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WIDEBAND MULTIPLEX SYSTEM.(U)
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LEVEL II

FINAL REPORT

WIDEBAND MULTIPLEX SYSTEM

February 1980

Revised: June 1980

Contract N62269-79-C-0037
Item No. 0002
CDRL Sequence No. A002

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Prepared For

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Warminster, Pennsylvania 18974

Prepared By

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SECTION I

INTRODUCTION AND SUMMARY

A. INTRODUCTION

The objective of this contract was to design and assemble a wideband video multiplexing system which would provide a means for distributing several wideband video and sync signals on a single coaxial cable to multiple video display terminals. Figure I-1 depicts system architecture~~, which includes two~~ separate signal buses. Interconnection of the transmitter and receiver units is accomplished with wideband passive devices and double-shielded coaxial cable.

Frequency Division Multiplexing (FDM) is employed in this system. It divides a particular portion of the RF spectrum into discrete information channels. Each channel contains separate composite video and sync signals for subsequent display. Five separate channels are provided with an assigned channel bandwidth of 6 MHz per channel. Channel frequency is determined by the modulator (transmitter) unit, which generates the appropriate RF carrier. Channel assignments conform to the commercial TV band and include channels 2, 4, and 5 for bus 1 and channels 7 and 9 for bus 2. Selection of these channels insures sufficient channel spacing to minimize interference.

Typical signal processing occurs in the following manner. Video and sync (composite) signals are applied to a transmitter terminal designated as T in Figure I-1. The terminal frequency translates the composite signal onto a selected radio frequency (RF) carrier. The RF at the terminal output is an amplitude modulated vestigial sideband signal.

Signals from the various transmitter terminals are applied to a passive summing junction (Σ), which provides the multiplexed output. A passive power splitter ($\div$) is inserted to provide the required signal distribution paths as shown. The multiplexed signals are subsequently applied to a series of directional couplers to provide a tap for each receiver's input terminal. Each receiver can be switched by a digital signal to any of the TV channels and to either bus. The receiver demodulates the RF signal and delivers the composite video signal to the cockpit display.

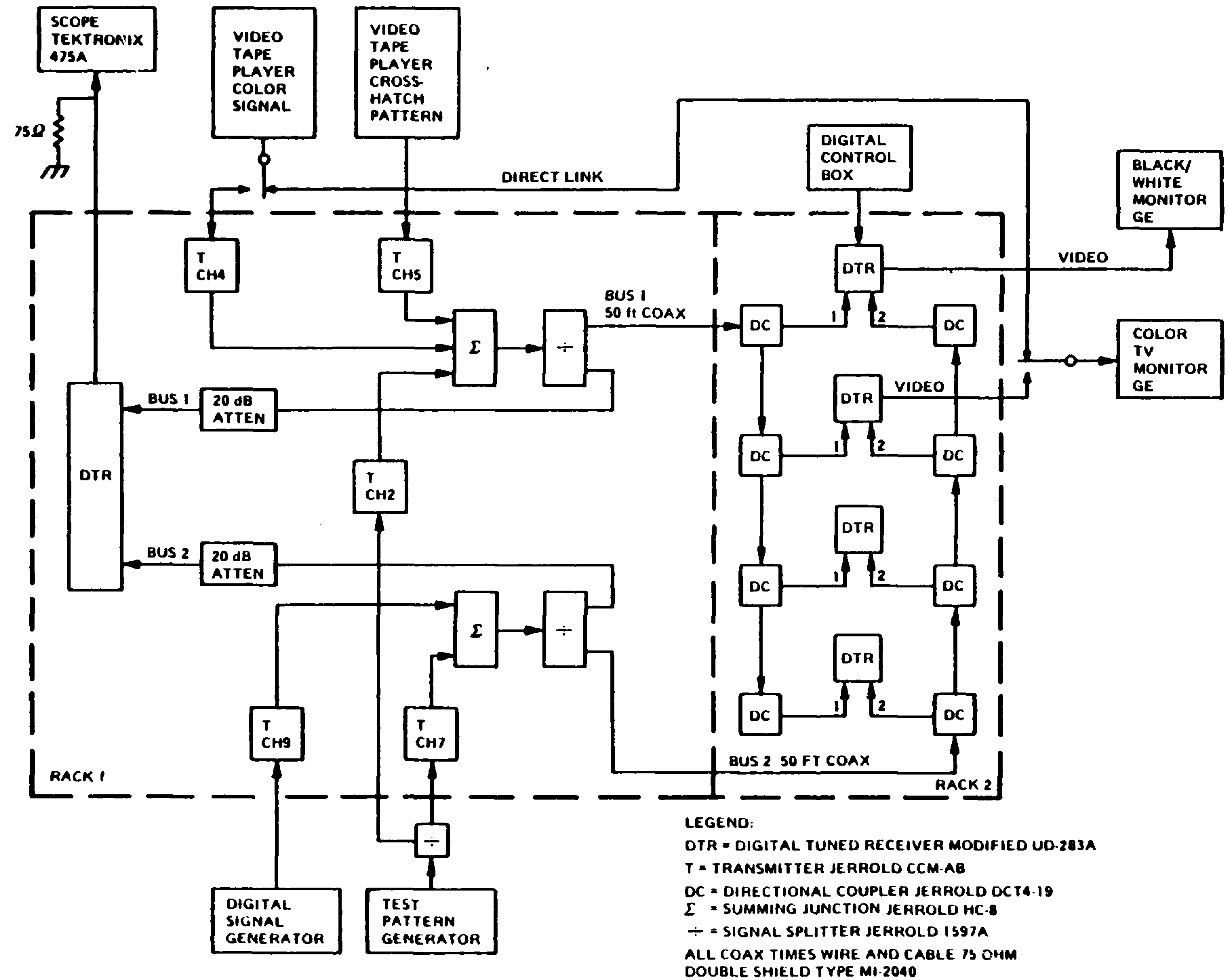


Figure I-1. Wideband Multiplex System Block Diagram

The complete system is housed within two standard equipment racks shown in Figure I-2. Figures I-3 and I-4 show each equipment rack in greater detail.

B. SUMMARY AND CONCLUSIONS

System implementation was accomplished by modifying commercial equipment designed for cable television service. The system was completed during the fourth quarter of 1979 with demonstration and acceptance testing for NADC taking place on 17 December 1979.

Specified system parameters were measured and evaluated, with the data and results being reported in Section III of this document. The test results indicate compliance with the specifications, and satisfactory operation was achieved during a complete system operational demonstration.

C. APPLICABLE DOCUMENTS

Prime Item Development Specification for Advanced Integrated Display System/Advanced Development Model (AIDS/ADM) Wideband Multiplex Subsystem (WMS)	AIDS 78-1511A dated 15 October 1979
Test Plan for Wideband Multiplex System	15 January 1980
Monthly Progress Reports Nos. 1 through 9, Wideband Multiplex System	December 1979

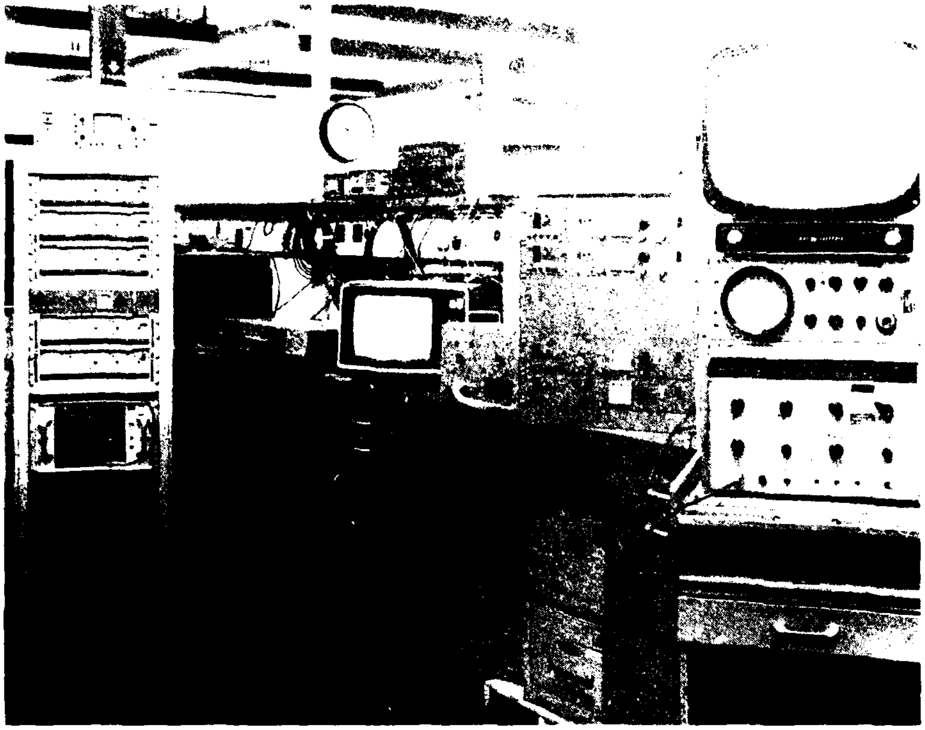


Figure 1-2. Wideband [illegible]

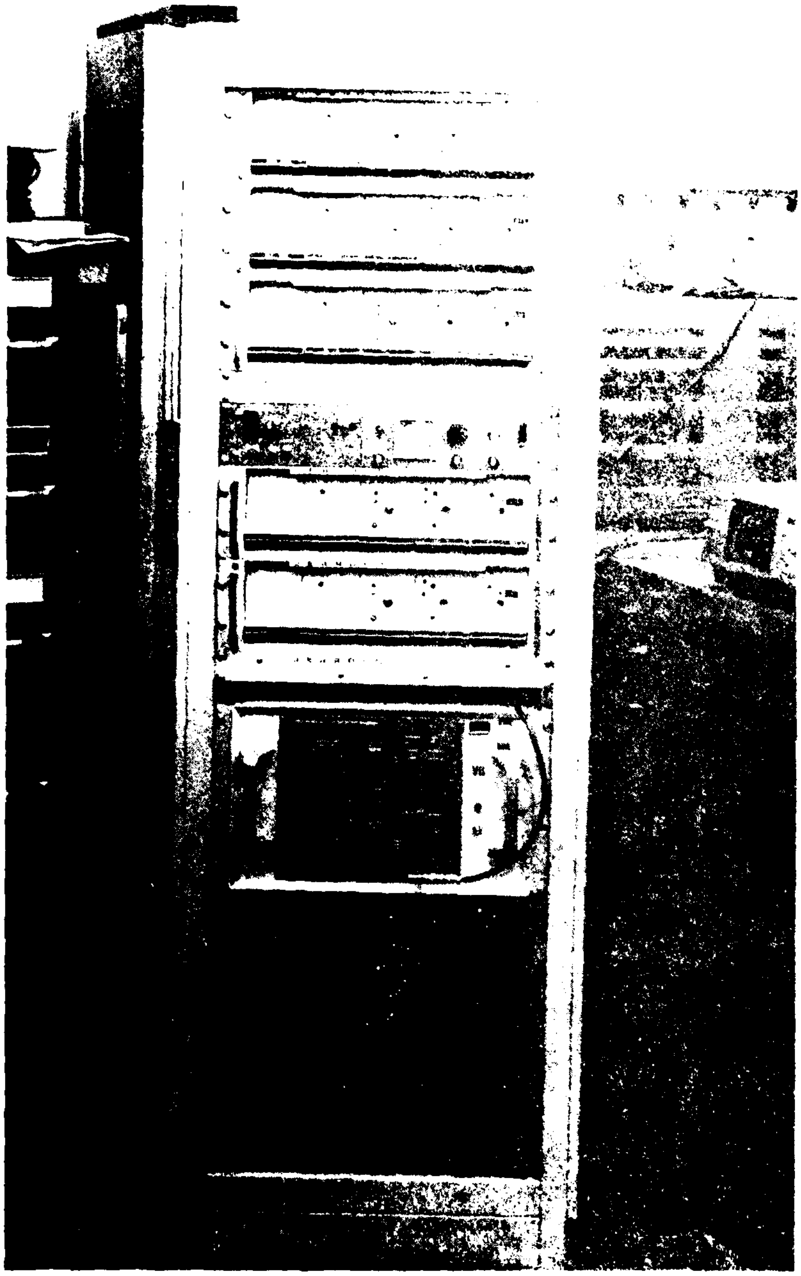


Figure I-8. Modulators and [illegible] Rack

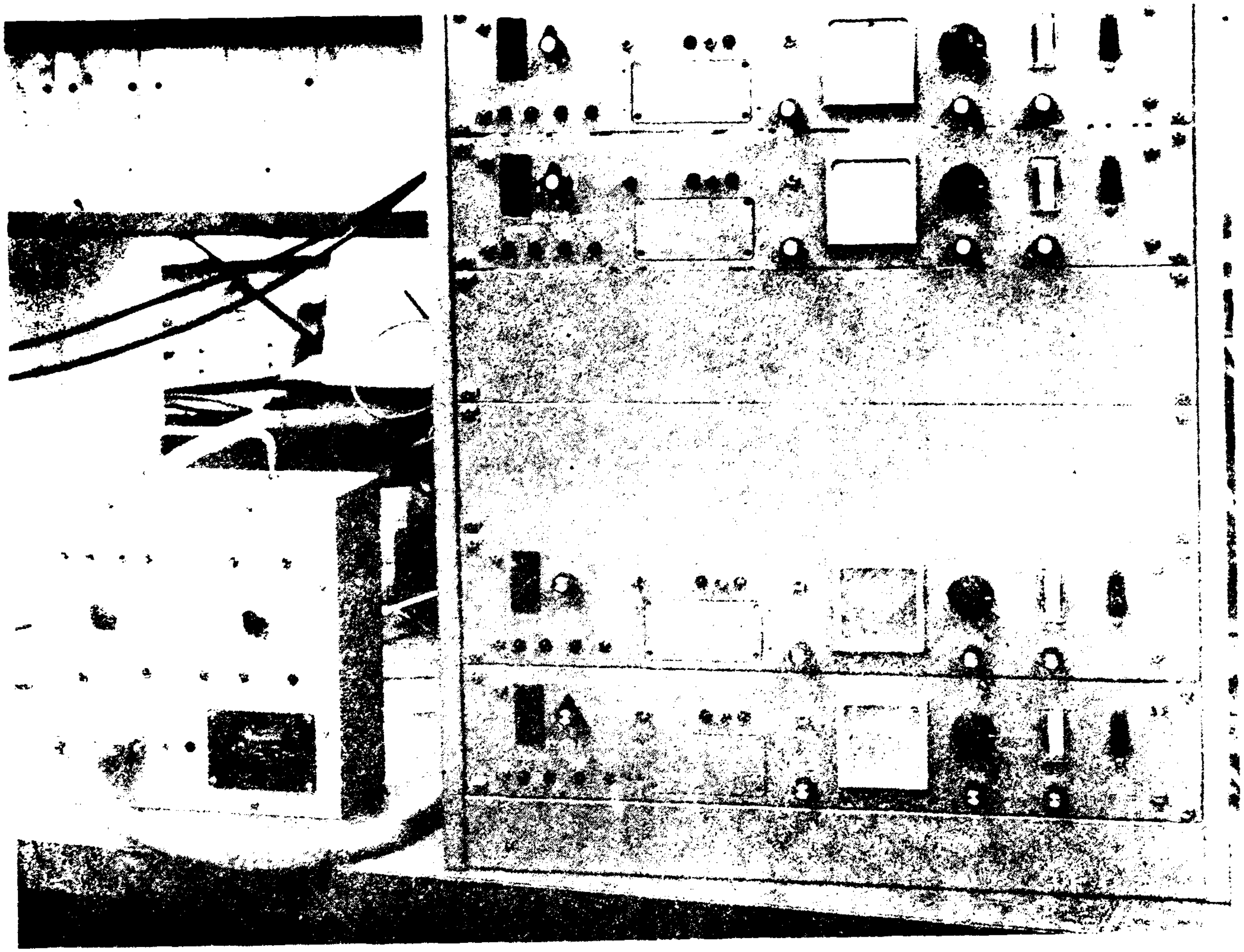


Figure 1-1. Demodulators Mounted in 19 Inch Rack

SECTION II

EQUIPMENT DESCRIPTION

A. GENERAL

The equipment employed to implement the Wideband Multiplex structure consists of modified commercial units normally utilized with cable television multiplex systems. This equipment consists of modulators (transmitters), demodulators (receivers), summing networks, signal splitters, and directional couplers, and was supplied by Jerrold Electronics of Pennsylvania. System coaxial wiring, supplied by Times Wire and Cable Co. of Connecticut, is type MI-2040, which is double-shielded, and has a silver plated copperweld center conductor. The impedance of 75 ohms is compatible with other system components, while the double-shield provides high noise immunity, and the rigid center conductor gives reliable contact with good durability. Improved "F" type connectors, installed on all system components, were selected for terminating the coaxial cable. The connectors (type GF59AHS, supplied by Telewire Supply, Great Neck, N.Y.) have extended back shells to provide improved gripping of the coax shield.

The equipment is designed to be housed in standard 19 inch racks as shown in Figure I-2.

B. MODULATOR

The modulator accepts composite video and sync signals, translates the frequency to a VHF TV channel, and suppresses a portion of the lower sideband to provide vestigial sideband signals at the output.

Five of these units are incorporated within the system. Each unit operates on a specific VHF channel (2, 4, 5, 7, or 9) as determined by the IF-to-RF Converter (IFC) plug-in module. Specifications for these units, type CCM-AB, are covered in document No. 78-1511A.

The only modification required for these units consisted of incorporating a built-in test (BITE) capability. Figure II-1 is a block diagram of the test circuitry. A small sample of the RF output is detected and integrated, and the resulting smoothed voltage is applied to the threshold detector. The threshold

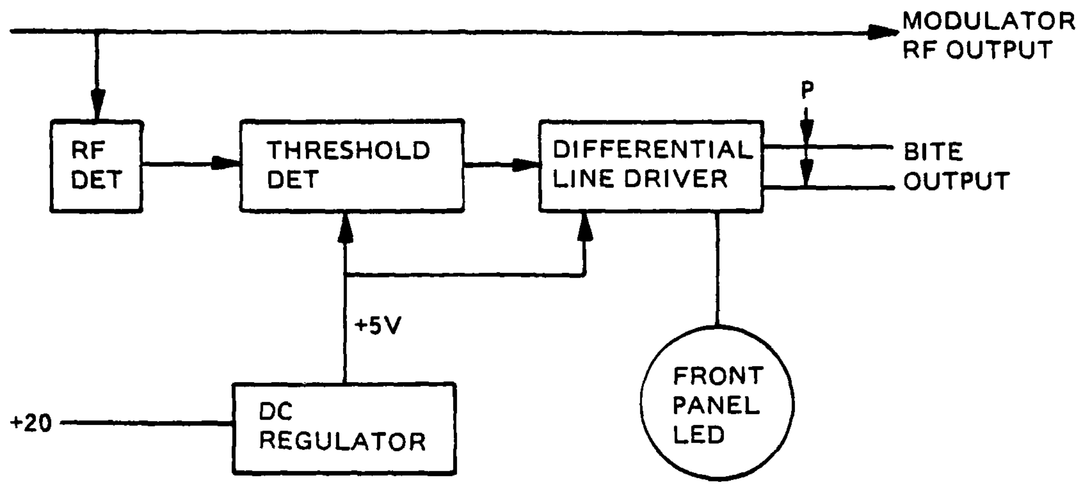


Figure II-1. Modulator Test Circuitry Block Diagram

detector drives a differential line driver, which is connected to the BITE output connector. A light emitting diode (LED) has been incorporated on the front panel of the IFC module to indicate BITE status. The loss of signal output will cause the LED to glow and will also be reported by the BITE line driver output. A DC voltage regulator is incorporated in the BITE circuitry to utilize the internally available +20 VDC of the module. The regulator converts the +20 VDC to +5 VDC for the BITE circuitry. All added circuitry is housed within the IFC module, and the BITE signal output utilizes spare pins on the module's power connector. Twisted-pair wiring interconnects the module connector to the added external BITE connector located on the rear main frame apron.

C. DEMODULATOR

The demodulator shown in Figure I-4 selects any one of ten VHF channels and demodulates the composite video and sync signals for direct application to an appropriate display. Five of these units are incorporated within the system. All ten channels are capable of being set to receive any channel in the VHF TV band (channels 2 through 13). Specifications for these units, type UD-283A, are covered in document No. 78-1511A.

Extensive modifications were incorporated into these units to obtain remote digital tuning, bus selection, and determination of the validity of the input digital control signal. Figure II-2 depicts both a modified and an unmodified unit. These modifications included:

(1) New front panel

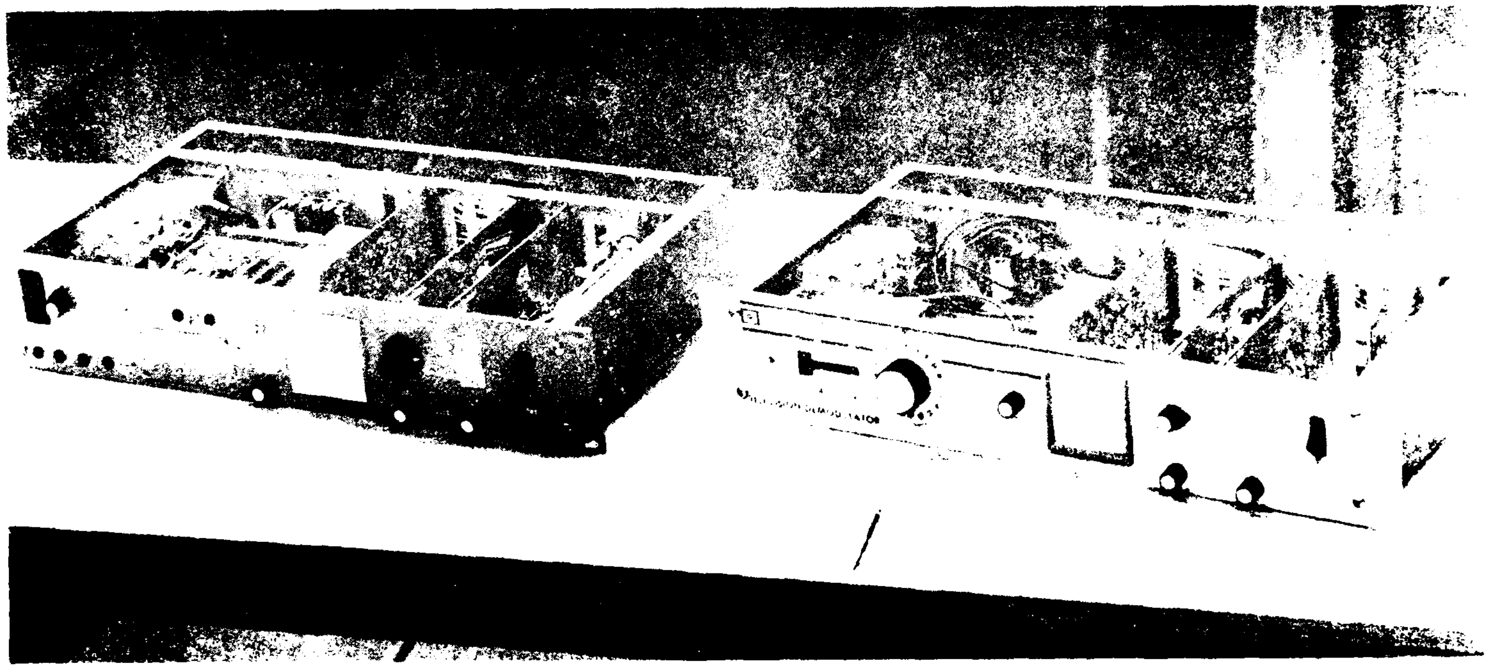


Figure II-2. Modified and Unmodified Demodulator Units
(Modified unit on the left)

(2) Addition of a wire wrapped board containing control and decision logic

(3) Addition of a +5 VDC power supply

(4) A new VHF coaxial switch

(5) New connectors for RF and control signals

(6) Wiring harness additions.

The block diagram in Figure II-3 details the control and decision logic incorporated into the demodulators. The design utilizes standard dual-in-line packaging (DIP) throughout, with low-power Schottky devices used wherever possible. Provisions are incorporated for control from two separate sources, A or B. The controlling source will be determined by the status of the command (CMD) lines from sources A or B. The controlling source will control frequency and bus selection (bus 1 or 2). In addition, these parameters can be manually selected by the controls located on the receiver front panel. With the front panel MODE switch in LOCAL position, the receiver is controlled by front panel controls and ignores all external control inputs. The REMOTE position of the MODE switch enables external control of receiver frequency and bus selection. The front panel indicates operating channel (LED display), controlling source (A or B), and operating bus (1 or 2). An LED indicator, identified as LOCAL/$\overline{\text{CMD}}$, serves two functions: (1) with the MODE switch in LOCAL position it indicates local control ON. (2) With the MODE switch in REMOTE, it indicates invalid command codes (i.e., if both sources are attempting to control the receiver, the LED will glow).

Figure II-4 is a logic flow diagram for channel frequency control. Note that invalid commands disable sources A and B and the receiver is tuned to a channel determined by the manual channel selector switch. Figure II-5 depicts the logic flow diagram for establishing bus control. Invalid command codes cause the receiver bus selection to be determined by the front panel manual BUS SELECT switch position.

The decision logic, which consists of four logic elements, receives all local and remote control information. This information is used to determine which source will be enabled and generates the appropriate enable, control, and advisory output signals. The flow diagrams depict the operation of this circuitry.

Referring to Figure II-3, a four digit BCD (Binary-Coded Decimal) signal is applied to a tri-state receiver from source A or source B for controlling frequency selection. The tri-state receiver data output is applied to a four-line data bus when

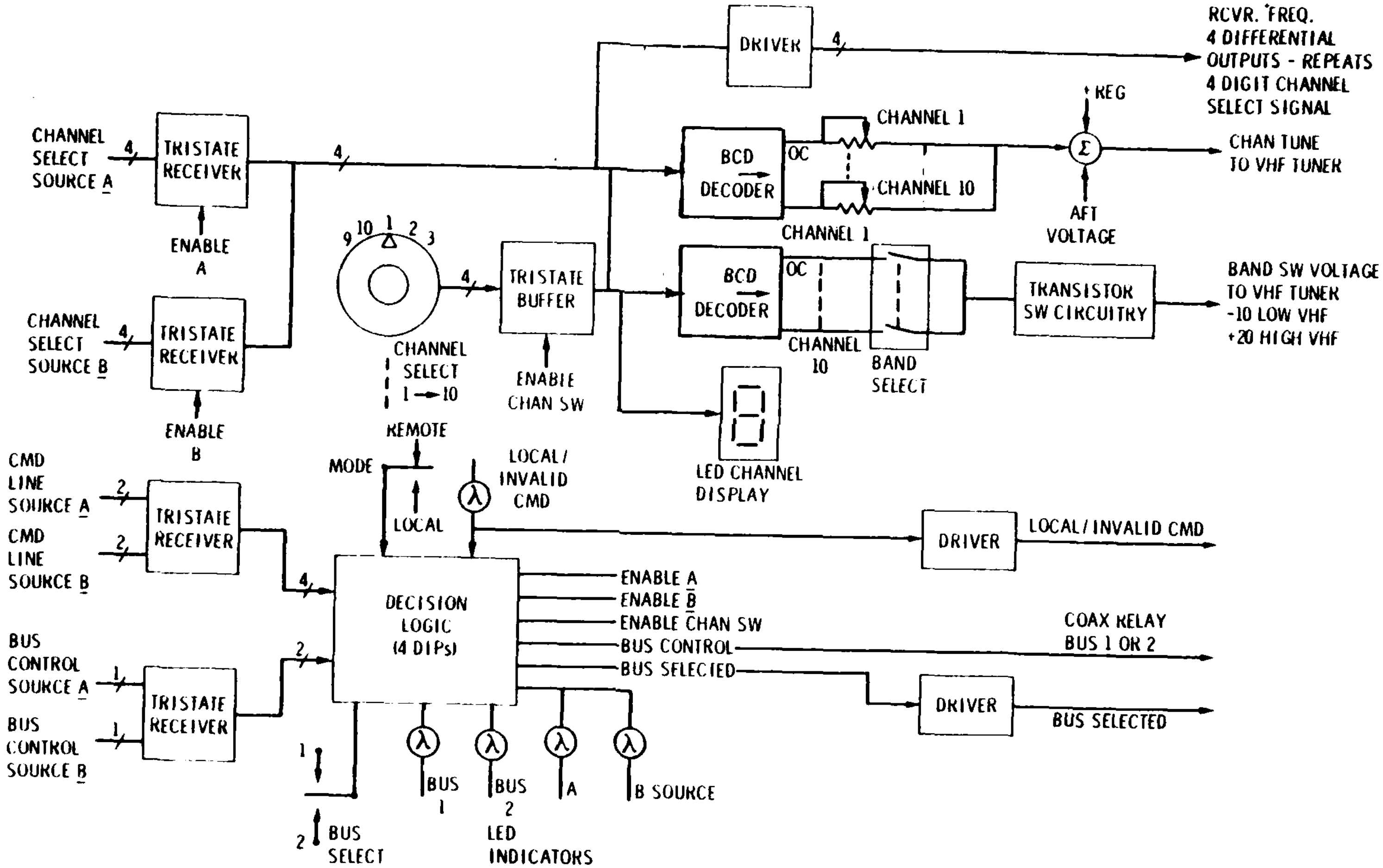


Figure II-3. Block Diagram of Receiver Modification

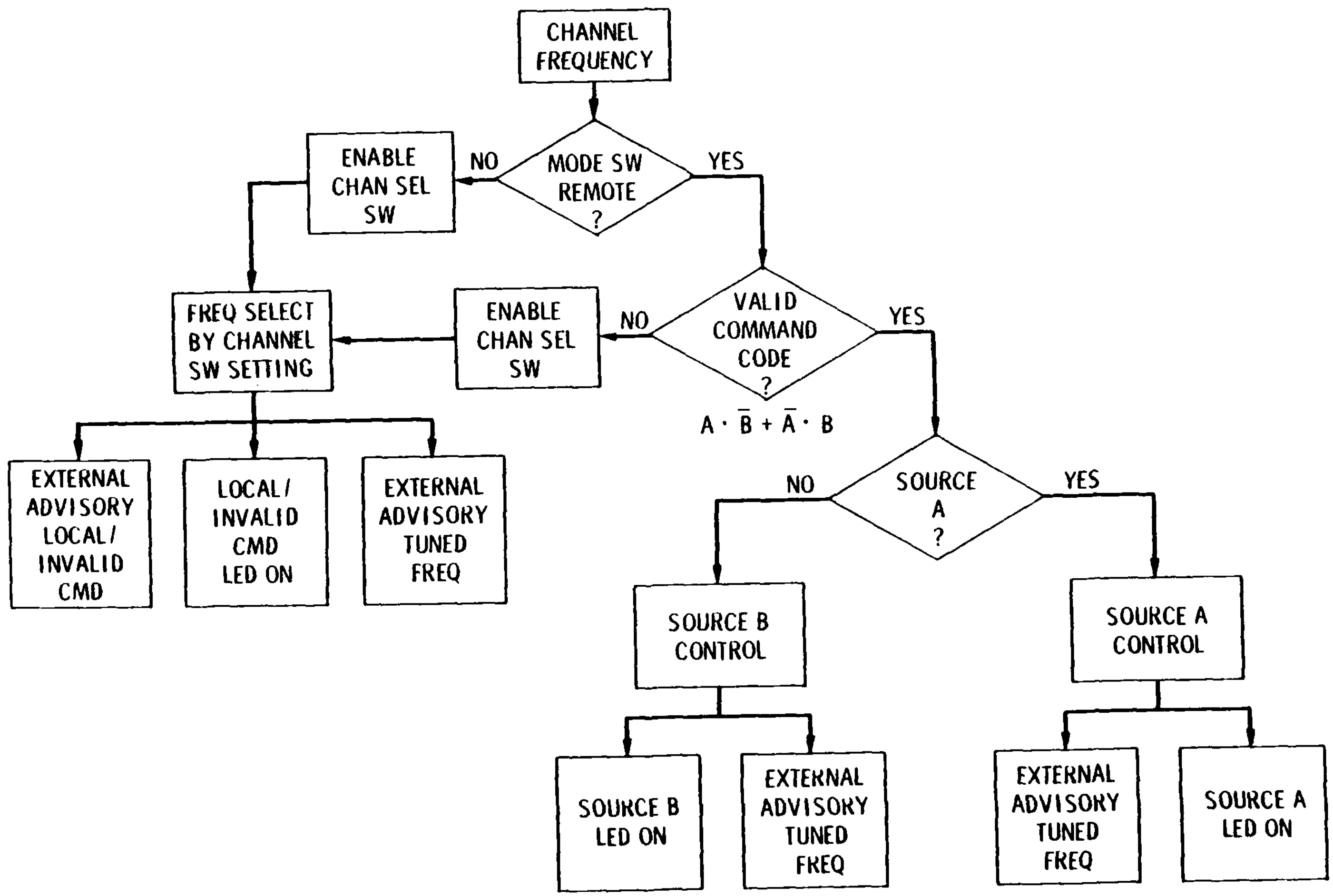


Figure II-4. Flow Diagram for Channel Frequency Control

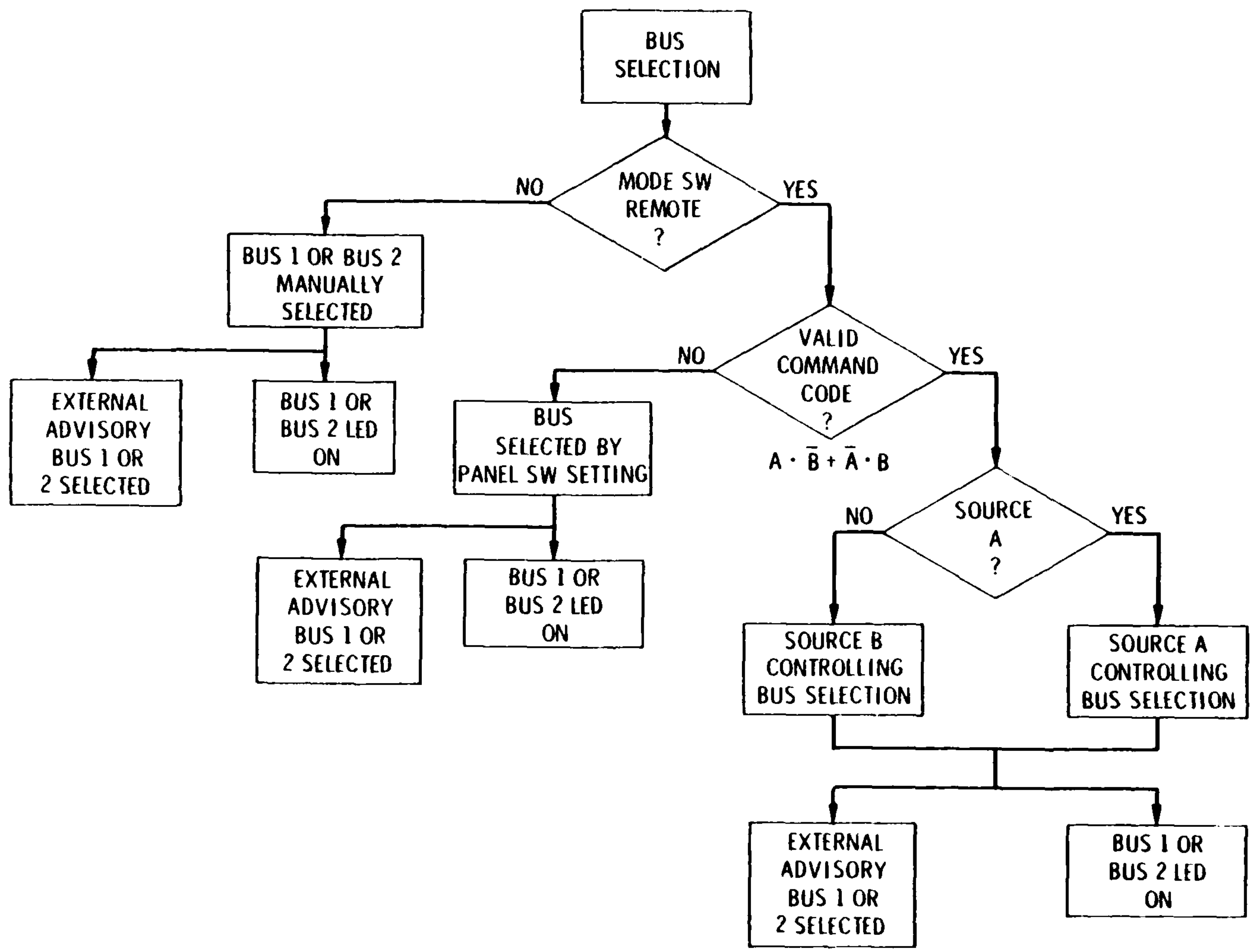


Figure II-5. Flow Diagram for Bus Control enabled by the decision logic (enable line A or enable line B). Data is subsequently applied to:

(1) A line driver to externally report the received operating channel

(2) A BCD-to-decimal decoder which allows selection of one of ten potentiometers

(3) A second BCD-to-decimal decoder for low VHF or high VHF band selection

(4) A seven-segment LED channel display.

The line driver output (RCVR FREQ) is designed to drive twisted-pair wiring and is connected to the control connector J1. Four differential outputs are provided to duplicate the received four-digit BCD signal.

Each potentiometer can be set for any voltage between +4 and +24 VDC, which enables tuning all VHF TV channels (2 through 13). Table III-2 on page 22 presents a voltage vs. frequency calibration chart for each receiver. The selected potentiometer output is summed with the AFT (automatic fine tuning) voltage via a resistive summing junction and subsequently applied to a varactor tuner. The tuner also requires a band select voltage; low VHF for channels 2 through 6 and high VHF for channels 7 through 13. This is provided by the second BCD-to-decimal decoder and the ten individual band select switches. Discrete transistor circuitry provides the interface between the band switches and the varactor tuner. The -10 VDC applied to the tuner band switch terminal enables receiving LOW VHF, while the +20 VDC enables HIGH VHF.

The seven-segment LED numeric display accepts the BCD signal directly and displays a numeral indicating the receiver operating channel in digital format.

Receiver frequency can also be controlled manually by the channel select switch shown connected to the four-line data bus via the tri-state buffer. The switch directly outputs a four-bit BCD signal to the tri-state buffer, which is enabled by the enable channel switch line originating from the decision logic.

Remote advisory signals, which indicate receiver status, include:

(1) Receiver frequency

(2) Local/invalid command code

(3) Bus selected

(4) Receiver BITE

All of these output signals are applied to drivers with differential outputs, designed to drive twisted-pair wiring. The status signals exit the unit via the J1 control connector on the receiver rear apron.

Receiver BITE circuitry is shown in Figure II-6. The circuitry is contained on the decision logic wire wrap board. A DC voltage proportional to the received signal level is developed within the unit. This voltage, which monitors the receiver video output, is applied to a threshold detector and subsequently to a line driver and front panel LED indicator. The output of the driver is designed to drive twisted-pair wiring and is fed to control connector J1.

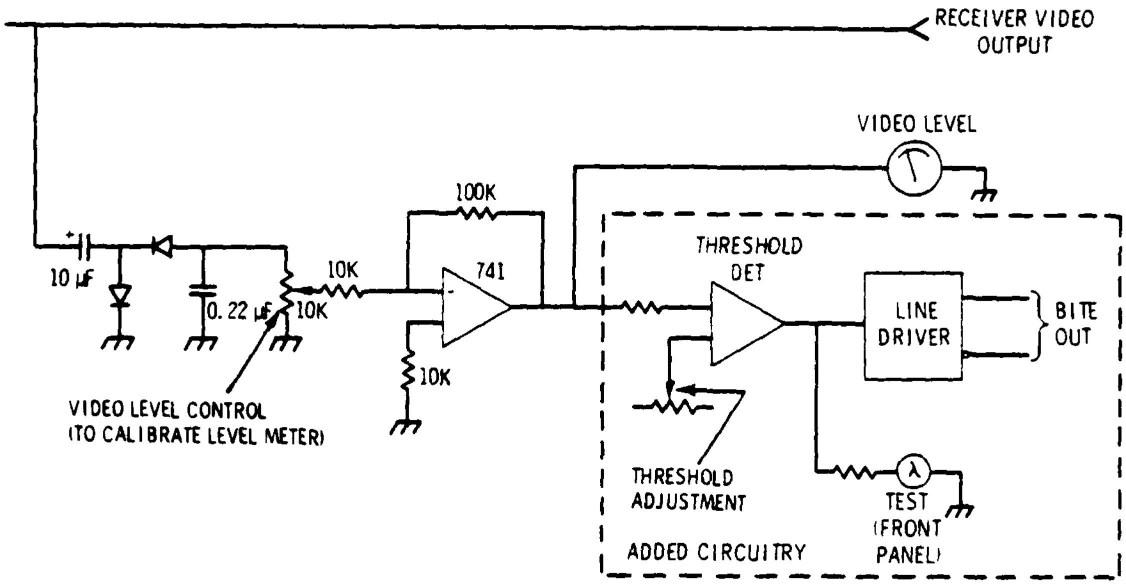


Figure II-6. Demodulator Test (BITE) Circuitry

D. SYSTEM PASSIVE ELEMENTS

Interconnection of the modulators and demodulators is accomplished with wideband passive devices. Individual device parameters are covered in specification No. 78-1511A.

An eight input port signal combiner (summing network), type HC-8, is used to combine transmitter terminal outputs. The output of this network consists of a single port containing all applied input signals, and enables single coax wire distribution. Each bus utilizes one combiner, with the unused input ports terminated in 75 ohms.

A signal splitter, type 1597A, consisting of one input port and four output ports, follows the HC-8. This network enables distribution of the combined signals to various points within the system. Each bus utilizes one splitter, with the unused output ports terminated in 75 ohms.

An output port from the signal splitter is applied directly to a demodulator through 20 dB of attenuation. This attenuation is incorporated to ensure correct signal level at the demodulator input.

A second output port is applied to a series of directional couplers, type DCT4-19, which provide for distribution of the bus signal to several demodulator terminals.

The coupler exhibits low insertion loss to the main bus signal, while providing a convenient tap-off point with good isolation between tap and main line. Four output tap ports are provided, with the unused ports terminated in 75 ohms. Identical couplers are used throughout bus 1 and bus 2.

E. RECEIVER CONTROL SIMULATOR

A test set was designed and built to exercise the digital control circuitry added to the receiver; see Figure I-4. This set simulates all external digital input control signals and can monitor all receiver digital output signals. Connection to the demodulator is accomplished via a 50-pin ITT-Cannon type DD-50P connector. The +5 VDC required for the logic circuitry is obtained through the cable from the unit under test.

A block diagram of the unit is shown in Figure II-7. The unit provides simulated external control signals for both source A and source B which include:

(1) Channel select

(2) Command source select

(3) Bus select.

It also can monitor demodulator digital output signals indicating receiver status as follows:

(1) Selected channel (7-segment LED display)

(2) Local/invalid command (LED indicator)

(3) BUS 1 or BUS 2 (LED indicator)

(4) Receiver operation (LED indicator)

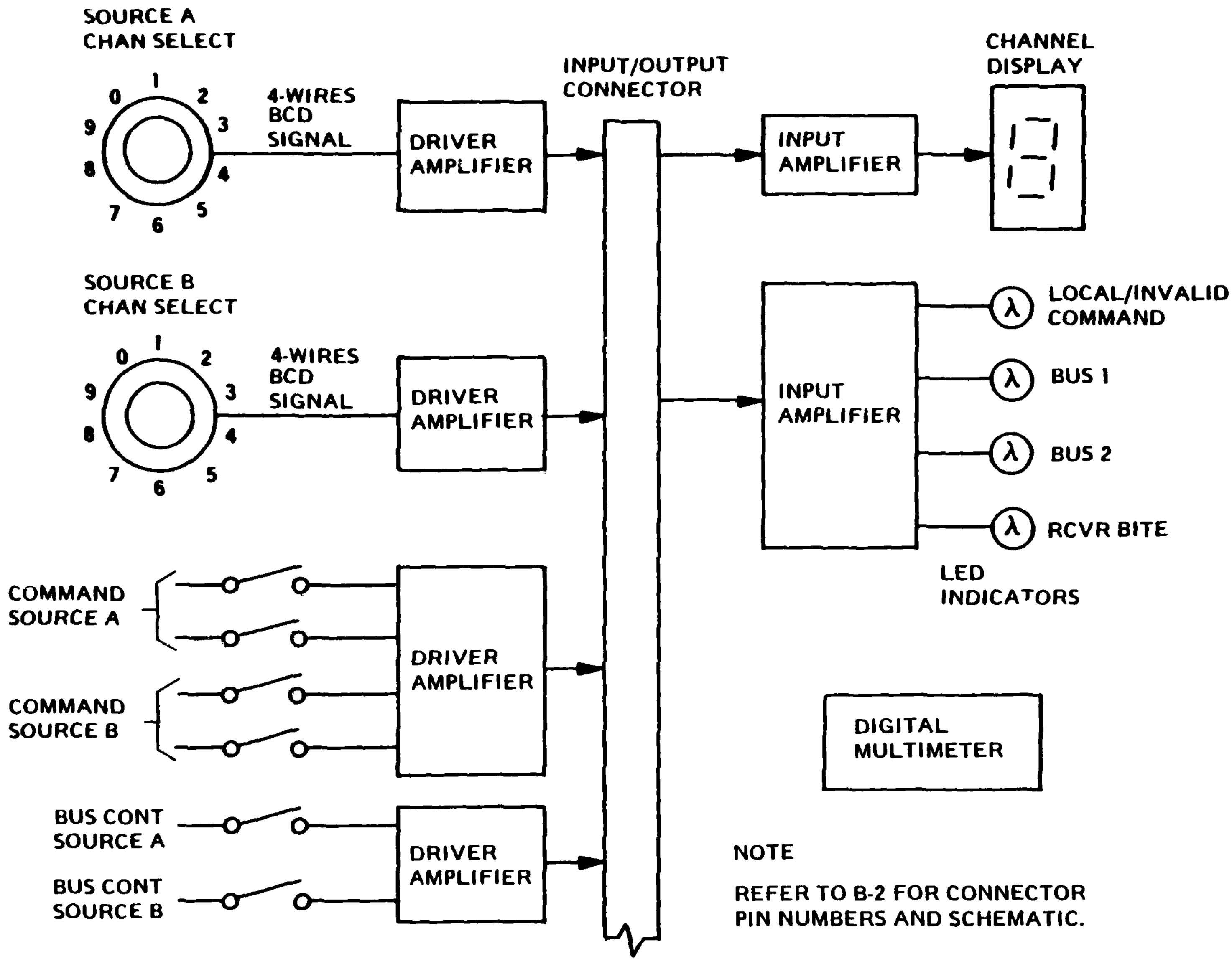


Figure II-7. Block Diagram of Receiver-Control Test Set

All input/output signals utilize differential line drivers and receivers interconnected by twisted-pair wiring.

A digital multimeter was incorporated into the test set to provide a convenient method of setting the DC voltage from the channel tuning potentiometers. By using this meter in conjunction with the associated receiver calibration data, a potentiometer can be adjusted to enable receiving any one channel in the VHF TV band (2 through 13). Internal batteries serve as the power source for this meter and must be replaced periodically.

SECTION III

ACCEPTANCE TESTS

A. GENERAL

Tests were performed on the completed system in accordance with the Test Specification (CDRL Sequence No. A001, Item 0002).

All tests were performed in the General Electric laboratory at Utica, N.Y., with several of the tests witnessed by an NADC representative.

B. RESULTS OF TESTS

1. Test: Receiver Remote/Local Control Operation.

Purpose: The purpose of this test was to determine satisfactory operation of the Receiver Remote/Local Control capability.

Results: All receivers performed satisfactorily in this test.

Data: See Table III-1.

2. Test: Transmitter BITE

Purpose: The purpose of this test was to determine satisfactory operation of the Transmitter output BITE indicator.

Results: All transmitters performed satisfactorily in this test.

Data:

Transmitter TV Channel	Step 5 BITE LED On	Step 5 Scope Level $\geq$2V	Step 6 BITE LED Off	Step 7 Scope Level $\leq$0.8V
2	SAT	SAT	SAT	SAT
4	SAT	SAT	SAT	SAT
5	SAT	SAT	SAT	SAT
7	SAT	SAT	SAT	SAT
9	SAT	SAT	SAT	SAT

Date: 14 November 1979

Table III-1. RECEIVER REMOTE/LOCAL CONTROL OPERATION

Receiver Serial No.	Step 4 Command Line	Step 4 LED Indicators Source A/B	Step 5 Video LED BITE	Step 6 Channel Indicator	Step 7 Local LED	Step 8 Channel Switching	Step 9 Channel Switching BUS 2
572118	SAT	SAT	SAT	SAT	SAT	SAT	SAT
572128	SAT	SAT	SAT	SAT	SAT	SAT	SAT
571935	SAT	SAT	SAT*	SAT	SAT	SAT	SAT
572103	SAT	SAT	SAT	SAT	SAT	SAT	SAT
571836	SAT	SAT	SAT	SAT	SAT	SAT	SAT

*Wires to output connector were initially reversed. After wiring was corrected, operation was satisfactory.

Date: 15 November 1979

3. Test: Receiver Frequency Calibration/Adjustment

Purpose: The purpose of this test was to determine the Receiver tuning voltage level required for receiving each VHF channel.

Results: The final tuning for all receivers has been adjusted as follows:

Front Panel Channel Switch Position	TV Channel
1	2
2	4
3	5
4	7
5	9
6	2
7	4
8	5
9	7
0	9

Any of the 10 channels available on the front panel can be set for receiving TV channels 2 through 13. The procedure for resetting a given channel is:

1. Set AFT switch to OFF.

2. Remove front panel access door.

3. Set meter to measure DC volts. Connect digital voltmeter on Receiver Control/Test Simulator to tuning voltage test points behind access door.

4. Program bandswitch for LOW VHF (TV channels 2 through 6) or HIGH VHF (TV channels 7 through 13).

5. Refer to data for the particular receiver and adjust corresponding potentiometer for DC voltage indicated.

Data: See Table III-2.

TABLE III-2. RECEIVER FREQUENCY CALIBRATION/ADJUSTMENT DATA

TV Chan	Center Freq (MHz)	Receiver Bandswitch	Tuning Voltage				
			Rcvr 1 Ser # 571935	Rcvr 2 Ser # 572103	Rcvr 3 Ser # 572128	Rcvr 4 Ser # 572118	Rcvr 5 Ser # 571836
2	57	LOW VHF	4.5	4.3	4.4	4.3	4.5
3	63	"	6.5	6.3	6.4	6.3	6.5
4	69	"	8.5	8.4	8.6	8.4	8.6
5	79	"	13.5	13.0	13.4	13.2	13.4
6	85	"	22.5	20.0	21.3	20.1	22.5
7	177	HIGH VHF	10.0	10.2	10.7	10.4	10.3
8	183	"	11.0	11.1	11.3	11.1	11.1
9	189	"	12.3	12.3	12.7	12.6	12.3
10	195	"	13.6	13.6	13.8	13.7	13.6
11	201	"	15.5	15.3	15.7	15.4	15.5
12	207	"	18.2	17.9	18.3	18.1	18.3
13	213	"	22.2	21.3	22.4	21.8	22.3

4. Test: System Signal Levels at Receiver Inputs

Purpose: The purpose of this test was to ensure that all signal sources (Modulators) were aligned to obtain equal signal levels on the bus.

Results:

1. Modulator RF levels were set in accordance with the procedure for this test. This ensured that the signal levels at the first and last receiver were operating within the dynamic range with sufficient signal/noise ratio.

2. The signal input to the receiver associated with the modulator equipment rack (serial 571836) resulted in 3.5 to 4 mV PP (+10.8 to +12 dBmV).

Date: 14 November 1979

5. Test: System Signal Losses

Purpose: The purpose of this test was to determine overall system losses in the passive devices, including signal splitters, summing networks, cable, and directional couplers.

Results: All measured losses were within 6 dB of the calculated loss.

Data:

BUS	LAST RCVR INPUT mV PP	MODULATOR CHANNEL	MODULATOR OUTPUT mV PP	MEASURED SYSTEM LOSS dB	CALCULATED SYSTEM LOSS dB
1	3	2	400	-42.5	-46.1
1	3	4	420	-42.9	-46.5
1	3	5	500	-44.4	-46.5
2	3	7	550	-45.3	-47.4
2	3	9	560	-45.4	-47.4

Date: 16 November 1979

6. Test: Adjacent Channel Carrier Rejection

Purpose: The purpose of this test was to determine the level of channel interference caused by the adjacent channel picture carrier.

Results: Carrier rejection exceeded 50 dB for all channels on Bus 1 and Bus 2.

Data:

BUS 1

Channel	Carrier Rejection
2	-56 dB
4	-56 dB
5	-55 dB

BUS 2

Channel	Carrier Rejection
7	-53 dB
9	-53 dB

Date: 17 December 1979

Witness: Mr. Frank Uphoff, NADC

7. Test: Gray Scale

Purpose: The purpose of this test was to determine the ability of the system to reproduce the required shades of gray between the black and white extremes. Gray scale is indicative of the system dynamic range.

Results: The data indicated satisfactory reproduction of the standard gray scale. The receiver which initially presented poor definition was corrected by alignment.

Data:

CHANNEL	BUS	RCVR SERIAL NUMBER	STEP 4 8 SHADES GRAY	STEP 5 UNIFORM	STEP 6 AMPLITUDE DISTORTION
*2	1	572118	SAT	SAT	SAT
*2	1	572128	SAT	SAT	1
*2	1	571935	SAT	SAT	SAT 2
*2	1	572103	SAT	SAT	SAT
2	1	571836	SAT	SAT	SAT
4	1	572118	SAT	SAT	SAT
5	1	572118	SAT	SAT	SAT
7	2	572118	SAT	SAT	SAT
9	2	572118	SAT	SAT	SAT
*7	2	572103	SAT	SAT	SAT

1 Noted slight differential in two shades below black level.

2 Gray scale on this receiver presented less definition than the other receivers. Subsequent tests indicated misalignment of receiver bandwidth. Receiver was realigned and test repeated with satisfactory results 19 December 1979.

Date: 19 December 1979

*Tests witnessed by Mr. Frank Uphoff, NADC 17 December 1979

8. Test: System Resolution

Purpose: The purpose of this test was to determine the system horizontal resolution.

Results: The data indicated resolution capability between 339 and 433 lines. The receiver exhibiting 339 lines exhibited narrow bandwidth. This unit was subsequently realigned and retested 19 December 1979 resulting in 390 lines.

Data:

CHANNEL	BUS	RCVR SERIAL NUMBER	RESOLVED PULSE WIDTH μs	CALCULATED HORIZONTAL LINE RESOLUTION
2	1	572118	.18 μs	433
2	1	572128	.19 μs	410
2	1	571935	.23 μs	339*
2	1	572103	.19-.21 μs	371-410
2	1	571836	.19 μs	410
4	1	572118	.19 μs	410
5	1	572118	.19 μs	410
7	2	572118	.19 μs	410
9	2	572118	.19 μs	410

Date: 17 December 1979

Witnessed: Mr. Frank Uphoff, NADC
*After realignment Pulse Width = .20 μs or 390 lines

9. Test: Crosstalk at RF Output

Purpose: The purpose of this test was to measure crosstalk (undesired signal coupling) between BUS 1 and BUS 2 at the Receiver RF inputs.

Results:

1. No signals were detected on BUS 2 when all modulators (TV Channels 2, 4, 5) connected to BUS 1 were active. The Spectrum Analyzer was set to maximum gain.

2. No signals were detected on BUS 1 when all modulators (TV Channels 7, 9) connected to BUS 2 were active. The Spectrum Analyzer was set to maximum gain.

Date: 17 December 1979

Witnessed: Mr. Frank Uphoff, NADC

10. Test: Crosstalk at Receiver Video Outputs

Purpose: The purpose of this test was to measure crosstalk (undesired signal coupling) between BUS 1 and BUS 2 signals at the Receiver video output.

Results:

1. No signals were detected in the receiver video output over the range of 0 to 10 MHz while monitoring BUS 2 channels. All modulators (TV channels 2, 4, 5) connected to BUS 1 were active.

2. No signals were detected in the receiver video output over the range of 0 to 10 MHz while monitoring BUS 1 channels. All modulators (TV channels 7, 9) connected to BUS 2 were active.

Date: 17 December 1979

Witnessed: Mr. Frank Uphoff, NADC

11. Test: System Bandwidth

Purpose: The purpose of this test was to determine overall system bandwidth from the Modulator inputs to the Receiver outputs.

Results: The data indicates a mean -3 dB bandwidth of 3.03 MHz, and a mean -6 dB bandwidth of 3.48 MHz.

Data:

Modulator Channel	Receiver Serial Number	BUS	-3 dB Bandwidth MHz	-6 dB Bandwidth MHz
2	1-572118	1	1.07-4.05	.73-4.15
*	2-572128	1	1.07-4.17	.85-4.3
	3-571935[1]	1	.83-3.9	.6-4.1
	4-572103	1	1.25-4.24	1.06-4.36
	5-571836	1	.95-3.75	.68-4.0
4	1	1	1.26-4.16	.85-4.3
	2	1	1.08-4.27	.85-4.38
	3	1	.75-3.75	.58-4.06
	4	1	1.1-4.08	.92-4.32
	5	1	.83-3.35	.6-3.93
5	1	1	1.1-4.05	.8-4.2
	2	1	1.1-4.31	.88-4.4
	3	1	.85-4.0	.65-4.15
	4	1	1.18-4.3	1.0-4.47
	5	1	.9-4.23	.66-4.34
7	1	2	1.1-4.12	.75-4.22
	2	2	1.36-4.36	.92-4.5

Data: (Continued)

Modulator Channel	Receiver Serial Number	BUS	-3 dB Bandwidth MHz	-6 dB Bandwidth MHz
	3	2	1.05-4.2	.75-4.35
	4	2	1.0-4.35	.87-4.55
	5	2	.82-3.73	.66-3.9
9	1	2	1.1-4.05	.75-4.15
	2	2	1.5-4.55	1.0-4.7
	3	2	1.05-4.17	.72-4.32
	4	2	1.2-4.26	1-4.4
	5	2	.76-3.5	.55-3.8

[1]Receiver was initially misaligned. Realignment resulted in the above data.

Date: 19 December 1979

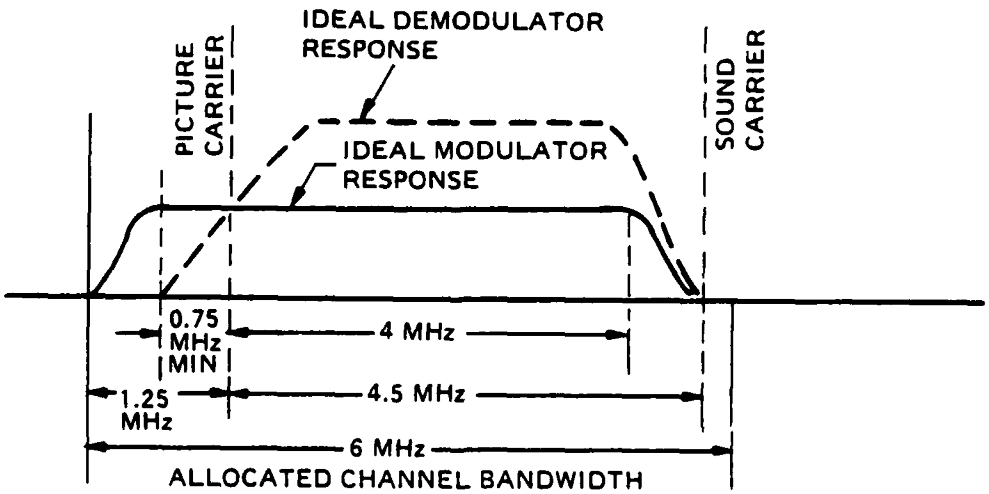
*Witnessed by Mr. Frank Uphoff, 17 December 1979

12. Test: Modulator and Demodulator Bandwidths

Purpose: The purpose of this test was to determine the individual bandwidths of the modulators and demodulators employed in the system.

Results:

1. The results indicate good conformity with idealized response curves published for this equipment. These idealized curves are shown in the following sketch:



FUNDAMENTALS OF TELEVISION ENGINEERING, GLENN M. GLASFORD, McGRAW-HILL, 1955 Pg. 278.

The data indicated that the picture carrier falls well within the flat portion of the measured modulator responses. Modulator upper frequency fall off, while not ideal, appears to conform closely at the -6 dB level.

2. The specification for the demodulator units indicates a -6 dB bandwidth of 3.8 MHz. Measurements shown in the data indicate close correlation with this specification.

3. The picture carrier, as depicted in the reference sketch, should occur near the -6 dB level of the demodulator response. Examination of the data for TV channel 2 indicates the -6 dB level occurs at 55.3 MHz to 55.6 MHz for the various units. Picture carrier assignment for channel 2 is 55.25 MHz indicating the demodulator responses were positioned reasonably close. Positioning of the response is controlled by the DC voltage applied to the varactor tuner.

Modulator Bandwidth Data

Channel	-3dB Bandwidth MHz	-3 dB Δ BW	-6 dB Bandwidth MHz	-6 dB Δ BW
2	.28-5	4.72	.12-5.4	5.28
4	.28-5	4.72	.12-5.4	5.28
5	.28-5	4.72	.11-5.4	5.29
7	.9-5	4.10	.3-5.4	5.1
9	.8-4.8	4.00	.5-5.2	4.70

Demodulator Bandwidth Data

Channel	Rcvr Serial Number	-3 dB Bandwidth MHz	-3 dB Δ BW	-6 dB Bandwidth MHz	-6 dB Δ BW
2	572118	55.5-59.1	3.6	55.3-59.2	3.9
4	572118	67.7-71.2	3.5	67.5-71.3	3.8
2	572128	55.7-59.3	3.6	55.4-59.4	4.0
4	572128	67.9-71.4	3.5	67.6-71.5	3.9
2	572103	56-59.5	3.5	55.6-59.57	3.97
4	572103	68-71.5	3.5	67.7-71.6	3.90
2	571836	55.8-59.4	3.6	55.6-59.6	4.0
4	571836	67.9-71.5	3.6	67.5-71.5	4.0

Date: 17 January 1980

13. Test: System Operational Demonstration

Purpose: The purpose of this test was to demonstrate full system operation with modulation applied to all transmitters, and, in addition, to compare a direct video signal to a bus processed signal.

Discussion: During this test, all modulators were active with the following modulation applied:

Modulator TV Channel	BUS	Type Modulation
2	1	Gray Scale
4	1	Color Program (TV Monitor Test)
5	1	Crosshatch Pattern
7	2	Gray Scale
9	2	Digital Signal $\approx$1 Mbps

A high resolution black and white monitor and a color monitor connected to the receiver video outputs were used to observe the TV-type signals. An oscilloscope connected to a receiver video output was used to observe the digital signal.

Results:

1. All channels exhibited good picture quality with no interference observed from adjacent channels on adjacent bus structures.

2. The comparison of the direct link (relay switched signal) with the same bus-processed color signals resulted in bus signals exhibiting a slight increase in overall picture noise level, coupled with slight flesh tone changes. Neither effect appeared objectionable.

Date: 18 December 1979

Witness: Mr. Frank Uphoff, NADC

SECTION IV

DIGITAL INTERFACE SIGNALS

A. GENERAL

The digital interface signals for the Wideband Multiplex System can be categorized within three major areas:

Receiver Control
Receiver Built-In Test
Transmitter Built-In Test

B. RECEIVER CONTROL

Each receiver is designed to accept control inputs from two independent sources, such as external computers or the Receiver Test Simulator. In the event both external sources attempt simultaneous control, or faults occur in the external sources/lines, the decision logic contained in each receiver will determine the controlling source. This is accomplished by accessing the status of the command lines originating from each source. The logic states of the command lines together with the resulting receiver response is contained within the specification for the Wideband Multiplex System 78-1511A dated 15 October 1979 and reproduced later in this section. When valid commands are received, the external controller (source) will control both the receiver operating channel (frequency) and bus selection (bus 1 or 2).

Figure IV-1 depicts the necessary connections and hardware required to externally control the receiver. Recommended differential line drivers type 26LS31 are available from Advanced Micro Devices, Inc. Twisted pair wiring is also recommended at each differential output as shown.

Individual devices and lines for each receiver (demodulator) can be implemented (repeat Figure IV-1's devices and wiring for each receiver) or a bus structure can be created by wiring receiver inputs in parallel. If a bus structure is implemented, the 120 ohm termination resistors within each receiver differential input must be removed with the exception of one receiver at the far end of the bus. This modification is essential to prevent excessive driver loading. Since the logic levels are continuous (latched) for each control state, line reflections and the associated difficulties with clocked data are minimized.

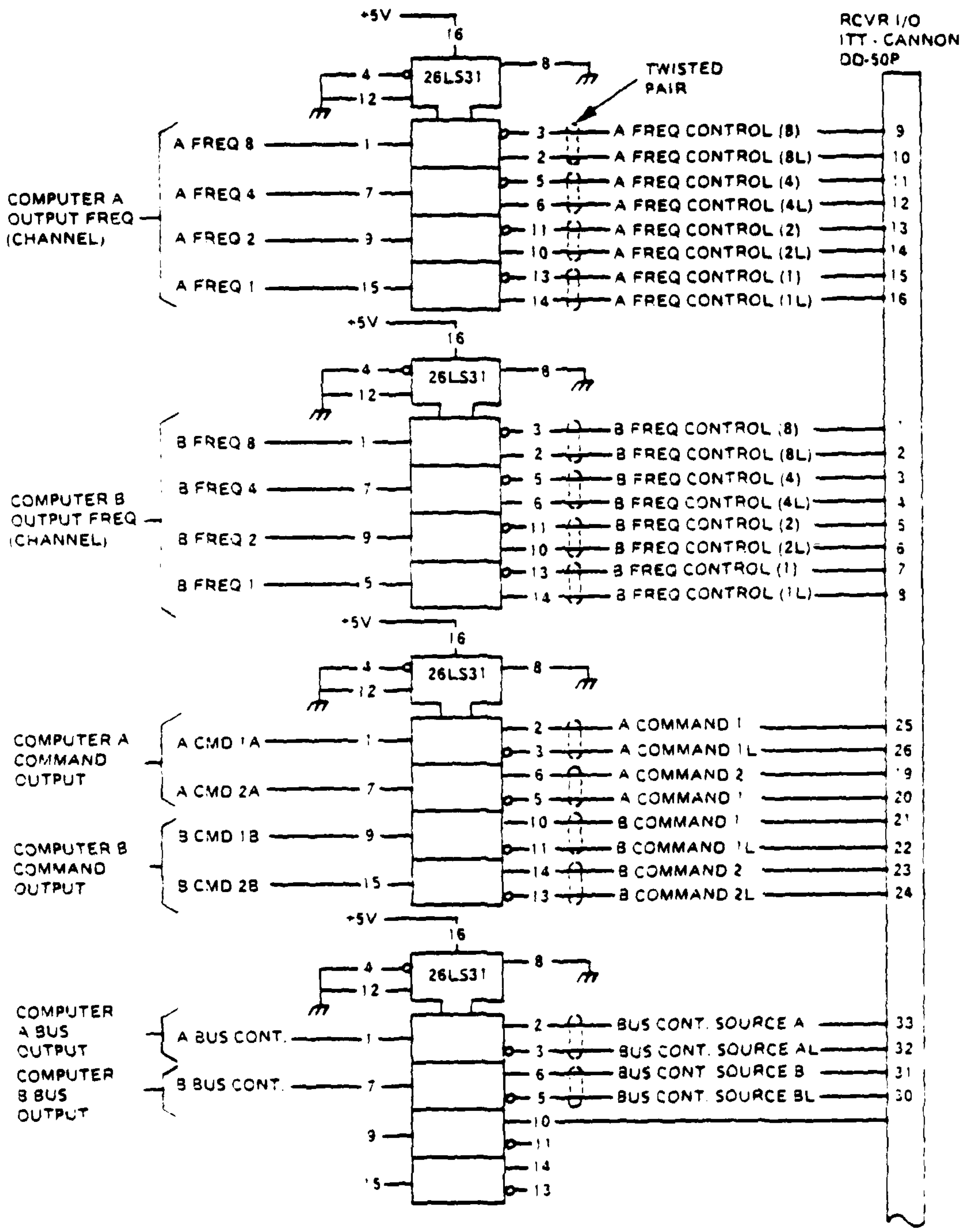


Figure IV-1. Receiver Control Interface

The following describes the requirements for external receiver control and is extracted from the referenced specification. It should be noted that:

- all signals are TTL levels, i.e., 1 = voltage level $\geq$ 2.5 V $\leq$ 5.0 V, and 0 = voltage level $\geq$ 0 V $\leq$ 0.6 V

- all logic states 1 or 0 shown are referenced driver (26LS31) data input terminals

- all input levels must remain in a continuous logic state for each defined operating condition.

(1) Remote Controls Control by application of remote digital signals shall be provided to enable selection of receiver channel and VHF input bus. Provisions for remote control from two independent sources of frequency and bus selection shall be provided. The remote source (A or B) controlling these parameters shall be determined by the command line status from each source. The front panel MODE switch must be positioned at REMOTE to enable external control.

(2) Channel (Frequency) Two sets of identical input channel control lines shall be provided for receiver frequency control from two sources. Each set of input control lines shall consist of four differential receivers as shown in Figure IV-2, with a terminated input of 120 ohms. The channel frequency shall be selected by a digital code (referenced to the driver (26LS31) data input terminals) per the following table:

Channel Selection	Driver Data Input Lines 8	4	2	1
1	1	1	1	0
2	1	1	0	1
3	1	1	0	0
4	1	0	1	1
5	1	0	1	0
6	1	0	0	1
7	1	0	0	0
8	0	1	1	1
9	0	1	1	0
0	1	1	1	1

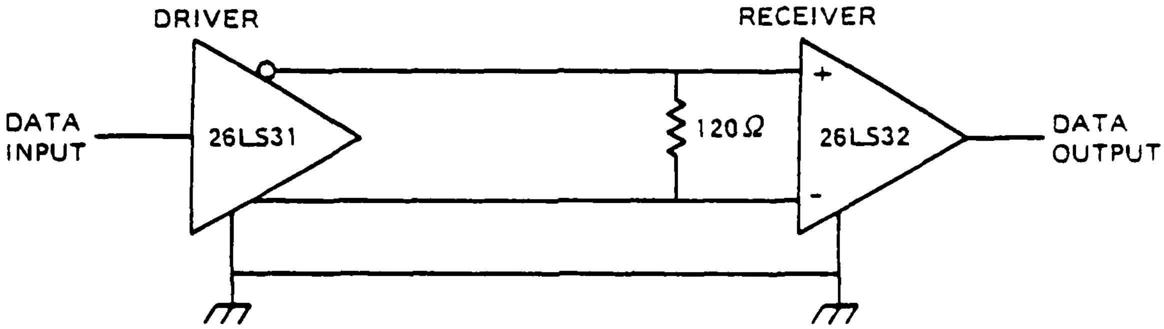


Figure IV-2. Control Interface

(3) Bus Select Two sets of identical input bus select control lines shall be provided for selection of bus 1 or bus 2 from two sources. Each set of input control lines shall consist of one differential receiver as shown in Figure IV-2 with a terminated input of 120 ohms. Bus 1 shall be selected when a "0" level is applied to the driver (26LS31) data input terminals (Figure IV-2) and bus 2 selected when a "1" level is applied to the driver data input terminals.

(4) Command Two sets of identical input command lines shall be provided to establish which external source will control receiver frequency and bus selection. Each set of input command lines shall consist of two differential receivers as shown in Figure IV-2 with terminated power inputs of 120 ohms. With the front panel MODE switch positioned in REMOTE, receiver frequency and bus selection will be determined by the status of the command lines (referenced to the driver 26LS31 data input terminals) per the following table:

Command Lines				
Source A		Source B		
1A	2A	1B	2B	Receiver Control
0	0	0	0	LOCAL
0	0	0	1	LOCAL
0	0	1	0	SOURCE B
0	0	1	1	LOCAL
0	1	0	0	LOCAL
0	1	0	1	LOCAL
0	1	1	0	SOURCE B
0	1	1	1	LOCAL
1	0	0	0	SOURCE A
1	0	0	1	SOURCE A
1	0	1	0	LOCAL
1	0	1	1	SOURCE A
1	1	0	0	LOCAL
1	1	0	1	LOCAL
1	1	1	0	SOURCE B
1	1	1	1	LOCAL

When the command line code generates LOCAL, the receiver channel and bus selection will be determined by the corresponding front panel control settings.

C. RECEIVER BUILT-IN TEST (BITE)

Digital output signals have been provided to enable external assessment of receiver operational status. These signals include:

- Receiver operating channel (frequency),
- Local/Invalid command,
- Bus selected, and
- Receiver video output.

All outputs are configured with differential line drivers type 26LS31 designed to drive twisted pair wiring with type 26LS32 differential line receivers as shown in Figure IV-2. The following describes the requirements for external receiver (demodulator) BITE monitoring. It should be noted that:

- all signals are TTL levels
- all logic states 1 or 0 are referenced to the driver (26LS31) data input terminals, and
- all output levels remain at a continuous logic state for each defined operating condition.

(1) Remote receiver status outputs Capability for remotely assessing receiver status shall be provided in the form of digital outputs configured with differential drivers (26LS31) as shown in Figure IV-2.

(2) Receiver operating channel The receiver operating channel will be present on four differential drivers coded in the following manner:

Operating Channel	Driver Data Input Lines 8	4	2	1
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
0	0	0	0	0

(3) Advisory outputs The following advisory outputs shall be available from individual differential drivers:

Output Identification	Driver Data Input Lines
LOCAL/INVALID COMMAND	1 = LOCAL/INVALID COMMAND
BUS SELECTED	0 = BUS 1, 1 = BUS 2
RCVR BITE (VIDEO)	1 = FAULT (NO RECEIVER OUTPUT SIGNAL)

D. TRANSMITTER BUILT-IN TEST (BITE)

The transmitter terminal RF output shall be continuously monitored and reported as a digital output. This output shall be provided from a differential driver (26LS31) per Figure IV-2. A "1" level on the driver DATA INPUT line shall represent loss of RF output.

SECTION V

HARDWARE REDUCTION

A. GENERAL

The present system was built without regard for minimum physical size. In order to estimate the minimum physical size required by the Wideband Multiplex System, the following assumptions have been made:

1. Present state-of-the-art techniques shall be used.

2. Development of custom devices using Large Scale Integration (LSI) shall not be considered.

3. Specifications relating to performance and operation of the new hardware shall be equivalent to those of the present Wideband Multiplex System, with the exceptions noted below in 4.

4. Deletion of the audio processing function and internal power supplies shall be assumed. It shall also be assumed that the necessary DC voltages are available externally.

B. MODULATOR

The present modulator (transmitter) unit is designed for standard 19-inch rack mounting. It occupies a volume of approximately 1800 cubic inches. Deletion of unused functions and substitution of a Surface Acoustic Wave (SAW) filter for the presently used discrete vestigial sideband filter will significantly reduce the volume required. Coupling these changes with other circuit and component changes results in an estimated volume of approximately 40 cubic inches for the required circuitry.

C. DEMODULATOR

The present demodulator (receiver) unit is designed for standard 19-inch rack mounting. It occupies approximately 665 cubic inches. Deletion of unused functions, along with other circuit and component changes, results in an estimated volume requirement of approximately 25 cubic inches for the new circuitry.

D. SYSTEM PASSIVE ELEMENTS

Signal combiners, directional couplers, and signal splitters are all available in reduced sizes from vendors specializing in these components. The devices are available for direct mounting on the circuit boards or with connectors.

The present eight-input port combiner, designed for standard 19-inch rack mounting, occupies a volume of approximately 50 cubic inches. A miniature version is available requiring a volume of approximately 9.4 cubic inches (not including connectors).

The two-port signal splitters currently occupy a volume of 1.1 cubic inch, while miniature versions of similar devices require approximately one-half of this volume.

The present directional couplers require approximately 7 cubic inches. The miniaturized directional couplers occupy approximately .55 cubic inches, and further volume reductions could be made if the couplers were incorporated into the demodulator unit. Connector and coaxial wiring sizes can also be reduced in volume by one-half if miniaturized versions are used.

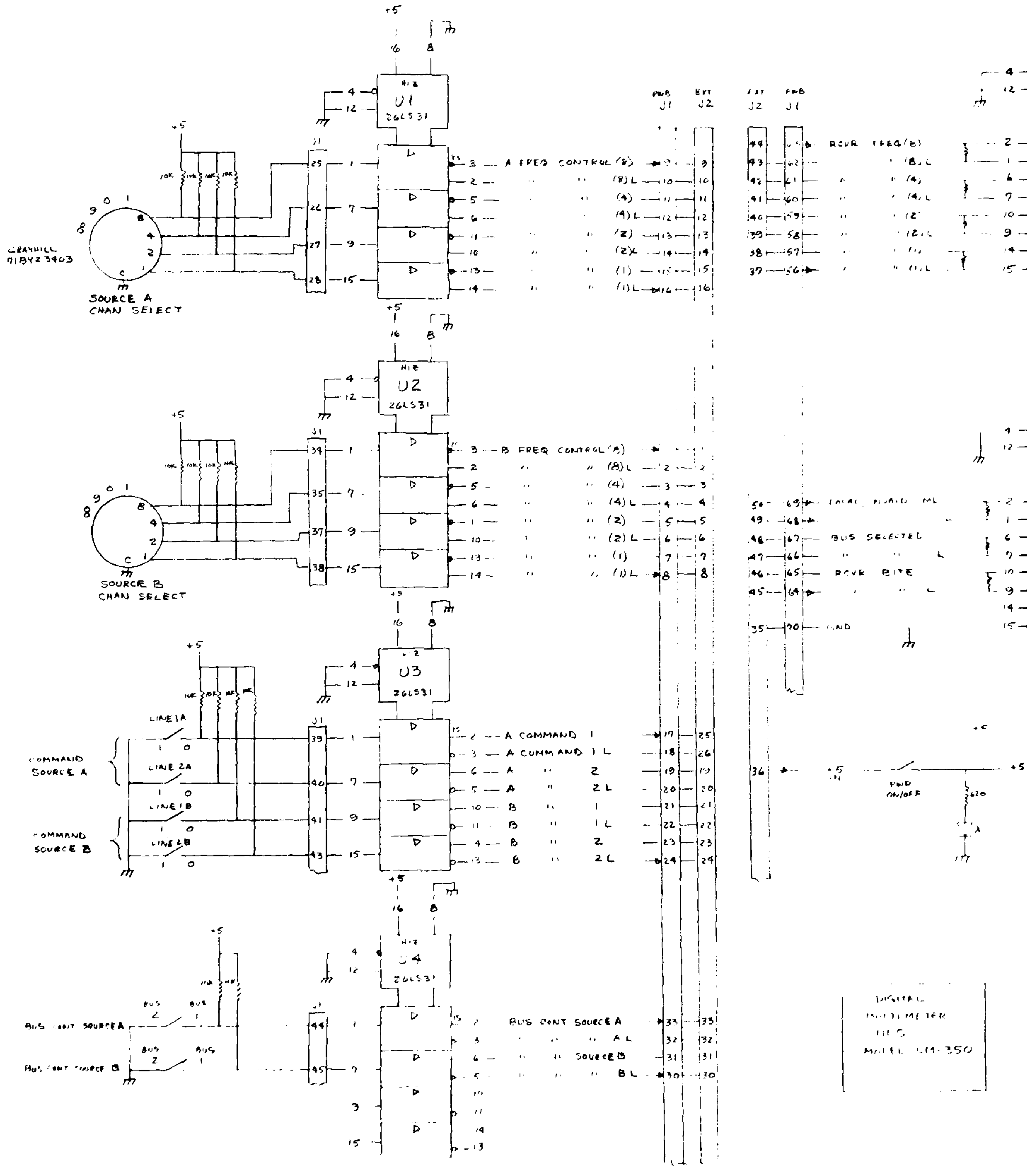
APPENDIX A

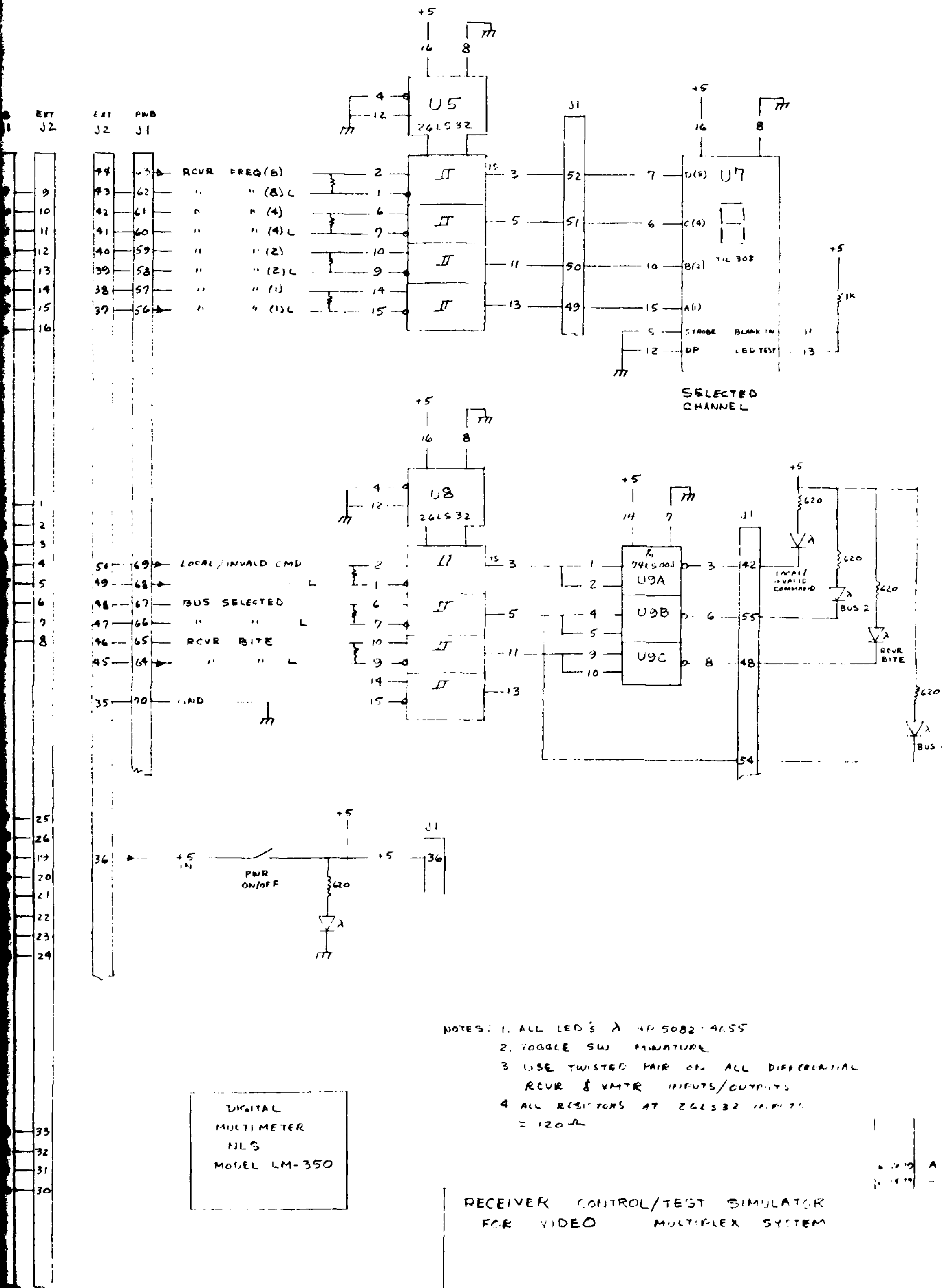
LIST OF EQUIPMENT
IN THE
WIDEBAND MULTIPLEX SYSTEM

Quantity	Item	Serial No.
1	Modulator, Model CCM-AB-2	A0836032
1	Modulator, Model CCM-AB-4	A0836013
1	Modulator, Model CCM-AB-5	A0836019
1	Modulator, Model CCM-AB-7	A0836256
1	Modulator, Model CCM-AB-9	A0836238
1	Demodulator, Model UD-283A	571836
1	Demodulator, Model UD-283A	572118
1	Demodulator, Model UD-283A	572128
1	Demodulator, Model UD-283A	571935
1	Demodulator, Model UD-283A	572103
2	Signal Combiner, Model HC8	N/A
2	4-Way Signal Splitters, Model 1597A	N/A
8	Directional Coupler, Model DCT4-19	N/A
1	Receiver Control/Test Simulator With Control Cable	N/A
2	Rolls 50 Ft. Coaxial Cable	N/A
1	19" Equipment Rack Height , With Coax Cable and Power Strip	N/A
1	19" Equipment Rack Height 72", With Coax Cable and Power Strip	N/A

APPENDIX B

LIST OF SCHEMATICS WITH GE MODIFICATIONS

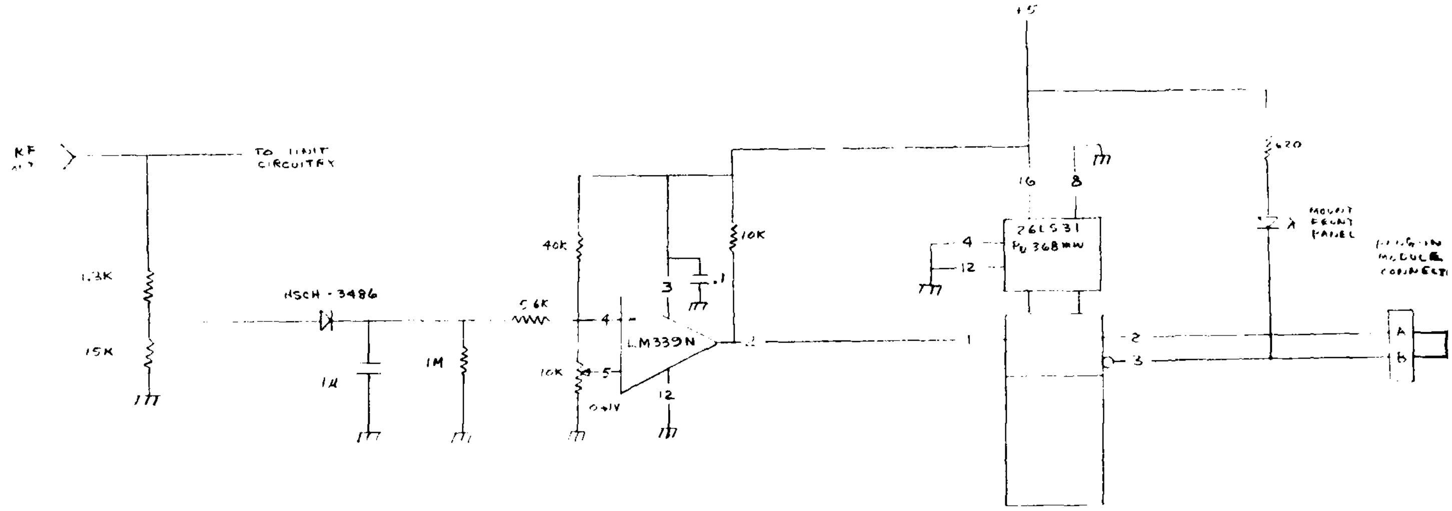

U1
26LS31
U2
26LS31
U3
26LS31
U4
26LS31
GRAYHILL
71BY23403
SOURCE A
CHAN SELECT
SOURCE B
CHAN SELECT
COMMAND
SOURCE A
COMMAND
SOURCE B
LINE 1A
LINE 2A
LINE 1B
LINE 2B
BUS CONT SOURCE A
BUS CONT SOURCE B
A FREQ CONTROL (8)
B FREQ CONTROL (8)
A COMMAND 1
A COMMAND 1 L
BUS CONT SOURCE A
RCVR FREQ (8)
BUS SELECTED
RCVR BITE
GND
PWR
ON/OFF
PWB
J1
EXT
J2

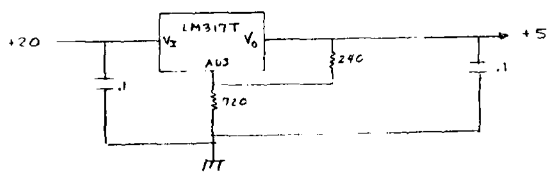


NOTES: 1. ALL LED'S λ HP 5082-4655
2. TOGGLE SW MINIATURE
3. USE TWISTED PAIR ON ALL DIFFERENTIAL RCVR & XMTR INPUTS/OUTPUTS
4. ALL RESISTORS AT 26LS32 INPUTS = 120 Ω

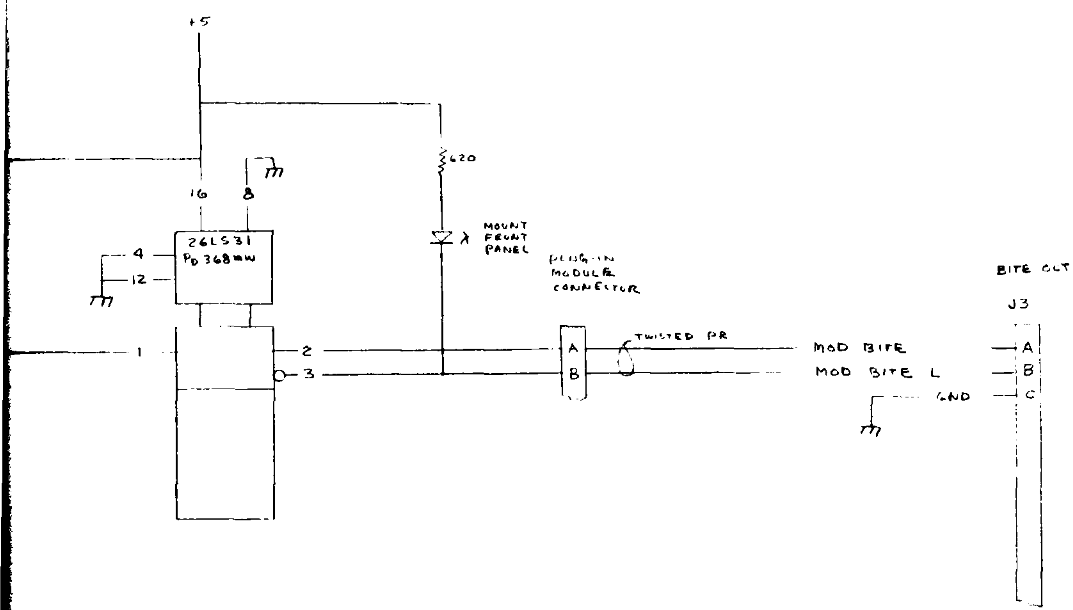
RECEIVER CONTROL/TEST SIMULATOR FOR VIDEO MULTIPLEX SYSTEM

SHEET 1 OF 1





NOTES: 1. LED INDICATOR HP 5082-4655
2. HSCH-3486 HEWLETT-PACKARD SCHOTTKY DIODE
3 ALL RESISTORS RNR55 UNLESS OTHERWISE INDICATED
4 ALL COMPONENTS NEAR DEVICE TERMINALS
5. GND ALL UNUSED SECTIONS PINS 1, 6, 7, 8, 9, 10, 11, 13, 14
6. ALL COMPONENTS MOUNTED ON IFC (IF TO OUTPUT CHANNEL CONVERTER) PLUG-IN MODULE



NNEL CONVERTER)

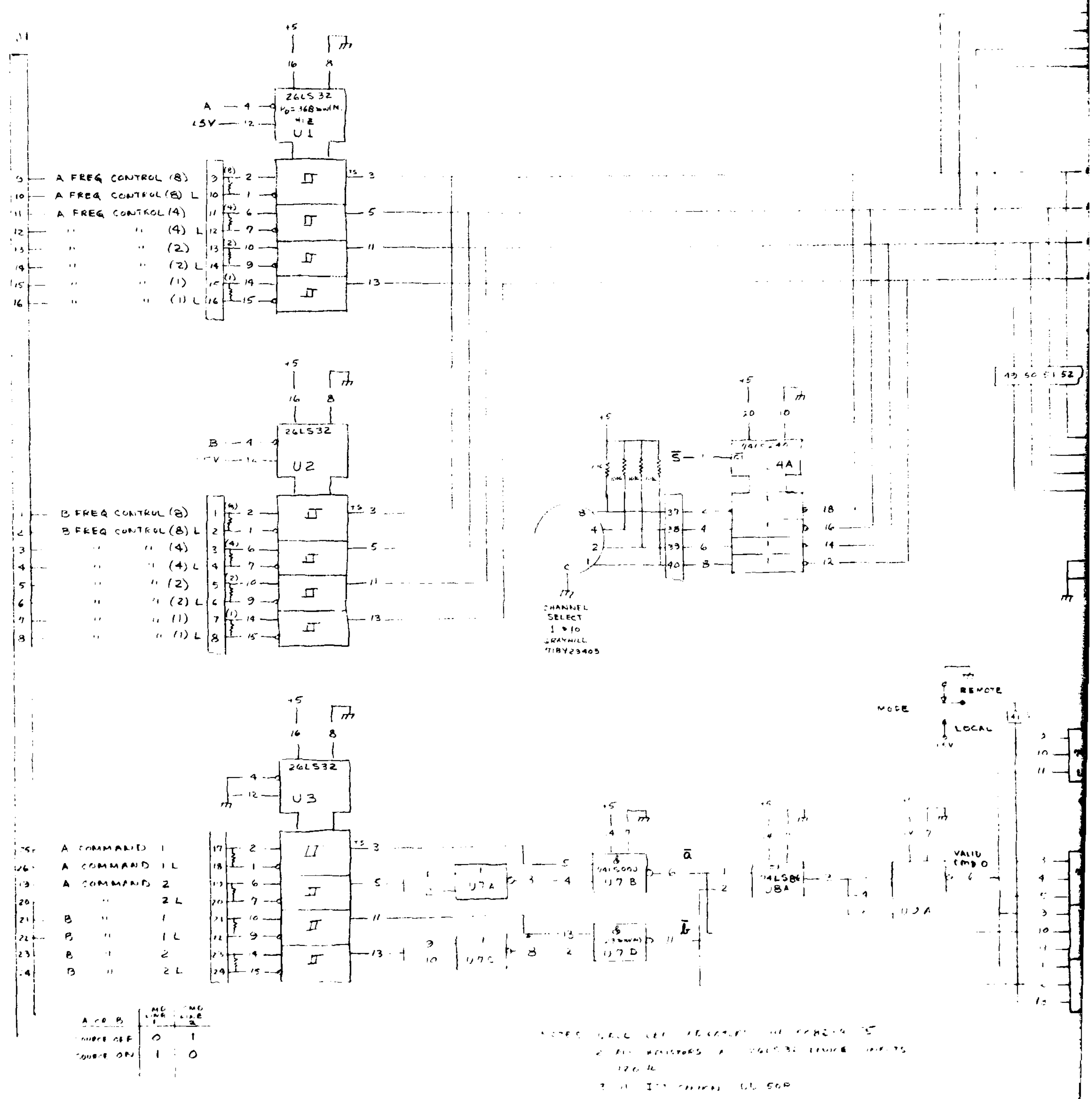
BUILT-IN TEST

FOR

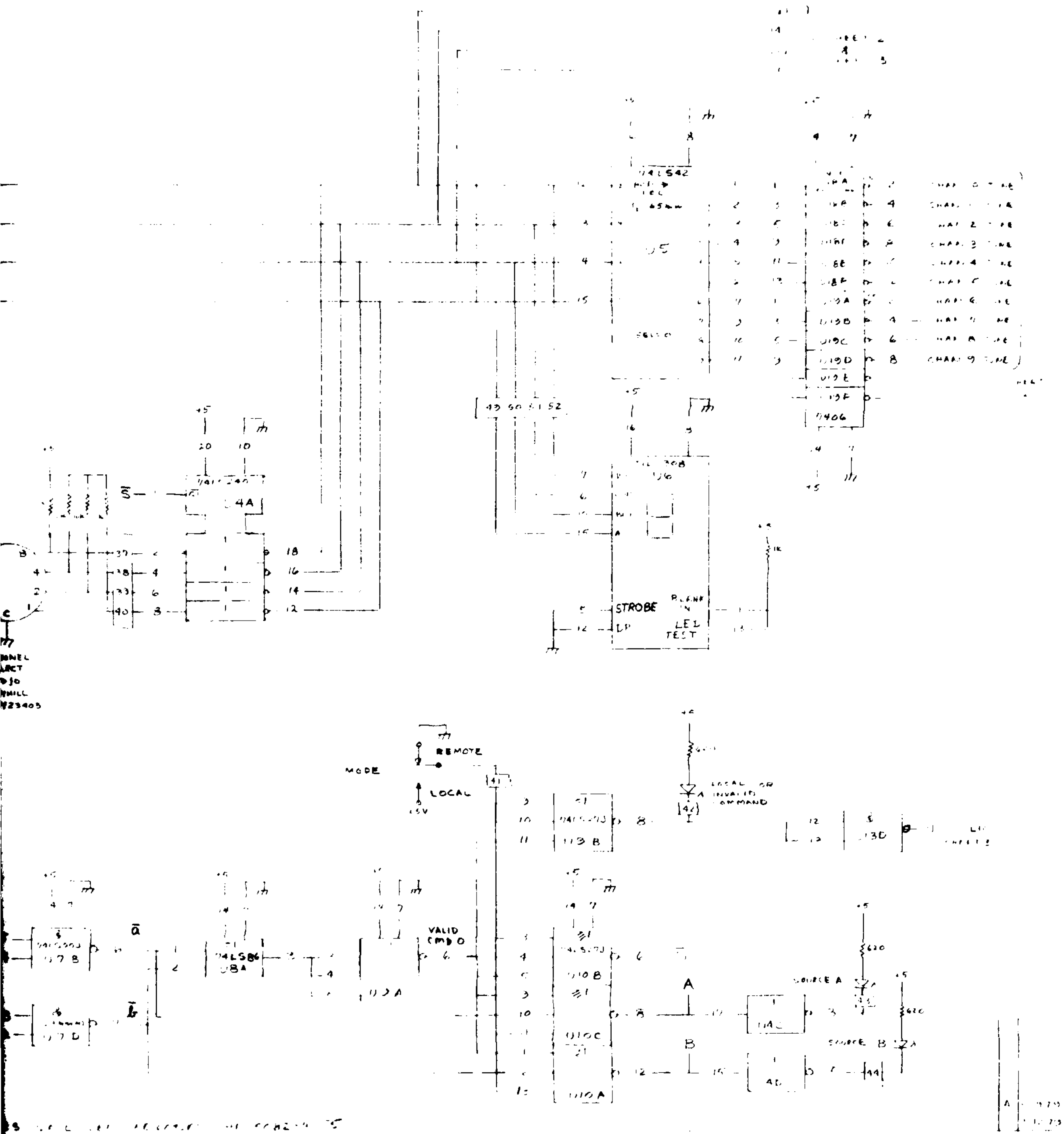
CCM-AB MODULATOR

(P/O VIDEO MULTIPLEX SYSTEM)

SHEET 1 OF 1



26LS32
U1
A FREQ CONTROL (8)
A FREQ CONTROL (8) L
A FREQ CONTROL (4)
(4) L
(2)
(2) L
(1)
(1) L
26LS32
U2
B FREQ CONTROL (8)
B FREQ CONTROL (8) L
(4)
(4) L
(2)
(2) L
(1)
(1) L
4A
CHANNEL
SELECT
GRAYHILL
26LS32
U3
A COMMAND 1
A COMMAND 1 L
A COMMAND 2
2 L
B 1
B 1 L
B 2
B 2 L
U7A
U7B
U7C
U7D
U8A
U9A
MODE
REMOTE
LOCAL
VALID
A OR B
SOURCE OFF
SOURCE ON

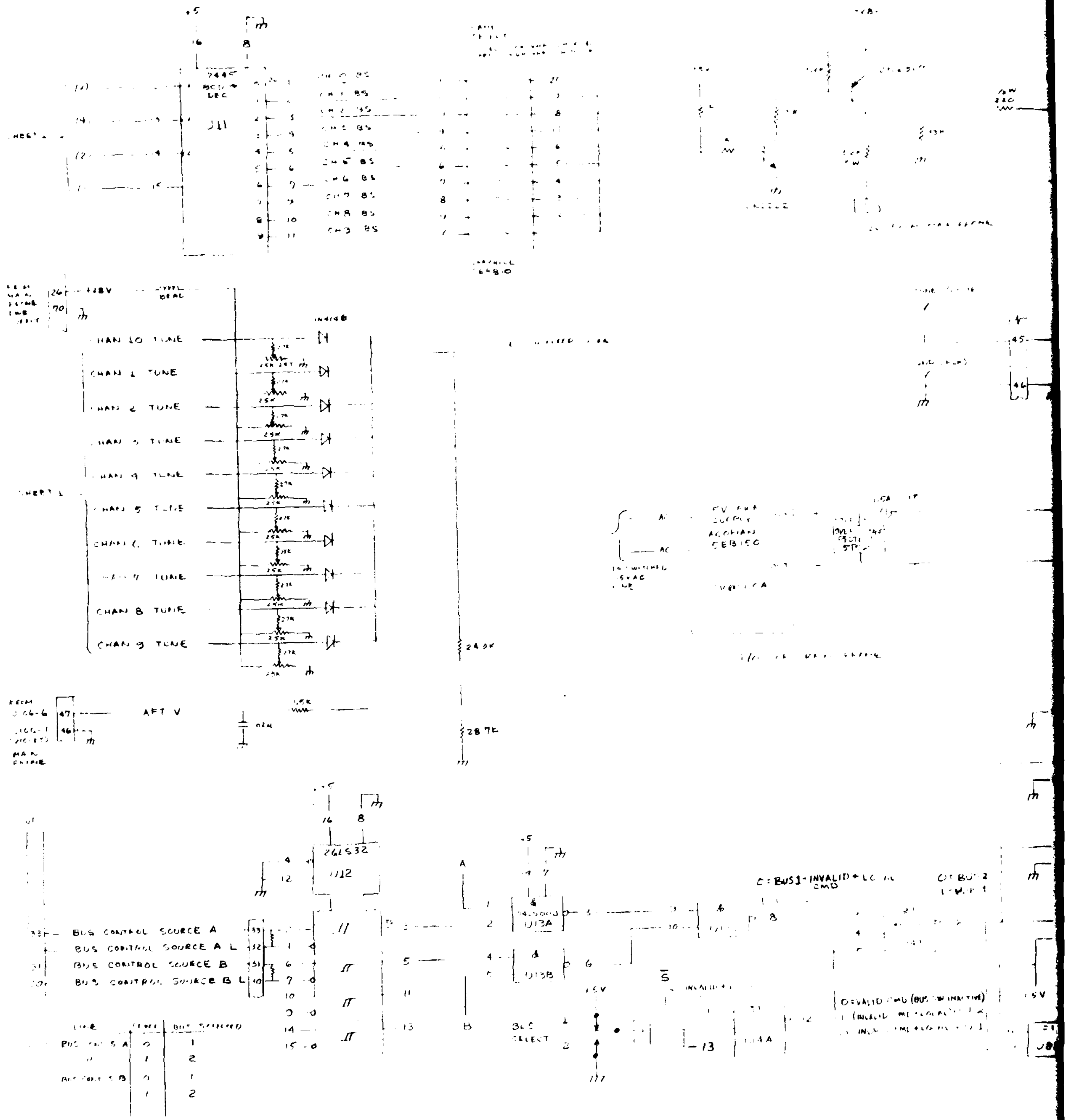


CONTROL LOGIC

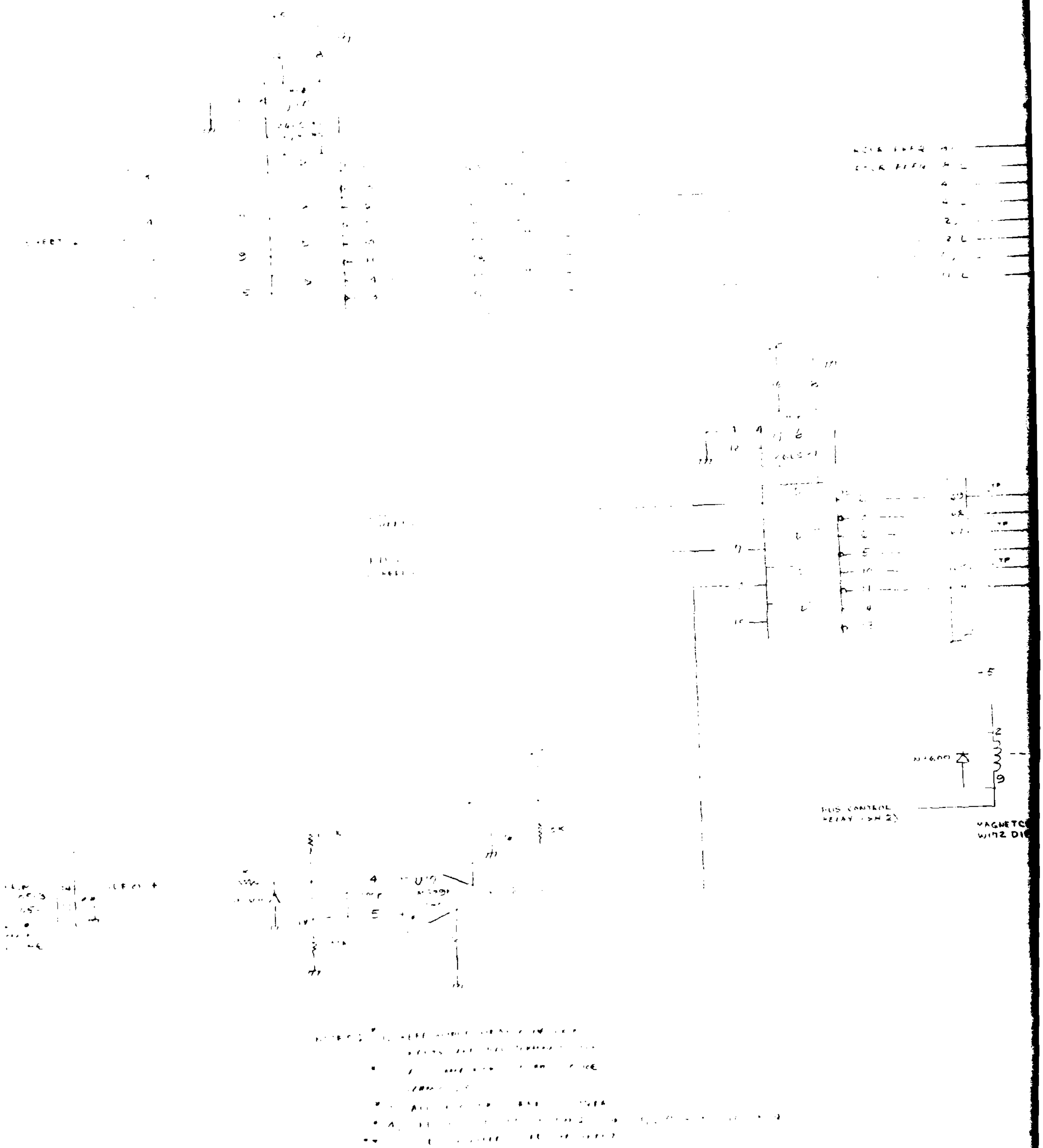
FOR UL-283A

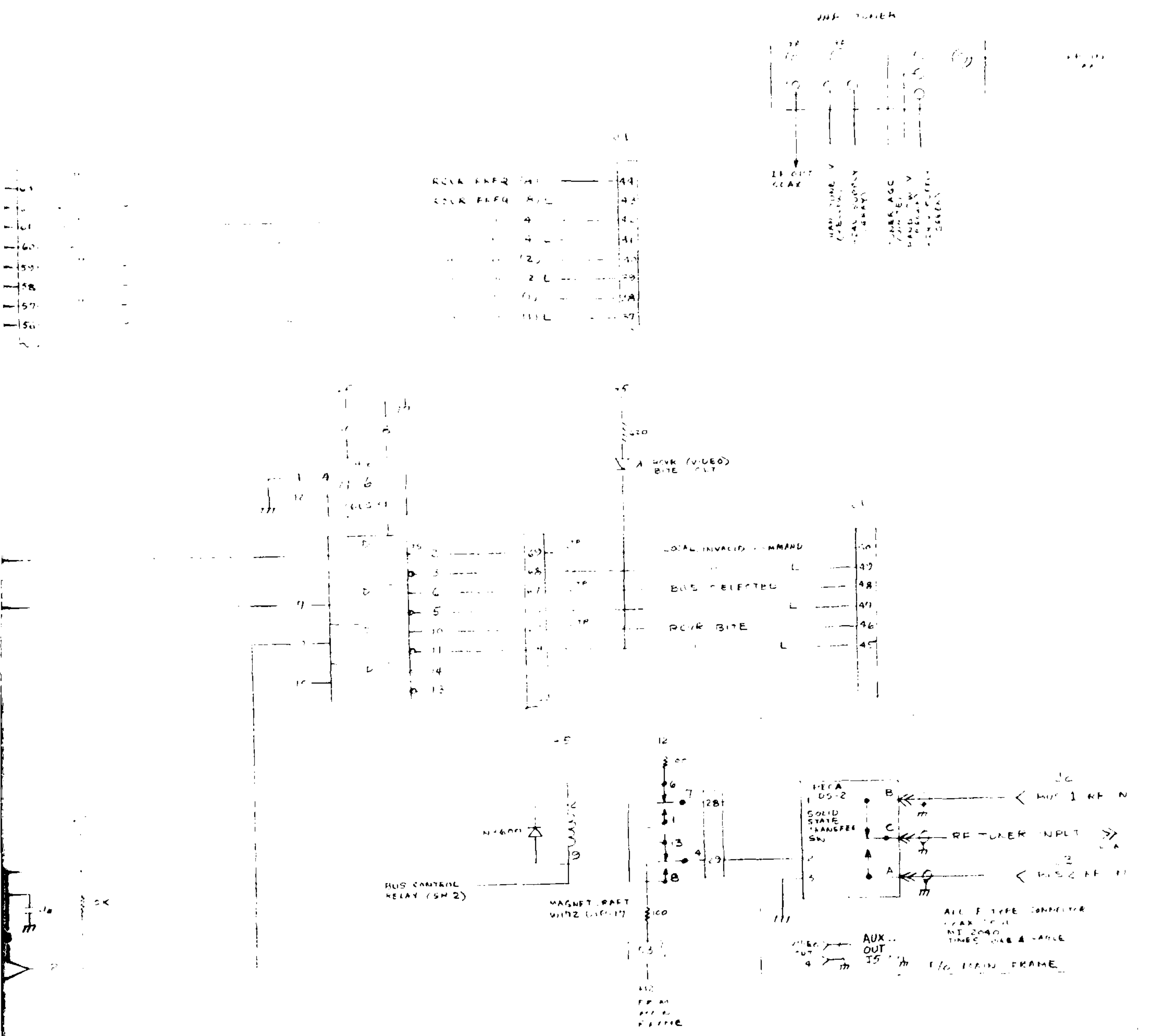
DEMODULATOR

SHEET 1 OF 3


7445
BCD TO DEC
U11
CH 0 BS
CH 1 BS
CH 2 BS
CH 3 BS
CH 4 BS
CH 5 BS
CH 6 BS
CH 7 BS
CH 8 BS
CH 9 BS
CHAN 10 TUNE
CHAN 1 TUNE
CHAN 2 TUNE
CHAN 3 TUNE
CHAN 4 TUNE
CHAN 5 TUNE
CHAN 6 TUNE
CHAN 7 TUNE
CHAN 8 TUNE
CHAN 9 TUNE
IN4148
24.9K
28.7K
AFT V
J-66-6
26LS32
U12
BUS CONTROL SOURCE A
BUS CONTROL SOURCE A L
BUS CONTROL SOURCE B
BUS CONTROL SOURCE B L
U13A
U13B
C=BUS1-INVALID CMD
BUS SELECT
+5V
LINE
LEVEL
BUS SELECTED
BUS CNTL S A
BUS CNTL S B
ACOPIAN
5EB150


2N2222
CEB150
O=BUS1+INVALID+LOCAL CMD
O=VALID CMD (BUS SW INACTIVE)


+5
POS CONTROL
RELAY (SH 2)
MAGNETC
WITZ DI



CONTROL LOGIC

DEMODULATOR

APPENDIX C

LIST OF JERROLD SUPPLIED DRAWINGS

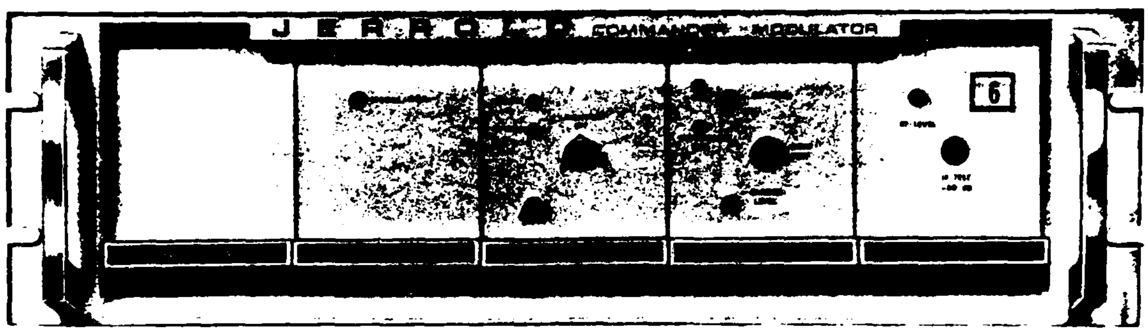
JERROLD ELECTRONICS CORPORATION
A subsidiary of
GENERAL INSTRUMENT CORPORATION

INSTRUCTION MANUAL

435-439-03

"COMMANDER MODULATOR" EQUIPMENT

Models CCM-A*, CCM-AB*, and CCM-C*



CY-560

Fig. 1 Commander Modulator for Output Channel 6—Front View

DESCRIPTION

Models CCM-A* and CCM-AB* are designed for CATV, MATV, ETV, or similar video and sound distribution systems. Installed at the head end, the unit serves as a single-output channel modulator, which accepts video and audio signals from any local source and generates a standard television channel for distribution over the system. Each modulator is factory-equipped with the IF-to-output channel converter module necessary for producing the channel designated by the user.

Model CCM-AB* is the same as Model CCM-A* except Model CCM-AB* is provided with an audio matching transformer which permits the use of a balanced audio input.

Model CCM-C* is the same as Models CCM-A* and CCM-AB* except that instead of an audio modulator module it has a sound carrier module which accepts 4.5 MHz aural sub-carrier signals and is primarily intended for use as an interface with microwave terminals. Model CST-4.5 external audio/video separator is required in such applications.

CCM equipment is designed to meet FCC specifications for equipment of this kind.

Because the power supply and output channel modules are the same as those used in Jerrold Channel Commander II equipment, the number of spare modules of this type can be kept to a minimum wherever both equipment types are used together. In addition, the housing is physically the same for both types; hence, both Channel Commander II and Commander Modulator equipment can be mounted harmoniously in the same rack and interconnected as required by head end design. The necessary mounting screws are shipped with the equipment.

Fig. 2 illustrates a typical head end where both units are used.

Models CCM-A* and CCM-AB* house the following plug-in modules.

1. **MODEL DEP Delay Equalizer**

   This module provides interface between the incoming video signals and the video modulator module and has two basic functions:

   a. to pre-distort the phase-frequency characteristic of the incoming video to conform to standard FCC pre-distortion requirements.

   b. to pre-distort the phase-frequency characteristic of the incoming video to equalize the variation in phase-frequency characteristic introduced by vestigial sideband transmission.

2. **MODEL VIM Video Modulator**

   This module accepts the video signal from the DEP module and modulates the signal onto a 45.75 MHz carrier. The output of the video modulator is a broadband double-sideband modulated carrier. The unit also provides a 45.75 MHz carrier reference signal required by the audio modulator module Model AMM, or the sound carrier module Model SCM. A modulation control is provided on the VIM front panel.

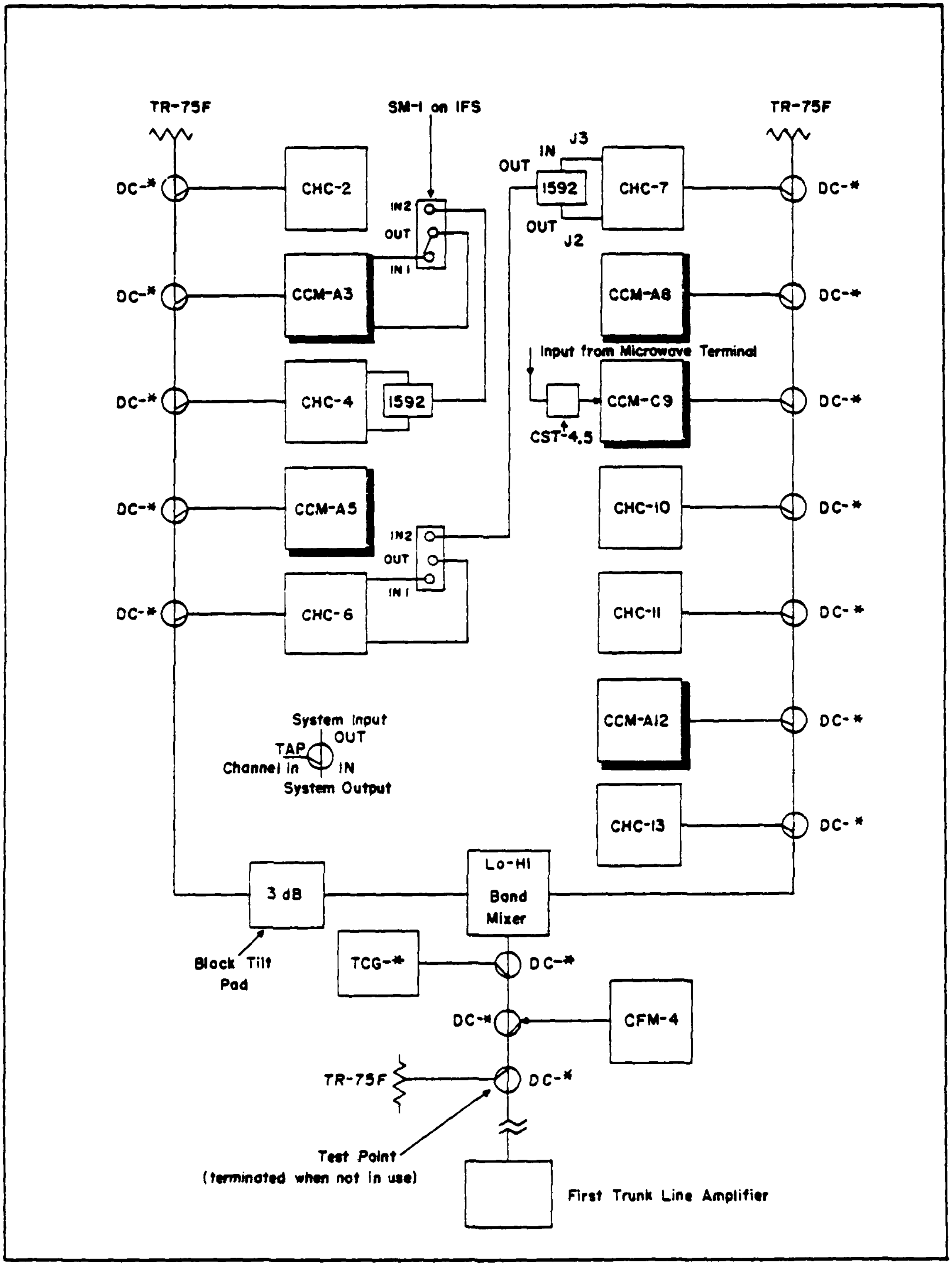


Fig. 2 Block Diagram of Typical Head-End

3. MODEL VSB Vestigial Sideband Filter

This module accepts the 45.75 MHz video modulated carrier from the VIM module and the 41.25 MHz sound carrier from the AMM or SCM module and provides a composite video-sound IF signal to the IFC module. The vestigial sideband amplitude frequency characteristic is developed in this unit. This transmission mode makes the CCM equipment usable for adjacent channels.

4. MODEL AMM Audio Modulator

This module accepts an either 600-ohm balanced or unbalanced audio input and provides the standard frequency-modulated 41.25 MHz sound carrier. The AMM front panel has the deviation and carrier level controls as well as test jacks necessary for monitoring and adjusting deviation and audio.

5. MODEL IFC-* (SER. 2) IF-to-Output Channel Converter

This module is a crystal-controlled converter/amplifier which accepts IF signals from the VSB module and provides a single channel output as specified by the user. The operational output level is set in accordance with system application and as described in the operational instructions. The necessary control and test jacks are provided on the IFC-* (Ser. 2) front panel. One of five basic modules is supplied, each factory-tuned to cover one channel in either the sub-band, low-band, mid-band, high-band, or super-band.

6. MODEL PSC-2 Power Supply

Power supply PSC-2 operates from a 100 to 130V 60Hz or a +24 VDC source. It provides a regulated 20 VDC output and has foldback current limiting capability. A power on-off switch, a pilot lamp, and DC test jacks are provided on the front panel. All CCM-* versions consume 20 W of power.

MODEL CCM-C*

This unit comprises all the above modules except that it has an SCM module instead of the AMM.

1. MODEL SCM Sound Carrier Module

This module accepts the 4.5 MHz aural sub-carrier and the unmodulated 45.75 MHz reference signal for mixing in order to provide a sound carrier output of 41.25 MHz. A CARRIER LEVEL control is provided on the SCM front panel.

ACCESSORY EQUIPMENT

1. MODEL CST-4.5 Video/Audio Separator

Model CST-4.5, a required option on CCM-C* equipment, is used at microwave terminals for separating the 4.5 MHz aural sub-carrier from the video carrier before application to the CCM-C*. The unit is a three terminal network which accepts the combined video and aural sub-carriers at its input and provides separate video and 4.5 MHz outputs. Separation is accomplished without loss to the video output and with a 10 dB loss to the 4.5 MHz aural sub-carrier. Terminal Match is specified at 18 dB over a frequency range of 30 Hz to 4.18 MHz.

2. MODEL PBF-* Bandpass Filters

Whenever non-standard TV channels are distributed in a system, or where by system design the modulator output is higher than +54 dBmV, the use of these filters is strongly recommended. Jerrold makes available on special order single-channel bandpass filters. These filters are the same as those used with Channel Commander II equipment under similar circumstances.

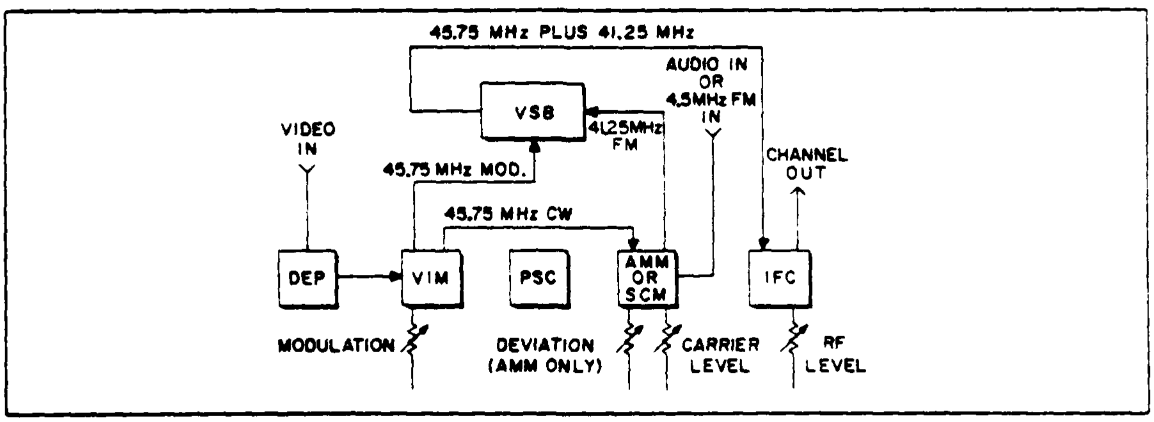


Fig. 3 CCM Equipment—Functional Block Diagram

SPECIFICATIONS

1. VIDEO SECTION

Input Impedance	75 Ω, unbalanced VSWR 1.38:1 max.
Input Type	Composite Video, SYNC Negative.
Input Level	Continuously variable, 0.50 V p-p min. for 87.5% depth of modulation.
Output Level	+45 dBmV to +60 dBmV.
Output Frequency	Any Standard VHF Channel, 2-13; Sub-Band, T7-T11; Mid-Band, A-1; Super-Band, J-R.
Output Amplitude/Frequency Response	Within ±1 dB of ideal demodulated response.
Tilt/Sag	1% max. on 60 Hz square wave.
Differential Gain	1 dB max. at 87.5% depth of modulation, 10%, 50%, 90% APL.
Differential Phase	2° max. at 87.5% depth of modulation, 10%, 50%, 90% APL Adjustment provided to obtain minimum differential phase at operating level.
Group Delay Response	Conforms to FCC predistortion requirements.
AC Hum and Noise	60 dB below 100% modulation.
Sync. Compression	0.5 dB max.

2. AUDIO SECTION

A. CCM-A*, CCM-AB*	
Input Type	Baseband Audio.
Input Impedance	600 Ω, unbalanced—CCM-A*. 600 Ω, balanced—CCM-AB*.
Input Level	Variable, 0.5 VRMS, (—35 dBmV) minimum for 25 kHz deviation.
Amplitude/Frequency	50 to 15,000 Hz ±1 dB, including standard pre-emphasis.
Harmonic Distortion	1% max., 50 to 15,000 Hz ±25 kHz deviation.
Carrier Stability	±1 kHz, referred to video carrier.
FM Hum and Noise	60 dB below ±25 kHz swing.
41.25 MHz Output Level	6 dB below video carrier, max.
B. CCM-C*	
Input Type	4.5 MHz FM.
Input Level	5 m V rms min.
Input Impedance	75 Ω, unbalanced.
41.25 MHz Output Level	6 dB below video carrier, max.
Operating Ambient Temperature Range	—20°F to +120°F.

INSTALLATION

1. CONTROLS AND CONNECTIONS

Before any attempt to install and operate CCM equipment, become familiar with the functions of the various controls, test points and connections.

UNIT	DESIGNATION	DESCRIP. & SCHEM. REF.	POSITION	FUNCTION
Power Supply PSC-2	Power	S101, SPST Switch	On	Energizes the equipment.
			Off	De-energizes the equipment.
	+20 VDC GND	J101, Tip Jack J102, Tip Jack	— —	For testing Power Supply DC output.
	—	DS101 Pilot Lamp	—	Indicates Status of Power Supply.
	—	Pot., R109	—	Factory-set for +20 VDC.
Video Modulator	Modulation	Pot., R302	max.	For adjusting depth of modulation.
Audio Modulator	Deviation	Pot., R568	max.	For adjusting depth of sound carrier.
	Carrier Level	Pot., R526	max.	For adjusting IF level of sound carrier.
	Deviation Test	J502, Tip Jack	—	For monitoring deviation of sound carrier with oscilloscope.
	GND	J503, Tip Jack		
	Audio Test	J501, Phone Jack	—	For monitoring modulation quality and deviation of sound carrier on 600 Ω audio.
4.5 MHz Modulator	Carrier Level	Pot., R608	max.	For adjusting IF level of sound carrier.
IF—to Channel Converter (Ser. 2)	RF Level	Pot., R403	max.	For setting the video and aural RF carriers.
	IF Test —30 dB	Test Jack	—	For monitoring the video and aural IF carriers.
Vestigial Sideband Filter	SND IF IN	J701, Connector	—	Input terminal for sound signal.
	VID IF IN	J702, Connector	—	Input terminal for video signal.
	IF OUT	J703, Connector	—	Output terminal for combined video and sound.
4.5 MHz and Video Separator	Video and Sound	J801, Connector	—	Input terminal for combined video and sound.
	Video	J802, Connector	—	Video output terminal.
	4.5 MHz	J803, Connector	—	4.5 MHz sub-carrier output terminal.
Rear Panel of Housing	Terminal Block	TB1	1	Input terminal 600 Ω, Unbalanced audio—Model CCM-A*. Input terminal 600 Ω, Balanced audio—Model CCM-AB*.
			2	Ground Terminal.
			3	Not used—Model CCM-A*, Input terminal 600 Ω, Balanced audio—CCM-AB*.
			4	For connection of DC microammeter to measure sound carrier level.
			5	For connection of DC microammeter to measure sound carrier deviation where AMM module is used.
	Output	J1, Connector	—	RF output terminal.
	Input	J4, Connector	—	Video input terminal.
	4.5 MHz	J5, Connector	—	Aural sub-carrier input terminal.

2. **ADAPTING THE COMMANDER MODULATOR FOR IF PROGRAMMING**

The Commander Modulator must be adapted for IF programming before rack mounting. Proceed as described below.

2.1 Construct two 16-inch coaxial cables with appropriate connectors at both ends.

2.2 Remove the screws holding the cover on the rear top of the unit and remove the cover.

2.3 Remove the button caps from holes J2 and J3 on the rear panel of the housing. Install a 5/16" diameter female coupling connector into each hole. J2 will serve as the IF input terminal and J3 will serve as the IF output terminal.

2.4 Disconnect and remove the jumper between the IF IN terminal J406 on the IFC (Ser. 2) module and the IF OUT terminal J703 on the VSB module. Then connect one of the two jumpers between J3 on the rear panel and the IF OUT terminal J703 on the VSB module. Connect the second jumper between J2 on the rear panel and the IF IN terminal J406 on the IFC (Ser. 2) module.

2.5 The unit can now be rack-mounted.

3. **RACK-MOUNTING**

3.1 Commander Modulator units should be rack-mounted so that their outputs can be mixed in the most optimum manner with the outputs of other head end equipment.

3.2 Use all four 10-32 x 3/8" screws supplied with each unit to ensure a sturdy mount.

4. **OUTPUT CONNECTIONS**

4.1 There are several methods currently practiced by system designers for combining the various outputs of head end equipment. Jerrold recommends the use of directional couplers for separately combining the various bands and then mixing the outputs of these bands by a combining network into a single line. This method offers all the advantages attendant with high isolation between individual units. Fig. 2 illustrates and the following procedure describes this method.

4.2 Mounting holes for Jerrold DC-* couplers are provided near the output terminals on the Commander Modulator rear panel.

4.3 Construct the required number of coaxial jumpers and equip each jumper end with an appropriate connector. Jumper length is not critical. DO NOT yet connect the jumpers to the output terminals on the modulator rear panel.

4.4 Where necessary install appropriate bandpass filters, connect the filters between the Commander Modulator OUTPUT terminals and the associated DC-* couplers.

5. **INPUT CONNECTIONS**

5.1 Video input. Connect the video source through a 75-ohm coaxial cable, equipped with appropriate connectors, to the video INPUT Terminal J4 on the rear panel of the modulator.

5.2 Audio input. Model CCM-A*, connect the 600-ohm unbalanced audio source through a pair of wires (preferably color-coded) to terminal block TB1 on the modulator rear panel, using terminal 1 for signal input and terminal 2 for ground connection. Model CCM-AB* is equipped to accept a 600-ohm balanced audio source. Connect the audio signals wires to TB1 terminals 1 and 3, connect the shield to terminal 2, circuit ground.

5.3 Aural sub-carrier input. Connect the 4.5 MHz aural sub-carrier source through a 75-ohm coaxial cable, equipped with appropriate connectors, to the 4.5 MHz IN terminal J5 on the modulator rear panel.

OPERATION

This procedure will require the removal and insertion of one or more modules of the Commander Modulator; the use of a Model EXM-1 module extender is recommended.

1. **SETTING DEPTH OF VIDEO MODULATION**

1.1 **ADJUSTMENT WITH A FIELD STRENGTH METER**

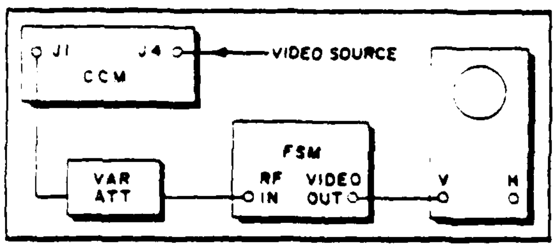


Fig. 4 Test Set-up for Adjusting Depth of Video Modulation

1.1.1 Connect the OUTPUT terminal J2 on the modulator rear panel through a variable attenuator to the RF IN jack on a field strength meter, and the VIDEO OUT jack of the field strength meter to the vertical input jack of an oscilloscope set for DC coupling as illustrated in Fig. 4.

1.1.2 Switch on the Commander Modulator and test instruments. For a staircase presentation set the oscilloscope vertical sensitivity of 0.5V/cm, sweep rate to 20 μsec/cm, and the sync to internal. For program video set the sweep rate to 2 msec/cm and the sync to line.

1.1.3 Tune the FSM to the carrier frequency of the video output signal and set the FSM step attenuator to obtain a meter reading between 0 dB and 10 dB.

1.1.4 Remove 30 dB from the FSM step attenuator and then turn the Modulation control on the VIM module clockwise to obtain a video waveform display on the oscilloscope; continue to increase the modulation until peak clipping is displayed, slightly reduce the modulation just below that level.

1.1.5 Insert attenuation into the variable attenuator corresponding to the desired depth of video modulation.

18 dB for 85.5%
16 dB for 84.0%
15 dB for 80.0%
12 dB for 75.0%
11 dB for 70.0%

1.1.6 Increase the vertical sensitivity of the oscilloscope to 0.05V CM and adjust the presentation so that the sync tips are displayed on a convenient graticule line.

1.1.7 Remove the attenuation inserted in the variable attenuator in step 1.1.5, adjust the modulation control until the peaks of the video waveform coincide with the level established in step 1.1.6.

NOTES

a. Where the video source signal does not include a VIT signal as the maximum white level reference, it is recommended that the depth of modulation be set at 80% or less to prevent over-modulation later on.

b. Since the field strength meter has a relatively narrow band detector, it may be necessary to reduce the maximum depth of modulation from 87% to allow for the contribution of high frequency components.

1.2 ADJUSTMENT WITH A PASSIVE DETECTOR

A passive 75-ohm detector may be substituted for the field strength meter in Fig. 4.

1.2.1 Proceed as in 1.1.1 through 1.1.7 except that the initial oscilloscope vertical sensitivity setting in 1.1.2 will depend on the detector sensitivity. Adjust for a full scale display as before in 1.1.4.

1.2.2 Detector low-level nonlinearity may cause loss of resolution and accuracy, particularly at high depth of modulation settings. In addition, the AMM audio module, if used, should be unplugged to remove the sound carrier from the output signal.

1.3 ADJUSTMENT WITH A TELEVISION DEMODULATOR

A standard television demodulator such as Jerrold Model CCD-* may be used in place of the field strength meter in Fig. 4

1.3.1 Adjust the attenuator as required to provide an operational input level to the demodulator. A 75-ohm termination must be provided at the oscilloscope input.

1.3.2 Adjust the demodulator for an operational output level. The oscilloscope graticule may now be calibrated in depth of modulation percentage as follows:

1.3.3 With direct-coupled video output.

a. Adjust the oscilloscope vertical sensitivity and position controls so that the sync tips coincide with the bottom line of the scope graticule and the top graticule is at 0V DC.

b. The graticule may now be read directly and linearly in depth of modulation percentage from bottom to top.

c. Example: for 87.5% depth of modulation, with an 8 cm graticule, adjust the MODULATION control on the CCM until the peaks of the video reach to the 7 cm level. For 75%, the peaks should reach the 6 cm level.

1.3.4 With AC coupled video output it will be necessary to use one of the following methods to locate the zero voltage or 100% depth of modulation level on the oscilloscope display.

a. A 100% reference line can be generated by inserting a high-speed RF chopper or switcher between the demodulator channel input and the modulator channel output. It may be necessary to operate the demodulator in the manual gain control mode. Adjust the oscilloscope vertical sensitivity and positioning so that the sync tips lie on the bottom graticule line when the chopper generated 100% reference level coincides with the top graticule line. The depth of modulation may now be set as in step 1.3.3, except that it will be necessary to readjust the vertical position control to keep the sync in the correct position on the graticule.

b. If a chopper is not available increase the MODULATION control setting until clipping or flattening of the video peaks is observed. Now adjust the oscilloscope vertical sensitivity and position controls so that, with the sync tips on the bottom graticule line, the level of clipping is at the top line of the graticule. Now reduce the MODULATION control setting to obtain a display whose peak-to-peak amplitude, expressed in percent of full scale, is equal to the desired percent depth of modulation.

1.4 ADJUSTMENT WITHOUT INSTRUMENTS

Two methods for setting modulation depth using only a conventional television broadcast receiver are available. While having somewhat less accuracy than the above methods, they are satisfactory for many applications and are especially suited to those in which broadcast signals are processed by demodulation and remodulation.

1.4.1 Connect the channel output of the modulator, suitably attenuated, to a television receiver.

1.4.2 If broadcast "air" signals are available:

a. Adjust the MODULATION control until the overall contrast level of the picture is comparable to that of a broadcast program.

b. In the case where a broadcast signal is demodulated and remodulated, this method can be considerably improved by providing a means whereby the receiver can be quickly switched between the "off-air" signal and the (re) modulator output. Adjust the MODULATION control for contrast equal to that of the directly received signal.

1.4.3 If no reference air signals are available proceed as follows:

a. Adjust the MODULATION control until whitening and loss of detail can be seen in the bright areas of the picture.

b. Reduce the modulation setting until no whitening can be seen. If possible, this method of adjustment should be performed when program material has a very high white content to avoid overmodulation at at later time.

2. ADJUSTMENT OF AUDIO MODULATION

Several methods of operational setting of audio modulation on the AMM module are possible, most of which take advantage of the deviation and audio monitoring circuits built into the AMM. The methods described here are in order of preference, starting with the most desirable one. The user will have to select one for which he has the necessary test equipment.

2.1 ADJUSTMENT WITH NORMAL INPUT

2.1.1 An FM Modulation Meter, such as Marconi Model TF2300 and a Jerrold extender module Model EXM-1 are required for deviation adjustments which can be made at any one of three frequencies.

a. 4.5 MHz: Switch off the Commander Modulator Power and remove the AMM module from its compartment. Insert the EXM-1 into the AMM compartment and attach the AMM to the EXM-1. Switch the power back on. Connect the modulation meter between test point TP 502 (4.5 MHz Test) on the AMM printed circuit board and chassis ground. Slowly adjust the DEVIATION control on the AMM module for a ±25 kHz indication on the meter. Shut off POWER and restore the AMM module to its compartment.

b. 41.25 MHz: Shut off POWER, remove the IFC (Ser. 2) module from its compartment. Insert the EXM-1 in its stead and connect the modulation meter to the bottom fitting on the front of the EXM-1. Turn POWER back on and turn the CARRIER LEVEL CONTROL on the AMM fully clockwise. Set the DEVIATION control on the AMM for a ±25 kHz indication on the meter. Switch off POWER and restore the IFC (Ser. 2) module to its compartment.

c. Channel Sound Carrier. Connect the modulation meter to the OUTPUT terminal J1 on the modulator rear panel. Turn the CARRIER LEVEL CONTROL on the AMM module fully clockwise. Adjust the DEVIATION CONTROL on the AMM for a ±25 kHz indication on the meter.

2.1.2 OSCILLOSCOPE METHOD

a. Connect the vertical input of an oscilloscope to the DEVIATION TEST and GND test jacks on the AMM module.

b. Set the sweep rate to 10 msec/cm and adjust the DEVIATION CONTROL on the AMM for a 0.20V peak-to-peak deflection on audio peaks.

2.1.3 VU METER METHOD

a. Connect a bridging type VU meter to the AUDIO TEST jack on the AMM module.

b. Adjust the DEVIATION control on the AMM for a reading of −7VU on audio peaks.

2.2 ADJUSTMENT WITH FIXED TONE AUDIO INPUT

If a fixed tone input is used, the DEVIATION control setting should be made with the tone level 7 dB higher than the anticipated peak level of the normal audio input as measured on a standard VU meter.

2.2.1 USING AN OSCILLOSCOPE

a. Model CCM-A*, apply a 1 kHz tone from an audio oscillator at the proper level to terminals 1 and 2 on TBI on the rear panel of the modulator. Model CCM-AB*, apply the audio input to terminals 1 and 3 of TBI on the rear panel of the modulator.

b. Connect the DEVIATION TEST and GND test jacks to the vertical input of an oscilloscope and adjust the DEVIATION control for 0.20V peak-to-peak deflection on the oscilloscope.

2.2.2 USING A VU METER

a. Apply a 1 kHz tone as under step 2.2.1 above.

b. Connect a bridging type VU Meter to the AUDIO TEST jack on the AMM module and adjust the DEVIATION control for a reading of zero VU.

c. Alternatively to a VU Meter an AC Voltmeter may be used and the DEVIATION control adjusted to give a meter reading of 0.78 V rms.

3. SETTING OF OUTPUT LEVELS

The IFC (Ser. 2) module may be operated with a maximum RF video carrier output level of +60 dBmV and a aural carrier output level of +45 dBmV. These output levels may be varied by adjustment of the RF LEVEL Control on the front panel. This control has a range of greater than 15 dB. Any output level may be used, although a 10 dB pad is recommended for output levels below 45 dBmV.

The above procedures should be followed for every Commander Modulator installed at the head end. When checking head end output levels during system tests, it may be necessary to adjust one or more of the Commander Modulator output controls to obtain satisfactory system performance.

CIRCUIT DESCRIPTIONS

1. MODEL VIM Video Modulator Module

The purpose of the video modulator module is to transform a video input into a 45.75 MHz video modulated IF output.

Video is applied to J301 and coupled across a lowpass filter consisting of L301 through L303 and C301 through C304 to the Modulation control R302. The signal, taken from the wiper arm of R302, is coupled across R303 and C305 to the base of buffer Q301. The signal is then emitter coupled to the base of amplifier Q302. The signal is amplified and applied to buffer Q303. CR301 and C310 make up the AGC portion of the amplifier. This AGC voltage is applied to Q304 and emitter coupled to the base of Q301. The video output of Q303 is emitter coupled through C309 and R304 to the negative side of C305, to form a negative feedback loop. The video output of Q303 is also injected into the mixer stage through the center tap of isolation transformer T301. C315 is used to control the differential phase of the output.

Integrated circuit amplifier Q305, crystal Y301, and associated circuitry make up the 45.75 MHz oscillator. The oscillator output is coupled across C318 and injected into the mixer stage across transformer T302. The oscillator output is also coupled across L304 and C314 to J304, 45.75 MHz OUT Terminal. The signal is then transferred to the AMM or SCM and IFC modules where it is used as a reference carrier.

Video modulated 45.75 MHz from the bridge mixer is coupled from the secondary of T301 across matching network R316 through R318 to the Video IF OUT terminal J303.

2. MODEL VSB Vestigial Sideband Filter

The purpose of the vestigial sideband filter is to combine the outputs of the AMM module or SCM module and the VIM module.

The circuit stages consist of a 41.25 MHz bandpass filter at one input, a directional coupler at the second input, and a 45.75 MHz bandpass filter at the output to develop the vestigial sideband characteristics.

41.25 MHz FM from the SCM or AMM enters the VSB at input terminal J701 where it is coupled by C701 to a high-Q critically-coupled, double-pole filter network consisting of C702, C703, C704, and L702. This filter rejects all frequencies other than 41.25 MHz. The output of this filter is coupled through C705 to the directional coupler circuit. The second input to the directional coupler is 45.75 MHz video from the VIM applied through input terminal J702, and a "T" pad consisting of R703, R704, and R705.

The directional coupler consists of R701, R702, and T702. Its function is to combine the sound and video carriers at the ouput with high isolation between the input.

The directional coupler output is then applied to a bandpass filter having a high-pass section and a low-pass section. The high-pass section consists of C706 through C710, L703 and L704. The low-pass section consists of C711 through C715, L705, and L710. The combined sections provide the desired vestigial sideband characteristic. Composite video-sound IF is then applied to output terminal J703 where it is jumpered to the IFC (Ser. 2) module.

3. MODEL AMM Audio Modulator Module

The purpose of the audio modulator is to transform an audio input into a frequency modulated 41.25 MHz output.

Transistor Q501, crystal Y501, and associated circuitry make up a 4.6 MHz reference oscillator and provides one input to the 100 kHz mixer Q502. The other input is 4.5 MHz coming from L-C oscillator Q505, CR506, and associated circuitry. The 100 kHz output of Q502 is coupled across a one-section Pi filter to an overdriven amplifier Q503 which produces a 100 kHz square wave. This square wave is differentiated and applied to the base of Q509.

Q509 and Q510 make up a single-shot multivibrator. This circuit generates a pulse train of constant amplitude and constant pulse width of approximately 3μsec.

Any increase or decrease in the 4.5 MHz frequency will appear in the 100 kHz difference frequency as the same amount of frequency change (1 kHz change at 4.5 MHz = 1 kHz at 100 kHz). This produces an equivalent change in the 100 kHz pulse train output of the multivibrator and a directly proportional change in the output of DC amplifier Q511. The pulse train is integrated out to develop a DC voltage which is a direct function of the pulse train repitition rate. This voltage change is then amplified by the DC and modulation amplifier Q512 and applied to the voltage variable capacitor CR506 in the 4.5 MHz oscillator circuit. The total polarity of this AFC loop is such that the voltage change presented to the 4.5 MHz oscillator will move its oscillation frequency in a direction opposite to the frequency change that produced the AFC voltage. The 4.5 MHz frequency control R550 is used to bring the 4.5 MHz to the exact frequency. Changing its setting can be compared to changing the zero crossover on a resonant type frequency discriminator.

Audio is applied to the base of Audio input amplifier Q513 from pin "A" of P501. DEVIATION control R568 is used to set the input of the audio amplifier to a level that provides 100% modulation on audio peaks. The audio signal is coupled across C544 and R558 to the emitter of Q512, the DC and modulation amplifier. Audio voltage variations are amplified, appear at the collector, and frequency modulate the 4.5 MHz oscillator. Modulated 4.5 MHz is applied to the base of mixer buffer amplifier Q506. Carrier level control R526 in the collector of Q506 adjusts the amplitude of the 4.5 MHz applied to the RF mixer. TP502, 4.5 MHz TEST, is provided for maintenance purposes.

The RF mixer consisting of T501, T502, and CR507 through CR510 provides 41.25 MHz FM. This is accomplished by mixing the 4.5 MHz modulated input from the mixer buffer amplifier Q506 and the 45.75 MHz reference carrier supplied by the video modulator module. The 100 kHz pulse train is also applied to audio buffer amplifier Q508. This amplifier provides isolation between the single-shot multivibrator and the 15 kHz low-pass filter. The 15 kHz filter consisting of L505, L506, and C533 through C535 removes the 100 kHz component from the pulse train allowing the audio frequency variations in the pulse train to pass through the base of Q507, the audio monitor amplifier. The reconstructed audio signal is amplified and presented at the AUDIO TEST and DEVIATION TEST jacks.

4. IFC (SER. 2) IF-to-Output Channel Converter

The purpose of the IF-to-Output Channel Converter is to transform the IF input to a TV Channel designated by the user. The Channel can be in the sub-band, low-band, mid-band, high-band, or super-band.

The following description is representative of the signal flow in the IFC (Ser. 2) modules. Circuit configurations and component values vary with band and individual channels in each band.

IF is applied through J402 to a bandpass filter consisting of inductors L401 through L404 and capacitors C401 through C403. The signal is applied to an attenuation pad consisting of R402, R403A and B, and R404 and to IF TEST —30dB test jack on the front panel. RF LEVEL control R403A and B on the front panel allows for adjustment of the attenuation provided by the pad from a minimum of 20 dB. The attenuated signal is then applied through T401 and T402 to a balanced mixer consisting of CR401 through CR404.

A shielded crystal-controlled oscillator, Models CCO-* or ICO-*, consisting of Q901, Y901 and associated circuitry generates the fundamental frequency which is used to convert the IF input to the desired output. The oscillator frequency in modules outputing a high-band or super-band channel is doubled. The fundamental frequency is also doubled in modules outputing mid-band channels E through I. The frequency doubling circuit consists of CR901, L903A and B, and associated circuitry. Modules outputing a low-band or high-band channel have a separate coaxial cable output from the local oscillator. This lead should be connected to the terminated storage facility for off channel conversions. The output of the crystal oscillator is applied to the balanced RF mixer through T401 and T402.

The output of the RF mixer is coupled through transformers T403, T404, and a bandpass filter to an RF amplifier consisting of transistors Q401, Q402, and associated circuitry, a second stage using Q403 and the output stage using Q404. Feedback is used to reduce distortion in all three stages. The filtered output exits the converter through J407.

5. MODEL SCM Sound Carrier Module

The purpose of the Sound Carrier Module is to accept a 4.5 MHz FM sound carrier and a unmodulated 45.75 MHz carrier and mix these signals to provide a 41.25 MHz FM output.

The circuit stages consist of a variable input attenuator, and RF amplifier, limiter, a buffer amplifier, a mixer, and a output level control circuit.

The FM sound carrier is applied through input terminal J601 to a variable attenuator network consisting of R601, R603 and potentiometer R602. The signal is then coupled through C601 to a single-tuned network C604 and L602. The signal is then applied through C605 to IC amplifier/limiter Q601 which removes any amplitude variations and provides a constant 4.5 MHz output level.

The output of Q601 is tuned to 4.5 MHz by the network consisting of L603 and C614. From there the signal is coupled through C615 to the base of buffer amplifier Q602. CARRIER LEVEL control potentiometer R608 develops the output of Q602. The 4.5 MHz signal from the wiper of R608 is applied to one input of the RF mixer. 45.75 MHz unmodulated, obtained from the VIM module via J602, is applied to the second input of the RF mixer.

T601, T602, CR602 through CR605 make up the RF mixer circuit. The mixer output in the form of 41.25 MHz is applied to output terminal J603 and subsequently jumpered to the VSB module.

6. MODEL PBF Bandpass Filters

The purpose of bandpass filters is to assist in overcoming semiadjacent channel overload problems at the head end. They may also be used on the output of head end equipment to eliminate spurious signals.

The filters are a Chebyshev type consisting of five quarterwave length helically wound resonators. Input and output from the filters are through matching capacitors C6 and C11 which are tied to the 75-ohm points of the end resonators. Coupling efficiency is determined by the spacing between the resonators and fine adjustment is accomplished by varying trimmer capacitors C7 through C10. The resonant frequency of the individual resonators L1 through L5 is adjusted by the tuning screws in the center of each resonator. These tuning screws essentially vary the capacitance shunting each coil and are labeled C1 through C5.

7. MODEL PSC-2 Power Supply

The power supply model PSC-2 is designed to operate from an input voltage of 100 to 130 V @ 60 Hz or 24 V DC. It delivers constant output voltage of 20 V DC. This unit is arranged in a self-contained plug-in module for the Commander Modulator.

The input voltage is connected to pins A and C of the plug-in socket P101. From Pin A this voltage is connected to the fuse F101, the on/off switch, and to transformer T101. A power indicating light DS101 is connected from the emitter of Q101 to ground.

The secondary voltage of transformer T101 is applied to bridge rectifier CR101-104. The rectified output is fed to a filter consisting of capacitors C102-104, to the collectors of the series regulator transistor Q101, regulator driver transistor Q102, and through resistor R114 and Zener diode CR 105 to ground.

The output passes from the emitter of Q101 through a current sensing network consisting of R102, R103, R104, R105 and thermistor RT101 to the 20 V DC output pin H of plug P101.

Regulation is accomplished in the following manner:

The potentiometer R109 in the output voltage divider circuit is adjusted to the desired voltage +20 V DC. The wiper of R109 is connected to the base of Darlington amplifier Q104 which is referenced to Zener diode CR106. Any change in the collector current of Q104 develops a change in the base voltage of the driver-regulator Q102, which in turn drives the series pass transistor Q101 into increased or decreased conduction, thereby altering the base voltage on a negative feedback basis. The collector load resistors for Q104, R113, and R112 are filtered by C105 to remove ripple.

A portion of the voltage drop produced by the output current flowing through R103 is developed across R104, R105, and RT101. This voltage is applied through R106 to the base of Q103. When this voltage, because of an overload, exceeds the semiconductor drop in the emitter junction it turns Q103 on and the collector-emitter current path of Q103 bypasses the base-emitter signal applied to Q101 and Q102, reducing their conduction so as to produce current limiting.

Foldback is produced by connecting R107 to a reference source formed by CR105 and R114. When the output voltage drops during current limiting, an additional base current to Q103 flows through R107, magnifying the effect of Q103 so that further limiting takes place at a lower load current.

When the excessive load is removed, transistor Q103 is turned off and the circuit operates normally.

Capacitor C106 is placed across the output to stabilize the regulator against reactive loads.

The positive and the negative potential are then connected to pins H and E. respectively, of the plug-in socket P101.

Pin F of P101 is provided to operate the power supply from an external DC source of 24V. It is connected to the collector of Q101 through diode CR108 which prevents backup currents from flowing through this path, and the process of regulation is completed in the same manner as described previously.

MAINTENANCE

1. The solid-state circuitry with resulting low power consumption should make the CCM-* equipment virtually maintenance-free. All that may be required for proper operation are routine checks on signal levels and firmness of cable connections.
2. Should it happen that for some reason a module becomes inoperative, it should be replaced with a spare, and the faulty one be returned to Jerrold Electronics Corp. Service Dept. where it will be repaired at no charge under warranty conditions; otherwise it will be repaired at a nominal charge.
3. Where qualified personnel desire to repair a module on site, the parts lists and schematic circuit diagrams given here will facilitate bench testing and repairing the defective unit.

INSTALLATION OF MODEL CST-4.5 ON MODEL CCM-C*

1. Slightly loosen two of the screws holding the VSB assembly to the CCM-C* rear panel, then mount the CST-4.5 through its keyhole slots and re-tighten the screws; See Fig. 6.

2. Connect one of the jumpers supplied with the CCM-C* between the VIDEO terminal on the CST-4.5 and the INPUT terminal on the CCM-C* rear panel. Connect the second jumper between the 4.5 MHz terminal on the CST-4.5 and the 4.5 MHz IN terminal on the CCM-C* rear panel.

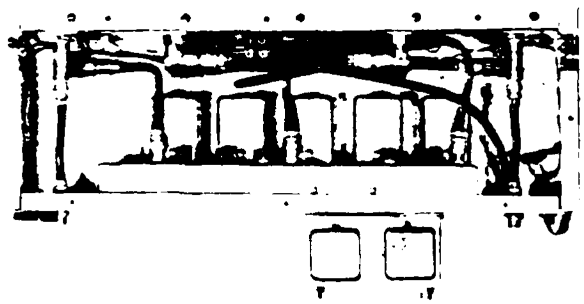


Fig. 6 Top View of Model CST-4.5 Mounted on Model CCM-C*

CY-425

REPLACEMENT PARTS LIST

MODEL DEP

DRAWING No. C863-130

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No.
CAPACITORS	
C201, 223	126-214
C202, 221	126-212
C203, 222	126-034
C204, 205	126-168
C206, 207	126-087
C208	126-194
C209, 210, 211	126-156
C212, 213	126-122
C214	126-124
C215, 216	126-033
C217, 218	126-153
C219, 220	126-167
C224	126-192
CONNECTORS	
J201, 202	B821-195
RESISTORS	
R201, 204	112-079
R202, 203	112-101

REPLACEMENT PARTS LIST

MODEL CST-4.5

DRAWING No. C863-168

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No.
CAPACITORS	
C801	126-124
C802, 805	128-538
C803	126-102
C804	126-111
C806	126-183
CONNECTORS	
J801, 802, 803	C821-155-0

REPLACEMENT PARTS LIST

MODEL PSC-2

DRAWING No. D863-296

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No.
CAPACITORS	
C101	124-076
C102, 103, 104	S127-161
C105	127-075
C106	S127-160
C107	S127-171
CONNECTORS	
P101	184-074
TP101	185-133
TP102	185-144
DIODES	
CR101-104, 108	137-686
CR105	137-781
CR106	137-738
CR107	137-824

REPLACEMENT PARTS LIST

MODEL PSC-2

DRAWING No. D863-296

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No.
TRANSFORMER	
T101	B141-260
TRANSISTORS	
Q101	S130-270-15
Q102	130-208
Q103	130-166
Q104	130-273
FUSE	
F101	101-236
PILOT LIGHT	
DS101	102-020
RESISTORS	
R101	112-290
R102	113-215
R103	112-128
R104	112-054
R105	112-179
R106, 108, 114	112-362
R107	112-557
R109	S118-410-02
R110	112-232
R111	112-374
R112, 113	112-410
SWITCH	
S101	162-018
THERMISTOR	
RT101	110-026

All data subject to change without notice.

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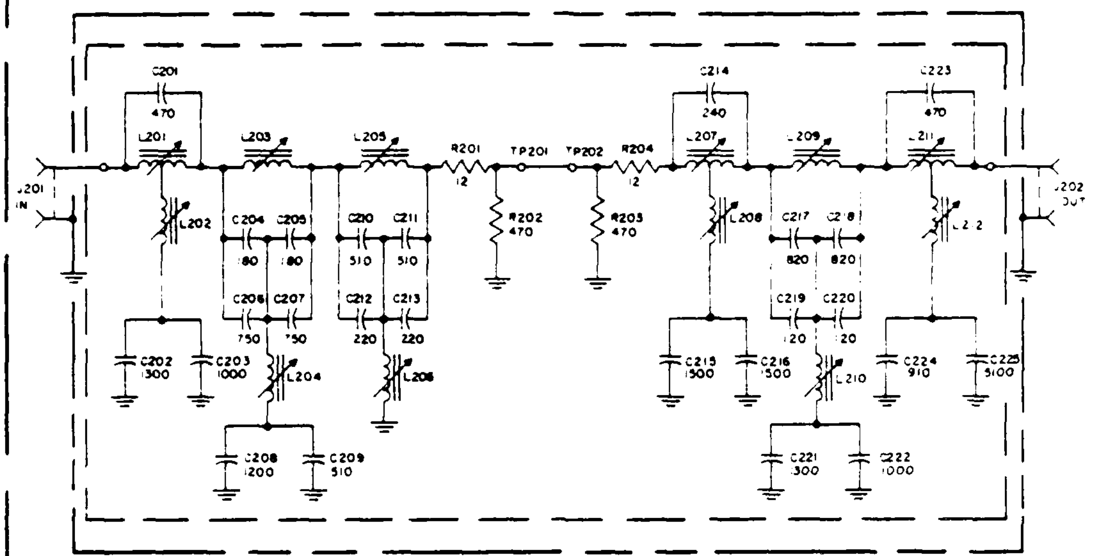
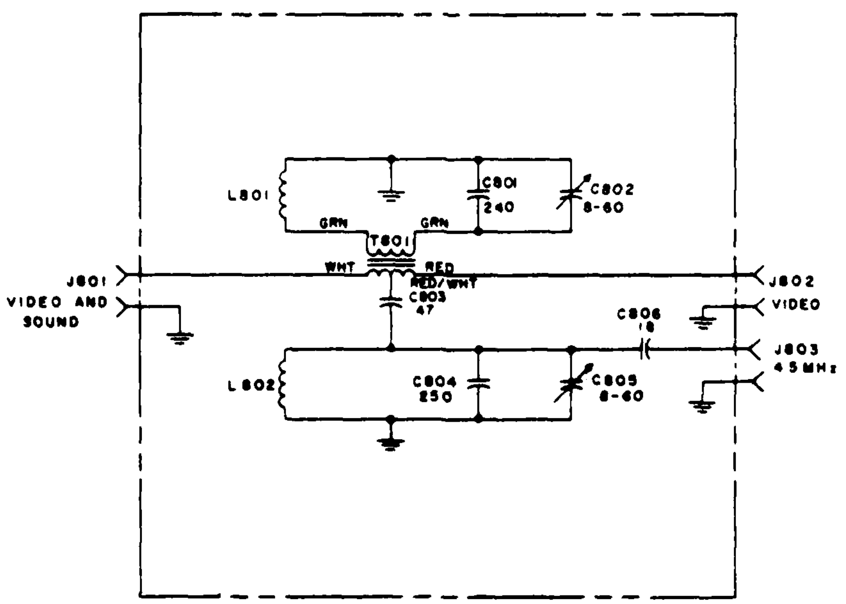


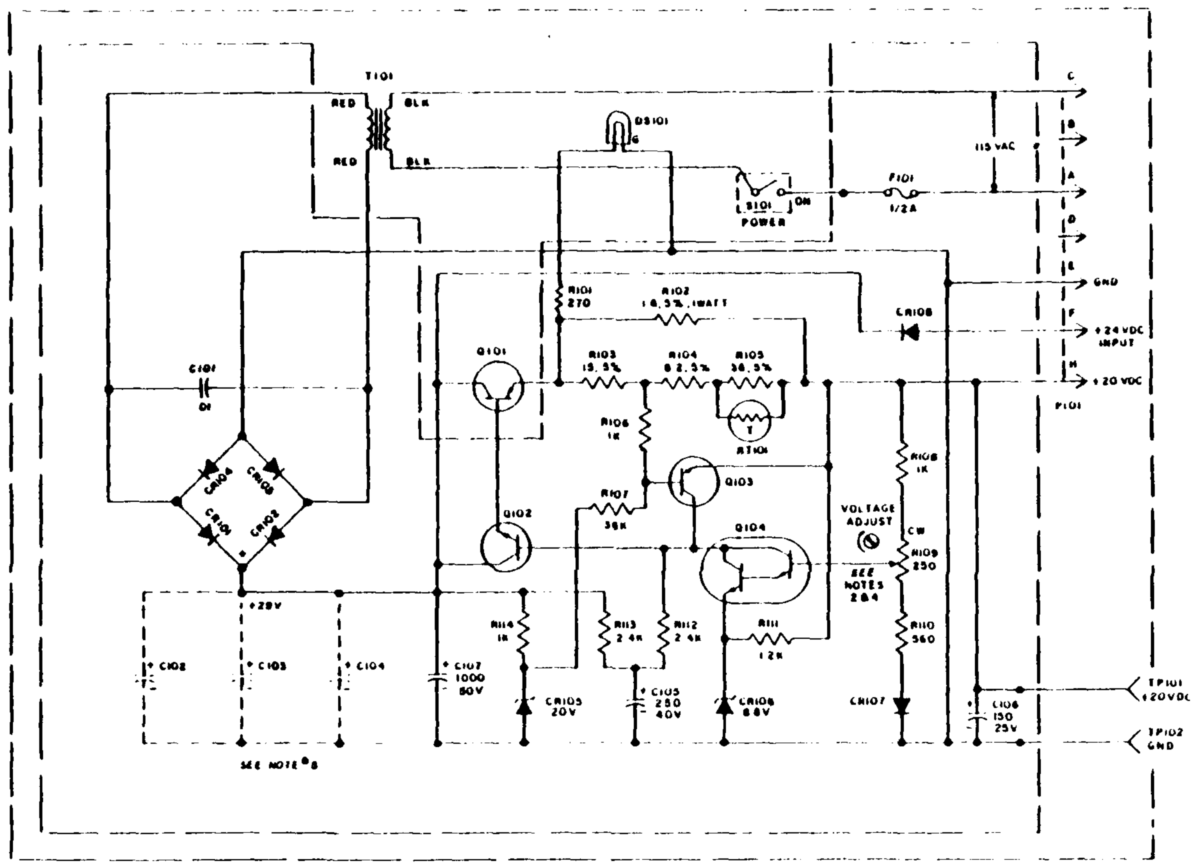
NOTES.
UNLESS OTHERWISE SPECIFIED,
A ALL RESISTORS ARE IN OHMS, 5%, 1/4 W
B ALL CAPACITORS ARE IN pF

DELAY EQUALIZER MODEL DEP
C863-130 REV. A



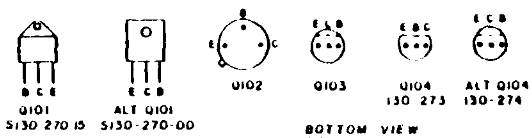
NOTE
ALL CAPACITORS ARE IN pF

VIDEO AUDIO SEPARATOR MODEL CST-4.5
863-168 REV. A



NOTES

1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS, 10%, 1/2 W
   ALL CAPACITORS ARE IN µF
2. FACTORY SET FOR +20 VDC AT TP101
3. VOLTAGES MEASURED WITH 20,000 OHM/VOLT METER
4. CW DENOTES THE POTENTIOMETER WIPER POSITION AT EXTREME CLOCKWISE ROTATION
5. C102, 103 & 104 (330 µF 60V) CAN BE USED AS AN ALTERNATE FOR C107



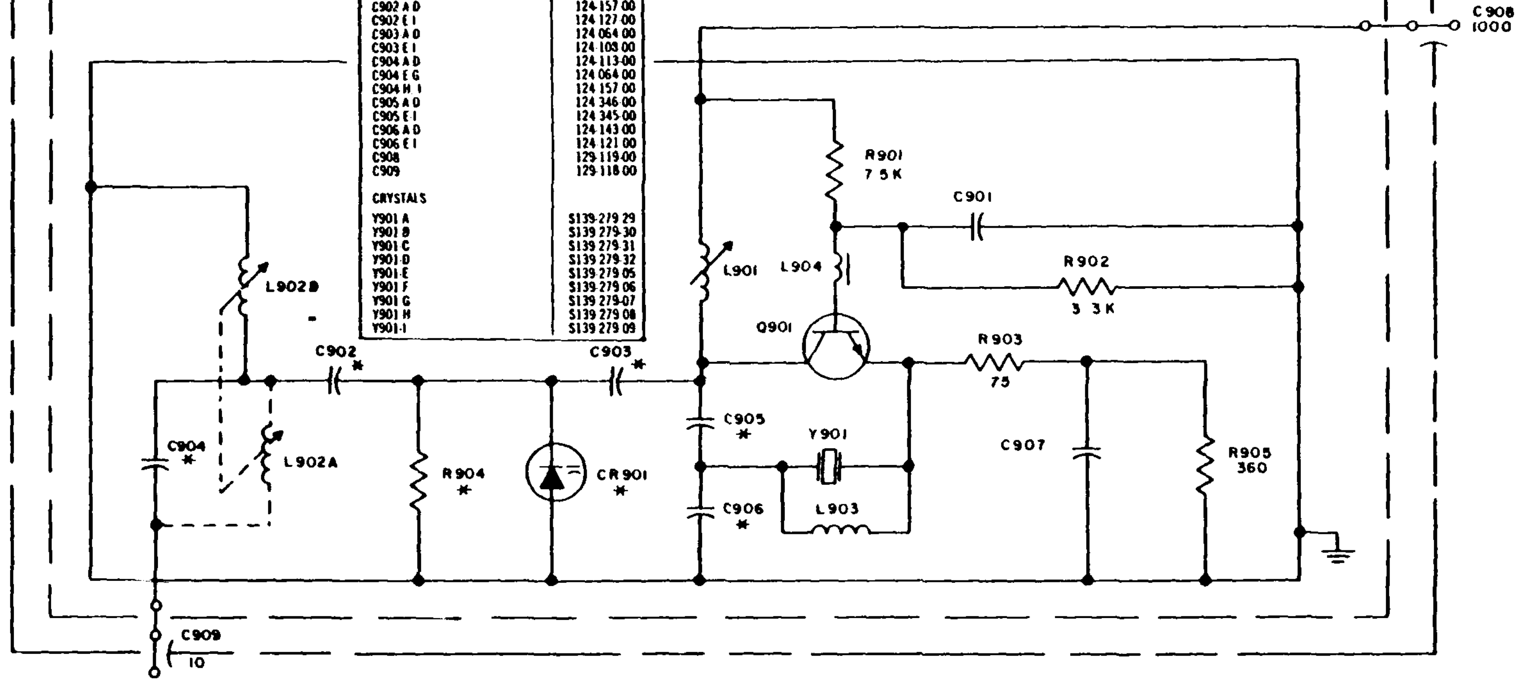
POWER SUPPLY MODEL PSC-2
863-296 REV A

REPLACEMENT PARTS LIST

MODEL CCO–MID-BAND

DRAWING No. B63-394

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No.
CAPACITORS	
C901, 907	S124-078-00
C902 A D	124-157 00
C902 E I	124 127 00
C903 A D	124 064 00
C903 E I	124-103 00
C904 A D	124-113-00
C904 E G	124 064 00
C904 H I	124 157 00
C905 A D	124 346 00
C905 E I	124 345 00
C906 A D	124 143 00
C906 E I	124 121 00
C908	129-119-00
C909	129-118 00
CRYSTALS	
Y901 A	S139-279 29
Y901 B	S139 279-30
Y901 C	S139 279 31
Y901 D	S139 279-32
Y901 E	S139 279 05
Y901 F	S139-279 06
Y901 G	S139 279-07
Y901 H	S139 279 08
Y901 I	S139 279 09
DIODES	
CR901 E I	137 307
RESISTORS	
R501	112 986 00
R902	112 936 00
R903	112 954 00
R904 A D	112 090 00
R904 E I	112 930-00
R905	112 098 00



COMPONENT	* CHANNEL A – D	E	F	G	H	I
C902	1 5pF	5 1pF	5 1pF	5 1pF	5 1pF	5 1pF
C903	2 2pF	9 1pF	9 1pF	9 1pF	9 1pF	9 1pF
C904	3 3pF	22pF	22pF	22pF	1 5pF	1 5pF
C905	5 1pF	10pF	10pF	10pF	10pF	10pF
C906	15pF	30pF	30pF	30pF	30pF	30pF
CR901	———	USED	USED	USED	USED	USED
R904	82Ω	2K	2K	2K	2K	2K

NOTES
UNLESS OTHERWISE SPECIFIED
1 ALL RESISTORS ARE IN OHMS, 5%, 1/4W
2 ALL CAPACITORS ARE IN pF
3 ALL UNMARKED CAPACITORS ARE 02μF
4 L902A ONLY USED ON CHANNELS E THRU I

Q901
WIRING SIDE

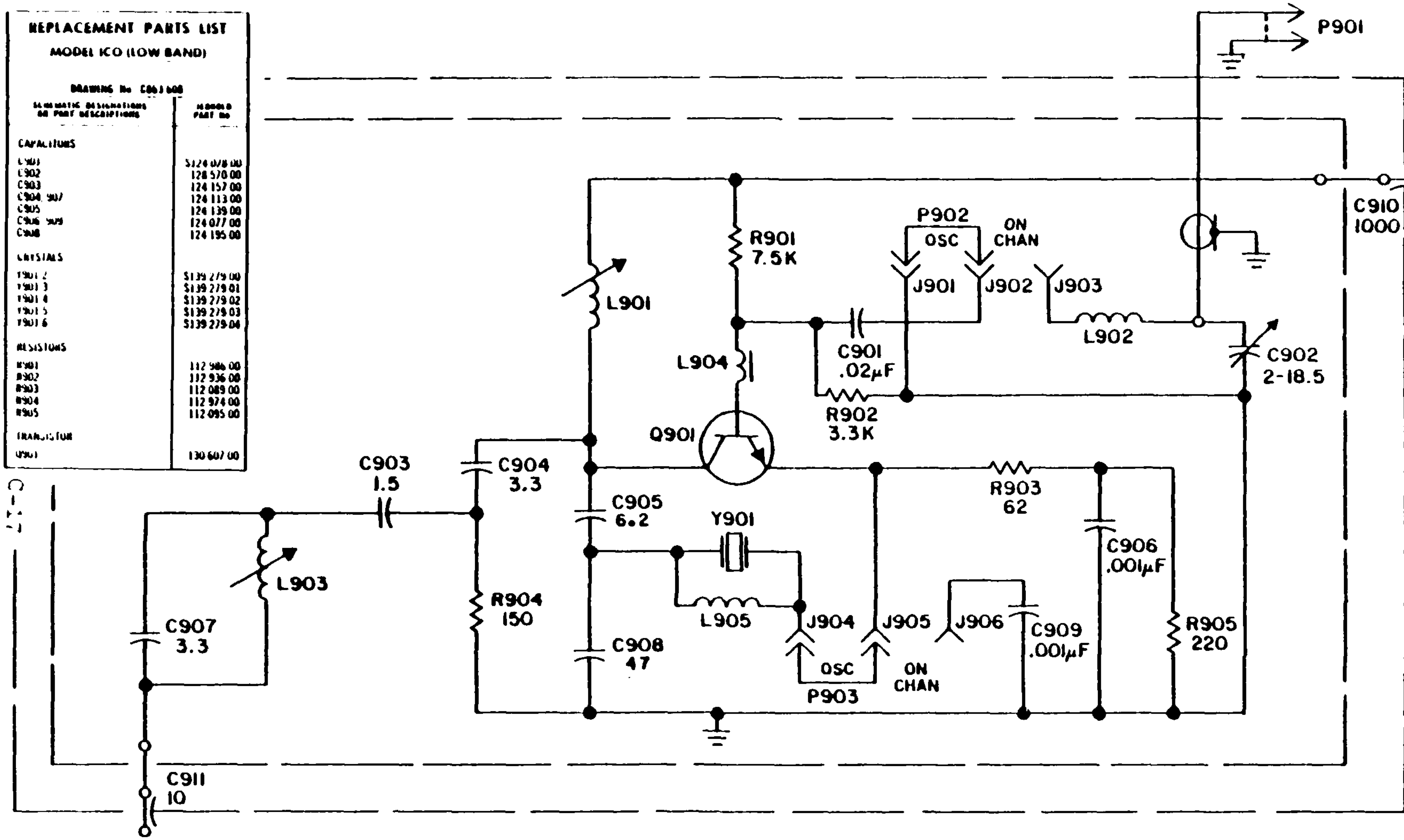
CHANNEL COMMANDER
OSCILLATOR
B63 394 REV O

REPLACEMENT PARTS LIST

MODEL ICO (LOW BAND)

DRAWING No. C863 608

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	PART No.
CAPACITORS	
C901	S124 078 00
C902	128 570 00
C903	124 157 00
C904, 907	124 113 00
C905	124 139 00
C906, 909	124 077 00
C908	124 195 00
CRYSTALS	
Y901-2	S139 279 00
Y901-3	S139 279 01
Y901-4	S139 279 02
Y901-5	S139 279 03
Y901-6	S139 279 04
RESISTORS	
R901	112 986 00
R902	112 936 00
R903	112 089 00
R904	112 974 00
R905	112 095 00
TRANSISTOR	
Q901	130 607 00



NOTES:
UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTORS ARE IN OHMS, 5%, 1/4 W.
2. ALL CAPACITORS ARE IN PF.

SCHEMATIC
CHANNEL COMMAND OSCILLATOR
LOW BAND 2-6
MODEL ICO - (LOW BAND)

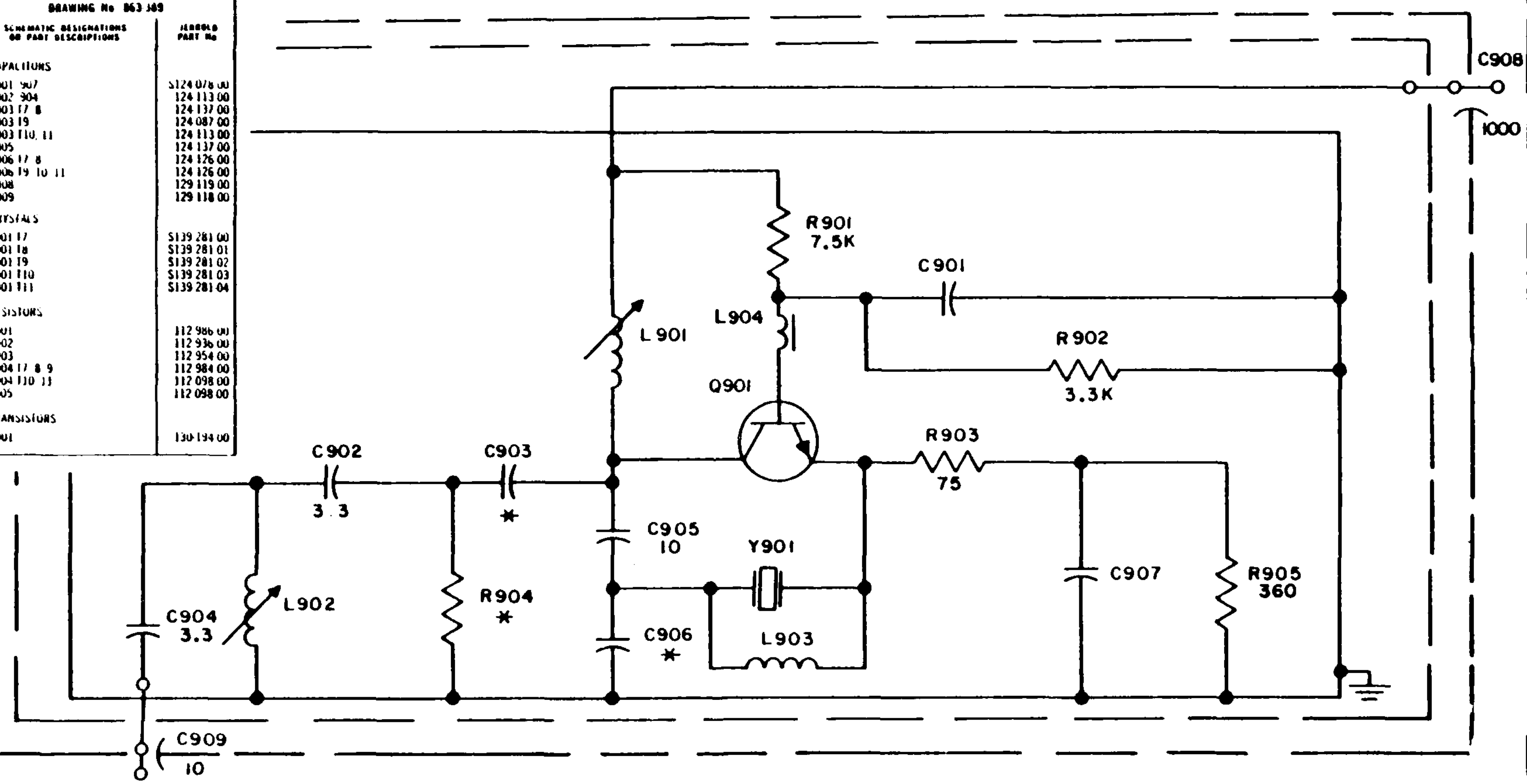
C863-608 REV. 0

REPLACEMENT PARTS LIST

MODEL CCO-T7-T11

DRAWING No 863 389

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No
CAPACITORS	
C901 907	S124 078 00
C902 904	124 113 00
C903 T7 8	124 137 00
C903 T9	124 087 00
C903 T10, 11	124 113 00
C905	124 137 00
C906 T7 8	124 126 00
C906 T9 10 11	124 126 00
C908	129 119 00
C909	129 118 00
CRYSTALS	
Y901 T7	S139 281 00
Y901 T8	S139 281 01
Y901 T9	S139 281 02
Y901 T10	S139 281 03
Y901 T11	S139 281 04
RESISTORS	
R901	112 986 00
R902	112 936 00
R903	112 954 00
R904 T7 8 9	112 984 00
R904 T10 11	112 098 00
R905	112 098 00
TRANSISTORS	
Q901	130 194 00



NOTES:
UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTORS ARE IN OHMS, 5%, 1/4W.
2. ALL CAPACITORS ARE IN pF.
3. ALL UNMARKED CAPACITORS ARE .02μF.

* CHANNEL					
COMPONENT	T7	T8	T9	T10	T11
C903	10	10	4.3	3.3	3.3
C906	56	56	39	39	39
R904	200Ω	200Ω	200Ω	360Ω	360Ω

CHANNEL COMMANDER
OSCILLATOR
863 389 REV O

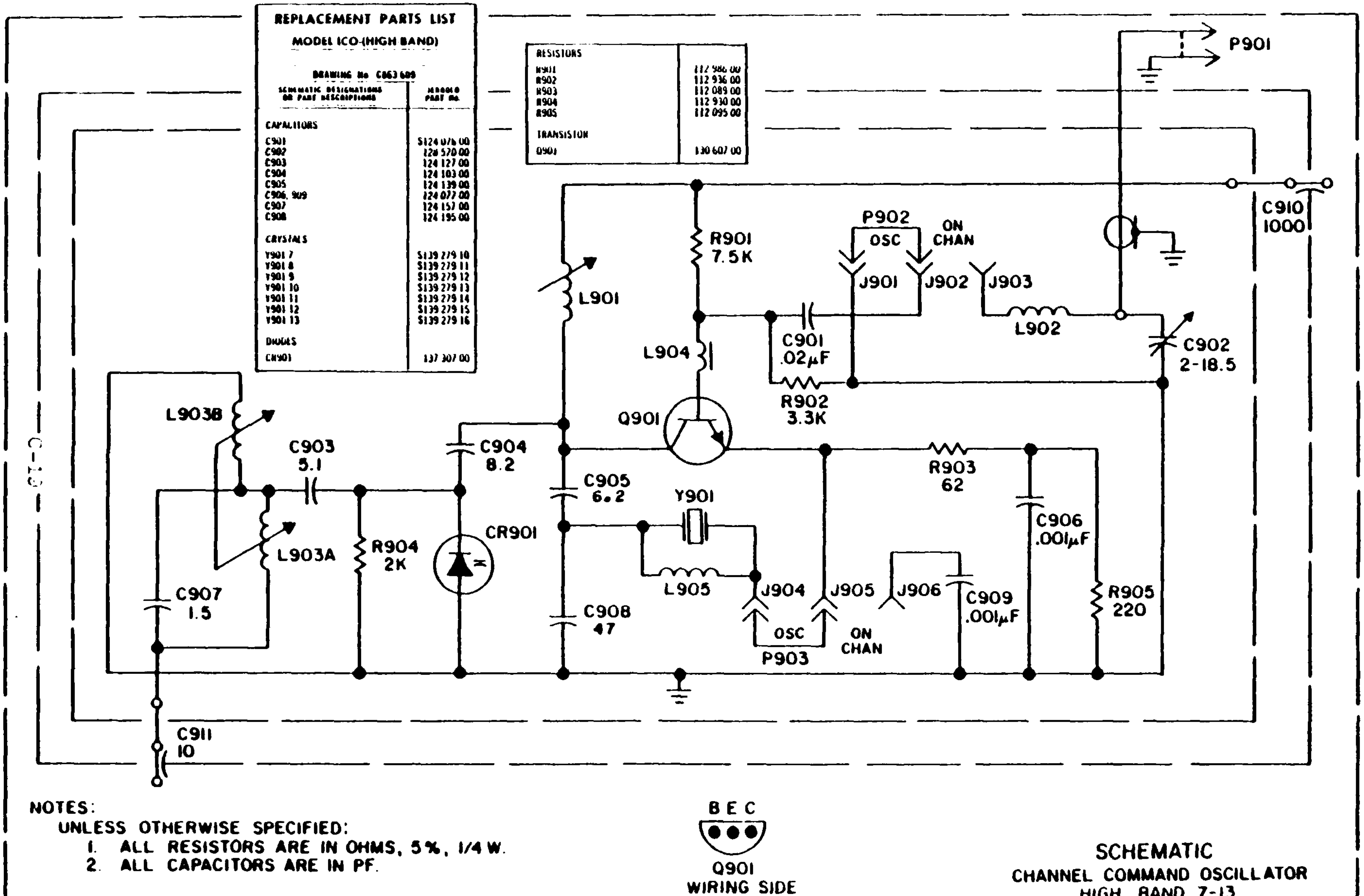
SUB-BAND T7-T11

REPLACEMENT PARTS LIST

MODEL ICO-(HIGH BAND)

DRAWING No. C863 609

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	MODEL PART No.
CAPACITORS	
C901	S124 076 00
C902	128 570 00
C903	124 127 00
C904	124 103 00
C905	124 139 00
C906, 909	124 077 00
C907	124 157 00
C908	124 195 00
CRYSTALS	
Y901 7	S139 279 10
Y901 8	S139 279 11
Y901 9	S139 279 12
Y901 10	S139 279 13
Y901 11	S139 279 14
Y901 12	S139 279 15
Y901 13	S139 279 16
DIODES	
CR901	137 307 00
RESISTORS	
R901	112 986 00
R902	112 936 00
R903	112 089 00
R904	112 930 00
R905	112 095 00
TRANSISTOR	
Q901	130 607 00



NOTES:
UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTORS ARE IN OHMS, 5%, 1/4 W.
2. ALL CAPACITORS ARE IN PF.

SCHEMATIC
CHANNEL COMMAND OSCILLATOR
HIGH BAND 7-13
MODEL ICO-(HIGH BAND)

C863-609 REV.0

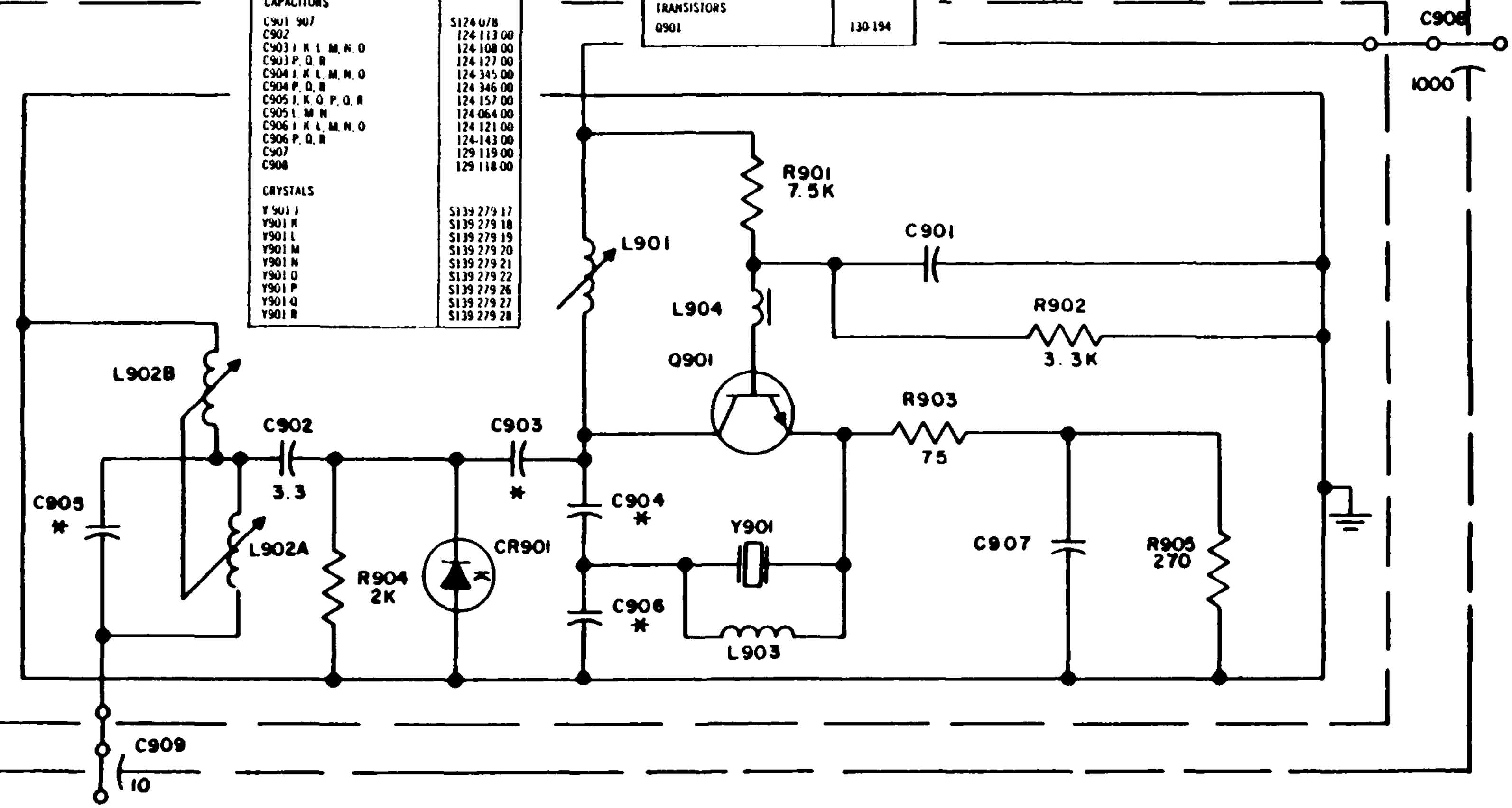
REPLACEMENT PARTS LIST

MODEL CCO—SUPER-BAND

DRAWING No C863 402

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	PART No
CAPACITORS	
C901 907	S124 078
C902	124 113 00
C903 J K L M, N, O	124 108 00
C903 P, Q, R	124 127 00
C904 J, K L, M, N, O	124 345 00
C904 P, Q, R	124 346 00
C905 J, K, O, P, Q, R	124 157 00
C905 L M N	124 064 00
C906 J K L, M, N, O	124 121 00
C906 P, Q, R	124 143 00
C907	129 119 00
C908	129 118 00
CRYSTALS	
Y901 J	S139 279 17
Y901 K	S139 279 18
Y901 L	S139 279 19
Y901 M	S139 279 20
Y901 N	S139 279 21
Y901 O	S139 279 22
Y901 P	S139 279 26
Y901 Q	S139 279 27
Y901 R	S139 279 28

DIODES	
CR901	137 307
RESISTORS	
R901	112 986
R902	112 936
R903	112 954
R904	112 930
R905	112 993
TRANSISTORS	
Q901	130 194



NOTES
UNLESS OTHERWISE SPECIFIED
1 ALL RESISTORS ARE IN OHMS, 5%, 1/4W
2 ALL CAPACITORS ARE IN pF
3 ALL UNMARKED CAPACITORS ARE 0 2 µF

Q901
WIRING SIDE

	* CHANNEL								
	J	K	L	M	N	O	P	Q	R
C903	9.1	9.1	9.1	9.1	9.1	9.1	5.1	5.1	5.1
C904	10	10	10	10	10	10	5.1	5.1	5.1
C905	1.5	1.5	2.2	2.2	2.2	1.5	1.5	1.5	1.5
C906	30	30	30	30	30	30	15	15	15

CHANNEL COMMANDER
OSCILLATOR
SUPER BAND
863 402 REV O

C863-402 REV A

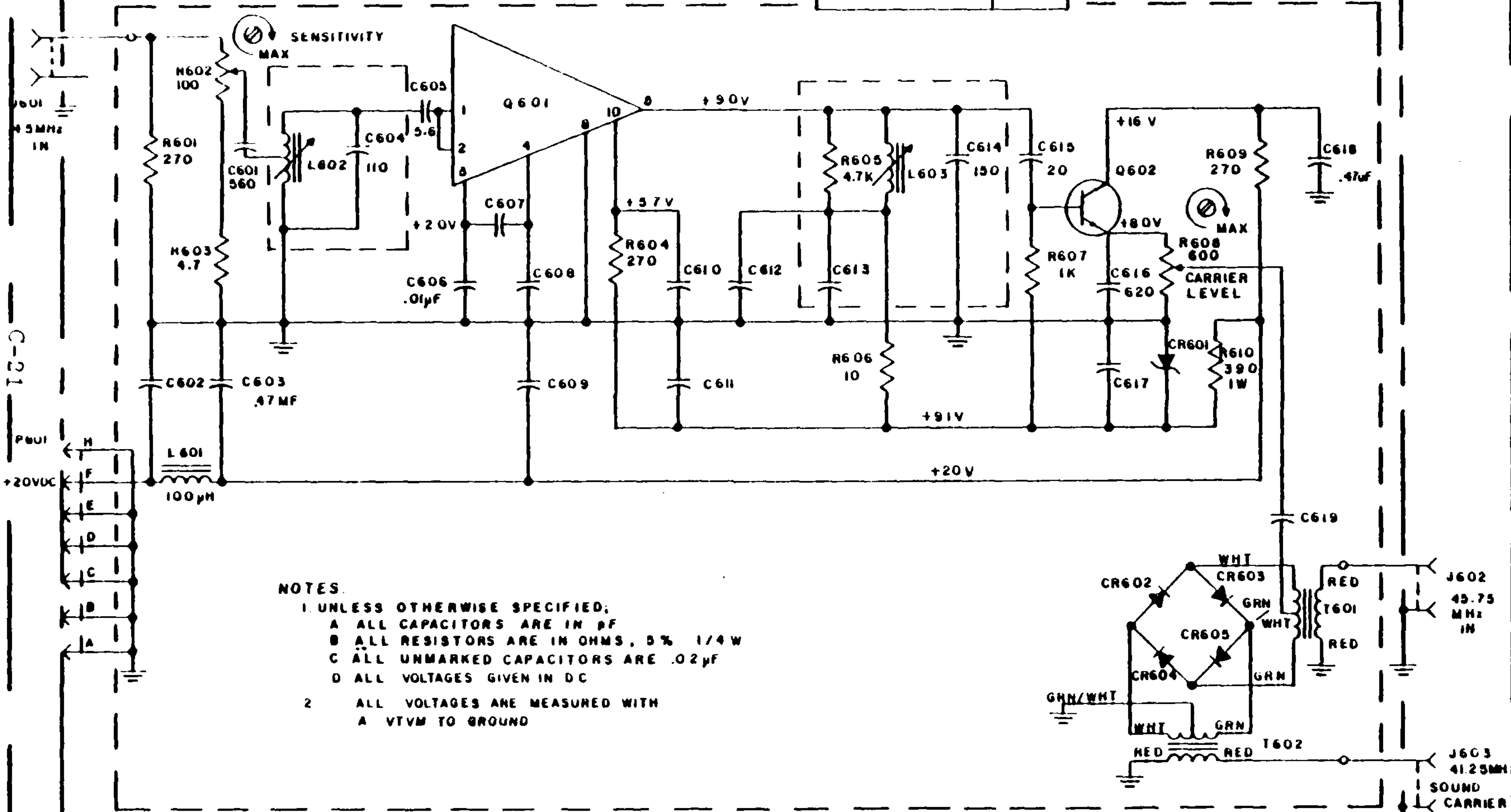
REPLACEMENT PARTS LIST

MODEL SCM

DRAWING No D863-147

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	MODULO PART No
CAPACITORS	
C601	126 029
C602 607/613 617 619	124 078
C603 610	[illegible]
C604	126 174
C605	124 064
C606	125 324
C614	126 088
C615	124 119
C616	126 169
CONNECTORS	
J601 602 603	8821 195
P601	184 074
DIODES	
CR601	S137 830
CR602 605	139 211
INTEGRATED CIRCUIT	
Q601	130 222
RESISTORS	
R601, 604, 609	112 993
R602	118 205
R603	112 069
R605	111 001
R606	112 077
R607	112 977
R608	S118 222 01
R610	S113 209
TRANSISTOR	
Q602	130 187

MODEL SCM
4.5 MHz MODULATOR
863 147 REV A



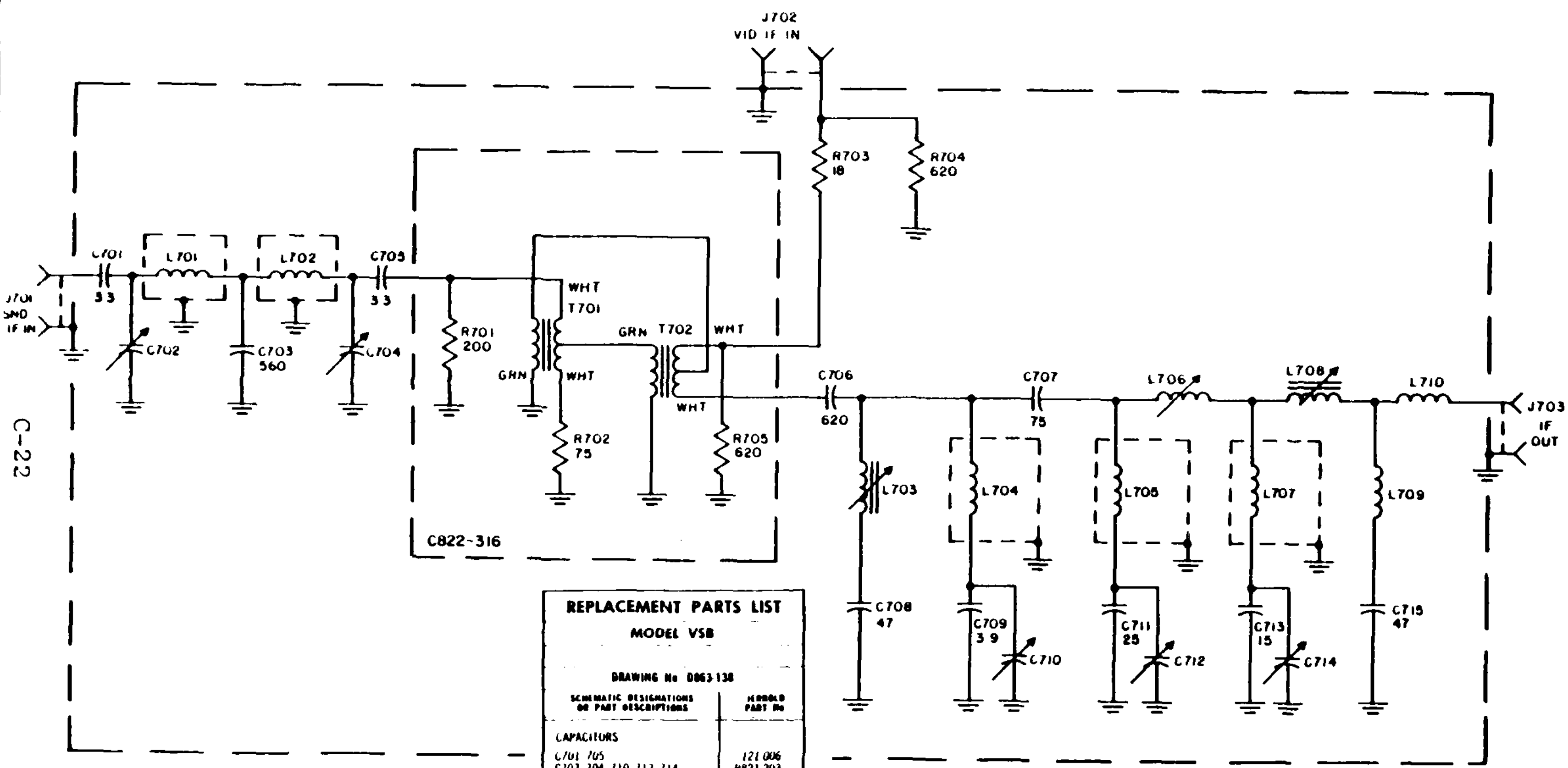
NOTES

1. UNLESS OTHERWISE SPECIFIED;
   - A ALL CAPACITORS ARE IN pF
   - B ALL RESISTORS ARE IN OHMS, 5% 1/4 W
   - C ALL UNMARKED CAPACITORS ARE .02µF
   - D ALL VOLTAGES GIVEN IN DC
2. ALL VOLTAGES ARE MEASURED WITH A VTVM TO GROUND

SOUND CARRIER MODULE MODEL SCM

D863-147 REV-A

MODEL VSB
VESTIGIAL SIDEBAND FILTER
863-138 REV O



REPLACEMENT PARTS LIST

MODEL VSB

DRAWING No D863-138

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	HAROLD PART No
CAPACITORS	
C701 705	121 006
C702, 704 710 712 714	B821 203
C703	126 029
C706	126 109
C707	121 169
C708, 715	121 100
C709	121 045
C711	121 017
C713	121 056
CONNECTORS	
J701 702, 703	C821 155 0
RESISTORS	
R701	112 984
R702	112 954
R703	112 082
R704 705	112 998

NOTES
1 ALL CAPACITORS ARE IN µF
2 ALL RESISTORS ARE IN OHMS, 5%, 1/4W

VESTIGIAL SIDEBAND FILTER MODEL VSB

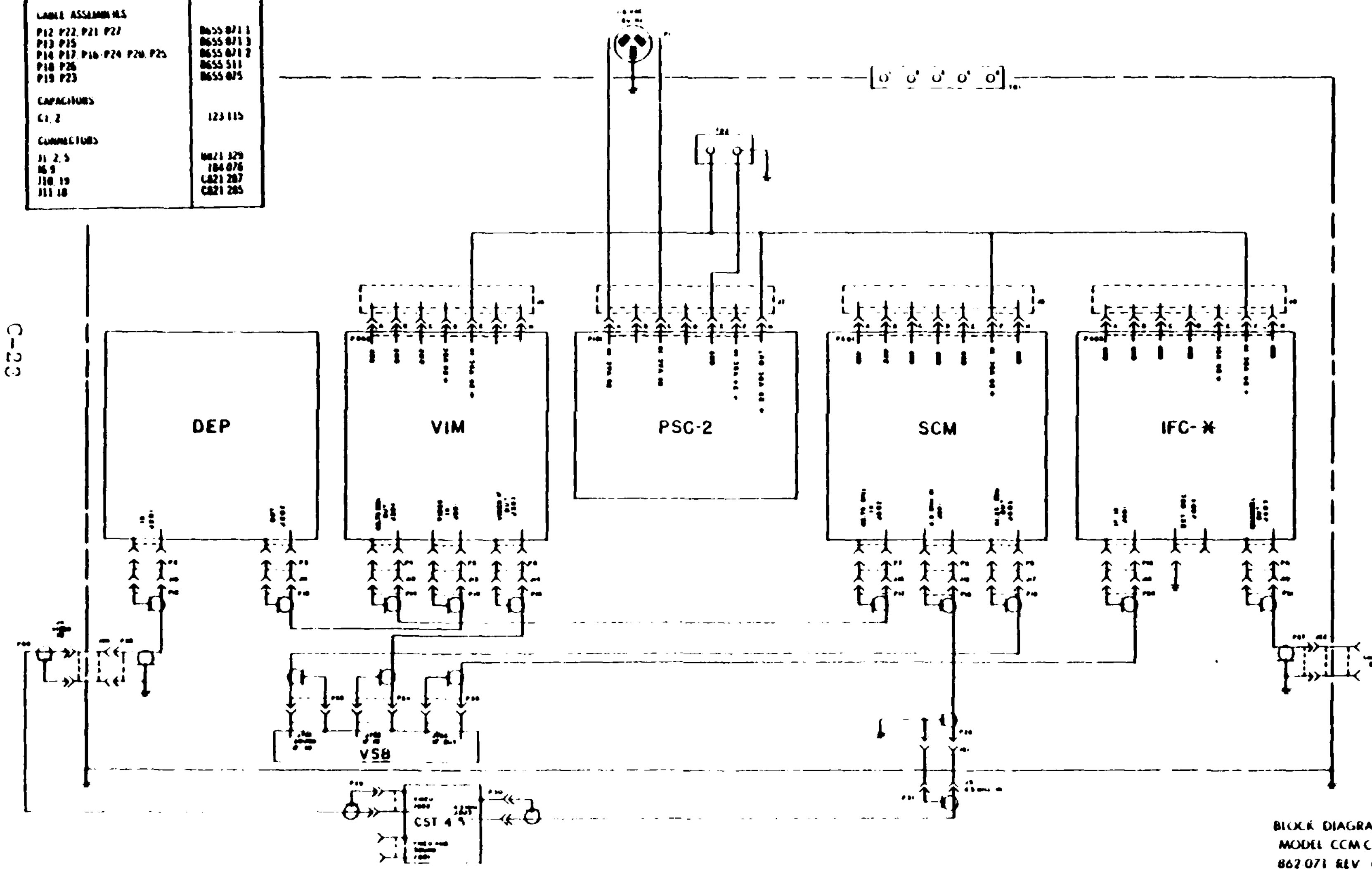
D863-138 REV-0

REPLACEMENT PARTS LIST

MODEL CCM-C*

DRAWING No. [illegible]

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	[illegible] PART No
CABLE ASSEMBLIES	
P12 P22, P21 P27	B655 071 1
P13 P15	B655 071 3
P14 P17, P16 P24 P20, P25	B655 071 2
P18 P26	B655 511
P19 P23	B655 075
CAPACITORS	
C1, 2	123 115
CONNECTORS	
J1, 2, 5	M821 329
J6, 9	184 076
J10, 19	C821 207
J11 18	C821 205



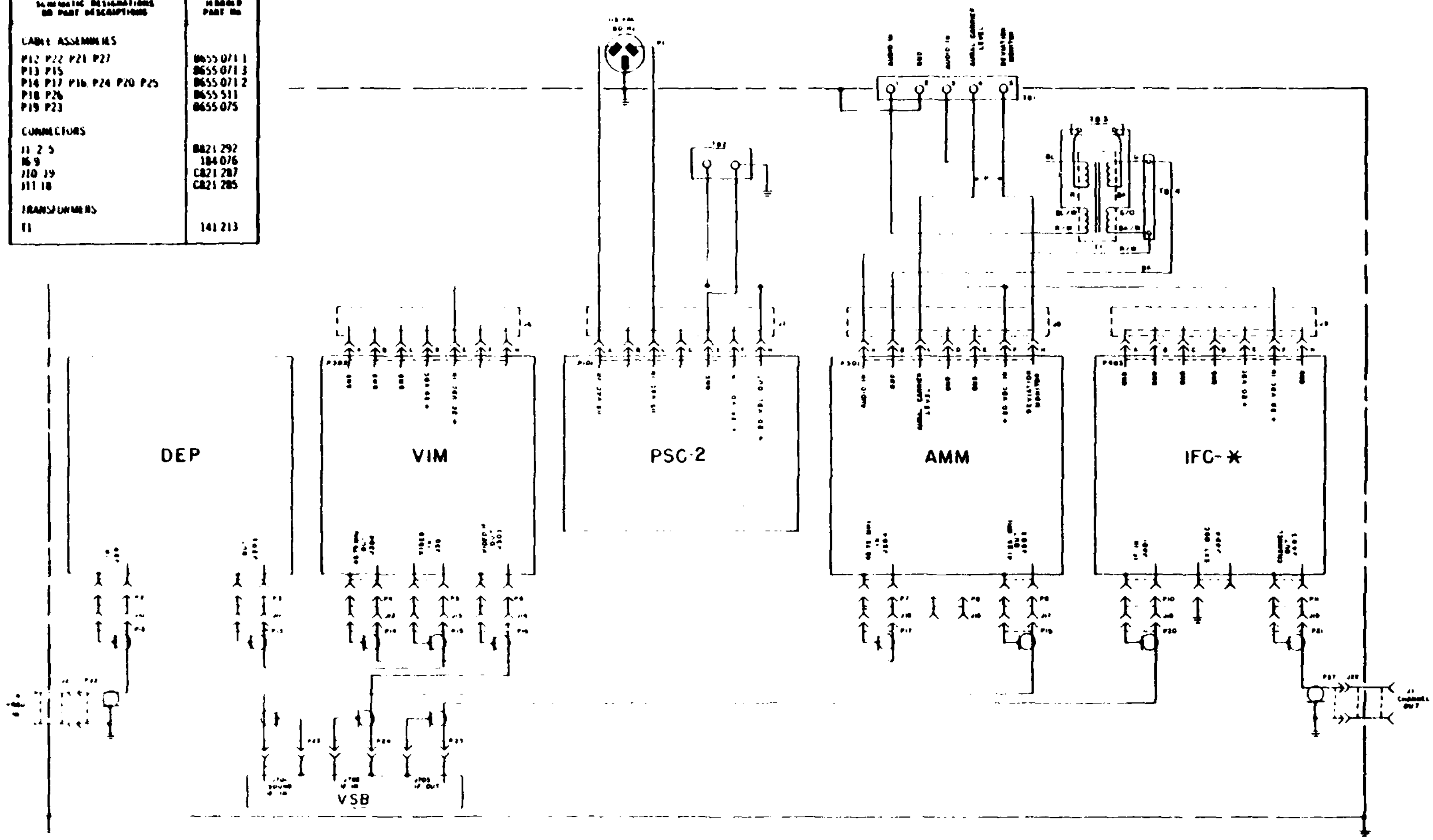
BLOCK DIAGRAM
MODEL CCM C*
862 071 REV C

REPLACEMENT PARTS LIST

MODEL CCM-AB*

DRAWING No. E863-406

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	HARRIS PART No.
CABLE ASSEMBLIES	
P12 P22 P21 P27	8655 071 1
P13 P15	8655 071 3
P14 P17 P16, P24 P20 P25	8655 071 2
P18 P26	8655 511
P19 P23	8655 075
CONNECTORS	
J1 2 5	8821 292
J6 9	184 076
J10 J9	C821 287
J11 18	C821 285
TRANSFORMERS	
T1	141 213



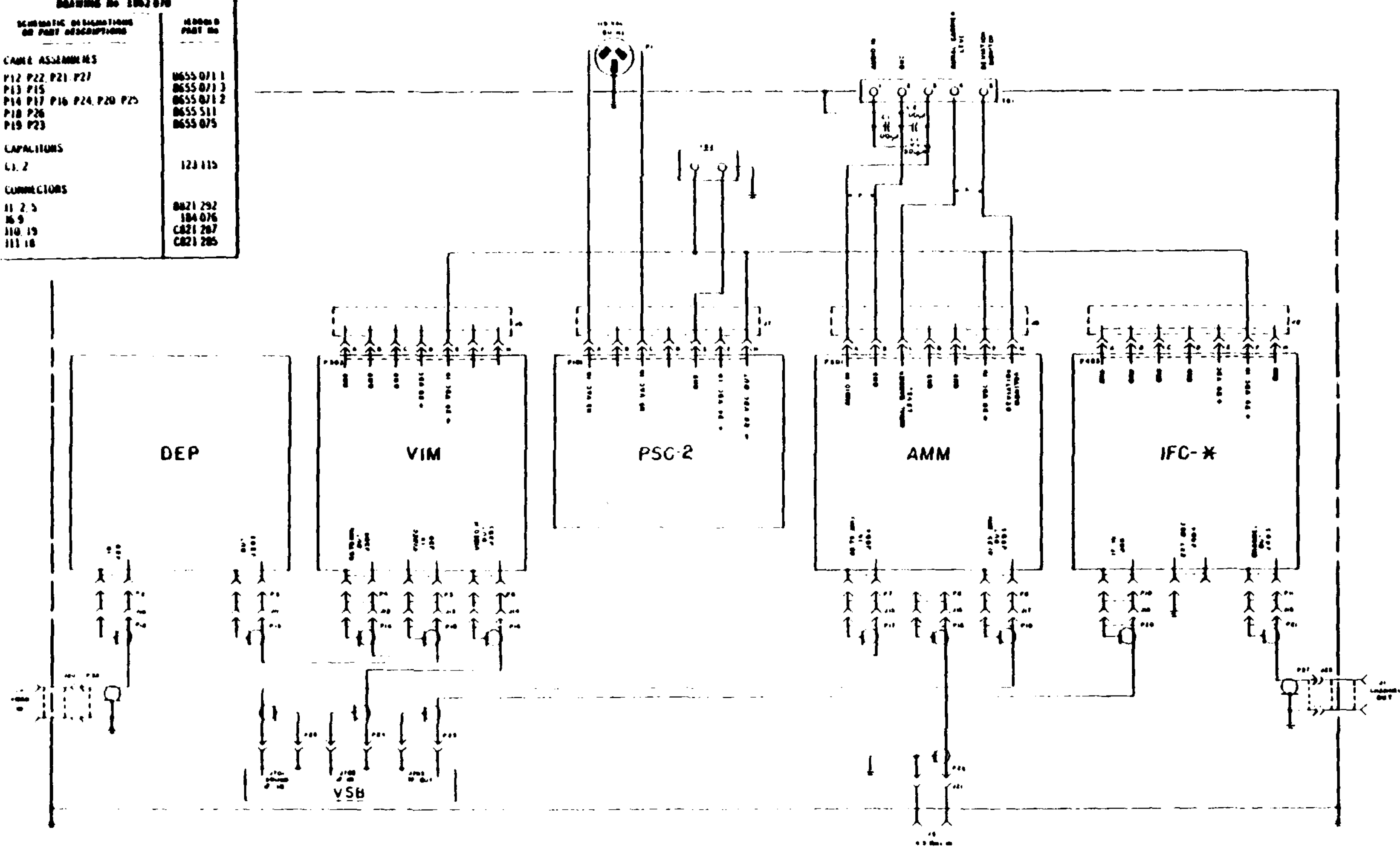
MODEL CCM AB* INTERCONNECTION
DIAGRAM
863 406 REV O

REPLACEMENT PARTS LIST

MODEL CCM-A*

DRAWING No 1862 070

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	PART No
CABLE ASSEMBLIES	
P12 P22 P21 P27	8655 071 1
P13 P15	8655 071 3
P14 P17 P16 P24 P20 P25	8655 071 2
P18 P26	8655 511
P19 P23	8655 075
CAPACITORS	
C1, 2	123 115
CONNECTORS	
J1 2,5	8821 292
J6 9	184 076
J10, 19	C821 267
J11 18	C821 285



MODEL CCM A* INTERCONNECTION DIAGRAM
862 070 REV A

REPLACEMENT PARTS LIST

MODEL VIM

DRAWING No. D863-129

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No.
CAPACITORS	
C301 304	126 214
C302 303	126 034
C305 306	S127 162
C307	127 075
C308 311, 312, 314	124 078
C309	127 073
C310	127 316
C313	124 087
C315	128 564
C316	124 143
C317	124 122
C318	124 084
CONNECTORS	
J301, 302	B821 286
J303, 304	B821 195
P302	184 074
CRYSTAL	
Y301	B139 238
DIODES	
CR301, 303 306	139 211
CR302	137 806
INTEGRATED CIRCUIT	
Q305	130 223
RESISTORS	
R301	112 100
R302	S118 222 01
R303	112 975
R304	112 966
R305	112 920
R306	112 101
R307, 324	112 104
R308, 310	112 077
R309	112 917
R311 312	112 950
R313	113 169
R314	112 934

REPLACEMENT PARTS LIST

MODEL VIM

DRAWING No. D863-129

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No.
R315	112 930
R316, 318	112 079
R317	112-095
R319-322	112 096
R323	112-972
R325	112-085
R326	112-993
R327	111-075
TRANSISTORS	
Q301 304	130-187

REPLACEMENT PARTS LIST

MODEL AMM

DRAWING No. E863-131

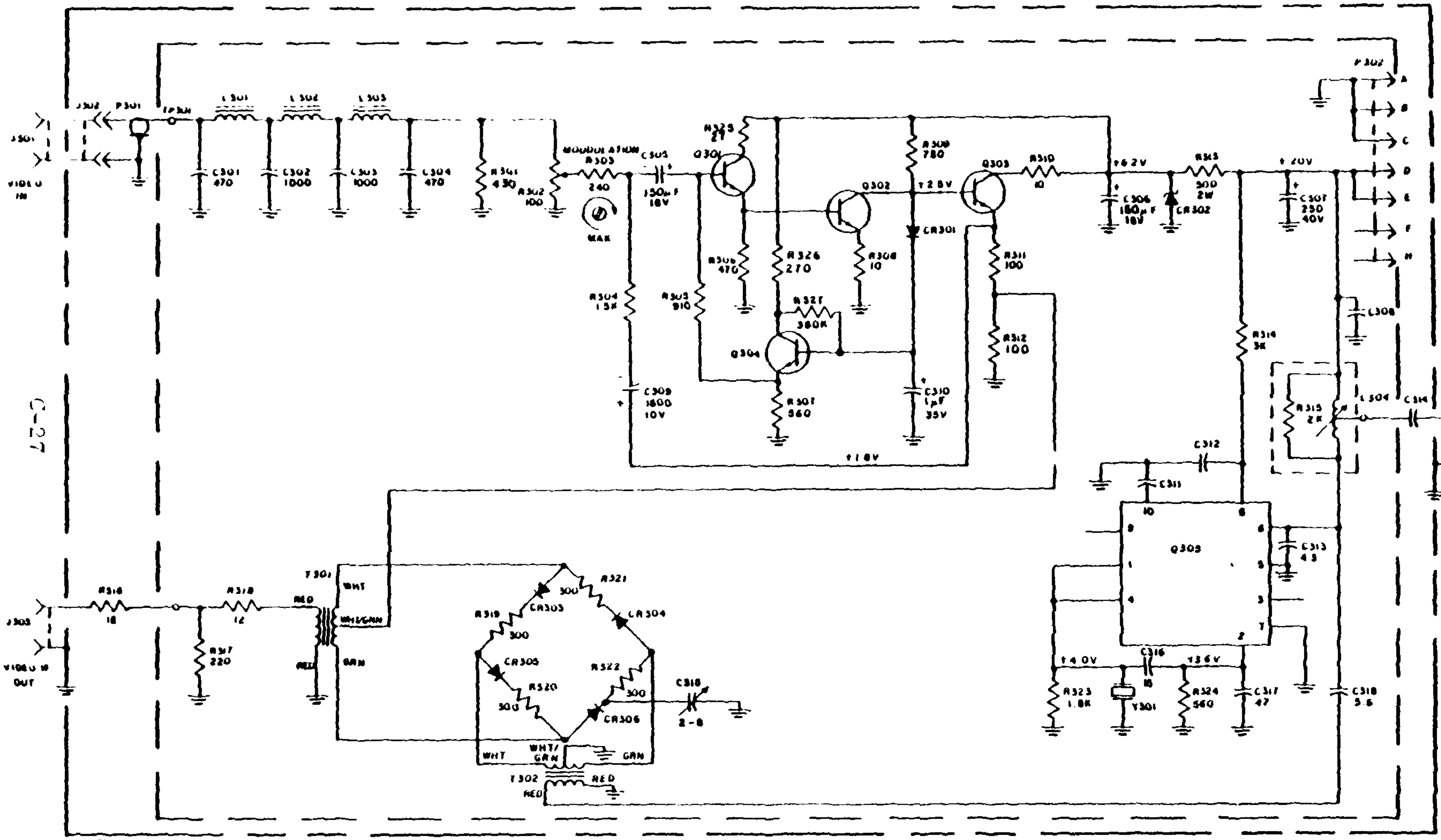
SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No.
CAPACITORS	
C501	S127-160
C502, 506, 510, 538	125-334
C503, 507, 523, 525	124-180
C504, 505, 511	126-091
C508	127 323
C509, 543	124 181
C512, 516, 517, 522, 532, 542, 545	125 301
C513	126 114
C514	126 167
C515, 524, 526	124 164
C518, 521	124-113
C519, 520	126-179
C527, 530, 539	127-319
C528, 531, 536	127 320
C529	124-144
C533	125-333
C534	125-335
C535	125-336
C537	125-700
C540	127 324
C541	126-123
C544, 546	127-321
C547	125-332
C548	127 322
C549	124-062
CONNECTORS	
J501	185-100
J502	185 133
J503	185 144
J504, 505	B821 195
CRYSTAL	
Y501	B139 267
DIODES	
CR501, 502, 507-510, 512, 513, 516, 520, 521, 522	139 211
CR503	137-827
CR504, 505	137 747
CR506	139 268

REPLACEMENT PARTS LIST

MODEL AMM

DRAWING No. E863-131

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No.
CR511	137-684
CR514	137-757
CR515, 518, 519	137-800
CR517	137-826
CR523	137-724
RESISTORS	
R501, 543, 561	112-936
R502, 504, 513, 514, 516, 519, 527, 551, 557, 564	112-977
R503	112-083
R505, 510, 544, 554, 556, 566	112 949
R506, 539	112 064
R507, 535	112 930
R508	112-099
R509	112 998
R511	112 983
R512	112-350
R515, 520, 524, 528, 536, 560	112-095
R517	112-927
R518, 525	112-981
R521, 565	111-006
R522	111-003
R523	112-979
R526	S118-222-02
R529, 545, 562	111-033
R530	112-976
R531	112-968
R532, 555, 558	112 980
R533	112-104
R534	112 093
R537	111-002
R538, 542, 569	112-932
R540, 548, 553	112-359
R541	112 984
R546	112 335
R547	115-313
R549	115-312
R550	S118-226
R552	112-929
R559	112 389
R563	112-994
R567	S118-195
R568	S118-226
TRANSISTORS	
Q501-507, 512, 513	130 166
Q508, 509, 510	130 184
Q511	130-249

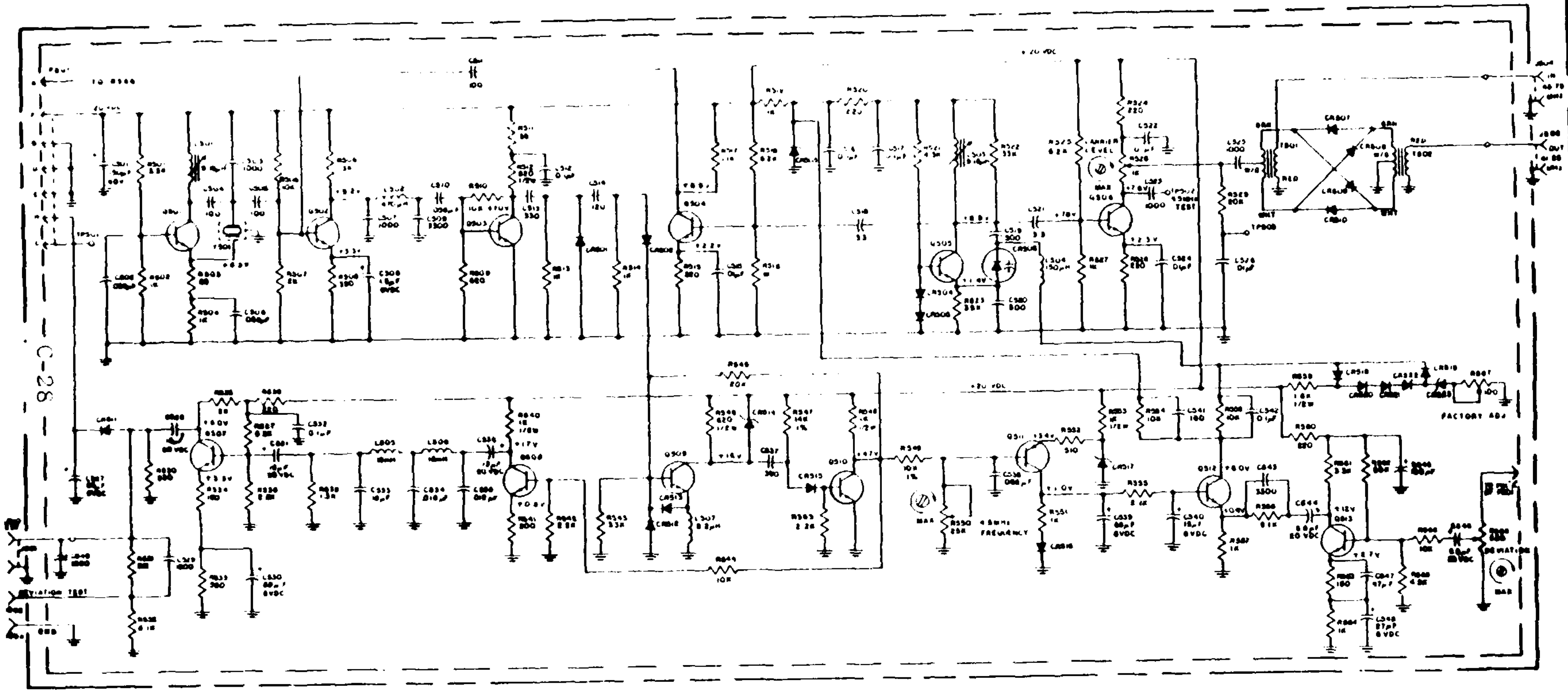


NOTES
1 UNLESS OTHERWISE SPECIFIED,
A ALL RESISTORS ARE IN OHMS, 5%, 1/4W
B ALL CAPACITORS ARE IN PF.
C ALL UNMARKED CAPACITORS ARE .02μF
D ALL VOLTAGES GIVEN IN D C

2 ALL VOLTAGES ARE MEASURED WITH A VTVM TO GROUND

SCHEMATIC
VIDEO MODULATOR
MODEL-VIM

0863-129 REV-D



NOTES
1 UNLESS OTHERWISE SPECIFIED
A ALL CAPACITORS ARE IN pF
B ALL RESISTORS ARE IN OHMS, 5% 1/4 W
C ALL VOLTAGES GIVEN IN DC
2 ALL VOLTAGES ARE MEASURED WITH A VTVM TO GROUND

MODEL AMM
AUDIO MODULATOR
E 863-131 REV-B

REPLACEMENT PARTS LIST
MODEL IFC (SER. 2) LOW-BAND

DRAWING No 863 369

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No
CAPACITORS	
C401, 403	126 237 00
C402	126 100
C404	124 084 00
C406, 408	128 546
C407, 430	128 566
C409	126 188
C410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425	S124 078
C426, 427	124 119 00
C428	S124 078
C429	124 079 00
DIODES	
CR401, 402, 403, 404	137 840
RESISTORS	
R401	112 918
R402, 404	112 954
R403 A, B	S118 600 00
R405, 407	112 080
R406, 416, 420	112 095
R408	112 972
R409, 415, 417	112 081
R410	112 984
R411, R413	112 097
R412	111 012
R414, 419	112 927
R418	112 233
R421	112 083
R422	112 200
R423	112 104
R424	112 966
TRANSFORMERS	
T401, 404	B144 444 00
T402	B144 445 00
T403	B144 447 00
T405, 406, 407	B144 379 02
TRANSISTORS	
Q401, 402	130 604
Q403	S130 199 1
Q404	S130 261 26

REPLACEMENT PARTS LIST
MODEL IFC (SER. 2) HIGH-BAND

DRAWING No. 863 370

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No.
CAPACITORS	
C401, 403	126 237 00
C402	126 100
C404	124 084 00
C405 7, 8, 9	124 120 00
C405 10, 11, 12, 13	124 119 00
C406, 408, 430	128 546
C407 7, 8, 9	124 143 00
C409	128 568
C410 7, 8, 9	124 104 00
C410 10, 11, 12, 13	124 079 00
C411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426	S124 078
C427	124 127 00
C428	124 104 00
C429 7, 8, 9	124 113 00
C429 10, 11, 12, 13	124 064 00
DIODES	
CR401, 402, 403, 404	137 840
RESISTORS	
R401	112 918
R402, 404	112 954
R403 A, B	S118 600 00
R405, 407	112 080
R406, 411, 416	112 095
R408	112 972
R409, 415, 421	112 081
R410	112 984
R412	111 012
R413	112 097
R414, 419	112 927
R417	112 078
R418	112 233
R420	112 994
R422	112 200
R423	112 104
R424	112 966
TRANSFORMERS	
T401, 404	B144 444
T402	B144 445
T403	B144 446
T405, 406	B144 379 02
T407	B144 704
TRANSISTORS	
Q401, 402	130 604
Q403	S130 199 1
Q404	S130 261 26

REPLACEMENT PARTS LIST
MODEL IFC (SER. 2) SUPER-BAND

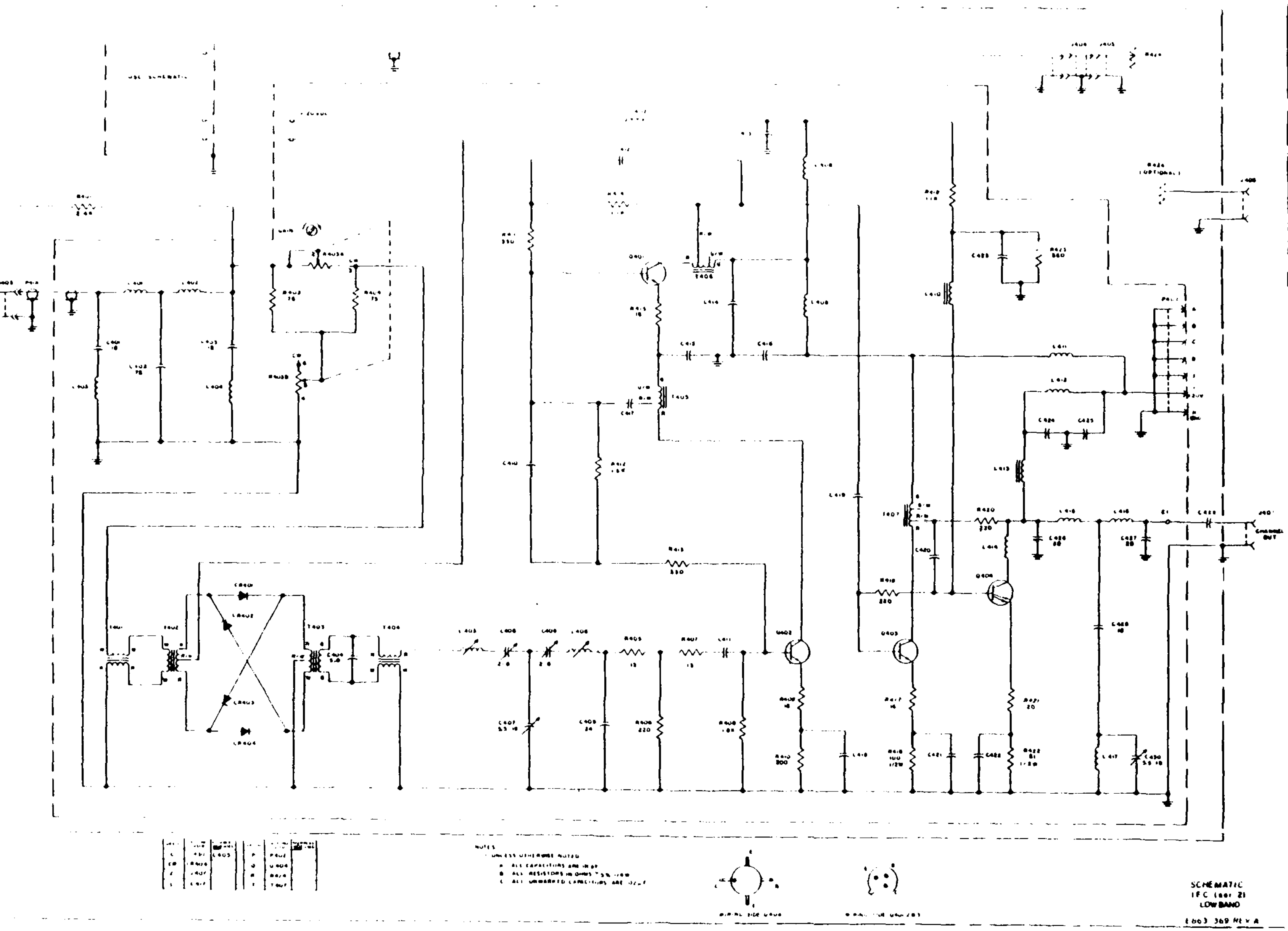
DRAWING No 863 401

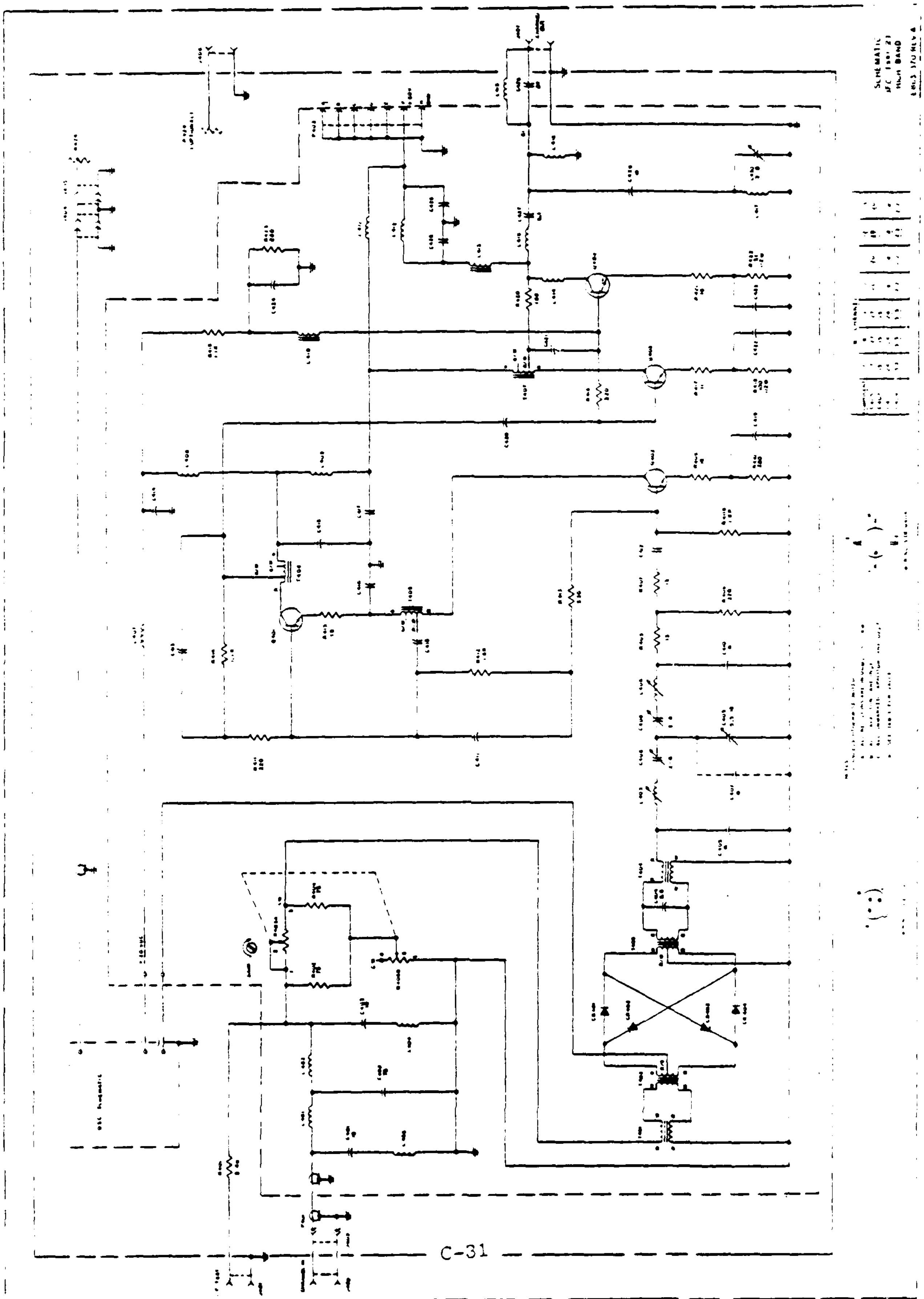
SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No
CAPACITORS	
C401, 403	126 237 00
C402	126 100 00
C404	124 084 00
C405 J, K	124 176 00
C405 L thru O	124 079 00
C405 P, Q, R	124 143 00
C406, 408	128 546
C407 J	126 101 00
C407 K	124 126 00
C407 L, M	124 125 00
C407 N, O	124 176 00
C407 P, Q, R	124 120 00
C409	128 566
C410 J, K	124 176 00
C410 L thru O	124 079 00
C410 P, Q, R	124 143 00
C411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426	S124 078
C427 J thru M	124 084 00
C427 N thru R	124 086 00
C428	128 566 00
C429	124 565 00
C430	124 086 00
DIODES	
CR401, 402, 403, 404	137 840
RESISTORS	
R401	112 918
R402, 404	112 954
R403 A, B	S118 600 00
405, 407	112 080
R406, 411, 416	112 095
R408	112 972
R409, 415	112 079
R410	112 984
R412	111 012
R413	112 097
R414, 419	112 927
R417	112 200

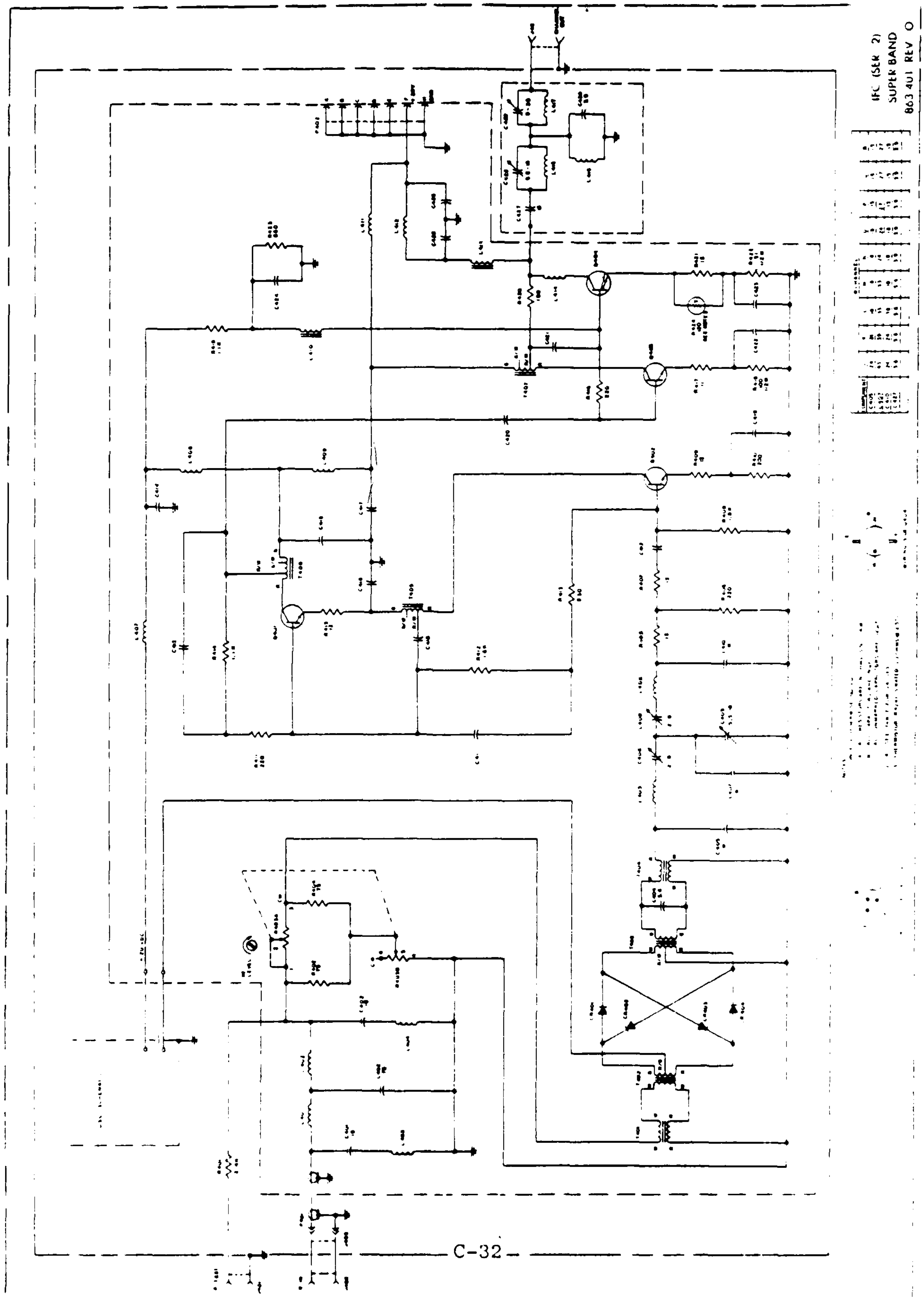
REPLACEMENT PARTS LIST
MODEL IFC (SER. 2) SUPER-BAND

DRAWING No 863 401

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No
R418	112 233
R420	112 994
R421	112 081
R422	112 200
R423	112 104
R424	110 155
TRANSFORMERS	
T401, 404	B144 444
T402	B144 445
T403	B144 446
T405	B144 379 02
T406	B144 470
T407	B144 471
TRANSISTORS	
Q401, 402	S140 261 26
Q403	S130 199 1
Q404	130 604


SCHEMATIC
LOW BAND




IFC (SER 2)
SUPER BAND
863 401 REV O

REPLACEMENT PARTS LIST

MODEL IFC (SER. 2) SUB-BAND

DRAWING No. E863 388

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No
CAPACITORS	
C401, 403	126 237 00
C402	126 100
C404	124 084 00
C405 T7	124 104
C405 T8, 9, 10	124 079 00
C405 T11	124 137
C406 T7	126 029
C406 T8	126 167
C406 T9	126 103
C406 T10	126 098
C406 T11	126 125
C407 T7	126 122
C407 T8	126 167
C407 T9	126 100
C407 T10	126 236 00
C407 T11	126 113
C408 T7	126 029
C408 T8	126 167
C408 T9	126 103
C408 T10	126 098
C408 T11	126 125
C409	126 188
C410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 428	S124 078
C426 T7, 8	126 097
C426 T9, 10, 11	126 107
C427 T7, 8	126 097
C427 T9, 10, 11	126 099
DIODES	
CR404, 402, 403, 404	137 840
RESISTORS	
R401	112 918
R402, 404	112 954
R403 A, B	S118 600 00

REPLACEMENT PARTS LIST

MODEL IFC (SER. 2) SUB-BAND

DRAWING No. E863 388

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No
RESISTORS	
R405, 407	112 080
R406, 416, 420	112 095
R408	112 972
R409, 415, 417	112 081
R410	112 984
R411, 413	112 097
R412	111 012
R414, 419	112 927
R418	112 233
R421	112 083
R422	112 200
R423	112 104
TRANSFORMERS	
T401	B144 444 00
T402	B144 445 00
T403 T7, 8	B144 447 01
T403 T9, 10, 11	B144 447 00
T404 T7, 8	B144 444 01
T404 T9, 10, 11	B144 444 00
TRANSISTORS	
Q401, 402	730 604
Q403	S130 199 1
Q404	S130 261 26

REPLACEMENT PARTS LIST

MODEL IFC (SER. 2) MID-BAND

DRAWING No. 863 396

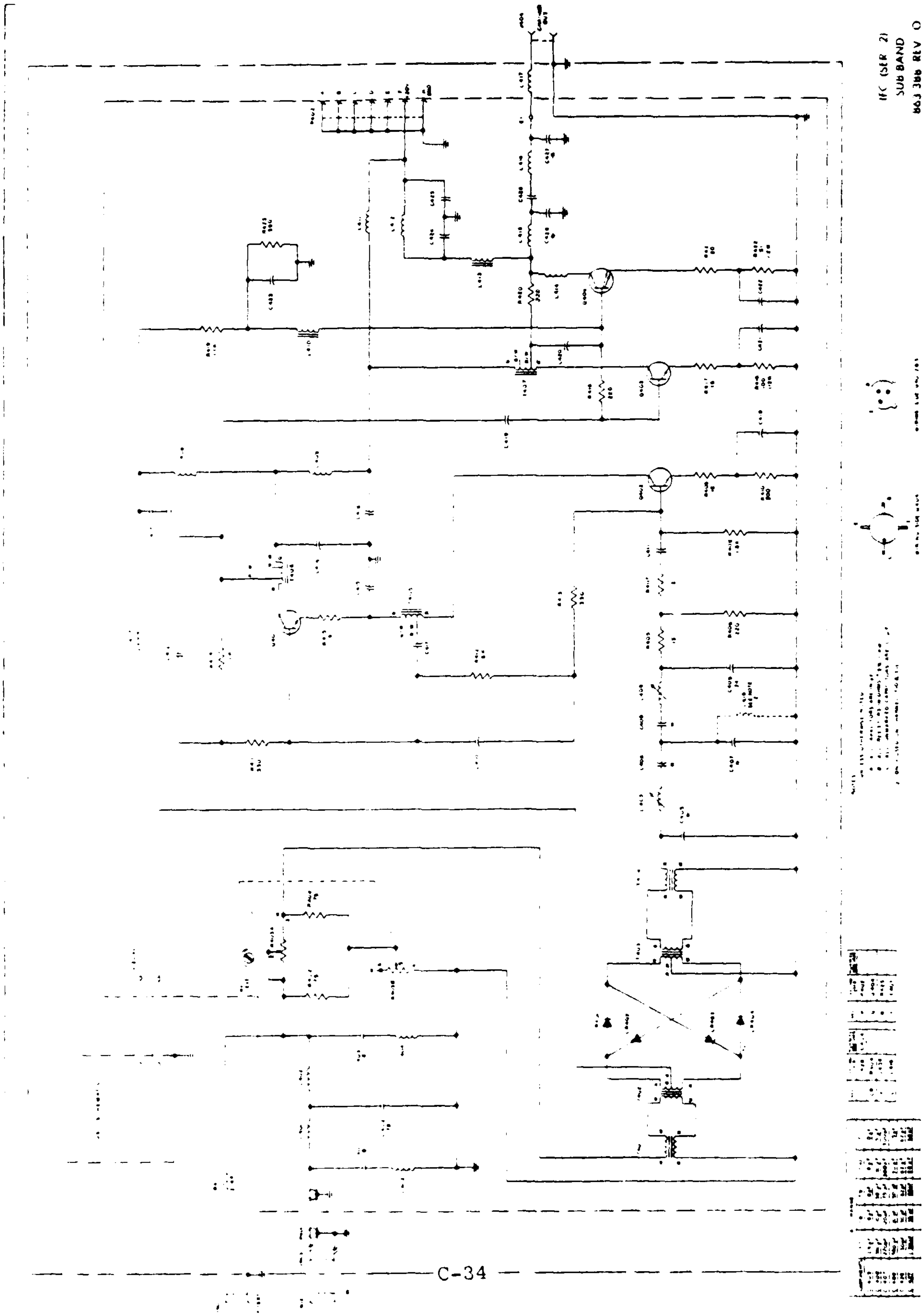
SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No
CAPACITORS	
C401, 403	126 237 00
C402	126 100 00
C404	124 084 00
C405 A, B	126 101 00
C405 C, D, E	124 126 00
C405 F	124 121 00
C405 G, H, I	126 188 00
C406, 408, 430 A, B, C, D	128 546
C407 A	124 121 00
C407 B	126 233 00
C407 C, D, E, F	124 125 00
C407 G, H, I	126 188 00
C409	126 566
C410 A thru H	124 121 00
C410 I	126 188 00
C411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 428	S124 078
C429	124 103 00
C431	124 103 00
C432	124 119 00
C433	124 143 00
C434, 435	128 565 00
C436	124 064 00
DIODES	
CR401, 402, 403, 404	137 840
RESISTORS	
R401	112 918
R402, 404	112 954
R403 A, B	S118 600 00
R405, 407	112 080
R406, 411, 416	112 095
R408	112 972
R409, 415, 421	112 081
R410	112 984

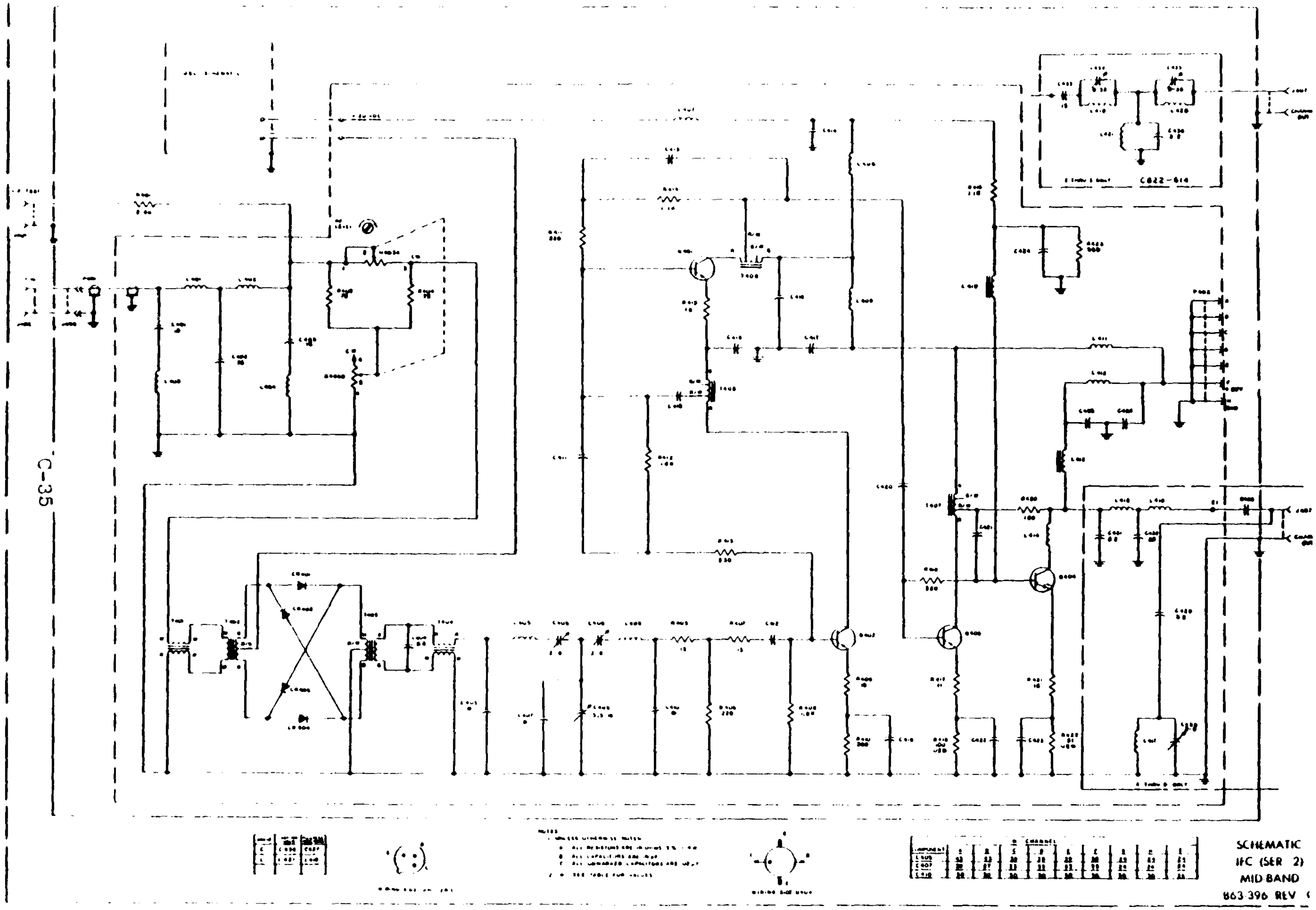
REPLACEMENT PARTS LIST

MODEL IFC (SER. 2) MID-BAND

DRAWING No. 863 396

SCHEMATIC DESIGNATIONS OR PART DESCRIPTIONS	JERROLD PART No.
R412	111 012
R413	112 097
R414, 419	112 927
R417	112 078
R418	112 233
R420	112 994
R422	112 200
R423	112 104
TRANSFORMERS	
T401, 404	B144 444
T402	B144 445
T403	B144 446
T405, 406, 407	B144 379 02
TRANSISTORS	
Q401, 402	130 604
Q403	S130 199 1
Q404	S130 261 26


SUB BAND


C822-614
SCHEMATIC
IFC (SER 2)
MID BAND
863 396 REV

JERROLD ELECTRONICS CORPORATION
A subsidiary of
GENERAL INSTRUMENT CORPORATION

Instruction Sheet
435-849-00

" UNI - DEMOD "

TELEVISION DEMODULATOR Model UD-283 A

DESCRIPTION

Model UD-283A is designed for receiving all OFF-AIR television signals in the VHF and UHF bands. Tuning is accomplished by modern varactor type tuners for all 12 VHF channels and for 8 UHF channels which can be preset by the user as required. The demodulator has automatic fine tuning circuitry (AFT) for proper frequency acquisition and for providing the feedback necessary to maintain the quality of video and audio signals. The video IF, sound IF audio, sound AFT, and metering circuits are individual plug-in type cards for easy servicing. The unit provides audio monitoring via a front panel speaker and video monitoring via the rear panel auxiliary output jack.

SPECIFICATIONS

RF INPUT	TV channels 2 through 13 and any 8 preselectable UHF channels; separate 75Ω VHF and UHF inputs.
RF TUNERS	Varactor type with automatic fine tuning (AFT).
RF SENSITIVITY	0 dBmV for high quality output.
NOISE FIGURE , average	VHF: 9 dB; UHF: 12 dB .
AUTOMATIC GAIN CONTROL	Amplified sync derived.
IF REJECTION	60 dB.
VIDEO IF: Bandwidth	3.8 MHz at -6dB , for best group delay.
Adjacent Chl. Rejection	Video: 50 dB; Sound: 60 dB.
VIDEO OUTPUT: main output	1 V p-p; with ±6 dB level control range.
auxiliary output	1 V p-p fixed, for monitoring.
AUDIO OUTPUT: main output	600 Ω unbalanced , with audio level control, front panel loudspeaker and volume control monitoring.
auxiliary output	600 Ω unbalanced for remote monitoring of AFT action .
RF TERMINAL MATCH, at 75 Ω	15 dB minimum return loss, all terminals.
POWER REQUIREMENTS	117 V, 60 Hz, ±10%, approx. 10 W.

INSTALLATION

1. Unpack the equipment and visually inspect it to ensure that no external damage was caused during transport.
2. Install the unit in a 19 inch standard relay rack or cabinet; use the four 3/8" x 10-32 nickel-plated mounting screws provided in the accessory bag.

OPERATIONAL SET-UP

1. Make sure the PWR switch is in the "off" position and that the fuse on the rear panel is properly seated; then plug the line cord into a 117 V 3-wire (grounded) outlet.
2. Connect the coaxial cables, equipped with " F " type connectors, carrying the VHF and UHF

signals to their associated rear panel terminals.

3. Connect the video and audio outputs to a TV monitor or to a modulator which feeds a standard TV receiver. If desired, connect equipment for remote monitoring of AFT action to terminal #2 on the rear panel. If desired, connect a TV monitor to the AUX video output terminal on the rear panel.

CHART OF CONTROL AND CONNECTOR FUNCTIONS

a. Rear Panel	
INPUTS, VHF	Off-air VHF channel input, 75 Ω "F" type fitting.
UHF	Off-air UHF channel input, 75 Ω "F" type fitting.
VIDEO OUTPUTS, MAIN	Video output, single channel, 75Ω SO-239 type fitting.
AUX	Video output, fixed 1 V p-p level, 75Ω SO-239 type fitting, for on-line video monitoring.
AUDIO OUTPUT, terminal #1	600 Ω unbalanced audio output.
terminal #2	Remote AFT monitoring.
terminal #3	common ground.
1 2 A SLO-BLO	Line fuse.
b. Front Panel	
PWR, ON	Lighted rocker switch applies AC to unit.
Channel Selector	Rotary Switch for selection of desired channel (A-H for UHF)
FINE TUNING	Thumbwheel type control for presetting and fine-tuning of desired channel.
AFT, ON	Applies AFT operating mode.
OFF	Bypasses AFT circuitry.
LEVEL, VIDEO	Permits adjustment of MAIN video output level.
AUDIO	Permits adjustment of AUDIO OUTPUT level at terminal #1 on rear panel with terminal #3 as common ground.
MONITOR VOLUME	Volume control for front panel loudspeaker.
Meter Mode Switch, AFT	Indicates VU-Meter status of AFT action.
VIDEO	Indicates VU-Meter status of video output level.
AUDIO	Indicates VU-Meter status of audio output level.

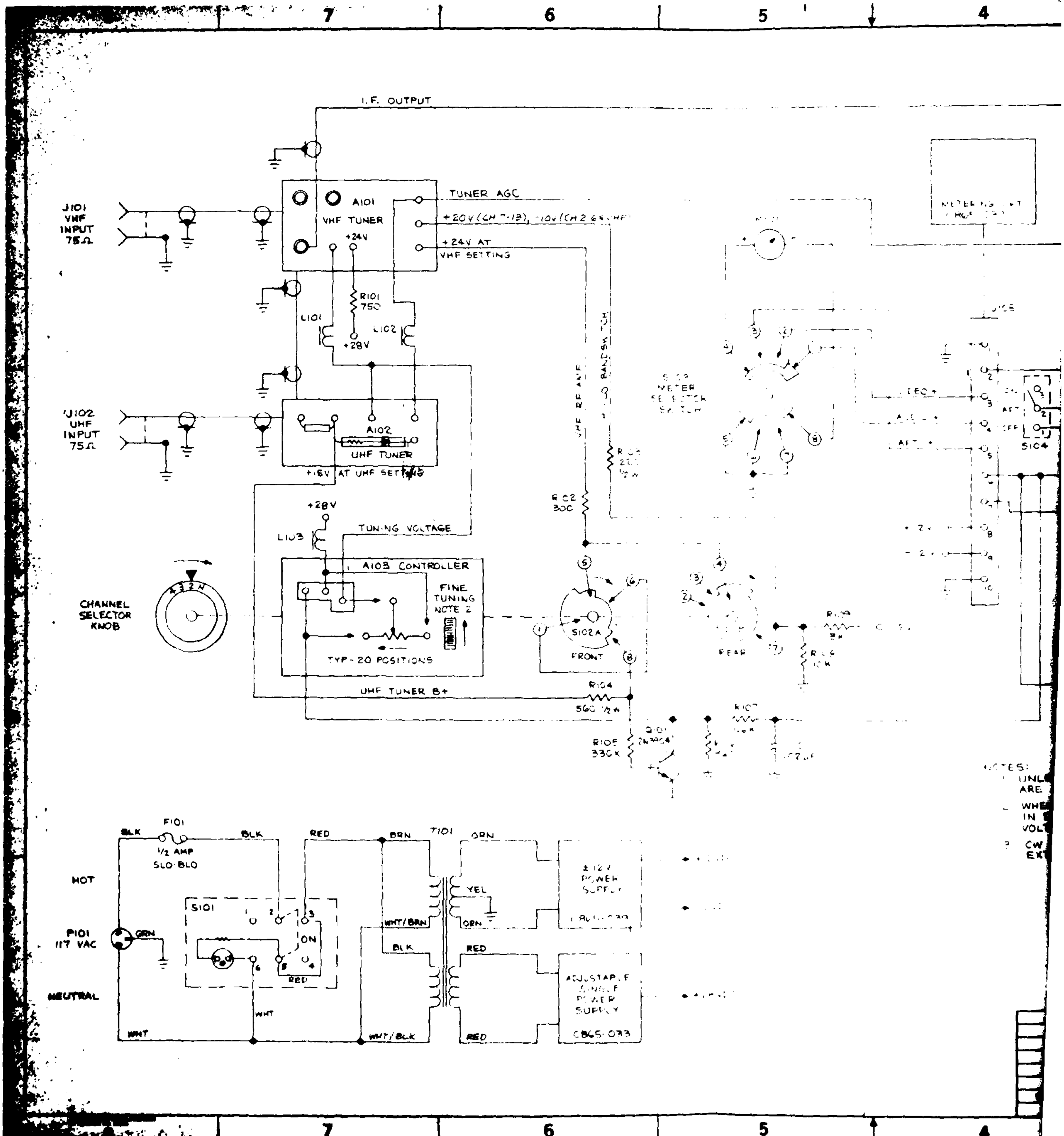
4. Set the PWR switch to the ON position and allow 30 minutes warm-up for the oscillator circuitry to stabilize with normal operating temperature.
5. Set the AFT toggle switch to the OFF position.
6. Turn the channel selector to the desired channel; the channel number (2-13, or 14 to 83 group) will also appear in the slot of the FINE TUNING control.
7. Use the thumbwheel for placing the red indicator in the slot at the top or the right hand edge of the channel number in the FINE TUNING control.
8. Check the TV monitor or TV receiver for best picture while adjusting the FINE TUNING control thumbwheel.
9. Set the metering mode switch to the AFT position and the AFT switch to the ON position; now check the position of the indicator on the VU-meter and use the FINE TUNING control for checking that the indicator will swing above and below center of scale. Then set the control for centering the indicator.
10. Set the metering mode switch to the VIDEO position and adjust the VIDEO LEVEL control for center scale indication on the Vu-meter. At this indication, the unit is calibrated to deliver a 1 V p-p video signal at the MAIN video output terminal.

11. Set the metering mode switch to the AUDIO position and adjust the AUDIO LEVEL control center scale indication on the Vu-meter. Note that at this indication the unit is calibrated to deliver a 0 dBm audio signal at terminal #1 on the rear panel.

This completes the installation and operational set-up of Model UD-283A.

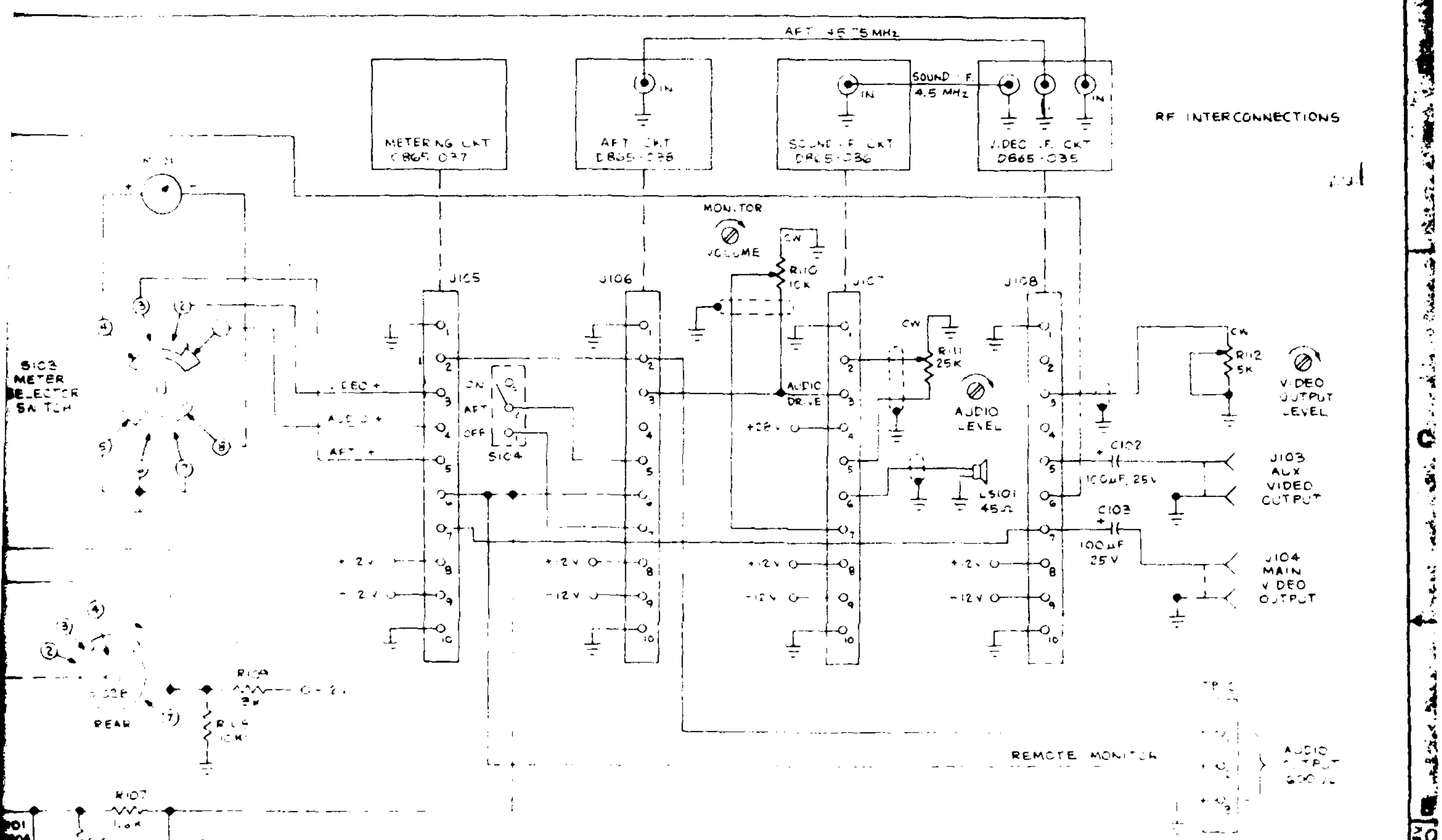
NOTE: Any Model UD-283A units requiring repair should be shipped, with freight and insurance charges prepaid, to : Jerrold Electronics Corporation, Factory Parts and Service Dept., 1322 Atlantic Street, North Kansas City, Mo. 64116.

All data subject to change without notice.



7
6
5
4
I.F. OUTPUT
J101
VHF
INPUT
75Ω
A101
VHF TUNER
TUNER AGC
+24V AT
VHF SETTING
+24V
R101
750
L101
L102
+28V
J102
UHF
INPUT
75Ω
A102
UHF TUNER
AT UHF SETTING
+28V
L103
TUNING VOLTAGE
A103 CONTROLLER
FINE
TUNING
NOTE 2
TYP-20 POSITIONS
CHANNEL
SELECTOR
KNOB
S102A
FRONT
REAR
UHF TUNER B+
R104
560 ½W
R106
330K
S104
NOTES:
F101
½ AMP
SLO-BLO
BLK
RED
BRN
T101
ORN
YEL
HOT
P101
117 VAC
NEUTRAL
S101
ON
WHT
WHT/BRN
WHT/BLK
GRN
ADJUSTABLE
POWER
SUPPLY
CB65-033

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	0	REL TO PROD	7-26-78	



NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCES ARE IN OHMS, 5%, 1/4 W.
2. WHEN THUMBWHEEL OF CONTROLLER A103 IS ROTATED IN DIRECTION INDICATED BY ARROW, WIPER OF TUNING VOLTAGE POTENTIOMETER MOVES TOWARD LEFT AS SHOWN.
3. CW INDICATES POTENTIOMETER WIPER POSITION AT EXTREME CLOCKWISE ROTATION.

SCHEMATIC
TELEVISION DEMODULATOR
MODEL UD 283A

NEXT ASSY	USED ON
	UD 283A

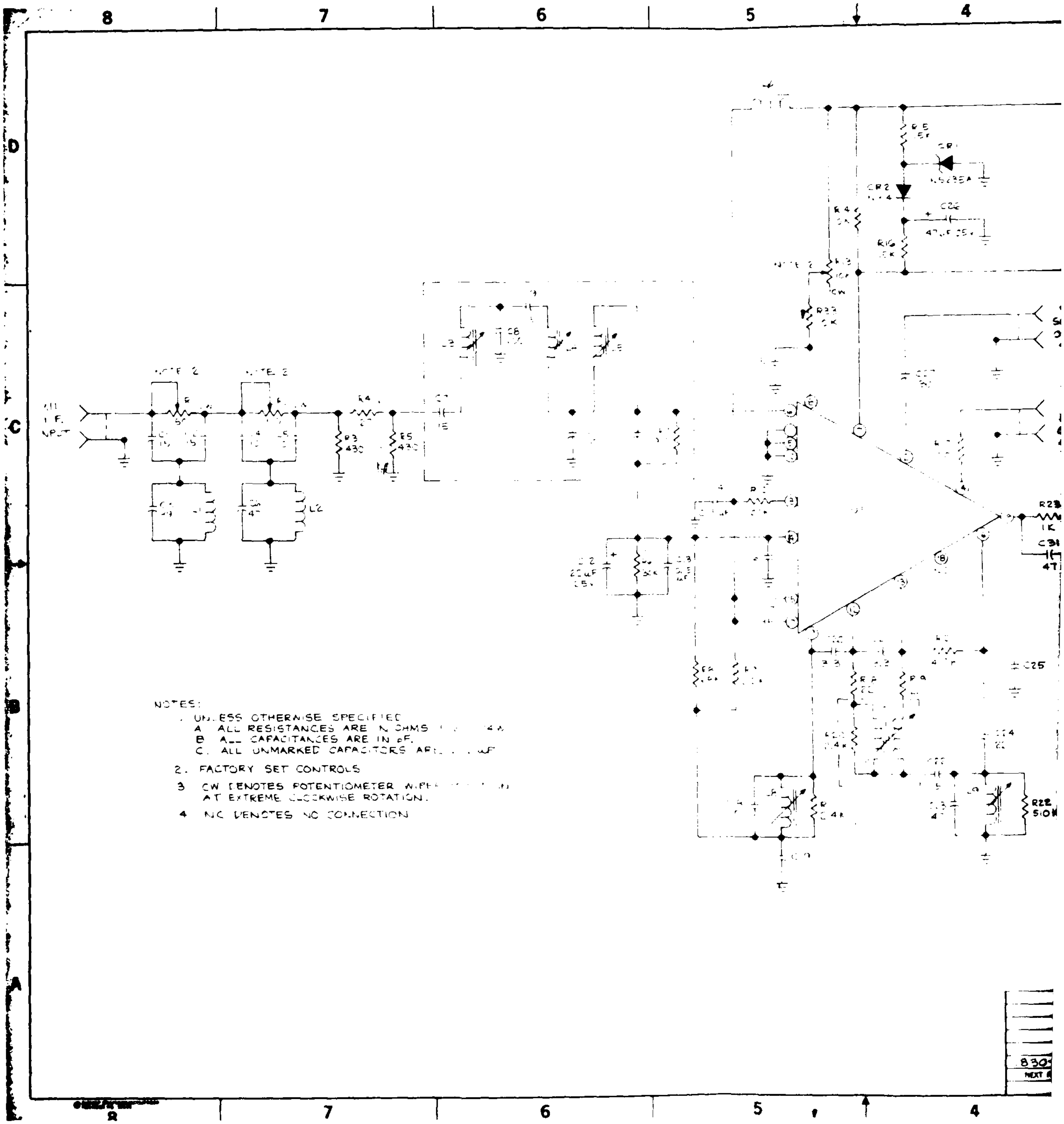
APPLICATION

DO NOT SCALE DRAWING

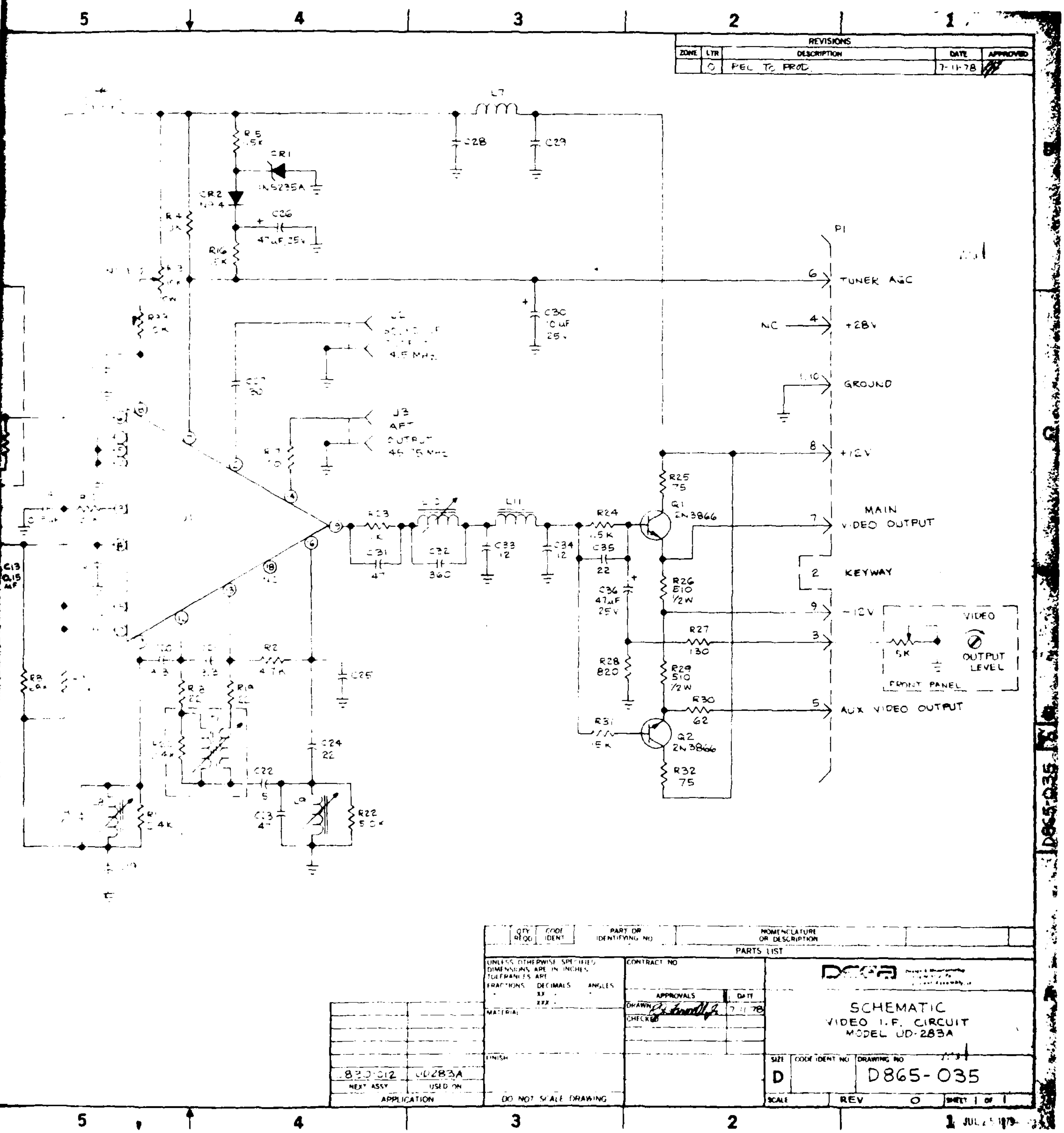
SIZE D DRAWING NO D865-043

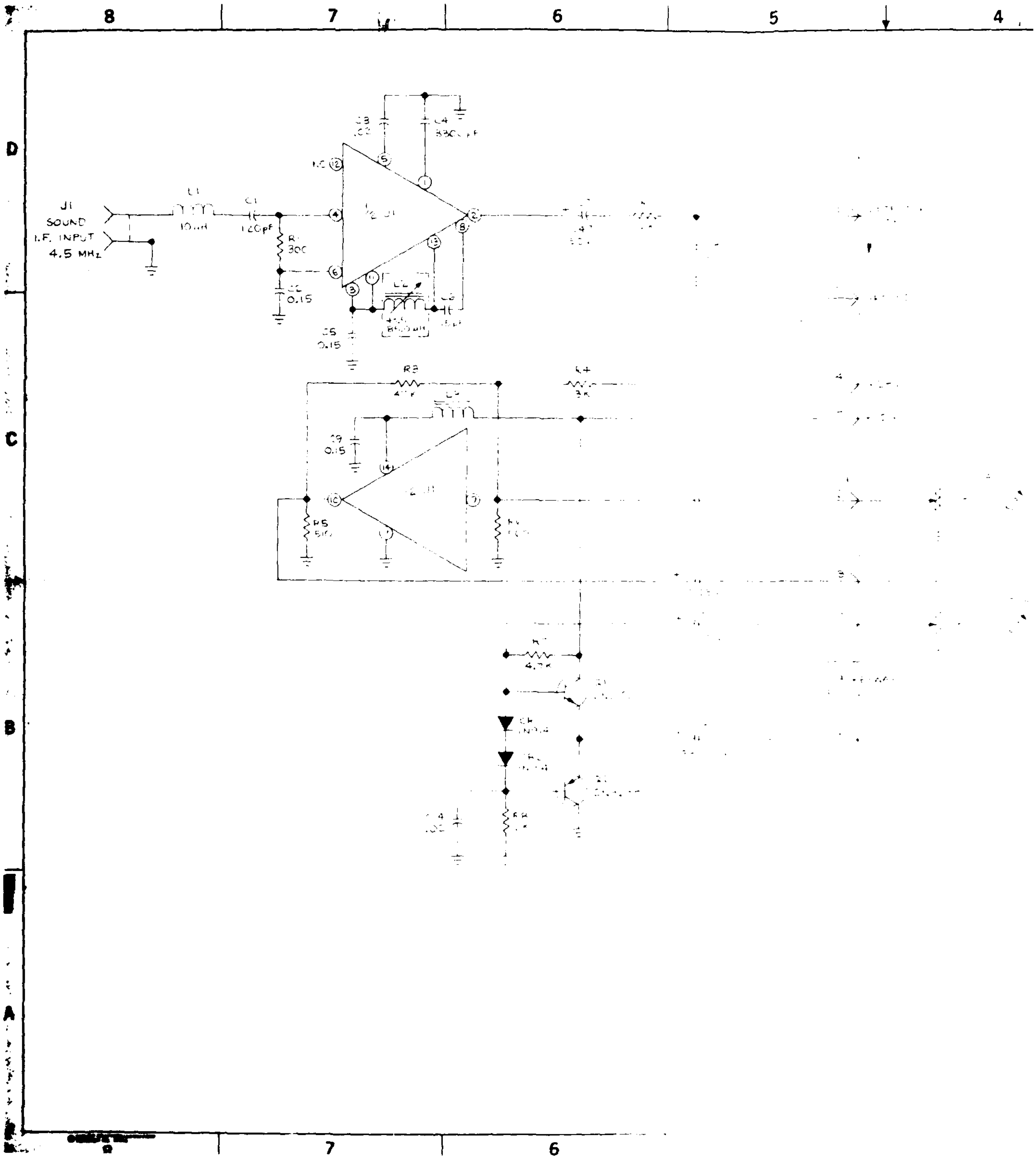
REV 0 SHEET 1 OF 1

D865-043



8
7
6
5
4
D
C
B
A
J11
I.F.
INPUT
NOTE 2
R3
430
R5
430
L2
CR1
CR2
C22
47uF 25V
R16
NOTE 2
CW
R23
1K
C31
C25
R22
510K
830
NOTES:
1. UNLESS OTHERWISE SPECIFIED
A ALL RESISTANCES ARE IN OHMS
B ALL CAPACITANCES ARE IN pF.
C. ALL UNMARKED CAPACITORS ARE
2. FACTORY SET CONTROLS
3 CW DENOTES POTENTIOMETER WIPER
AT EXTREME CLOCKWISE ROTATION.
4 NC DENOTES NO CONNECTION


REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVED
O | REL TO PROD | 7-11-78
L7
C28
C29
R5
1.5K
CR1
1N5235A
CR2
C26
47uF,25V
R16
P1
6 TUNER AGC
NC 4 +28V
GROUND
C30
10uF
25V
J3
AFT
OUTPUT
45.75 MHz
4.5 MHz
8 +12V
R25
75
Q1
2N3866
R24
1.5K
7 MAIN VIDEO OUTPUT
R23
1K
L11
C31
47
C32
360
C33
12
C34
12
C35
22
C36
47uF
25V
2 KEYWAY
R26
510
1/2W
9 -12V
R27
130
3
VIDEO
5K
OUTPUT LEVEL
FRONT PANEL
R28
820
R29
510
1/2W
R30
62
5 AUX VIDEO OUTPUT
R31
1.5K
Q2
2N3866
R32
75
C13
0.15 MF
R2
4.7K
C25
C24
22
C22
5
R22
5.0K
L9
R1
2.4K
QTY REQD | CODE IDENT | PART OR IDENTIFYING NO | NOMENCLATURE OR DESCRIPTION
PARTS LIST
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
FRACTIONS DECIMALS ANGLES
CONTRACT NO
APPROVALS DATE
DRAWN 7-11-78
CHECKED
MATERIAL
FINISH
SCHEMATIC
VIDEO I.F. CIRCUIT
MODEL UD-283A
SIZE D
CODE IDENT NO
DRAWING NO D865-035
SCALE
REV O
SHEET 1 OF 1
D830-012 | UD283A
NEXT ASSY | USED ON
APPLICATION
DO NOT SCALE DRAWING
D865-035



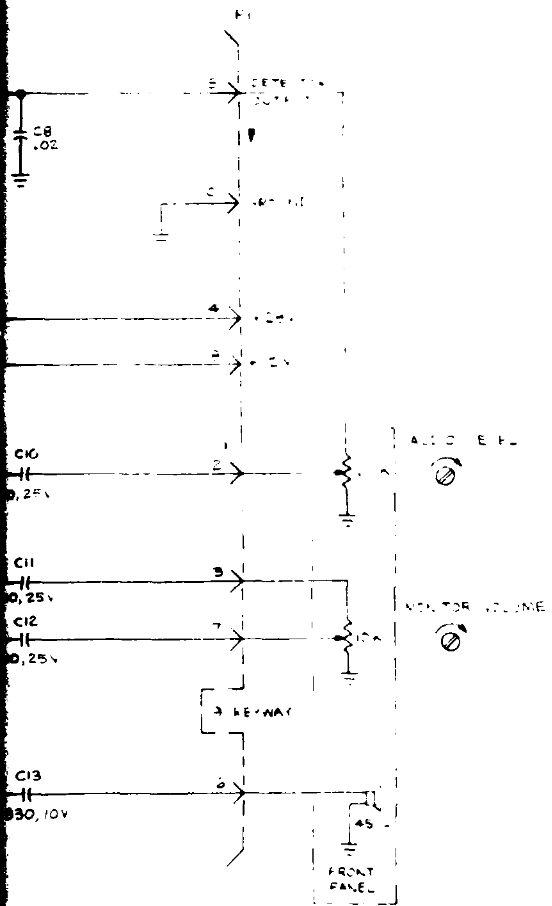
8
7
6
5
4
D
C
B
A
J1
SOUND
I.F. INPUT
4.5 MHz
L1
C1
120pF
R1
300
C2
0.15
C3
.02
C5
0.15
R3
R4
3K
C9
0.15
R5
510
R7
4.7K

AD-A090 770 GENERAL ELECTRIC CO UTICA NY AIRCRAFT EQUIPMENT DIV F/G 17/2
WIDEBAND MULTIPLEX SYSTEM.(U)
JUN 80 N62269-79-C-0037
UNCLASSIFIED NL

2 OF 2
AD A
090770

END
DATE FILMED
11-80
DTIC

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	O	REL TO PROD	7-12-78	



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
A. ALL RESISTANCES ARE IN OHMS, ±5%, 1/4W.
B. ALL CAPACITANCES ARE IN µF.
2. NC DENOTES NO CONNECTION.

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION

PARTS LIST

NEXT ASSY	USED ON
C830-009	UD-283A

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS ± DECIMALS XX ± XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO

APPROVALS	DATE
DRAWN	7-12-78
CHECKED	

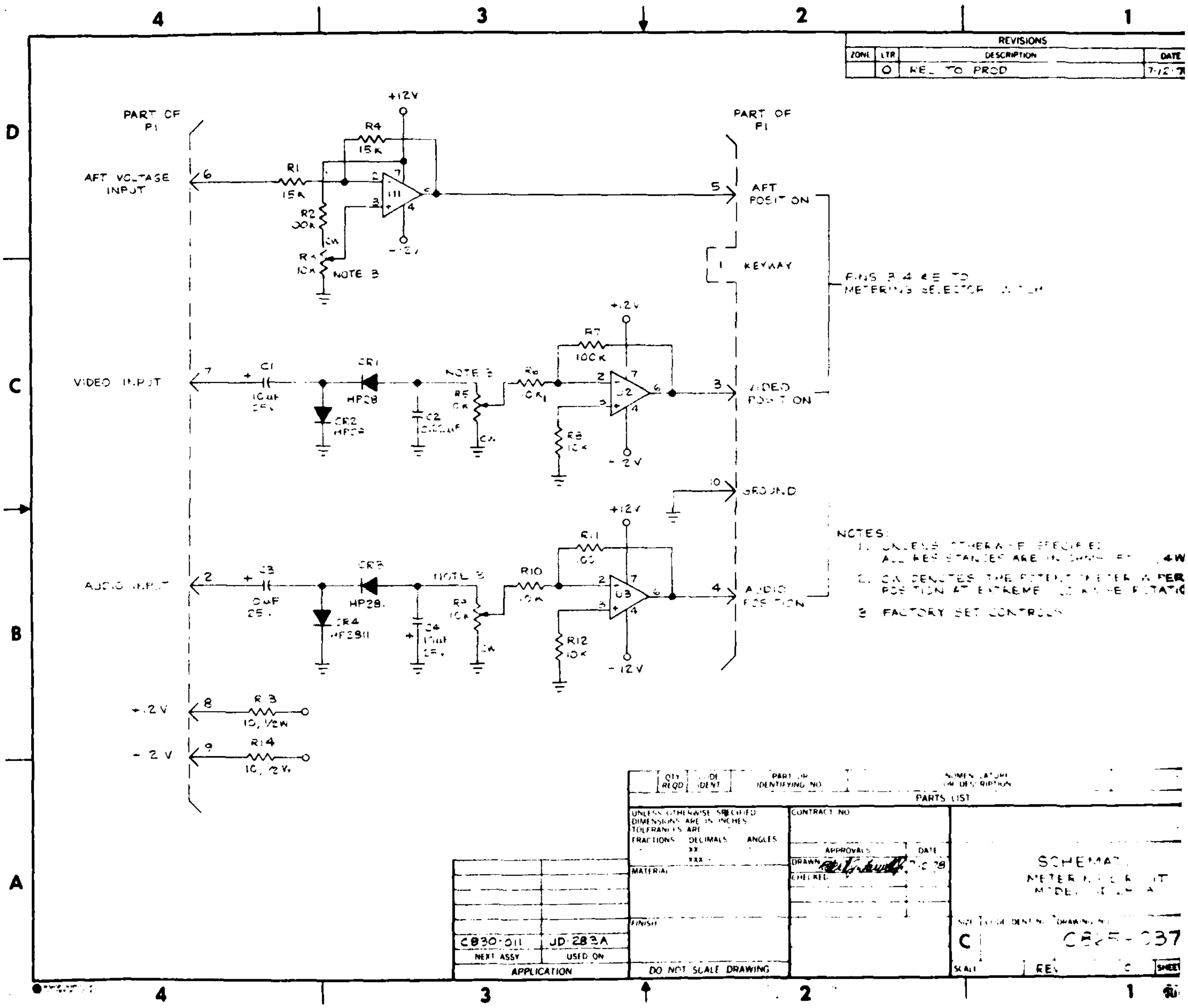
SCHEMATIC
SOUND I.F. CIRCUIT
MODEL UD-283A

SIZE	CODE IDENT NO	DRAWING NO
D		D865-036

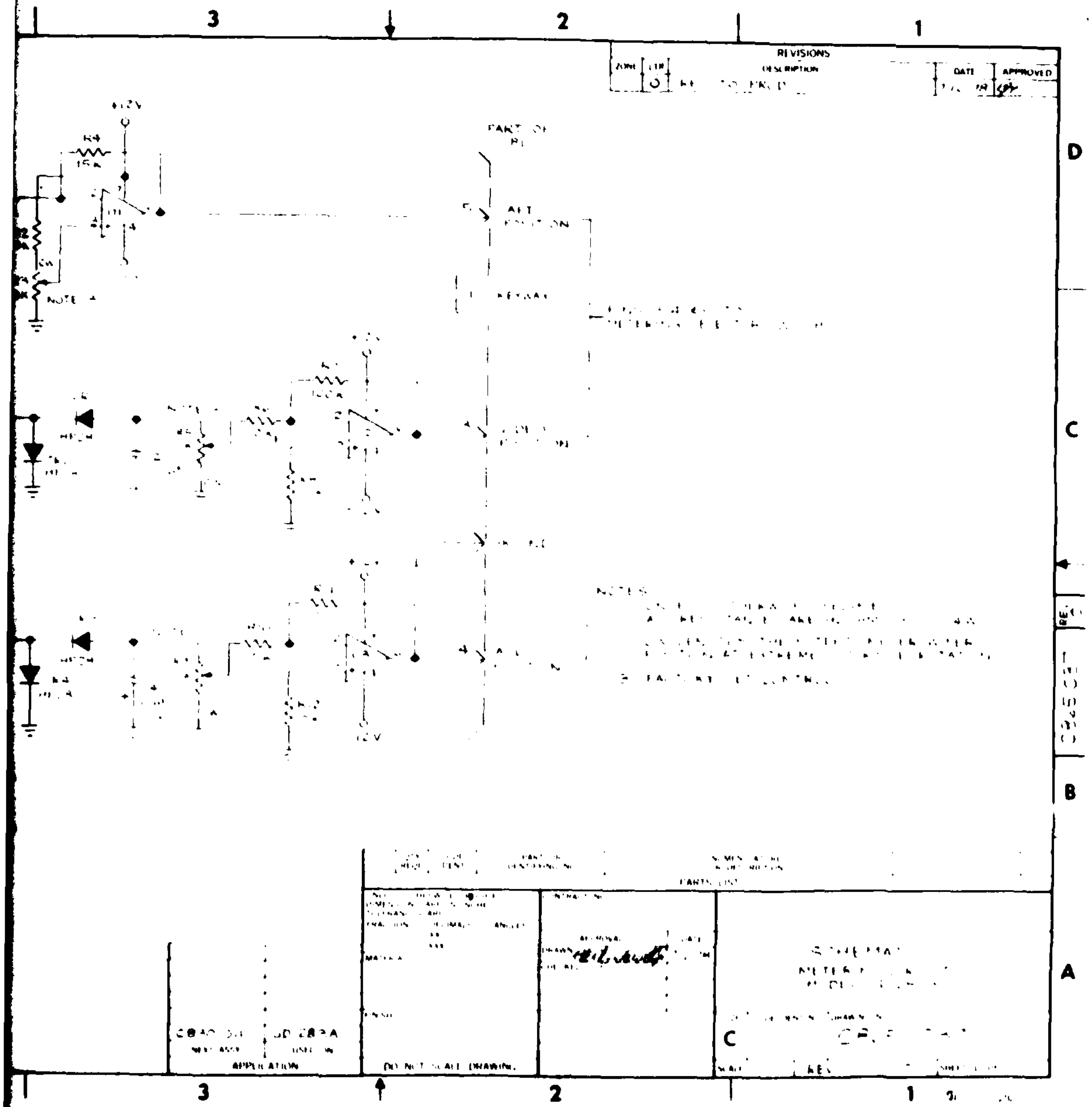
SCALE | REV O | SHEET 1 OF 1

... 25 1979

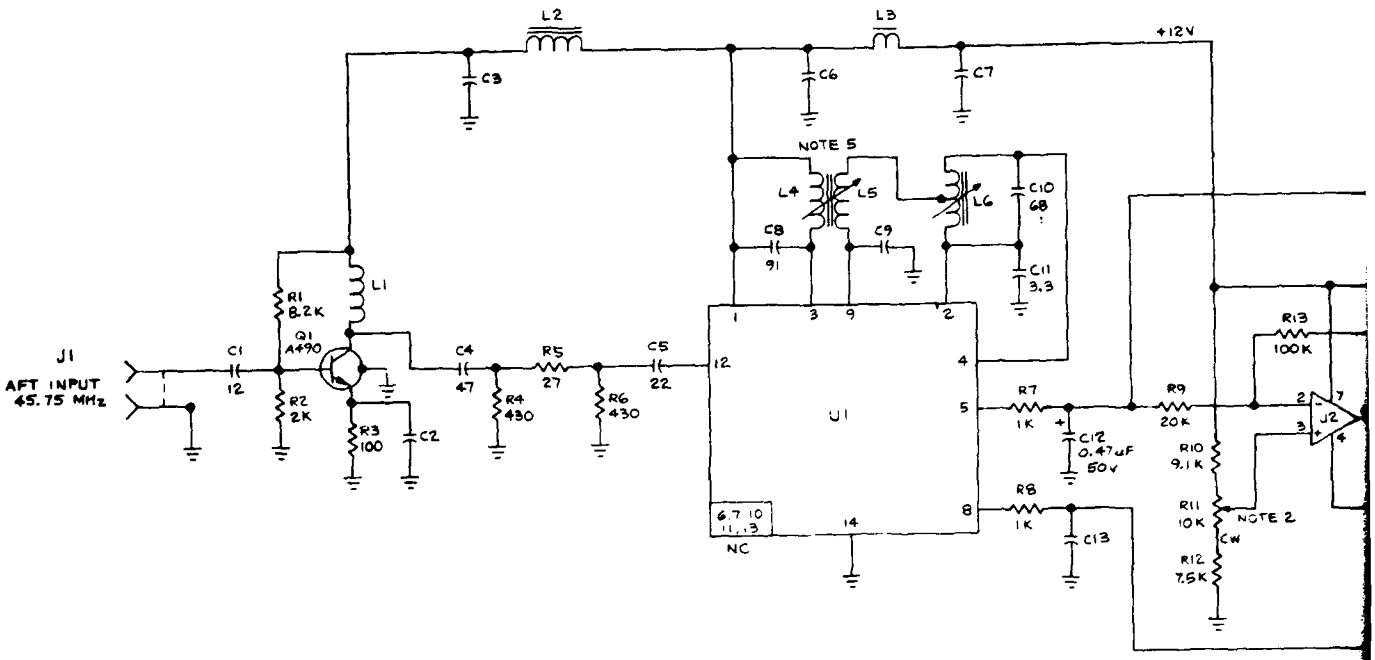
D865-036 REV O

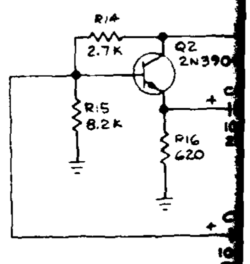


REVISIONS
ZONE | LTR | DESCRIPTION | DATE
O | REL TO PROD
PART OF P1
AFT VOLTAGE INPUT
VIDEO INPUT
AUDIO INPUT
AFT POSITION
KEYWAY
VIDEO POSITION
GROUND
AUDIO POSITION
NOTES:
3. FACTORY SET CONTROLS
C830-011
JD-283A
NEXT ASSY
USED ON
APPLICATION
DO NOT SCALE DRAWING
PARTS LIST
CONTRACT NO
APPROVALS
DRAWN
CHECKED
MATERIAL
FINISH
SCHEMATIC



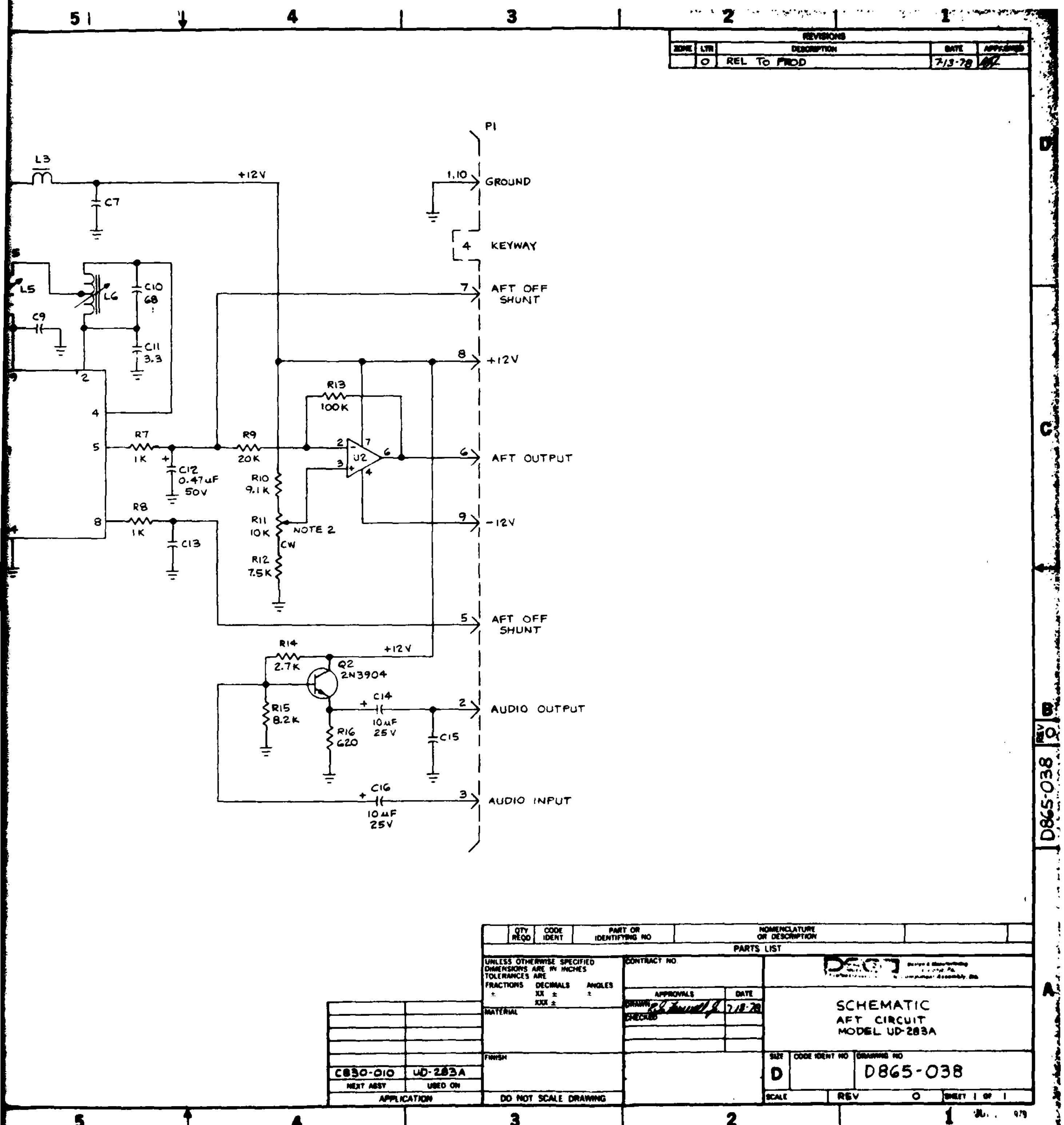
REVISIONS
DESCRIPTION
DATE
APPROVED
+12V
R4
15K
PART OF R1
ALT
NOTE 4
NOTES
PARTS LIST
APPLICATION
DO NOT SCALE DRAWING



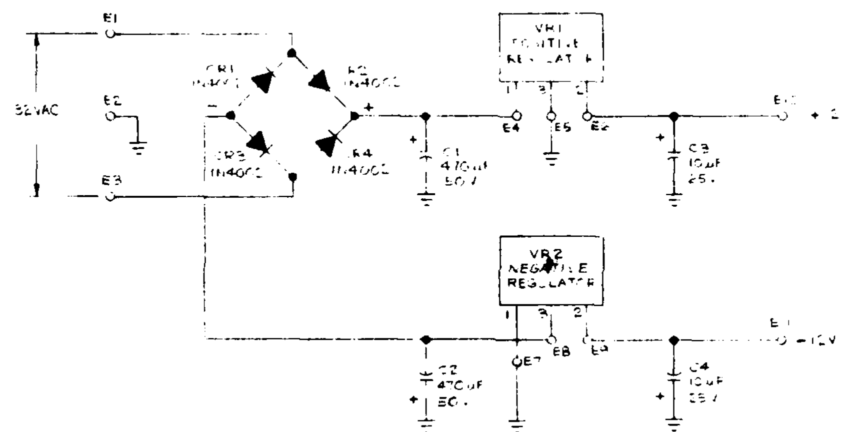


NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   A. ALL RESISTANCES ARE IN OHMS 5%, 1/4 W
   B. ALL CAPACITANCES ARE IN pF.
   C. ALL UNMARKED CAPACITORS ARE .02 uF.
2. FACTORY SET CONTROL
3. NC DENOTES NO CONNECTION.
4. CW DENOTES POTENTIOMETER WIPER POSITION AT EXTREME CLOCKWISE ROTATION.
5. L4 & L5 ARE TWO SEPARATE COILS WOUND ON ONE FORM.


REVISIONS
ZONE LTR DESCRIPTION DATE APPROVED
O REL TO PROD 7-13-78
P1
L3
+12V
C7
1,10 GROUND
4 KEYWAY
L5
L6
C10 68
C9
C11 3.3
7 AFT OFF SHUNT
8 +12V
R13 100K
R7 1K
C12 0.47uF 50V
R9 20K
U2
6 AFT OUTPUT
R10 9.1K
R11 10K
NOTE 2
CW
R12 7.5K
R8 1K
C13
9 -12V
5 AFT OFF SHUNT
R14 2.7K
+12V
Q2 2N3904
R15 8.2K
C14 10uF 25V
R16 620
C15
2 AUDIO OUTPUT
C16 10uF 25V
3 AUDIO INPUT
QTY REQD
CODE IDENT
PART OR IDENTIFYING NO
NOMENCLATURE OR DESCRIPTION
PARTS LIST
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
FRACTIONS DECIMALS ANGLES
MATERIAL
FINISH
CONTRACT NO
APPROVALS DATE
DRAWN 7-18-78
CHECKED
SCHEMATIC
AFT CIRCUIT
MODEL UD-283A
SIZE D
CODE IDENT NO
DRAWING NO D865-038
SCALE
REV O
SHEET 1 OF 1
C830-010
UD-283A
NEXT ASSY
USED ON
APPLICATION
DO NOT SCALE DRAWING
D865-038
REV O

REVISIONS		
ZONE	LTR	DESCRIPTION
	O	REL TO PROD



QTY REQD	CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
FRACTIONS DECIMALS ANGLES

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO

APPROVALS	DATE
DRAWN	7-14-78
CHECKED	

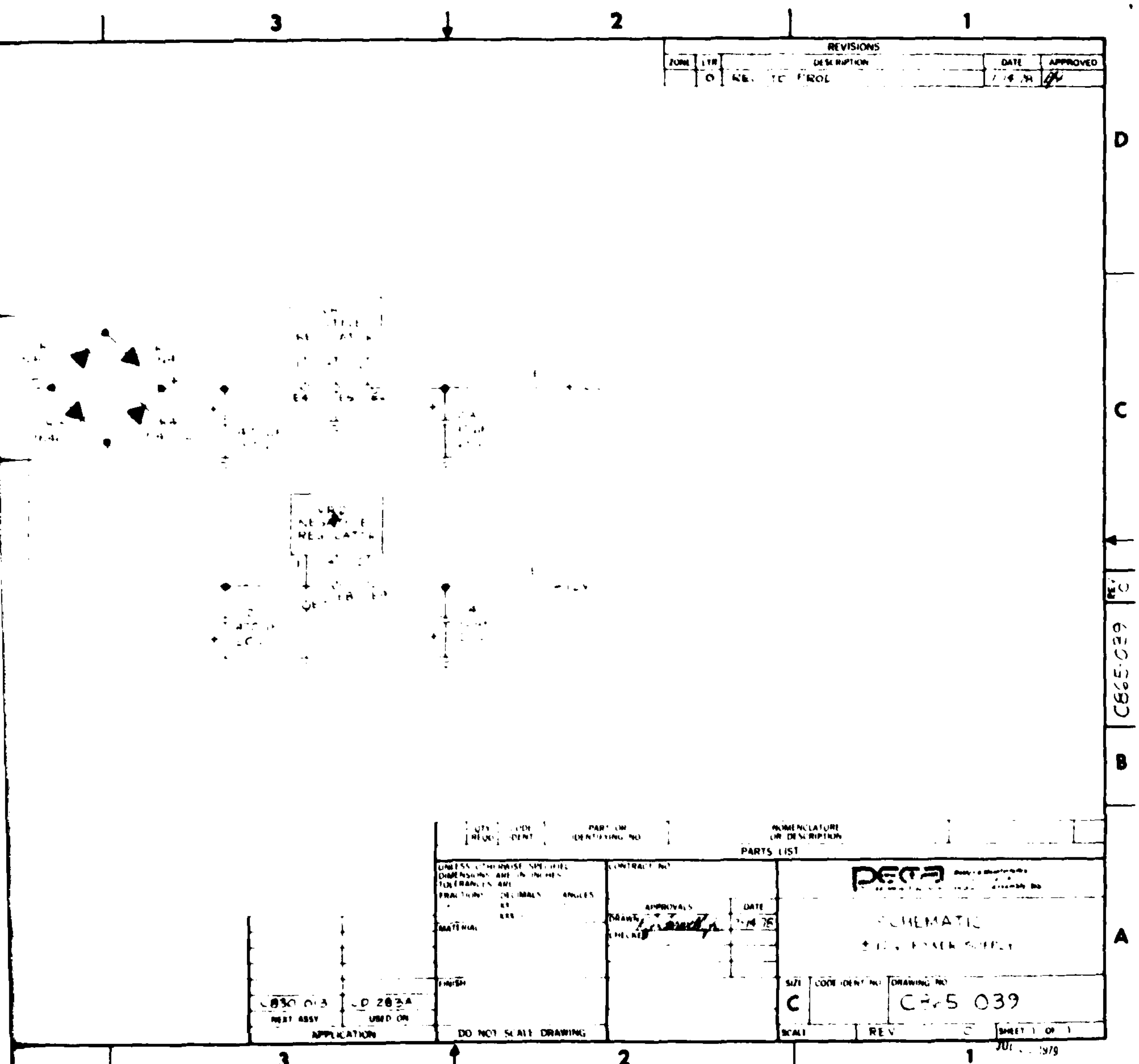
SCHEMATIC

C830-013	UD-283A
NEXT ASSY	USED ON

APPLICATION

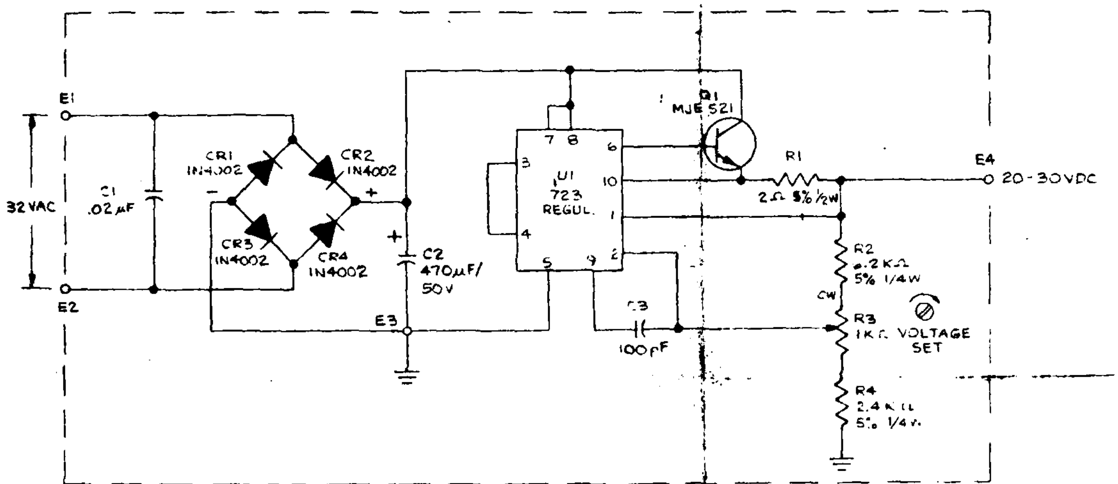
SIZE C | CODE IDENT NO | DRAWING NO C-5-0

SCALE | REV O



3
2
1
D
C
B
A
REVISIONS
ZONE
LTR
DESCRIPTION
DATE
APPROVED
PARTS LIST
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS
DECIMALS
ANGLES
MATERIAL
FINISH
CONTRACT NO
APPROVALS
DATE
DRAWN
CHECKED
SCHEMATIC
NEXT ASSY
USED ON
APPLICATION
DO NOT SCALE DRAWING
SIZE
C
CODE IDENT NO
DRAWING NO
SCALE
REV

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE
	O	REL TO PROD	



NOTES:

1. CW DENOTES POTENTIOMETER WIPER POSITION AT EXTREME CLOCKWISE ROTATION.
2. R3 IS A FACTORY-SET CONTROL.

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION

PARTS LIST

NEXT ASSY	USED ON
C830-008	UD-283A
C830-008	SRS-350

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS DECIMALS ANGLES

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO

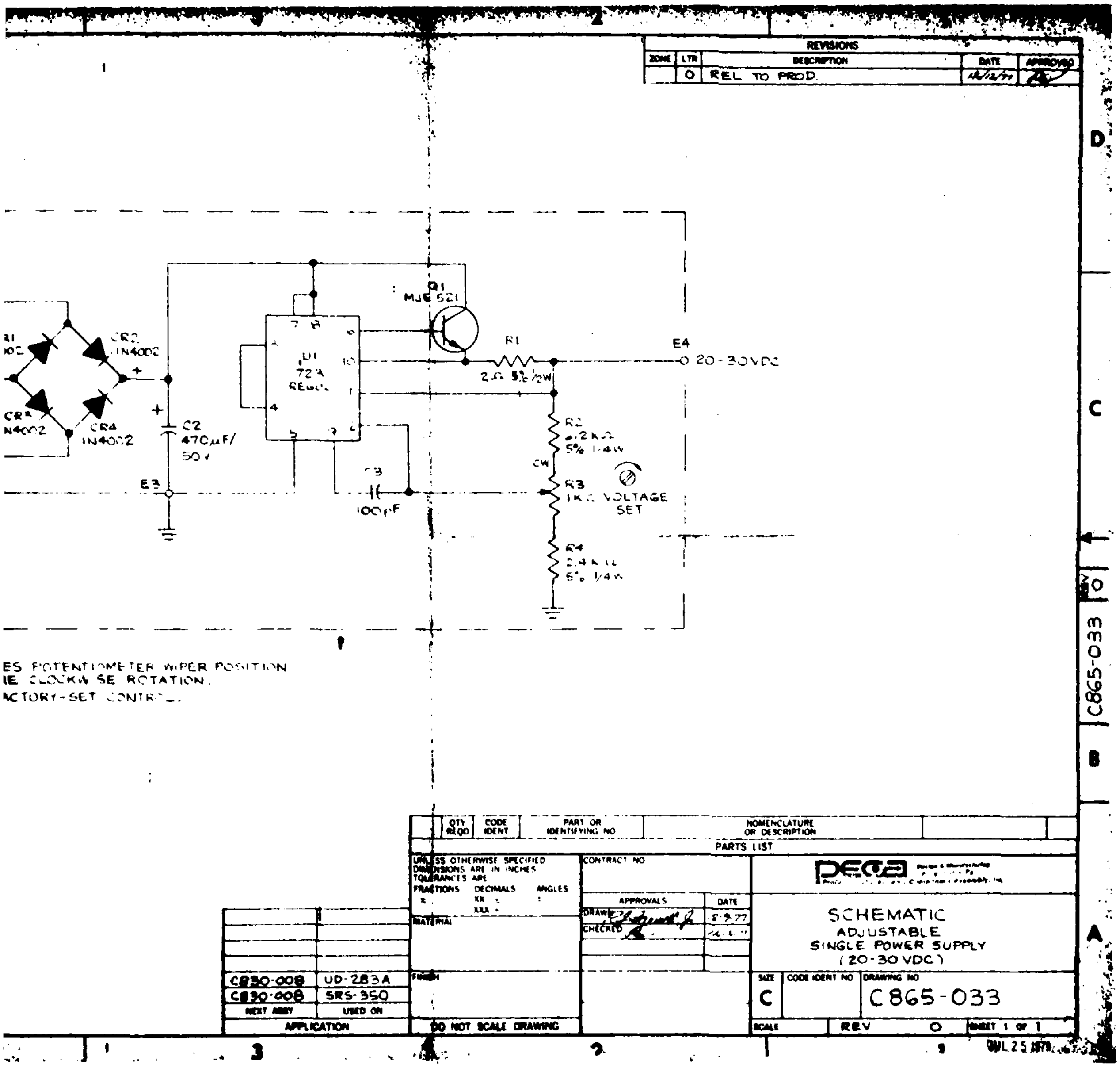
APPROVALS — DRAWN / CHECKED — DATE 2-9-77

DECCA

SCHEMATIC
ADJUSTABLE
SINGLE POWER SUPPLY
(20-30 VDC)

SIZE C | CODE IDENT NO | DRAWING NO C865-033

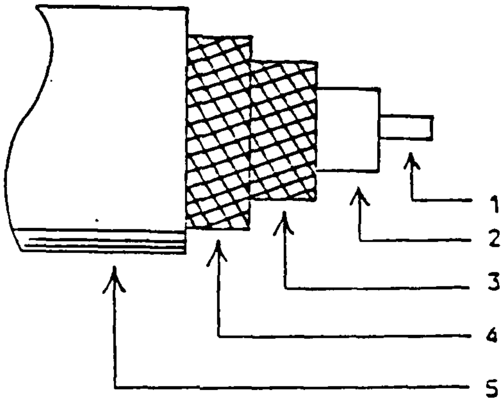
SCALE | REV O | SHEET 1


REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVED
O | REL TO PROD.
D
C
B
A
Q1
MJE 521
U1
723
REGUL
CR2
1N4002
CR4
1N4002
C2
470μF/
50V
R1
2Ω 5% 1/2W
E4
20-30VDC
R2
5% 1/4W
CW
R3
1KΩ VOLTAGE
SET
R4
5% 1/4W
C3
100pF
E3
ES POTENTIOMETER WIPER POSITION
IE CLOCKWISE ROTATION.
ACTORY-SET CONTROL.
QTY REQD | CODE IDENT | PART OR IDENTIFYING NO | NOMENCLATURE OR DESCRIPTION
PARTS LIST
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS
DECIMALS
ANGLES
CONTRACT NO
APPROVALS
DATE
DRAWN
CHECKED
MATERIAL
FINISH
DO NOT SCALE DRAWING
SCHEMATIC
ADJUSTABLE
SINGLE POWER SUPPLY
(20-30 VDC)
SIZE
C
CODE IDENT NO
DRAWING NO
C865-033
SCALE
REV
O
SHEET 1 OF 1
C830-008 | UD-283A
C830-008 | SRS-350
NEXT ASSY | USED ON
APPLICATION
C865-033
O
JUL 25 1979

REV STATUS OF SHEETS	REV LTR					
	SHEET NO					

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
—	Released	Apr. 1/75	
A	Rev. 1 — Changed O.D. .270 to .250	Sept. 1/75	



PHYSICAL CHARACTERISTICS	U.S. System		Metric System
1. #22 Ga. Silver Plated Copperweld	0.0253"	nom.	0.642 mm
2. Solid polyethelene	0.146"	nom.	3.708 mm
3. ?6% Braid — 34 Ga. copper	0.175"	nom.	4.445 mm
4. 96% Braid — 34 Ga. copper	0.204"	nom.	5.182 mm
5. Low temp — PVC — Black	0.250"	nom.	6.350 mm

Put-ups — 500 ft. reels
1,000 ft. reels

ELECTRICAL CHARACTERISTICS

Shielding — 90 db down nom.

Nom. Attenuation

Frequency (mhz)	5	30	50	216	240	260	270	300
Attenuation (†) (db/100 ft)	0.69	1.70	2.21	4.71	4.98	5.20	5.30	5.60
Attenuation (‡) (db/100 meters)	2.263	5.576	7.249	15.448	16.334	17.056	17.384	18.368

† @ 68°F. (Attenuation varies ± 1% per 10°F ambient variance)
‡ @ 20°C. (Attenuation varies ± 2% per 10°C ambient variance)

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES TOLERANCES ON DECIMALS .X ± .XX ± .XXX ± ANGLES ± FRACTIONS ±

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DR	
CHK	
APPD PROD MGR	
FLD ENG MGR	

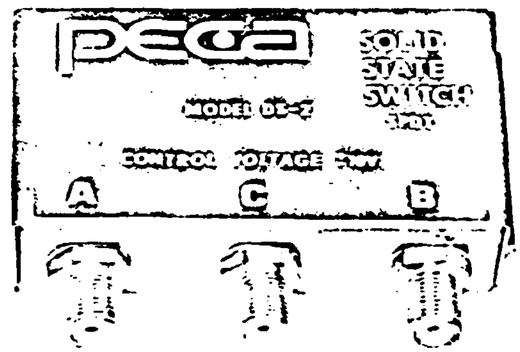
TIMES WIRE AND CABLE COMPANY
Wallingford, Connecticut
Tel. 203-265-2361 TWX 710-476-0763

MI-2040 HEADEND
(RG 59/U DOUBLE COPPER BRAID)

SIZE		DWG NO.
A		SALES

SCALE None — SHEET 1 of 1

The PECA DS-2 Self-Terminating, Coaxial SPDT Diode Switch



PECA's DS-2 is a solid state RF transfer switch which offers many advantages over conventional diode, and reed switches.

High Isolation:
Shielding and construction techniques are carefully controlled, reducing potential co-channel problems in RF switching systems.

Low Insertion Loss:
The design of the DS-2 allows a minimization of insertion loss which can be important in switching low level signals.

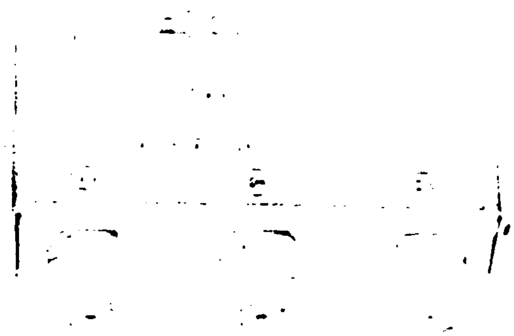
Self-Termination:
The DS-2 offers a unique feature of self-termination of its blocked port. (Some equipment must always see matched load-class C amp., some preamplifiers, etc.)

Excellent Return Loss:
Possibly the most outstanding feature of the DS-2: when closed it looks like a small piece of coaxial cable. This high degree of return loss makes it possible to match switches to each other in special test equipment.

Compact, Low Power:
Because of its small physical size and low power consumption, the DS-2 is an ideal choice for high density switching applications.

Reliable:
Because of its solid state construction the DS-2 offers fast switching times and long life; also it can be mounted in any position.

Reasonable Price:
Considering its performance and quality the DS-2 offers the most for your switching dollar.



DS-2 Self-Terminating, SPDT Diode Switch Specifications

FREQUENCY RANGE	1 to 300 MHz	Usable to 500 MHz At Reduced Specification
ISOLATION	> 55 dB to 300 MHz > 65 dB to 200 MHz	
MATCH	Closed Port > 30 dB to 300 MHz Common Port > 30 dB to 300 MHz Blocked Port > 16 dB to 300 MHz	Impedance 75 ohms 50 ohms on Special Request
INSERTION LOSS	< 0.5 dB	
DRIVE	A to C White −10V Red +10V Black Gnd. @ 20 ma. B to C White +10V Red −10V Black Gnd. @ 20 ma.	
SIZE	3½″ × 1⅞″ × 1″	
MODELS	DS-2 Custom Models	See Price List Contact Factory

[illegible], Inc.
...67 Pearson Ave. • Philadelphia, Pa. 19114 • (215) [illegible]-3545 • 332-2550 / [illegible]