	Crab lamp
20		
21	713	CPU error lamp

CN205

Cap Housing 172516-1 White 17P AMP

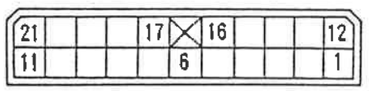


Plug Housing 172500-1 White 17P AMP

Pin No.	Wire No.	Specification
1	715	Counter
2	703	Data
3	704	
4	727	
5	728	
6	729	
7	730	
8	731	
9	732	
10	733	
11	701	+5V
12	702	0V
13	801	+24V
14	735	RK450/RK250II Shift signal
15	26	Night light
16	734	Data
17	Earth	

CN206

Cap Housing 171367-1 White 21P AMP

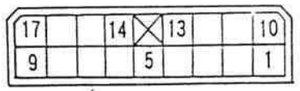


Plug Housing 172501-1 White 21P AMP

Pin No.	Wire No.	Specification
1	E	
2	111	0V (to ML)
3	110	+24V (to ML)
4		
5		
6	122	145% signal (to ML)
7		
8	123	Stop solenoid valve
9	132	Overhoist lamp (OK mon), overhoist release sw.
10	112	90%, 100% alarm singal (to ML)
11	623	Accumulator alarm
12		
13		
14	119	Stop signal (to ML)
15	120	Boom hoist lever limit switch
16		
17	114	Telescope mistake signal (to ML)
18	123	Stop solenoid valve
19	670	Stop release (control device)
20		
21		

CN207

Cap Housing 172516-1 White 17P AMP

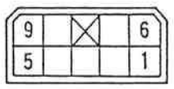


Plug Housing 172500-1 White 17P AMP

Pin No.	Wire No.	Specification
1	36	+24V (to outside)
2	509	+24V (F14)
3	36A	PTO SW.
4	716	PTO lamp
5	1013	LO air SW.
6	121	Overhoist limit switch
7		
8		
9	669	Control device (stop release switch)
10	684	Swing limit switch
11	608	Power for swing alarm light
12	685B	Swing alarm light
13	676	Dynamic damper (engine rpm, judge)
14	677	Engine overrun buzzer signal
15	627	Power for PTO
16		
17		

CN208

Cap Housing 172513-1 White 9P AMP

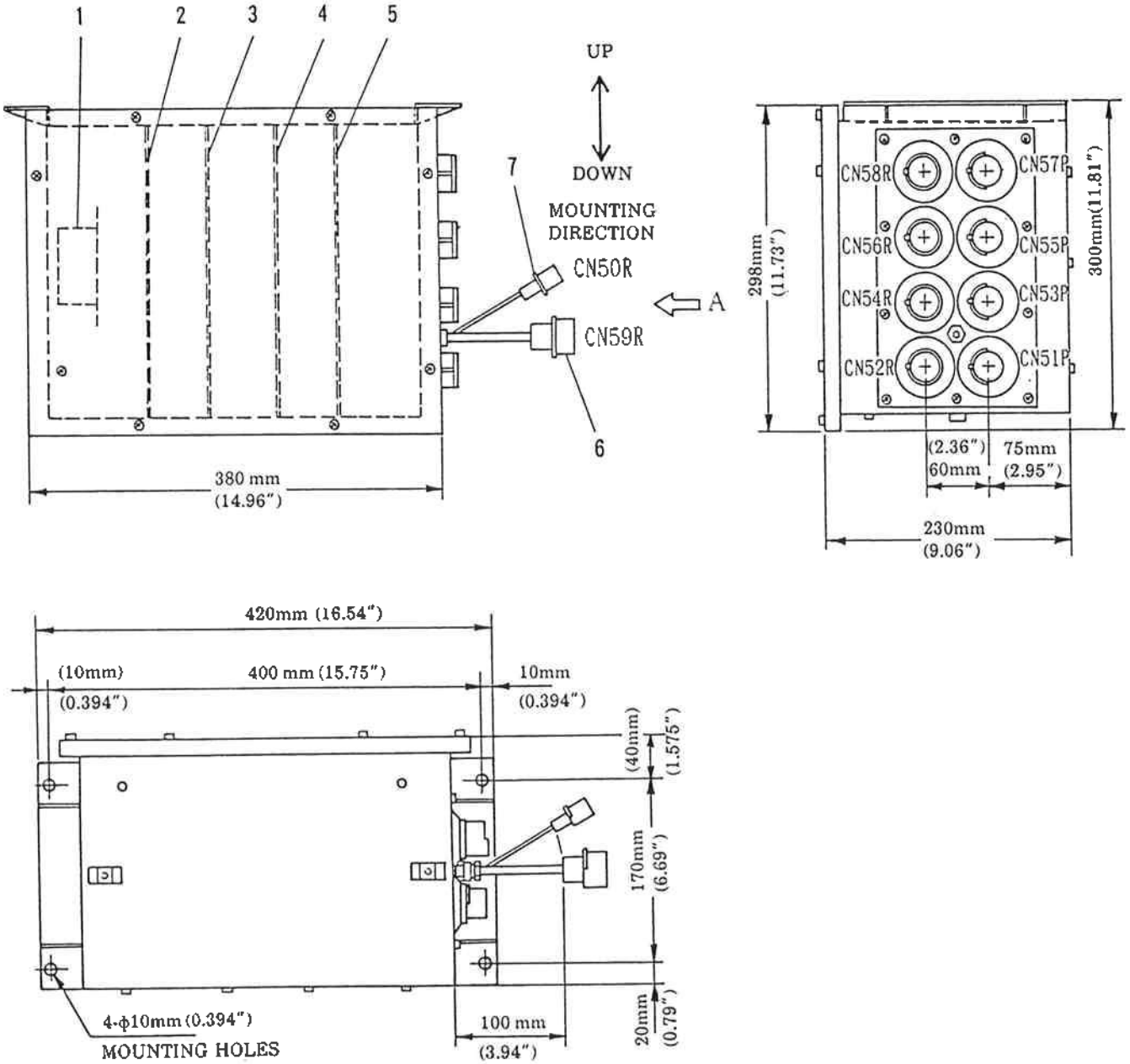


Plug Housing 172496-1 White 9P AMP

Pin No.	Wire No.	Specification
1	27	Left winker
2	28	Right winker
3	622	+24V
4	45	Cramp
5	601	Lock pin IN
6	602	Lock pin OUT
7	604	Cable signal
8		
9		

(3) CONSTRUCTION OF LOWER MULTIPLEX DATA TRANSMISSION

1. Whole Construction



1. POWER SOURCE BASE PLATE
2. CPU (COMPUTER) BASE PLATE
3. I/O (INPUT/OUTPUT) BASE PLATE
4. RELAY (SMALL) BASE PLATE
5. RELAY (LARGE) BASE PLATE
6. EMERGENCY CABLE CONNECTOR
7. SPARE

Fig. 4-6

2. Construction of Lower Unit

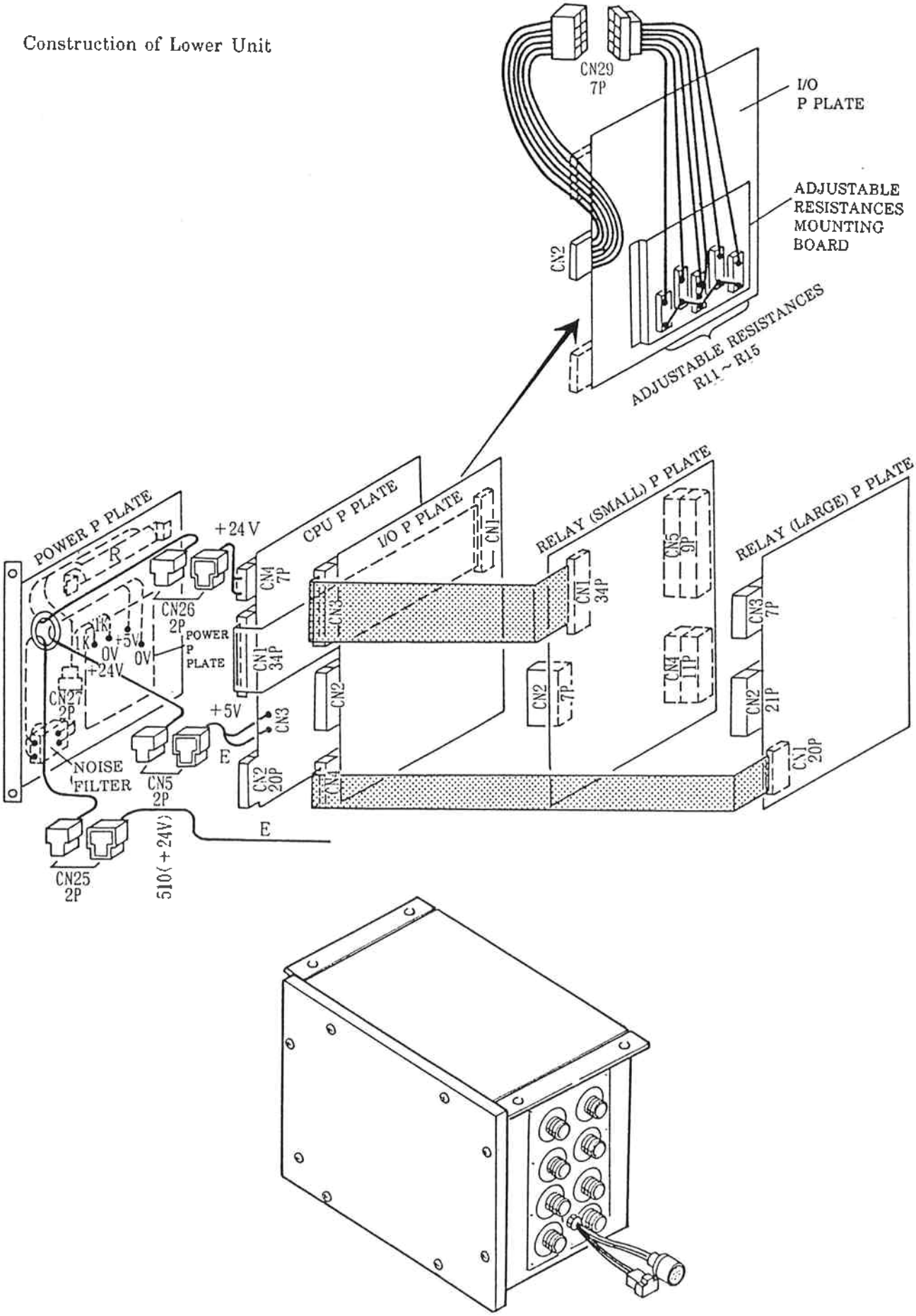
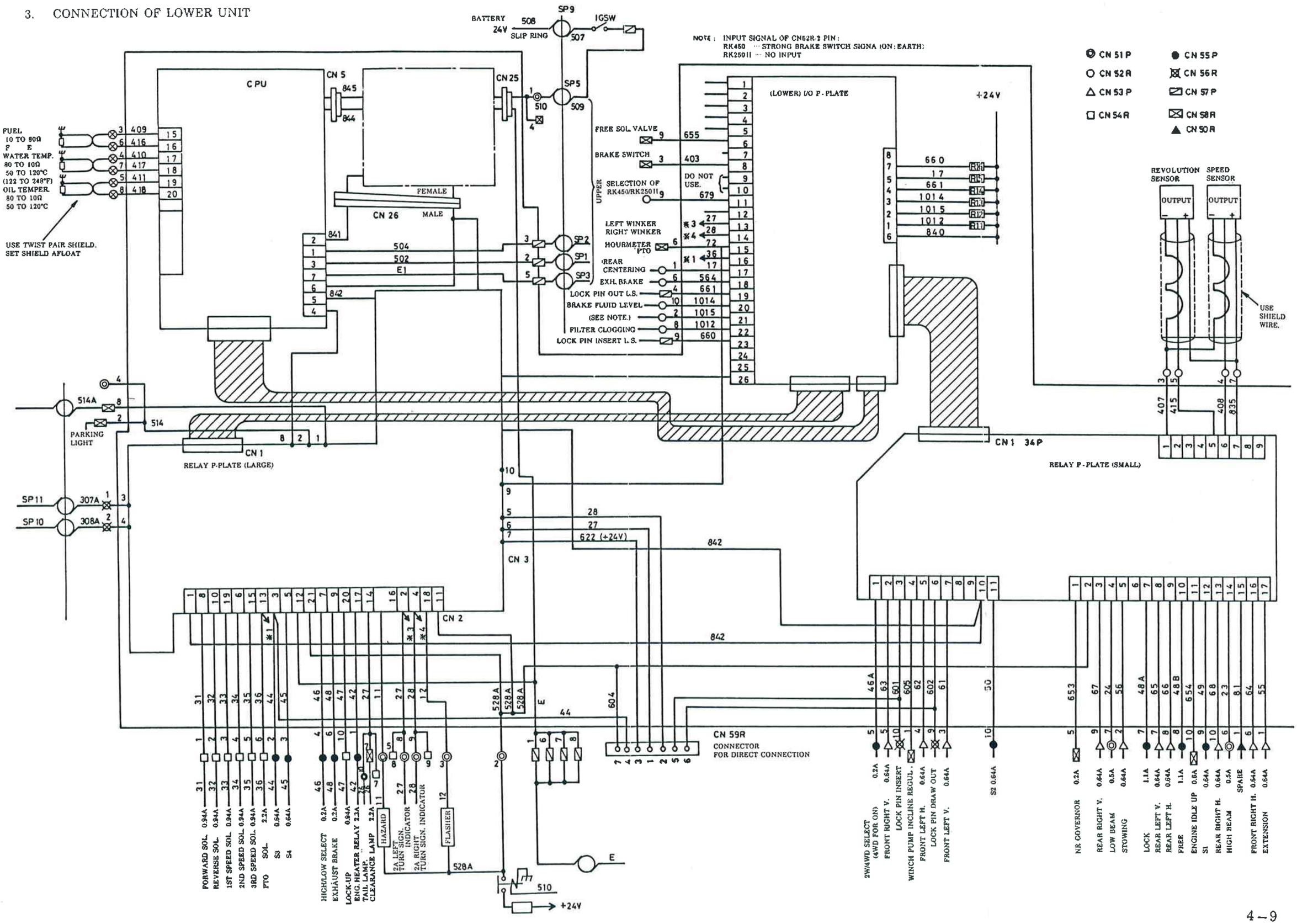
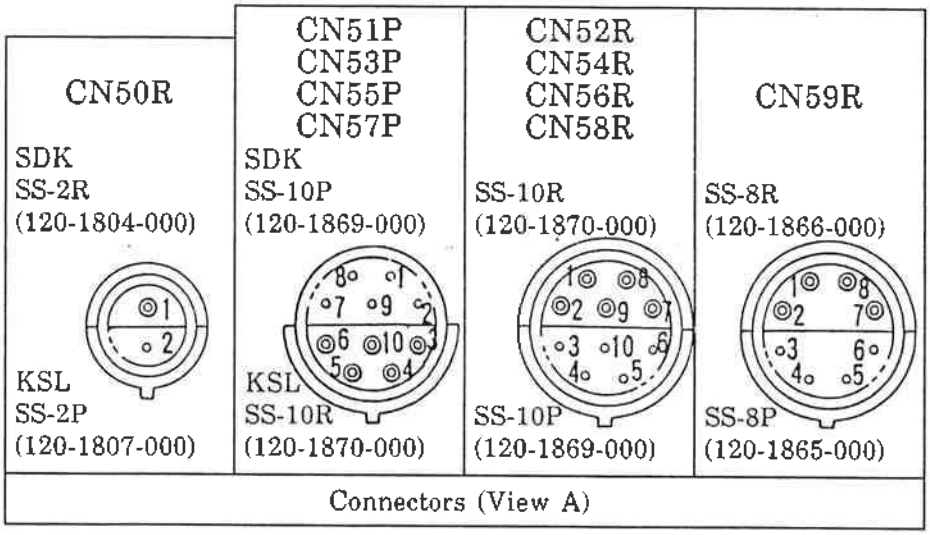


Fig. 4-7 Construction of Lower Unit

3. CONNECTION OF LOWER UNIT



4. Arrangement of Connector Pins



Connectors (View A)

CN50R	
Location	Wire No.
1	B1
2	

CN51P	
Location	Wire No.
1	510
2	528A
3	12
4	514
5	11
6	23
7	24
8	27
9	28
10	26

CN52R	
Location	Wire No.
1	17
2	1015
3	407
4	408
5	415
6	564
7	835
8	1012
9	679
10	1014

CN53P	
Location	Wire No.
1	55
2	56
3	61
4	62
5	63
6	64
7	65
8	66
9	67
10	68

CN54R	
Location	Wire No.
1	31
2	32
3	33
4	34
5	35
6	36
7	26
8	27
9	28
10	47

CN55P	
1	42
2	44
3	45
4	46
5	46A
6	48
7	48A
8	48B
9	49
10	50

CN56R	
1	307A
2	308A
3	409
4	410
5	411
6	416
7	417
8	418
9	602
10	601

CN57P	
1	E
2	502
3	504
4	661
5	E1
6	E
7	E
8	E
9	660
10	

CN58R	
1	605
2	514
3	403
4	510
5	653
6	72
7	26
8	514A
9	655
10	654

CN59R	
1	27
2	28
3	622
4	44
5	601
6	602
7	604

4.3 INPUT AND OUTPUT TABLE OF MULTIPLEX DATA TRANSMISSION

(1) UPPER UNIT

Input			Output		
NO	Name	Remarks	NO	Name	Remarks
1	Combination switch (high)	24V S.W. input	1	Combination switch (high)	24V pulse
2	Combination switch (low)	24V S.W. input	2	Flusher buzzer	24V buzzer
3	Lighting switch (1 step) (clearance)	24V S.W. input	3	Engine overrun buzzer	24V buzzer
4	Combination switch (right flasher)	24V S.W. input	4	Rev. steering indication	24V lamp
5	Combination switch (left flasher)	24V S.W. input	5	Steering, normal indication	24V lamp
6	Shift lever, forward.	24V S.W. input	6	Steering, rear indication	24V lamp
7	Shift lever, reverse	24V S.W. input	7	Steering, crab indication	24V lamp
8	Shift lever, D	24V S.W. input	8	Steering, cramp indication	24V lamp
9	Shift lever, 2nd	24V S.W. input	9	H/L indication	24V lamp
10	Shift lever, L	24V S.W. input	10	2WD/4WD indiction	24V lamp
11	PTO	24V S.W. input	11	PTO indication	24V lamp
12	Steering, normal	24V S.W. input	12	CPU trouble indication	24V lamp
13	Steering, rear	24V S.W. input	13		
14	Steering, crab	24V S.W. input	14	Dynamic damper	24V volt output
15	Steering, cramp	24V S.W. input			
16	Engine air heater	24V S.W. input	※	Lock pin abnormality buzzer is common to 2 above.	
17	H/L shift	24V S.W. input			
18	2WD/4WD selection	24V S.W. input			
19	Exhaust brake	24V S.W. input			
20	Axle switch, lock	24V S.W. input		Electronic Meter Indications	
21	Axle switch, free	24V S.W. input	1	Speed/tacho. indication	
22	Indication select. speed/tacho.	24V S.W. input	2	Unit indication, km/h	
23	Outrigger, extension	24V S.W. input	3		
24	Outrigger, storage	24V S.W. input	4	High beam indication	
25	Outrigger, vertical	24V S.W. input	5	Turn signal indicaition, right	
26	Outrigger, horizontal	24V S.W. input	6	Turn signal indication, left	
27	Outrigger, same time	24V S.W. input	7	Engine rpm indication	
28	Outrigger, left front	24V S.W. input	8	Fuel gauge	
29	Outrigger, right front	24V S.W. input	9	Water temperature gauge	
30	Outrigger, left rear	24V S.W. input	10	Oil temperature gauge	
31	Outrigger, right rear	24V S.W. input	11	Odometer (counter)	
32	Outrigger relative position selection	24V S.W. input	12	Low brake oil level indication	
33	Rear steering lock pin insertion	24V S.W. input	13		
34	Rear steering lock pin drawing out	24V S.W. input	14	Low engine oil pressure and T/C-T/M oil pressure indication	
35	Rev. steering selection	24V S.W. input	15	Low air pressure indication	
36	Winch inching speed	24V S.W. input	16	Battery charge indication	
37	Low air pressure	Earth input	17	Centering indication	
38	Emergent shunt	24V S.W. input	18	Rear steering lock pin insert. indic.	
39	Acceleration signal	24V S.W. input	19	Rear steering lock pin out indication	
40	Engine idling up switch	24V S.W. input	20	Lock-up indication	
41	RK250II/RK450 select. signal	24V S.W. input	21	Full-acceleration drive power	
42	Signal for lock pin connect. cable	24V S.W. input		Electronic meter drive power	5V
				Electronic meter drive power	24V

(2) LOWER UNIT

Input			Output		
No	Name	Remarks	No	Name	Remarks
1	Engine oil filter clogging	Earth input	1	High beam relay	24V relay drive
2			2	Low beam relay	24V relay drive
3	Low brake oil level	Earth input	3	Clearance light	24V lamp
4	Exhaust brake limit switch	24V coil voltage	4	Left flasher	24V lamp
5	Rear steering limit switch	Earth input	5	Right flasher	24V lamp
6	Strong brake switch (RK450 only)	Earth input	6	Forward SOL	24V SOL drive
7	Alternator generation	24V relay input	7	Reverse SOL	24V SOL drive
8	Rear steering lock pin insertion detecting limit switch	Earth input	8	1st SOL	24V SOL drive
9	PTO SOL feedback	24V coil voltage	9	2nd SOL	24V SOL drive
10	Left winker feedback	24V coil voltage	10	3rd SOL	24V SOL drive
11	Right winker feedback	24V coil voltage	11	PTO SOL	24V SOL drive
12	Rear steering lock pin drawing out detecting limit switch	Earth input	12	Steering S1 SOL	24V SOL drive
13	Swing lock pin insertion detecting limit switch	24V input	13	Steering S2 SOL	24V SOL drive
14	RK250II/RK450 select. signal	24V input	14	Steering S3 SOL	24V SOL drive
15	Brake SW. signal (When brake in on, switch in on)	24V input	15	Steering S4 SOL	24V SOL drive
16	Transmission oil pressure	Earth input	16	Engine heater	24V relay drive
			17	H/L SOL	24V SOL drive
			18	2WD/4WD SOL	24V SOL drive
	Pulse Signals		19	Exhaust brake SOL	24V SOL drive
1	Speed sensor	0/5V pulse signal	20	Axle lock SOL	24V SOL drive
2	Engine rotation sensor	0/5V pulse signal	21	Axle free SOL	24V SOL drive
			22	Torque conv. lock-up SOL	24V SOL drive
			23	Outrigger, ext. SOL	24V SOL drive
	Analog Signals		24	Outrigger, retr. SOL	24V SOL drive
1	Fuel sensor	10 ~ 80Ω 5V	25	Outrigger, L.Fr. Vert. SOL	24V SOL drive
2	Eng. cool. water temp. sensor	10 ~ 80Ω 5V	26	Outrigger, L.Fr. Hori. SOL	24V SOL drive
3	TC. oil temperature sensor	10 ~ 80Ω 5V	27	Outrigger, R. Fr. Vert. SOL	24V SOL drive
			28	Outrigger, R.Fr. Hori. SOL	24V SOL drive
			29	Outrigger, L.Re. Vert. SOL	24V SOL drive
	Power Source		30	Outrigger, L.Re. Hori. SOL	24V SOL drive
1	Flasher power source	24V	31	Outrigger, R.Re. Vert. SOL	24V SOL drive
2	Hazard power source	24V	32	Outrigger, R.Re. Hori. SOL	24V SOL drive
			33	Rear steering lock pin. IN SOL	24V SOL drive
			34	Rear steering lock pin. OUT SOL	24V SOL drive
			35	Winch inching speed SOL	24V SOL drive
			36	Max. speed regulating SOL	24V SOL drive
			37	PTO governor SOL (common to PTO)	24V SOL drive
			38		
			39	Engine idling speed up	24V SOL
				Power Source	
			40	Sensor power (pulse sensor)	12V
			41	Sensor power (analog sensor)	5V

4.4 RELATED MAIN SYSTEMS

4.4.1 ENGINE GOVERNOR CONTROL SYSTEM

(1) Purpose

The following engine governor control system is provided, through a part of the computer, so that the engine speed is properly controlled in the respective condition of travelling or crane operation.

1) Normal governor control ..... Governor control of all speed (Low↔High) linked with the accelerator pedal.

2) Low idling up ..... By placing the idle up switch in ON, the low idling speed is increased approximately 200rpm.

3) High idling regulation ..... (a) Regulation for crane operation.
Place the PTO switch in the ON position.
(b) Regulation of maximum high speed (NR control) when traveling.
By the speed sensor signal, the computer controls the governor (output for more than 49km/hr.——30.4 mph).

PTO SOL.	Engine rpm	NR SOL.
OFF	NR condition 2400 rpm	OFF
ON	PTO condition 2100 rpm	OFF
OFF	FULL 2500 rpm	ON

(2) Operation

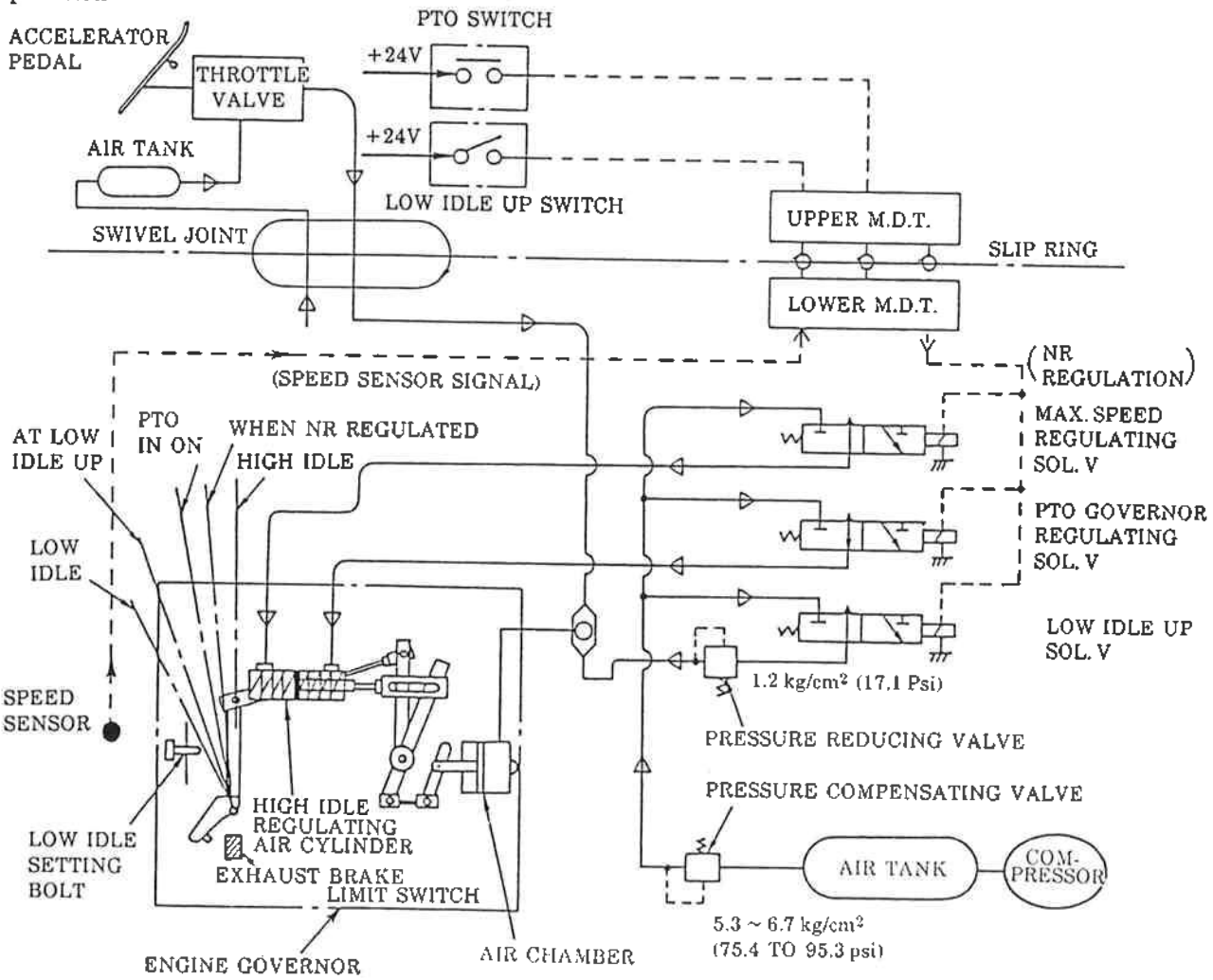


Fig. 4-8

4.4.2 EXHAUST BRAKE CONTROL SYSTEM

(1) Purpose

The rough terrain crane is a more severe vehicle than the truck crane or other heavy vehicle in the traveling weight. Therefore, it is required to apply the exhaust brake, not to mention when descending a slope, according to the condition even when normally traveling.

Therefore, this machine is provided with the exhaust brake control system linked with the lock-up device of the torque converter by control of the computer.

(2) Operation

① During traveling, always place the exhaust brake lever switch in the ON position (this side).

② When it is required to apply the exhaust brake, release the accelerator pedal to allow the exhaust brake and torque converter lock-up device to link and to operate.

NOTE : When the PTO switch is set in the ON position, the exhaust brake does not function.

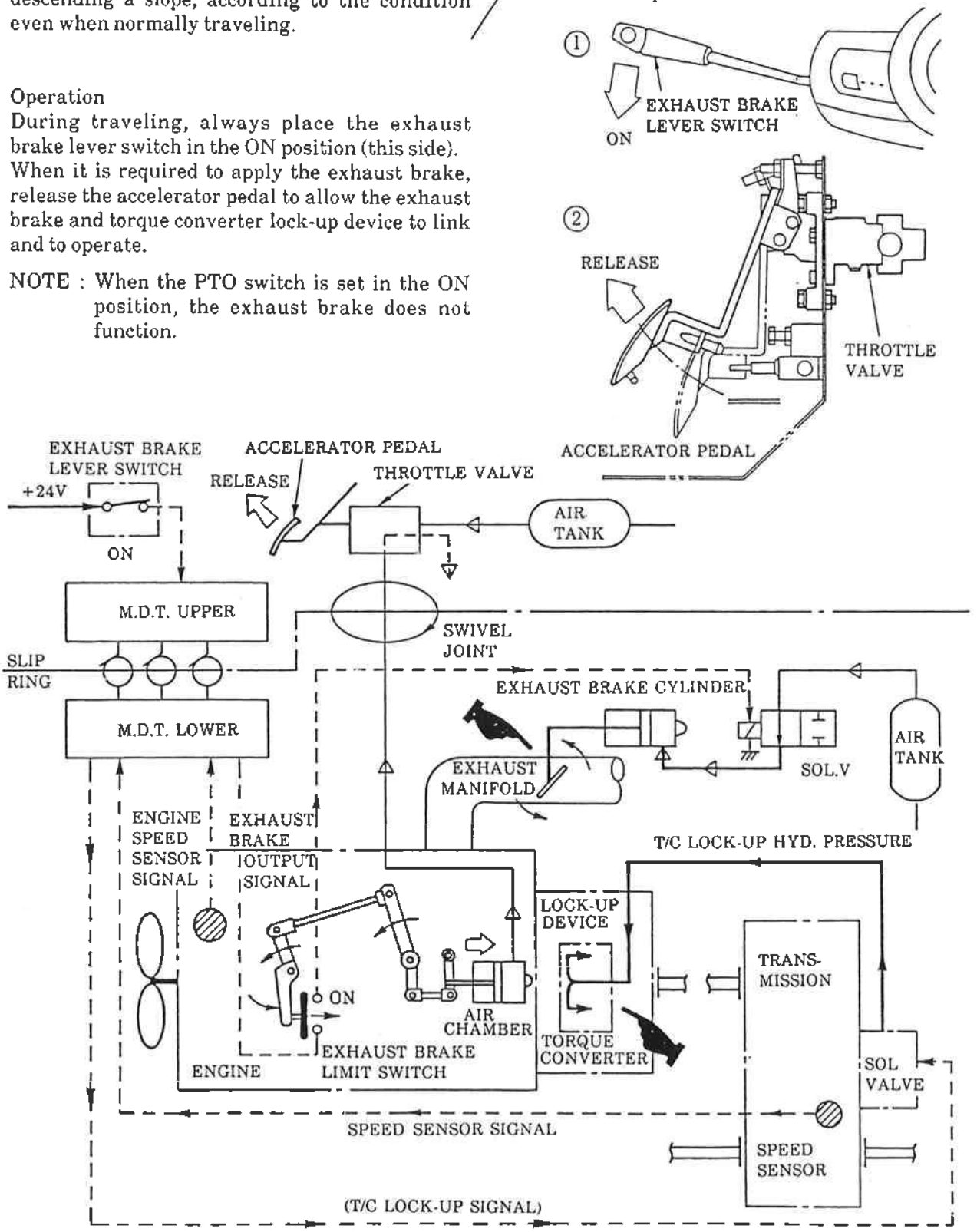


Fig. 4-9

4.4.3 AXLE LOCK/FREE SELECTING SYSTEM

The axles are installed to the carrier frame with the leaf springs and axle lock cylinders. When traveling or operating crane work without the use of the outriggers, the axle lock cylinders are required to be set in the free or lock condition. The outine of this system is shown in Fig. 4-10.

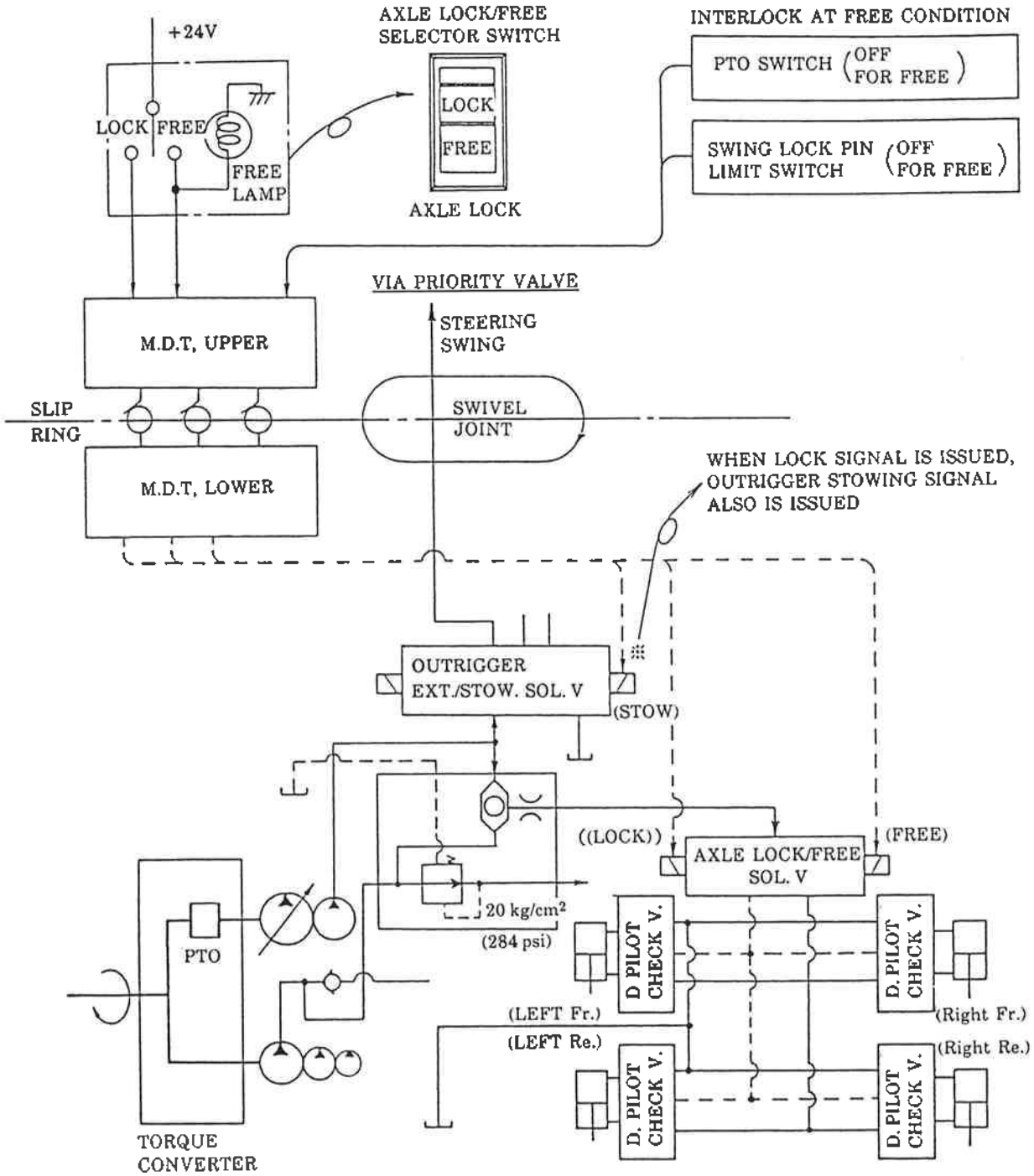


Fig 4-10

4.4.4 STEERING MODE SELECTING SYSTEM

(1) Purpose. In addition to the normal, crab and cramp, the rear steering which makes turning from a wide road into a narrow road easy is provided. By combining these four kinds of steering modes, the machine can enter a complicated city area easily.

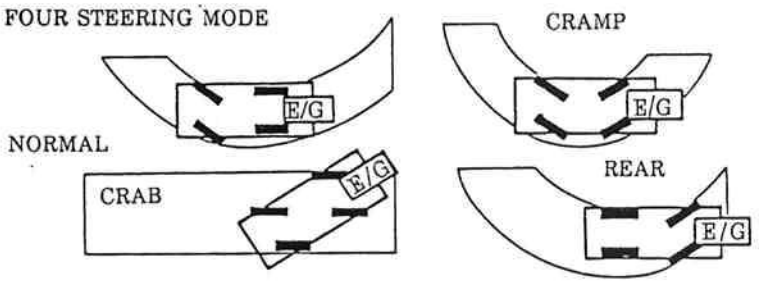
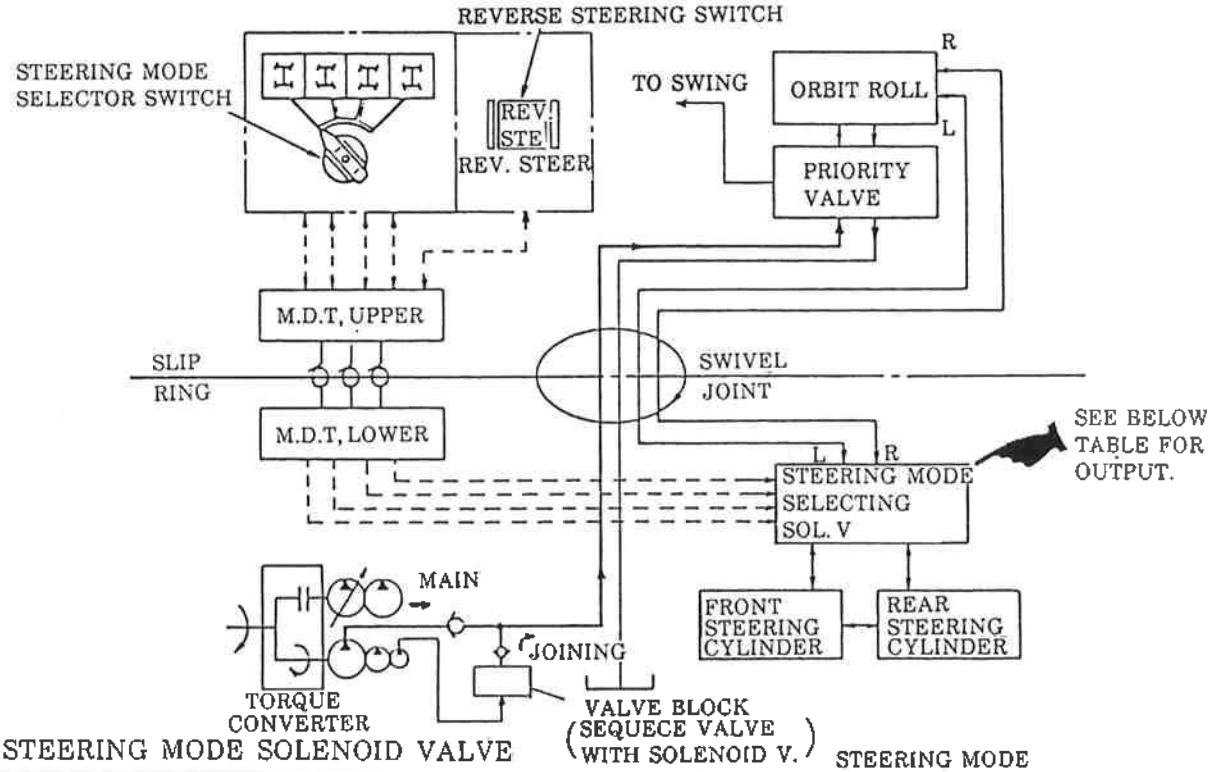


Fig. 4-11

(2) Operation. The computer takes in the position selected with the steering mode selector switch, and issues the out put to the steering mode selecting solenoid valve in accordance with the condition of the rear steering lock pins and tires.



STEERING MODE SOLENOID VALVE

STEERING MODE					SOL			
REV. STEER.	NORM.	CRAB	CRAMP	REAR	S1	S2	S3	S4
	○							
		○						○
			○				○	
				○	○		○	
○	○				○			○
○		○						○
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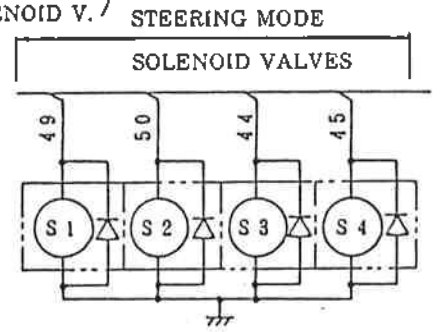


Fig. 4-12

4.4.5 ELECTRONIC CONTROL, FULL AUTOMATIC TRANSMISSION AND TORQUE CONVERTER CONTROL SYSTEM

(1) Purpose. In order to reduce the operator's load for operation when traveling, the computer controls shifting of the transmission and torque converter in the most suitable timing by setting the minimum switches beforehand.

(2) Principle. Since the computer takes in the various traveling conditions as the various sensors' signals (engine rpm, traveling speed and acceleration), the computer issues the necessary shift signals and lock-up signals according to the variation of traveling conditions such as start, acceleration, deceleration and stop, etc.

(3) Operation

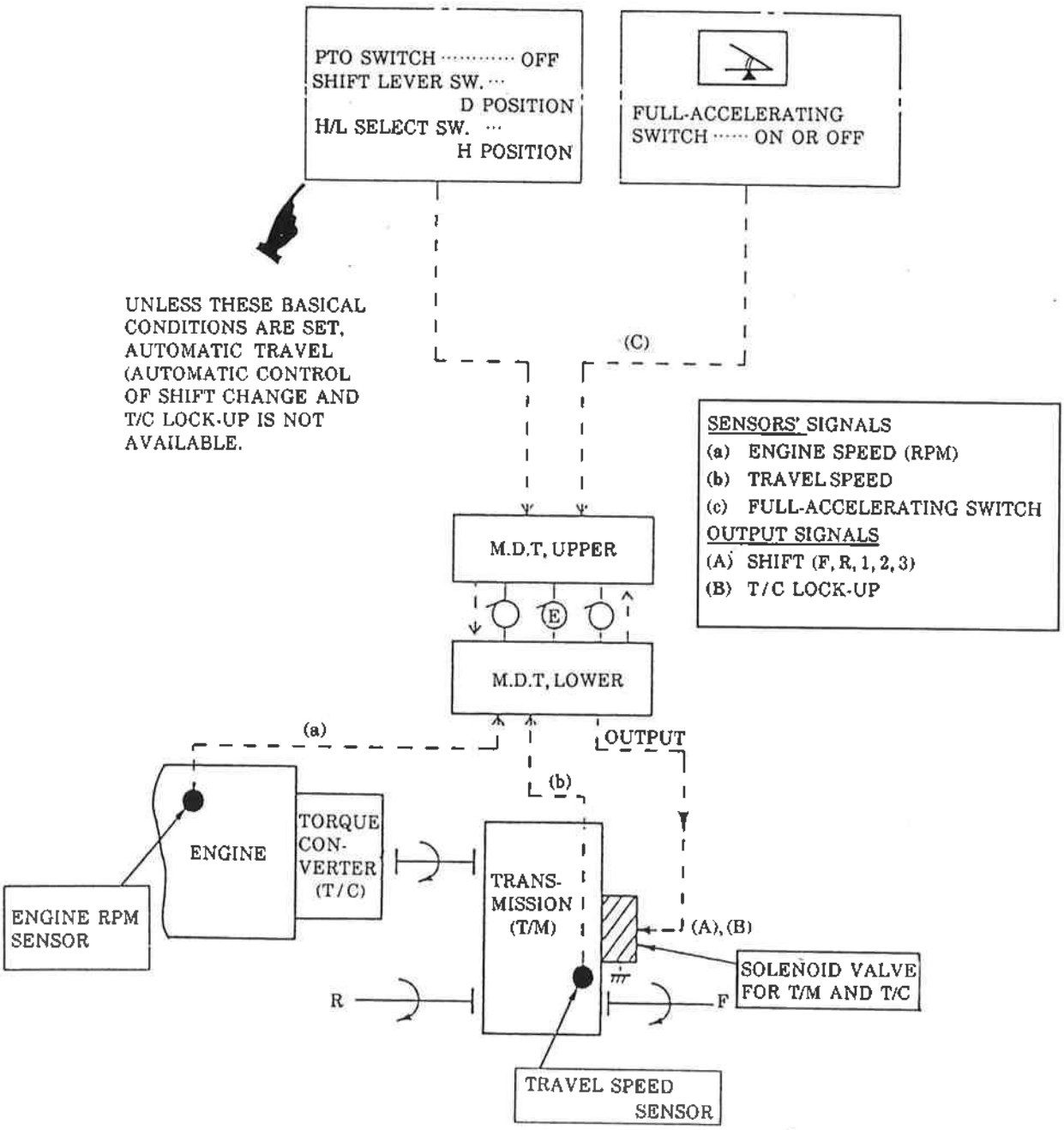


Fig. 4-13

4.4.6 FUEL SAVING SYSTEM DURING TRAVEL

1) Unloading of pilot pressure ..... Unloading of the pilot pressure through the pilot solenoid valve.

2) Unloading of 1st speed pressure of winch (RK450 only) .... Unloading of the 1st speed pressure of the winch with the main relief valve through the winch unloading solenoid valve.

3) Regulation of minimum flow from variable pump (RK450 only) .. Minimizing the inclination angle of variable pump to regulate the deliverred flow to the minimum.

OPERATION

(RK450)

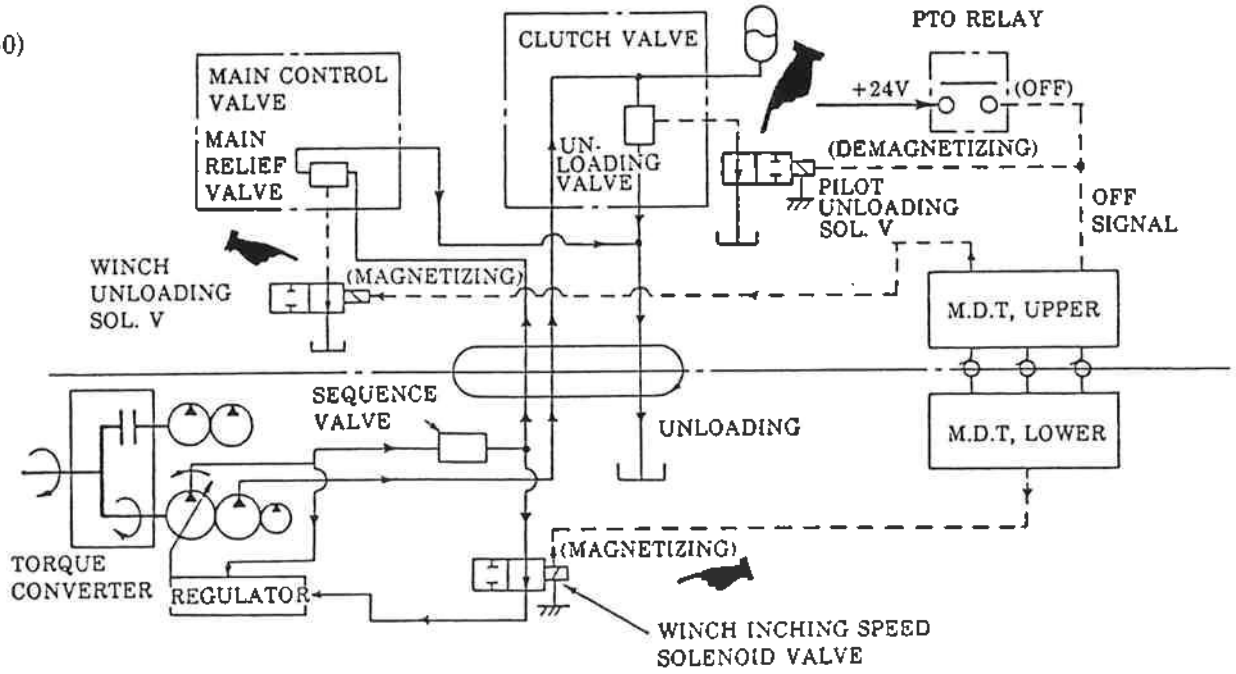
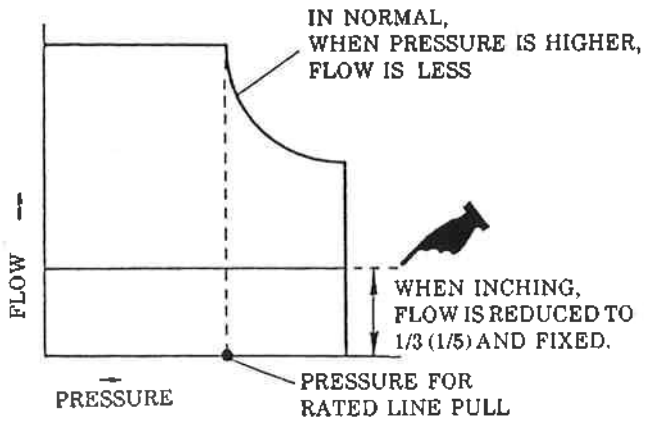


Fig. 4-14

4.4.7 INCHING SPEED SYSTEM OF RAISING AND LOWERING OF WINCH

(1) Purpose. This system is a system to arrange a more lower speed than the normal low speed (1st speed) of raising and lowering of winch in order to make inching operation when aligning bolts of iron frames in construction work and when installing equipments.

(2) Principle. Place snap switch "Winch Inching Switch" in the INCHING position, and operate low speed operation (half lever strake) to minimize the delivery of the variable pump. By this, winch speed becomes 1/3 of the low speed in RK250-II, and becomes 1/5 of the winch speed in RK450.



NOTE:
Since full stroke of winch lever allows confluence of winch 2nd speed pump pressure, inching control is not available.

(3) Operation

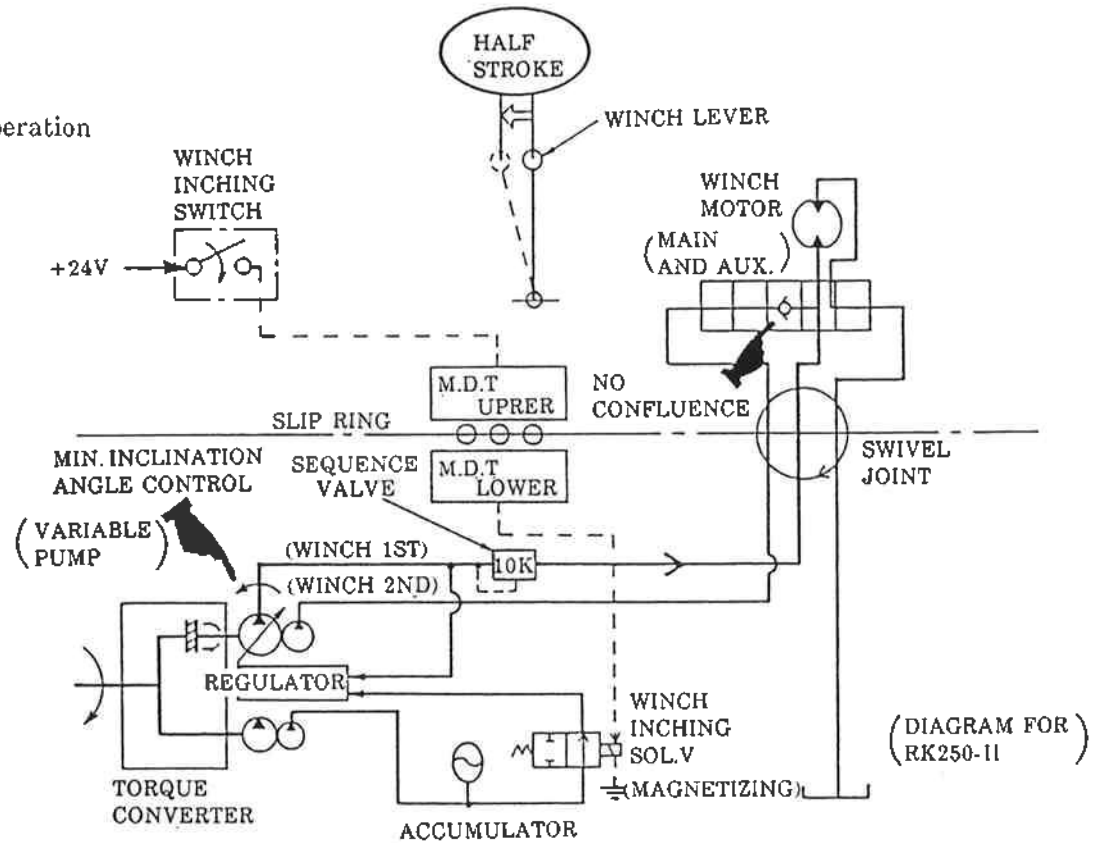
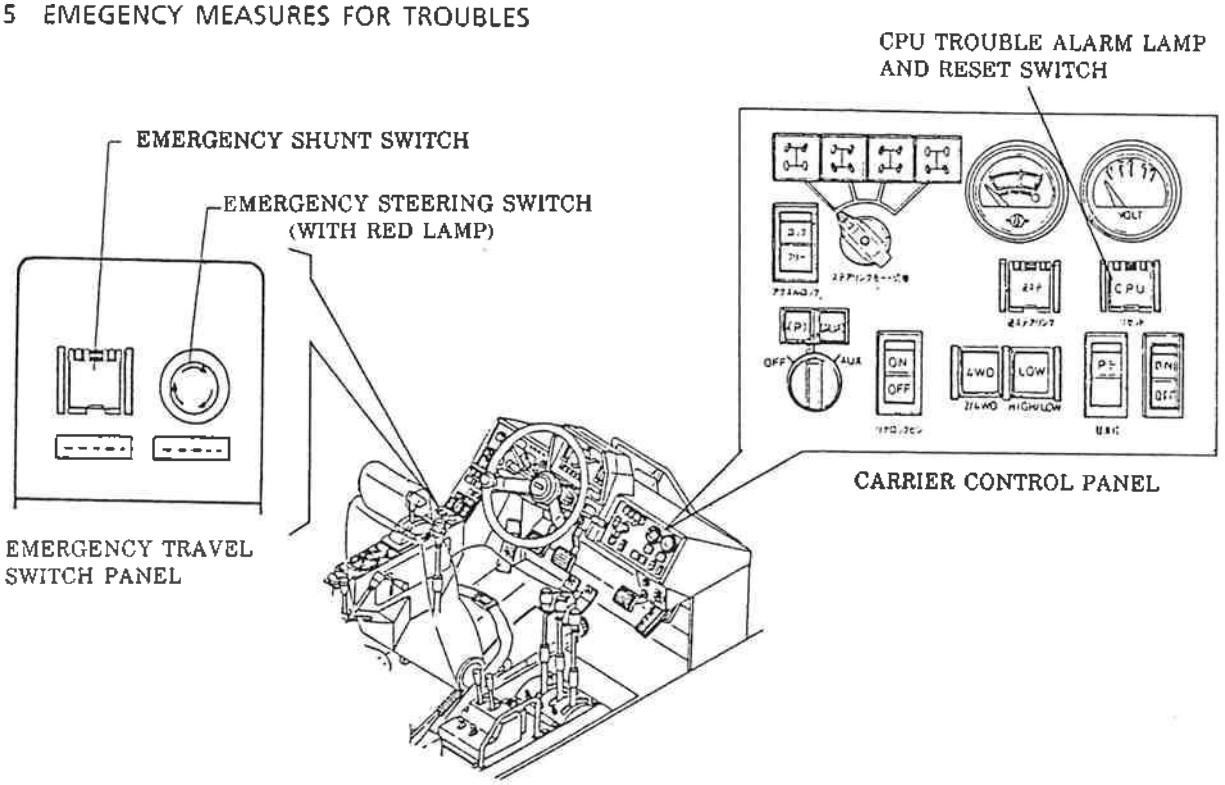


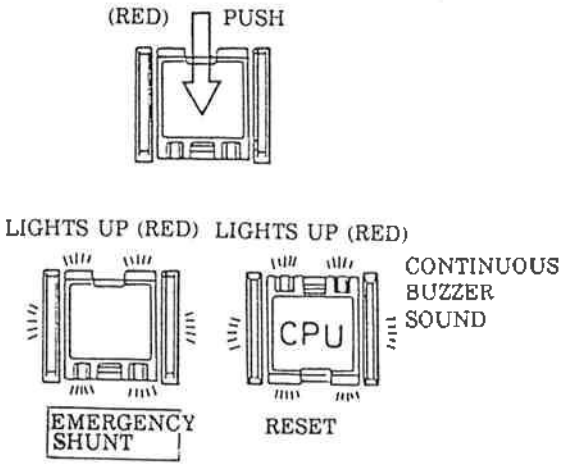
Fig. 4-15

4.5 EMEGENCY MEASURES FOR TROUBLES



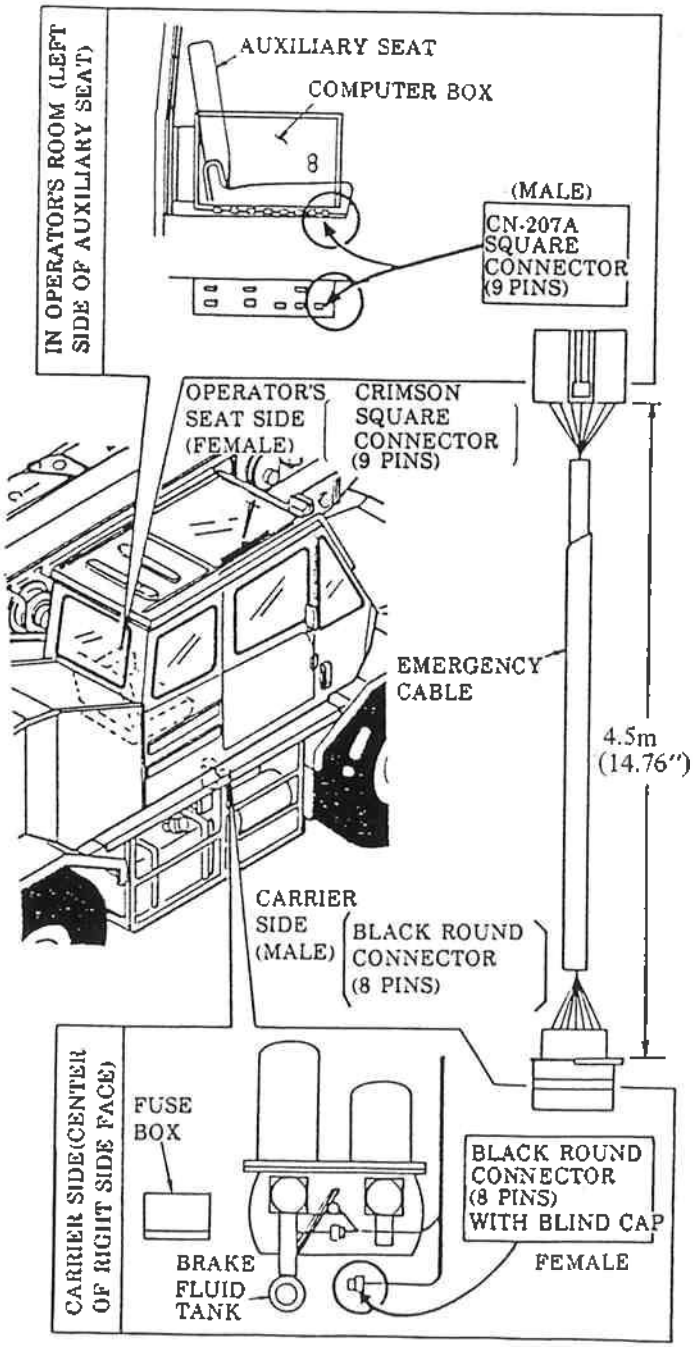
(1) Conditions of and Measures for Central Processing Unit (CPU) Troubles.
When the central processing unit is out of order, the CPU trouble alarm lamp (CPU reset switch) on the carrier control panel in front right of the operator's seat lights up to inform the trouble to the operator. This lamp, however, may light up also for misoperation and temporary drop of voltage, so check the following items first.
(a) Even by pushing the CPU reset switch, the CPU lamp does not go out.
(b) The emergency shunt switch is turned off.
When the CPU trouble alarm lamp is still lit even after checking items (a) and (b) the machine is in the condition shown in the clumn "Condition of CPU Trouble" in the following table (on page 4-22), and it is impossible to continue crane operation. And traveling function is also limited. This machine is provided with the following emergent measures to meet such emergent cases.

1. Emergency PTO switch
This switch is provided on the side face of the carrier side fuse box. By turning this switch on, the PTO is forcibly engaged, and crane operation can be performed even when the PTO alarm lamp lights.



At this time, the PTO switch in the operator's room lights up.

2. Emergency cable
   This cable is used for conecting the central processing unit terminals in the upper to those in the carrier. By connecting the cable, the operations in the range shown in the column "Condition when Emergency Cable connected" in the following table.



Conditions of CPU Trouble and Conditions When Emergency Cable connected

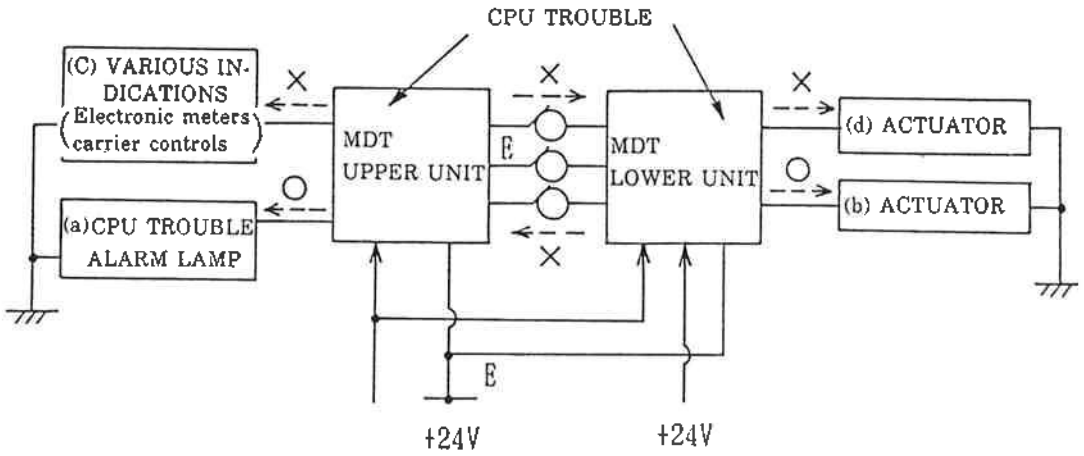
Operation	Conditions of CPU Trouble	Conditions when Emergency Cable connected	Remarks
PTO	· Disengaged automatically.	· The same as the left.	By turning carier side PTO switch on, crane operation is possible.
Crane operation	· Boom telescoping, boom raising / lowering and winch raising / lowering impossible. · As the negative brake is engaged, the lifted load is held at the lifted position.	· The same as the left.	
Swing	· Operation possible while enging running.	· The same as the left.	
Outrigger	· Operation with switch panel (upper) impossible.	· The same as the left.	
	· Operaiton with lower switch panel possible.	· The same as the left.	As the circuit is different from CPU circuit.
Steering	· Normal (front 2 wheel) steering possible. · Others (reverse steering, rear steering, crab steering and cramp steering) impossible.	· Only normal and cramp steerings possible. Others impossible.	
Selection of steering mode	· Selection impossible. (When traveling with crab or cramp mode, the rear wheels are held in the position.)	· Only selection of normal mode and cramp mode possible.	
Carrier driving	· Shifting forward and reverse possible. · Shifting 1st and 2nd speeds possible. (Even when selecting 3rd gear, actual speed is 2nd speed.)	· The same as the left.	
Parking brake	· Operation possible.	· The same as the left.	When air pressure is lowered, release impossible.

(2) Condition of Machine when the CPU is out of Order.

When anytrouble occurs in the transmission system related to the micro computer, an automatic self holding function for the CPU trouble is provided in the micro computer to prevent the machine form running away by misoperating for safety

Principle

One set of the upper and lower micro computer units (multiplex data transmission system ; abbreviated name is MDT.) alway checks the transmitting condition for itself. When the following troubles of transmission occurs, the unit stops the transmission and becomes the self holding condition.



Causes of Troubles
- Low voltage of power source and disconnection of power line.
- Disconnection and wrong contact of transmission line.
- Unmatching of upper and lower transmitting signals.
- Damage of base plates (boards).

Operation

When the CPU is out of order, the operating condition of each part is devided into the two groups of the mark × group (operation stops) and mark ○ group (operates reversely) in the above figure as shown in the following table.

	Upper	Lower
Function to stop operation for CPU trouble.	· Most of indications of electronic meters go out. · Most of indicator lamp on carrier control panel go out.	· Outputs are not given to solenoid valves and relays related to travel. · As output is not given also to PTO solenoid valve, crane operation is stopped.
Function to operate automatically for CPU trouble.	· CPU trouble alarm lamp lights up, and buzzer sounds continuously.	· Some lamps operate. (Left and right turn signal lamps go on and off. Low beams, clearance lamps and license number lamps light up.) · Even when shift lever is placed in D or 2 position, speed is shifted to 2nd range, and continuing travel is possible.

(3) Fail Safe System During Travel

This is a system which compensates the shift signals with the bypass circuits through the relays and soon so that travel can be continued safely and freely even when the trouble of the micro computer function (CPU trouble) occurs at the worst during travel.

Operation

By shifting all relays related to the micro computer automatically, operation is possible.

Actuation

1. When abnormality of transmission occurs in the multiplex data transmission system between the upper and lower MDT units due to some cause, the micro computer stops function automatically. As the result, the CPU trouble alarm lamp lights up, and the warning buzzer sounds continuously.
   At this time, most of the systems related to travel is influenced, and some functions are limited.
2. If the CPU trouble occurs during normal travel condition (automatic drive), the F and D signals are not transmitted through the MDT, but are transmitted directly from the upper to the lower through the bypass circuits by actuation of the relays on the base plates in the MDT and the outside relays.
3. In the process, the D (or 2nd) signal is put in as the 2nd signal, and the F signal is put in as the F signal, as they are, to the solenoid valve of the transmission at last.

Remarks

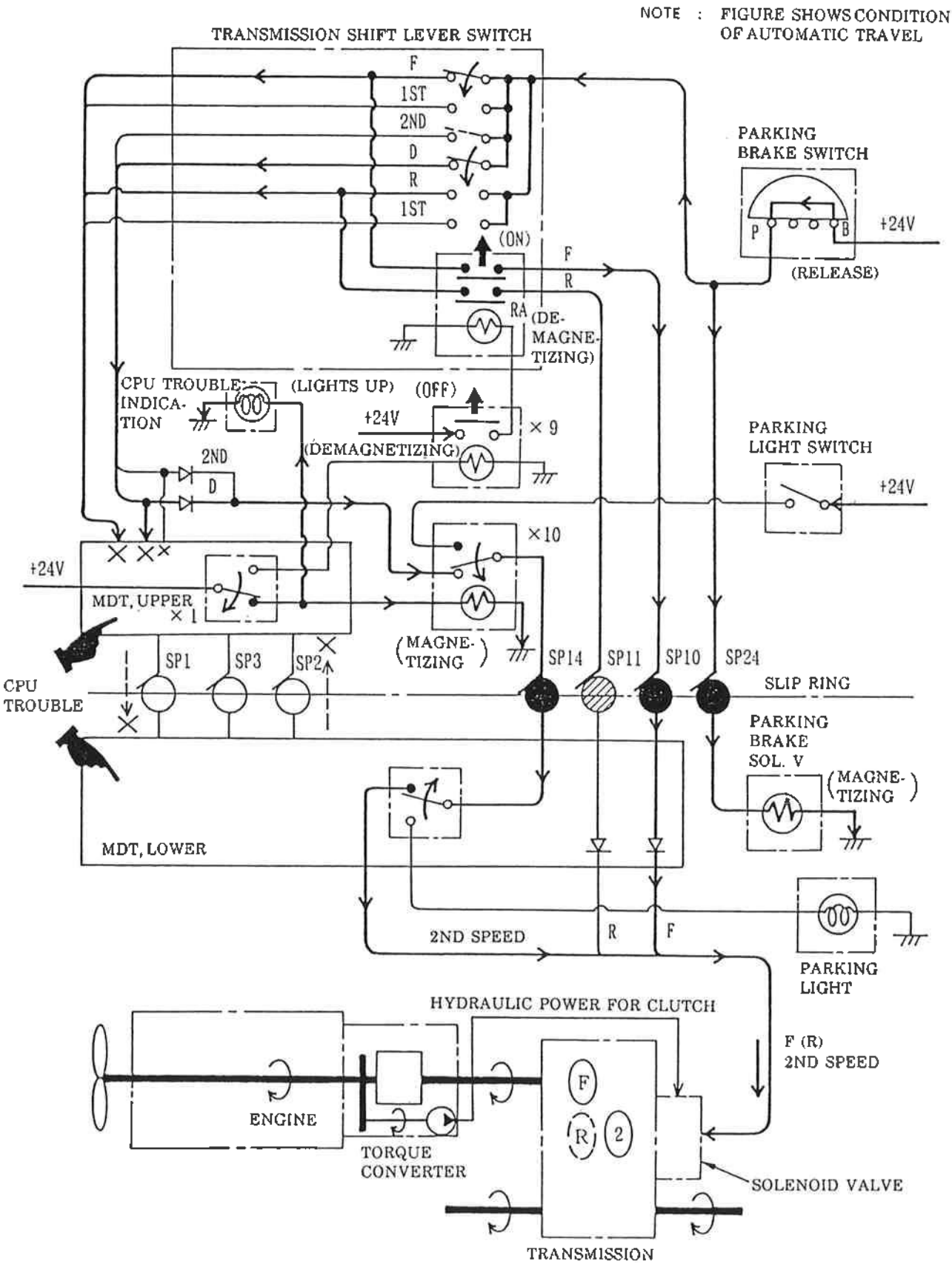
When the CPU is out of order, the shift signals are supplied to the solenoid valve of the transmission in the respective position of the shift lever as shown in the following table.

Shift lever position	Signal supplied to transmission sol. v.
D	F, 2
2	F, 2
1	F, 1
R	R, 1

At this time, however, even when the shift lever is placed in the D position, automatic drive cannot be operated.

And, as the lock-up is also not engaged, the carrier travels with the torque converter drive for the all shift lever positions.

SYSTEM DIAGRAM OF OPERATION ····· CPU Troube during normal travel with { automatic drive. or F, 2 drive.

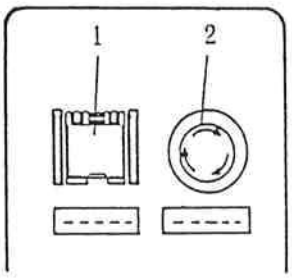


(4) Emergency Shunt System

This is a system which uses the power of the engine self-starter motor to drive the axle when the engine stops due to short of fuel and so on at a rail road crossing or at an intersectin and when it is required to shunt (move a short distance) the carrier to a safe place

Operation

1. Place the transmission shift lever in the 1 (1st, Forward) or R (1st, Reverse) position.
2. Turn the emergency shunt switch on to light up the red lamp. At this time, the CPU trouble alarm lamp (red) lights up and the buzzer sound at the same time.
3. Turn the key switch to the START position and hold it in the position. After a while, the power system is driven by the power of the self-starter motor and the carrier is moved forward (or backward.)
4. When it is required to steer, turn the emergency steering switch on to light up the red lamp. Hydraulic power for steering is obtained from the auxiliary pump provided separately, and operating force required to steer is lighten.

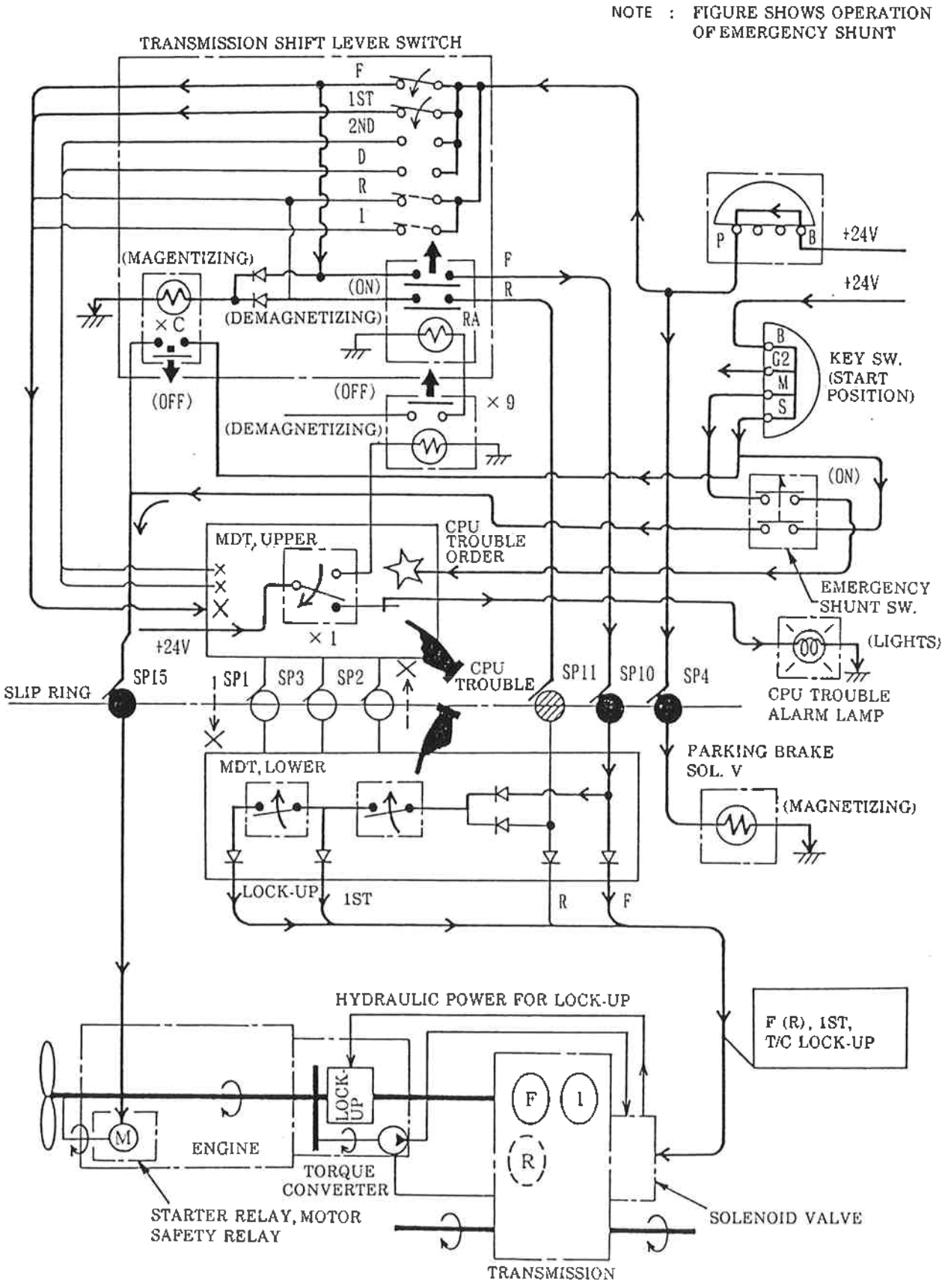


1. EMERGENCY SHUNT SWITCH (WITH RED LAMP)
2. EMERGENCY STEERING SWITCH (WITH RED LAMP)

Actuation

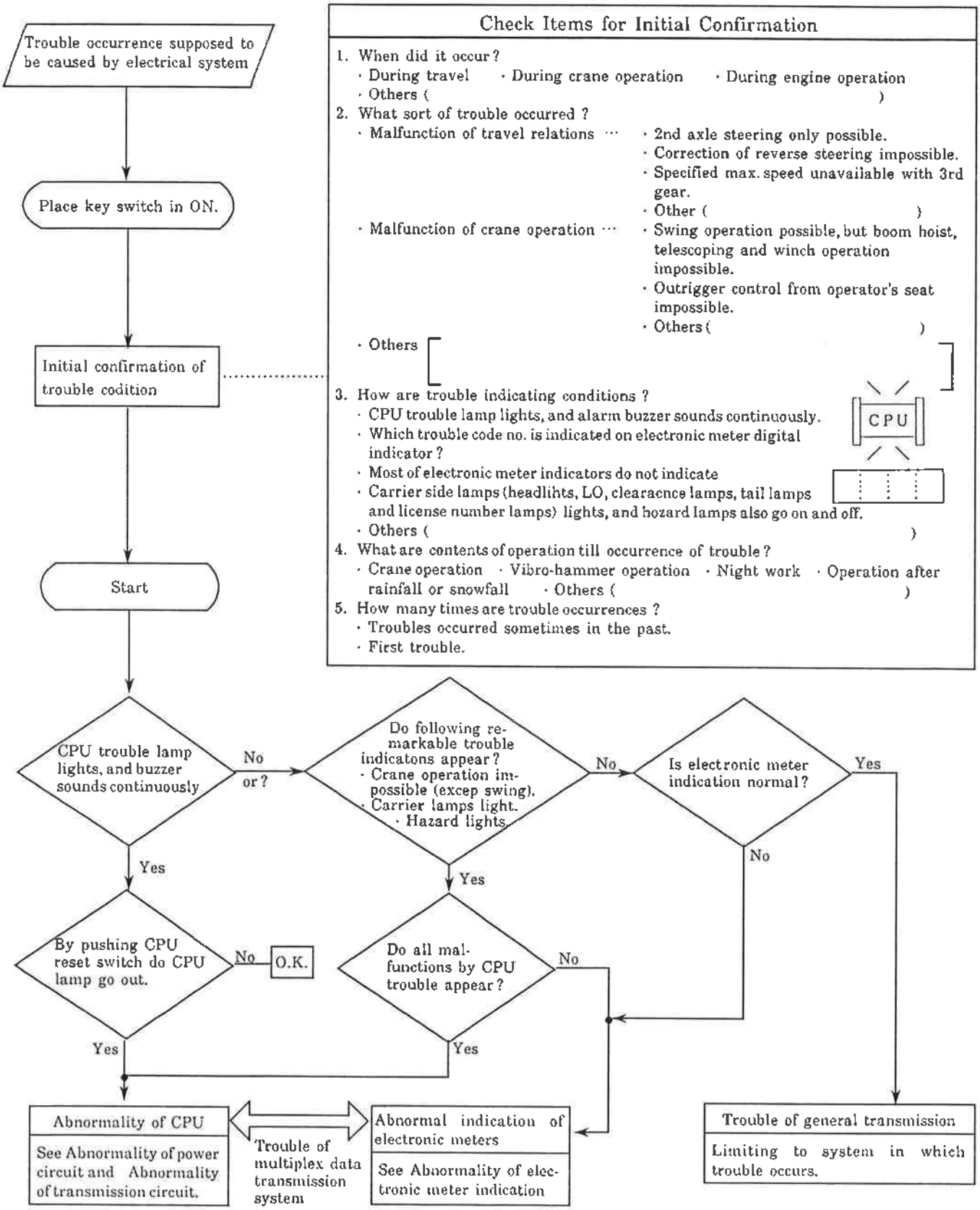
1. When the emergency shunt switch is turned on, the emergency shunt signal (CPU trouble order) is issued to the upper MDT unit, and the micro computer forces the CPU of the upper and lower units not to function at the same time.
2. As the result that the CPU of the upper and lower MDT does not function, the F (R) signal of the shift lever is not transmitted through the MDT, but is transmitted directly from the upper to the lower through the bypass circuits by actuation of the relays on the base plates in the MDT and the outside relay.
3. In the process, the F(R) signal is divided into the each signal of ① F (R), ② 1st speed and ③ T/C lock-up, and is put in to the solenoid valve at last.
4. By engine starting operation of the key switch, the self-starter motor is energized through the emergency shunt switch and starts.
5. As the result, the charging pump in the torque converter is driven, and the hydraulic power is supplied to the solenoid valve. Therefore, the torque converter lock-up is engaged, and at the same time the axle is driven with the low speed (1st speed).

SYSTEM DIAGRAM OF OPERATION ····· When Emergency Shunt is operated.

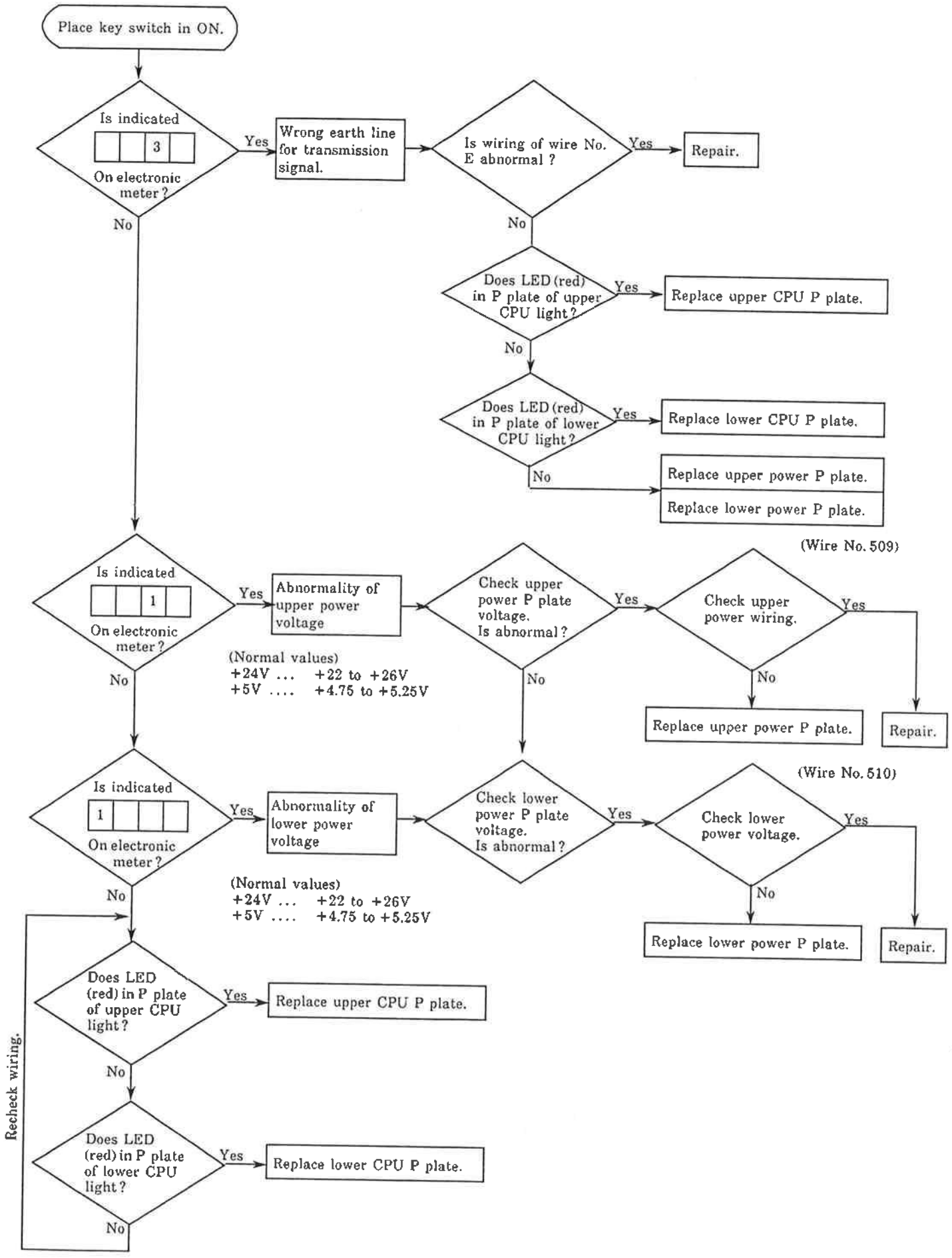


· When abnormality of each system related to the electrical system occurs, peform first the general initial confirmation following the procedures shown in paragraph (1). Taking a whole view of the machine conditions just after the abnormality occurs, and checking if the cause of the abnormality is related with the mutiplex data transmission system or not are the important point to trouble shoot quickly.

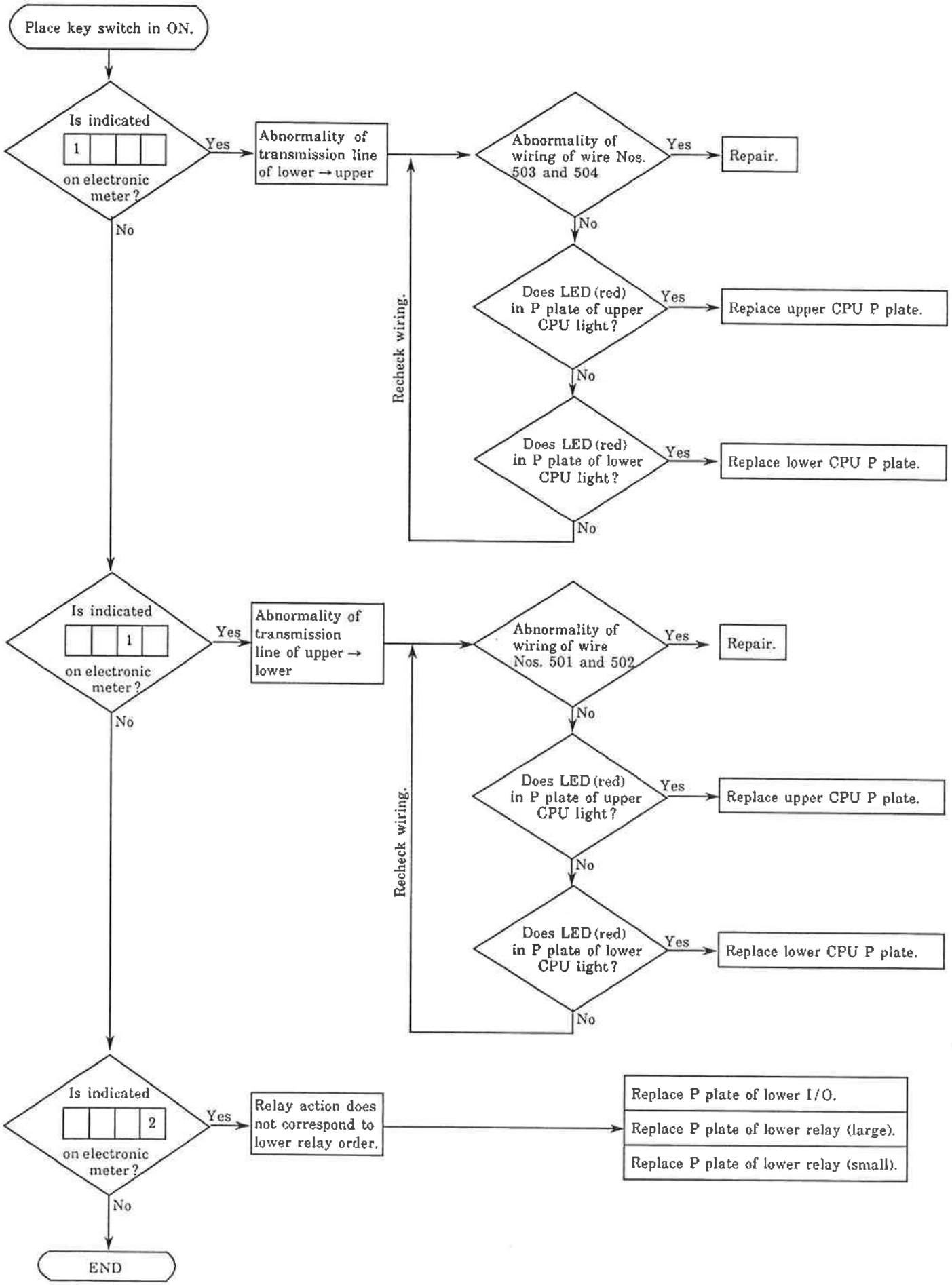
(1) Initial Confirmation (Judgement for Existence of Abnormality of Multiplex Data Transmission System)



(2) Abnormality of Power Votage Circuits



(3) Abnormality of Transmission or Signal (M.D.T.) Lines



(4) Abnormality of Electronic Meter Indication

When the CPU trouble alarm lamp does not light up and up and when transmission related to the electronic meter indicaiton.