SECTION 15.
FRONT-PANEL INTERFACE BOARD (A15)

15.1 DESCRIPTION

The Front-Panel Interface board provides two system functions. The first of these is to interface the system's Processor board (A14) with other system modules: primarily the Receiver board (A8), the Front-Panel Interface board itself, the RF Input module (A17), and the Front Panel (A18). The second function is to provide an analog interface between 1) external signals or internal-modulation/demodulation signals and 2) the basic measurement functions in the System Analyzer, the DVM, the scope, and the frequency counter.

A block diagram of the Front-Panel Interface board is shown at the end of this section in Figure 15-1, a schematic in Figure 15-2, and the printed wiring board assembly and parts list in Figure 15-3.

15.1.1 PROCESSOR-CONTROL INTERFACE

Control information for the front panel is carried by the AF DATA BUS in 4-bit groups. Information that the microprocessor reads from the Front-Panel Interface includes encoded data from the RF ATTN 0-130 and horizontal SWP SEL inputs, data from the vertical RNG SEL INPUTS, and data from other miscellaneous inputs. Information that the microprocessor sends to the Front-Panel Interface includes data that controls the input switches (Q2, Q3, Q6), the range attenuator (Q4, Q5, Q7, Q8), and the LEDs on the front panel.

Data is transferred to the AF DATA BUS by 3-state input buffers U13, U17, U19, and U20, and it is transferred from the AF DATA BUS by latches U8 and U9. The microprocessor sequentially addresses each buffer and latch through the AF ADD BUS and address decoder U21. Data is transferred to/from the selected latch/buffer while the AF BUS EN 2 signal is low.

15.1.2 ANALOG INTERFACE

The analog outputs of the Front-Panel Interface are driven by four amplifiers: the scope-vertical pre-amplifier (U3, Q9, Q13, Q14), the DVM buffer amplifier (U5, U6, U4B), the frequency-counter pre-amplifier (Q12, U7) and the scope-horizontal pre-amplifier (U4A). Circuits for input selection (K2-K4, Q2, Q3, Q6), the range attenuator (K5-K8, Q4, Q5, Q7, Q8), and the unity-gain buffer amplifier (Q1) drive the inputs of the first three amplifiers. The input to the scope-horizontal pre-amplifier comes directly from the edge-card connector.

15.2 THEORY OF OPERATION

15.2.1 PROCESSOR-CONTROL INTERFACE

15.2.1.1 AF Bus

Information is carried between the microprocessor and the Front-Panel Interface by the AF Bus. It consists of a 4-bit, tri-state data bus (AF DATA BUS 0-3) and a 4-bit address bus (AF ADD BUS 0-3). When $\overline{\text{AF BUS EN 2}}$ is asserted low, the input/output (I/O) function of the AF DATA BUS lines is determined by the address on the AF ADD BUS lines. Depending on that address, address decoder U21 can select the following I/O devices: 1) data buffers U13, U17, U19, and U20; 2) data latches U8 and U9; and data latches A18U6, A18U7, and A18U8.

A summary of the functions of the AF DATA BUS lines for each state of the AF ADD BUS is given in Table 15-1.

15.2.1.2 LED Control

The AF BUS ADDRESSES 0, 1, and 2 control the output to the display, function, and modulation LEDs on the Front-Panel Display board (A18A1). Latch-selects LS0, LS1, and LS2 are asserted low to latch the data that is present on the AF ADD BUS. These latch-selects and the AF DATA BUS are connected to the Display board (A18A1) via J1 and a ribbon cable assembly.

Table 15-2 shows which LED is selected when the state of the AF DATA BUS is as shown and the appropriate latch-select (LS0, LS1, or LS2) is strobed low.

15.2.1.3 Range-Attenuator Control (ATTN X1, X0.1, X0.01, X0.001)

Location 3 of the AF BUS accesses outputs which control the range attenuator. Table 15-3 shows the allowable states of these four control bits, and the function of those states.

Table 15-1. AF ADD and DATA BUS

$\overline{\text{AF BUS EN 2}}$	AF ADD BUS Lines				INPUT/ OUTPUT	$\overline{\text{LSX}}$ ASSERTED	AF DATA BUS 3	AF DATA BUS 2	AF DATA BUS 1	AF DATA BUS 0	NOTE
	3	2	1	0							
0	0	0	0	0	I	0	DISPLAY 3	DISPLAY 2	DISPLAY 1	DISPLAY 0	*
0	0	0	0	1	I	1	FUNCTION 3	FUNCTION 2	FUNCTION 1	FUNCTION 0	*
0	0	0	1	0	I	2	MODE 3	MODE 2	MODE 1	MODE 0	*
0	0	0	1	1	I	3	ATTEN X 0.001	ATTEN X 0.01	ATTEN X 0.1	ATTEN X 1	
0	0	1	0	0	I	4	Not Used	Not Used	EXT INPUT SELECT	DC SELECT	
0	0	1	0	1	O	5	RF ATTEN 3	RF ATTEN 2	RF ATTEN 1	RF ATTEN 0	
0	0	1	1	0	O	6	RF OVER TEMP	$\overline{\text{WB SIG PRES}}$	ANT SEL	SPARE	
0	0	1	1	1	O	7	$\overline{\text{IF OVERLOAD}}$	$\overline{\text{SIG PRES}}$	OFFSET ON/ OFF	WB/NB	
0	1	0	0	0	O	8	$\overline{\text{CSSG CONT EN}}$	$\overline{\text{CSSG BURST EN}}$	IMAGE HI/LO	MON/GEN	
0	1	0	0	1	O	9	10V/DIV RNG SEL	1V/DIV RNG SEL	0.1V/DIV RNG SEL	0.01V/DIV RNG SEL	
0	1	0	1	0	O	10	SPARE BIT	SWP SEL 2	SWP SEL 1	SWP SEL 0	
0	1	0	1	1	X	N	X	X	X	X	
0	1	1	X	X	X	N	X	X	X	X	
1	X	X	X	X	X	N	X	X	X	X	

*LS0-LS2 are decoded and sent to A18. Decoding of data shown is done on A18.

Table 15-2. Decoding for Display, Function, and Modulation LEDs

AF DATA BUS Lines				Display LED Selected ($\overline{\text{LS0}}$ Strobed Low)	Function LED Selected ($\overline{\text{LS1}}$ Strobed Low)	Modulation LED Selected ($\overline{\text{LS2}}$ Strobed Low)
0	1	2	3			
0	0	0	0	Gen/Mon Mtr	FM	PL/DPL
0	0	0	1	Modulation	CW	PL/DPL INV
0	0	1	0	Spect Analyzer	AM	Tone A
0	0	1	1	Duplex Gen	SSB/DSBSC	Tone B
0	1	0	0	RF Memory	SWP 1-10 MHz	Tone Seq
0	1	0	1	Signaling Seq	SWP 0.01-1 MHz	Tone Remote
0	1	1	0	Freq Counter	Not Allowed	Not Allowed
0	1	1	1	DVM/DIST	Not Allowed	Not Allowed
1	0	0	0	Ext Wattmeter	Not Allowed	Not Allowed
1	0	0	1	IF	Not Allowed	Not Allowed
1	0	1	0	Scope AC	Not Allowed	Not Allowed
1	0	1	1	Scope DC	Not Allowed	Not Allowed
1	1	0	0	Not Allowed	Not Allowed	Not Allowed
1	1	0	1	Not Allowed	Not Allowed	Not Allowed
1	1	1	0	Not Allowed	Not Allowed	Not Allowed
1	1	1	1	Not Allowed	Not Allowed	Not Allowed

Table 15-3. Range-Attenuator Switching

Attenuation	ATTEN Lines				Gain from Selected Input to DVM FROM RNG SW Output	Gain from Selected Input to VERT FROM RNG SW Output (VERNIER CAL POS)	Sensitivity of EXT FREQ. CNTR and $\overline{\text{EXT FREQ. CNTR}}$ Outputs to Selected Input
	X0.001	X0.01	X0.1	X1			
X1	0	0	0	1	1	50	30 MV
X0.1	0	0	1	0	0.1	5	300 MV
X0.01	0	1	0	0	0.01	0.5	3 V
X0.001	1	0	0	0	0.001	0.05	30 V

15.2.1.4 Input-Switching Control

Location 4 of the AF BUS accesses outputs which control selection of the external (P1-1) or internal (P1-24) inputs and ac or dc coupling of the external input. This control is achieved with data-bus bits 0 and 1 as shown in Table 15-4.

Table 15-4. Input Switching

EXT INPUT SELECT	DC SELECT	Input Source	Coupling
1	1	EXT INPUT	dc
1	0	EXT INPUT	ac
0	X	INT SCOPE TO RNG SW	dc

15.2.1.5 RF-Attenuator Encoding

The RF ATTEN 0-130 dB inputs indicate the setting of the RF step attenuator in the RF Input module (A17). When one of these inputs is driven high, the corresponding attenuation has been selected. These fourteen inputs are converted to a 4-bit code (RF ATTEN 0-3) by priority encoders U10 and U12 and OR gates U12. Location 5 of the AF BUS accesses these outputs. Table 15-5 shows the encoding of the RF ATTEN 0-130 dB inputs into the RF ATTEN 0-3 output.

Table 15-5. RF-Attenuator Encoding

RF ATTEN Lines														RF ATTEN Bits			
130 dB	120 dB	110 dB	100 dB	90 dB	80 dB	70 dB	60 dB	50 dB	40 dB	30 dB	20 dB	10 dB	0 dB	3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1
0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1
0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0
0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1

15.2.1.6 Miscellaneous Inputs

Locations 6-8 of the AF BUS access miscellaneous data inputs. Table 15-1 gives the specific location of each input on the bus. Table 15-6 gives a brief description of each input.

Table 15-6. Functions of Miscellaneous Inputs

Input	Function
RF OVER TEMP	When high, indicates the Wattmeter (A17A1) is overheated.
$\overline{\text{WB SIG PRES}}$	Comes from the Receiver (A8) – during the system's scan-acquisition, indicates the presence of a signal at the monitor input.
ANT SEL	Comes from the Front Panel (A18) – selects the system's I/O port. When the variable RF Level control is pulled out, this signal goes high, selecting the Antenna port. When the control is pushed in, this signal goes low, selecting the RF In/Out port.
$\overline{\text{IF OVERLOAD}}$	Comes from the Receiver – indicates the monitor is being over-driven.
$\overline{\text{SIG PRES}}$	Comes from the Receiver – indicates the presence of a signal on the monitor input which is sufficiently high to open the Receiver squelch.
OFFSET ON/OFF	Indicates the position of the Duplex Gen switch on the RF Input module (A17).
WB/NB	Indicates the position of the bandwidth (BW) switch on the front panel.
$\overline{\text{CSSG CONT EN}}$ and $\overline{\text{CSSG BURST EN}}$	Indicate whether the front panel's Modulation switch is set to Cont or Burst, respectively.
IMAGE HI/LO	Indicates the position of the Image/Duplex switch on the front panel.
MON/GEN	Indicates the position of the Function switch on the front panel.

15.2.1.7 Range-Select Inputs

The 0.01 to 10V/Div RNG SEL inputs indicate which scope vertical-input sensitivity has been selected. When one of these inputs is low, the corresponding sensitivity has been selected. The microprocessor programs the appropriate attenuation in the range attenuator via the ATTN X0.001 to 1 signals. Location 9 on the AF BUS accesses the 0.01 to 10V/Div RNG SEL inputs.

15.2.1.8 Sweep-Select Encoding

The 1 µs to 100 ms/DIV SWP SEL and EXT HORIZ SEL inputs indicate the position of the Oscilloscope Horiz switch on the front panel. When one of these inputs is high, the corresponding switch position has been selected. These inputs are converted to a 3-bit code, SWP SEL 0-2, by priority encoder U18, according to the algorithm in Table 15-7. Location 10 on the AF BUS accesses the SWP SEL 0-2 outputs.

Table 15-7. Sweep-Select Encoding

SWP SEL Lines							SWP SEL Bits		
EXT HORIZ SEL	100 ms/DIV	10 ms/DIV	1 ms/DIV	100 µs/DIV	10 µs/DIV	1 µs/DIV	2	1	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	1
0	0	0	0	1	0	0	0	1	0
0	0	0	1	0	0	0	0	1	1
0	0	1	0	0	0	0	1	0	0
0	1	0	0	0	0	0	1	0	1
1	0	0	0	0	0	0	1	1	0

15.2.1.9 RF-Scan Encoding

The OPTICAL ENC A and B inputs carry information from the RF Scan optical encoder on the front panel. This encoder is interfaced to the system microprocessor by U22, U23, and Q16 on the Front-Panel Interface. As the RF Scan control is rotated, each change in the OPTICAL ENC A input causes the FIRQ output, which goes to the microprocessor, to pull low for approximately 10 µs. The OPTO CCW output, which goes to a PIA on the Processor board (A14), indicates the direction of the scanning. This output is generated by latching the OPTICAL ENC B input and exclusively ORing it with the OPTICAL ENC A input.

15.2.1.10 Input/Output Characteristics

All digital inputs and outputs are interfaced to 'B' series CMOS logic, which operates from 0V/5V supplies. To facilitate interface with a mechanical switch, some inputs have pull-up or pull-down resistors.

15.2.1.11 Miscellaneous Front-Panel Interconnections

The Front-Panel Interface provides miscellaneous interconnections between the front panel and the rest of the system. These connections come from the front panel through two ribbon cables and connectors, J1 and J2. They are then routed through edge connector P1.

15.2.2 ANALOG INTERFACE

15.2.2.1 Input Switching (K2-K4, Q2, Q3, Q6)

The input to the range attenuator can be selected from either the EXT INPUT or the INT SCOPE TO RNG SW inputs. Ac or dc coupling may be selected for the external input. Input switching is controlled by the DC SELECT and EXT INPUT SELECT signals, as shown in Table 15-4. The generation of these signals is discussed in paragraph 15.2.1.4.

15.2.2.2 Range Attenuator (K5-K8, Q4, Q5, Q7, Q8)

The range attenuator provides four selectable values of attenuation: X1, X0.1, X0.01, and X0.001. Attenuation is controlled by the ATTEN X0.001 to 1 signals, as shown in Table 15-3. Compensation capacitor C11 is adjusted for maximum bandwidth. To adjust C11, see Section 3 on alignment.

15.2.2.3 Unity-Gain Buffer Amplifier

Unity-gain buffer amplifier Q11 buffers the signals under test from the frequency-counter pre-amplifier, the DVM buffer amplifier, and the scope's vertical pre-amplifier inputs. R54 (coarse) and R55 (fine) are adjusted so that there is a voltage gain of one from the EXT INPUT to TP1. To align R54 and R55, see Section 3 on alignment.

15.2.2.4 Scope Vertical Pre-Amplifier (U3, Q9, Q13, Q14)

The scope's vertical pre-amplifier has a nominal gain of 50 when the front panel's vertical-gain potentiometer (which is connected between VERT GAIN and VERT GAIN RETURN) is set to 0 ohms. When the gain potentiometer is set at 5K ohms, the gain of the amplifier is less than or equal to 5. The front panel's 5K ohm vertical-position potentiometer (which is connected between VERT POSITION and ground) varies the dc offset of the amplifier. This amplifier drives the VERT FROM RNG SW output. R19 and R25 adjust the gain and balance, respectively, of the vertical pre-amplifier. To align R19 and R25, see Section 3 on alignment.

Table 15-3 shows, as a function of the range-attenuator setting, the vertical pre-amplifier's gain from the selected input to the VERT FROM RNG SW output.

15.2.2.5 DVM Buffer Amplifier

The DVM buffer amplifier provides switched-bandwidth buffering between the unity-gain amplifier (Q11) and the DVM circuitry on the Scope/DVM Control board(A7). In ac mode, operational amplifier U7 operates as a unity-gain amplifier with a gain flatness of ± 2 percent out to 20 kHz. In dc mode, analog switches U6A and U6C switch C26 and C22, respectively, into the amplifier circuit. In this configuration, the amplifier has a dc gain of 1 and a minimum attenuation of 30 dB at 50 Hz. The amplifier bandwidth is controlled by a signal from latch U9, which has the opposite sense of the DC SELECT signal. U4B inverts the sense of this signal and then translates it from a logic level of 0 to $+5$V to a logic level of -8 to $+8$V. The signal is now compatible with the control inputs of U6A and U6C. R41 is adjusted for a gain of one from TP1 to the DVM FROM RNG SW output. To adjust R41, see Section 3 on alignment.

Table 15-3 shows the gain from the selected input to the DVM FROM RNG SW output as a function of the range-attenuator setting.

15.2.2.6 Frequency-Counter Pre-Amplifier

The frequency-counter pre-amplifier (Q12 and U7) converts the output of unity-gain buffer Q11 to ECL levels. The output is differentially connected through the EXT FREQ CNTR and $\overline{\text{EXT FREQ CNTR}}$ outputs to the Processor Interface board (A11). Table 15-3 shows the sensitivity of this amplifier as a function of the range attenuator.

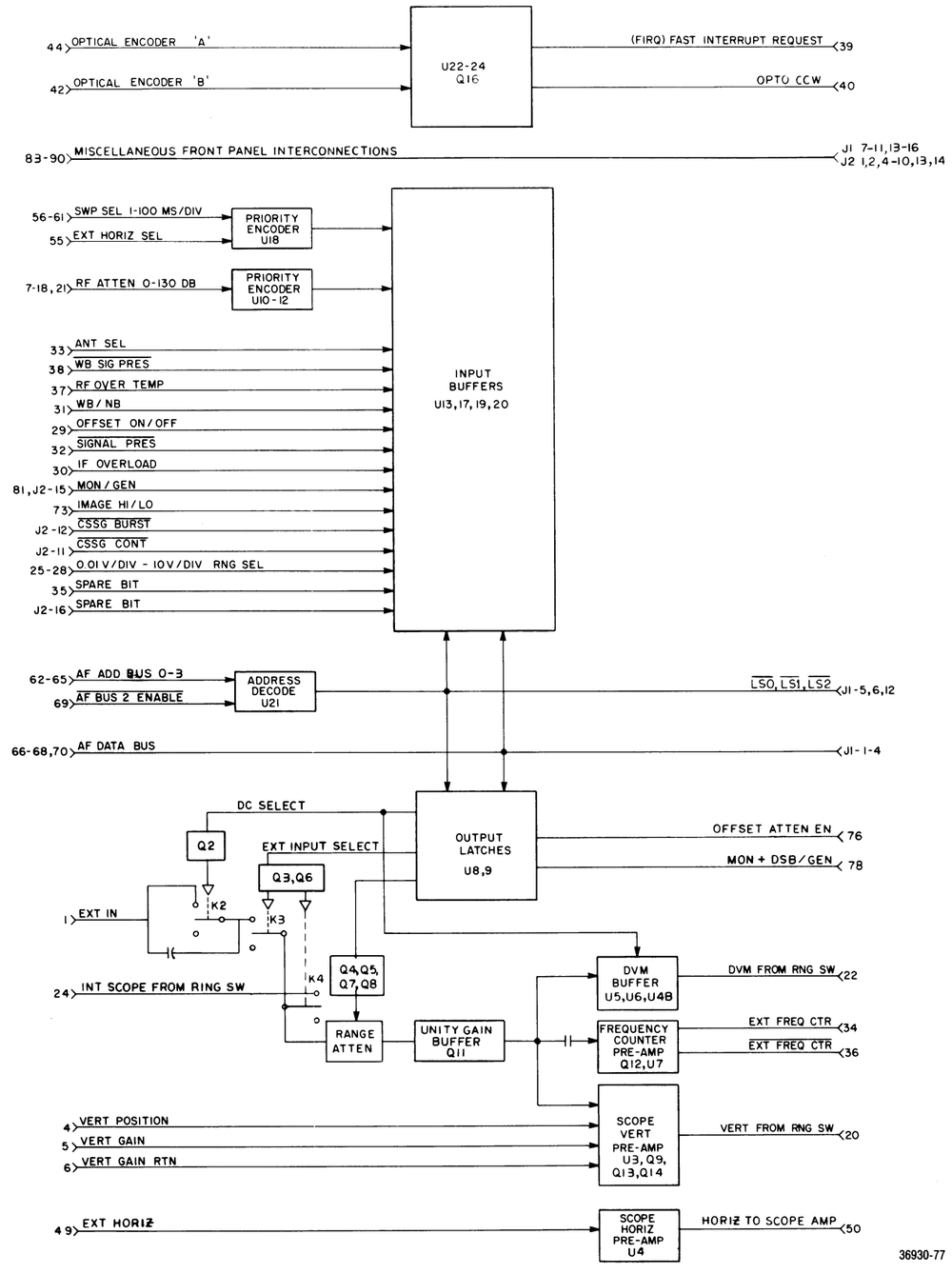
15.2.2.7 Scope Horizontal Pre-Amplifier

The scope's horizontal pre-amplifier provides a nominal voltage gain of 5 between the HORIZ INPUT and the HORIZ TO SCOPE AMP output.

FRONT-PANEL INTERFACE BOARD (A15)

(RTC-1011A)

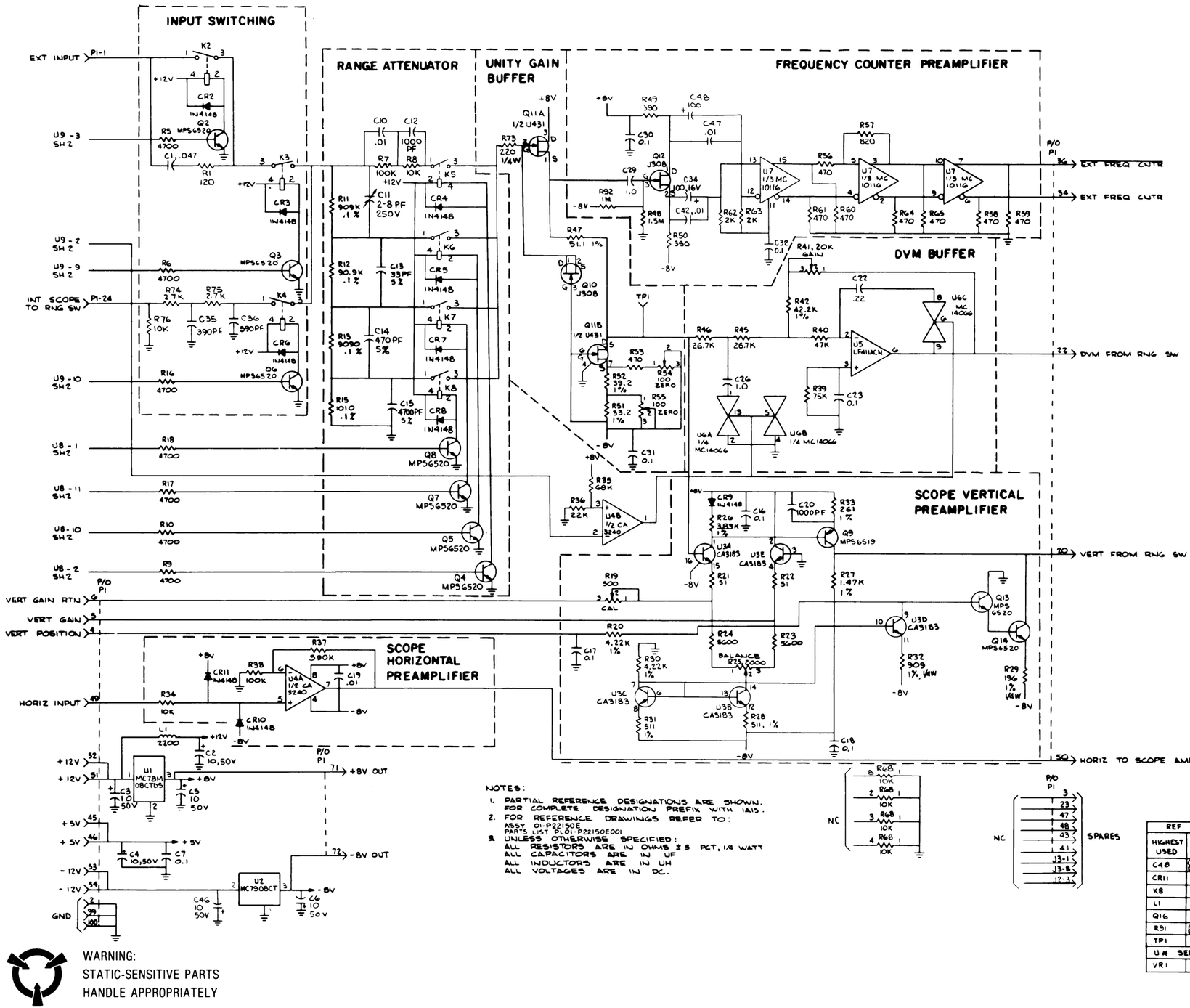
Figure 15-1. Block Diagram



FRONT-PANEL INTERFACE BOARD (A15)

(RTC-1011A)

Figure 15-2a. Schematic (Sheet 1 of 2)



REF DESIGNATIONS	
HIGHEST USED	NOT USED
C48	C44,C21,C24,C27, C28,C35,C41,C43
CR11	
K8	
L1	
Q16	Q15
R91	R4,R5,R9,R10,R43,R44 R11,R17-91,R84,R87
TP1	
U14	SEE TABLE 1
VR1	

369130-79A

FRONT-PANEL INTERFACE BOARD (A15)

(RTC-1011A)

Figure 15-2b. Schematic (Sheet 2 of 2)

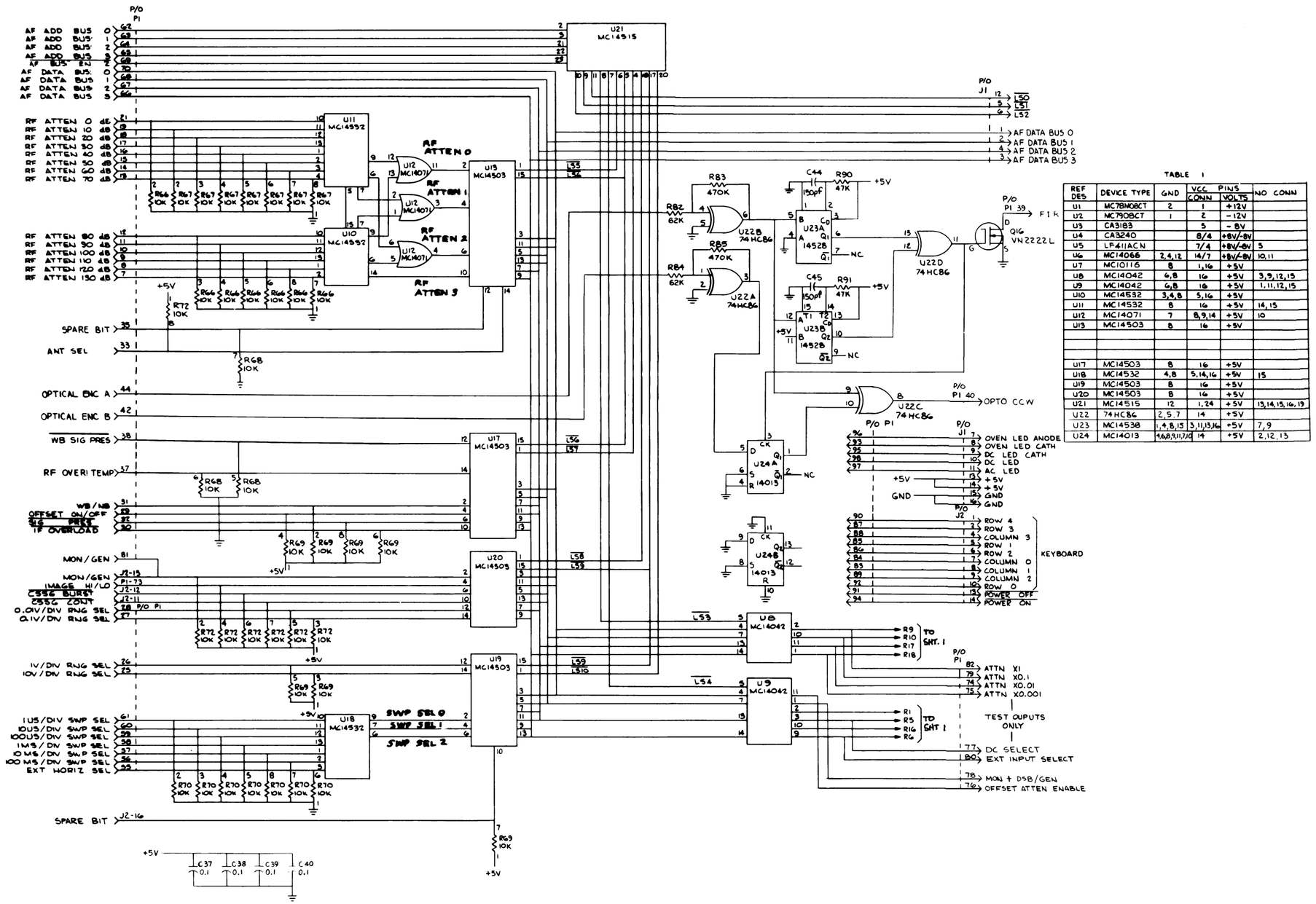
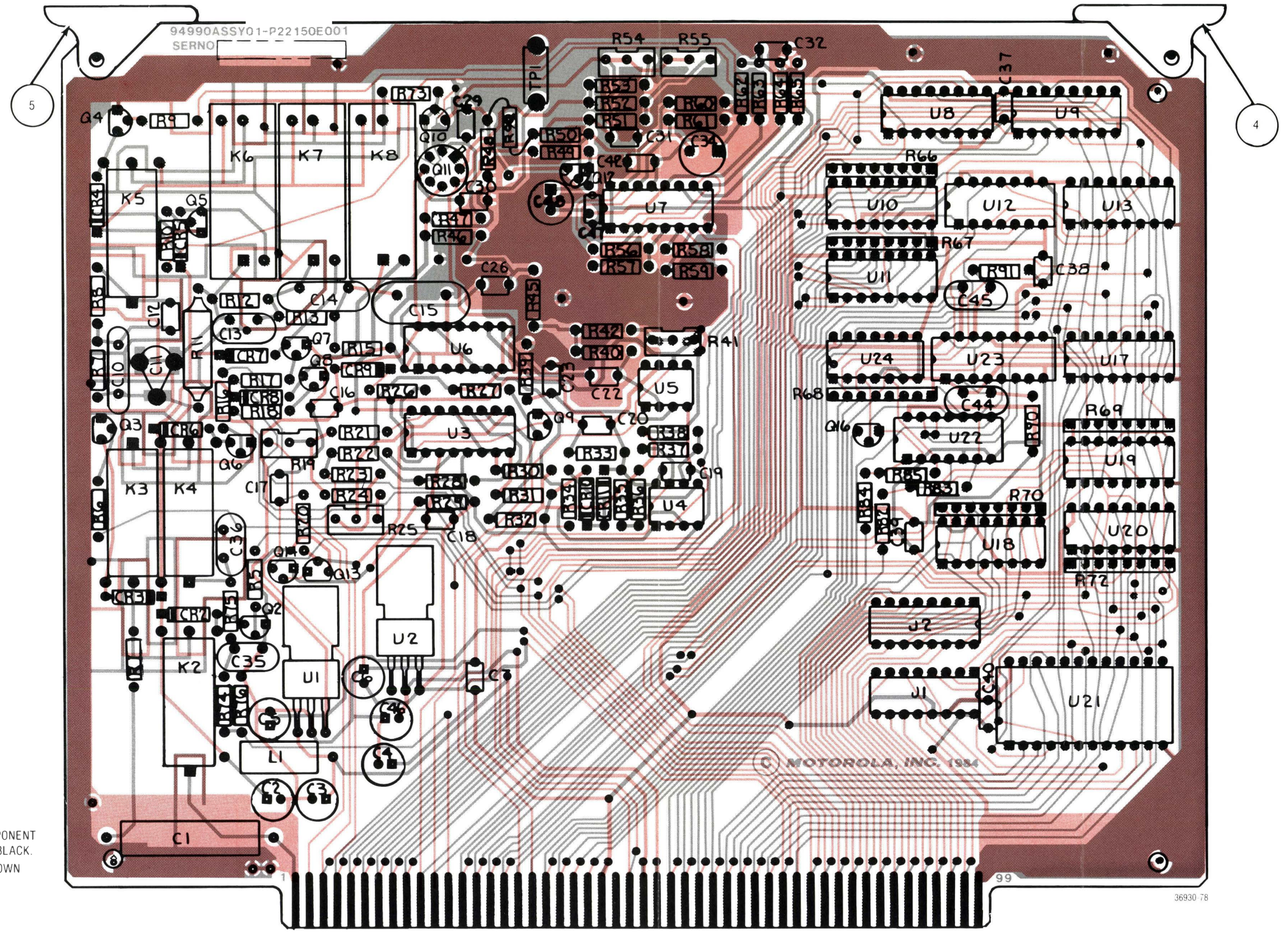


TABLE 1

REF DES	DEVICE TYPE	GND	VCC PINS CONN	VCC PINS VOLTS	NO CONN
U1	MC7812CT	2	1	+12V	
U2	MC7912CT	1	2	-12V	
U3	CA3183		5	-8V	
U4	CA3240		8/4	+8V/-8V	
U5	LF411ACN		7/4	+8V/-8V	5
U6	MC14066	2,4,12	14/7	+8V/-8V	10,11
U7	MC10116	8	1,16	+5V	
U8	MC14042	6,8	16	+5V	3,9,12,15
U9	MC14042	6,8	16	+5V	1,11,12,15
U10	MC14532	3,4,8	5,16	+5V	
U11	MC14532	8	16	+5V	14,15
U12	MC14071	7	8,9,14	+5V	10
U13	MC14503	8	16	+5V	
U17	MC14503	8	16	+5V	
U18	MC14532	4,8	5,14,16	+5V	15
U19	MC14503	8	16	+5V	
U20	MC14503	8	16	+5V	
U21	MC14515	12	1,24	+5V	13,14,15,16,19
U22	74HC86	2,5,7	14	+5V	
U23	MC14538	1,4,8,15	3,11,13,16	+5V	7,9
U24	MC14013	4,6,8,9,11,7,10	14	+5V	2,12,13

WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

36930-798



COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK. SOLDER SIDE TRACK SHOWN IN ORANGE

FRONT-PANEL INTERFACE BOARD (A15)
RTC-1011A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
004	1	45-80339B34	CARD EJECTOR	MARKED
005	1	45-80339B28	CARD EJECTOR	
C 001	1	08-80343B09	CAPACITOR	.047UF-5-600
C 002	1	23-80341B15	CAPACITOR	10UF-20-50
C 003	1	23-80341B15	CAPACITOR	10UF-20-50
C 004	1	23-80341B15	CAPACITOR	10UF-20-50
C 005	1	23-80341B15	CAPACITOR	10UF-20-50
C 006	1	23-80341B15	CAPACITOR	10UF-20-50
C 007	1	21-80342B10	CAPACITOR	.1UF-20-50
C 010	1	08-80343B11	CAPACITOR	.01UF-10-400
C 011	1	20-80370A32	CAPACITOR	2-8PF-250V
C 012	1	21-80341B92	CAPACITOR	1000PF-10-100
C 013	1	21-80369A90	CAPACITOR	33PF-5-500
C 014	1	21-80339B27	CAPACITOR	470PF-5-500
C 015	1	21-80369A96	CAPACITOR	4700PF-5-500
C 016	1	21-80342B10	CAPACITOR	.1UF-20-50
C 017	1	21-80342B10	CAPACITOR	.1UF-20-50
C 018	1	21-80342B10	CAPACITOR	.1UF-20-50
C 019	1	21-80342B09	CAPACITOR	.01UF-20-50
C 020	1	21-80341B92	CAPACITOR	1000PF-10-100
C 022	1	21-80342B11	CAPACITOR	.22UF-20-50
C 023	1	21-80342B10	CAPACITOR	.1UF-20-50
C 026	1	21-80342B46	CAPACITOR	1UF-20-50
C 029	1	21-80342B46	CAPACITOR	1UF-20-50
C 030	1	21-80342B10	CAPACITOR	.1UF-20-50
C 031	1	21-80342B10	CAPACITOR	.1UF-20-50
C 032	1	21-80342B10	CAPACITOR	.1UF-20-50
C 034	1	23-84665F26	CAPACITOR	100UF-20-16
C 035	1	21-80339B21	CAPACITOR	390PF-5-100
C 036	1	21-80339B21	CAPACITOR	390PF-5-100
C 037	1	21-80342B10	CAPACITOR	.1UF-20-50
C 038	1	21-80342B10	CAPACITOR	.1UF-20-50
C 039	1	21-80342B10	CAPACITOR	.1UF-20-50
C 040	1	21-80342B10	CAPACITOR	.1UF-20-50
C 042	1	21-80342B09	CAPACITOR	.01UF-20-50
C 044	1	21-80369A94	CAPACITOR	150PF-5-500
C 045	1	21-80369A94	CAPACITOR	150PF-5500
C 046	1	23-80341B15	CAPACITOR	10UF-20-50
C 047	1	21-80342B09	CAPACITOR	.01UF-20-50
C 048	1	23-84665F26	CAPACITOR	100UF-20-16
CR002	1	48-84463K02	DIODE	
CR003	1	48-84463K02	DIODE	
CR004	1	48-84463K02	DIODE	
CR005	1	48-84463K02	DIODE	
CR006	1	48-84463K02	DIODE	
CR007	1	48-84463K02	DIODE	
CR008	1	48-84463K02	DIODE	
CR009	1	48-84463K02	DIODE	
CR010	1	48-84463K02	DIODE	
CR011	1	48-84463K02	DIODE	
J 001	1	09-80331A97	SOCKET,SOLDER DIP	16 PIN
J 002	1	09-80331A97	SOCKET,SOLDER DIP	16 PIN
K 002	1	80-80346A01	RELAY,REED	1A-500V
K 003	1	80-80346A01	RELAY,REED	1A-500V
K 004	1	80-80346A01	RELAY,REED	1A-500V
K 005	1	80-80346A01	RELAY,REED	1A-500V
K 006	1	80-84157B01	REED RELAY	1A
K 007	1	80-84157B01	REED RELAY	1A
K 008	1	80-84157B01	REED RELAY	1A
L 001	1	24-80369A43	COIL	2200UH
Q 002	1	48-80340B86	TRANSISTOR	MPS6520
Q 003	1	48-80340B86	TRANSISTOR	MPS6520
Q 004	1	48-80340B86	TRANSISTOR	MPS6520
Q 005	1	48-80340B86	TRANSISTOR	MPS6520
Q 006	1	48-80340B86	TRANSISTOR	MPS6520
Q 007	1	48-80340B86	TRANSISTOR	MPS6520
Q 008	1	48-80340B86	TRANSISTOR	MPS6520
Q 009	1	48-80340B85	TRANSISTOR	MPS6519
Q 010	1	48-80345A41	TRANSISTOR	N-CHANNEL JFET
Q 011	1	48-80368A90	TRANSISTOR	DUAL N-CHANNEL JFET
Q 012	1	48-80345A41	TRANSISTOR	N-CHANNEL JFET
Q 013	1	48-80340B86	TRANSISTOR	MPS6520
Q 014	1	48-80340B86	TRANSISTOR	MPS6520
Q 016	1	48-80341B23	TRANSISTOR,MOSFET,	N-CHANNEL
R 001	1	06-11009C27	RESISTOR	120-5-1/4
R 005	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 006	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 007	1	06-11009C97	RESISTOR	100K-5-1/4
R 008	1	06-11009C73	RESISTOR	10K-5-1/4
R 009	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 010	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 011	1	06-80396A73	RESISTOR	909K-.1-1/4
R 012	1	06-80396A71	RESISTOR	90.9K-.1-1/4

FRONT-PANEL INTERFACE BOARD (A15)

(RTC-1011A)

Figure 15-3. Printed Wiring Board Assembly and Parts List

FRONT-PANEL INTERFACE BOARD (A15) (Cont)

RTC-1011A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
R 013	1	06-80396A70	RESISTOR	9090-.1-1/4
R 015	1	06-80396A60	RESISTOR	1010-.1-1/4
R 016	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 017	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 018	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 019	1	18-83452F07	RESISTOR,VARIABLE	500
R 020	1	06-10621C55	RESISTOR	4.22K-1-1/4
R 021	1	06-11009C18	RESISTOR	51-5-1/4
R 022	1	06-11009C18	RESISTOR	51-5-1/4
R 023	1	06-11009C67	RESISTOR	5.6K-5-1/4
R 024	1	06-11009C67	RESISTOR	5.6K-5-1/4
R 025	1	18-83452F01	RESISTOR,VARIABLE	2K
R 026	1	06-10621C51	RESISTOR	3.83K-1-1/4
R 027	1	06-10621C11	RESISTOR	1.47K-1-1/4
R 028	1	06-10621B66	RESISTOR	511-1-1/4
R 029	1	06-10621B26	RESISTOR	196-1-1/4
R 030	1	06-10621C55	RESISTOR	4.22K-1-1/4
R 031	1	06-10621B66	RESISTOR	511-1-1/4
R 032	1	06-10621B90	RESISTOR	909-1-1/4
R 033	1	06-10621B38	RESISTOR	261-1-1/4
R 034	1	06-11009C73	RESISTOR	10K-5-1/4
R 035	1	06-11009C93	RESISTOR	68K-5-1/4
R 036	1	06-11009C81	RESISTOR	22K-5-1/4
R 037	1	06-11009D12	RESISTOR	390K-5-1/4
R 038	1	06-11009C97	RESISTOR	100K-5-1/4
R 039	1	06-11009C94	RESISTOR	75K-5-1/4
R 040	1	06-11009C89	RESISTOR	47K-5-1/4
R 041	1	18-83452F15	RESISTOR,VARIABLE	20K
R 042	1	06-10621D52	RESISTOR	42.2K-1-1/4
R 045	1	06-10621D33	RESISTOR	26.7K-1-1/4
R 046	1	06-10621D33	RESISTOR	26.7K-1-1/4
R 047	1	06-10621A69	RESISTOR	51.1-1-1/4
R 048	1	06-10621F03	RESISTOR	1.5M-5-1/4
R 049	1	06-11009C39	RESISTOR	390-5-1/4
R 050	1	06-11009C39	RESISTOR	390-5-1/4
R 051	1	06-10621D42	RESISTOR	33.2-1-1/4
R 052	1	06-10621A58	RESISTOR	39.2-1-1/4
R 053	1	06-11009C41	RESISTOR	470-5-1/4
R 054	1	18-83452F03	RESISTOR,VARIABLE	100
R 055	1	18-83452F03	RESISTOR,VARIABLE	100
R 056	1	06-11009C41	RESISTOR	470-5-1/4
R 057	1	06-11009C47	RESISTOR	820-5-1/4
R 058	1	06-11009C41	RESISTOR	470-5-1/4
R 059	1	06-11009C41	RESISTOR	470-5-1/4
R 060	1	06-11009C41	RESISTOR	470-5-1/4
R 061	1	06-11009C41	RESISTOR	470-5-1/4
R 062	1	06-11009C56	RESISTOR	2K-5-1/4
R 063	1	06-11009C56	RESISTOR	2K-5-1/4
R 064	1	06-11009C41	RESISTOR	470-5-1/4
R 065	1	06-11009C41	RESISTOR	470-5-1/4
R 066	1	06-80340B10	RESISTOR	10K
R 067	1	06-80340B10	RESISTOR	10K
R 068	1	06-80340B10	RESISTOR	10K
R 069	1	06-80340B10	RESISTOR	10K
R 070	1	06-80340B10	RESISTOR	10K
R 072	1	06-80340B10	RESISTOR	10K
R 073	1	06-11009C33	RESISTOR	220-5-1/4
R 074	1	06-11009C59	RESISTOR	2.7K-5-1/4
R 075	1	06-11009C59	RESISTOR	2.7K-5-1/4
R 076	1	06-11009C73	RESISTOR	10K-5-1/4
R 082	1	06-11009C92	RESISTOR	62K-5-1/4
R 083	1	06-11009D14	RESISTOR	470K-5-1/4
R 084	1	06-11009C92	RESISTOR	62K-5-1/4
R 085	1	06-11009D14	RESISTOR	470K-5-1/4
R 090	1	06-11009C89	RESISTOR	47K-5-1/4
R 091	1	06-11009C89	RESISTOR	47K-5-1/4
R 092	1	06-11009D22	RESISTOR	1M-5-1/4
TP001	1	09-80331A88	JACK	WHITE

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
U 001	1	51-05292H02	INTEGRATED CIRCUIT	
U 002	1	51-80345A07	INTEGRATED CIRCUIT	MC7908CT SCREENED
U 003	1	51-80343B25	INTEGRATED CIRCUIT	CA3183E SCREENED
U 004	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U 005	1	51-80339B98	INTEGRATED CIRCUIT	
U 006	1	51-82884L71	INTEGRATED CIRCUIT	
U 007	1	51-80323A60	INTEGRATED CIRCUIT	
U 008	1	51-82884L15	INTEGRATED CIRCUIT	
U 009	1	51-82884L15	INTEGRATED CIRCUIT	
U 010	1	51-80074C03	INTEGRATED CIRCUIT	
U 011	1	51-80074C03	INTEGRATED CIRCUIT	
U 012	1	51-82884L52	INTEGRATED CIRCUIT	
U 013	1	51-82884L74	INTEGRATED CIRCUIT	
U 017	1	51-82884L74	INTEGRATED CIRCUIT	
U 018	1	51-80074C03	INTEGRATED CIRCUIT	
U 019	1	51-82884L74	INTEGRATED CIRCUIT	
U 020	1	51-82884L74	INTEGRATED CIRCUIT	
U 021	1	51-80340B18	INTEGRATED CIRCUIT	
U 022	1	51-80340B81	INTEGRATED CIRCUIT	
U 023	1	51-82884L28	INTEGRATED CIRCUIT	
U 024	1	51-05596E15	INTEGRATED CIRCUIT	