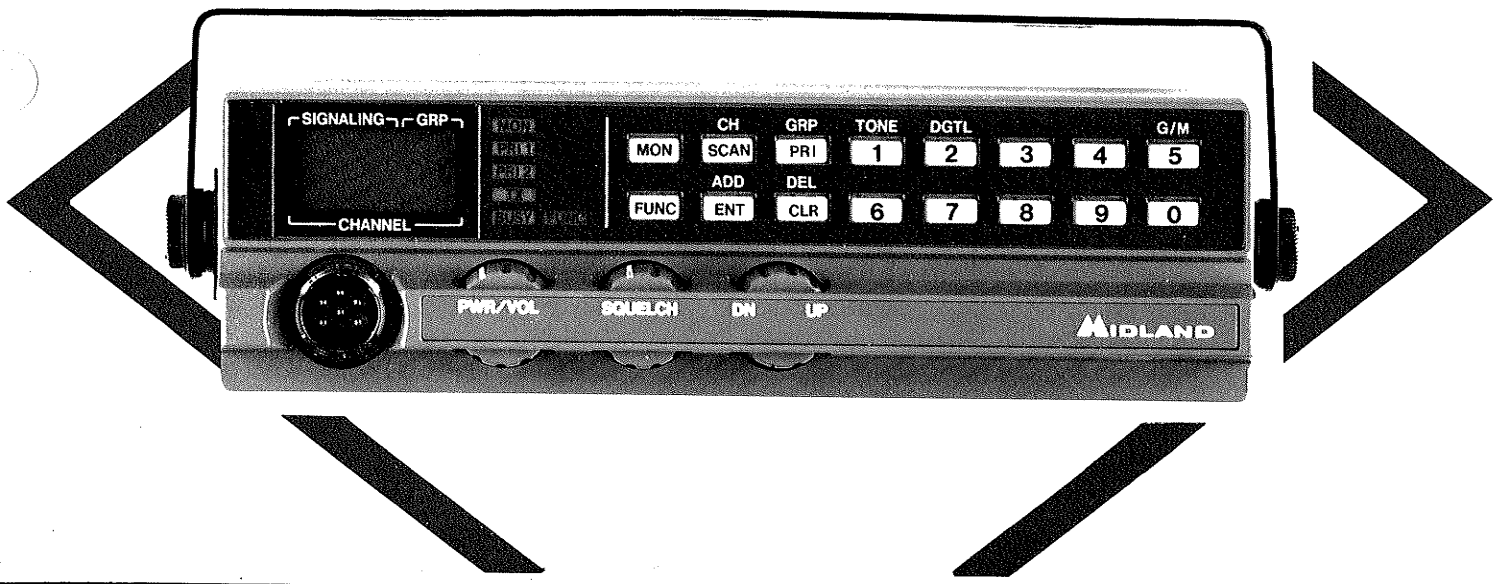
MIDLAND LMR
LAND MOBILE RADIO
SYNTECH™-II
SERVICE MANUAL

PART TWO (CONTROL HEADS)



70-0002 DELUXE CONTROL HEAD

MANUAL NO. 70-340383
09-3400/3800-SM-7/88-1.5M.

SYN-TECH II SERVICE MANUALS

SYN-TECH II service information is published in three separately-bound parts. Redundant information is segmented out so that numerous copies of the same material need not be purchased to acquire a library of various MIDLAND transceivers models.

Part One contains general servicing and installation information that is common to the entire SYN-TECH line.

Part Two contains technical data and drawings for the SYN-TECH II Control Heads. Two versions of this section exists: one for the Deluxe Control Head, and one for the Standard Control Head plus the Small-Remote Control Head.

Part Three contains technical data and diagram for SYN-TECH II TX/RX units. Versions of this section are nearly as numerous as SYN-TECH II models.

This service manual section is Part Two, and it contains specific technical data and diagrams for the SYN-TECH II Deluxe Control Heads. As necessary, service manual supplements will be published and distributed on the following forms:

Manual Addition (MA): For supplemental information useful in equipment alignment, service, or improvement. Printed on BLUE paper.

Change Notice (CN): For circuitry-change details made during production. Printed on YELLOW paper.

Manual Correction (MC): For correcting literature errors not related to production changes. Printed on GREEN paper.

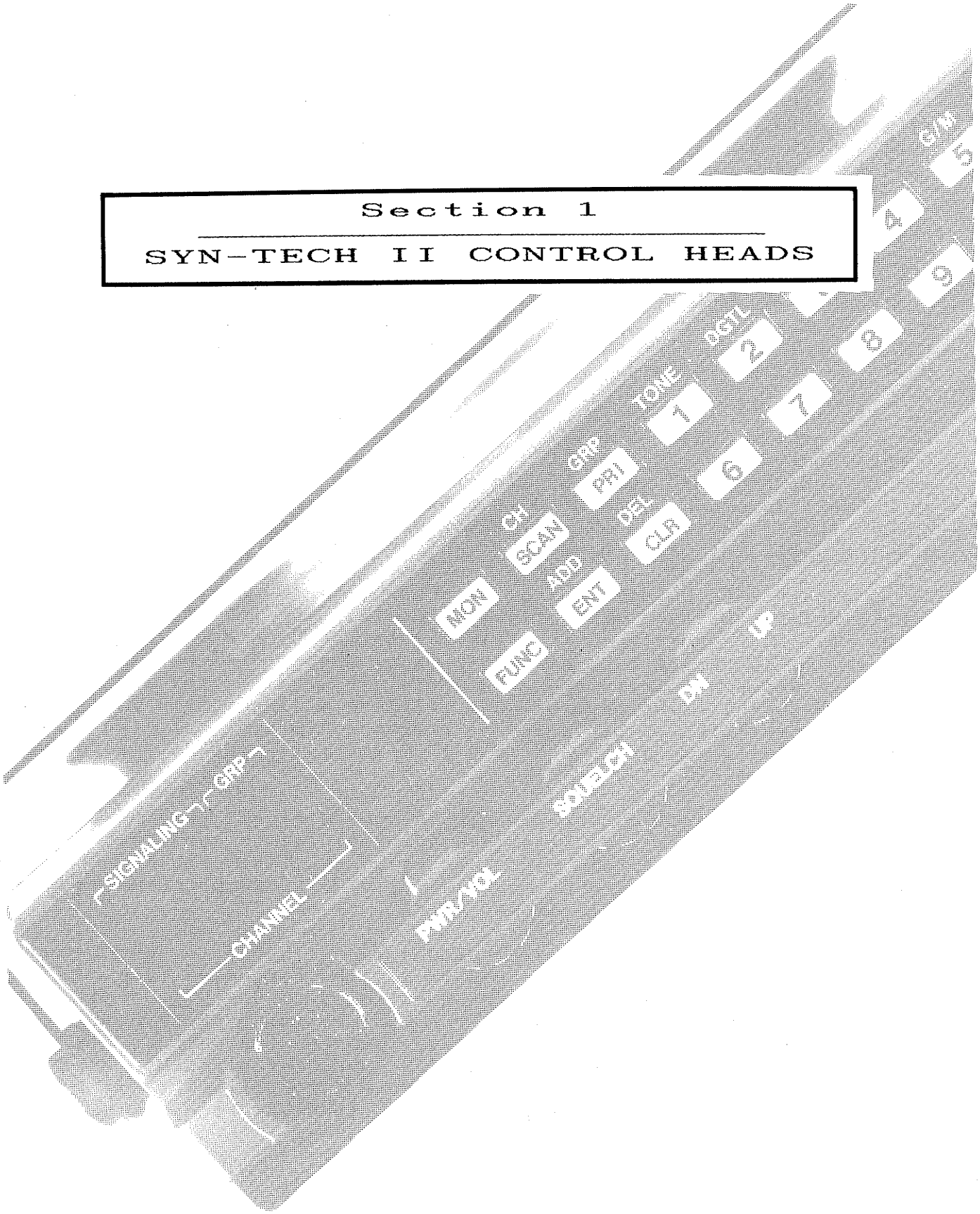
Technical Bulletin (TB): For solutions to field problems and tips for performance improvement. Printed on PINK paper.

Many useful facts and tips are provided in the text. If the reader intends to service several of the transceivers described herein, spending time to read applicable text will save time in the end.

TABLE OF CONTENTS

Section 1

SYN-TECH II CONTROL HEADS



DESCRIPTION

The 70-0002 Deluxe Control Head provides operator control of SYN-TECH II transceivers. It presents operator controls and displays, and is equipped with a microcomputer that illuminates the displays and monitors the controls. The microcomputer communicates with the TX/RX Unit via data lines when displays change or pushbuttons are pressed.

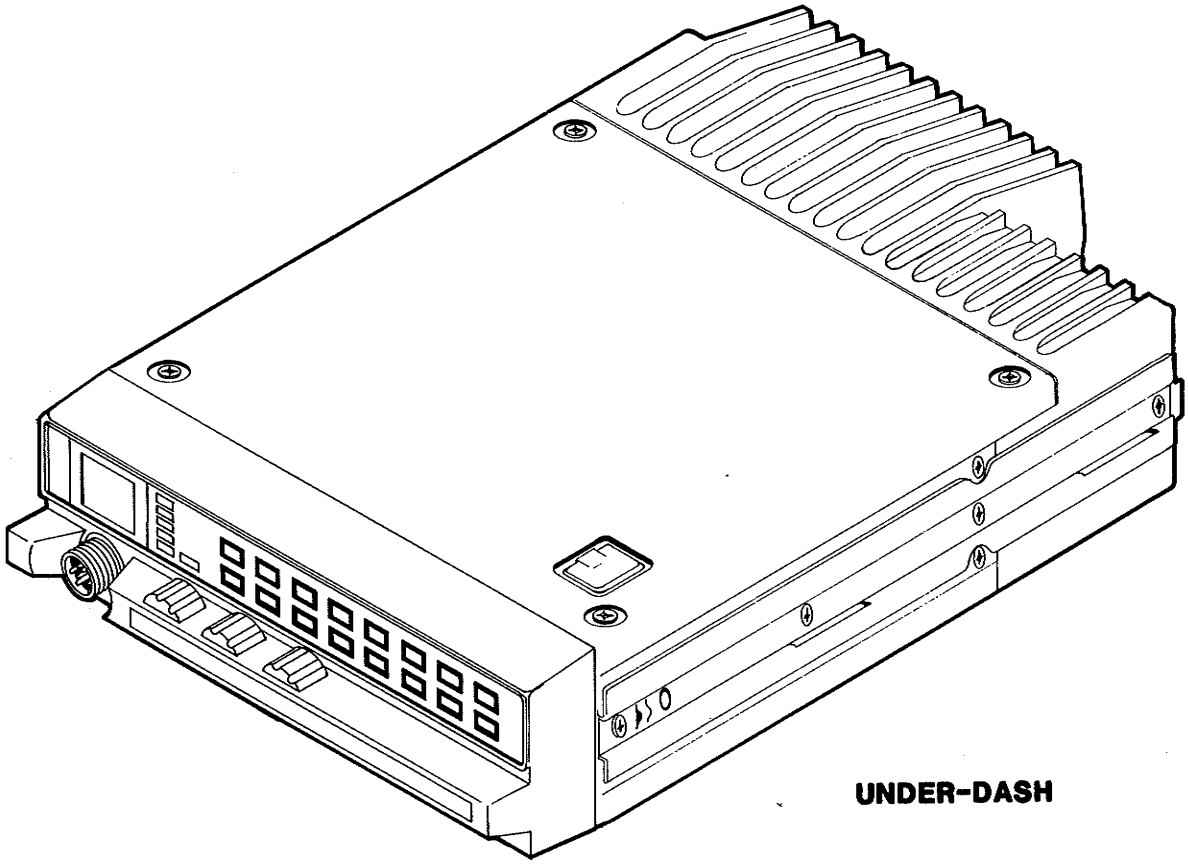
The SYN-TECH II is comprised of two parts: a TX/RX Unit and a detachable Control Head. If the SYN-TECH II radio is configured for under-dash mounting, the Control Panel is attached to the TX/RX Unit to comprise a single package. The TX/RX Unit of the trunk-mount configurations has connector and handle assembly mounted in place of the Control Head. A connector and rear cover assembly is also added to the Control Head. The two units are then connected together with the multi-conductor 70-0014 Control Cable (provided) when installed.

By itself, the 70-0002 Deluxe Control Head has no back cover and it fits directly onto the TX/RX Unit. To adapt the Control Head to trunk-mount, the 70-2986 Control-Head Conversion Kit adds a back cover, bracket, and the Cable Interface Board. Because of its size, the Small-Remote Control Head is used in trunk-mount configurations only; therefore, it is already equipped with a back cover, bracket, and the Cable Interface Board.

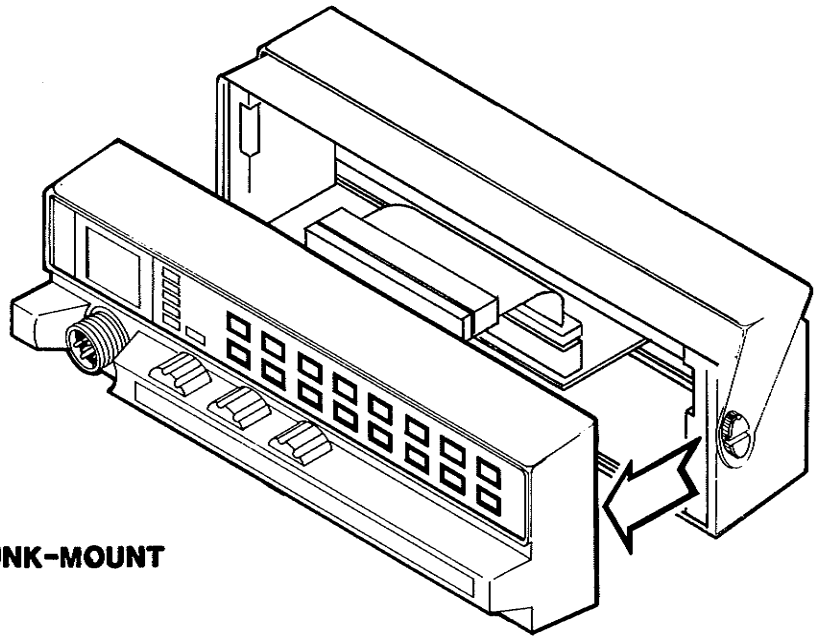
As standard, the Deluxe Control Head has a twelve-digit alphanumeric LCD display, sixteen pushbuttons, and six LED indicators. Spaces exist for four additional indicators that can be added for optional features. There are many permutations of these optional functions, which are grouped into four arrangements. Four different trim plates can replace the standard plate and they are defined: Type 1, Type 2, Type 3, and Type 4. LED's can be purchased in a kit of four; part number 70-2941. Refer to SYN-TECH II Capabilities Guide for further option information.

Each configuration Type accommodates a subset of all optional functions. The Type that best fits the equipped options must be chosen to purchase the correct trim plate and to program the radio. Because many features are labeled by each trim plate, radio programming also provides a means to disable unused keys.

The SYN-TECH II Deluxe Control Head does not contain an internal speaker; therefore an External Speaker must be connected (use MIDLAND 70-2355). The Deluxe Control Head contains four PC boards: the Control Board that contains the microcomputer; the Display Board that supports the pushbuttons, LCD displays, and LED indicators; the Knob Board that contains the Volume, Squelch, and Channel Knobs; and the Microphone Jack. The 70-2986 Control-Head Conversion Kit contains a fifth PC board, the Cable Interface Board, that interfaces the Control Cable to the Control Board.



UNDER-DASH



TRUNK-MOUNT

DELUXE CONTROL HEAD

DELUXE CONTROL HEADS

The SYN-TECH II Deluxe Control Head contains its own 4-bit microcomputer (IC301) that monitors pushbuttons and activates display segments. It communicates with microcomputer IC903 in the TX/RX Unit via a five-bit bidirectional data buss, through which display and pushbutton information is passed between the microcomputers. IC301 contains RAM, I/O ports, and masked ROM. IC301 activity is motivated by an 800KHz clock signal that is produced by X301.

Parallel with the five-bit data buss (IC301 pins 70-73 and 79), a data clock signal (CLK) and direction control logic (DCL) is passed from IC301 pin 78 and 64, respectively. Display information is sent up the buss to the Control Head while DCL is high. Pushbutton information is sent down to the TX/RX Unit when a pushbutton is pressed and DCL is low.

IC311 is the Liquid-Crystal Display (LCD) driver that receives serial data from microcomputer IC301 and energizes appropriate LCD segments. Additional direct connections from the microcomputer to the display energize LCD segments, too. Light from un-energized areas is polarized such that it passes through the polarized lens over the display. The energizing potential across LCD segments causes physical realignment of crystal molecules, thus altering the polarity of passing light. The misaligned light cannot pass through the lens and a dark area is formed.

Source current of LED current driver IC302 is regulated by Q301. If the Manual Dimmer Option is installed, Q301 bias is reduced by Q302 which is biased on by a logic high from IC301 pin 80. This limits current supply to the LED's.

Until a pushbutton is pressed, IC301 sequentially applies momentary logic lows to D10-D15 to test pushbutton rows (D10 is not used). When a pushbutton is closed, the low pulse originating from the respective row output is passed to the respective column input of IC301 (pins 14-17). By vectoring the tested row and the returned column, the microcomputer knows which button was pressed. It then sends appropriate data to the TX/RX Unit.

When a logic low is applied to IC301 pins 1 or 2 by the CHANNEL KNOB, the microcomputer sends appropriate data to the TX/RX Unit indicating UP or DOWN channel selection. If the CHANNEL KNOB is changed to the Momentary Rotary type (like SYN-TECH I), jumpers JP321 and JP322 must be swapped to adapt pin arrangement of the new switch. The same must be done to JP323 and JP324.

Push-To-Talk from the Hand Microphone also applies a logic low to IC301 via pin 65 to indicate operator request to transmit. This input interrupts IC301 activity to force immediate attention.

During power-up, IC301 RESET input is held high for a short duration that is determined by C331 and R309. After enough time for source lines to stabilize, Q303 is turned on and RESET input is released. The microcomputer then processes its initialization routine.

Jumpers JP301 through JP312 can be altered to re-configure Microphone Jack P317 for accepting the 70-2305 Desktop Microphone.

CABLE INTERFACE BOARD

The Cable Interface Board adapts the 70-0002 Deluxe Control Head for trunk-mount use. It is not used in under-dash configurations. The Cable Interface Board interfaces P308 of the Control Board to the trunk-mount Control Cable and adds Control Head Accessory Jack J319.

The external MONITOR function (on the Desktop Microphone), which disables Coded Squelch when pulled logic low, is routed to the UNMUTE input of the TX/RX Unit microcomputer. When the Control Head is configured for trunk-mount installation, the Cable Interface Board is added to interface the Control Cable connections. Included on the Cable Interface Board is Q306, which inverts Hang-Up logic so that the UNMUTE line is pulled low when the Hang-Up Box option is open (no on-hook contact closure). If the Hang-Up Box option is not installed, its connections to Accessory Jack J319 must be jumpered so that Q306 does not defeat Coded Squelch.

Zener diode D331 drops B+ to 5 Volts for use as interconnect pullup on the interface lines that connect to digital circuitry in the Control Head and the TX/RX Unit. D332 through D338 absorb voltages above 5.7 Volts and below -0.7 Volts that may be induced on Control Cable wires by extraneous energy.

IC301 PINOUTS

CONTROL HEAD MICROCOMPUTER IC301 — HD613901				
PIN NO.	PIN NAME	FLOW	FUNCTION LABEL	LOGIC & FUNCTION
1	D3	INP	UP	LOW = CHANNEL UP switch engaged
2	D4	INP	DN	LOW = CHANNEL DOWN switch engaged
3	D5	OUT	DN0	LOW = LED group one select
4	D6	OUT	DN1	LOW = LED group two select
5	D7	OUT	DN2	LOW = LED group three select
6	D8	OUT	DN3	LOW = LED group four select
7	D9	OUT	DN4	not used
8	D10	OUT	R0	not used
9	D11	OUT	R1	LOW = testing push-button row-1
10	D12	OUT	R2	LOW = testing push-button row-2
11	D13	OUT	R3	LOW = testing push-button row-3
12	D14	OUT	R4	LOW = testing push-button row-4
13	D15	OUT	R5	LOW = testing push-button row-5
14	R00	INP	C1	LOW = Push button in col. 1 pressed
15	R01	INP	C2	LOW = Push button in col. 2 pressed
16	R02	INP	C3	LOW = Push button in col. 3 pressed
17	R03	INP	C4	LOW = Push button in col. 4 pressed
18	RESET	INP		HIGH = Microcomputer reset
19	TEST	INP		not used
20	OSC1			Clock oscillator, 800 KHz
21	OSC2			Clock oscillator, 800 KHz
22	Vcc			5 Volts
23	HLT	INP		not used
24	V1			not used
25	V2			not used
26	V3			not used
27	COM1	INP		Common of LCD display data
28	COM2	INP		Common of LCD display data
29	COM3	INP		Common of LCD display data
30	COM4	INP		Common of LCD display data
31	SEG1	OUT		LCD display data
32	SEG2	OUT		LCD display data
33	SEG3	OUT		LCD display data
34	SEG4	OUT		LCD display data
35	SEG5	OUT		LCD display data
36	SEG6	OUT		LCD display data
37	SEG7	OUT		LCD display data
38	SEG8	OUT		LCD display data
39	SEG9	OUT		not used
40	SEG10	OUT		not used

CONTINUED ON NEXT PAGE

IC301 continuing....

PIN NO.	PIN NAME	FLOW	FUNCTION LABEL	LOGIC & FUNCTION
41	SEG11	OUT		not used
42	SEG12	OUT		not used
43	SEG13	OUT		not used
44	SEG14	OUT		not used
45	SEG15	OUT		not used
46	SEG16	OUT		not used
47	SEG17	OUT		not used
48	SEG18	OUT		not used
49	SEG19	OUT		not used
50	SEG20	OUT		not used
51	SEG21	OUT		not used
52	SEG22	OUT		not used
53	SEG23	OUT		not used
54	SEG24	OUT		not used
55	SEG25	OUT		not used
56	SEG26	OUT		not used
57	SEG27	OUT		not used
58	SEG28	OUT		not used
59	SEG29	OUT		not used
60	SEG30	OUT		not used
61	SEG31	OUT		not used
62	SEG32	OUT		not used
63	GND			ground
64	INT0	INP	DCL	Radio-intrf buss direction. HI=recv
65	INT1	INP	PTT	LOW = Push-To-Talk
66	R10	OUT		LCD serial data, M
67	R11	OUT		LCD serial data, CLK 1
68	R12	OUT		LCD serial data, CLK 2
69	R13	OUT		LCD serial data, DATA
70	R20	BOTH	DATA1	Interface data buss to radio uP
71	R21	BOTH	DATA2	Interface data buss to radio uP
72	R22	BOTH	DATA3	Interface data buss to radio uP
73	R23	BOTH	DATA4	Interface data buss to radio uP
74	R30	OUT		HIGH = LED select
75	R31	OUT		HIGH = LED select
76	R32	OUT		HIGH = LED select
77	R33	OUT		HIGH = LED select
78	D0	BOTH	CLK	Strobe of Radio-interface buss
79	D1	BOTH	DATA5	Interface data buss to radio uP
80	D2	OUT	MDIM	HIGH = LED's dimmed

CONTROL CABLE MEASUREMENTS

The following measurements were made with:

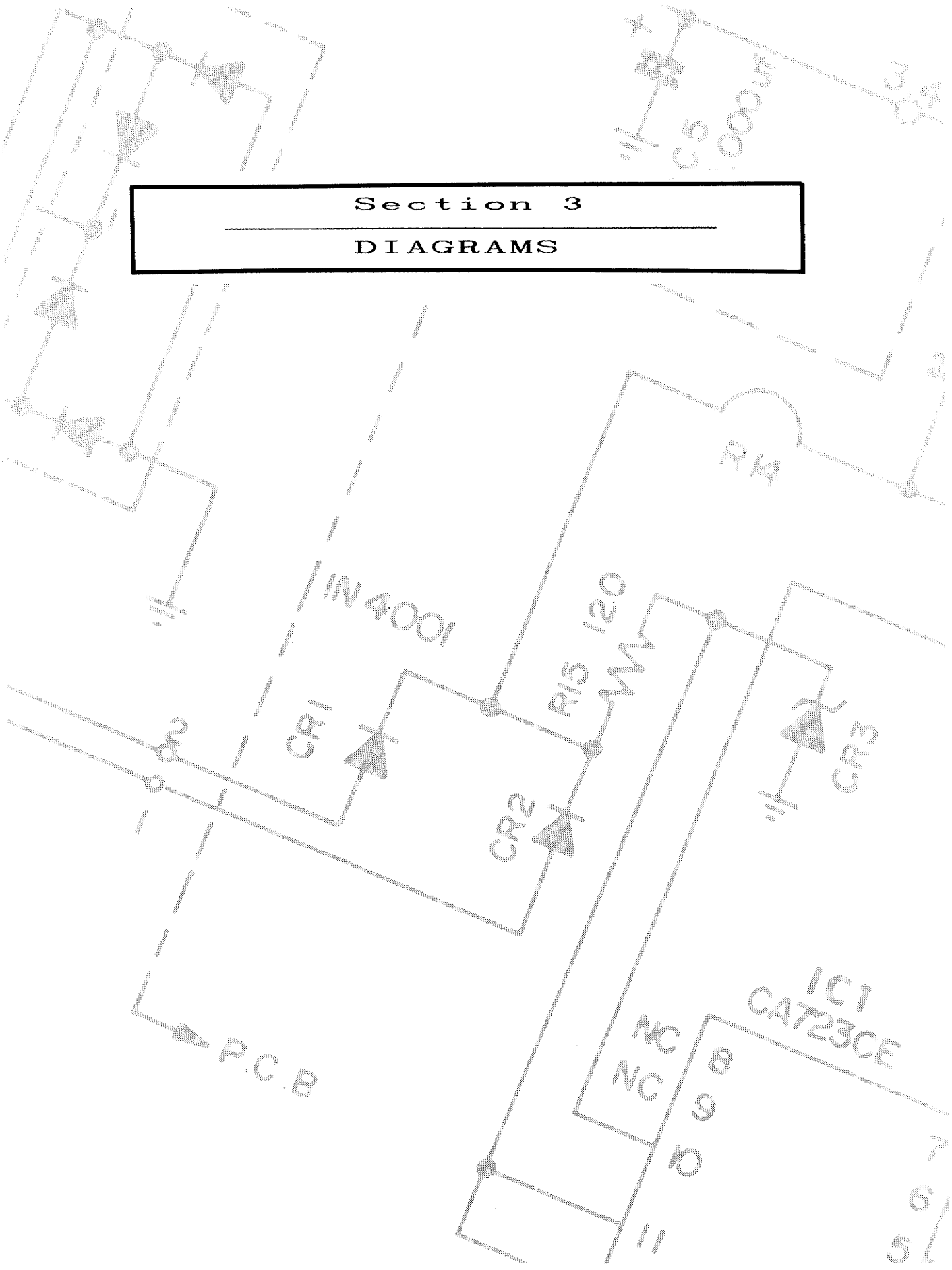
* No options installed or active,
* SQUELCH Control set just below threshold,
* No signal received,
* Coded Squelch off (MON on),
* VOLUME Control set to produce 1 Volt peak-to-peak signal between one speaker terminal and ground.

PIN NO.	NAME	FUNCTION	DC or AC VOLTAGE
1	SP(2)	Audio amplifier output, side 2	1 Vp-p audio sgnl
2	SP(2)	Audio amplifier output, side 2	1 Vp-p audio sgnl
3	SP(2)	Audio amplifier output, side 2	1 Vp-p audio sgnl
4	SP(2)	Audio amplifier output, side 2	1 Vp-p audio sgnl
5	DCL	Radio-to-C/H buss data direction	Logic low
6	CLK	Radio-to-C/H buss data clock	5-Volt logic high
7	DATA5	Radio-to-C/H data buss, MSB	5-Volt logic high
8	DATA4	Radio-to-C/H data buss	5-Volt logic high
9	DATA3	Radio-to-C/H data buss	5-Volt logic high
10	DATA2	Radio-to-C/H data buss	5-Volt logic high
11	DATA1	Radio-to-C/H data buss, LSB	5-Volt logic high
12	SG	Ground	0 Volts
13	+B	Primary DC source	13.6 Volts DC
14	MIC	Microphone audio	1 Vp-p audio sgnl *
15	MIC G	Microphone audio return	0 Volts
16	VOLA	Volume control feed (top)	2.5 Vp-p audio sgnl
17	VOLB	Volume control output (tap)	0.1 Vp-p audio sgnl
18	VOLG	Volume signal ground	0 Volts
19	UNMUTE	Monitor function	5-Volt logic high
20	SQ VOL	Squelch control	approx. 0.6 VDC
21	SQ G	Squelch control return	0 Volts
22	PSW1	Power Switch hot	13.6 Volts DC
23	PSW2	Power Switch return	13.6 Volts DC
24	SPINT	Internal Speaker signal	1 Vp-p audio sgnl
25	HORN G	Horn relay contacts, side 2	--
26	SP(1)/PA(1)	Std-Speaker/Pub-Spkr, side 1	1 Vp-p audio sgnl
27	SP(1)/PA(1)	Std-Speaker/Pub-Spkr, side 1	1 Vp-p audio sgnl
28	SP(1)/PA(1)	Std-Speaker/Pub-Spkr, side 1	1 Vp-p audio sgnl
29	IGNTN SW2	Power relay loop, coil side	13.6 VDC
30	IGNTN SW1	Power relay loop, hot side	13.6 VDC
31	HANGUP G	Hang-up Box ground	0 Volts
32	HORN	Horn relay contacts, side 1	--
33	PA(2)	Public Address spkr, side 2	--
34	PA(2)	Public Address spkr, side 2	--
35	PA(2)	Public Address spkr, side 2	--
36	PA(2)	Public Address spkr, side 2	--
37	SP(1)/PA(1)	Std-Speaker/Pub-Spkr, side 1	1 Vp-p audio sgnl

* with Hand Microphone keyed

Section 3

DIAGRAMS



NOTES

MIDLAND LAND MOBILE RADIO LMR

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MANUAL ADDITION

MODEL NO(s).: 70-0002
SERVICE MANUALS NO(s).: 70-340383
MANUAL PRINTING DATE: 7/88

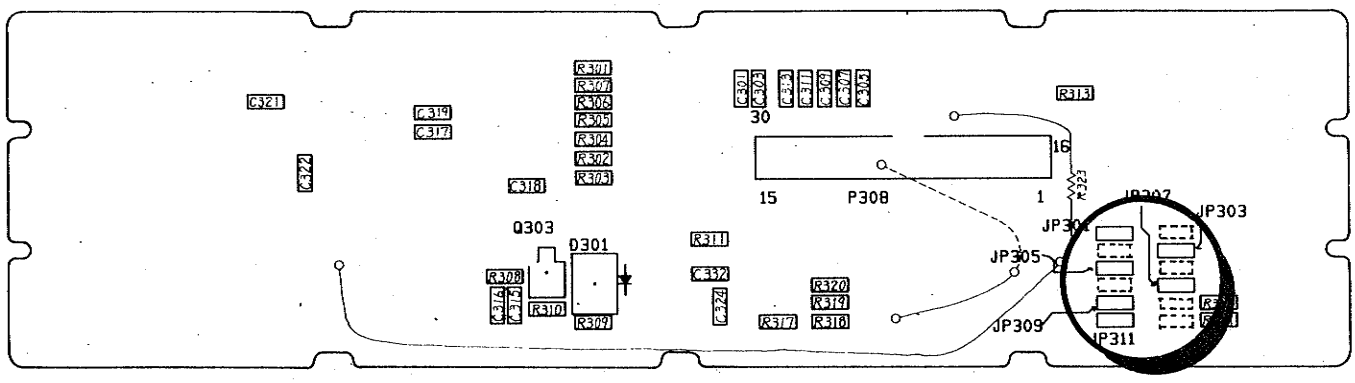
MANUAL ADDITION NO.: MA-137A
DATE: 11/2/92
SUBJECT: Microphone Jack Jumpering

Add the following supplemental information to the 70-0002 Syn-Tech II Deluxe Control Head Service Manuals (Part 2). **NOTE:** This manual addition replaces information given in MA-137.

MICROPHONE JACK CONFIGURATION

The Control Board contains six jumpers that can be moved to change the Microphone Jack pin functions to make the Jack compatible to the 70-2305B Desk-Top Microphone. The jumpers consist of six zero-ohm resistors that can be unsoldered and resoldered in new positions.

Control Board Jumpers	Microphone Jack P317 Configuration	
	70-2326 Standard Hand Microphone	70-2305B Desk-top Microphone
JP301	IN	OUT
JP302	OUT	IN
JP303	IN	OUT
JP304	OUT	IN
JP305	IN	OUT
JP306	OUT	IN
JP307	IN	OUT
JP308	OUT	IN
JP309	IN	OUT
JP310	OUT	IN
JP311	IN	OUT
JP312	OUT	IN


C321
C319
C317
C322
C318
R301
R307
R306
R305
R304
R302
R303
Q303
D301
R308
R310
R309
C314
C315
C301
C303
C311
C309
C307
C305
30
16
15
P308
1
R313
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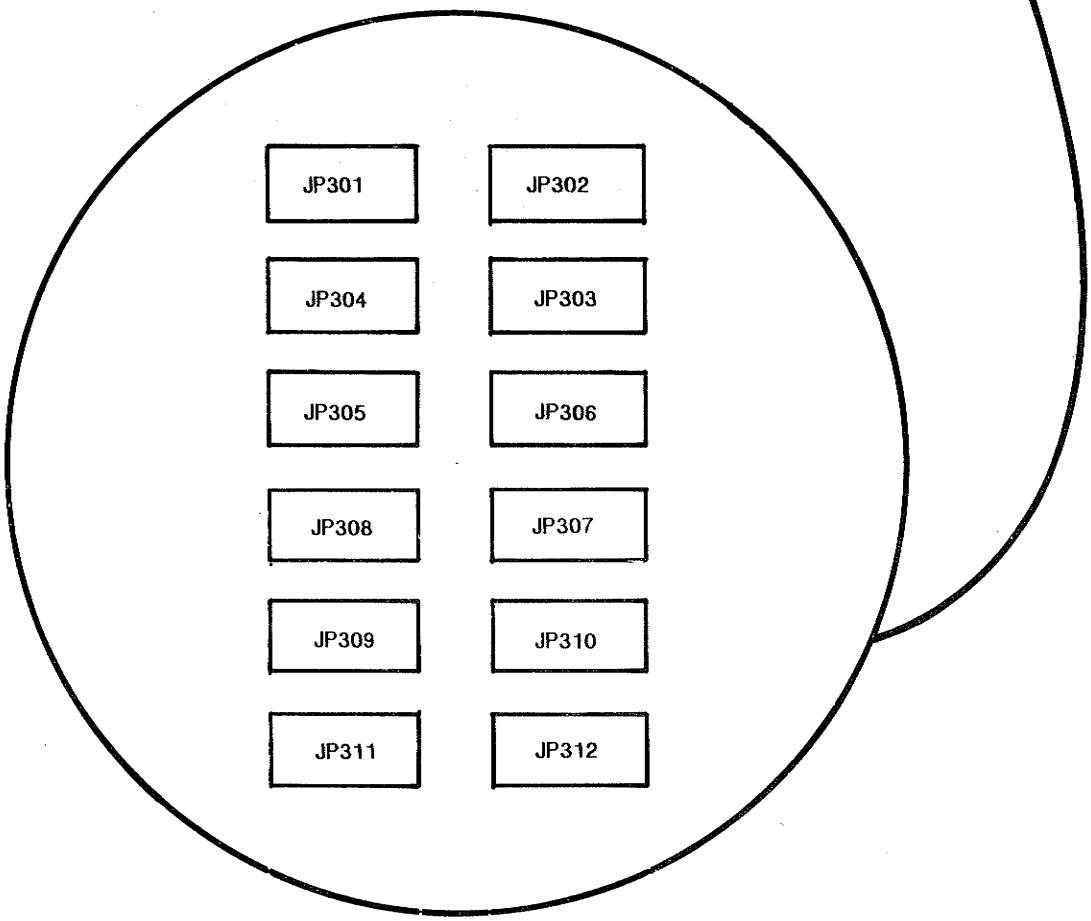
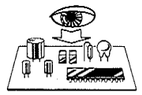
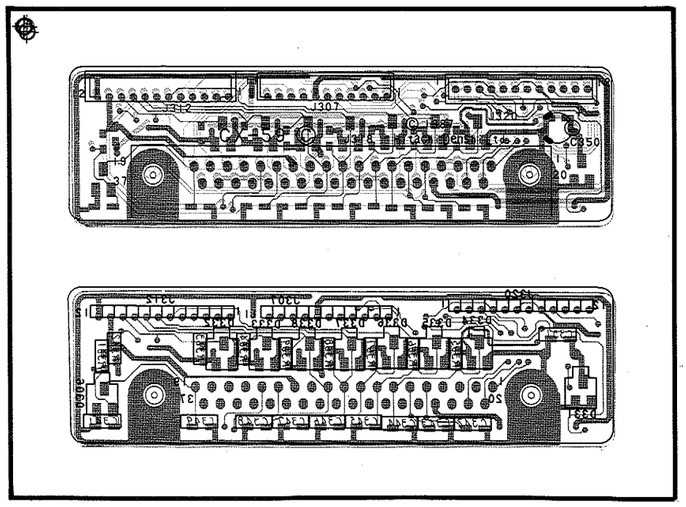
R311
C332
C328
R320
R319
R317
R318


JP301
JP302
JP304
JP303
JP305
JP306
JP308
JP307
JP309
JP310
JP311
JP312

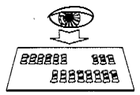
CX-59 CABLE INTERFACE BOARD (T/M ONLY)



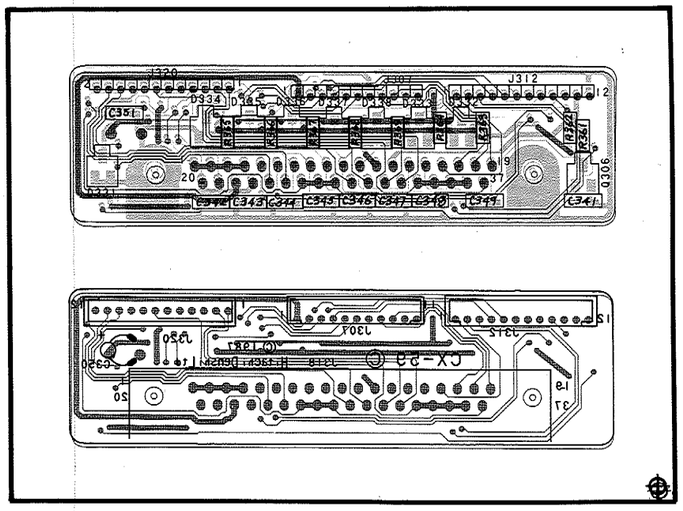
TOP VIEW



BLUE: VISIBLE PLATING
RED: UNDERSIDE PLATING



BOTTOM VIEW



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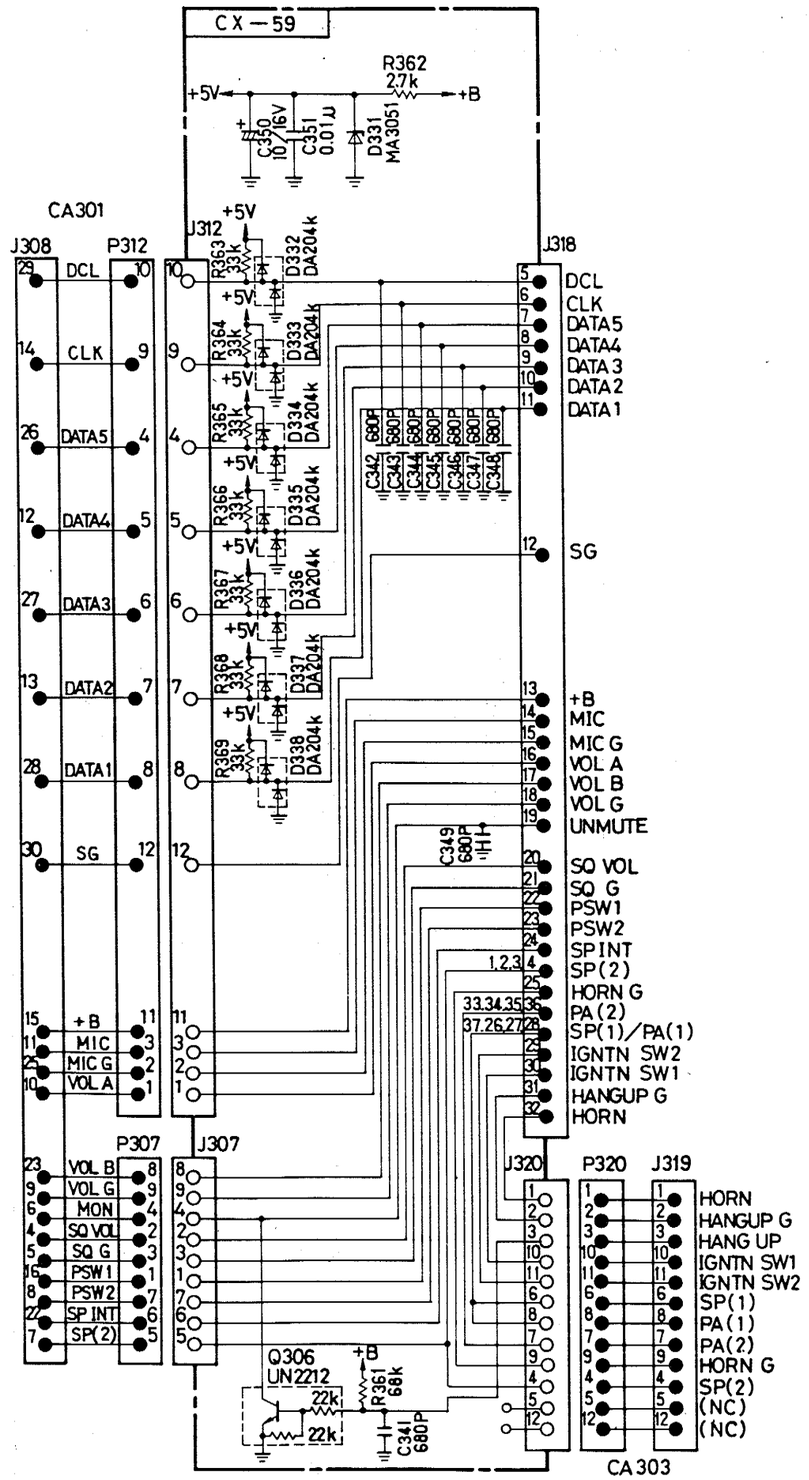
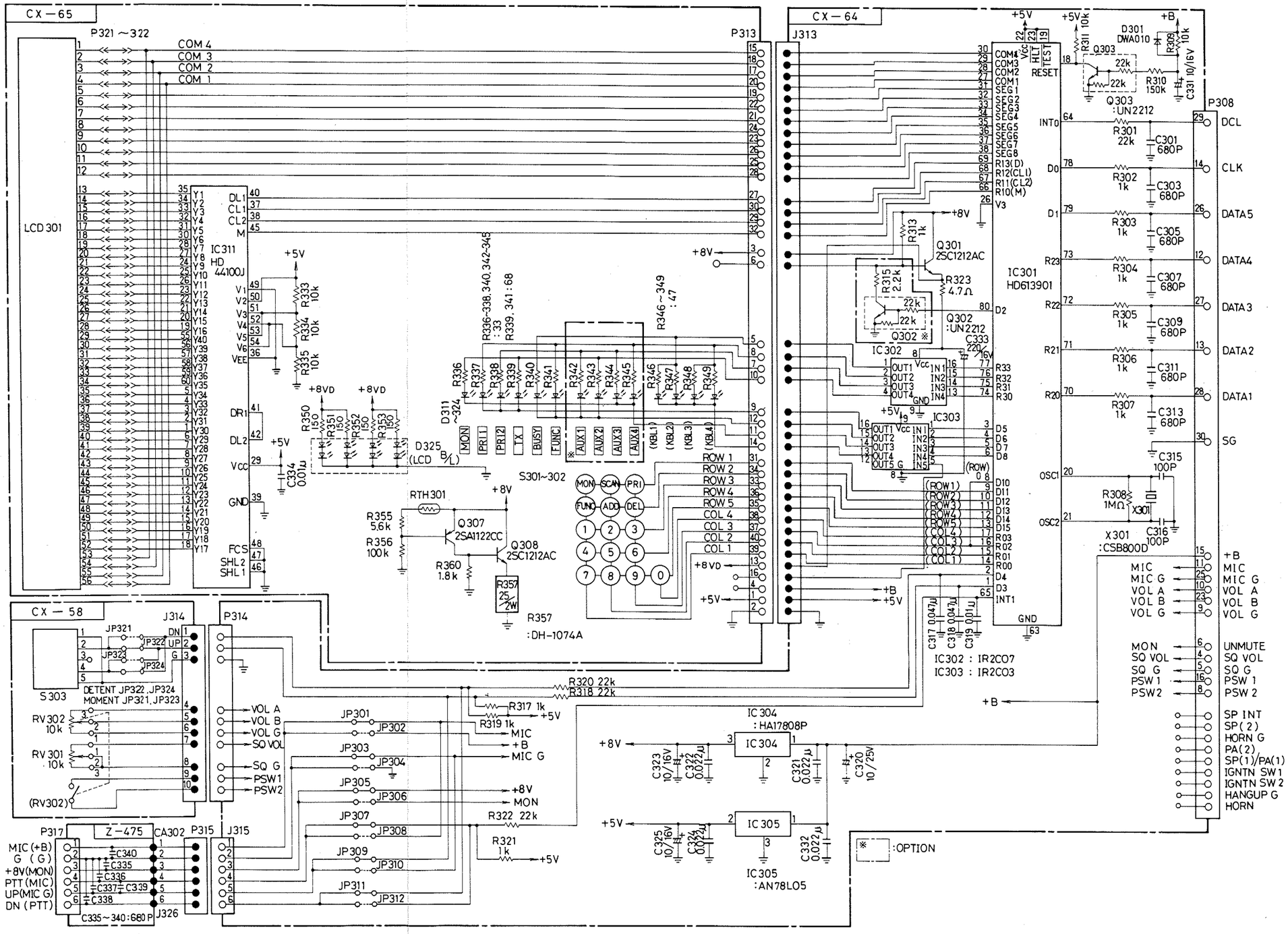


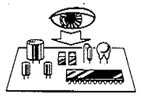
70-0002 DELUXE CONTROL HEAD SCHEMATIC



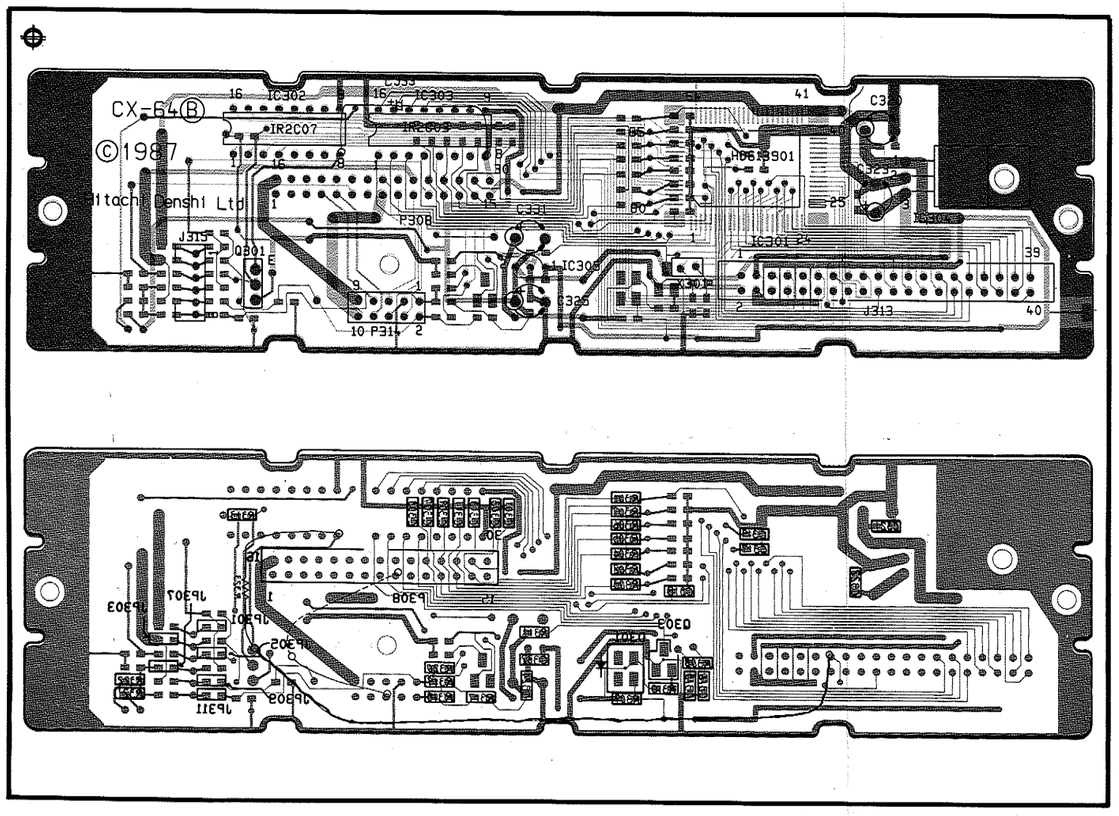
S3-4

FOLD OUT

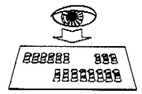
CX-64 CONTROL BOARD MAP



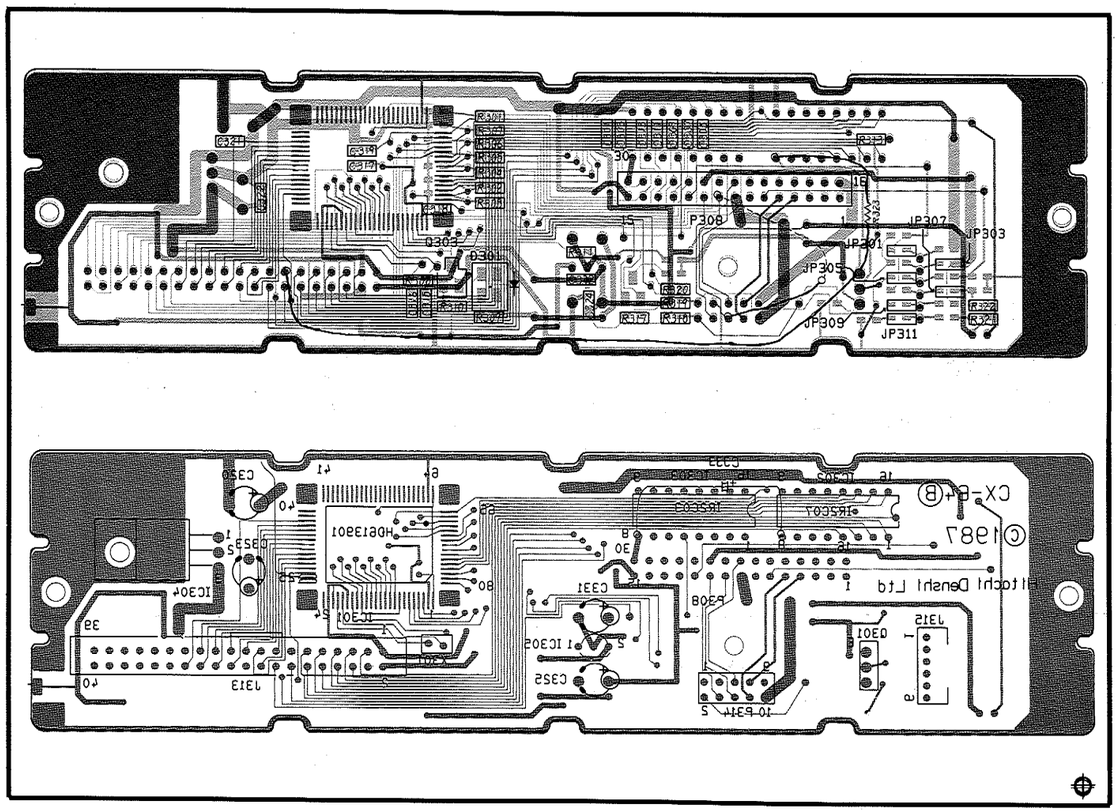
TOP VIEW



BLUE: VISIBLE PLATING
RED: UNDERSIDE PLATING



BOTTOM VIEW



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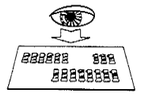
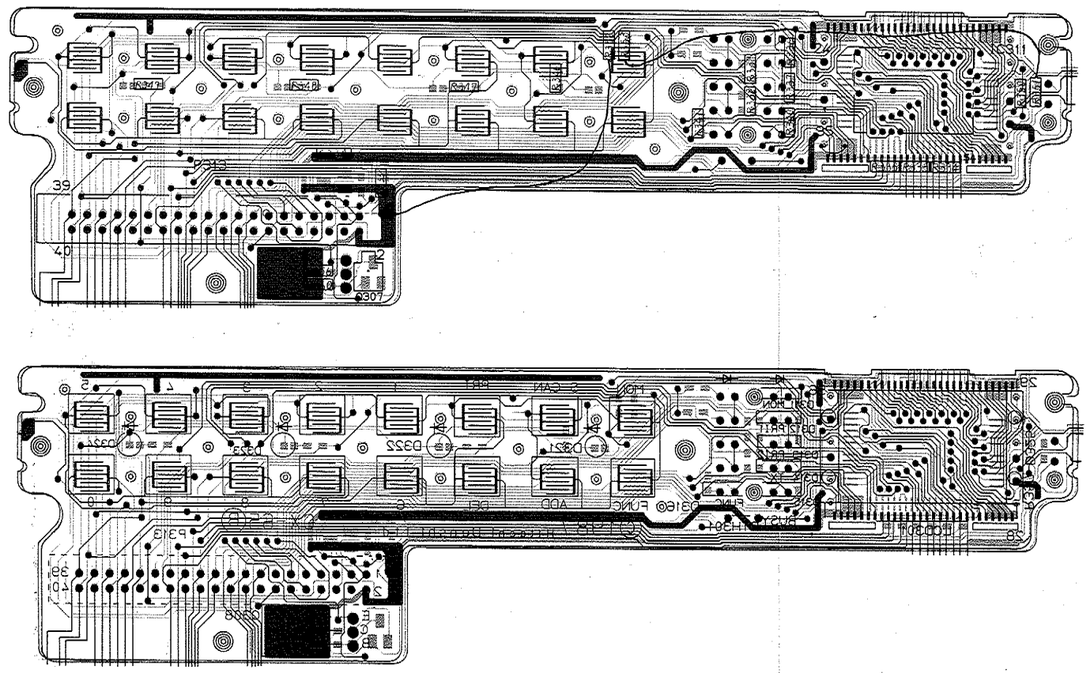
RED: UNDERSIDE PLATING

CX-65 DISPLAY BOARD MAP

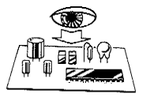
BOTTOM VIEW

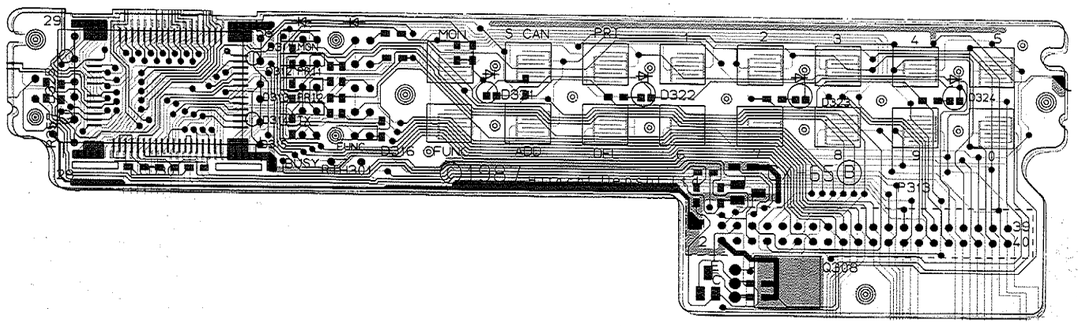




BLUE: VISIBLE PLATING
RED: UNDERSIDE PLATING

TOP VIEW

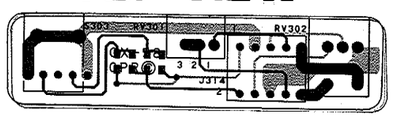




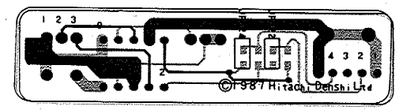
BLUE: VISIBLE PLATING
RED: UNDERSIDE PLATING

CX-58 KNOB BOARD MAP

TOP VIEW



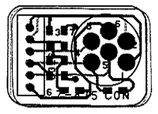
BOTTOM VIEW



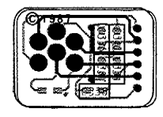
BLUE: VISIBLE PLATING
RED: UNDERSIDE PLATING

Z-475 MICROPHONE JACK

TOP VIEW



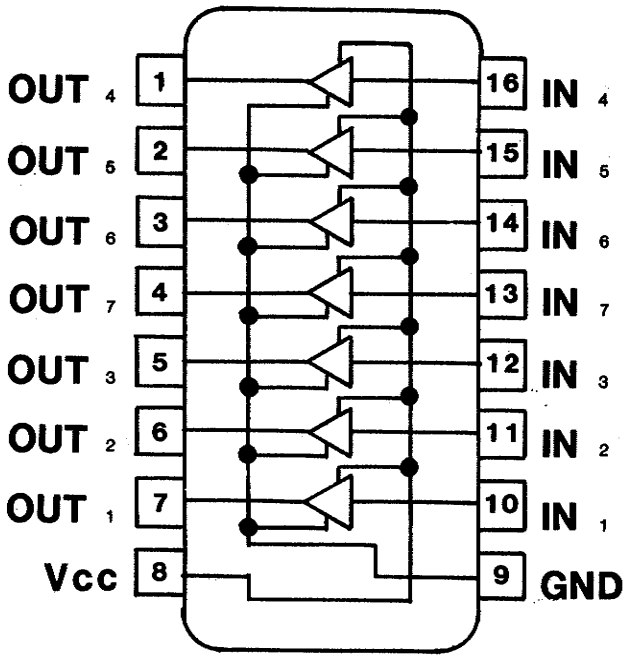
BOTTOM VIEW

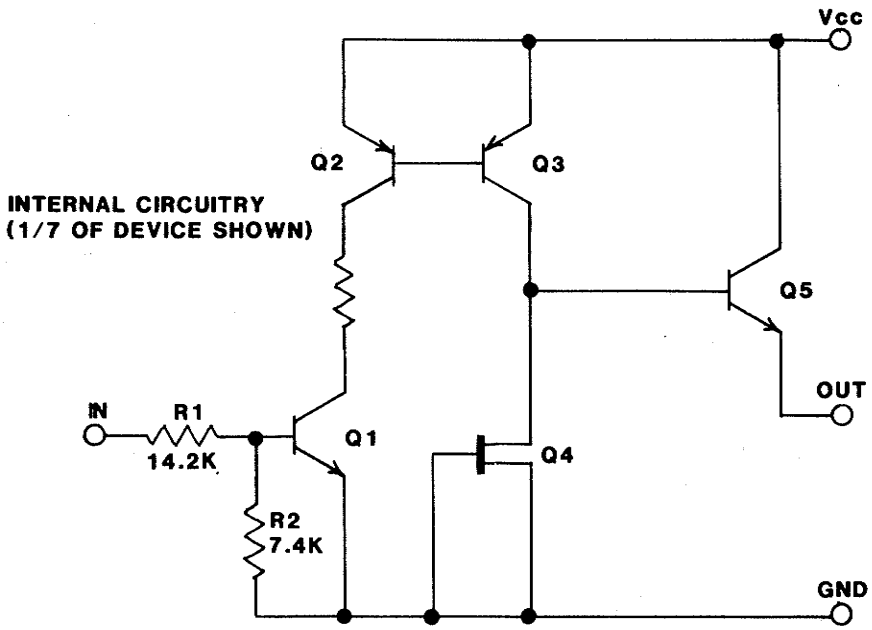


BLUE: VISIBLE PLATING
RED: UNDERSIDE PLATING

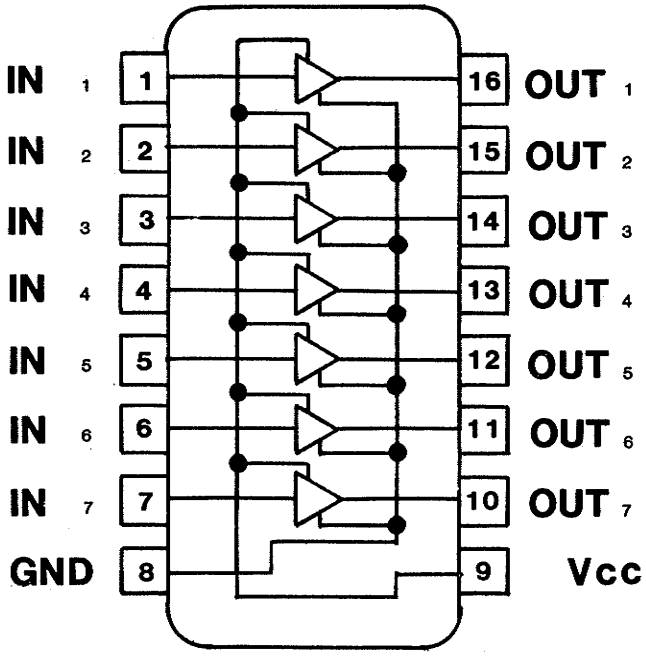
FOLD OUT

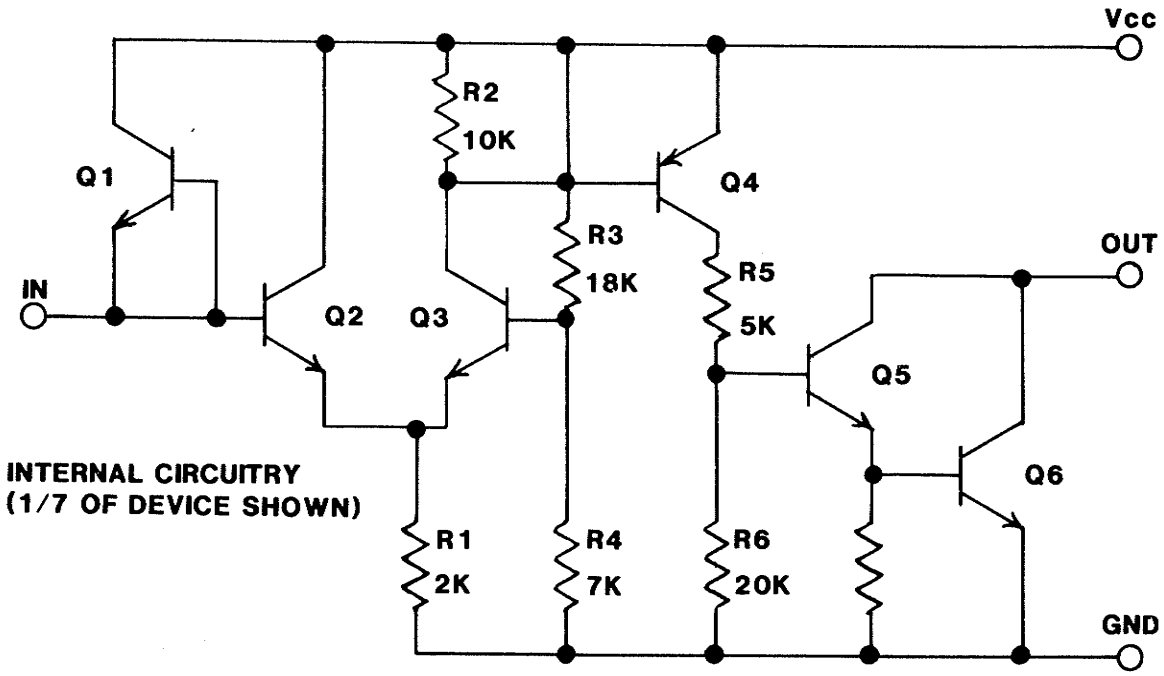
IC302 DETAIL





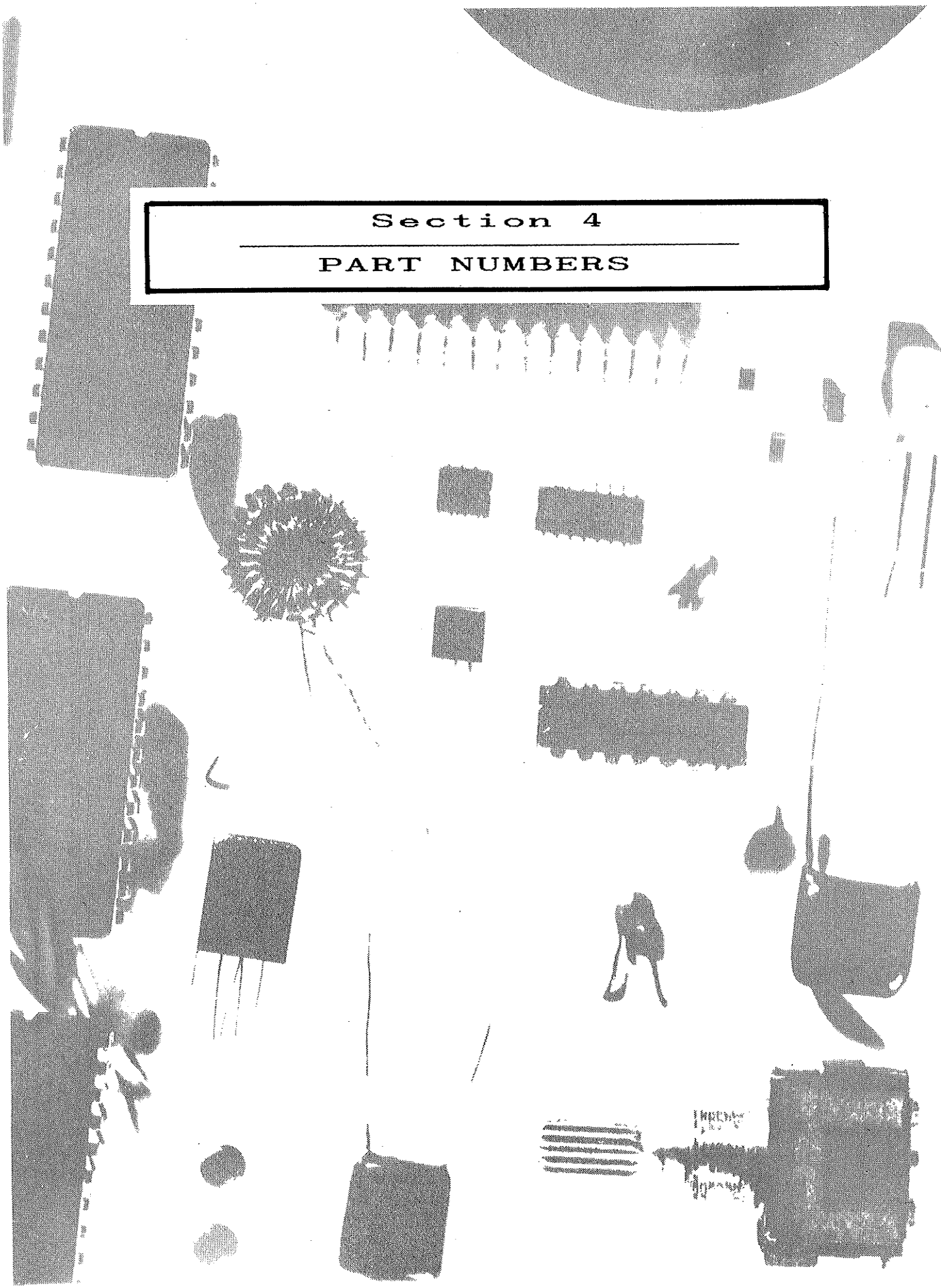
IC303 DETAIL

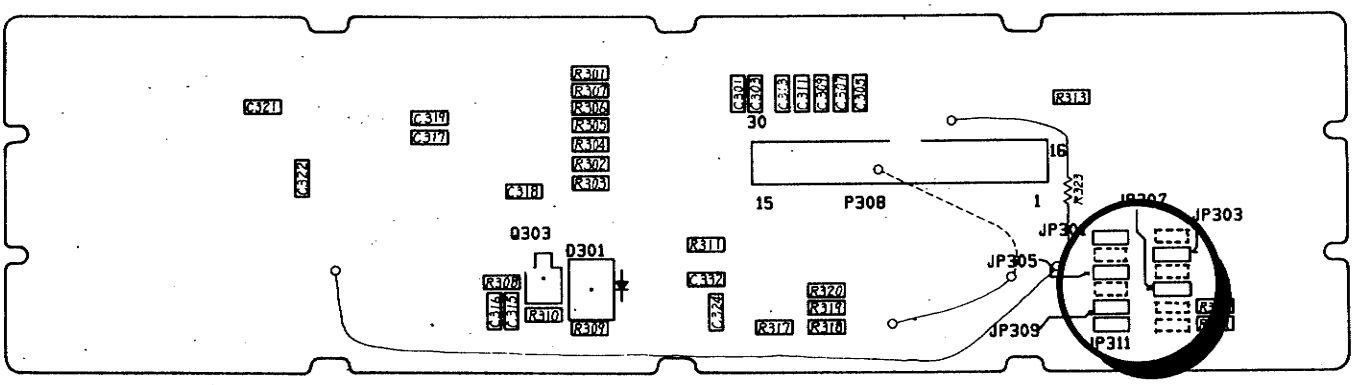


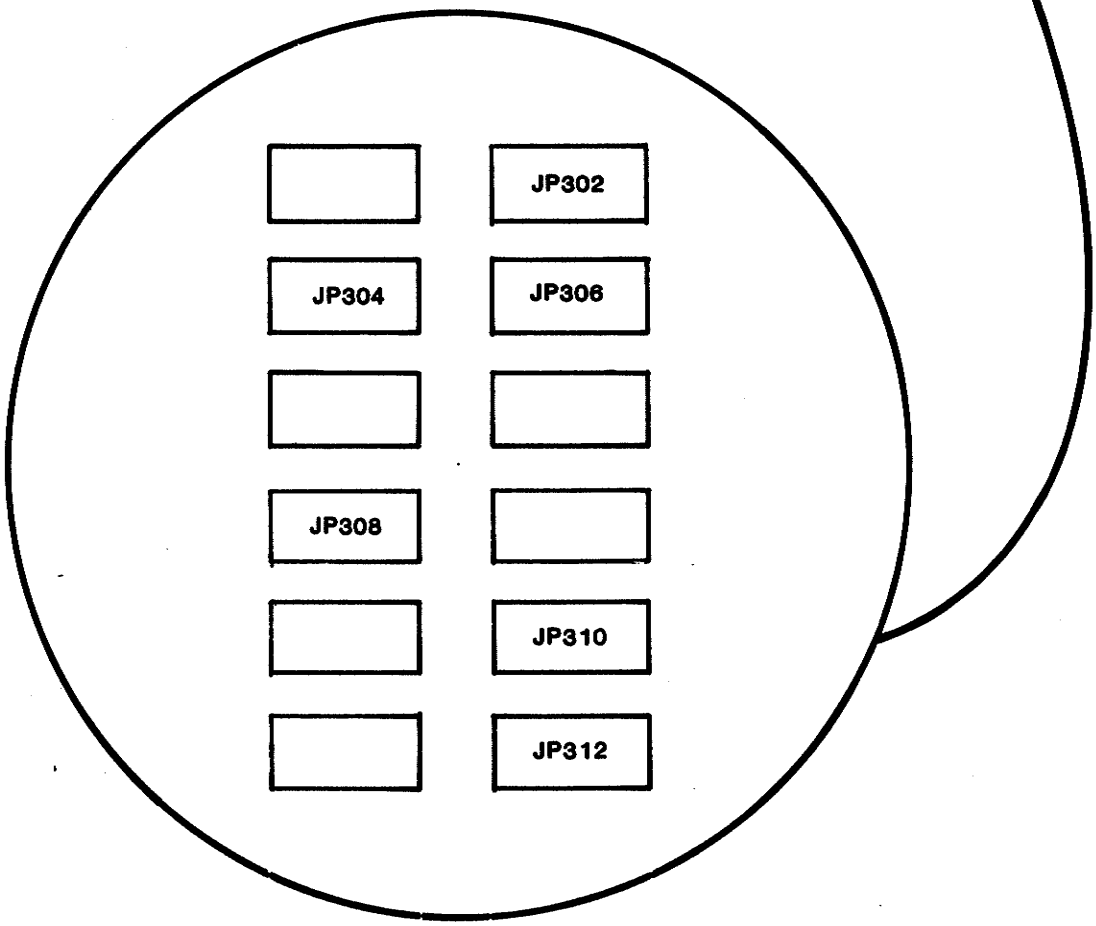


Section 4

PART NUMBERS




C321
C319
C317
C322
C318
R307
R306
R305
R304
R302
R303
Q303
D301
R308
R310
R309
C316
C315
C301
C302
C311
C303
C304
C312
30
16
15
P308
1
R313
R323
JP307
JP303
JP304
JP305
JP309
JP311
R311
C332
C324
R320
R319
R318
R317


JP302
JP304
JP306
JP308
JP310
JP312

MIDLAND LMR
LAND MOBILE RADIO
1690 N. TOPPING • KANSAS CITY • MISSOURI • 64120
(P. O. BOX 419903 • KANSAS CITY • MISSOURI • 64141)
TELEPHONE: (816) 241-8500 • TELEX: 43-4045 • CABLE: MICO

SERVICE MANUAL REVISION

MODEL NO.: 70-0002
SERIAL NOS.: 1191 and UP
SERVICE MANUAL NO.: 70-340383
REASON FOR CHANGE: MFRS. IMPROVEMENT

REVISION NO.: CN - 446
DATE: 12/19/88
SUBJECT: CIRCUIT CHANGES

REF. NO.	DESCRIPTION	FROM	TO	PART NO.	LOCATION
CX64	PCB	"B"		70-075339	- - - - - -
CX64	PCB		"C"	70-075371	- - - - - -
CX65	PCB	"B"		70-075340	- - - - - -
CX65	PCB		"C"	70-075372	- - - - - -
CX58	PCB	"A"		70-075318	- - - - - -
CX58	PCB		"B"	70-075373	- - - - - -
R323	Resistor	4.7 Ohm Carbon		70-147216	Q301 Emtr
R323	Resistor		10 Ohm chip	70-144115	Q301 Emtr
R324	10 Ohm Resistor		Added	70-144115	Q301 Emtr
R342-345	30 Ohm Resistor		Added	70-140320	Aux 1-4 LED's
	Wire	Deleted		Pin 9 P308 to Pin 6 P314	
	Wire		Added	C333 to Pin 8 IC303	
	Wire	Deleted		D325 to Ground	
	Wire	Deleted		Pin 1 RV302 to Pin 6 J314	
	Wire	Deleted		Pin 26 IC302 to ground	

REPLACEMENT PARTS ORDERING

To speed delivery and avoid errors, always include the following information when ordering replacement parts:

1. Best identification of the part.
   - A. MIDLAND part number, or
   - B. Model and Serial numbers of equipment in which the part is used, with
   - C. Part description, and
   - D. Schematic reference designator, and,
   - E. If necessary, return the old part as sample

2. Specify quantity desired of each part.

3. Ship-to address (and billing address if different)

Mail or phone your order to:

Parts Department

MIDLAND

RADIO CORPORATION

5900 Parretta Drive **Kansas City, MO 64120**

Tele: 816-241-8500 **Fax: 816-241-5713**

www.midlandradio.com **Email: mail@midlandradio.com**

(Info correct as of 2/10/2006)

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