MAINTENANCE MANUAL

FRONT COVER ASSEMBLY
19D438676G5

TABLE OF CONTENTS

ERICSSON

Ericsson Inc.
Private Radio Systems
Mountain View Road
Lynchburg, Virginia 24502
1-800-528-7711 (Outside USA, 804-528-7711)

Printed in U.S.A.

DESCRIPTION

Front Cover Assembly 19D438676G5 is used with the Aegis M-PA portable radios. This assembly consists of LCD Board 19C337096G1, Keypad Flex 19D438658P2, Speaker Flex 19B235116G1, UDC Flex 19C337149G1, Emergency Button Board 19A149627G1, Battery Plate 19B235165G1, the die-cast aluminum front cover and the related hardware. The speaker and microphone are also included in this assembly.

Control Board 19D903081G1 is installed in the 19D438676G5 assembly at the factory when the radio is assembled. This board contains all of the microcomputer and audio circuitry for the portable radio. It is not included with the 19D438676G5 assembly. See LBI-38828 for service information on the Control Board.

CIRCUIT ANALYSIS

LCD BOARD

M-PA radios utilize an LCD Board located behind the display bezel. When the display is updated, the Control Board serially loads the LCD Board with new display data. Four (4) interconnections on the Keypad Flex provide the serial connections between J4 on the Control Board and J10 on the LCD Board. The Keypad Flex also provides power and ground connections from the Control Board and two logic (2) outputs for the LCD Board. One logic output provides command/data selection for the LCD controller/driver IC and the other output controls the backlight driver circuit.

Integrated circuit U1 is a 7225 LCD controller/driver chip that accepts the serial display data from the Control Board and provides multiplex operation for liquid crystal display DS3. This IC generates four (4) common plane and 32 segment drive signals for the LCD. An oscillator and divider circuit in U1 generates the multiplex clock. Resistor R1 sets the oscillator's frequency to approximately 130 kHz. Voltage divider R2 - R5 provides the four required LCD drive reference voltages. The 7225 contains a refresh memory bit for each of the 128 display segments. This memory allows the display to operate without constant updating from the Control Board.

The LCD is arranged with four common planes and 32 segments. Each display digit utilizes 4 segments in all 4 common planes for a total of 16 segments. The alphanumeric portion utilizes 14 segments and the remaining 2 segments are the status flags located above and below the respective digit. Liquid crystal displays respond to alternating currents through a segment rather than a constant current; the display is driven with a varying AC waveform. The four common planes are driven with constant waveforms and the segment waveforms are varied depending on whether segments are on or off.

A backlight driver circuit on the LCD Board drives the two (2) light-emitting diodes (LEDs) on each side of the display when a button or control on the radio is operated. This feature may be enabled or disabled on a per channel basis with the programmable options. Backlighting is controlled by the Q6 output (pin 13) of serial-to-parallel shift register U2 on the Keypad Flex. This signal, when high, saturates Q2 and Q1, lighting DS1 and DS2 from the power supply. This switched source is also supplied to J10 pin 8 to light the LEDs under the keypad buttons on radios equipped with keypads.

FLEX CIRCUITS

Keypad Flex

The Keypad Flex interfaces all operating controls to the Control Board. This flex circuit also interconnects the Control Board to the LCD Board.

Volume control (R20) and group/channel switch (S1) are soldered to this flex. Logic on the flex interfaces the group/channel control and various key switches to the I/O Microcontroller on the Control Board. On M-PA Scan and System model radios the four (4) switches on the top of the keypad (S2, S3, S4 and S5) are used. Keypad switches S6 through S17 are utilized in M-PA System model radios.

The keypad is arranged in a four (4) column by eight (8) row matrix. It is read by successively setting each column output to a logic 0 and examining the row inputs. Any row at logic 0 when examined indicates a closed switch. Three (3) columns are used to read the key switches and the fourth column reads the gray-coded group/channel switch. To read the keypad, the I/O Microcontroller on the Control Board clocks a byte into shift register U2, setting one column low. It then latches it with SR STB (See Keypad Flex schematic). The I/O Microcontroller next pulses SR ENA to load the row information into shift register U1; it then clocks the row data into itself. This process is repeated for subsequent columns.

Shift register U2 also has outputs for LCD controller command/data selection (DISP C/D) and backlight control (DISP LIGHT). They are clocked-out as a part of the same byte that sets the column outputs.

UDC Flex

This flex circuit provides interconnections between the Control Board and the UDC. It also incorporates the internal microphone into the circuitry. A schematic diagram of the UDC Flex is included on the interconnection diagram.

Speaker Flex

The Speaker Flex connects the speaker to the Control Board. High and low speaker leads are available at the Battery Plate connector for test purposes. When the battery pack is installed, enabling (shorting) contacts on the pack connects the low-side of the speaker to the Control Board, thus enabling the speaker. A schematic diagram of the Speaker Flex is included on the interconnection diagram.

EMERGENCY BUTTON BOARD

The Emergency Button Board is comprised of the Emergency Switch Board and a feed-thru plate. Emergency transmission are enabled by pressing this momentary push-button switch. Feed-thru capacitors C1 and C2 provide RF bypass. The switch is interfaced to the Control Board via the Keypad Flex circuitry.

BATTERY PLATE

The Battery Plate furnishes connections between the battery and the radio and it provides RF bypassing for the speaker. Fuse F1 is also housed in this plate. F1 is externally accessible by removing the small cover on the bottom of the radio after the battery pack is removed. A schematic diagram of the Battery Plate is provided on the interconnection diagram.

MICROPHONE & SPEAKER

The internal electret microphone used in the Front Cover Assembly requires a dc bias. A pull-up resistor on the Control Board delivers this current to the MIC HI line (approximately 2.2 Vdc). Average speech into microphone will produce 10 - 30 mV rms on the MIC HI line.

The speaker is a 24 ohm, 1/2 watt device which connects to the 3-pin connector at the base of the Control Board. The Speaker Flex provides this interconnection.

TROUBLESHOOTING

LCD BOARD PROBLEMS

Follow the below steps if a problem on the LCD Board is suspected. Remove the board and use Front Cover Test Accessory Kit SPK9010 if it is necessary to gain access to all of the test locations. See LBI-38518 for details.

1. Since the Keypad Flex interconnects the LCD Board to the Control Board, check the associated flex connections first. Failures of the LCD Board are generally due to a problem with J10/P10, J4/P4 or DS3.

> **NOTE**
>
> Avoid touching the J10/P10 Zebra connector. Body oils and dirt will contaminate the contacts.

2. Verify 5.5 Vdc is on J10 pin 1. The display board consumes less than 1.5 mA with all segments and backlighting off.

3. Inspect display DS3 and verify it is tightly secured and there are no cracks in it.

4. U2 on the Keypad Flex must be operating properly for the display to function. The Q5 (pin 14) output from U2 is the command/data line (DISP C/D) to U1 on the LCD Board. Check J10/P10 pin 2 for pulse activity when the display is updated.

5. Check voltage divider R2 - R5 and verify proper LCD reference voltages are being delivered to U1 pins 3, 4 and 5. The measurements should be within ±0.3 Vdc of the values listed on the Keypad Flex schematic.

6. Monitor U1 pin 2 with an oscilloscope; a test pad is provided. Negative-going pulse pairs should be present spaced 4 milliseconds apart. The pulses will be approximately 30 us wide. Suspect R1 or U1 if pulses are not present.

7. Monitor J10/P10 pin 4 and 5 for pulse activity. DATA OUT and CLOCK from the Control Board should be seen here. These signals from the I/O Micro are writing/reading the Keypad Flex, writing/reading the Audio Processor IC and writing to the LCD controller/driver IC.

KEYPAD FLEX PROBLEMS

The keypad is arranged in a matrix of four (4) columns by eight (8) rows. Columns 0 (C0) through 2 (C2) are connected to the buttons on the flex. Column 3 (C3) is connected to S1's common terminal (the group/channel control). See the charts on the Keypad Flex schematic for details on column-to-row connections and the coding of S1.

The I/O Microcontroller on the Control Board serially reads the matrix as follows:

- Using CLOCK and DATA OUT, a byte is clocked into U2 on the Keypad Flex.
- The byte is then latched to the Q outputs of U2 via SR STB, the strobe pulse; one of the C0 - C3 columns is set low.
- SER ENA is pulsed to latch new instantaneous row data into shift register U1 on the Keypad Flex. Any row with a closed switch contact will latch a 0 into U1 for that row. NOTE: Switch S1 is gray-coded; see the chart on the schematic.
- Using CLOCK and DATA IN, the I/O Micro clocks the new row data into itself.
- This process is repeated twice every 50 ms, with the I/O Micro scanning each column by setting the subsequent column output low.

The Keypad Flex circuitry can be easily tested using Front Cover Test Accessory Kits SPK9010 and SPK9011. Troubleshooting information is presented below.

1. Verify the flex is properly connected to the Control Board.

2. Verify 5.5 Vdc is present on pin 16 of U1 and U2.

3. Verify the C0 - C3 outputs of U2 on the flex are being sequentially set to logic 0. If they are not and the serial inputs are good, replace U2.

4. Suspect D5, D6 or D8 if all rows on a single column are inoperative and the corresponding U2 output is OK. For example, if D8 opens, the Monitor and PTT Buttons will not operate, but the Control Knob (group/channel control) will operate normally.

5. Suspect one of the series connecting 1K resistors, the 100K pull-ups or an input of U1 on the Keypad Flex if the same row in each column is inoperative. For example, if R9 opens, PTT and some positions of the Control Knob (group/channel control) will not operate, but the Monitor Button will operate normally.

6. Monitor DATA IN for a change of pulse pattern when a button is pressed or the Control Knob is rotated.

DISPLAY/KEYPAD BACKLIGHTING PROBLEMS

1. With the PC Programmer, verify backlighting is enabled for the particular channel(s).

2. Monitor J10/P10 pin 3 (DISP LIGHT). It should go high when the Control Knob is rotated. Suspect U2 on the Keypad Flex if the logic level does not change or if it is inverted.

3. On the LCD Board, check Q2's collector. It should be less than 1.0 Vdc with backlighting on.

4. On the LCD Board, check Q1's collector. It should be greater than 4.0 Vdc with backlighting on.

5. If there is a problem with keypad backlighting on Scan and System model radios (with LCD backlighting OK), suspect the J10/P10 pin 8 contact.

FRONT COVER ASSEMBLY
19D438676G5

ISSUE 1

SYMBOL	PART NUMBER	DESCRIPTION
		LCD BOARD 19C337096G1 (See Separate Parts List)
		KEYPAD FLEX 19D438658P2 (See Separate Parts List)
		SPEAKER FLEX 19B235116G1
		— — — CONNECTORS — — —
P3	19A704852P163	Plug: 3-Pin, Gold Plated.
		UDC FLEX 19C337149G1
		— — — MISCELLANEOUS— — —
2	19D438711P1	UDC connector.
3	19D902265P1	PTT keypad.
4	19D438640P1	Flex board.
		EMERGENCY BUTTON BOARD 19A149627G1
		— — — — CAPACITORS — — —
C1 and C2	19A149635P1	Feed-Thru: 1000 pF, 50 VDCW; sim to KCK PLE 22CYNE102P.
		— — — — — JACKS— — — — —
J6	19B801235P11	Terminal, 4 pins: sim to Samtec HLT-104-G-R.
		— — — MISCELLANEOUS— — —
	19A149611G1	Feed-thru Plate Assembly. (Includes C1, C2 and below Ground Plate).
	19B235127P1	Ground plate.
		BATTERY PLATE 19B235165G1
		— — — — CAPACITORS — — —
C1 thru C5	19A149635P1	Feed-Thru: 1000 pF, 50 VDCW; sim to KCK PLE 22CYNE102P.
		— — — MISCELLANEOUS— — —
	19B235098G1	Feed-Thru Plate Assembly. (Includes C1 - C5, and 19C337127P1 Plate).
	19C337127P1	Plate.
2	19D438665P1	Baseplate.
3	19B235111P1	Contact, Battery
4	19B235112P1	Contact, Mute.
5	19A149591P1	Pad, Rubber.
		FRONT COVER ASSEMBLY
		— — — — — FUSES— — — — —
F1	19A702169P11	Enclosed link; rated 5 amps @ 125 v; sim to Littelfuse 255003.

* COMPONENTS, ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	PART NUMBER	DESCRIPTION
		— — — LOUDSPEAKERS — —
LS1	19A149673P1	Round: Water Proof, 24 ohms, 1/2 w.; sim to Line Electric Co. VS-50W24.
		— — — — MICROPHONES — —
MK1	19A701301P3	Cartrige: Electret.
		— — — — RESISTORS — — —
R20	19A134528P4	Varible: 50K ohms ±10%, linear taper, 1/2 w. sim to Allen Bradley Type SP.
		— — — — SWITCHES — — —
S1	19A149612P1	Rotary: 16 Position Gray Code; sim to Cole #1800-4240 or Grayhill 26YY Special.
		— — — MISCELLANEOUS — —
		(See drawing 19D438676)
2	19C851782G1	Front Cover.
3	19D438663P1	Shield. (Under Control Board).
4	19B235140P1	Pad. (Used at UDC Flex Connector).
5	19B235140P2	Pad. (Used at Keypad Flex Connector).
6	19D438664P1	Shield. (Covers Control Board).
7	19C337278P1	Insulator. (Used with above Shield).
8	19A705701P104	Screw, Machine: Torx, Pan Head; M2 x 4.
9	19A705701P105	Screw, Machine: Torx, Pan Head; M2 x 5.
10	19A705940P104	Screw, Machine: Torx, Flat Head; M2 x 4.
13	19D903484P1	Clamp. (Secures P10).
15	19A705937P105	Screw, Machine: Torx, Oval Head; M2 x 5. (Secures P10 Plate).
16	19D438670P1	Button, Emergency: Red.
17	19D438669P1	Control Panel Top.
18	19A705937P105	Screw, Machine: Torx, Oval Head; M2 x 5. (Secures Top Control Panel).
20	19A127319P9	Nut, 1/4-32. (Secures R20).
21	19A127319P2	Nut, 1/4-28. (Secures S1).
22	19C852161G2	Knob, Volume. (Includes Set Screw L19DP10005V2)
23	19C852161G1	Knob, Group/Channel. (Includes Set Screw L19DP10005V2)
25	19A149546P1	Nut, UDC.
26	19C337462P1	Gasket. (Used with LS1 and MK1).
27	19D438666P1	Insert, Baseplate.
28	19C337134P1	Seal. (Used with Battery Plate).
29	19B235074P1	Cover, Fuse. (Used with Battery Plate).
30	19B235124P1	Contact, Fuse. (Used with Battery Plate).
31	19B235125P1	Contact, Fuse. (Used with Battery Plate).
32	19A702362P102	Screw, Machine: Torx, Flat Head, M2 x 2.75. (Secures Battery Plate).
33	19A705701P6	Screw, Machine: Torx, Pan Head; M1.6 x 6. (Secures Battery Contacts).
34	19A705701P7	Screw, Machine: Torx, Pan Head; M1.6 x 7. (Secures Battery Contacts).

SYMBOL	PART NUMBER	DESCRIPTION
35	19A705701P4	Screw, Machine: Torx, Pan Head; M1.6 x 4. (Secures Battery Contact).
36	19B801539P3	Pad, Friction.
37	19B801539P4	Pad, Friction. (Located below UDC/ Monitor/PTT Assembly).
43	4037064P25	Washer, non-metallic.
48	19A149706P1	Spacer. (Used under S1).
50		Adhesive, Silicon.
51	344A3243P1	Insulator.
52		Adhesive.
53	19B234763P22	Pad, .35" x .3".
54	19C851997P2	Gasket, Speaker.
55	344A3854P1	Insulator.
56	19B234763P26	Pad.
		——— ASSOCIATED PARTS——
	19D438683P1	Stop Plate. (Used with S1 Group/ Channel Control).
	19D902963P1	Shield, Control Board. (Used in 800 MHz radios only)

KEYPAD FLEX
19D438658P2

ISSUE 2

SYMBOL	PART NUMBER	DESCRIPTION
		——— CAPACITORS———
C1	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCV.
		——— DIODES———
D1 thru D6	19A700155P2	Silicon: 100 mA, 35 PIV.
D7	19A134587P2	Silicon: 2 Diodes with Common Cathode; sim to BAV 70 and BAV 74.
D8	19A700155P2	Silicon: 100 mA, 35 PIV.
		—— INDICATING DEVICES ——
DS1 thru DS6	19A705713P2	Diode: Green LED; sim to HLMP-6505.
		——— PLUGS ———
P4		Part of Flex Board.
P6	19B801451P8	Socket: 4 pins.
P10		Part of Flex Board.
		——— RESISTORS ———
R1 thru R8	19B801251P104	Metal film: 100K ohms ±5%, 1/10 w.
R9 thru R16	19B801251P102	Metal film: 1K ohms ±5%, 1/10 w.
R17 thru R19	19B801251P221	Metal film: 220 ohms ±5%, 1/10 w.
R20		Part of Front Cover Assembly.
		——— SWITCHES ———
S1		Part of Front Cover Assembly.
S2 thru S19		Part of Flex Board.
		— INTEGRATED CIRCUITS——
U1	19A704423P2	Digital: 8-Bit Shift Register; sim to MC14021BD.
U2	19A704423P3	Digital: 8-Bit Shift Register; sim to MC14094BD.
		——— MISCELLANEOUS ———
	19B235119P1	Dome Switch Snap. (Used with S18 and S19).

* COMPONENTS, ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

LCD BOARD
19C337096G1

ISSUE 4

SYMBOL	PART NUMBER	DESCRIPTION
		——— CAPACITORS ———
C1 thru C3	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.
C4	19A702052P22	Ceramic: 0.047 µF ±10%, 50 VDCW.
C6 and C7	19A705205P2	Tantalum: 1 µF, 16 VDCW; sim to Sprague 293D.
		—— INDICATING DEVICES——
DS1 and DS2	19A705713P2	LED: Green; sim to HLMP-6500.
DS3	19B801594P1	LCD: sim to LXD 57IE3F99KGSZ.
		——— JACKS ———
J10		Part of Printed Wire Board and Item 9.
		——— TRANSISTORS ———
Q1	19A700059P2	Silicon, PNP.
Q2	19A700076P2	Silicon, NPN.
		——— RESISTORS ———
R1	19B801251P184	Metal film: 180K ohms ±5%, 1/10 w.
R2 thru R4	19B801251P103	Metal film: 10K ohms ±5%, 1/10 w.
R5	19B801251P101	Metal film: 100 ohms ±5%, 1/10 w.
R6	19B801251P104	Metal film: 100K ohms ±5%, 1/10 w.
R7	19B801251P101	Metal film: 100 ohms ±5%, 1/10 w.
R10	19B801251P152	Metal film: 1.5K ohms ±5%, 1/10 w.
R11	19B801251P332	Metal film: 3.3K ohms ±5%, 1/10 w.
R13	19B801251P473	Metal film: 47K ohms ±5%, 1/10 w.
R14	19B801251P223	Metal film: 22K ohms ±5%, 1/10 w.
R15	19B801251P471	Metal film: 470 ohms ±5%, 1/10 w.
		—— INTEGRATED CIRCUITS —
U1	19A705799P1	LCD Controller/Driver: sim to NEC uPD7225G-00.
		——— MISCELLANEOUS ——
		(See Drawing 19C337096, Sh. 2)
5	19C337137P1	Frame, LCD
6	19A703685P4	Connector, LCD.
7	19A149626G1	Diffuser, Light.
8	19B235142P1	Support, Connector. (Used with J10).
9	19A705662P2	Connector, Zebra Strip.
10	19A116357P5	Tape. (Used between Connector and Support).

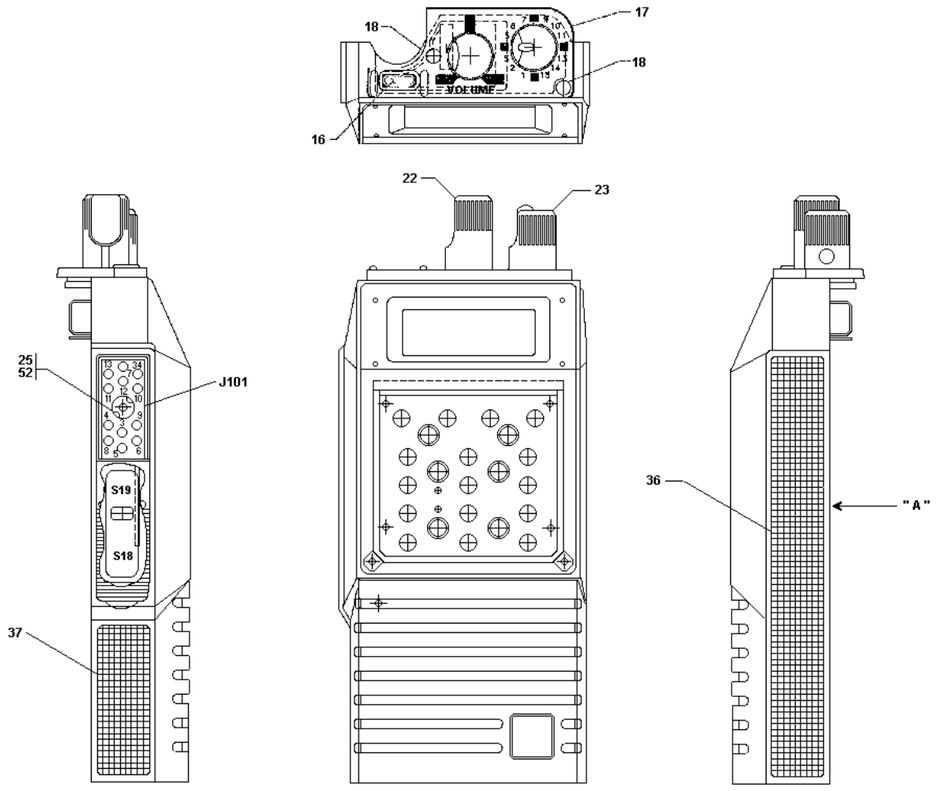
* COMPONENTS, ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter" which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for the descriptions of parts affected by these revisions.

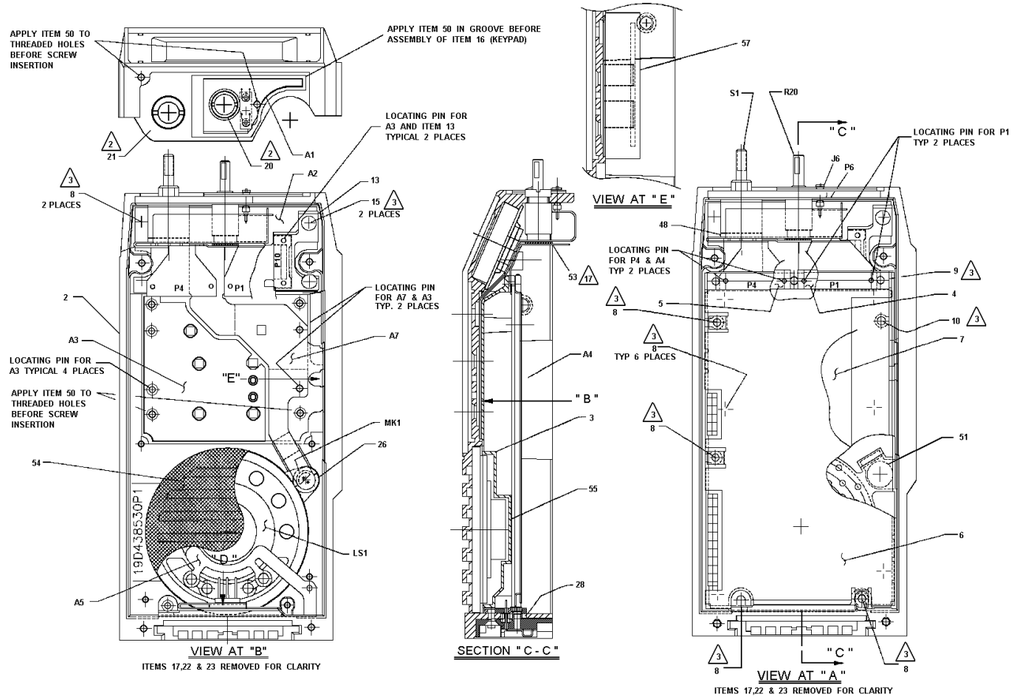
REV. A - LCD BOARD 19C337096G1

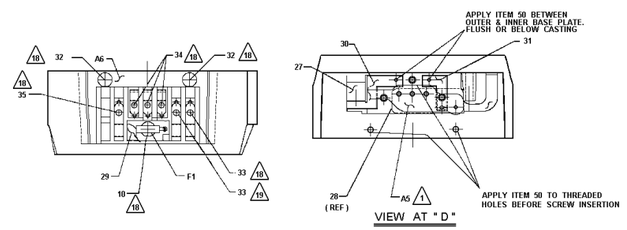
To improve manufacturing process, relocated Q2 and R13.



FRONT COVER ASSEMBLY
19D438676G5

(19D438676, Sh. 2, Rev. 11)





NOTES:

2 TORQUE NUTS ITEM 20 & 21 TO 5 LB-IN.

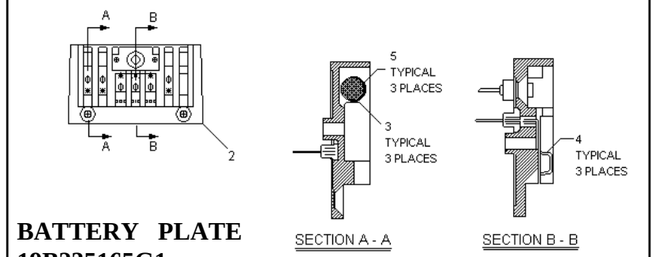
3 TORQUE KNOB SET SCREWS AND ITEMS 8, 9, 13, 15 & 18 TO 3.0 LB-IN.

18 TORQUE ITEMS 10, 32, 33, 34 & 35 TO 1.5 LB-IN.

19 TORQUE ITEM 33 TO 0.75 LB-IN.

FRONT COVER ASSEMBLY
19D438676G5

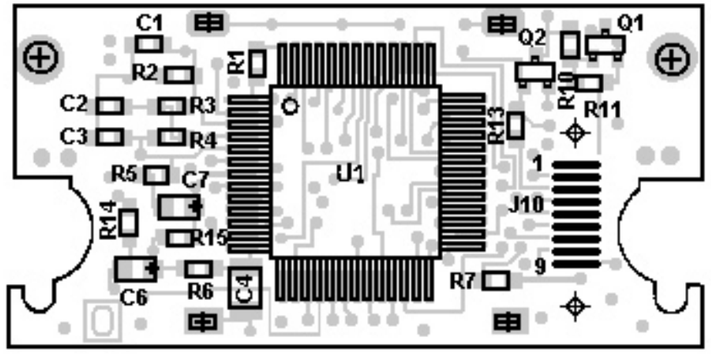
(19D438676, Sh. 1, Rev. 14)



BATTERY PLATE
19B235165G1

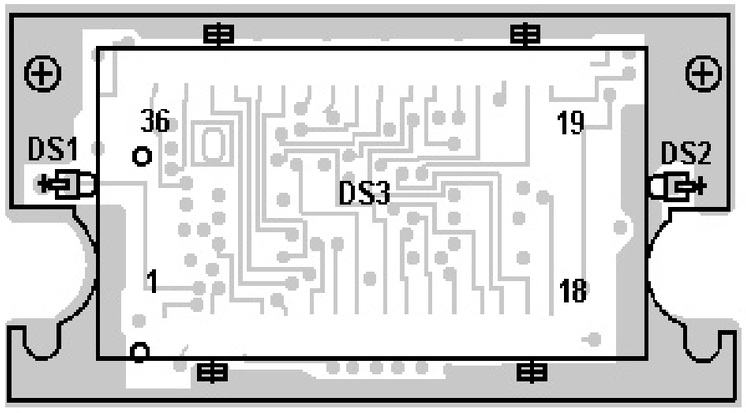
(19B235165G1, Sh.1, Rev.1)

COMPONENT SIDE



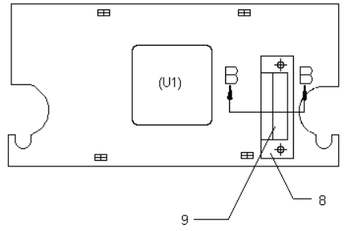
(19C337096, Sh. 1, Rev. 1)
(19D903152, Layer 1, Rev. 0)

SOLDER SIDE

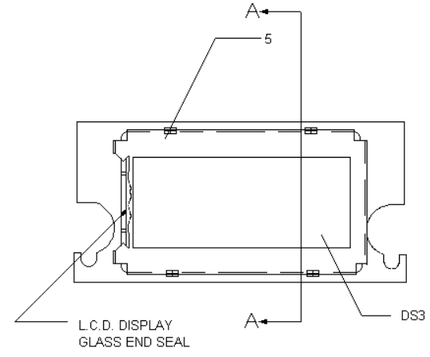


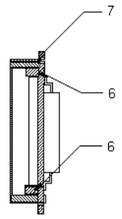
(19C337096, Sh. 1, Rev. 1)
(19D903152, Layer 4, Rev. 0)

CAUTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES

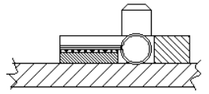


(19C337096, Sh. 2, Rev.3)





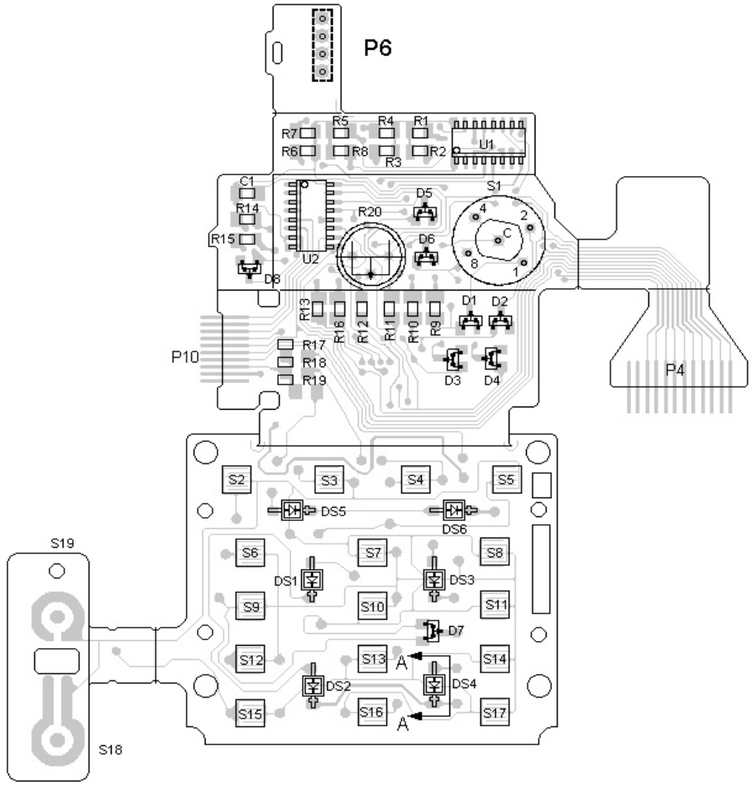
SECTION A - A



SECTION B - B

ENLARGED

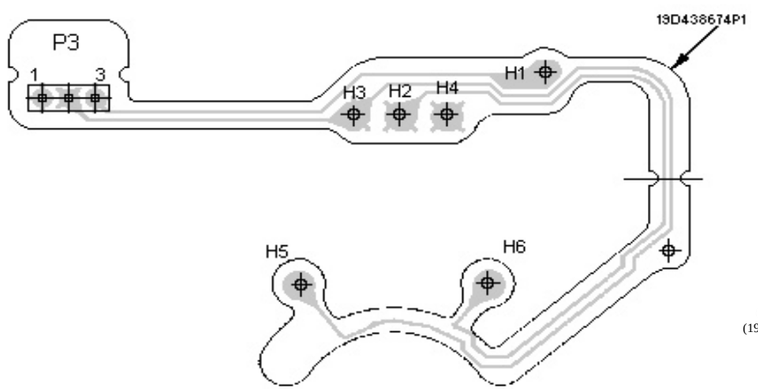
LCD BOARD
19C337096G1



KEYPAD FLEX
19D438658P2

(19D438658, Sh. 1, Rev. 1)

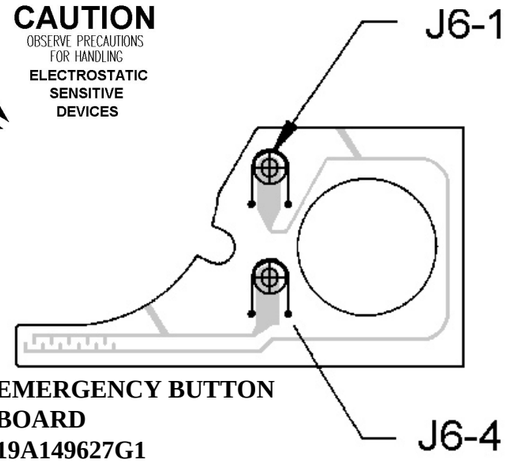
(19D438658, Sh. 1, Rev. 5)
(19D438658, Top Image, Rev. 0)

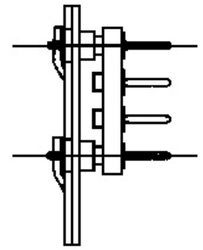


(19B235116, Sh. 1, Rev. 4)
(19D438674, Top Image, Rev. 2)

SPEAKER FLEX
19B235116G1

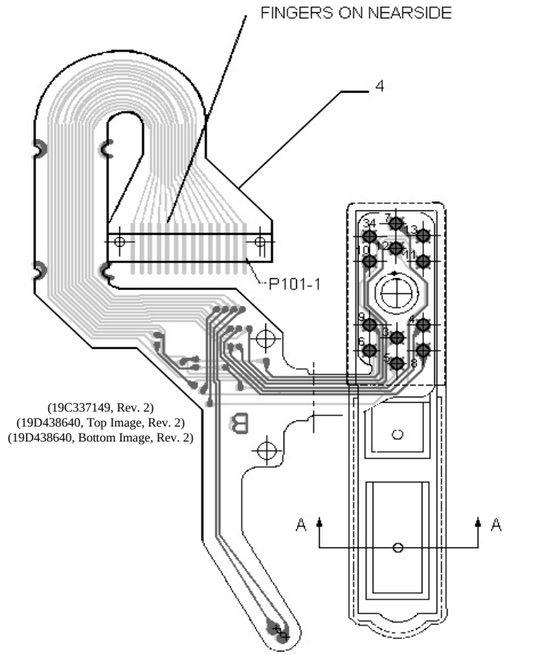
CAUTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES



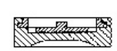


EMERGENCY BUTTON BOARD
19A149627G1

(19A149627, Rev. 0)
(19C337132, Rev. 1)

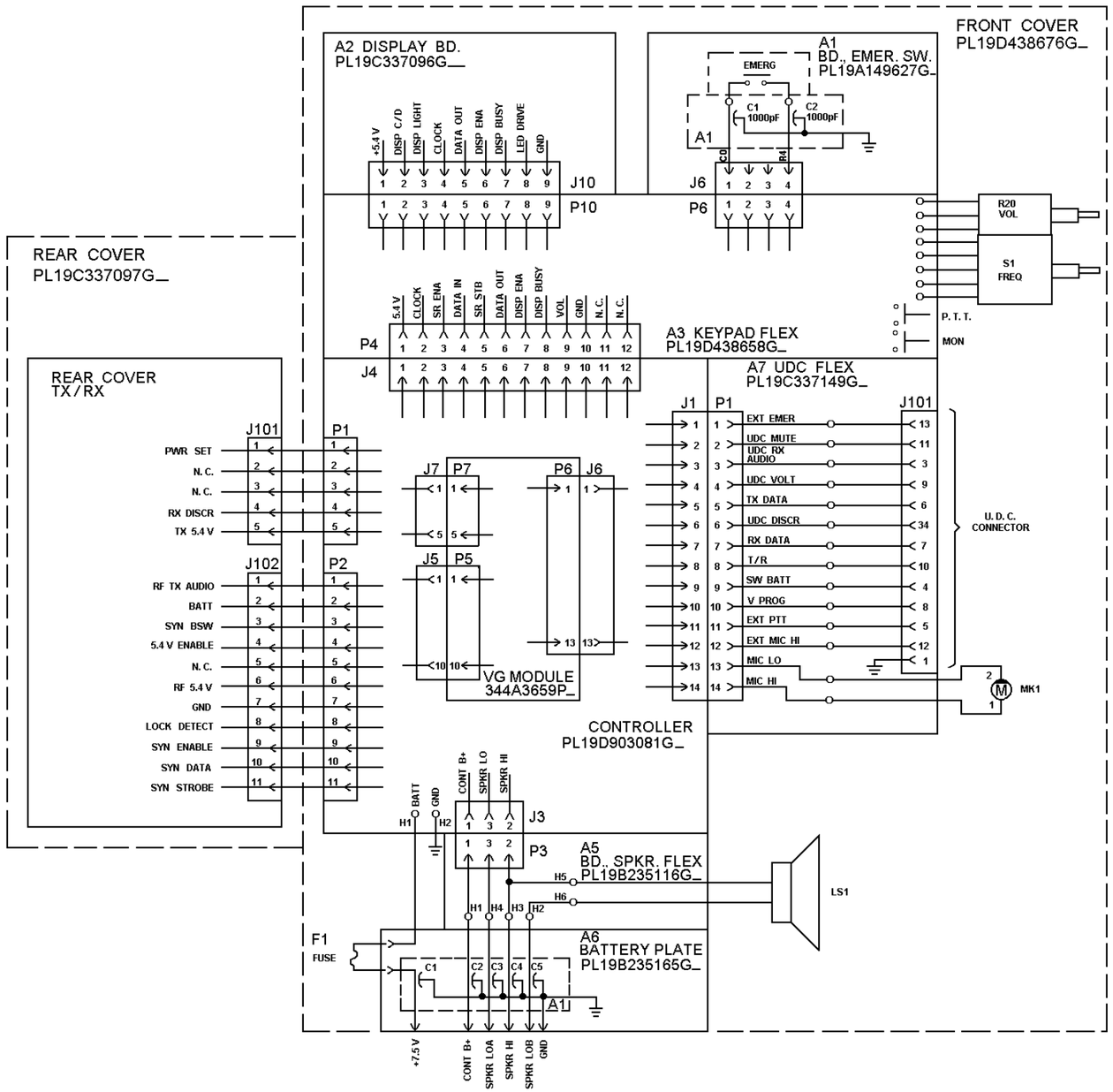


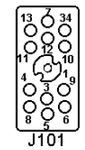
(19C337149, Rev. 2)
(19D438640, Top Image, Rev. 2)
(19D438640, Bottom Image, Rev. 2)



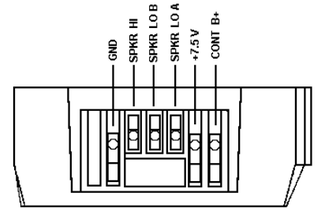
SECTION A - A

UDC FLEX
19C337149G1



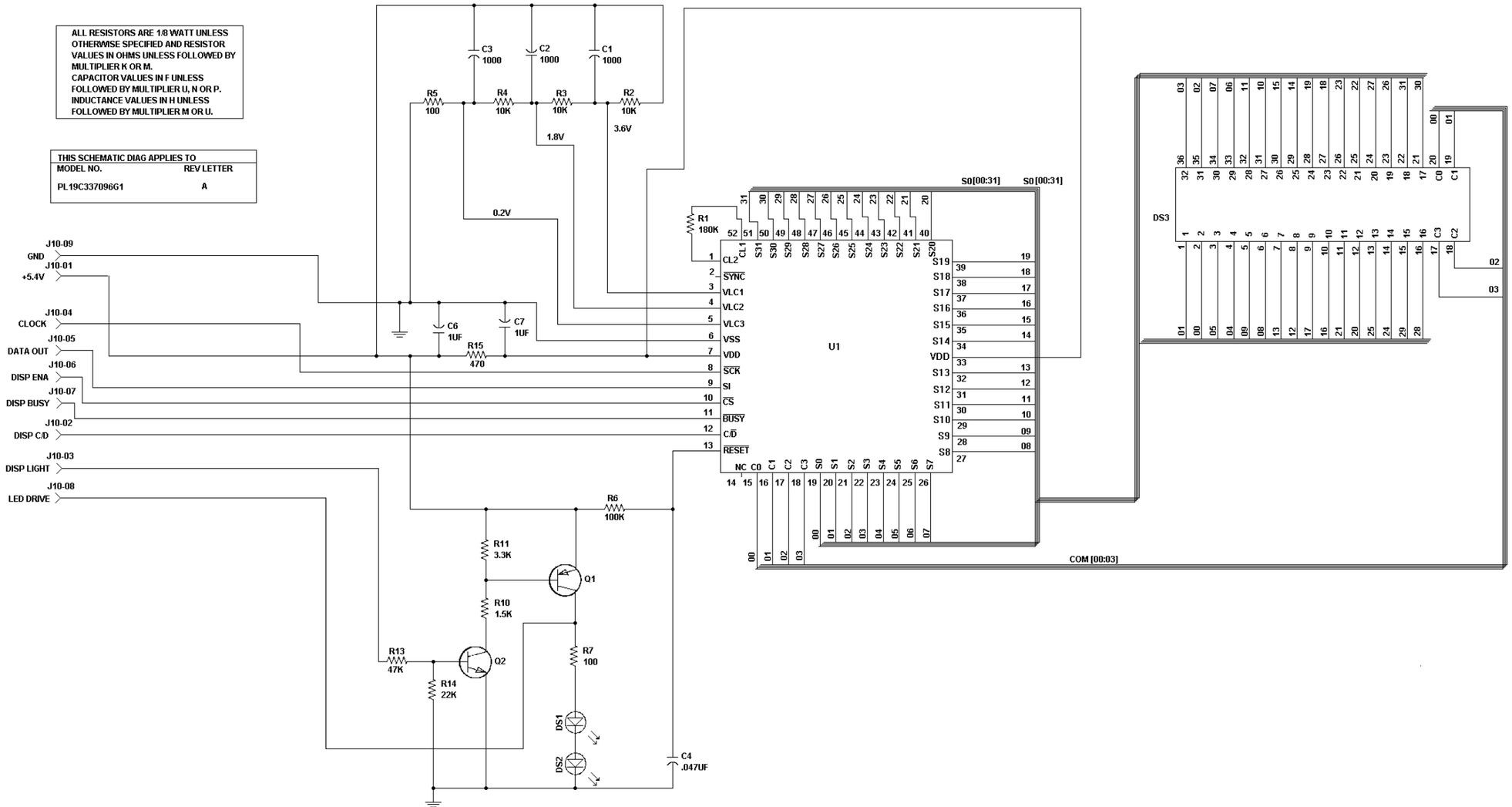


UDC CONTACT IDENTIFICATION
VIEWED FROM OUTSIDE OF CASE



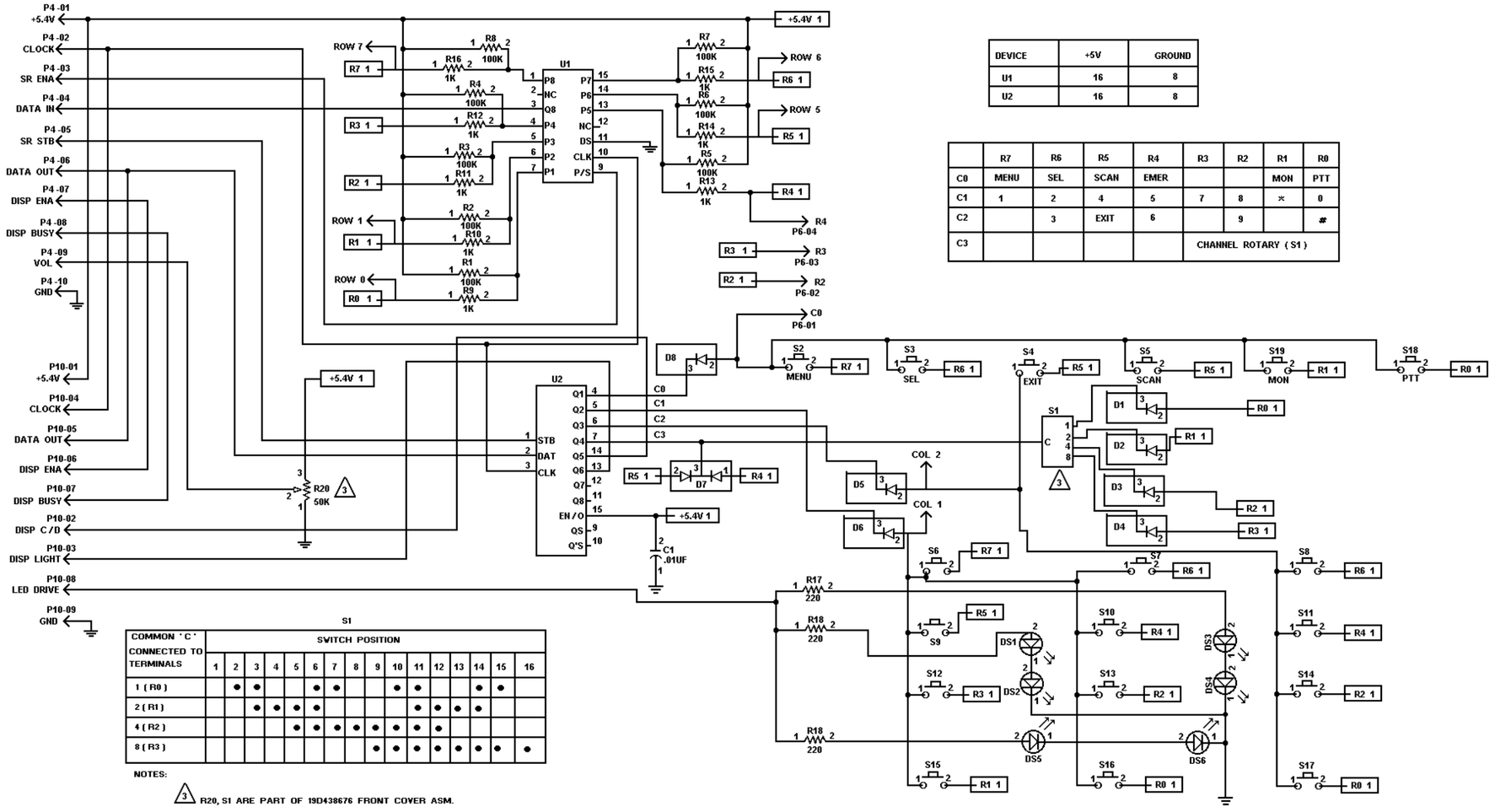
BATTERY CONTACT IDENTIFICATION
VIEWED FROM OUTSIDE OF CASE

COMPLETE RADIO INTERCONNECTION
(19D902383, Sh. 2, Rev. 1)



LCD BOARD
19C337096G1

(19D902236, Sh. 1, Rev. 1)



DEVICE	+5V	GROUND
U1	16	8
U2	16	8

	R7	R6	R5	R4	R3	R2	R1	R0
C0	MENU	SEL	SCAN	EMER			MON	PTT
C1	1	2	4	5	7	8	*	0
C2		3	EXIT	6		9		#
C3					CHANNEL ROTARY (S1)			

S1

COMMON "C" CONNECTED TO TERMINALS	SWITCH POSITION															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 (R0)		●	●			●	●			●	●			●	●	
2 (R1)			●	●	●	●					●	●	●	●		
4 (R2)					●	●	●	●	●	●	●	●				
8 (R3)									●	●	●	●	●	●	●	●

NOTES:

(3) R20, S1 ARE PART OF 19D438676 FRONT COVER ASM.

KEYPAD FLEX
19D438658P2
(19D902237, Sh. 1, Rev. 4)