MAINTENANCE MANUAL
TMX 8510 HANDSET
19A704950P1

SPECIFICATIONS

POWER SUPPLY
    Nominal   13.8 Vdc
    Range   10.5 Vdc to 16 Vdc
                                  No failure or lack of functions within this range

CURRENT DRAIN   Less than 5 milliamperes

OPERATING TEMPERATURE RANGE
    Nominal   25°C
    Operating Range   -30°C to +60°C

VCC VOLTAGE   At 25°C, 5.0 Vdc to 5.4 Vdc typical

CLOCK FREQUENCY   28.800 kHz +0.1 Hz at 25°C
                                  28.800 kHz +10 PPM at -20°C to 50°C

WATCH DOG FREQUENCY   2 to 4 Hz at 25°C

The General Electric TMX 8510 Handset, shown in Figure 1, consists of a telephone numeric keypad with special function keys, a liquid crystal display and two circuit boards. Interface Board (A1) contains the handset microphone, microphone preamplifier, sidetone mixer, amplifier, earpiece driver and handset earpiece. Logic Board (A2) contains the keypad switches, a microprocessor, receive and transmit buffers and a clock generator.

Figure 1 - TMX 8510 Handset

Interface Board A1

Audio from the electret microphone (B101) is amplified by U101A and passed to the transmit audio path of the radio. A portion of this is connected to the sidetone mixer and amplifier U101B through divider resistors R127, R128 and R104. Audio from the receiver is amplified by U101B, along with the sidetone, and passed to the earpiece driver transistors Q101 and Q102. The output of the driver is connected to the earpiece B102.

Regulator U102 and diodes D103 thru D109 provide a temperature compensated supply for the Logic Board.

Hookswitch S1, (located on Logic Board A2) controls Q103 and Q104 to signal the radio unit of a on/off hook condition.

Logic Board

The 4-bit microprocessor (U3) scans the keypad and provides output control to the display driver. The microprocessor also provides control of the display backlighting. When a key is closed on the keypad, an ASCII code is generated by the microprocessor and sent to the radio logic circuits over a 2-wire asynchronous serial bus. The logic unit in the radio interprets the code and returns an appropriate response to the microprocessor which in turn, completes the command. A watchdog timer (Q2, U1D) periodically pulses the microprocessor to prevent runaway operation.

Backlighting of the display and keypad is provided by five LED's (H1-H5). Control for the backlighting is provided by a pulsed signal from the microprocessor to the LED driver transistor Q5. The duty cycle, determined by the microprocessor, establishes the intensity of the backlighting. Pressing the E (END/FUNCTION) key followed by the VOLUME "up" or "down" key adjusts the backlighting intensity.

The eight-digit liquid crystal display (H1) is driven by the multiplexed output of the microprocessor. Due to the board operating temperature range requirement for the LCD, the driving signal must be temperature compensated to maintain good contrast and operating speed. This compensation is provided by the temperature compensating regulator (located on interface board A1).

TEST SPECIFICATIONS

Microphone

1. Sensitivity: An input level of 97 dB SPL will produce an output of 35 mV rms ± 5 dB. (dB SPL = 20 Log 10 (Pn/Po) where Pn is the rms sound pressure in Pascals and Po = 2 x 10⁻⁵ Pascal)

2. Distortion: For an input signal of <1% distortion, the output distortion will not exceed 3% from 300 Hz to 3000 Hz.

Receiver

1. Offhook Sensitivity: A 1 kHz, 3 V rms input signal will produce an output level of 94 ± dB SPL, as measured at the artificial ear (approximately 26 mV rms across the DH52 speaker).

2. Distortion: For an input signal of 3 V rms with less than 1% distortion, the output distortion is less than 5% as measured at the artificial ear, from 300 to 3000 Hz.

3. Ear Protection: An audio limiter is provided to ensure that the maximum acoustic output does not exceed 120 dB.

Sidetone Level

The acoustic-to-acoustic sidetone response shall be such that a 1000 Hz, 97 dB SPL transmit- audio input signal shall produce 85 ± 4 dB SPL at the artificial ear.

Hook Condition

The hook condition is created by a hanger containing a magnet to activate a reed switch. The hook condition must operate as follows:

1. OFF Hook: 0.2V maximum, 0.6 mA sink minimum.

2. ON Hook: (Properly mounted on the hanger): Open collector (high impedance)

Serial Data

The serial data format is a pseudo RS-232 format. Specifically, it is an asynchronous serial bus operating between Vcc and 0 volts.

Baud Rate:	300 + 5%
Bit Pattern:	1 start, 2 stop, 8 data (No parity check)
Format:	0 to Vcc inverted (Vcc is the "No Data" condition)
Vcc:	4.5 to 6.0 Vdc
Keypad Data:	High - Open collector Low - 0.2 Vdc, 1 mA sink
Display Data:	High - Open collector drive <50μA current drain Low - 0.8V maximum

KEYPAD/DISPLAY

To test the handset by itself, loop the output to the input by connecting P1-1 to P1-6 on a test connector. Apply nominal +13 volts to P1-3 and ground to P1-8. Connect the connector on the handset cord to the test connector. To turn ON the audio and backlighting portions of the handset, press the RCL (RECALL) button and while holding it pressed, push the "*" button. The audio and backlighting portion of the handset will turn on. This step must be completed before performing any other test.

Operation of the handset will now cause changes in the display according to the following:

1. Numerical keys, pressed individually, will display the number entered. If more than eight digits are entered, the digits will disappear to the left in the order they were entered.

2. When the control keys (BLUE) are pressed individually, either a character will be displayed or there will be no reaction from the display.

Single Key Entries

Key	Display
CNCL/MON	No Reaction
VOL▼	h
VOL▲	-
STO	r
E	No Reaction
RCL	No Reaction
S	=
*	≡
#	Space
1	ı
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
0	0

Extra Functions

To execute the following commands, hold the first key down while pressing the second key.

1. To clear the display at any time, press "E" first and simultaneously press "VOL".

2. Commands used to display specific functions:

Display Functions:

	To Display		To Clear	
	1st Key	2nd Key	1st Key	2nd Key
In Use	CNCL/MON	8	CNCL/MON	9
Roam	CNCL/MON	STO	CNCL/MON	S
Horn	CNCL/MON	*	CNCL/MON	#

3. Commands used to backlight the keys and the display:

Function	First Key	Second Key
Increment The Backlight	CNCL/MON	3
Decrement the Backlight	CNCL/MON	4

The backlight has eight levels of intensity; therefore, it can be incremented eight times and decremented eight times. The second key can be pressed more than eight times but will stay at its highest level when incrementing and will stay off while decrementing.

4. Commands used to turn on the audio and backlighting portions of the handset:

To turn ON the audio and backlighting portions of the handset, press the (RECALL) button and while holding it pressed, push the "*" button. The audio and backlighting portion will turn on. This step must be completed before performing any other tests.

To turn OFF the audio and backlighting portions of the handset, press the RCL (RECALL) button. (NOTE: Pressing the RCL (RE-CALL) and "#" buttons at the same time will have the same effect). The audio and backlighting portion of the handset will shut off.

Adjustments

The contrast ratio on the LCD display may be adjusted by using the following procedure:
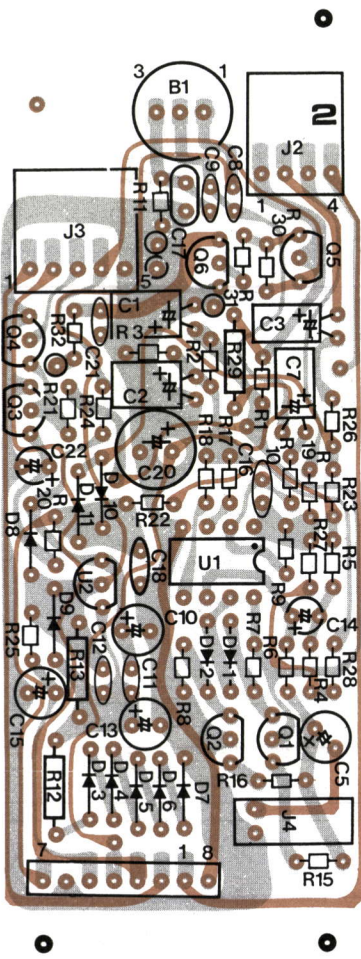
1. Press Key "1".

2. Slowly turn R25 counterclockwise until a "1" is displayed at the rightmost digit on the display. Ignore any other digits at this time.

3. Continue to turn R25 in the same direction until the five normally off segments around the "1" begin to glimmer. Then, turn R25 clockwise 1/8 turn (45°).

4. If the five normally off segments do not glimmer for any setting of R25, set R25 to its full counterclockwise position.
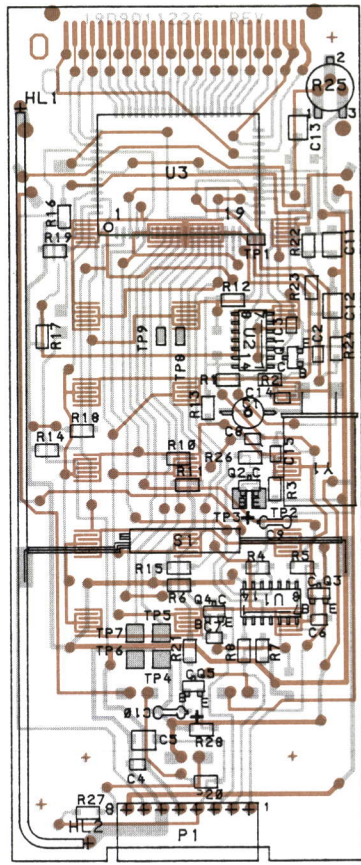
GE Mobile Communications

(90-603-4, REV. 2)
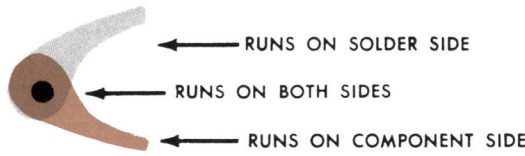

*Earlier Models
(19D901175, Rev. 0)
(19A703251, Sh. 1 Rev. 0)
(19A703251, Sh. 2 Rev. 0)

*Earlier Models
(19D901175, Rev. 0)
(19A703251, Sh. 2, Rev. 0)

← RUNS ON SOLDER SIDE

← RUNS ON BOTH SIDES

← RUNS ON COMPONENT SIDE

Interface Board A1
(90-603-3)

Logic Board A2
(19D901122G1, G2)

**TMX 8510 Handset
19A704950P1
(Earlier Models)**
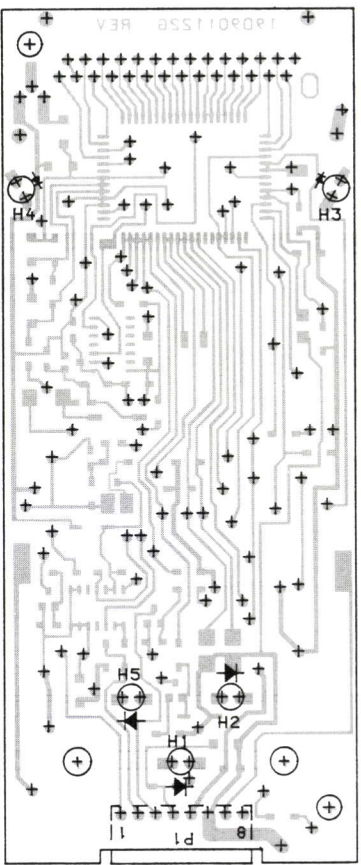
Viewed From Component Side

(19D901175, Rev. 0)
(19A703251, Sh. 1, Rev. 0)
(19A703251, Sh. 2, Rev. 0)
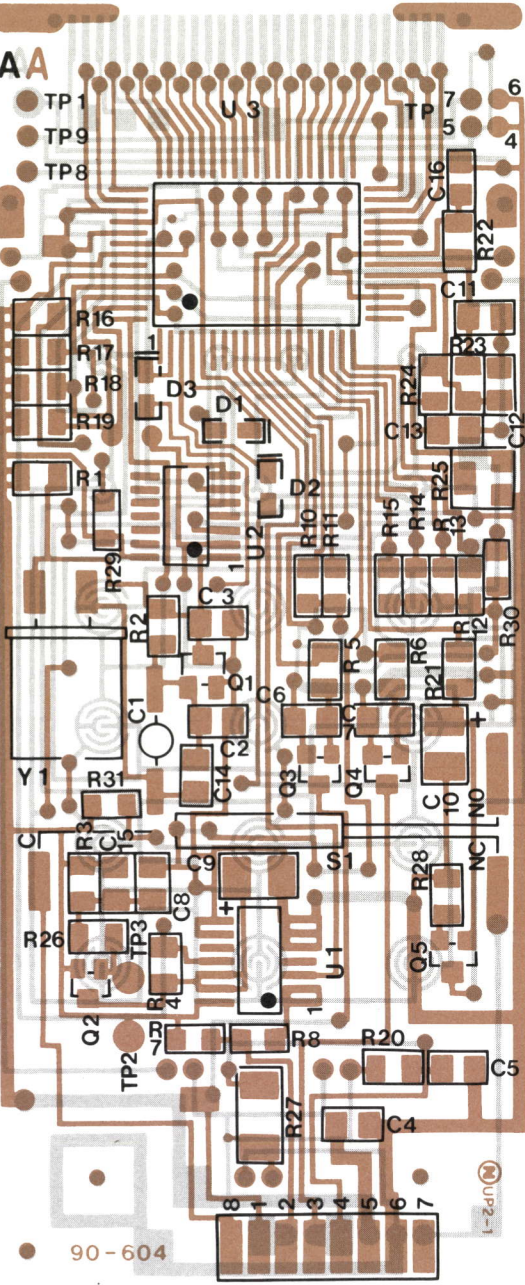
Logic Board A2
(90-604-3)

Viewed From Solder Side
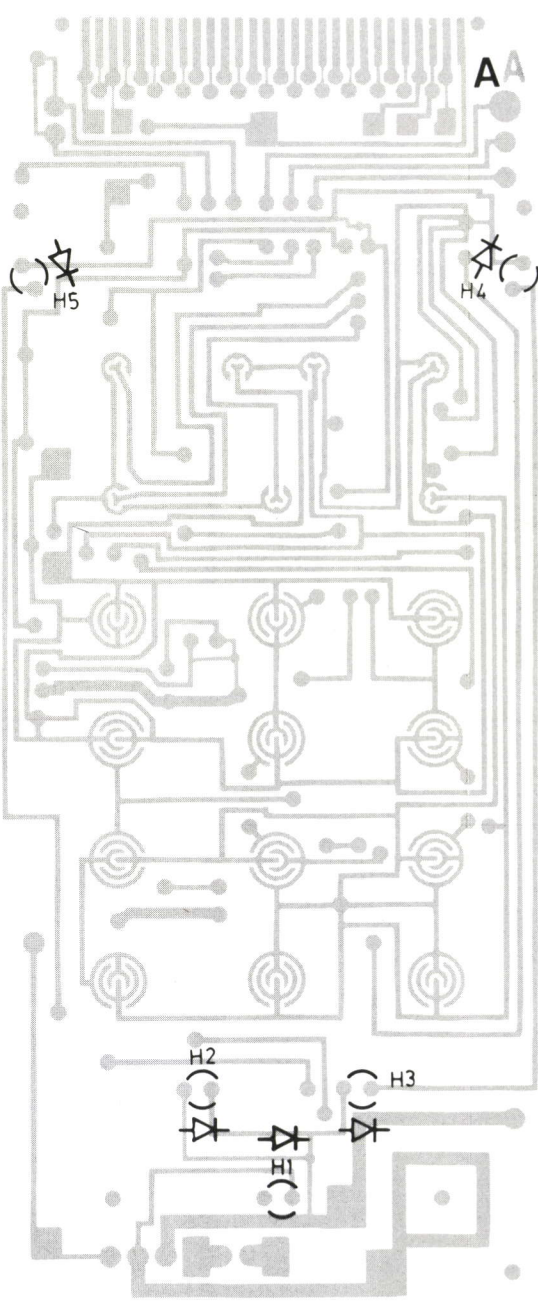
(19D901175, Rev. 0)
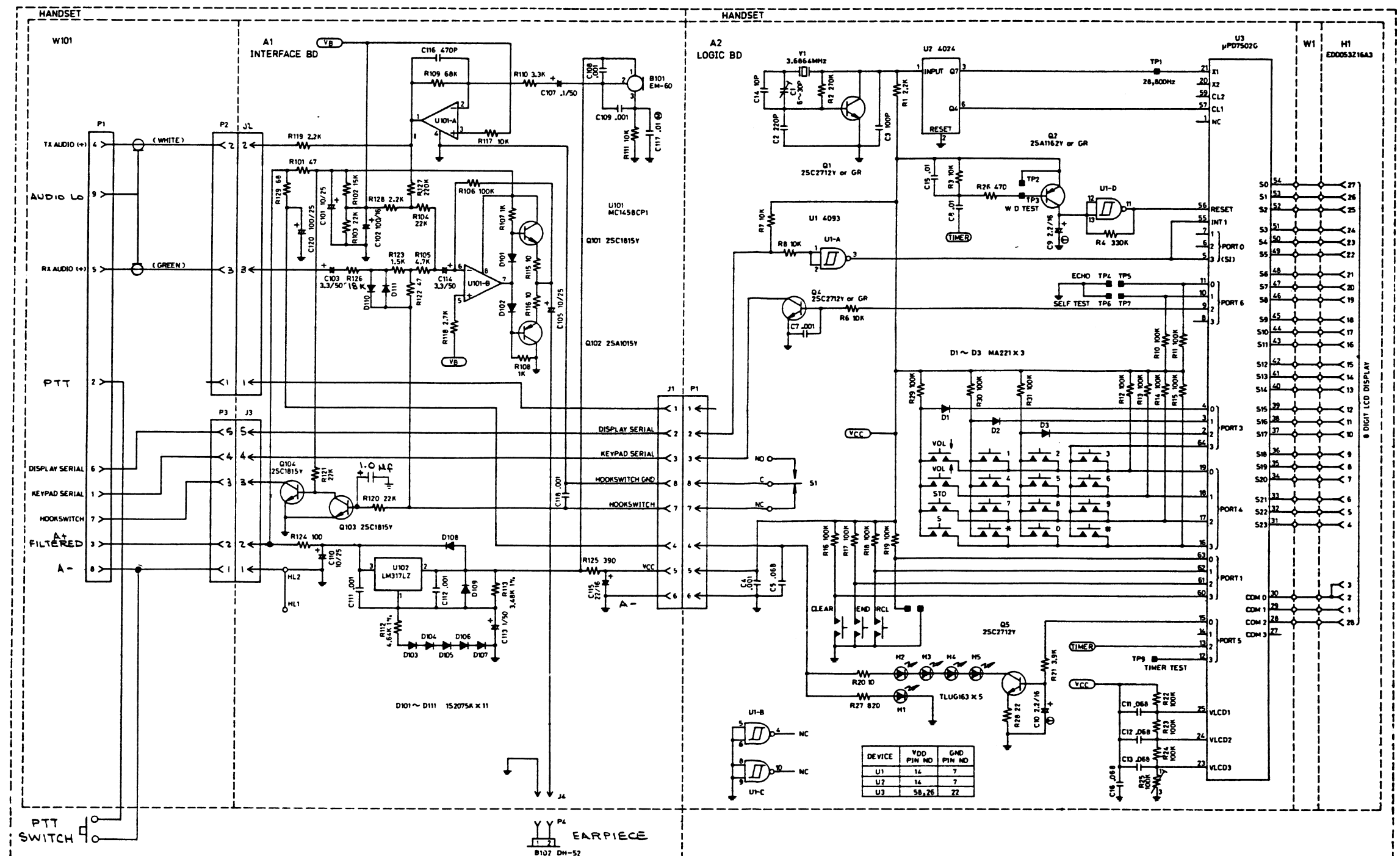(19A703251, Sh. 2, Rev. 0)

Interface Board A1
(90-603-03)

(90-603-4, Rev. 2)

RUNS ON SOLDER SIDE

RUNS ON BOTH SIDES

RUNS ON COMPONENT SIDE
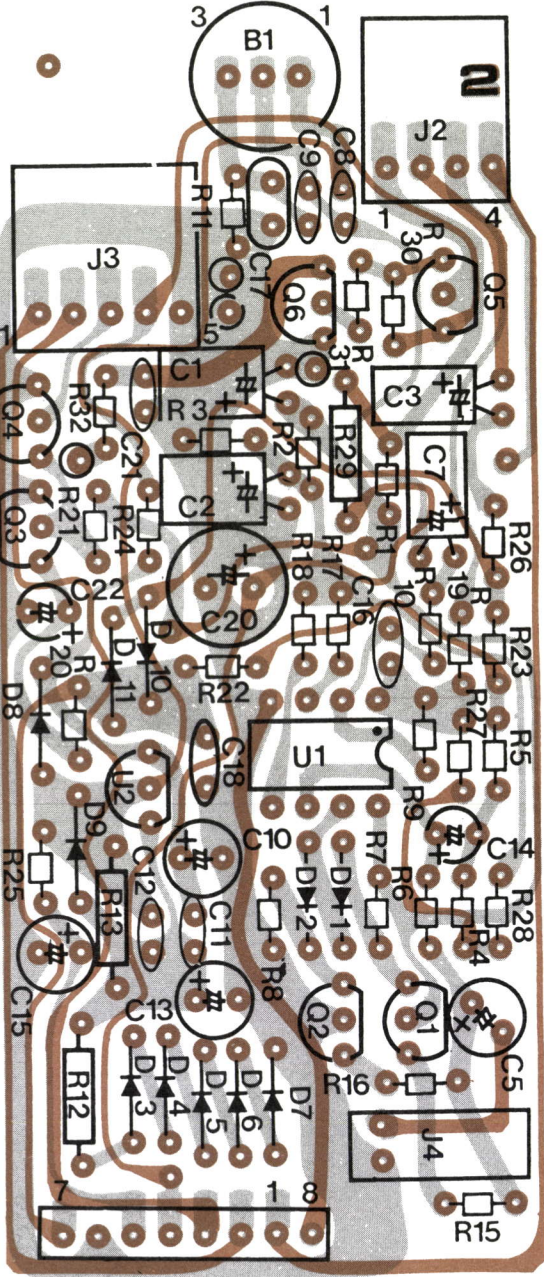
TMX 8510 Handset
19A704950P1
(Later Models)

(19D901762, Rev. 1)

PARTS LIST

TMX-8510 HANDSET
19A704950P1

ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		NOTE: When ordering replacement parts all part numbers should be preceded by: N19/
		LOGIC BOARD 90-604-3
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	20-064-2	Variable, 6-30 pF.
C2	11-797-0	Chip, ceramic, 220 pF.
C3	11-789-0	Chip, ceramic, 100 pF.
C4	11-892-0	Chip, ceramic, 0.001 uF.
C5	11-899-0	Chip, ceramic, 0.068 uF.
C7	11-892-0	Chip, ceramic, 0.001 uF.
C8	11-896-0	Chip, ceramic, 0.01 uF.
C9 and C10	14-118-0	Chip, tantalum, 2.2 uF, 16V.
C11 thru C13	11-899-0	Chip, ceramic, 0.068 uF.
C14	11-765-0	Chip, ceramic, 10 pF.
C15	11-896-0	Chip, ceramic, 0.01 uF.
C16	11-899-0	Chip, ceramic, 0.068 uF.
		- - - - - - - - - - LEDS - - - - - - - - - -
H1 thru H5	38-074-0	LED, I_F = 25 mA P_D = 70 mW
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	31-171-0	Chip transistor, NPN.
Q2	30-063-0	Chip transistor, PNP.
Q4 and Q5	31-171-0	Chip transistor, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	5-207-0	Metal film: 2.2K ohms ±5%, 1/8 w.
R2	5-257-0	Metal film: 270K ohms ±5%, 1/8 w.
R3	5-223-0	Metal film: 10K ohms ±5%, 1/8 w.
R4	5-259-0	Metal film: 330K ohms ±5%, 1/8 w.
R6 thru R8	5-223-0	Metal film: 10K ohms ±5%, 1/8 w.
R10 thru R19	5-247-0	Metal film: 100K ohms ±5%, 1/8 w.
R20	5-151-0	Metal film: 10 ohms ±5%, 1/8 w.
R21	5-213-0	Metal film: 3.9K ohms ±5%, 1/8 w.
R22 thru R24	5-247-0	Metal film: 100K ohms ±5%, 1/8 w.
R25	10-199-0	Variable: 100K ohms ±5%.
R26	5-191-0	Metal film: 470 ohms ±5%, 1/8 w.
R27	4-1241-0	Metal film: 820 Ohms ±5%, 1/8 w.
R28	5-159-0	Metal film: 22 ohms ±5%, 1/8 w.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
U1	40-193-0	CMOS QUAD 2-INPUT SCHMITT "NRNO"
U2	40-192-0	CMOS QUAD 7-STAGE RIPPLE COUNTER
U3	40-196-0	CMOS QUAD 4-BIT MICROPROCESSOR

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	53-046-0	Reed Switch.
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
Y1	23-104-0	Crystal: 3.6864 MHz.
		INTERFACE BOARD 90-603-3
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C101	14-132-6	Electrolytic: 10 uF, 25 VDCW.
C102	14-692-0	Electrolytic: 100 uF, 25 VDCW.
C103	14-667-0	Electrolytic: 3.3 uF, 50 VDCW.
C105	14-132-6	Electrolytic: 10 uF, 25 VDCW.
C107	14-663-0	Electrolytic: 0.1 uF, 50 V.
C108 and C109	611-100-0	Ceramic: 0.001 uF, 50 V.
C110	14-132-6	Electrolytic: 10 uF, 25 VDCW.
C111 and C112	611-100-0	Ceramic: 0.001 uF, 50 V.
C113	14-577-0	Electrolytic: 1 uF, 50 VDCW.
C114	14-667-0	Electrolytic: 3.3 uF, 50 V.
C115	14-579-0	Electrolytic: 22 uF, 50 V.
C116	11-616-2	Ceramic: 470 pF, 50 V.
C117	13-039-0	Polyester: 0.01 uF, 50 V.
C118	611-100-0	Ceramic: 0.001 uF, 50 V.
C120	14-149-6	Electrolytic: 100 uF, 25 V.
C122	14-577-0	Electrolytic: 1 uF, 50V.
		- - - - - - - - - - DIODES - - - - - - - - - -
D101 thru D111	34-034-0	Silicon, 100 mA, 30 V.
		- - - - - - - - - - LEDS - - - - - - - - - -
H1	38-073-0	8 Digit LCD Display.
		- - - - - - JACKS AND RECEPTACLES - - - - - -
J1	60-541-0	8 Pin Flat Cable Connector.
J4	60-515-0	2 Pin Connector.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q101	31-117-0	Silicon, NPN.
Q102	30-046-0	Silicon, PNP.
Q103 and Q104	31-117-0	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R101	4-1721-0	Carbon: 47 ohms ±5%, 1/6 w.
R102	4-1781-0	Carbon: 15K ohms ±5%, 1/6 w.
R103 and R104	4-1785-0	Carbon: 22K ohms ±5%, 1/6 w.
R105	4-1769-0	Carbon: 4.7K ohms ±5%, 1/6 w.
R106	4-1801-0	Carbon: 100K ohms ±5%, 1/6 w.
R107 and R108	4-1753-0	Carbon: 1K ohms ±5%, 1/6 w.
R109	4-1797-0	Carbon: 68K ohms ±5%, 1/6 w.
R110	4-1765-0	Carbon: 3.3K ohms ±5%, 1/6 w.

SYMBOL	GE PART NO.	DESCRIPTION
R111	4-1777-0	Carbon: 10K ohms ±5%, 1/6 w.
R112	5-139-1	Metal film: 4.64K ohms ±1%.
R113	5-138-1	Metal film: 3.48K ohms ±1%.
R115 and R116	4-1705-0	Carbon: 10 ohms ±5%, 1/6 w.
R117	4-1777-0	Carbon: 10K ohms ±5%, 1/8 w.
R118	4-1763-0	Carbon: 2.7K ohms ±5%, 1/6 w.
R119	4-1761-0	Carbon: 2.2K ohms ±5%, 1/6 w.
R120 and R121	4-1785-0	Carbon: 22K ohms ±5%, 1/6 w.
R122	4-1721-0	Carbon: 47 ohms ±5%, 1/6 w.
R123	4-1757-0	Carbon: 1.5K ohms ±5%, 1,6 w.
R124	4-1729-0	Carbon: 100 ohms ±5%, 1/6 w.
R125	4-1743-0	Carbon: 390 ohms ±5%, 1/6 w.
R126	4-1783-0	Carbon: 18K ohms ±5%, 1/6 w.
R127	4-1809-0	Carbon: 220K ohms ±5%, 1/6 w.
R128	4-1761-0	Carbon: 2.2K ohms ±5%, 1/6 w.
R129	4-1045-0	Carbon: 68 ohms ±5%, 1/4 w.
		- - - - - - - INTEGRATED CIRCUITS - - - - - - -
U101	39-158-0	DUAL OP AMP
U102	39-157-0	3-TERMINAL REGULATOR
		- - - - - - - - - - CABLES - - - - - - - - - -
W101	60-514-1	Cable, Handset
		- - - - - - - - MISCELLANEOUS - - - - - - - -
B101	56-093-0	Microphone Cartridge
B102	54-043-0	Speaker
	60-518-0	SP Lead with 2 Pin Connector
	64-270-0	Support for LCD
	64-271-1	Striker Plate
	64-279-0	Support for S. Plate
	72-207-0	Bushing
	73-168-0	LCD Connector
	73-220-1	Key Pad, 18 Keys
	91-051-0	Mic Support
	74-697-0	Indicator, (Plastic Window)
	74-1004-0	Keypad Housing.
	74-823-0	Housing, XMTR/RX.
	74-701-0	Frame.
	74-702-0	Lightpipe
	74-1005-0	Nameplate.
	90-655-0	PTT Switch PWB
	83-119-0	Card Holder
	84-007-0	Number Card
	75-233-0	Fiber Washer, for Mic
	51-072-0	PTT Switch
	1-604-0	Screw M3 x 10 Pan Head, TORX®
	1-605-0	Screw M2.5 x 6 Flat Head, TORX®
	1-626-0	Screw M4.2 x 20, Slotted Oval Head
	1-627-0	Screw M4.2 x 38, Slotted Oval Head
	74-825-0	PTT Knob

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.