Frequency Display (637-1781-( ))

Rockwell International

instructions

Collins Telecommunications Products Division

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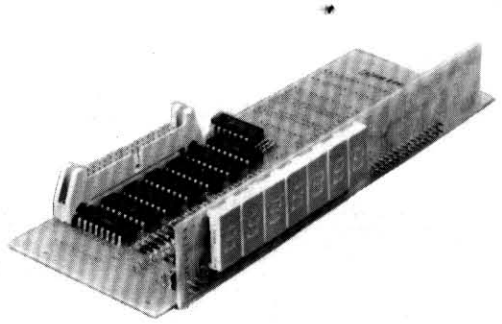
1. DESCRIPTION

The Frequency Display 635-1781-( ) consists of two subassemblies hard-wired together. One subassembly, the frequency display driver board, contains the logic and decoder/driver circuits. The other, the frequency display board, contains the 7-segment displays. The subassemblies are 2-layer circuit boards with a cable connector on the section containing the decoder/drivers. Figure 1 is a picture of the assembled subassemblies.



TP5-2370-017

Frequency Display
Figure 1

2. PRINCIPLES OF OPERATION

2.1 General

The frequency display configuration differences are as follows:

a. 637-1781-001, 100 Hz operating frequency display and no BFO frequency display.
b. 637-1781-002, 10 Hz operating frequency display and no BFO frequency display.
c. 637-1781-003, 10 Hz operating frequency display and BFO frequency display of ±0-9990 Hz (operating frequency can be expanded to 1 Hz by adding display device U27).
d. 637-1781-004, 1 Hz operating frequency display and BFO frequency display of ±0-9990 Hz.
e. 637-1781-005, 100 Hz operating frequency display and no BFO frequency display (can be expanded to 10/1 Hz operating frequency display and/or BFO frequency display by adding display devices U26/U27 and/or U15 through U19).

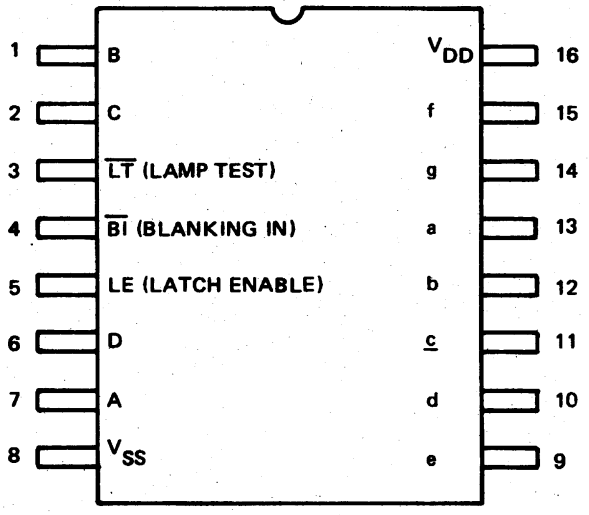
2.2 Theory of Operation (Refer to figure 4.)

For each frequency digit, a 4-bit binary input is applied to the decoder/driver. This input data is decoded into seven binary outputs. These logic-level outputs are applied directly to the 7-segment display associated with the decoder/driver. Each output causes a certain LED segment to light to form a part of the numeral equivalent to the 4-bit binary input to the board.

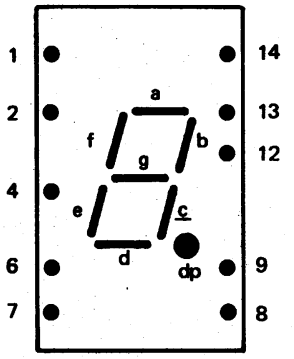
Figure 2 shows the decoder/driver input-output truth table and the 7-segment display connections.

The units and tens megahertz displays are blanked if the frequency is not within the 1- to 30-MHz range (for which these digits would be needed). This suppresses the leading zeros in lower frequency displays. The blanking (suppression) input ($\overline{BI}$ at logic 0 level) is generated by OR gates U6B-U6D. When all inputs

NOTICE: This section replaces second edition dated 1 June 1978.



BCD–TO–7–SEGMENT DECODER/DRIVER



TRUTH TABLE

INPUTS							OUTPUTS							
LE	$\overline{BI}$	$\overline{LT}$	D	C	B	A	a	b	c	d	e	f	g	DISPLAY
0	0	1	X	X	X	X	0	0	0	0	0	0	0	BLANK
0	1	1	0	0	0	0	1	1	1	1	1	1	0	
0	1	1	0	0	0	1	0	1	1	0	0	0	0	
0	1	1	0	0	1	0	1	1	0	1	1	0	1	
0	1	1	0	0	1	1	1	1	1	1	0	0	1	
0	1	1	0	1	0	0	0	1	1	0	0	1	1	
0	1	1	0	1	0	1	1	0	1	1	0	1	1	
0	1	1	0	1	1	0	0	0	1	1	1	1	1	
0	1	1	0	1	1	1	1	1	1	0	0	0	0	
0	1	1	1	0	0	0	1	1	1	1	1	1	1	
0	1	1	1	0	0	1	1	1	1	0	0	1	1	
0	1	1	1	0	1	0	0	0	0	0	0	0	0	BLANK
0	1	1	1	0	1	1	0	0	0	0	0	0	0	BLANK
0	1	1	1	1	0	0	0	0	0	0	0	0	0	BLANK
0	1	1	1	1	0	1	0	0	0	0	0	0	0	BLANK
0	1	1	1	1	1	0	0	0	0	0	0	0	0	BLANK
0	1	1	1	1	1	1	0	0	0	0	0	0	0	BLANK

X = DON'T CARE

7–SEGMENT LED DISPLAY

PIN NO.	PIN CONNECTIONS
1	ANODE F
2	ANODE G
3	NO PIN
4	COMMON CATHODE
5	NO PIN
6	ANODE E
7	ANODE D
8	ANODE C
9	ANODE DP
10	NO PIN
11	NO PIN
12	COMMON CATHODE
13	ANODE B
14	ANODE A

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Decoder/Driver and Display Elements Operation
Figure 2

to the decoder/driver are at logic 0, the OR gate outputs cause the $\overline{BI}$ input to be logic 0, causing a blanking command to be applied to the display. For this input to the indicators, no LED segments light and the display remains off, or blank.

3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test and troubleshoot the frequency display board are listed in the maintenance section of this instruction book.

3.2 Testing

The test procedures in table 1 check the total performance of the frequency display. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.

4. REPAIR

Repair of the frequency display is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

5. PARTS LIST/DIAGRAMS

This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 3). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator.

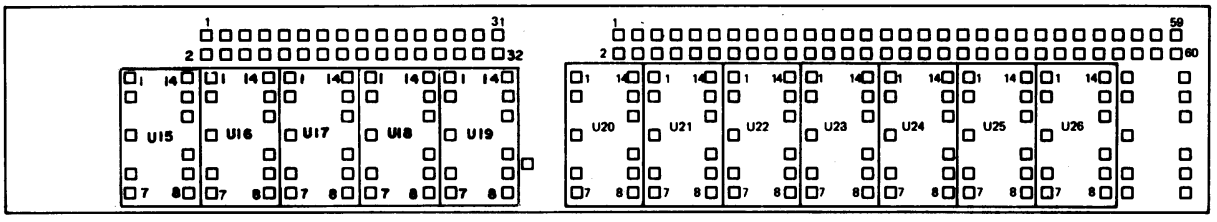
Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

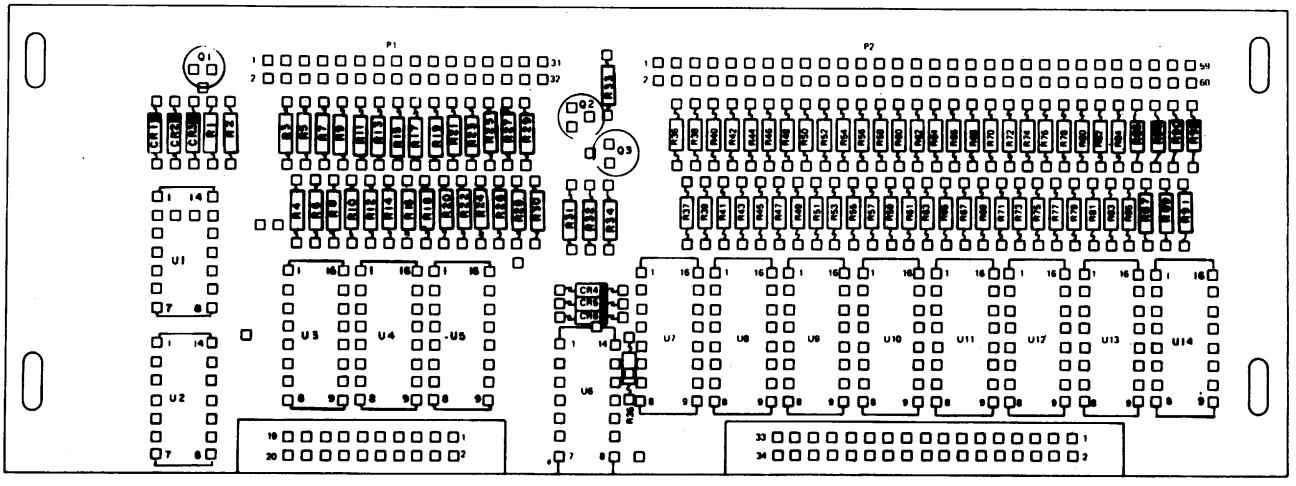
CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Frequency Display	637-1781-001	REV B
Frequency Display	637-1781-002	REV B
Frequency Display	637-1781-003	REV E
Frequency Display	637-1781-004	REV D
Frequency Display	637-1781-005	REV E
Frequency Display Driver Board	635-0896-001	REV H
Frequency Display Driver Board	635-0896-002	REV H
Frequency Display Driver Board	635-0896-004	REV G
Frequency Display Board	635-0897-001	REV C
Frequency Display Board	635-0897-002	REV C
Frequency Display Board	635-0897-003	REV D
Frequency Display Board	635-0897-004	REV E

Table 1. Frequency Display Testing and Troubleshooting Procedures.

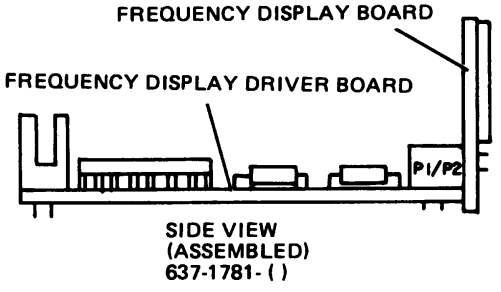
TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Test setup	Set all FREQUENCY switches to 0. Turn on PWR switch and set CONT switch to TEST.		
2. Zero suppression and decimal point display	Observe FREQUENCY readout display.	Units' and tens' zeros of MHz range suppressed (blanked). Zeros for kHz and tenths displayed. Decimal point after fifth digit from left displayed.	If MHz-range zeros displayed, troubleshoot U6B, U6C, U6D, and U7. If decimal point not displayed, troubleshoot U24.
3. Digit selection and display	Rotate each FREQUENCY switch through all its positions. (Leftmost switch has positions 0, 1, and 2 only.) Observe readout display to see that corresponding selected digit is displayed. ***Note*** Wait approx 1 second after switching for time delay to elapse and circuit to strobe in new digit. If switch is changed too slowly, strobe signal may be generated while old number is still applied to circuit. In this case, the new number will not be displayed even though switch is set to new position. Switch away from and back to new position if this occurs.	Readout digit displayed corresponds to that selected on thumbwheel switch.	Refer to schematic diagram and troubleshoot decoder/driver and readout unit corresponding to selected digit showing malfunction. For normal display, decoder/driver inputs and outputs at logic 1 are listed below for each digit. DIGIT — INPUTS — OUTPUTS 0 — (all 0's) — a+b+c+d+e+f 1 — A — b+c 2 — B — a+b+c+e+g 3 — A+B — a+b+c+d+g 4 — C — b+c+f+g 5 — A+C — a+c+d+f+g 6 — B+C — c+d+e+f+g 7 — A+B+C — a+b+c 8 — D — a+b+c+d+e+f+g 9 — A+D — a+b+c+f+g



FREQUENCY DISPLAY BOARD 635-0897- ( )



FREQUENCY DISPLAY DRIVER BOARD 635-0896- ( )



SIDE VIEW
(ASSEMBLED)
637-1781- ( )

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Frequency Display, Schematic Diagram
Figure 3 (Sheet 1 of 4)

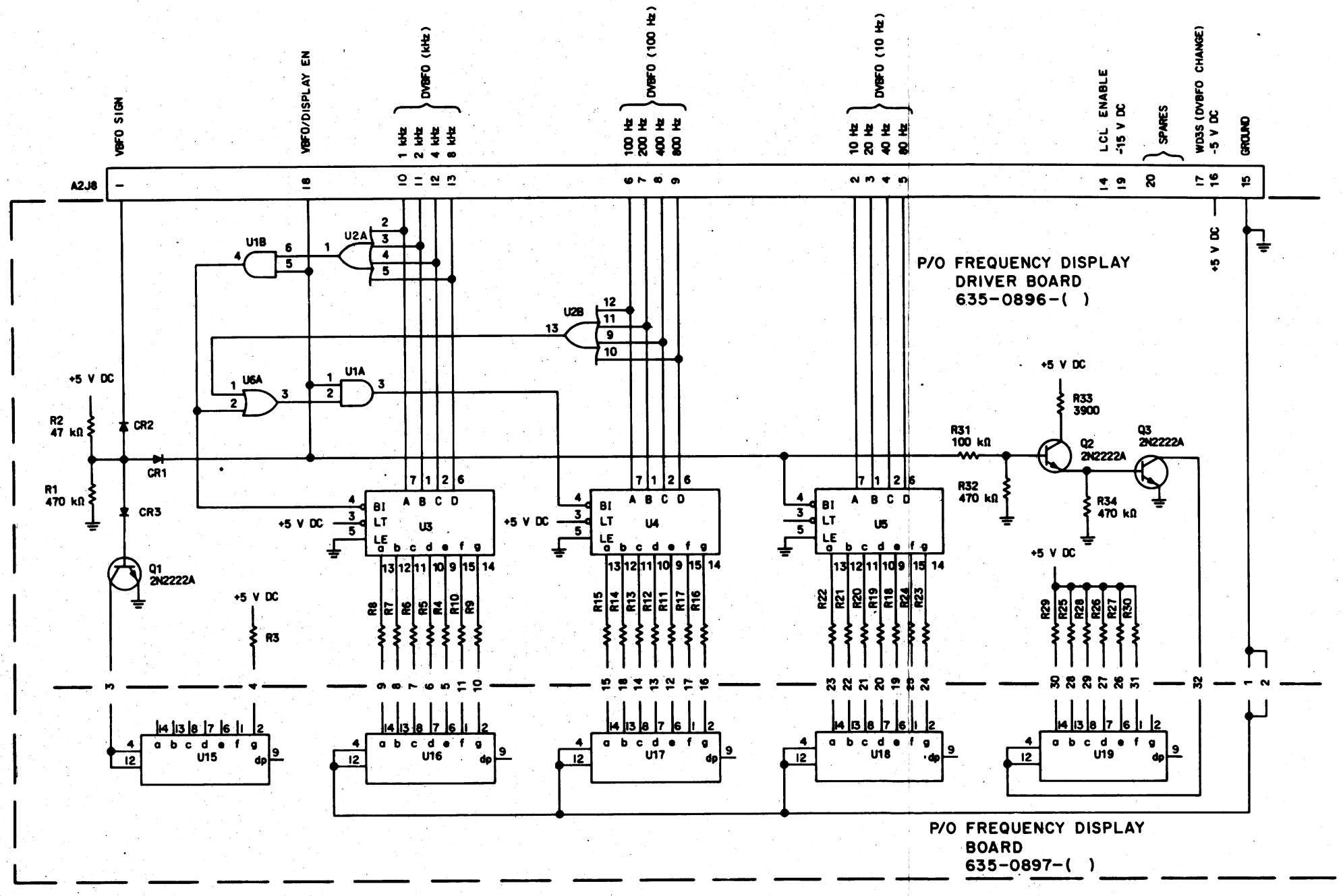
PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NO	USABLE ON CODE
	FREQUENCY DISPLAY 637-1781-001		A
	FREQUENCY DISPLAY 637-1781-002		B
	FREQUENCY DISPLAY 637-1781-003		C
	FREQUENCY DISPLAY 637-1781-004		D
	FREQUENCY DISPLAY 637-1781-005		E
	FREQUENCY DISPLAY DRIVER BD	635-0896-001	A
	FREQUENCY DISPLAY DRIVER BD	635-0896-002	B
	FREQUENCY DISPLAY DRIVER BD	635-0896-004	C,D,E
	FREQUENCY DISPLAY BD	635-0897-001	A,E
	FREQUENCY DISPLAY BD	635-0897-002	B
	FREQUENCY DISPLAY BD	635-0897-003	C
	FREQUENCY DISPLAY BD	635-0897-004	D
	FREQUENCY DISPLAY DRIVER BD	635-0896-001	
CR1-CR3	NOT USED		
CR4-CR6	SEMICOND DEVICE, 1N4454	353-3644-010	
R1-R34	NOT USED		
R35	RESISTOR, FXD, CMPSN, 1MΩ, 10%, 1/8W	745-2449-000	
R36-R78	RESISTOR, FXD, CMPSN, 180Ω, 10%, 1/8W	745-2314-000	
U1-U5	NOT USED		
U6	INTEGRATED CKT, MC14071BCP	351-8287-010	
U7-U12	INTEGRATED CKT, MC14511BCP	351-8304-010	
	FREQUENCY DISPLAY DRIVER BD	635-0896-002	
CR1-CR3	NOT USED		
CR4-CR6	SEMICOND DEVICE, 1N4454	353-3644-010	
R1-R34	NOT USED		
R35	RESISTOR, FXD, CMPSN, 1MΩ, 10%, 1/8W	745-2449-000	
R36-R85	RESISTOR, FXD, CMPSN, 180Ω, 10%, 1/8W	745-2314-000	
U6	INTEGRATED CKT, MC14071BCP	351-8287-010	
U7-U13	INTEGRATED CKT, MC14511BCP	351-8304-010	
	FREQUENCY DISPLAY DRIVER BD	635-0896-004	
CR1-CR6	SEMICOND DEVICE, 1N4454	353-3644-010	
Q1-Q3	TRANSISTOR, 2N2222A	352-0661-020	
R1	RESISTOR, FXD, CMPSN, 470kΩ, 10%, 1/8W	745-2437-000	
R2	RESISTOR, FXD, CMPSN, 47kΩ, 10%, 1/8W	745-2401-000	
R3-R30	RESISTOR, FXD, CMPSN, 180Ω, 10%, 1/8W	745-2314-000	
R31	RESISTOR, FXD, CMPSN, 100kΩ, 10%, 1/8W	745-2413-000	
R32	RESISTOR, FXD, CMPSN, 470kΩ, 10%, 1/8W	745-2437-000	
R33	RESISTOR, FXD, CMPSN, 3.9kΩ, 10%, 1/8W	745-2362-000	
R34	RESISTOR, FXD, CMPSN, 470kΩ, 10%, 1/8W	745-2437-000	
R35	RESISTOR, FXD, CMPSN, 1MΩ, 10%, 1/8W	745-2449-000	
R36-R92	RESISTOR, FXD, CMPSN, 180Ω, 10%, 1/8W	745-2314-000	
U1	INTEGRATED CKT, MC14081BCP	351-8287-030	
U2	INTEGRATED CKT, MC14072BCP	351-8287-040	
U3-U5	INTEGRATED CKT, MC14511 BCP	351-8304-010	
U6	INTEGRATED CKT, MC14071BCP	351-8287-010	
U7-U14	INTEGRATED CKT, MC14511BCP	351-8304-010	
	FREQUENCY DISPLAY BD 635-0897-001		
U1-U19	NOT USED		
U20-U25	SEMICOND DEVICE, MAN3640A	262-1461-010	
	FREQUENCY DISPLAY BD 635-0897-002		
U1-U19	NOT USED		
U20-U26	SEMICOND DEVICE, MAN3640A	262-1461-010	
	FREQUENCY DISPLAY BD 635-0897-003		
U1-U14	NOT USED		
U15-U26	SEMICOND DEVICE, MAN3640A	262-1461-010	
	FREQUENCY DISPLAY BD 635-0897-004		
U1-U14	NOT USED		
U15-U27	SEMICOND DEVICE, MAN 3640A	262-1461-010	

Frequency Display, Schematic Diagram
Figure 3 (Sheet 2)

CIRCUITS USED PER FREQUENCY DISPLAY

		CIRCUIT	637-1781-( )				
			-001	-002	-003	-004	-005
FREQUENCY DISPLAY DRIVER BOARD	VBFO DISPLAY ENABLE	U1			X	X	X
	1 kHz	U2			X	X	X
	100 Hz	U3			X	X	X
	10 Hz	U4			X	X	X
	DISPLAY BLANKING	U5			X	X	X
	OPER FREQ DISPLAY DRIVERS	U6	X	X	X	X	X
	10 MHz	U7	X	X	X	X	X
	1 MHz	U8	X	X	X	X	X
	100 kHz	U9	X	X	X	X	X
	10 kHz	U10	X	X	X	X	X
	1 kHz	U11	X	X	X	X	X
	100 Hz	U12	X	X	X	X	X
	10 Hz	U13		X	X	X	X
	1 Hz	U14			X	X	X
FREQUENCY DISPLAY BOARD	SIGN	U15			X	X	
	1 kHz	U16			X	X	
	100 Hz	U17			X	X	
	10 Hz	U18			X	X	
	1 Hz	U19			X	X	
	VBFO DISPLAY	U20	X	X	X	X	X
	1 MHz	U21	X	X	X	X	X
	100 kHz	U22	X	X	X	X	X
	10 kHz	U23	X	X	X	X	X
	1 kHz	U24	X	X	X	X	X
	100 Hz	U25	X	X	X	X	X
	10 Hz	U26		X	X	X	
	1 Hz	U27				X	



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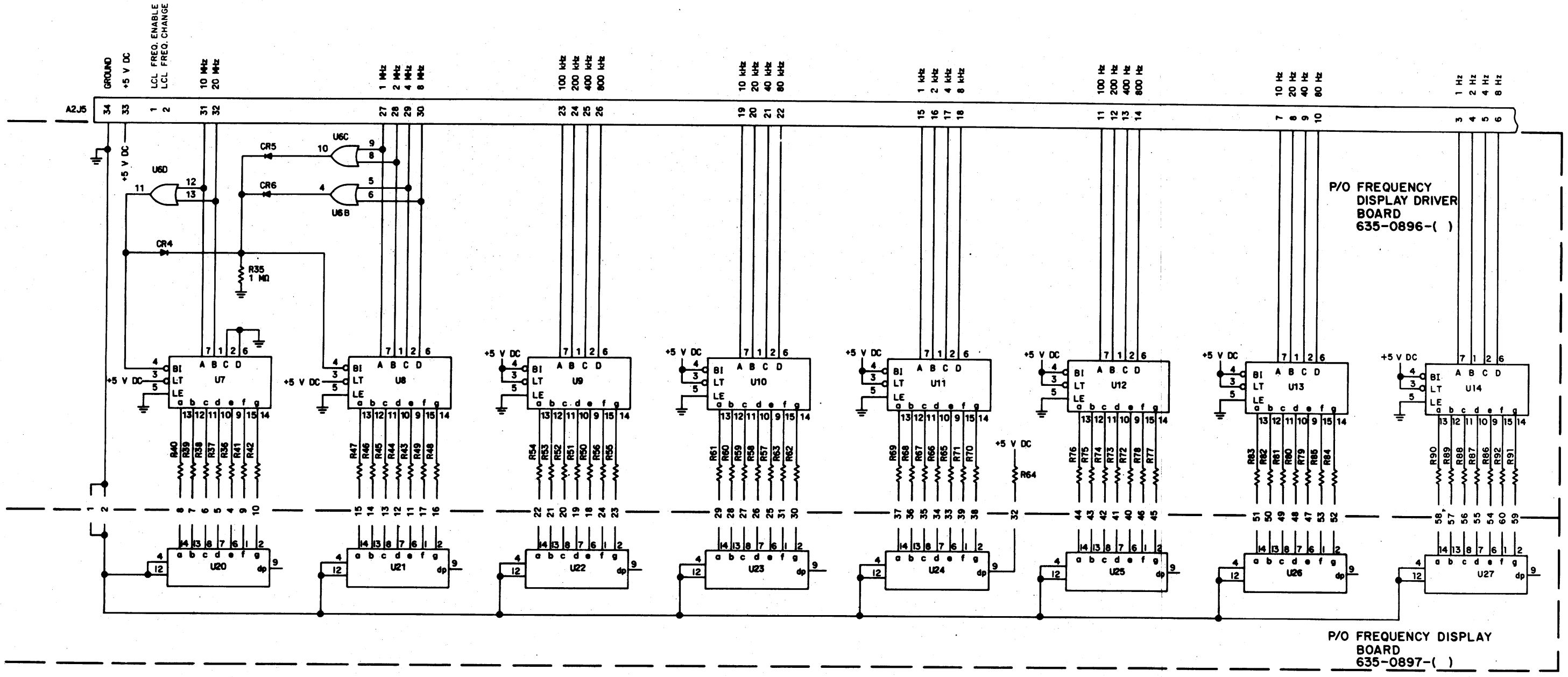
Frequency Display, Schematic Diagram
Figure 3 (Sheet 3)



NOTES:

1. RESISTORS R3 THRU R30 AND R36 THRU R92 ARE 180 OHM.
2. DIODES ARE TYPE 1N4454.
3. POWER AND GROUND CONNECTIONS

U NO.	TYPE	POWER (V DC)	
		+5	GND
U1	MC14081BCP	14	7
U2	MC14072BCP	14	7
U3, U4, U5, AND U7 THRU U14	MC14511BCP	16	8
U6	MC14071BCP	14	7
U15 THRU U27	MAN3640A		

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Frequency Display, Schematic Diagram
Figure 3 (Sheet 4)