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TECHNICAL MANUAL

for

TECHNIMATIC TUNED RECEIVER

MODEL DDRR-5B

THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N.Y. OTTAWA, ONTARIO

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THE TECHNICAL MATERIEL CORPORATION
COMMUNICATIONS ENGINEERS
700 FENIMORE ROAD MAMARONECK, N. Y.

Warranty

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes,* fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.

2. That the defect is not the result of damage incurred in shipment from or to the factory.

3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.

4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes*furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

*Electron tubes also include semi-conductor devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

THE TECHNICAL MATERIEL CORPORATION
Engineering Services Department
700 Fenimore Road
Mamaroneck, New York

RECORD OF CORRECTIONS MADE

Change No.	Date of Change	Date Entered	Entered By

FOREWORD

The DDRR-5B TechniMatiC* Tuned Receiver is made up of one each of 11 major components. These are:

HFRR-2	Continuous RF Tuner
HFSR-1	Control Synthesizer
HFIR-1	IF Amplifier
HFAR-1	Audio Amplifier
AFC-3	Automatic Frequency Control
HAF-1	Audio Filter
HNF-1	Variable Notch Filter
HSS-3	Speaker Panel
HFP-1	Power Supply
RTMU-1	Signal Data Converter-Storer
RTTD-1	Receiver Decoder

The DDRR-5B Manual consists of the following manuals, covering the DDRR-5B system and the individual components:

DDRR-5B	system manual
HFR-2	manual (w/addendum describing HFRR-2)
HFS-1	manual (w/addendum describing HFSR-1)
HFI-1	manual (w/addendum describing HFIR-1)
HFA-1	manual (w/addendum describing HFAR-2)
AFC-3	manual
HAF-1	manual
HNF-1	manual
HSS-3	manual
HFP-1	manual
RTMU-1	manual
RTTD-1	manual

*Trademark applied for

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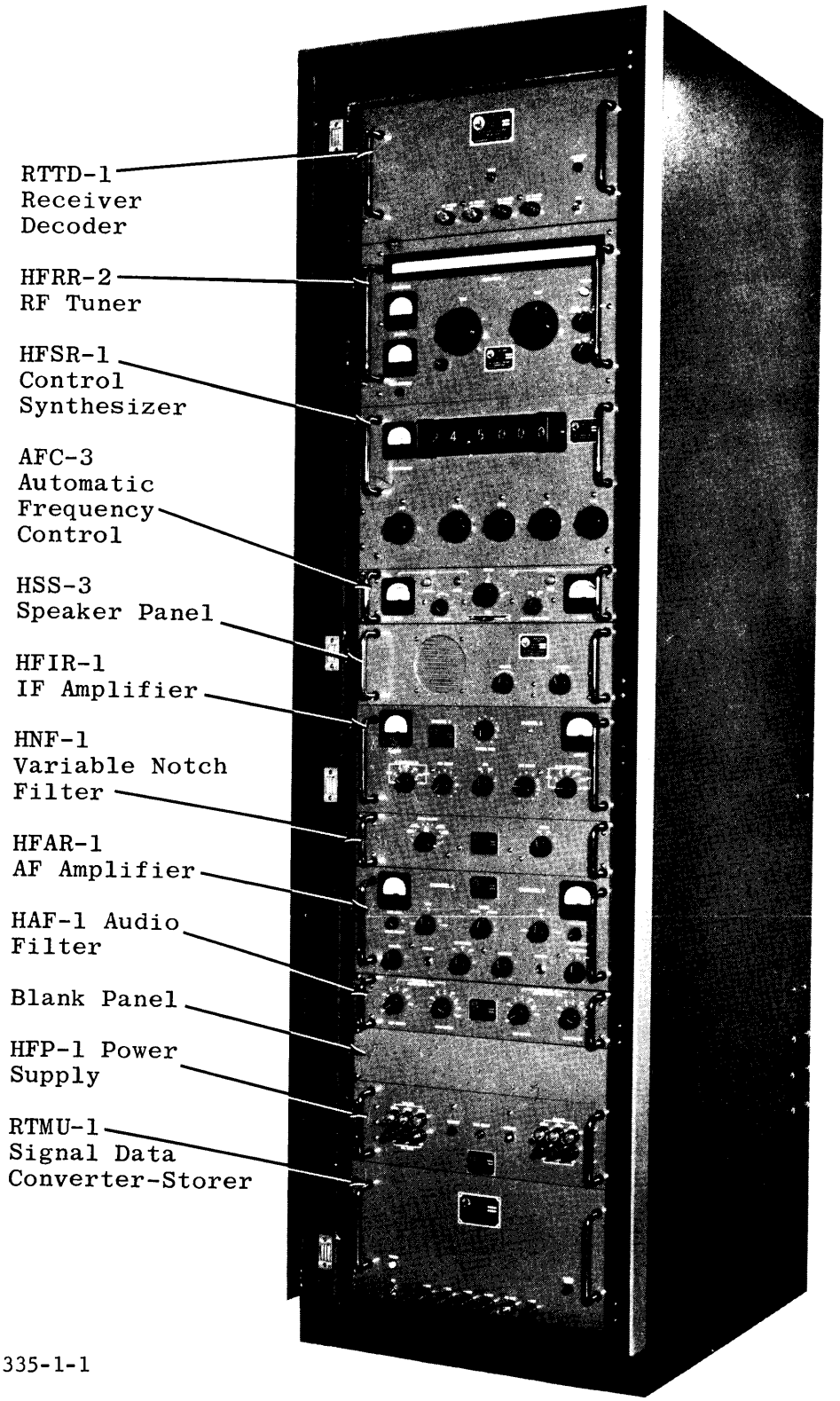

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Figure 1-1. TechniMatiC Tuned Receiver, Model DDRR-5B

SECTION 1
GENERAL INFORMATION

1-1. GENERAL DESCRIPTION

TechniMatiC* Tuned Receiver, Model DDRR-5B, (figure 1-1) is a receiving system covering the frequency range of 2- to 32-mc for the reception of SSB, AM, CW, MCW, FSK, and FAX. The receiver may be tuned either manually or by a combination of 5-bit teletype signals (or equivalent) from a remote or local control station. These signals actuate rotary-solenoid decoder switches and servo mechanisms in the receiver. Control by teletype signal makes the receiver adaptable to preprogrammed punched cards or punched tape for automatic tuning from remote or local equipment as well as remote keyboard control by radio or wire telegraph transmission. Tuning time from receipt of a receiver-tune function (E) code is 20 seconds maximum.

The 2- to 32-mc range covered by the receiver is divided into eight r-f bands, with synthesized coverage in 100-cps steps.

The receiver comprises various modular units (refer to paragraph 1-2) mounted in a single rack and is used in fixed-station or mobile communication systems. Figure 1-1 illustrates the chassis location of modular units that are contained in the receiver.

When tuning the receiver from a remote control station, a readback of control positions is sent to the remote station.

An alignment signal, an internally generated low-level r-f signal from the synthesizer (HFSR), facilitates accurate and rapid tuning of the complete system in the absence of any received signal. This locally generated signal is also usable as a maintenance tool for checking the alignment of the receiver system.

All major components are mounted on drawer slides. The rack has its own forced-air cooling system using squirrel cage blowers and washable air filters in the rack intake and exhaust.

1-2. DESCRIPTION OF UNITS

a. GENERAL. - Paragraphs b through l below give a brief description of the modular units used in the receiver. For more detailed information pertaining to any of these units, refer to the individual modular-unit manuals.

All tuning controls (except the HFIR AFC Switch) are rotary type for either manual or stepping-switch operation. All such controls consist of a front-panel function switch with a stepping wafer, readback wafer, and rotary solenoid attached to the shaft. The stepping wafer receives an "action function" code (refer to table 1-2) from Receiver Decoder RTTD and activates the rotary solenoid which in turn rotates the control to the proper position. When the control has reached its proper position, the readback wafer provides an appropriate indication to Signal Data Converter Storer RTMU for remote monitoring purposes. Automatic r-f tuning occurs from the action of a servo-mechanism.

b. RECEIVER DECODER, MODEL RTTD-1.- Receiver Decoder RTTD receives 5-bit character codes from Signal Data Converter Storer RTMU and: (1) decodes addressal functions (refer to table 1-2) into control locations on the receiver; (2) routes the subsequent action function code to the associated control. The RTTD also contains the servo amplifier and sequential relays that control the servo motors in Continuous RF Tuner HFRR. The RTTD has a self-contained power supply which is triggered by Signal Data Converter-Storer RTMU.

c. CONTINUOUS RF TUNER, MODEL HFRR-2.- Continuous RF Tuner HFRR provides coverage from 2- to 32-mc in eight bands, and displays the tuned frequency on a 14-inch slide rule dial. The oscillator in Continous RF Tuner HFRR may or may not (depending upon operational requirements) utilize a synthesized control voltage from control synthesizer and standard HFSR. However, in remote control only synthesized operation is possible. The HFRR obtains its operating voltages from Power Supply HFP.

d. CONTROL SYNTHESIZER AND STANDARD, MODEL HFSR-1.- Control Synthesizer and Standard HFSR monitors the high-frequency oscillator in Continuous RF Tuner HFRR and provides correction voltage to maintain the free-running oscillator to a stability of 1 part in 10^8 for a 24-hour period. The frequency of the incoming r-f signal to the receiver is displayed on front-panel 1-inch high, illuminated numerals. Change of frequency in 100-cps increments is accomplished by means of detented switches (in manual control) or code inputs (in remote control). The HFSR obtains its operating voltages from Power Supply HFP.

*Trademark applied for.

e. AUTOMATIC FREQUENCY CONTROL, MODEL AFC-3. - Automatic Frequency Control AFC contains the 2-mc and 250-kc injection frequency oscillators for the second and third mixer stages in the receiver.

In SSB, in which the signal contains a fully to partially-suppressed carrier*, the AFC provides automatic frequency control by locking onto the carrier component. The AFC provides drift-corrected injection frequencies to IF Amplifier HFIR and Audio Amplifier HFAR in order to compensate for carrier drift thus maintaining the audio output of the receiver correct to within one cycle.

f. SPEAKER PANEL, MODEL HSS-3. - Speaker Panel HSS houses a single speaker and is used to monitor the output of Audio Amplifier HFAR.

g. IF AMPLIFIER, MODEL HFIR-1. - IF Amplifier HFIR accepts a 1.75-mc input signal from Continuous RF Tuner HFRR, processes the signal through dual (channel A & B) front-panel selectable sideband or symmetrical filters and converts this signal to 250-kc for further demodulation in Audio Amplifier HFAR. The HFIR obtains its operating voltages from Power Supply HFP.

h. AUDIO AMPLIFIER, MODEL HFAR-1. - Audio Amplifier HFAR accepts the 2-channel 250-kc output from IF Amplifier HFIR and independently detects the audio information by a diode detector (AM) or a product detector (SSB, CW). The audio outputs from the detectors are extended to contacts on the rear of the HFAR where an audio filter can be inserted into the signal path.

i. AUDIO FILTER, MODEL HAF-1. - The two audio outputs from Audio Amplifier HFAR are independently extended through adjustable bandpass filters within the audio filter where the upper and lower audio-frequency limits of either channel (A or B) can be selected before final amplification. Filter bandpass adjustment is accomplished by means of two 8-position switches; the first seven positions provide varying degrees of frequency response (from .1 kc to 10 kc); the eighth position removes Audio Filter HAF from the circuit. The HAF is a passive device requiring no power supply.

j. POWER SUPPLY, MODEL HFP-1.- Power Supply, HFP converts line voltage into regulated B+, regulated bias voltages, and filament voltages for the entire DDRR system, with the exception of the RTTD and RTMU units. The HFP also furnishes power for the HFSR 1-mc frequency standard, and crystal ovens throughout the receiver system. The STANDBY positions of manually-operated MAIN POWER and POWER switches in the HFP and in Audio Amplifier HFAR respectively may be used to maintain operating voltages to all ovens contained within the receiver, while all other power voltages are turned off.

k. SIGNAL DATA CONVERTER-STORER, MODEL RTMU-1. - Signal Data Converter-Storer RTMU receives the coded 5-bit teletype pulse input (representing the remote tuning directions) to the receiver system and: (1) rejects all character-recognition codes except the code for which it is programmed thus opening its memory cores only for the subsequent tuning-direction codes addressed to its associated receiver; (2) stores tuning-direction codes until a receiver-tune ("E") code is received; (3) releases all stored information to Receiver Decoder RTTD upon receipt of an "E" code; (4) provides control-position readback information. The RTMU has a self-contained power supply that is connected to the line-voltage strip in the rack.

l. VARIABLE NOTCH FILTER, MODEL HNF-1. - Variable Notch Filter, HNF is a fixed crystal band suppressor unit designed to attenuate an interfering signal within ±8 kc of a 250-kc i-f.

1-3. TECHNICAL SPECIFICATIONS

Table 1-1 lists the technical specifications that are pertinent to the DDRR. For technical specifications concerning the modular units in the receiver, refer to the individual modular-unit manuals.

TABLE 1-1. DDRR-5B TECHNICAL SPECIFICATIONS

a. Frequency Range	2 to 32 mcs, synthesized in 100-cps steps.
b. Tuning	DDRR can be tuned to any one of eight RF bands as listed below: BAND 1 2-3 mc BAND 2 3-4 mc BAND 3 4-6 mc BAND 4 6-8 mc BAND 5 8-12 mc BAND 6 12-16 mc BAND 7 16-24 mc BAND 8 24-32 mc

*Suppressed 30 dB.

TABLE 1-1. DDRR-5B TECHNICAL SPECIFICATIONS (CONT)

c. Modes of Operation	SSB, ISB, AM, CW, MCW, FSK, FAX, FM and PM.
d. Stability	Synthesized stability of 1 part in 10^8 for 24 hours for a change in ambient temperature of 15°C within the limits of 0 to 50 degrees. For AM and SSB reception with afc, the residual audio output will remain within 1 cycle of the transmitted intelligence.
e. RF Signal Input Impedance	Nominal 50 ohms, unbalanced.
f. Noise Figure and Sensitivity	6 dB or better over the band, i.e.; with a 1 uv signal and a 7.5 KC bandwidth, the output signal to noise ratio is 15 dB or better.
g. Intermodulation	Intermodulation products are down 60 dB from the maximum tone in the desired sideband as a result of two signals in the un-wanted sideband.
h. Image Ratio	80 dB referenced to 1 uv input signal.
i. Spurious Response, as defined by CCIR	Better than 100 dB referenced to 1 uv. For synthesized operation, all spurious will be no greater than .01 uv when referred to the antenna.
j. IF Rejection	Better than 80 dB average.
k. AFC Characteristics	Automatic Frequency Control compensates for transmitter/receiver frequency drift. AFC locks onto carrier suppressed to maximum of 30 dB below PEP* and will remain synchronized for approximately ±750-cps at a maximum drift rate at 10-cps per second. A memory circuit will maintain tuning position during signal fades. Audio output is within 1-cycle of transmitted intelligence.
l. IF Selectivity	Seven optional bandwidths selected from the following: 1. 250 to 7500 cps usb ±1.5 db 2. 250 to 7500 cps lsb ±1.5 db 3. 250 to 3500 cps usb ±1.5 db 4. 250 to 3500 cps lsb ±1.5db 5. 250 to 6000 cps usb ±1.5 db 6. 250 to 6000 cps lsb ±1.5 db 7. 1 kc symmetrical ±1.5 db 8. 6 kc symmetrical ±1.5 db 9. 15 kc symmetrical ±1.5 db
m. AGC	Output remains within plus or minus 1.5 dB for a 100 dB change in input within the input voltage range of 1 uv to .1 volt. The agc circuit has a fast attack time and a front panel adjustable decay time from 1 to 10 seconds. The agc voltage is derived from the strongest of 2 i-f channel signals.

*When PEP =5-microvolt minimum input signal at the antenna.

TABLE 1-1. DDRR-5B TECHNICAL SPECIFICATIONS (CONT)

n. Phase Distortion	The system is capable of receiving pulse or phase information without seriously degrading intelligence when the 15 kc symmetrical i-f strip of IF Amplifier HFIR-1 is used in synthesized operation.
o. Audio Amplifier	Plus or minus 1.5 dB, 20-cps to 20-kc. Bandpass is dependent on filter selected.
p. Audio Frequency Distortion	Intermodulation products are down at least 40 dB through the audio channels.
q. Adjustable Audio Filtering	Passive audio filters provide adjustable low pass and high pass cutoff points at approximately: 100 cps 2.5 KC 250 cps 5.0 KC 500 cps 10.0 KC 1 kc
r. Tunable IF	Notch rejection with ±8-cps at 1 dB points, and ±10-cps at 60 dB points. Notch tunable across full i-f of 15-kc.
s. Audio Output	One 600 ohm balanced and center-tapped 1-mw output per receiver channel. One 4-watt monitor speaker. One headset monitor jack output per receiver channel.
t. Hum Level	Minus 50 dB at 1 watt audio output.
u. Remote Tuning Input	Dry contact keying for serial pulses in 7.42-unit teletype transmission pattern with 22 millisecond (60 WPM) or 13.7 millisecond (100 WPM) pulse widths selected by printed circuit card insertion.
v. Remote Tuning Input Teletype Codes	See table 1-2.
w. Remote Tuning Readback Output	Dry Contact keying through polar relay for serial pulses in 7.42-unit teletype transmission pattern. 60 WPM or 100 WPM transmission speed, selected by printed circuit card insertion.
x. Remote Tuning Readback Output Codes	See table 1-3.
z. Temperature and Humidity	The equipment is designed to operate in an ambient temperature of 0° to 50°C and any value of relative humidity up to 90%.

TABLE 1-2. REMOTE TUNING INPUT CODE, DDRR-5B

CODE RECEPTION ORDER*	ADDRESSAL FUNCTION CODE	ACTION FUNCTION CODE	5-BIT CODE	TELETYPE CHARACTERS	
				CCIT	ASCII**
1	Character		11010	J	Z
	Recognition		10100	S	T
2	HFRR BAND & TUNING controls and HFSR MC switch (2-16 MC)		11001	W	Y
	HFRR BAND & TUNING controls and HFSR MC switch (17-31 MC)		10001	Z	Q
3		2 or 17 MC	01001	L	I
		3 or 18 MC	01000	Line Feed	H
		4 or 19 MC	00100	Space	D
		5 or 20 MC	01100	I	L
		6 or 21 MC	01010	R	J
		7 or 22 MC	01110	C	N
		8 or 23 MC	01101	P	M
		9 or 24 MC	01111	V	O
		10 or 25 MC	00110	N	F
		11 or 26 MC	00111	M	G
		12 or 27 MC	01011	G	K
		13 or 28 MC	00011	O	C
		14 or 29 MC	00101	H	E
		15 or 30 MC	00001	T	A
		16 or 31 MC	00010	Carriage Return	B
4	HFSR 100 KC switch		10011	B	S

* Except for the 1st and 24th character, characters may be received in any order, as long as the corresponding action function character follows its addressal function character. However, quickest tuning results are obtained by the reception of the characters in the order shown.

** With first 5 bits of 7-bit code transmitted in reverse.

TABLE 1-2. REMOTE TUNING INPUT CODE, DDRR-5B (CONT)

CODE RECEPTION ORDER*	ADDRESSAL FUNCTION CODE	ACTION FUNCTION CODE	5-BIT CODE	TELETYPE CHARACTERS	
				CCIT	ASCII**
5		0	01000	Line Feed	B
		1	00100	Space	D
		2	00010	Carriage Return	B
		3	01001	L	I
		4	01100	I	L
		5	00110	N	F
		6	01011	G	K
		7	01101	P	M
		8	01110	C	N
		9	00111	M	G
6	HFSR 10 KC Switch		10010	D	R
7		0-9	Same as 5th Code		
8	HFSR 1 KC Switch		10111	X	W
9		0-9	Same as 5th Code		
10	HFSR .1 KC switch		10101	Y	U
11		0-9	Same as 5th Code		
12	HFIR CH A BAND-WIDTH KC		11111	None	←
13		1 DSB	01000	Line Feed	H
		6 DSB	00100	Space	D
		15 DSB	00010	Carriage Return	B
		3.5 U SSB	01001	L	I
		3.5 L SSB	01100	I	L

*With first 5 bits of 7-bit code transmitted in reverse.

TABLE 1-2. REMOTE TUNING INPUT CODE, DDRR-5B (CONT)

CODE RECEPTION ORDER	ADDRESSAL FUNCTION CODE	ACTION FUNCTION CODE	5-BIT CODE	TELETYPE CHARACTERS	
				CCIT	ASCII*
13 (CONT)		7.5 L SSB	00110	N	F
		7.5 L SSB	01011	G	K
		OFF	01101	P	M
14	HFAR CH A DETECTION switch		11011	None	[
15		AM	01000	Line Feed	H
		CW	00100	Space	D
		SSB	00010	Carriage Return	B
16	HFIR CH B BAND-WIDTH KC switch		10110	F	V
17			Same as 13th Code		
18	HFAR CH B DETECTION switch		11110	K	↑
19			Same as 15th Code		
20	HFIR AFC switch		11100	U	\
21		ON	01000	Line Feed	H
		OFF	00010	Carriage Return	B
22	HFIR MANUAL GAIN control		11101	Q	]
23		0	01000	Line Feed	H
		1	00100	Space	D
		2	00010	Carriage Return	B
		3	01001	L	I
		4	01100	I	L
		5	00110	N	F
		6	01011	G	K
		7	01101	P	M
		8	01110	C	N

*With first 5 bits of 7-bit code transmitted in reverse.

TABLE 1-2. REMOTE TUNING INPUT CODE, DDRR-5B (CONT)

CODE RECEPTION ORDER	ADDRESSAL FUNCTION CODE	ACTION FUNCTION CODE	5-BIT CODE	TELETYPE CHARACTERS	
				CCIT	ASCII*
23 (CONT)		9	00111	M	G
		10	00011	O	C
		AGC	00001	T	A
24		Receiver tune	10000	E	P

TABLE 1-3. REMOTE TUNING READBACK OUTPUT CODE, DDRR-5B

CODE TRANSMISSION ORDER	CONTROL	POSITION INDICATED	5-BIT CODE	TELETYPE CHARACTERS	
				CCIT	ASCII*
1	To reset readback indicator panel for new cycle		10000	E	P
2	HFRR BAND & TUNE controls and HFSR MC switch	2 MC	11001	W	Y
		3 MC	11000	A	X
		4 MC	10100	S	T
		5 MC	11100	U	\
		6 MC	11010	J	Z
		7 MC	11110	K	
		8 MC	11101	Q	]
		9 MC	11111	Letters	←
		10 MC	10110	F	V
		11 MC	10111	X	W
		12 MC	11011	Figures	[
		13 MC	10011	B	S
		14 MC	10101	Y	U
		15 MC	10001	Z	Q
		16 MC	10010	D	R
		17 MC	01001	L	I
		18 MC	01000	Line Feed	H

*With first 5 bits of 7-bit code transmitted in reverse.

TABLE 1-3. REMOTE TUNING READBACK OUTPUT CODE, DDRR-5B (CONT)

CODE TRANSMISSION ORDER	CONTROL	POSITION INDICATED	5-BIT CODE	TELETYPE CHARACTERS	
				CCIT	ASCII*
2 (CONT)		19 MC	00100	Space	D
		20 MC	01100	I	L
		21 MC	01010	R	J
		22 MC	01110	C	N
		23 MC	01101	P	M
		24 MC	01111	V	O
		25 MC	00110	N	F
		26 MC	00111	M	G
		27 MC	01011	G	K
		28 MC	00011	O	C
		29 MC	00101	H	E
		30 MC	00001	T	A
		31 MC	00010	Carriage Return	B
3	HFSR 100 KC switch	0	01000	Line Feed	H
		1	00100	Space	D
		2	00010	Carriage Return	B
		3	01001	L	I
		4	01100	I	L
		5	00110	N	F
		6	01011	G	K
		7	01101	P	M
		8	01110	C	N
		9	00111	M	G
4	HFSR 10 KC switch	0-9	Same as 3rd Code		
5	HFSR 1 KC switch	0-9	Same as 3rd Code		
6	HFSR .1 KC switch	0-9	Same as 3rd Code		

*With first 5 bits of 7-bit code transmitted in reverse.

TABLE 1-3. REMOTE TUNING READBACK OUTPUT CODE, DDRR-5B (CONT)

CODE TRANSMISSION ORDER	CONTROL	POSITION INDICATED	5-BIT CODE	TELETYPE CHARACTERS	
				CCIT	ASCII*
7	HFIR CH A IF BANDWIDTH KC switch	1 DSB	01000	Line Feed	H
		6 DSB	00100	Space	D
		15 DSB	00010	Carriage Return	B
		3.5 U SSB	01001	L	I
		3.5 L SSB	01100	I	L
		7.5 U SSB	00110	N	F
		7.5 L SSB	01011	G	K
8	HFAR CH A DETECTION switch	AM	01000	Line Feed	H
		CW	00100	Space	D
		SSB	00010	Carriage Return	B
9	HFIR CH B IF BANDWIDTH KC switch		Same as 7th Code		
10	HFAR CH B DETECTION switch		Same as 8th Code		
11	HFIR AFC ON/OFF switch and receiver status "in tune process" "ready"	AFC ON and "in tune process"	01100	I	L
		AFC ON and "ready"	01001	L	I
		AFC OFF and "in tune process"	00110	N	F
		AFC OFF and "ready"	00011	O	C
12	HFIR MANUAL GAIN control	0	01000	Line Feed	H
		1	00100	Space	D
		2	00010	Carriage Return	B
		3	01001	L	I
		4	01100	I	L
		5	00110	N	F

*With first 5 bits of 7-bit code transmitted in reverse.

TABLE 1-3. REMOTE TUNING READBACK OUTPUT CODE, DDRR-5B (CONT)

CODE TRANSMISSION ORDER	CONTROL	POSITION INDICATED	5-BIT CODE	TELETYPE CHARACTERS	
				CCIT	ASCII*
12 (CONT)		6	01011	G	K
		7	01101	P	M
		8	01110	C	N
		9	00111	M	G
		10	00011	O	C
		AGC	00001	T	A

*With first 5 bits of 7-bit code transmitted in reverse.

SECTION 2
INSTALLATION

2-1 UNPACKING AND HANDLING.

Inspect the DDRR packing cases for possible damage when it arrives at the operating site. With respect to equipment damage for which the carrier is liable, The Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts. Inspect the packing material for parts that may have been shipped as loose items. Most of the cable assemblies used in the DDRR are mounted in the rack and taped in place.

2-2. POWER REQUIREMENTS.

All units of the DDRR leave the factory wired for 115 volt, 50/60 cycle operation. Change may be made to 230 volt, 50/60 cycle operation by making minor wiring changes. Consult the installation sections of the following individual modular unit manuals receiving line voltage: HFP, RTMU, RTTD and AFC (oven heater elements).

CAUTION

If 230 volt, 50/60 cycle operation is used, all line fuses must be reduced to one-half their rated current values to assure adequate circuit protection.

Change wiring at AX-390 Blower Panel in rear of rack as shown in figure 2-3.

Power consumption of the DDRR is approximately 1070 watts; power cabling of sufficient size to provide 10-amperes at 115 vac, single phase, is adequate for each DDRR. Connect the power cable to the input of Line Filter AF-103 in the rear of the rack (see figure 2-3). The connection points for the three conductors are No. 10 screw terminals.

2-3. INSTALLATION.

a) INSTALLATION OF MODULAR UNITS. - Refer to figure 1-1 for information regarding location of all modular units. All major units are slide-mounted on tilt-lock drawer slides. To install any slide-mounted unit in its compartment, refer to figure 2-1 and proceed as follows:

(1) Untape or unstrap cable assemblies and all other components secured to the rack frame for shipment.

CAUTION

Start by installing bottom units first per steps 2 through 6 in order to avoid tipping over the rack from extended center of gravity.

(2) Pull out center section of associated compartment slide track until it locks in an extended position.

(3) Position slide mechanisms of modular unit in tracks, and ease modular unit into rack until release buttons engage holes in track.

(4) Make the necessary cable and electrical connections as described in paragraph 2-3c. To prevent the cables extending from the modular units from snagging, utilize the reel-mounted clamps located inside the rear of the rack as shown in figure 2-2.

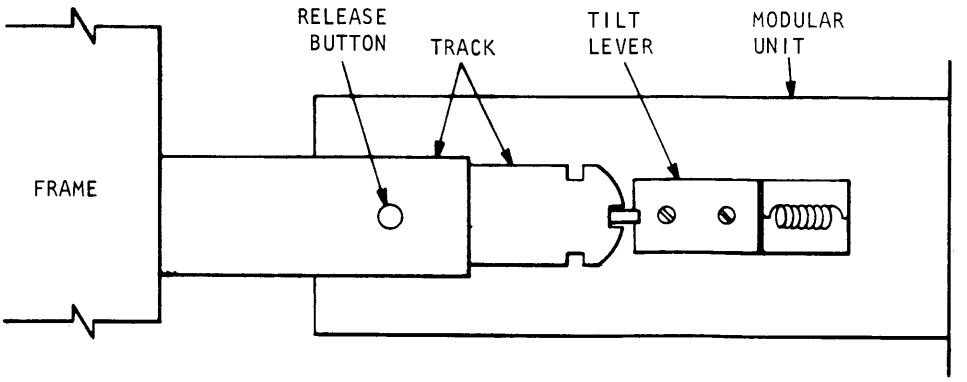
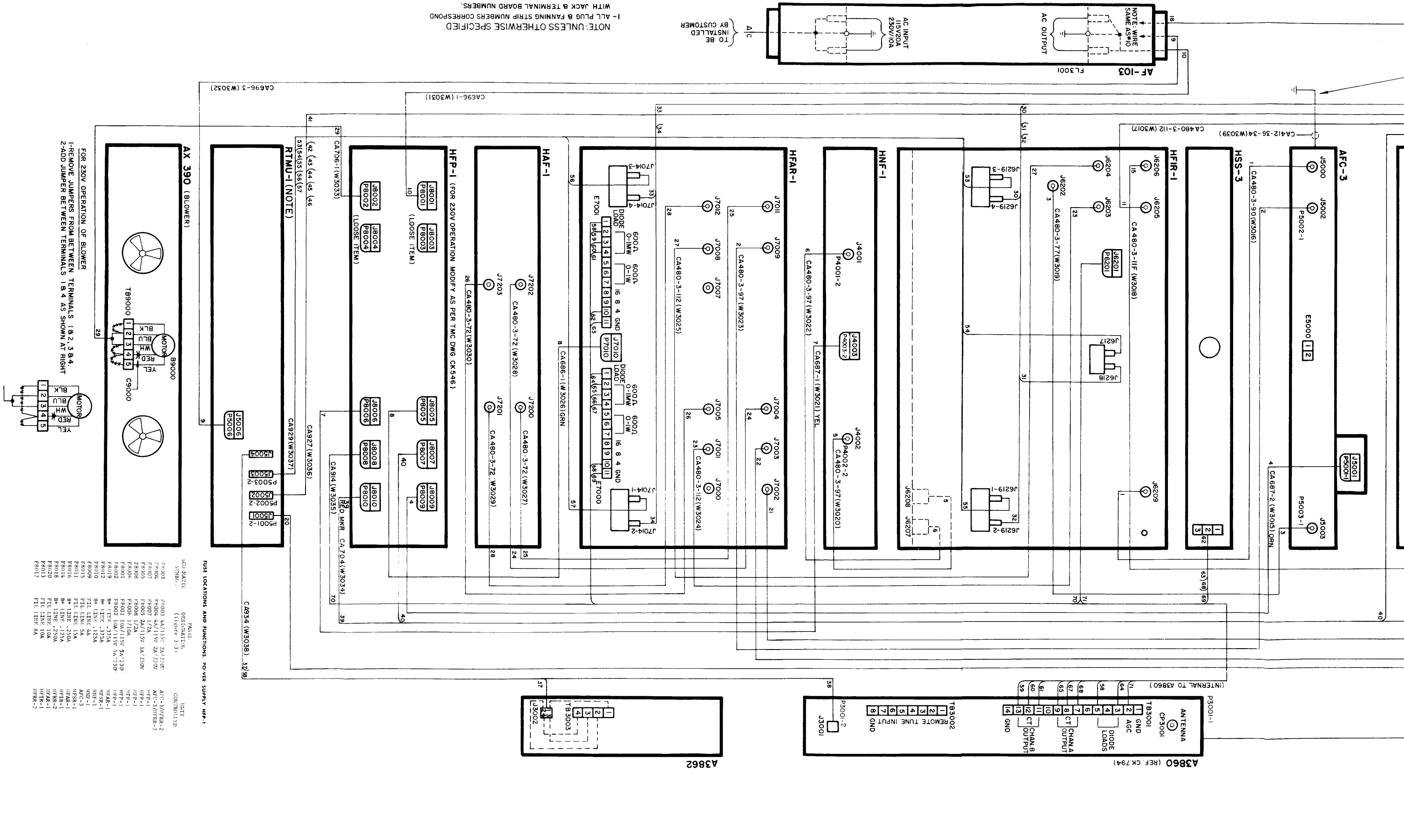


Figure 2-1. Slide Mounting Details



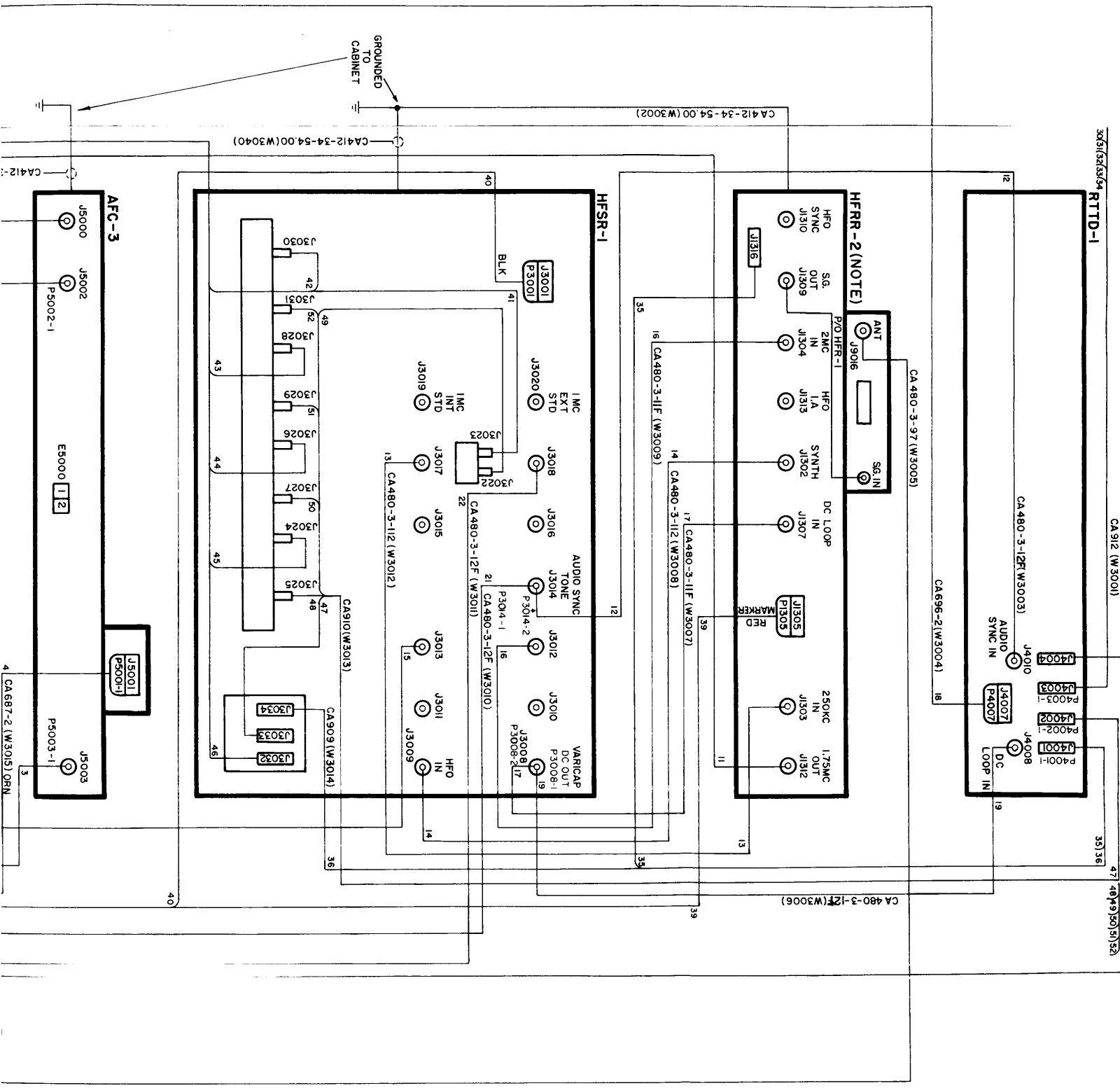
NOTE: UNLESS OTHERWISE SPECIFIED
1- ALL PLUG & FANNING STRIP NUMBERS CORRESPOND WITH JACK & TERMINAL BOARD NUMBERS.
2-WHEN CALLING OUT FOR A DDRR-582 SYSTEM REPLACE RTMU-1 WITH RTMU-2 & REPLACE HFRR-2 WITH HFRR-2B.

FOR 230V OPERATION OF BLOWER
1-REMOVE JUMPERS FROM BETWEEN TERMINALS 1 & 2, 3 & 4.
2-ADD JUMPER BETWEEN TERMINALS 1 & 4 AS SHOWN AT RIGHT

FUSE LOCATIONS AND FUNCTIONS, POWER SUPPLY HFP-1

SCHEMATIC SYMBOL	PANEL DESIGNATION (Figure 3-3)	UNIT CONTROLLED
FB9003	F9003 4A/115V 2A/230V	AFC-3/HFBR-2
FB9004	F9004 4A/115V 2A/230V	AFC-3/HFBR-2
FB9005	F9005 2A/115V 1A/230V	HFP-1
FB9006	F9006 1/2A	HFP-1
FB9008	F9008 1/10A	HFP-1
FB9001	F9001 10A/115V 5A/230V	HFP-1
FB9002	F9002 10A/115V 5A/230V	HFP-1
FB8012	B+ LINE -375A	HFP-1
FB8010	B+ LINE -125A	HFSR-1
FB8013	FIL LINE 4A	HNF-1
FB8009	FIL LINE 5A	HFP-1
FB8011	FIL LINE 15A	APC-3
FB8015	B+ LINE -250A	HFSR-1
FB8016	B+ LINE -250A	HFAR-1
FB8014	B+ LINE -125A	HFTR-1
FB8018	B+ LINE -250A	HFRR-2
FB8003	FIL LINE 10A	HFAR-1
FB8013	FIL LINE 8A	HFTR-1
FB8017	FIL LINE 8A	HFRR-2

FIGURE 2-3. Cabling Interconnections, DDRR-5B


GROUNDED TO CABINET
CA412-34-54.00(W3002)
CA412-34-54.00(W3040)
AFC-3
J5000
J5002
P5002-1
E5000
J5001
P5001-1
J5003
P5003-1
CA687-2 (W3015) ORN
CA910(W3013)
CA909 (W3014)
HFSR-1
J3030
J3031
J3028
J3029
J3026
J3027
J3024
J3025
J3034
J3033
J3032
J3001
P3001
BLK
J3019
IMC INT STD
J3020
IMC EXT STD
J3023
J3022
J3017
J3018
J3016
J3015
J3014
P3004-2
P3004-1
J3013
J3012
J3011
J3010
J3009
AUDIO SYNC TONE
VARICAP DC OUT
P3008-1
P3008-2
HFO IN
CA480-3-112 (W3012)
CA480-3-12F (W3011)
CA480-3-12F (W3010)
CA480-3-112 (W3008)
CA480-3-11F (W3007)
CA480-3-11F (W3009)
HFRR-2(NOTE)
P/O HFRR-1
HFO SYNC J1310
S.G. OUT J1309
J1316
2MC IN J1304
HFO I.A J1313
SYNTH J1302
DC LOOP IN J1307
MARKER J1305
P1305
250KC IN J1303
1.75MC OUT J1312
SG. IN
ANT J9016
SG
CA480-3-11F (W3009)
CA480-3-97 (W3005)
CA480-3-12F(W3003)
AUDIO SYNC IN J4010
J4004
P4004-1
J4003
P4003-1
J4002
P4002-1
J4001
P4001-1
J4007
P4007
J4008
DC LOOP IN
CA696-2(W3004)
RTTD-1
CA912 (W3001)
CA923 (W3041)
CA480-3-12F(W3006)
30(51(52(53(54
35) 36
47
48(49(50)51)52)

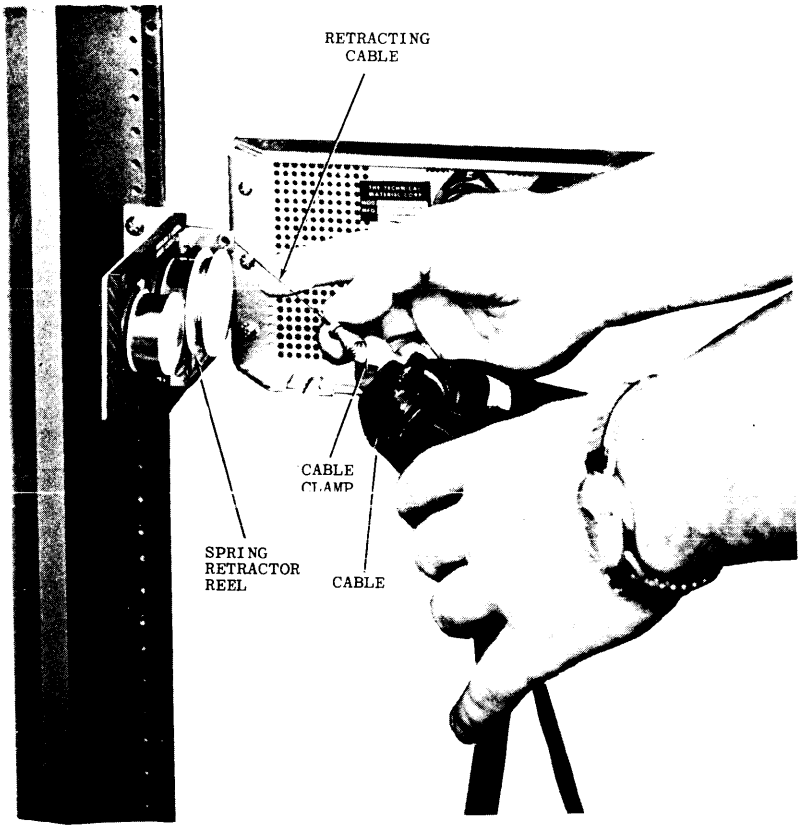


Figure 2-2. Attaching Cable Retractor

(5) Depress release buttons and slide modular unit completely into compartment.

(6) Secure front panel of modular unit to rack with screws.

b. REMOTE TUNING AND READBACK SPEED SELECTION. - Remote tuning input and readback output teletype is adjustable to either 60 WPM or 100 WPM by inserting printed circuit cards in the memory and readback card bins of the RTMU. The DDRR is shipped with the 60 WPM cards installed in the bins. Clock circuit card Z5001 with a "60 WPM" decal is installed in J5022 receptacle in the readback bin. Z5001 and Z5015 cards with "100 WPM" decals are included as loose items in the DDRR shipment.

NOTE

60 and 100 WPM refers to the speed of character transmissions for the RTMU readback output, bases on 5 characters to a word, with each character immediately following the other. In the RTMU tuning input, however, the 60 and 100 WPM refers to the two pulse widths (22 and 13.7 milliseconds, respectively) associated with these speeds, within each character. The characters themselves may be fed into the RTMU at any speed or timing.

c. CABLING. Connect interconnecting cabling per figure 2-3.

d. CONNECTION OF EXTERNAL EQUIPMENT. -

(1) Antenna. - The DDRR is normally used with a sloping V, rhombic, or log-periodic antenna. The antenna input to the receiver is for a 50 ohm, unbalanced transmission line. Make antenna connections at ANTENNA adapter CP3001, located on A3860 vertical panel on inside of rack at rear. CP3001 is a receptacle for a QDS (quick-disconnect) series r-f coaxial plug. TMC #PL-149 QDS plug is supplied in shipment for this purpose. TMC #SA-105 QDS-to-BNC adapter and UG-88/U BNC plug are also supplied to provide a BNC connection, if preferable.

(2) Audio Loads. - Connect loads for channels A and B 0-1 mw audio output to TB3001 terminal block on A3860 vertical panel on inside of rack at rear. See figure 2-4 connections for balanced or unbalanced loads.

(3) Remote tuning Codes Source. - Connect remote tuning codes source input line at TB3002 terminal block on A3860 vertical panel on inside of rack at rear. See figure 2-4 for connection details.

(4) Remote Readback Indicator. - Connect remote tuning readback output line at TB3002 terminal block on A3860 vertical panel on inside of rack at rear. See figure 2-4 for connection details.

e. DIVERSITY CONNECTION. - Two or more DDRR receivers may be operated together in space or frequency diversity. For space diversity, attach an antenna to each receiver; for frequency diversity, attach all receivers to the same antenna. For either type of diversity, use the 1-mc frequency reference standard in only the first receiver HFSR unit for a common reference source for other receivers. Do this by running a cable from J3019 HFSR receptacle in the first receiver to J3020 HFSR receptacle in all other receivers. Set the first receiver HFSR 1MC EXT/INT switch to INT and this switch in the other receivers to EXT. For either type of diversity, if a voice combiner is not being used in the audio outputs,

tie the receiver AGC outputs together by jumpering TB3001 #2 terminals together as shown in figure 2-5. For space diversity operation, install identically coded Z5003 receiver selector code cards in the RTMU units of each receiver. This will enable the simultaneous tuning of all receivers from one set of tuning codes. For frequency diversity, install differently coded cards in order that the different messages may be sent containing the different frequency codes. (See also paragraph 2-3f, MULTIPLE RECEIVER SITES).

f. MULTIPLE RECEIVER SITES. - When more than one DDRR is controlled by the same remote control station, either singly or in diversity, make jumper connections between receivers as shown in figure 2-6. Jumper the tuning code inputs at TB3002 together from the common code source. When each receiver contains a different receiver selector code card in its RTMU, run jumper wires between the TB3003 terminals 1 and 2 of each receiver as shown in figure 2-6. When receivers have identical receiver selector codes, the stunt jumper wires are not necessary. In all cases, run the readback output out separately from each receiver to separate readback indicators or to a selector switch for the same indicator.

2-4. INITIAL ADJUSTMENTS.

The DDRR has been factory tested and aligned as a complete system before disassembly for shipment. No initial adjustments of chassis-mounted variable components are necessary before operation.

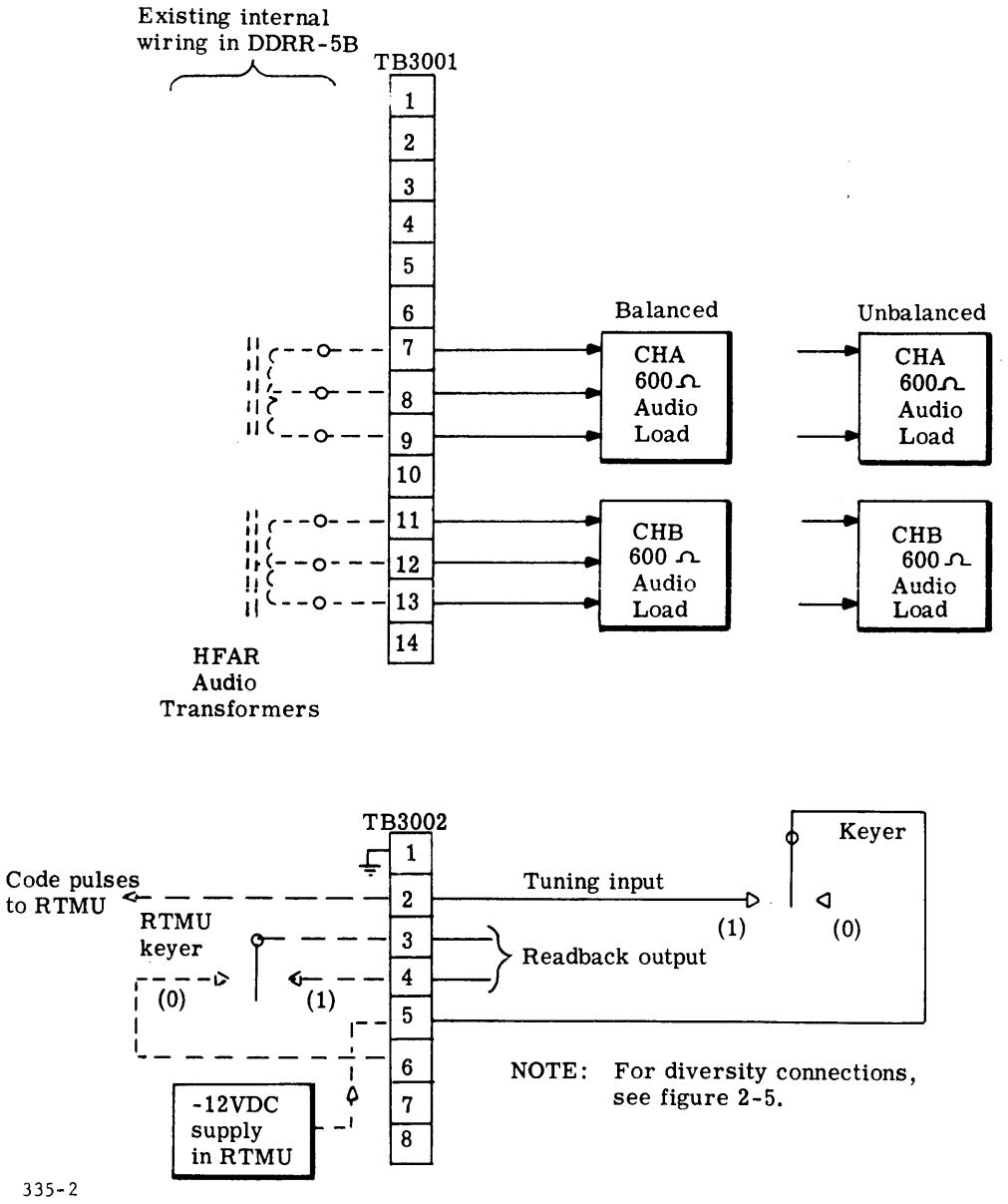
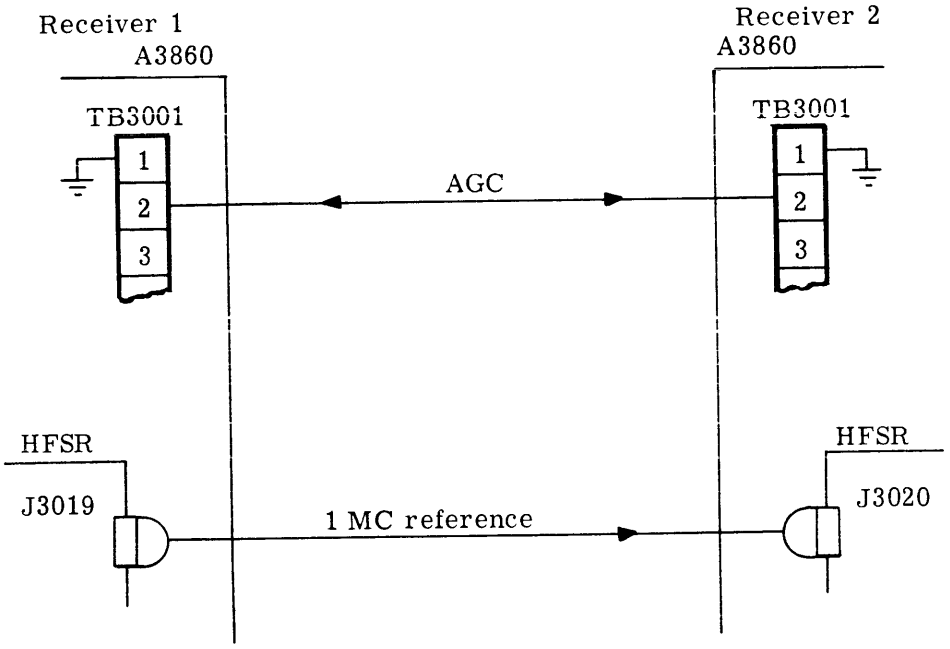
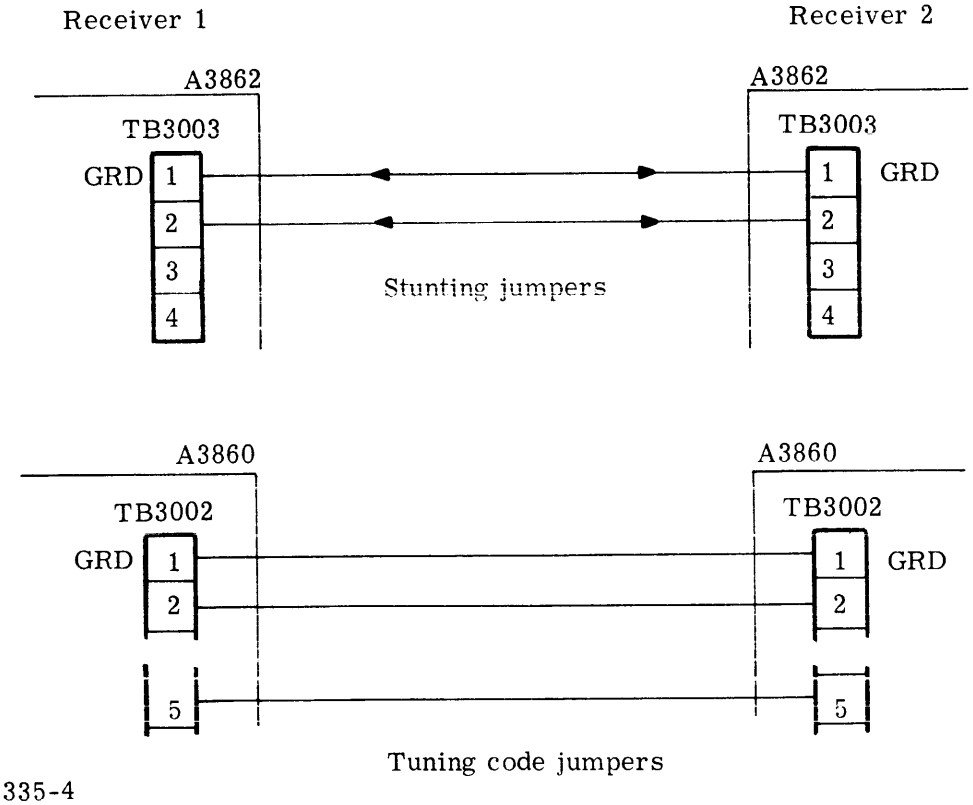


Figure 2-4. Connection Diagram, External Equipment to DDRR-5B



335-3

Figure 2-5. Diversity Connections



335-4

Figure 2-6. Multiple Receiver Jumpers

SECTION 3
OPERATOR'S SECTION

3-1. GENERAL

The DDRR may be operated either manually or by remote control teletype signal input. The coded message in the teletype input, containing tuning information (see table 1-2), may originate from a pushbutton keyboard, or from the insertion of a pre-programmed punched card or tape (see note). The readback output (see table 1-3) back to the remote control station begins cycling upon application of a-c power to the RTMU and provides the remote operator with continuous information on control positions.

NOTE

CCIT or ASCII teletypewriters may be used for code input, if desired (see table 1-2). When using ASCII 7-bit code, use the first 5 bits only and reverse the order of the bits by turning the punched tape over as it enters the tape reader.

Control functions should be reviewed by the operator (remote or local) for familiarization. These functions are described in detail in the individual modular manuals.

CAUTION

Front-panel knobs for automated controls may be rotated in a clockwise direction only. Do not force knobs in a counter-clockwise direction. Exceptions are the HFRR knobs; they may be moved in either direction.

3-2. REMOTE CONTROL

a. TUNING PROCEDURE

(1) INITIAL CONTROL SETTINGS AT RECEIVER SITE. Manually set DDRR controls at positions indicated in table 3-1 in the order given, before operating by remote control. Positions of controls not listed are optional.

TABLE 3-1. LOCAL CONTROL SETTINGS FOR REMOTE TUNING

Control	Position
RTMU POWER ON/OFF switch	ON
HFRR NOISE SILCENCER/OFF/ALIGNMENT SIGNAL switch	OFF
HFRR TUNE/SYNC/OPERATE switch	OPERATE
AFC TUNING knob	0
AFC CARRIER SELECTOR switch	OSC
AFC SENSITIVITY knob	fully cw
HSS CHANNEL, A/OFF/B switch	OFF
HFIR CHANNEL A & B AGC DECAY knob	mid-position
HFIR AFC ON/OFF switch	ON*
HFIR MANUAL GAIN knob	AGC position
HFAR CHANNEL A LEVEL ADJUST knob	**
HFAR CHANNEL B LEVEL ADJUST knob	**

*If AFC feature is to be used, set at ON; if AFC is not desired, set HFIR switch at OFF.

**With audio load attached, tune receiver as described in paragraph 3-3b (2), and adjust LEVEL ADJUST knob to obtain "VU" indication on the channel LINE LEVEL meter.

TABLE 3-1. LOCAL CONTROL SETTINGS FOR REMOTE TUNING (CONT)

Control	Position
HFAR CHANNEL A BFO knob	0
HFAR CHANNEL B BFO knob	0
HFAR POWER STANDBY/OPERATE switch	OPERATE
RTTD ON/OFF switch	ON
HFP MAIN POWER, STANDBY/OFF switch (on chassis rear)	STANDBY*
HAF HIGH and LOW CUTOFF switches	OUT

*For full rated stability, HFP MAIN POWER switch should be in STANDBY for at least 24 hours. This switch should be left in STANDBY continually.

(2) TUNING METHODS. - A variety of remote-control station designs may be used for tuning the DDRR. The only specification is that the teletype tuning characters conform to the code shown in table 1-2. Tuning codes may be in any sequence but the first code must be the Character Recognition Code and the last code a "10000". Time is saved, however, by sending the tuning codes in the order shown in table 1-2, since this ascertains the minimum number of correction movements in the r-f tuning servo-mechanism. The remote readout panel, on the other hand, must be designed to receive the readback characters in the order and code as shown in table 1-3. Tuning codes may be originated by manual push-buttons on a keyboard or by insertion of a pre-programmed punched card or tape, as well as the other variations. The readback indicator panel may be in the form of an indicator light for each control and its position or one light to show that the controls have stabilized on the correct positions as programmed. It may also include a "fault" light to indicate when an operator at the site has turned a control into a non-programmed position or to indicate malfunctioning.

The bit characters of each tuning code may be sent at any speed. The memory section (RTMU) of the DDRR stores each character in its cells indefinitely and will not release them to the tuning mechanism until it receives the "10000" (receiver-tune) code.

NOTE

The DDRR is always tuned for the carrier frequency, even though, as in some cases of sideband reception, the carrier is fully suppressed at the transmitter. The exception to this is tuning for FSK and FAX reception (non-sideband), in which case the receiver is tuned for the center frequency.

To program the DDRR to receive a signal with a carrier of 9.0524 megacycles (as an example) send the following codes in the order shown:

1. Character Recognition Code (coded for each receiver)
2. HFSR 2-16 MC code (11001)
3. 9 MC code (01111)
4. HFSR 100 KC switch code (10011)
5. 0 code (01000)
6. HFSR 10 KC switch code (10010)
7. HFSR 50 KC code (00110)
8. HFSR 1 KC switch code (10111)
9. 2 KC code (00010)
10. HFSR .1 KC switch code (10101)
11. 400 cps code (01100)

NOTE

Steps 12 through 19 should be selected from Table 1-2 in accordance with the type of signal being received (channel A & B i-f bandwidth and detection mode).

20. HFIR AFC switch code (11100)
21. For SSB or ISB with partially suppressed carrier (-30dB): ON (01000). For all other modes: OFF (00010).
22. HFIR MANUAL GAIN knob code (11101)
23. For control of r-f gain:

    Manual 0 (01000)
    1 (00100)

2 (00010)
3 (01001)
4 (01100)
5 (00110)
6 (01011)
7 (01101)
8 (01110)
9 (00111)
10 (10010)
Automatic AGC (00001)
24. Receiver Tune (E) (10000)

b. READBACK MONITORING. - Readback of the control positions is continuous and starts when line voltage is applied to the receiver. The readback is in the form of 12 control position characters repeated in cycles as listed in table 1-3. The repitition frequency of the cycles is 1 cycle per 2.5 seconds (for 60 WPM output) or 1 cycle per 1.5 seconds (for 100 WPM output). Readback transmission from the receiver can only be turned off at the receiver site by interrupting the readback transmission equipment, or setting the RTMU POWER switch at OFF.

Included in the readback information, besides control positions, is a "ready" and an "in tune process" signal. This information is included in the HFIR AFC ON/OFF switch position code (Refer to table 1-3). The "in tune process" code indicates to the remote operator that the HFRR HFO has not yet sychronized with the HFSR: the "ready" signal indicates the synchronization point has been reached.

c. RETUNING. - At any time after the controls are stabilized any or all of the controls may be re-positioned by a new message from the remote control station. The new message must start with the Character Recognition Code and end with a 10000 code in order to reactivate the controls. In the case of retuning for another reception, all characters will be used again with the new information contained in them.

For any type of operational change, the new message need contain only the character Recognition code, the addressal function (control selector) code, its corrected action function (control position) code and the 10000 code (receiver tune).

d. LOCAL ADJUSTMENTS FOR NOISE ELIMINATION.- R-f interference can be eliminated by positioning the IF BANDWIDTH, IF NOTCH, or AF bandwidth filters; if this does not eliminate the interference set the HFRR NOISE SILENCER/OFF/ALIGNMENT SIGNAL switch at NOISE SILENCER.

3-3. LOCAL CONTROL

a. GENERAL. - By placing the RTMU, and RTTD power switches at OFF, the DDRR may be disconnected from remote tuning input messages in order to leave it free for pure manual control.

b. TUNING PROCEDURE

(1) PRELIMINARY CONTROL POSITIONS. - Before operating the DDRR manually, set the controls (except RTTD and RTMU at positions listed in Table 3-1. Set RTMU and RTTD power switch at OFF.

(2) TUNING METHOD. - In all modes of reception, the DDRR is tuned to the carrier frequency, even if the carrier is fully suppressed at the transmitter. The exception is FSK or FAX reception (non-sideband) in which the DDRR is tuned to the center frequency. To tune for the carrier frequency, proceed as follows:

Set HFAR POWER switch at OPERATE. Yellow TIME DELAY lamp on HFP will light and remain lit for 60 seconds, then go out; the red OPERATE lamp on HFP will light. If the carrier frequency falls between 100 cps increment, the HFSR cannot be used and the DDRR is operated in its "non-synthesized" condition. Operating the receiver in its synthesized condition, however, in which it is tunable in 100-cps increments, provides its full rated stability (within 1 part in 10^8). Tuning for synthesized or non-synthesized operation is hereafter referred to as synthesized and non-synthesized tuning, respecively.

For synthesized or non-synthesized tuning, all modes, first set HFIR CH A and B IF BW KC knob and HFAR CH A and B DETECTION switches at appropriate positions for type of signal expected. For AM, MCW, FSK, FAX and PM modes, set the IF BANDWIDTH KC knob for one of the DSB positions depending on bandwidth to be received and the channel output desired; for SSB or ISB, set knob/s at one of the USB and/or LSB positions. For AM and MCW modes, set CH A or B DETECTION switch on HFAR at AM. For CW reception with adjustable pitch, set switch at CW. For ISB, FSK, FAX, FM and PM, set switch/es at SSB. For SSB set desired channel switch at SSB and other channel switch at AM.

For non-synthesized tuning all modes, first set HFSR MC, 100 KC, 10 KC, 1 KC and .1KC knobs to bring zeros on HFSR lighted numeral indicators. Then tune HFRR to the carrier frequency by means of its BAND switch and TUNE knob.

For synthesized tuning all modes, proceed with the steps as follows:

Step 1. - Set HFRR BAND switch and TUNE knob for frequency. Set HFSR MC, 100 KC, 10 KC, 1 KC and .1KC switches for frequency. Set HFRR TUNE/SYNC/OPERATE switch at SYNC. Carefully tune HFRR TUNE knob for a zero beat at HFAR PHONES jack and to obtain a steady light on HFRR SYNC IND lamp. Proceed to Step 2.

Step 2. - Set HFRR TUNE/SYNC/OPERATE switch at OPERATE; SYNC IND lamp should be lit and SYNCHRONIZE meter should indicate zero center scale or nearly so. Carefully adjust TUNE knob to bring SYNCHRONIZE meter to zero center scale, then tighten LOCK control on knob.

(3) SIGNAL ADJUSTMENTS AND CLARIFICATION

(a) All Modes. - Set HFIR MANUAL GAIN knob for AGC by turning knob clockwise until HFRR RF LEVEL meter reading just begins to drop off. Then set HFAR LEVEL ADJ knob/s to obtain "0 VU" on LINE LEVEL meters. If interference is present at either end of the audio output range, adjust HAF CH A and/or B HI- LO- CUTOFF switches to eliminate noise without losing part of desired signal.

(b) SSB and ISB Modes. - Adjust CH A and/or B AGC DECAY switches on HFIR to obtain clearest signal. If suppressed carrier is above 30 dB below PEP (peak envelope power) the AFC feature may be employed as follows:

Set HFIR AFC ON/OFF switch at ON, AFC TUNING/KCS control at 0, SENSITIVITY control fully clockwise, CARRIER SELECTOR switch at OSC. Observing CARRIER LEVEL meter, hold down RESET button and adjust TUNING/KCS control to obtain peak indication on meter. Then release RESET button and observe DRIFT meter; needle will remain steady within the green zone through tone frequency variations if the AFC is locked onto the carrier. If this condition is not realized, the control loops are locked onto a sideband and the process should be repeated. It may be necessary to also try a new .1 KC setting of the HFSR (for synthesized tuning) or an adjustment of the HFRR TUNE control (for non-synthesized tuning) to ultimately capture the carrier. When the AFC has been adjusted satisfactorily, the SENSITIVITY control may be backed off, if necessary, to eliminate noise.

In the case of tuning in a SSB or ISB signal containing tone telegraph channels, a steady telegraph tone on one of the sidebands may be captured instead of the carrier. To prevent this, the operator should vary the HFRR TUNE control up and down the frequency scale in order to identify the carrier by its relative position and level to the sideband tones before tuning the AFC.

(c) AM, SSB, ISB and MCW Modes. - For SSB, ISB and MCW, adjust the HFIR CH A or CH B AGC DECAY switch to some low value. Sometimes reception of an AM signal can be greatly improved by tuning in one of its sidebands; usually one sideband will give excellent reception. This is done by the same procedure as tuning in a SSB signal using AFC.

(d) CW, FSK, FAX, FM and PM. There are several ways that these signals may be sent out and received. For instance, FSK and FAX may be transmitted as two alternating mark and space frequencies by themselves or they may be transmitted on a sideband with partially suppressed carrier as is VFT (voice-frequency telegraph). In the latter case, these signals are tuned in by the DDRR by methods as for SSB, using AFC to a great advantage to compensate for transmitted frequency drift. In the former case, FSK and FAX signals are brought in by tuning to the center frequency and switching the HFAR DETECTION switch to either CW or SSB. The CW position gives a tone adjustment by means of the HFAR BFQ control; the SSB position gives no tone adjustment but does give the greater stability of the HFSR injection frequency. These statements also hold true for CW, FM and PM reception. The AGC DECAY knob on the HFIR is set for the cleanest signal in some of its slower decay speeds because of the intermittent nature of the signal. The HAF may be used to narrow the audio output and cut out adjacent noise.

3-4. STANDBY CONDITION

a. FOR REMOTE CONTROL. - To place DDRR in standby condition for remote control, set switches as listed in Table 3-1, Local Control Settings for Remote Tuning. This keeps all power on, ready for operation, tuning input open and readback transmitting. For continuous remote operation, leave the switches in positions as listed.

b. FOR LOCAL CONTROL. - To set DDRR in standby condition for local control only, set HFP MAIN POWER switch in STANDBY and HFAR POWER switch in STANDBY. Set RTMU and RTTD switches at OFF. This keeps power supplied to the frequency-stabilizing ovens only and keeps the remote tuning input closed.

SECTION 4
PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

Functional and detailed analysis for local- and remote-controlled operation of the DDRR is given in the following paragraphs. Local-controlled operation analysis is given first; analysis of the remote control tuning circuits follows separately.

4-2. FUNCTIONAL ANALYSIS.

a. LOCAL-CONTROLLED OPERATION (Figure 4-1).

(1) RF AMPLIFICATION AND FIRST CONVERSION. - R-f signals from the antenna are applied to Continuous RF Tuner HFRR. Within the HFRR, a BAND switch and TUNE control selects the carrier frequency in the 2- to 32-mc range. This frequency undergoes 4 tuned stages of amplification and is beat with a high frequency oscillator (HFO) output signal of 3.75-mc to 33.75-mc to produce the first i-f of 1.75-mc which is applied to IF Amplifier HFIR.

A sample of the HFO output signal from the HFRR is applied to Control Synthesizer and Standard HFSR where it is converted to a 3.25- to 4.25-mc* signal. This 3.25- to 4.25-mc signal (containing the error, if any) is applied to a phase detector where it is compared with a nominally identical, ultrastable 3.25- to 4.25-mc signal developed by the HFSR circuits. Any phase difference between the two signals produces a proportional d-c voltage that is used to correct the HFO output of Continuous RF Tuner HFRR thereby maintaining a high stability. A front-panel SYNCHRONIZE meter monitors the d-c correction voltage being applied to the HFO.

An audio sync tone (developed by the HFSR phase detector) is applied simultaneously to: (1) the servo amplifier in Receiver Decoder RTTD (paragraph 4-3h); (2) channel A audio amplifiers of AF Amplifier HFAR via contacts of relay K7001 which is energized when the TUNE/SYNC/OPERATE switch of Continuous RF Tuner HFRR is set at SYNC.

Noise silencer stages in Continuous RF Tuner HFRR may be switched in to eliminate noise in the 1.75-mc output by means of the NOISE SILENCER/OFF/ALIGNMENT SIGNAL switch. When set at ALIGNMENT SIGNAL, this switch disconnects the antenna input and replaces it with a 2- to 32-mc alignment signal in order to check TUNE dial calibrations. The alignment signal is produced by beating the 3.75- to 33.75-mc HFO output with a stable 1.75-mc balanced modulator output. Injection frequencies (250-kc and 2-mc) for the balanced modulator are derived from the 1-mc standard in Control Synthesizer and Standard HFSR. When set at OFF, the NOISE SILENCER/OFF/ALIGNMENT SIGNAL switch disconnects the noise silencer circuit and the alignment signal, and reconnects the HFRR to the antenna.

(2) SECOND CONVERSION AND IF AMPLIFICATION. - Within IF Amplifier HFIR, the 1.75-mc signal from Continuous RF Tuner HFRR is applied to a second converter where it is beat with a 2-mc injection frequency to produce a 250-kc i-f. This 250-kc i-f signal is extended through selectable bandpass filters and i-f amplifiers and is provided as a dual-channel (A & B) output for detection in AF Amplifier HFAR. The 2-mc injection frequency for the converter stage is obtained from the 1-mc standard in Control Synthesizer and Standard HFSR or from the drift-corrected 2-mc signal from Automatic Frequency Control AFC, depending upon the setting of the AFC switch.

The IF BANDWIDTH KC selector switches select the bandpass filter output for the appropriate channel (A or B). The DSB (symmetrical) filters used for CW, MCW, AM, FSK**, FAX**, FM** and PM**, provide the desired bandwidth centered at 250-kc. The USB (upper sideband) and LSB (lower sideband) filters, used for SSB and ISB, attenuate the 250-kc carrier component and pass only the upper or lower sideband.

Two AGC voltages, one for each channel, are developed from the output of the filters for that channel. The strongest AGC voltage is selected by means of an AGC comparator circuit and applied to the input i-f amplifier stage of the HFIR and to the r-f amplifier stages of the HFRR. The AGC DECAY switch on the HFIR has 10 adjustments for setting slow to fast AGC decay time constants for various types of signals.

(3) DETECTION AND AUDIO AMPLIFICATION. Channel A and B signals, in the 250-kc range, are received by one of two detector circuits contained in AF Amplifier HFAR. When the channel A or channel B DETECTION switch is set at SSB or CW, the associated product detector is selected for CW, SSB, ISB, FAX, FSK, FM and PM reception. In the AM position, the diode detector circuit is selected for MCW and AM reception. In CW recep-

*Depending on the setting of the HFSR MC, 100-KC, 10-KC, 1-KC and .1-KC switches.
**With appropriate converter.

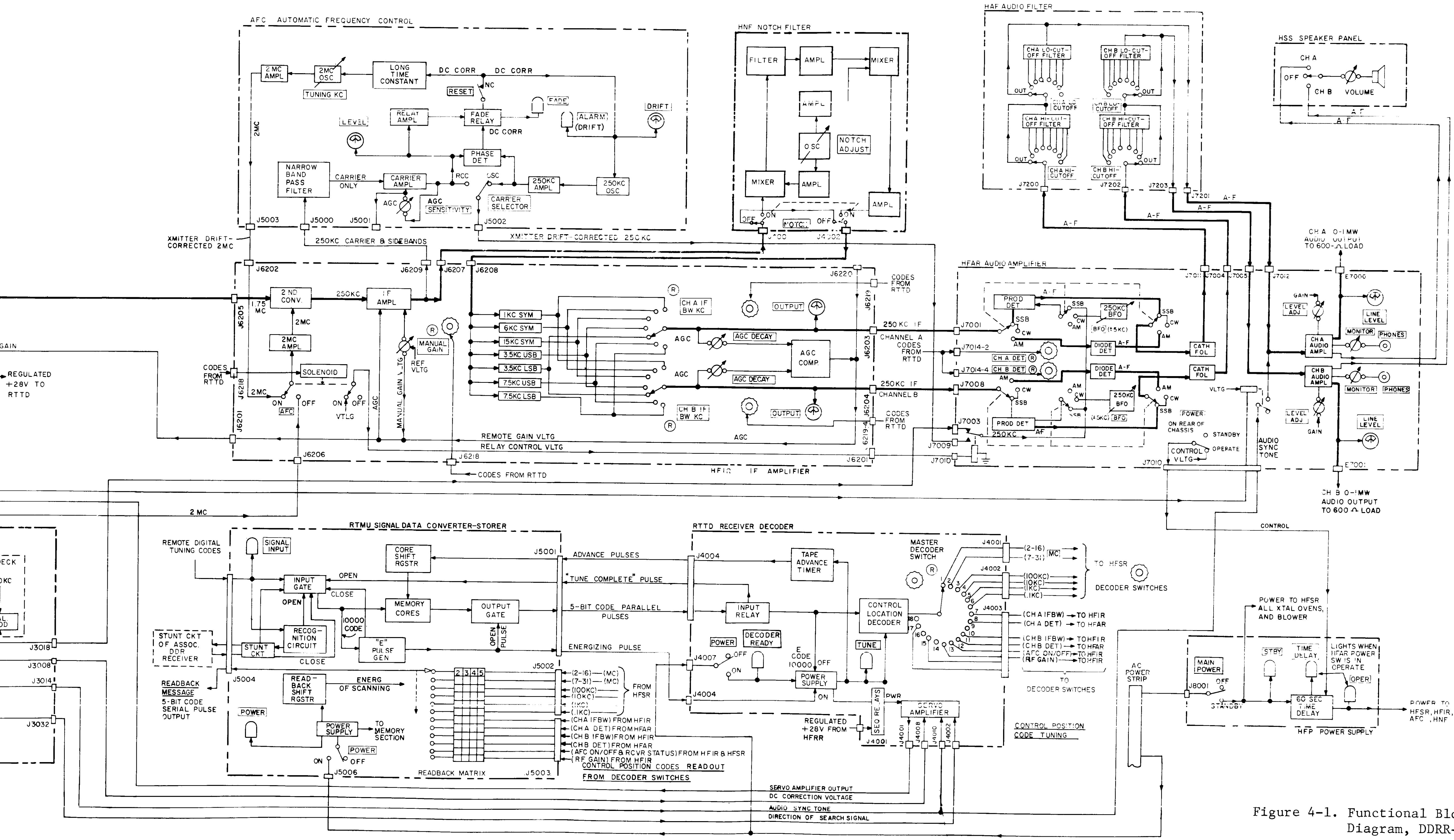
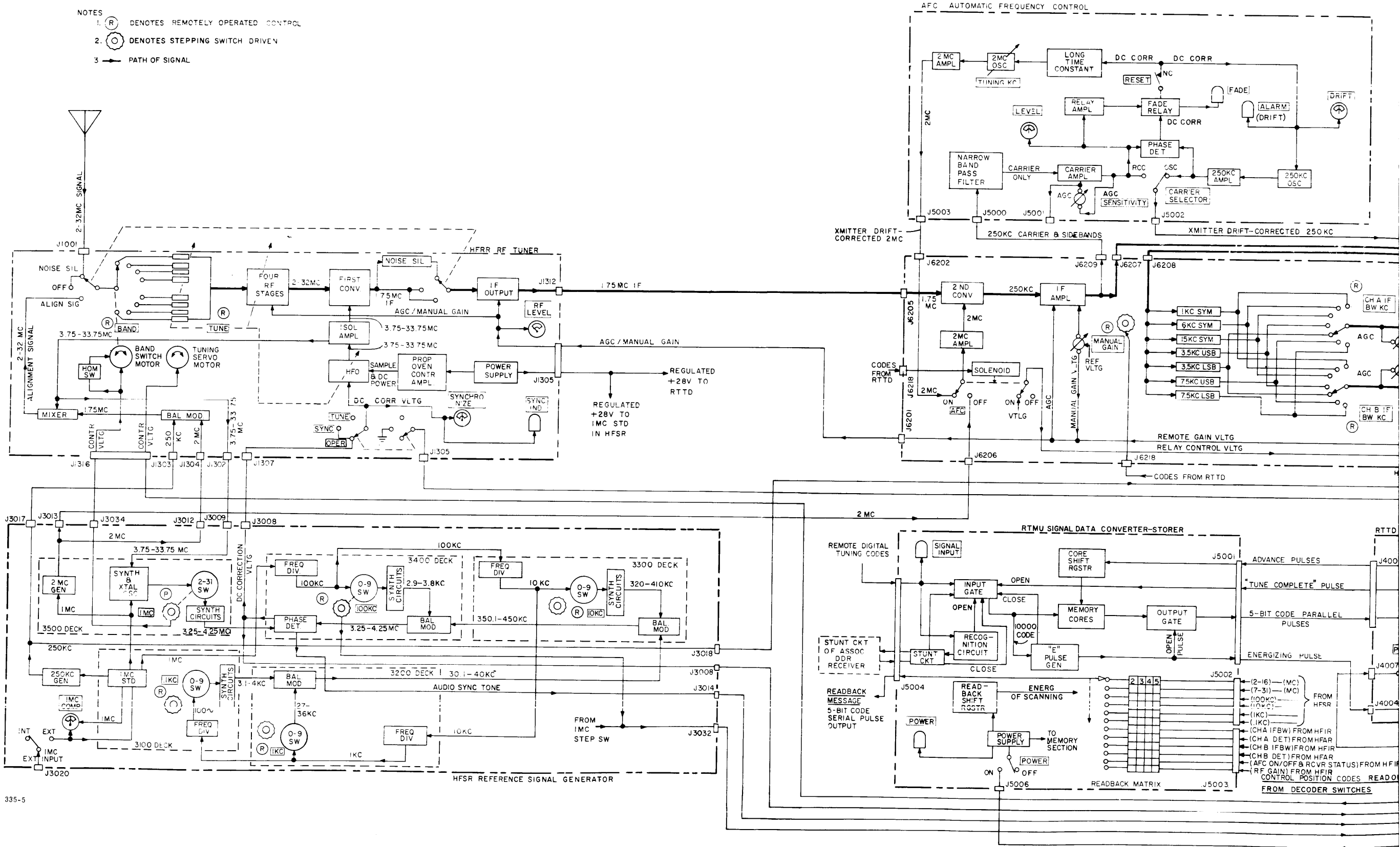


Figure 4-1. Functional Block Diagram, DDRR-5B



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tion, the keyed 250-kc frequency enters the product detector and is beat with the output of the BFO (adjustable through 247- to 253-kc) to produce the keyed audio tone. In SSB and ISB the sideband frequencies are beat with an ultra-stable 250-kc signal derived from the 1-mc standard of Control Synthesizer and Standard HFSR or the drift-corrected 250-kc signal from Automatic Frequency Control AFC (depending upon the setting of the AFC switch).

The resulting difference frequency is the audio output.

The outputs of channels A and B detector circuits are routed to the HAF Audio Filter. By means of front-panel switches this filter may be used to chop off the low and/or high ends of the audio band in varying amounts in order to eliminate adjacent noise.

The A and B audio signals are routed back to AF Amplifier HFAR, through two audio amplifiers, and out to the DDRR audio outputs and to Speaker Panel HSS.

(4) AUTOMATIC FREQUENCY CONTROL. - Automatic Frequency Control AFC is generally used to overcome audio-frequency output changes that occur as a result of a combined frequency drift in the receiver and distant transmitter.

A sample of the 250-kc output (carrier and sideband energy with $\pm\Delta f$, if any) from the amplifier stages of IF Amplifier HFIR is passed through a narrow bandpass filter which allows only carrier energy to be amplified and applied to a phase detector circuit in the AFCR. With the phase detector circuit, the amplified 250-kc $\pm\Delta f$ signal is compared with an internally generated 250-kc signal to produce a d-c correction voltage. Within the AFC, this d-c correction voltage is applied simultaneously: (1) to the 250-kc oscillator stage; (2) through a time-constant network to a 2-mc variable oscillator.

The internal 250-kc oscillator output frequency is rapidly adjusted and closely resembles the 250-kc $\pm\Delta f$ from IF Amplifier HFIR. This internally generated 250-kc $\pm\Delta f$ (drift-corrected 250-kc) is extended via the CARRIER SELECTOR switch to the detector stages of Audio Amplifier HFAR. Thus instabilities in the i-f are proportionately applied to the detector stages maintaining the audio frequency stability to within ± 1 cps.

The internal 2-mc oscillator output undergoes slow frequency changes in accordance with the d-c correction voltage applied. The output, 2-mc $\pm$ delayed Δf (drift-corrected 2-mc), is applied via the AFC switch of IF Amplifier HFIR to the converter stage within the HFIR. Thus, the output of the converter stage is corrected and kept within the capture range of the AFC and of the selectable filters within the HFIR.

(5) NON-SYNTHESIZED OPERATION. - Non-synthesized operation of the DDRR is similar to synthesized operation except that Control Synthesizer and Standard HFSR is not used for stabilizing the high-frequency oscillator of Continuous RF Tuner HFRR. The TUNE/SYNC/OPERATE switch of the HFRR is kept in TUNE, and the d-c correction voltage and audio sync tone from the HFSR is disconnected. Outputs from the HFSR are still used, however, for the test alignment signal and the 2-mc and 250-kc injection frequencies when Automatic Frequency Control AFC is not used.

b. REMOTE-CONTROLLED OPERATION. - Refer to figure 4-1. The additional components, the functions of which are purely for remote control, are: Signal Data Converter-Storer RTMU and Receiver Decoder RTTD. These units convert remote-control information (digital signals) to voltages that operate appropriate controls of the receiver system.

The RTMU receives 5-bit digital tuning signals in the form of addressal function and action-function codes (refer to table 1-2). After receipt of a character-recognition code, additional addressal function codes may enter the RTMU in any sequence as long as their corresponding action function codes followed them. The quickest tuning action is accomplished, however, by programming the message to enter in the order given in table 1-2 (particularly for the first 12 codes). This order permits the servo action on the TUNE control of continuous RF Tuner HFRR to stabilize more quickly. For purposes of simplification, the following description is based on receiving the codes in the sequence shown in table 1-2.

Each RTMU is programmed for a particular character-recognition code (first addressal function). A recognition circuit within the RTMU samples all character-recognition codes; upon receipt of the proper code, an input gate permits all succeeding characters (arranged in code groups), including a receiver-tune code (10000), to be stored temporarily in the RTMU memory cores. As the receiver-tune code enters the memory cores, it is simultaneously applied to an E-pulse generator which: (1) causes the RTMU input gate to close and an output gate for the memory cores to open; (2) energizes Receiver Decoder RTTD; (3) causes a tamping action to be applied to the message characters in the RTMU memory cores (refer to paragraph 4-3f).

As a result of the tamping action, the message characters are progressively moved toward the output end of the memory cores. When the message characters reach the output end of the memory cores, a monitor pulse is generated. This monitor pulse, in conjunction with the E pulse, causes a core-shift register to advance the first character to the input-relay circuit of Receiver Decoder RTTD.

The first character (addressal function) applied to the input-relay circuit (a 5-bit parallel pulse input circuit) of Receiver Decoder RTTD

advances the Master Decoder Switch to the appropriate position. The input-relay circuit then functions together with a clock and timer circuit to send advance pulses into an advance circuit of Signal Data Converter Storer RTMU causing the remaining characters in the memory cores to advance, one at a time, into Receiver Decoder RTTD (refer to paragraph 4-3f).

The second character (action function) applied to the input-relay circuit of the RTTD is extended through the Master Decoder Switch to the appropriate rotary-solenoid decoder switch within the receiver. The decoder switch then drives the associated control to the correct position. When the control has reached its correct position, the decoder-switch drive circuit is opened, the clock and timer circuit is activated, and an advance pulse is applied to the memory cores of Signal Data Converter-Storer RTMU causing the next character to be advanced into the input relays of Receiver Decoder RTTD.

The remaining characters (addressal functions and action functions) of the tuning message are advanced through the RTMU and RTTD in the same manner thereby positioning the RTTD Master Decoder Switch and rotary-solenoid decoder switches throughout the receiver to complete the tuning procedure.

Frequency-change information (addressal function and action function codes) contained in the tuning message drives the MC, 100 KC, 10 KC, 1 KC, and .1 KC controls of Control Synthesizer and Standard HFSR to the appropriate positions. These controls, in turn, position the BAND switch of Continuous RF Tuner HFRR, and prepare the HFRR for frequency search. When the wiper arm of the Master Decoder Switch in Receiver Decoder RTTD makes contact with pin 7 or 8 (CH A IF BANDWIDTH KC or CH A DET.), +28 vdc is applied to a servo amplifier in Receiver Decode RTTD. The servo amplifier activates a motor in Continuous RF Tuner HFRR and causes this motor (coupled to the TUNE control) to rotate either clockwise or counterclockwise (depending upon the setting of 100 KC switch in HFSR). As the HFRR is tuned closer and closer to the proper frequency, a phase detector circuit in control Synthesizer and Standard HFSR emits an audio sync tone and a d-c correction voltage that are used by the servo amplifier to complete the alignment of Continuous RF Tuner HFRR to the incoming frequency. To prevent continual searching due to an error, after 30 seconds from the time that Receiver Decoder RTTD has been energized (from the E pulse), a delay circuit shuts off the RTTD power supply.

c. DIGITAL REMOTE CONTROL READBACK. - Readback information (control-position indications) from each decoder switch (ⓒ on figure 4-1) in the receiver is supplied in 4-bit parallel form to a diode matrix in Signal Data Converter-Storer RTMU. A Code Shift Register within the RTMU scans the diode matrix and applies the 4-bit readback information and an internally-generated bit (corresponding to the first bit of a 5-bit character) simultaneously to inputs of a Bit Shift Register. This Bit Shift Register converts the parallel 5-bit input to a 5-bit serial pulse (a 7.42 baudot code) for application to remote indicating device.

4-3. DETAILED ANALYSIS.

a. INTRODUCTION. - A detailed analysis of each modular component in the DDRR is contained in the instruction manual for the component. The following detailed analysis of the DDRR describes that part of its circuitry (the TechniMatiC tuning system) that extends through the receiver, and, in some cases, causes interaction between modular components. The description is arranged in the same order in which events occur in TechniMatiC tuning.

b. APPLICATION OF POWER. - The remote tuning feature of the DDRR is enabled by application of line voltage to Signal Data Converter-Storer RTMU and Receiver Decoder RTTD through their respective POWER switches. Line voltage to the RTMU immediately energizes the readback circuits; logic voltages are also supplied to the RTMU's memory circuits, preparing it for reception of the first code. When the POWER switch of the RTTD is set at ON (see figure 4-2), the line voltage lights the DECODER READY lamp. Full line voltage is not connected across the primary of power transformer T4001 in the RTTD until the circuit is completed through contacts of energized relay K4030 and power lock-up relay K4027. These relays only energize when the RTMU receives the E (10000) code at the end of a tuning message.

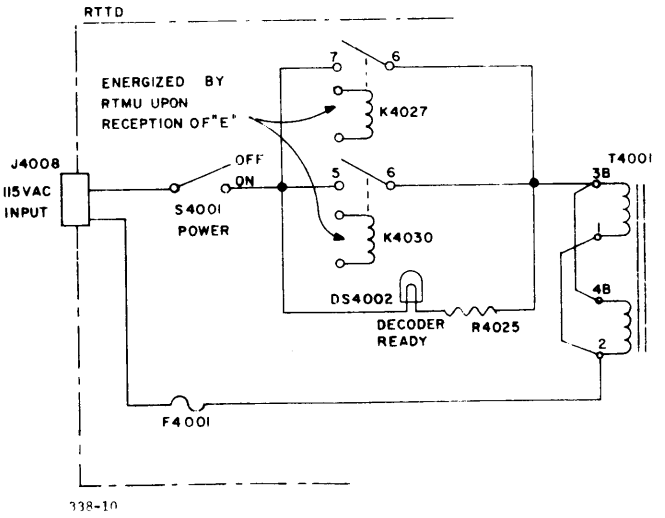

Figure 4-2. Simplified Schematic, Energization of RTTD by RTMU.

c. CODE ENTRY. - (See figure 4-3). All input codes enter the receiver at terminals 2 and 5 of terminal block TB3002 on A3860. Terminals 2 and 5 of TB3002 are extended to terminals 1 and 9 respectively of Signal-Data Converter Storer, RTMU. The RTMU requires voltage keying

at terminal 1 of J5004. Terminal 9 of the RTMU provides the -12 vdc required to voltage key the RTMU double inverter 7. From here, the code proceeds into the RTMU as described in the RTMU manual.

d. CHARACTER - RECOGNITION CODE. - The first character in the tuning message constitutes the character-recognition code. The function of this code is to open the RTMU input gate in order that the rest of the tuning codes may proceed into the memory cores, and to close the input Gates of other receivers connected to the TTY line. The input 5-bit character (in serial form) to Signal Data Converter-Storer RTMU is applied to Shift Register Circuits (Z5002 and Z5006) where the serial pulses are converted to parallel form.

The first 5-bit parallel pulse is then applied to the input of nandgate Z3 in Input Recognition Module Z5003 (refer to figure 4-4); upon satisfying input conditions, Z6 will open and set flip flop Z2. The negative output of flip flop Z2 is applied simultaneously to: (1) an inverter which energizes relay K1; (2) andgate 5 of Z9 contained in Shift Register No. 6 (Z5006) - this establishes one of the two conditions required to trigger andgate 5.

One set of energized relay K1 contacts connects ground to pin 7 of nandgate Z3 in the Input Recognition Module (Z5003) and to terminal 10 of J5004; this action closes Z3. Interconnection of J5004 terminal 10 of each RTMU utilizing a common teletype input line results in closing all recognition gates. This prevents any of the succeeding tuning codes (which might also correspond with one of the character recognition codes) from opening the recognition gate (Z3) of a receiver sharing the common teletype line.

Another set of contacts on energized relay K1 complete the operate path for relay K5002 in the readback section. Energized relay K5002 performs two functions: (1) it provides an In-Tune Process signal to an indicating device at the remote operating site; (2) it opens the operate path of relay K5001 which was held energized by closed contacts of sync relay K3001 within Control Synthesizer and Standard HFSR.

e. TUNING CODE STORAGE. - After receipt of the proper recognition code, each character of the tuning message applied to Shift Registers Z5002 and Z5006 are extended into the RTMU cores by an interaction between Shift Registers Z5002 and Z5006 and Advance Circuit No. 2 Z5005. The 5 bits of each character applied to Shift Register Z5002 are extended in serial form to Shift Register No. 6 (Z5006). Flip flop circuits (Z2 through Z8) contained in Shift Register Z5002 operate sequentially; each time flip flop Z8 is set, circuits contained in Advance Circuit No. 2 Z5005 extend a triggering pulse to Shift Register No. 6 causing each bit of the tuning message to be advanced into the memory cores. For detailed information, refer to the RTMU technical manual.

f. E CODE INTO RTMU. - The last 5-bit character to be stored in the memory cores is a receiver tune (E) code. This code also opens nandgate Z4 of Equipment Recognition Module Z5003 (refer to figure 4-5); Z4 then issues a 5 us pulse that is applied simultaneously to Equipment Recognition Module Z5003, to Shift Register Z5006, and to Advance Circuit Z5004.

1. The 5 us pulse from nandgate Z4 resets flip flop Z2 of Equipment Recognition Module Z5003; thereby producing the positive swing necessary to close the memory core input gate and de-energize relay K1 which in turn re-opens the recognition code gates of other receivers utilizing the common teletype input line. For detailed analysis, refer to the RTMU manual.

2. The 5 us pulse from nandgate Z4 sets flip flop Z3 of Shift Register Z5006 which results in triggering clock generator Z2 to produce regularly timed pulses (tamping action); these pulses working through one shot Z1 ultimately move the code bits to the output end of the RTMU memory cores (not shown). For detailed analysis, refer to the RTMU manual.

3. The 5 us pulse from nandgate Z4 fires one shot Z4 of Advance Circuit Z5004 producing a negative 450 millisecond pulse that: (1) is extended through an inverter to relay K4030 of Receiver Decoder RTTD thus energizing the RTTD power supply (see note below); (2) is applied directly to diode andgate (comprising CR2 and CR3) of Equipment Recognition Module Z5003 thus satisfying one of the input requirements for the diode andgate. For detailed analysis, refer to the RTMU manual.

NOTE

Relay K4027 operates when RTTD is energized and: (1) closes a secondary operating path for relay K5002 of RTMU (2) extends +12V to flip flop Z5 of Advance Circuit Z5004 which succeeds in closing the code input gate of Clock Timing Circuit Z5001 (refer to RTMU manual).

g. CODE TRANSFER FROM RTMU TO RTTD (Refer to Figures 4-5, 4-6 and 4-7). - When the first character of the tuning message reaches the 29th position in the memory cores, a negative 5 us monitor pulse is applied through an inverter to diode andgate CR2 and CR3 of Recognition Module Z5003; the output of the diode andgate swings positive and resets flip flop Z3 of Shift Register Z5006 which will: (1) stop clock generator Z2 thereby stopping the tamping action; (2) apply a negative pulse to a diode andgate (comprising CR1 and CR2) of Advance Circuit Z5004 thus satisfying one of the input requirements of the diode andgate.

When Receiver Decoder RTTD is energized (paragraphs 4-3b and 4-3f), relays K4006 and K4027 operate; closed contacts of relay K4006

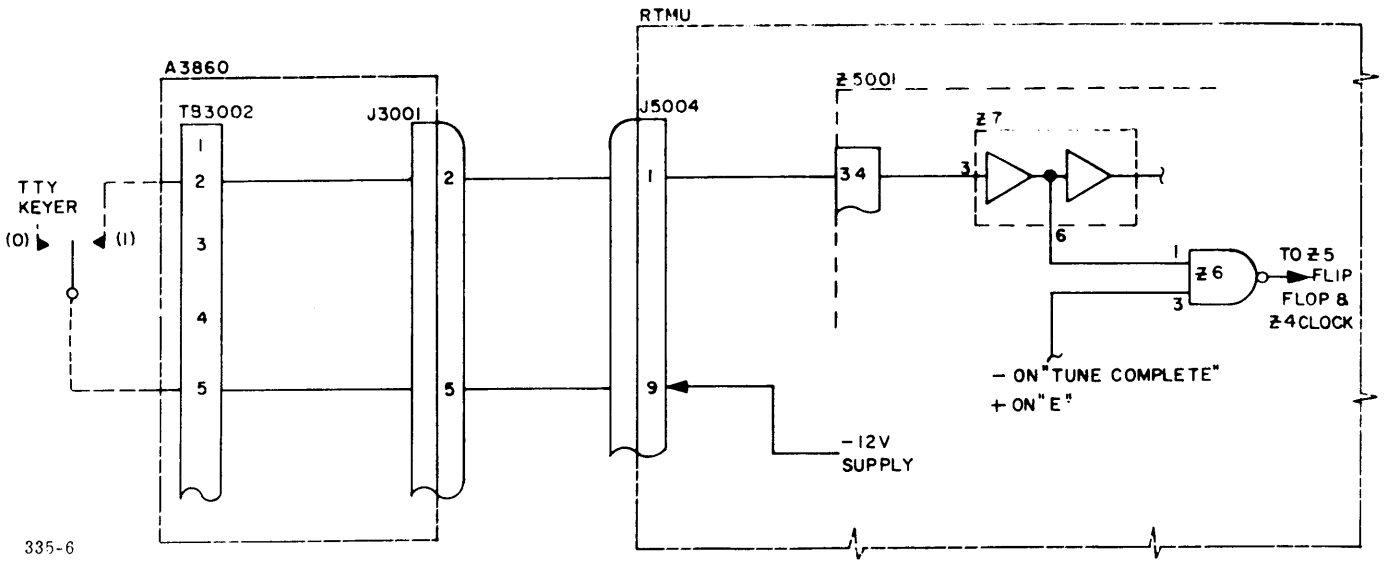

Figure 4-3. Tuning Code Entry into RTMU

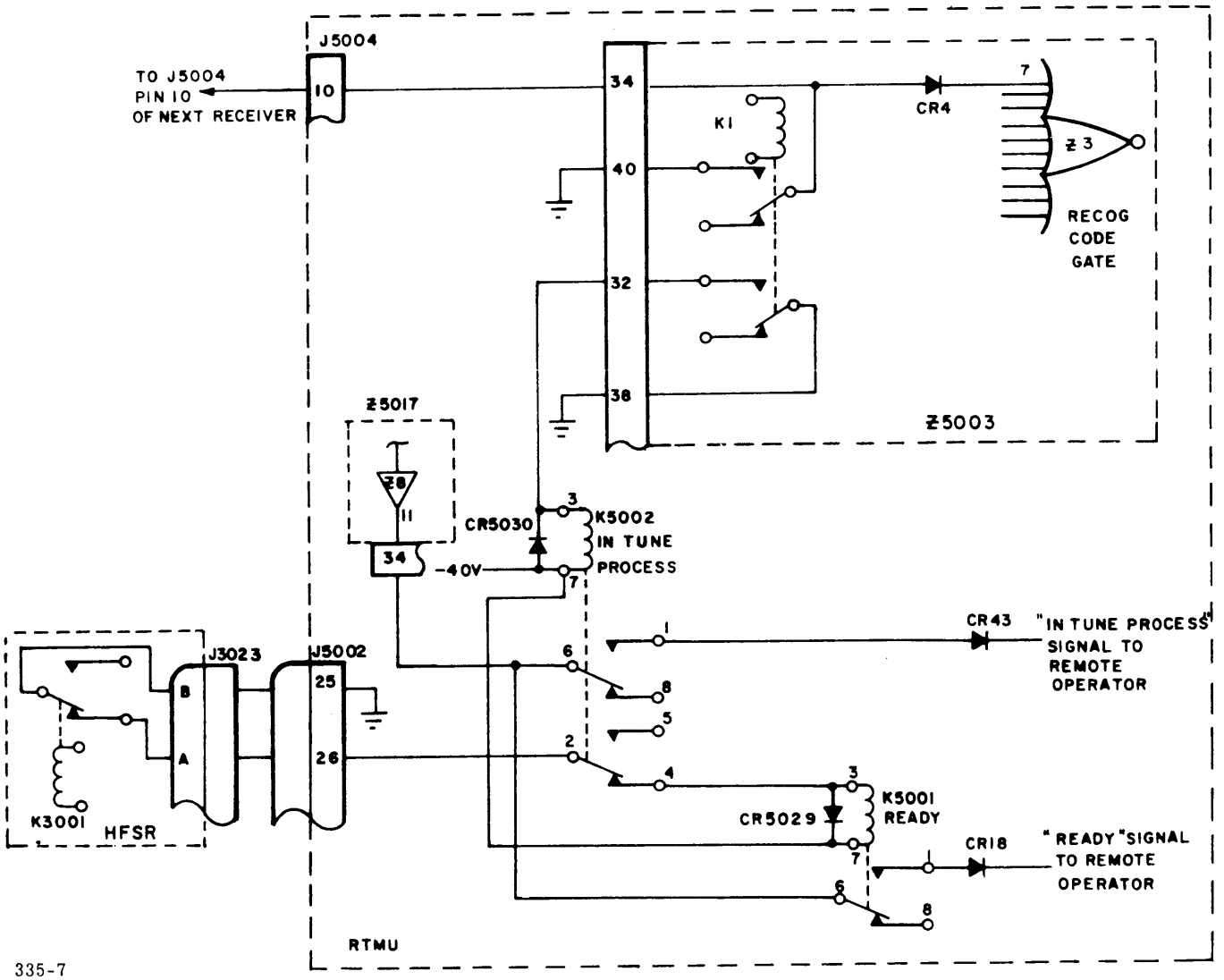

Figure 4-4. In-Tune Process/Ready Readback Circuits, Simplified Schematic.

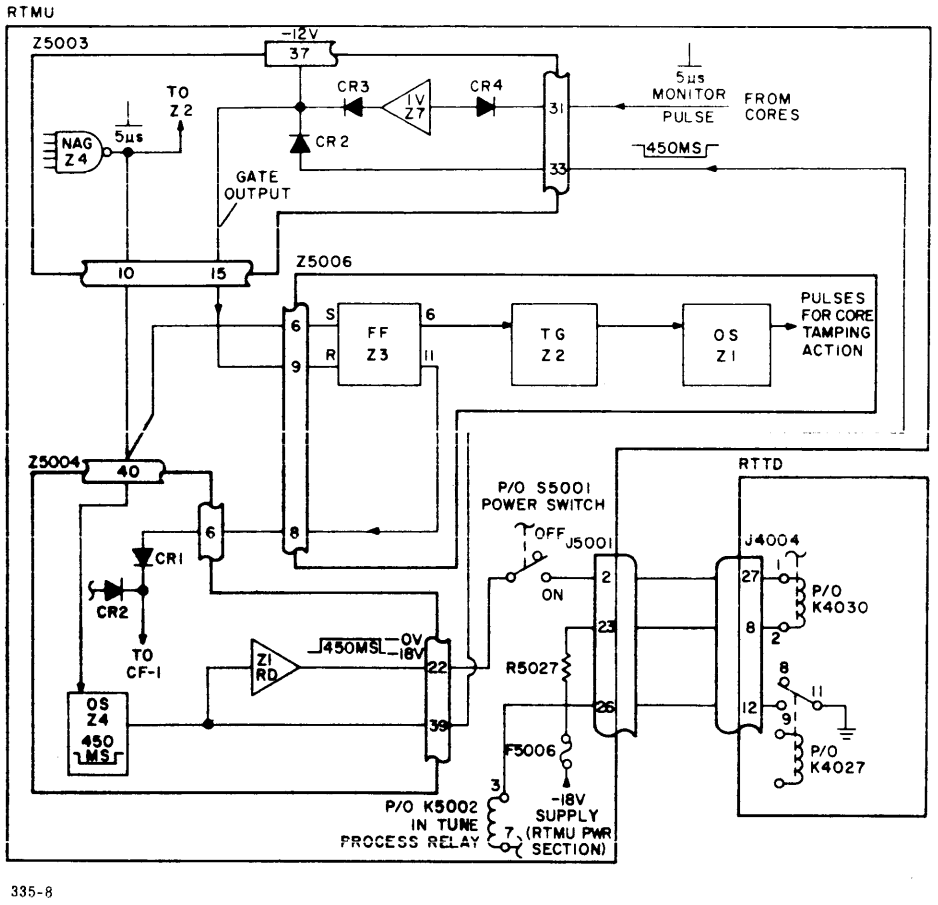

Figure 4-5. E Code Action, RTMU to RTTD

simultaneously extend: (1) +12vdc to contact 18 of relay K4008; (2) +28vdc to a multivibrator control circuit (comprising Q4001 and Q4002) for relay K4008. Relay K4008 controls the code-advance circuits as follows:

(1) Initially relay K4008 is held de-energized by a time-delay circuit; during this time, +12vdc from contacts 17 and 18 resets flip flop Z6 of Advance Circuit Z5004 in the RTMU.

(2) Upon completion of the time-delay interval, relay K4008 operates momentarily, operating voltage (+28vdc) is removed from relays K4001 through K4005, and +12vdc from contacts 18 and 19 of K4008 sets flip flop Z6 of Advance Circuit Z5004. The output of Z6 fires one shot Z3 which produces a .4 millisecond pulse that opens diode andgate CR1 and CR2 and is applied to emitter follower Z2. The amplified output of Z2 is applied to the RTMU memory cores moving the first code through Relay Drive Circuit Z5014 to the coils of input relays K4001 through K4005 of Receiver Decoder RTTD. For detailed analysis, refer to the RTMU and RTTD instruction manuals.

Closed contacts of relays K4001 through K4005 of the RTTD energize relays K4020 through 4025 in accordance with the tuning code (bit information) received from Signal Data Converter Storer RTMU. Depending upon the first bit of the tuning code, closed contacts of relays (K4020 through K4025) that are energized complete a path for +28vdc from contacts 6 and 7 of relay K4015 to the solenoid of the Master Decoder switch (S4004) in the RTTD or to the solenoids of the appropriate decoder switch in the receiver system. If the first bit of the tuning code is 1, relays K4001 and K4019 are energized and +28vdc is applied to the Master Decoder Switch S4004. If the first bit of the tuning code is 0, relays K4001 and K4019 are not energized and +28vdc is applied to the appropriate decoder switch in the Receiver.

In either case, the current drawn by a moving rotary solenoid results in energizing relay K4012 thus disabling the multivibrator control circuit (Q4001 and Q4002) and opening the operate path of relay K4008. When the stepping switch (S4004 or DDRR decoder switch) reaches the position prescribed by the tuning code, contact of a notch homing wafer open the +28 volt connection to the solenoid and the switch stops at the perscribed position. The operate path of relay K4012 is opened, the multivibrator control circuit is enabled, and relay K4008 is again energized. The sequential operation of relay K4008 sets and resets flip flop Z6 of Advance Circuit Z5004, thus advancing the tuning code from Signal Data Converter Storer

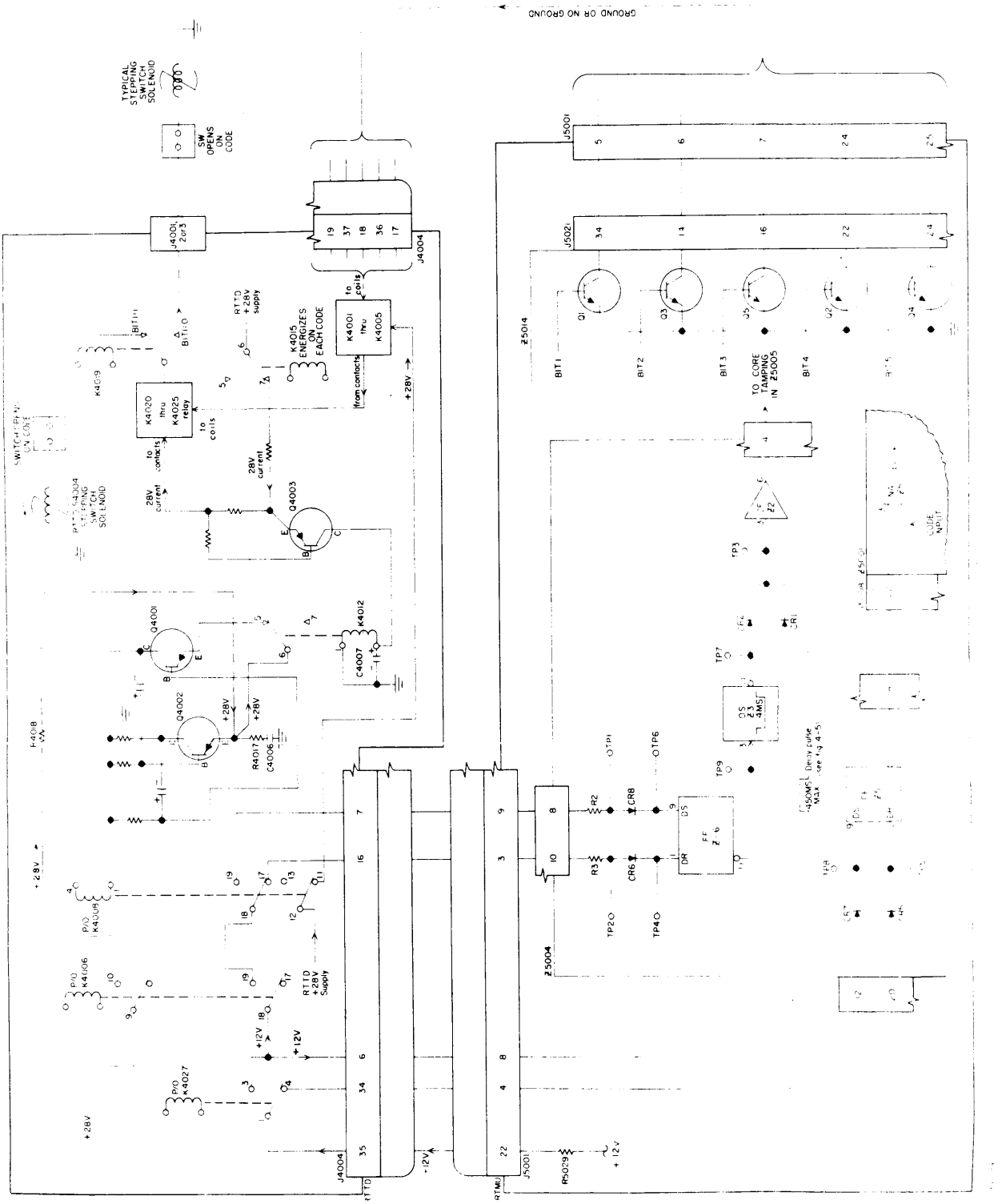

Figure 4-6. Simplified Schematic, Code Transfer from RTMU to RTTD.

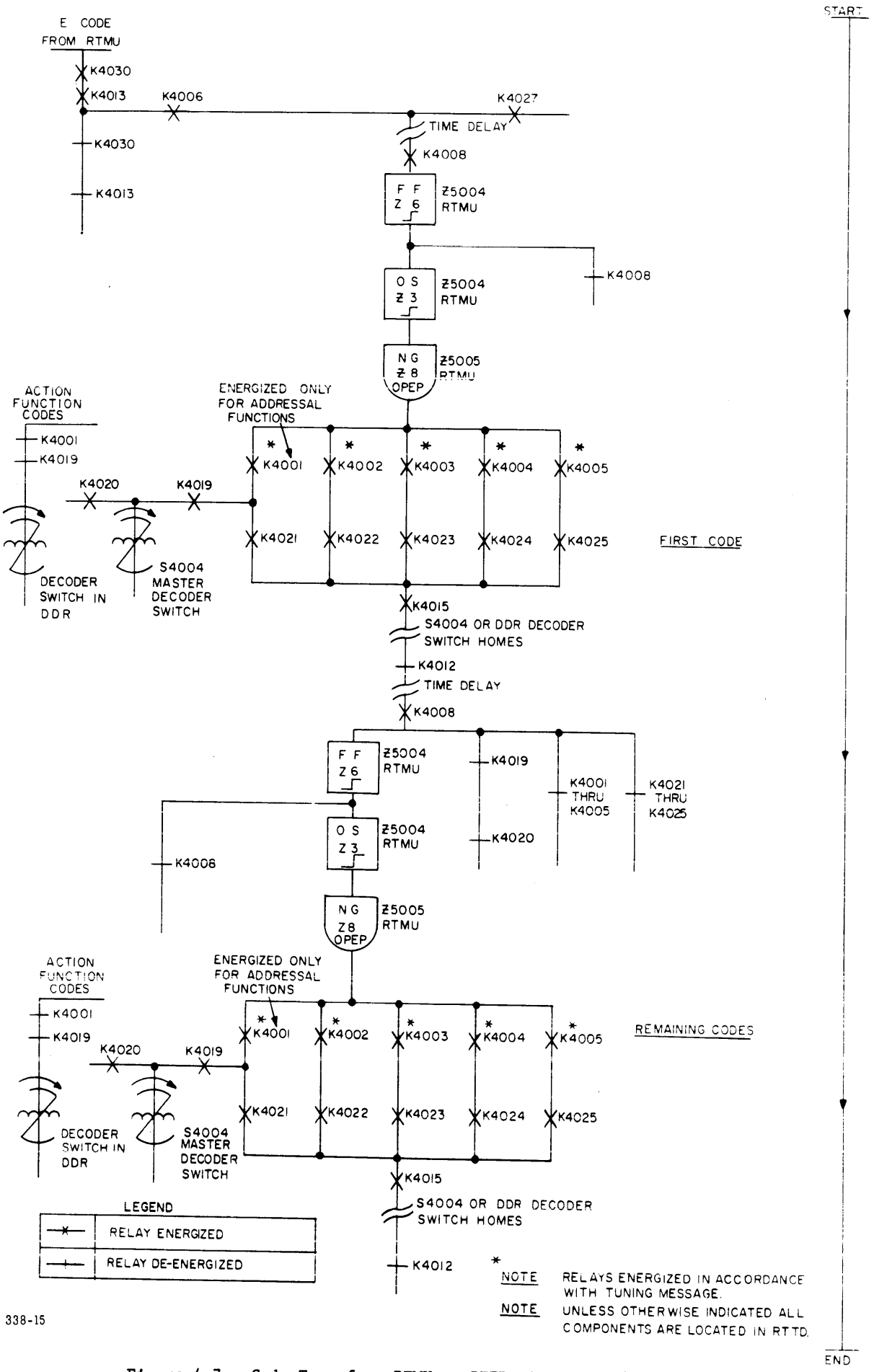

Figure 4-7. Code Transfer, RTMU to RTTD, Sequence Chart.

RTMU to Receiver Decoder RTTD and activating rotary solenoids throughout the receiver system. For detailed analysis, refer to the RTTD and RTMU instruction manuals.

h. SERVO TUNING ACTION. - There are three distinct stages of servo tuning action: (1) TUNE servo AZ103 of the RTTD is disabled until the BAND switch of Continuous RF Tuner HFRR is properly positioned; (2) motor B1002 of the HFRR is energized and the BAND switch is positioned in accordance with tuning information received; (3) TUNE servo AZ103 is then energized and frequency search takes place.

(1) DISABLING TUNE SERVO AZ103 (Refer to figure 4-8). - As the wiper of Master Decoder switch S4004 in Receiver Decoder RTTD makes connection with contacts 1 and 2, relay K4032 of the RTTD energizes and disconnects +28vdc from contact 6 of relay K4007 thus opening the locking path of K4007. (This is in the event that K4007 is still energized from a previous tuning sequence). De-energized relay K4007 opens contacts 9 and 10 and removes regulated +28vdc supplied from Continuous RF Tuner HFRR.

(2) ENERGIZING BAND SWITCH MOTOR OF HFRR (Refer to Figure 4-9). - As the wiper of Master Decoder switch S4004 in Receiver Decoder RTTD makes connections with contacts 3 and 4, +28vdc is extended through contacts 8 and 9 of de-energized relay K4017, through the BAND switch positioning wafer of Control Synthesizer and Standard HFSR, through homing switch S1007 in Continous RF Tuner HFRR, to the coil of relay K4028 energizes and: (1) closed contacts 6 and 7 connect 115 vac to solenoid L1063 in the HFRR. Current through the solenoid draws the cam follower out of the BAND switch cam; this action closes contacts 1 and 2 of micro switch S1006, thus applying +28vdc to the coil of relay K4017. Relay K4017 energizes and: (1) contacts 8 and 9 open the initial operate path of relay K4028--K4028 is locked operated at this time by its closed contacts 1 and 3; (2) contacts 20 and 21 open the operate path of the TUNE servo thus preventing servo operation until the BAND switch has positioned; (3) contacts 6 and 7 apply a-c power to motor B1002 causing it to rotate the BAND switch. When the BAND switch has positioned, homing switch S1007 opens the +28vdc locking path to relay K4028, K4028 is de-energized, the operate paths of relay K4017 and solenoid L1063 are opened, and the cam follower is released locking the BAND switch in its prescribed position.

(3) ENERGIZING TUNE SERVO OF RTTD (Refer to Figures 4-8 and 4-10). - As the wiper of Mas-

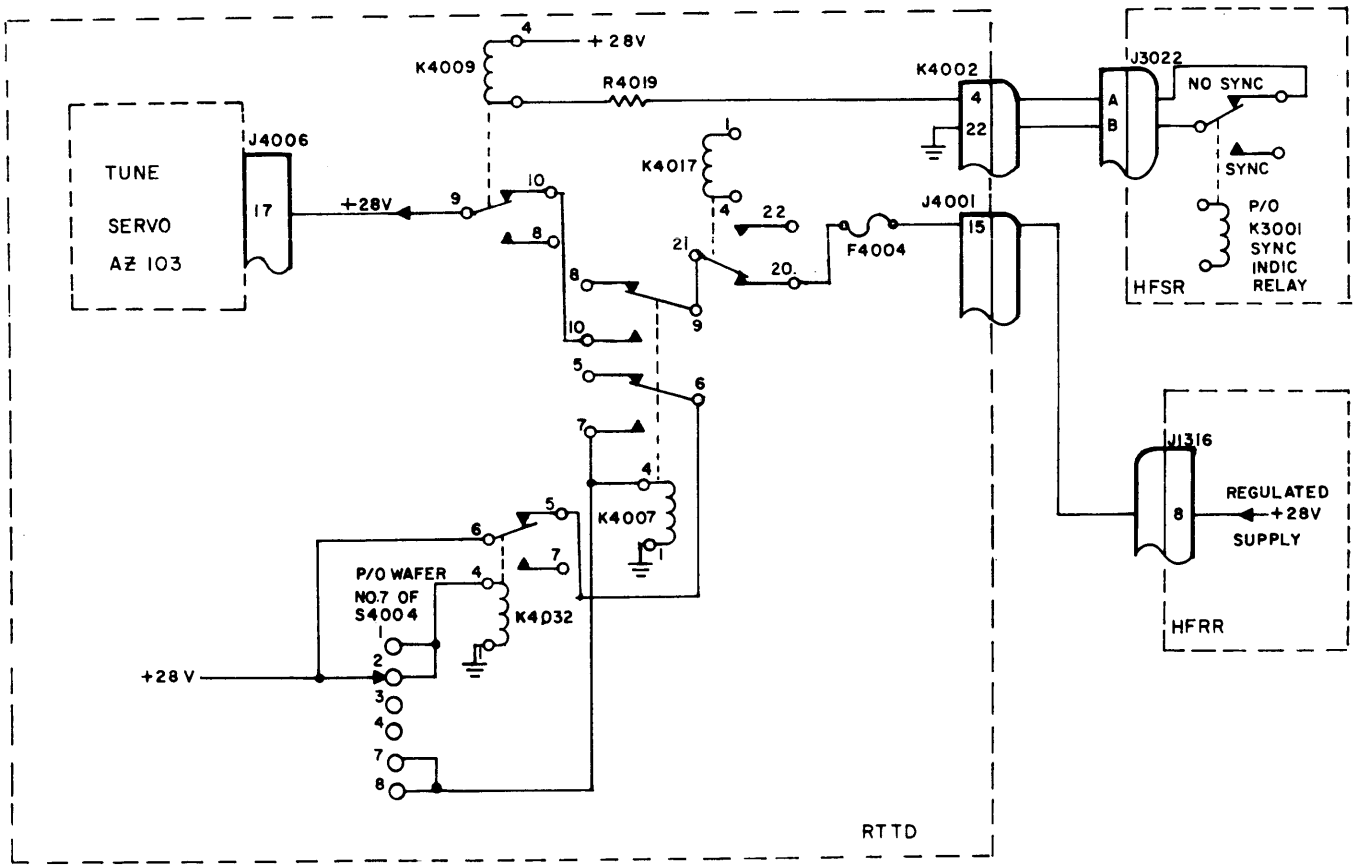

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Figure 4-8. Operate Path of Tune Servo AZ103, Simplified Schematic

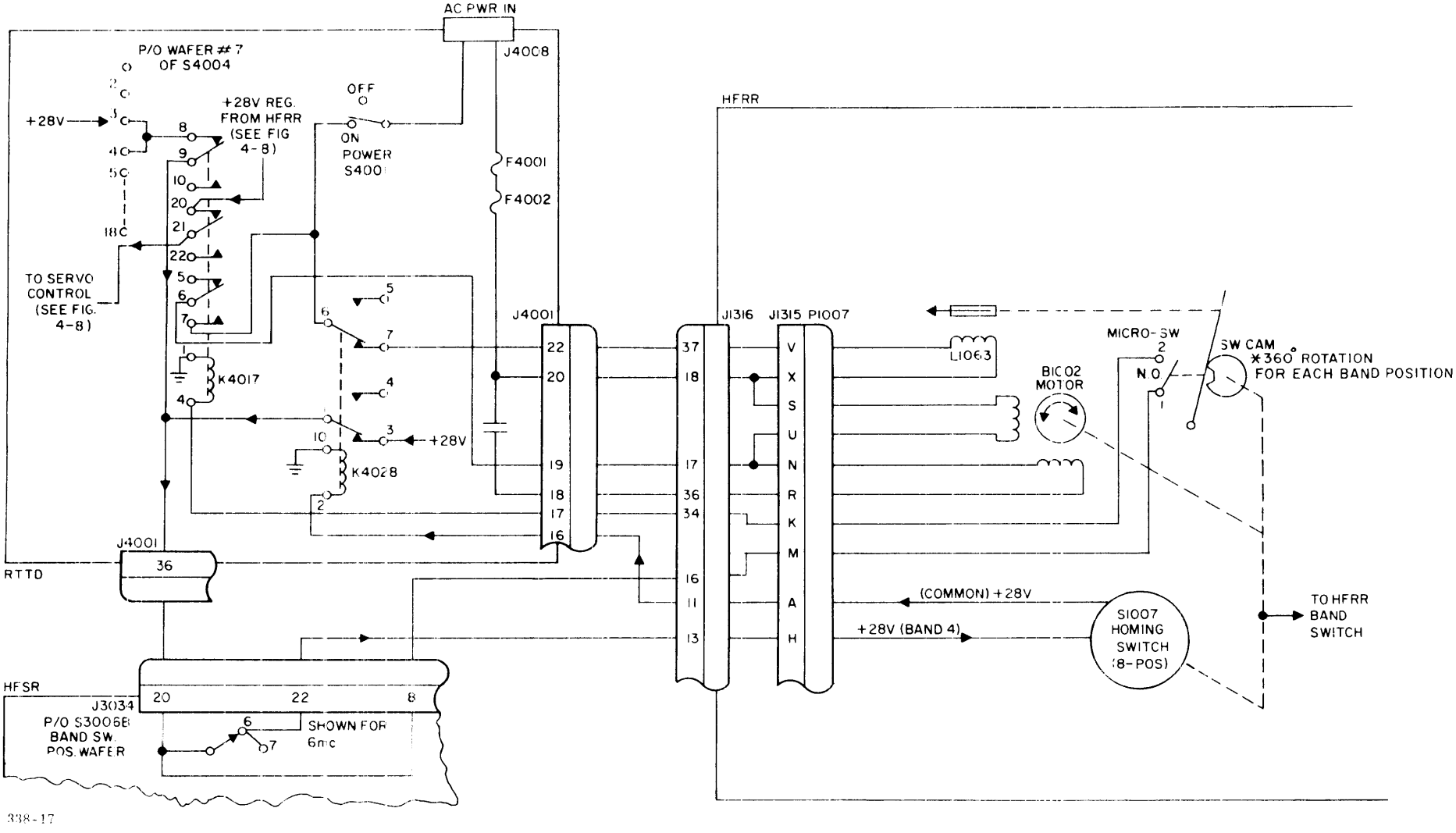


Figure 4-9. Energization of Band Switch Motor, Simplified Schematic.

ter Decoder switch S4004 makes connection with contacts 7 and 8, relay K4007 energizes and locks operated by means of its contacts 6 and 7. Closed contacts 9 and 10 of relay K4007 complete the +28vdc operate path for TUNE servo AZ103 through contacts 9 and 10 of relay K4009. Relay K4009 is held energized by the no-sync condition of relay K3001 of Control Synthesizer and Standard HFSR.

When the wiper of Master Decoder switch S4004 in the RTTD has passed contacts 7 and 8, the HFSR stepping switches (MC, 100KC, 10KC, 1KC, and .1KC) have stopped at their prescribed positions. The MC and 100 KC switches (S3006 and S3004) in the HFSR determine the operate or non-operate condition of relay K4018 in the RTTD. Relays K4018 and K4011 then determine the "direction of search" signal applied to TUNE servo AZ103 which in turn causes motor B1001 of Continuous RF Tuner HFRR to rotate in the correct direction. If the frequency selected falls in the left half of the MEGACYCLES dial of Continuous RF Tuner HFRR, the operate path of relay K4018 is completed through switches S3006C and S3004C, relay K4018 is energized, 6.3vac of proper phase is applied to TUNE servo AZ103, and motor B1001 in the HFRR moves the cursor of the MEGACYCLE dial towards the low-frequency end of the dial (refer to figure 4-10). If the selected frequency falls in the right half of the MEGACYCLES dial, the operate path of relay K4018 is not completed, relay K4018 remains de-energized, 6.3vac of proper phase is applied to TUNE servo AZ103, and motor B1001 in the HFRR moves the cursor of the MEGACYCLES dial toward the high-frequency end of the dial. For detailed analysis, refer to the RTTD instruction manual.

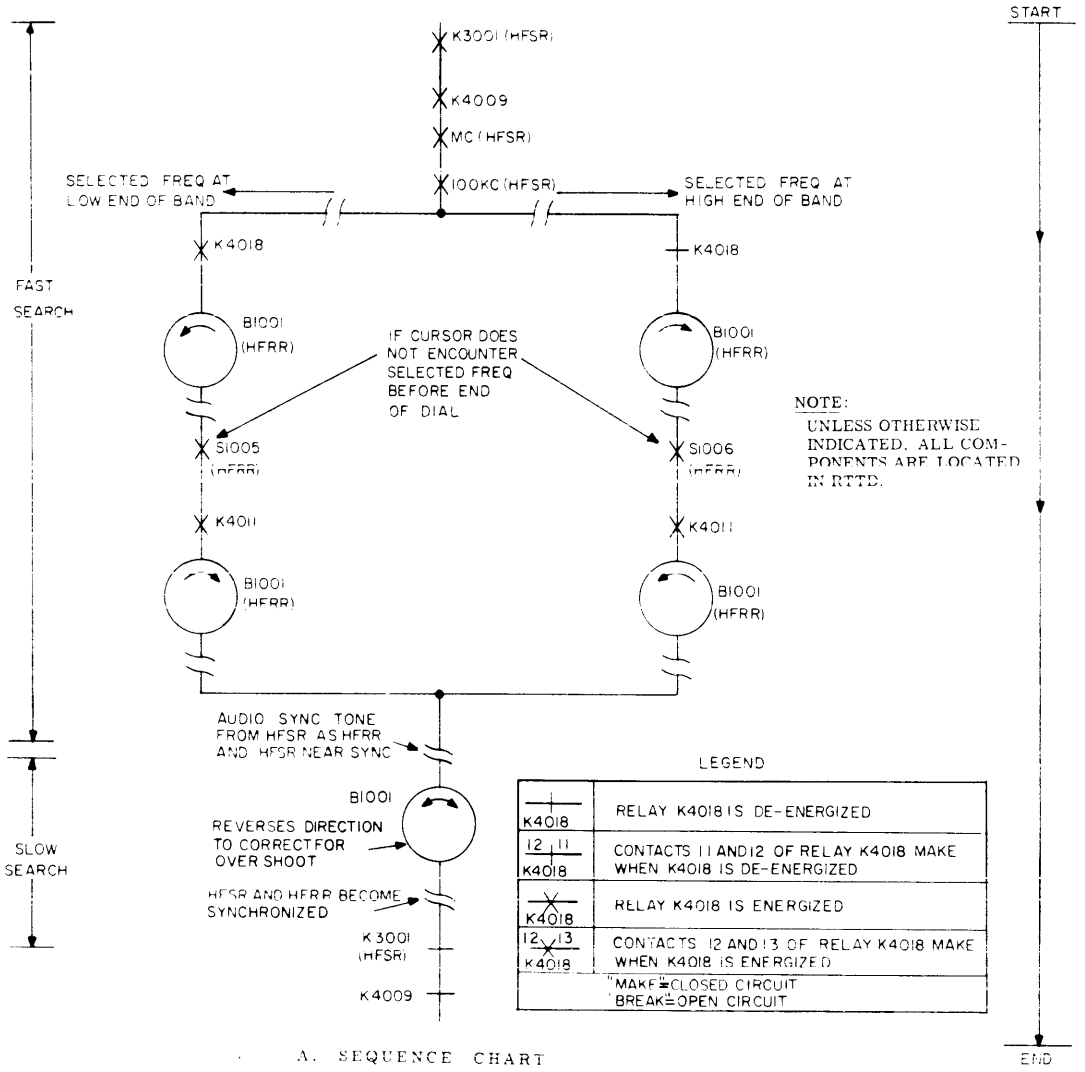
If the cursor on the HFRR MEGACYCLES dial does not encounter the prescribed frequency setting, it will continue to the end of the dial. When the cursor reaches the end of the dial, a limit switch (S1005 or S1006) is actuated, relay K4011 is energized, the phase of the 6.3vac applied to TUNE servo AZ103 is reversed, and motor B1001 reverses its direction. For detailed analysis, refer to the RTTD instruction manual.

i. E CODE INTO RTTD. - The receiver tune code (E) is transferred from Signal Data Converter-Storer RTMU to Receiver Decoder RTTD in the same manner as all other characters of the tuning message (refer to paragraph 4-3f). When the E code enters the code bit relays of the RTTD, Master Decoder switch S4004 moves to position 16 and wafer 7 connects +28 vdc to the coil of relay K4014 via contacts 5 and 6 of de-energized relay K4013 and contacts 12 and 13 of energized relay K4006 (refer to figure 4-11). Relay K4014 then energizes and opens the +28vdc locking path of relay K4006 (through its own contacts 6 and 7).

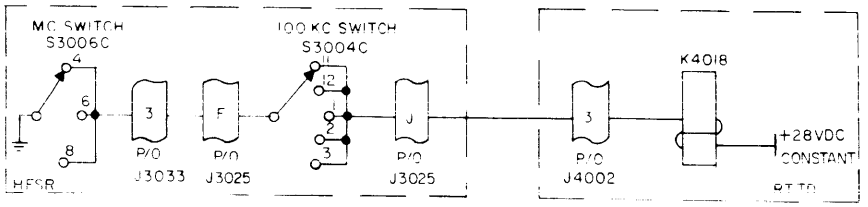
When the high-frequency oscillator of Continuous RF Tuner HFRR and Control Synthesizer and Standard HFSR are synchronized, the operate path of relay K4009 in the RTTD is opened via energized relay K3001 in the HFSR. Relay K4009 of the RTTD de-energizes and opens one of the two operate paths of relay K4027 (de-energized relay K4006 opened the other operate path). Relay K4027 de-energizes and: (1) shuts off the RTTD power supply (refer to RTTD manual); (2) de-energizes relay K5002 of the RTMU; (3) applies +12vdc to diode CR5 of Advance Circuit Z5004 thus resetting flip flop Z5.

De-energized relay K5002 energizes relay K5001 and the tuning cycle is complete with the readback code being transmitted to the remote operating site. The output of reset flip flop Z5 swings negative and sets nandgate Z5 of Clock Timing Circuit Z5001; Z5 opens to receive the first code of the next remote tuning message.

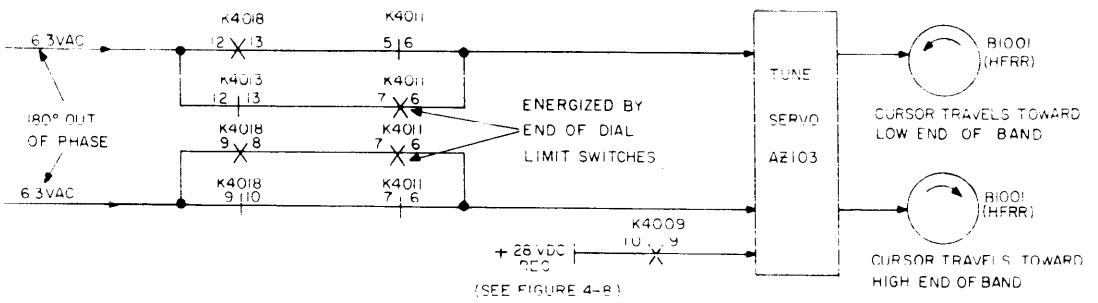
j. DIGITAL READBACK. - Except for the "in-tune process" and "ready" signals from Control Synthesizer and Standard HFSR and Continuous RF Tuner HFRR, all readback signals are generated by Signal Data Converter-Storer RTMU. A complete description of RTMU scanning and transmission of codes on the receiver stepping switch readback wafers may be found in the RTMU manual.



A. SEQUENCE CHART



B. OPERATIONAL SCHEMATIC



C. OPERATIONAL SCHEMATIC

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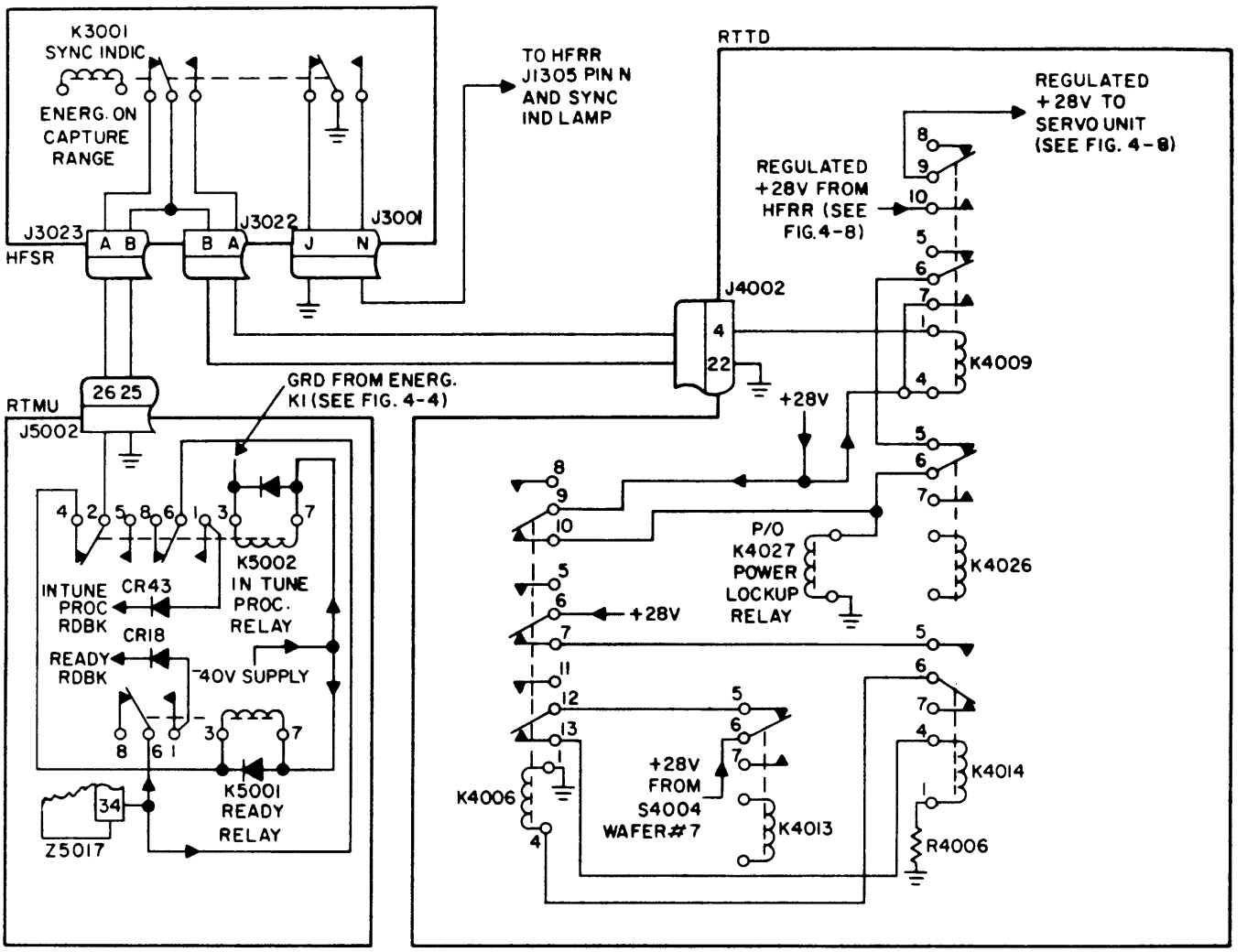
Figure 4-10. Frequency Search, Sequence Chart and Operational Schematic



338-19

Figure 4-11. Shut-Down of Digital Tuning System

SECTION 5
MAINTENANCE

5-1. SPECIAL TOOLS AND TEST EQUIPMENT

Special tools included in the shipment and required for DDRR alignment and maintenance are shown in figures 5-1 and 5-2. Table 5-1 lists standard laboratory equipment required but not supplied.

5-2. PREVENTIVE MAINTENANCE

a. CLEANING AND INSPECTION. - In order to prevent equipment failure due to dust, dirt or other destructive elements, it is suggested that a schedule of preventive maintenance be set up and adhered to.

At periodic intervals, the equipment should be removed from its mounting for cleaning and inspection. The wiring and all components should be inspected for dirt, dust, corrosion, grease or other harmful conditions. Remove dust with a soft brush or vacuum cleaner. Remove dirt or grease with any suitable cleaning solvent. Use of carbon tetrachloride should be avoided due to its highly toxic effects. Trichlorethylene or methylchloroform may be used, providing the necessary precautions are observed.

WARNING

When using toxic solvents, make certain that adequate ventilation exists. Avoid prolonged or repeated breathing of the vapor. Avoid prolonged or repeated contact with skin. Flammable solvents shall not be used on energized equipment or near any equipment from which a spark may be received. Smoking, "hot work", etc. is prohibited in the immediate area.

CAUTION

When using trichlorethylene, avoid contact with painted surfaces, due to its paint removing effects.

b. REPLACEMENT OF ELECTRON TUBES. - While the modular units are out of the cabinet for periodic inspection, all electron tubes should be checked and replaced as required. Particular attention should be paid to the following:

(1) When withdrawing miniature tubes from their sockets, pull them straight out; do not rock or turn them. If pins of minature tubes are bent, straighten them with a proper pin straightener before replacing the tube.

(2) Some circuits, for example oscillator circuits, may function better with one tube than with another even though both tubes are new or both tubes measure the same when checked on a tube tester.

(3) Tubes should not be replaced or discarded merely because thay have been used for some time. Satisfactory operation in a circuit is the final proof of tube quality; the tube in use may work better than a new tube.

TABLE 5-1. TEST EQUIPMENT, DDRR

ITEM	MANUFACTURER
Frequency Counter	Hewlett Packard, Model 524C, or equivalent.
Signal Generator	Measurements, Model 82, or equivalent.
Vacuum Tube Voltmeter	Hewlett Packard, Model 410B, or equivalent.
R-f Voltmeter	Ballantine Laboratories, Model 314, or equivalent.
Teletypewriter Set (with keyboard, tape puncher, tape reader and 7.42 baudot CCIT-5level code electrical output)	Smith-Corona Marachante (Kleinschmidt Div.) AN/FGC-25 or equivalent.

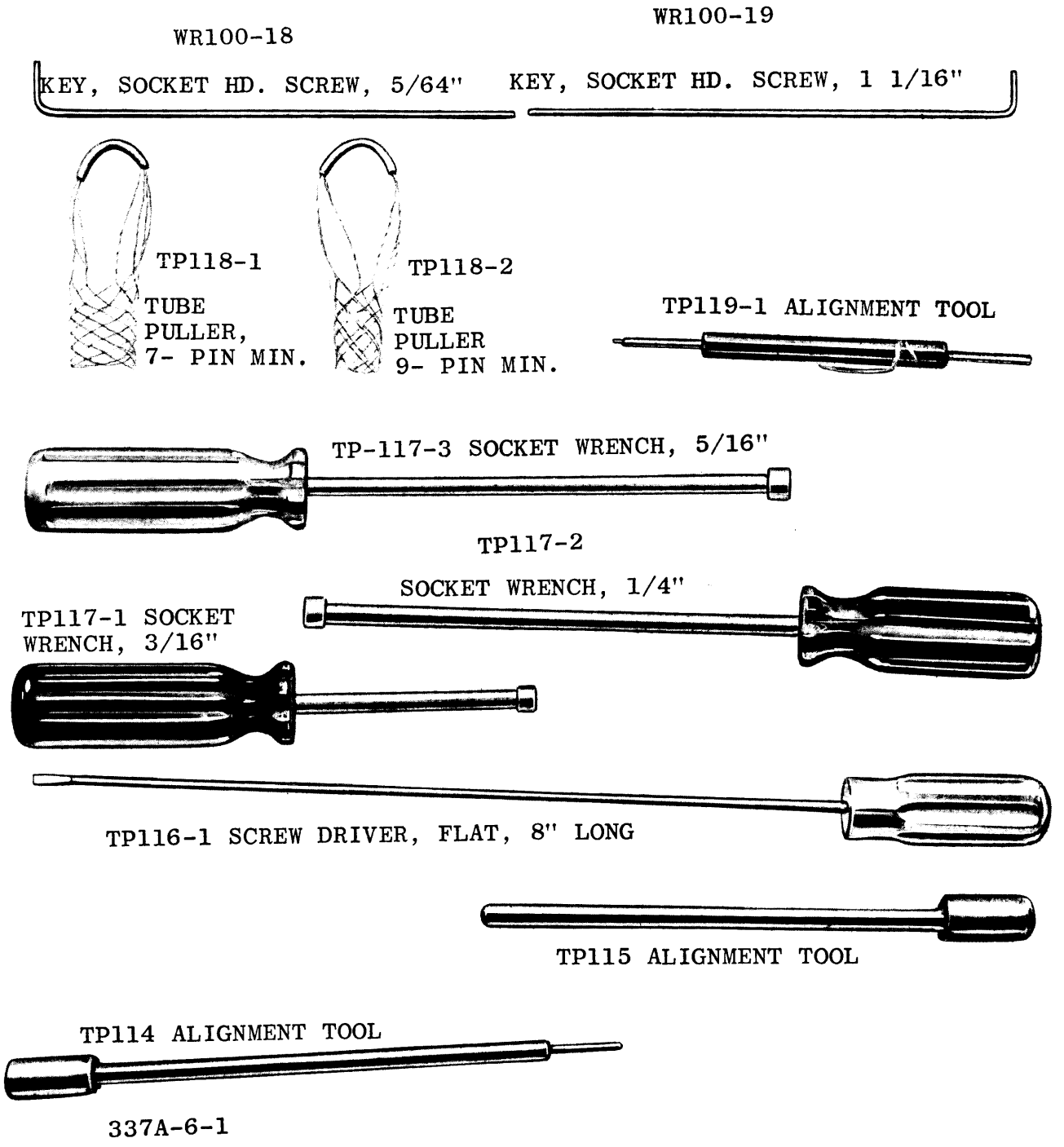


Figure 5-1. Special Tools, DDRR Maintenance

c. GEAR LUBRICATION. - Examine all gears and gear assemblies contained in the modular units. If any of the gears show signs of becoming dry, coat them heavily with a molydenum disulphide compound such as Molykote Type G made by the Alpha Corporation of Greenwich, Conn.

5-3. ALIGNMENT AND ADJUSTMENT

a. INTRODUCTION. - With the exception of the procedure given in the following paragraphs (b, c, and d), all alignment and adjustment is accomplished on an individual modular unit basis. Refer to the appropriate modular-unit manual for the necessary alignment and adjustment procedures. The following procedure is for alignment of HFRR circuits, utilizing a tested HFSR and the audio sync tone generated by it.

b. ALIGNMENT OF HFO CIRCUIT IN HFRR. - Proceed as follows:

(1) Ascertain that the receiver has been in the STANDBY condition for at least 24 hours.

(2) Set RTMU and RTTD POWER switches at OFF.

(3) Set HFAR CHANNELS A and B LEVEL ADJUST knobs fully clockwise.

(4) Set HFRR NOISE SILENCER/OFF/ALIGNMENT SIGNAL switch at ALIGNMENT SIGNAL.

(5) Set HFSR selector switches for a reading of 2.0000 mc on the digital display.

(6) Adjust HFRR TUNE knob to bring exactly 2 mc on dial. If SYNC IND lamp lights and remains lit and SYNCHRONIZE meter indicates zero center scale, no adjustment is necessary. If these indications are not present, insert alignment tool TP115 in rear orifice on top of HFO oven enclosure and adjust oscillator trimmer to obtain them.

(7) Set HFSR selector switches for a reading of 3.0000 mc on the digital display.

(8) Adjust HFRR TUNE knob to bring exactly 3 mc on dial. If SYNC IND lamp lights and remains lit and SYNCHRONIZE meter indicates zero center scale, or nearly so, no adjustment is necessary. If these indications are not present, insert alignment tool TP114 in front orifice on top of HFO oven enclosure and adjust HFO trimmer to obtain them.

(9) Repeat steps (5) through (8) until no further adjustment is necessary.

CAUTION

When performing the following step, be sure to remove alignment tools before attempting to rotate the HFRR BAND control.

(10) Using procedures outlined in steps (5) through (9), align HFO circuit at high and low frequencies of each band.

c. ALIGNMENT OF RF CIRCUITS IN HFRR. - Proceed as follows:

(1) Repeat steps (1) through (4) in HFO alignment procedure.

(2) Set HFSR selector switches for a reading of 2.0000 mc on the digital display.

(3) Adjust HFRR TUNE knob to bring exactly 2 mc on dial. Remove top cover of HFRR r-f turret to expose "L" and "C" adjustments of r-f tuner strips. Using alignment tool TP115, adjust inductors L1001, L1005, L1007 and L1009 of HFRR for maximum indication on associated RF LEVEL meter. Adjustment of L1001 will be very broad.

(4) Set HFSR selector switches for a reading of 3.0000 mc on the digital display.

(5) Adjust HFRR TUNE knob to bring exactly 3 mc on dial. Using alignment tool TP114, adjust capacitors C1009, C1015, C1023, and C1031 for maximum indication on RF LEVEL meter.

(6) Repeat steps (2) through (5) until no further peaking can be obtained.

(7) Repeat procedure outlined in steps (2) through (6) for high low frequencies of each band. Adjust inductors at low end of band and capacitors at high end of band; in all cases, adjustment of input inductor will be very broad.

d. ADJUSTMENT OF HFRR SYNCHRONIZE METER. - To adjust the SYNCHRONIZE meter, set the HFRR TUNE/SYNC/OPERATE switch at TUNE or SYNC, and adjust R1320 for zero center scale on the SYNCHRONIZE meter.

5-4. TROUBLESHOOTING

Figure 4-1, depicting the detailed paths of frequencies and signals in the DDRR, is included in this manual as a primary aid in troubleshooting the receiver system as a whole. Running the receiver system through a typical manual operation, per paragraph 3-3, and referring to figure 4-1, should reveal which modular unit (HFRR, HFSR, etc.), is at fault. With this determined, reference to the detailed troubleshooting procedure in the modular-unit manual should reveal the faulty area or component. In the case of a tion of the circuit. For wire tracing, refer to section 7 of this manual, and the schem sections of the individual modular-unit manuals.

If, after a manual tuning, the receiver performs satisfactorily, it may be assumed that the trouble lies in either the RTMU, or RTTD

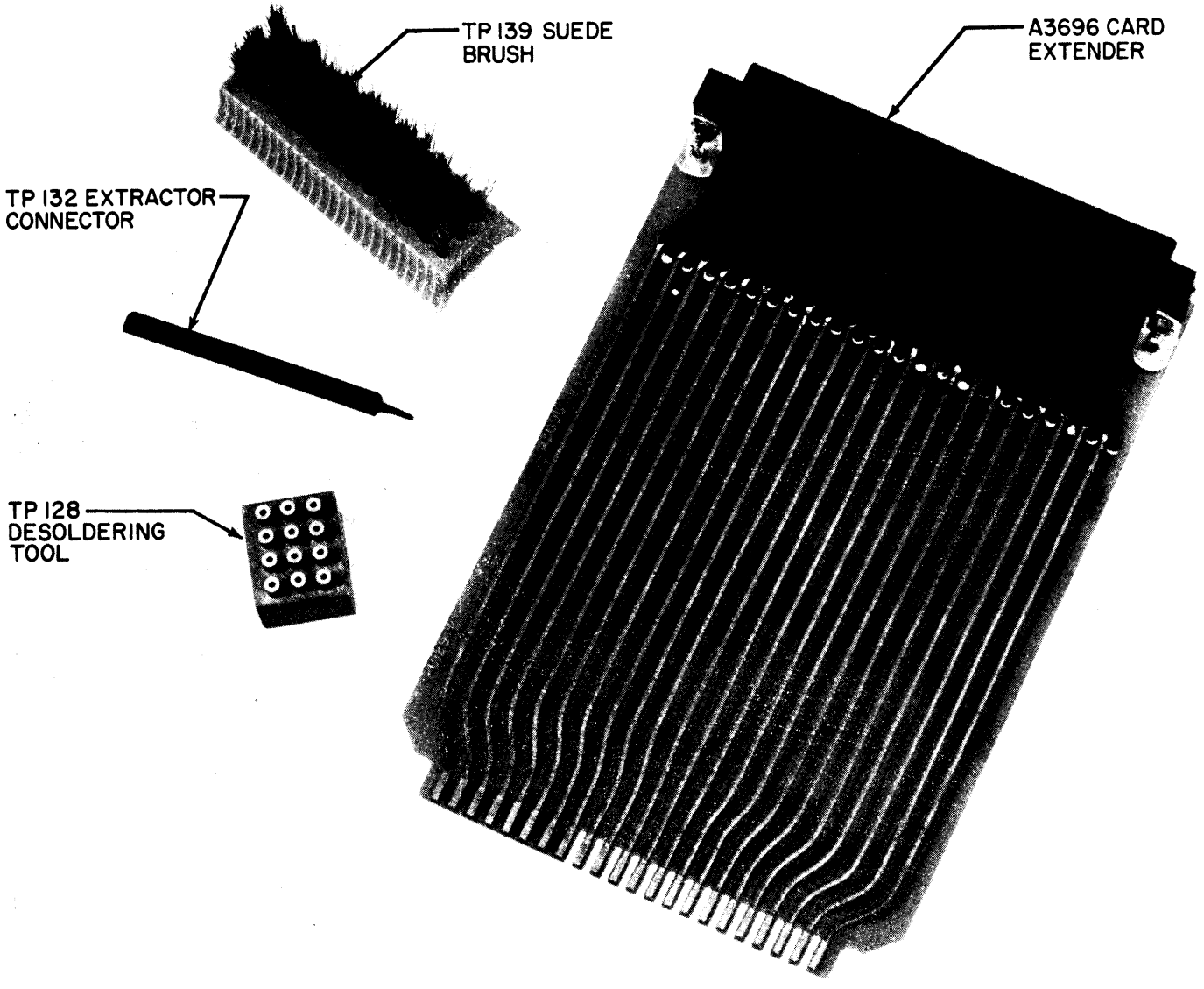


Figure 5-2. Special Tools, DDRR Maintenance, Logic Circuit

units or possibly in the automated circuitry and stepping switches in the remote controlled modules. For checking the RTMU and RTTD, a substitute code input signal is required.

CAUTION

Do not apply test probe to pins of encapsulated logic modules on RTMU printed circuit cards! Apply probe only to "TP" test points indicated on card or to receptacle pin test points at the bottom of the card. It is difficult to touch the probe to the miniature pins on the module without shorting and destroying the module. (See figure 5-3).

Technical Materiel Corporation manufactures equipment, such as the Model RTDA TechnMatiC Test Set, specifically to act as a convenient substitute code input at the RTTD Receiver Decoder receptacle J4004. This unit tests the RTMU, RTTD and the automated circuitry in the modules fed by it as a whole. The RTDA provides a selection of four modes of testing (see figure 5-4): - (1) by pre-punched tape from a CCIT 5-level or ASCII 7-level teletype puncher, (2) by bit pushbutton code generation from the RTDA keyboard, (3) a code-by-code extraction of the message stored in the RTMU memory by "advance" pulse generation manually controlled at the RTDA and (4) extraction of the entire message stored in the RTMU, triggered manually at the RTDA. By testing with all 4 modes, the RTDA will pinpoint the area of trouble (i.e.: RTMU, RTTD, individual module stepping switch). The RTDA, (see figure 5-5) is designed to mount in a 19-inch width rack or in its own desk model cabinet. It receives its power from the RTTD unit under test. Detailed instructions for the test setup and procedure are included in the RTDA manual. Interconnecting cables between RTDA, RTMU and RTTD are shipped as loose items with the RTDA.

TMC's TechniMatiC remote control equipment (code generator, card/tape puncher and reader) and the TechniMatiC receivers are designed for the CCIT 5-level code as shown in table 1-2.

However, an easy adaptation is made to ASCII 7-level code puncher may be used by punching the equivalent ASCII 7-level codes as referenced in table 1-2 and turning the tape over to reverse the reading order as the tape is fed into the 5-bit reader in the RTDA. This arrangement enables the sprocket holes in the tape to engage with the 5-level reader sprockets.

If an RTDA unit is not used, code input at the RTMU can be substituted by test tape into a CCIT 5-level teletype reader (TTY). In this case, the output of the reader should be modified to dry contact keying into the RTMU at J5004 receptacle. Refer to the RTMU manual for pin numbers in the connector. Ascertain that the pulse widths (60 WPM or 100 WPM) of the reader match those of the RTMU (Z5001 printed circuit card in RTMU).

Another method, that may be used, is the employing of the DDRR controls and RTMU readback section as the substitute code input. This method has the added advantage of testing the RTMU readback section at the same time. Figure 5-6 shows the test setup. The procedure is to manually set the receiver controls for a particular combination of positions and note these positions. This sets up readback codes, representing the positions, on the RTMU diode matrix. The readback shift-register transmits the codes in 7.42 pattern serial pulse form to the TTY tape puncher, including the "E" code at the end of each cycle. After the tape is punched with two or more readback cycles, the receiver controls are manually re-set to positions other than those in the test arrangement. Then the tape is fed into the TTY tape reader to transmit one cycle with the "E" code falling at the end of the message. The reader transmits this set of codes into the RTMU memory section in a 7.42 pattern serial pulse form. If the RTMU and RTTD are performing correctly they work together to bring the receiver controls to their former positions.

5-5. REPAIR

Repair procedures and replaceable electrical parts lists for the modular units may be found in the modular Technical Manuals for these units. Repair of DDRR rack interconnecting cabling and replacement of components may be done by referring to the rack components parts list in Section 6 and detail cable wire run lists in Section 7 of this manual.

CAUTION

Repair of the printed circuit logic cards in the RTMU require special techniques and tools as described in the RTMU manual. Do not attempt to repair these cards without first referring to the manual.

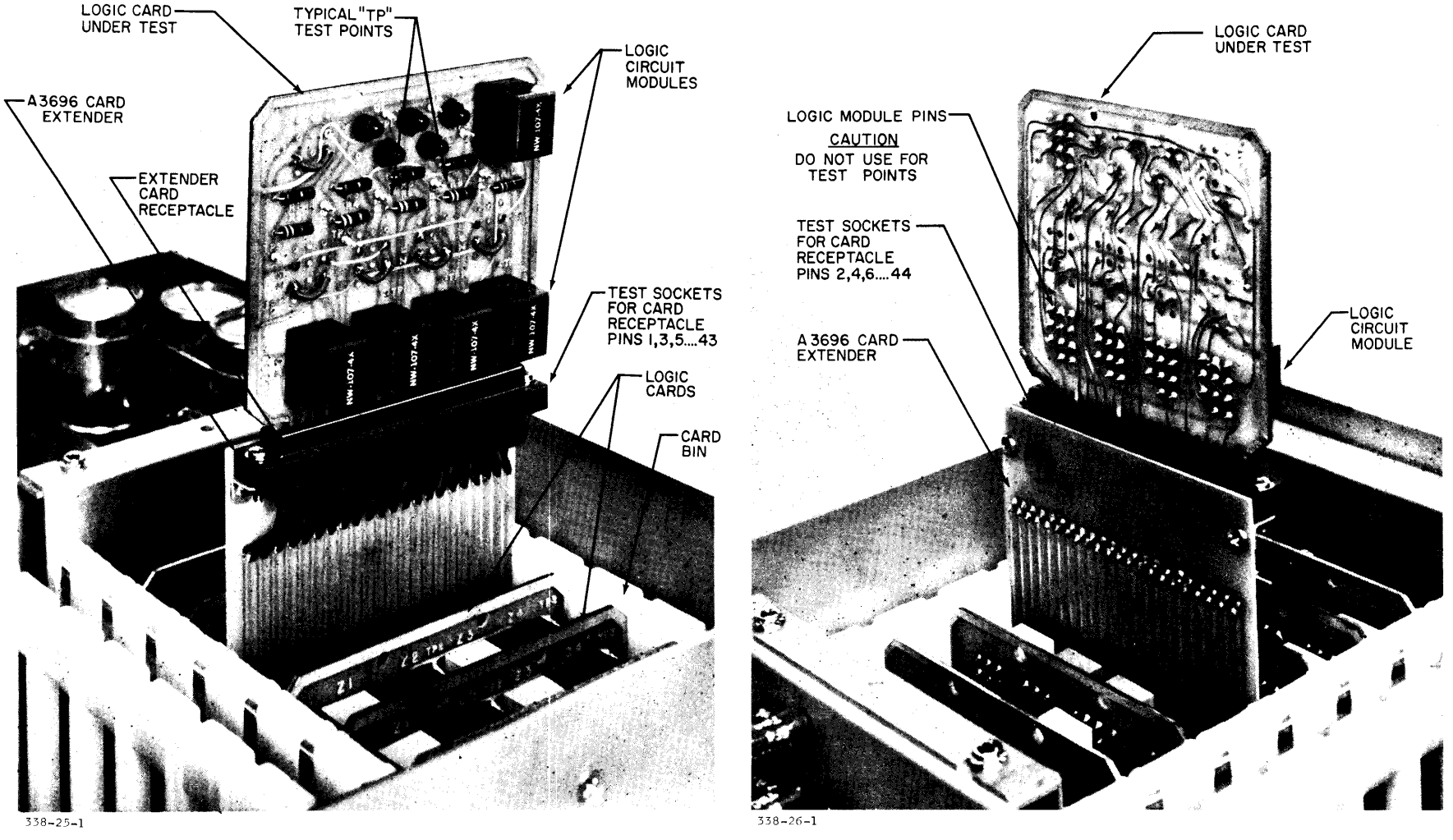


Figure 5-3. RTMU P/C Cord in Test Position.

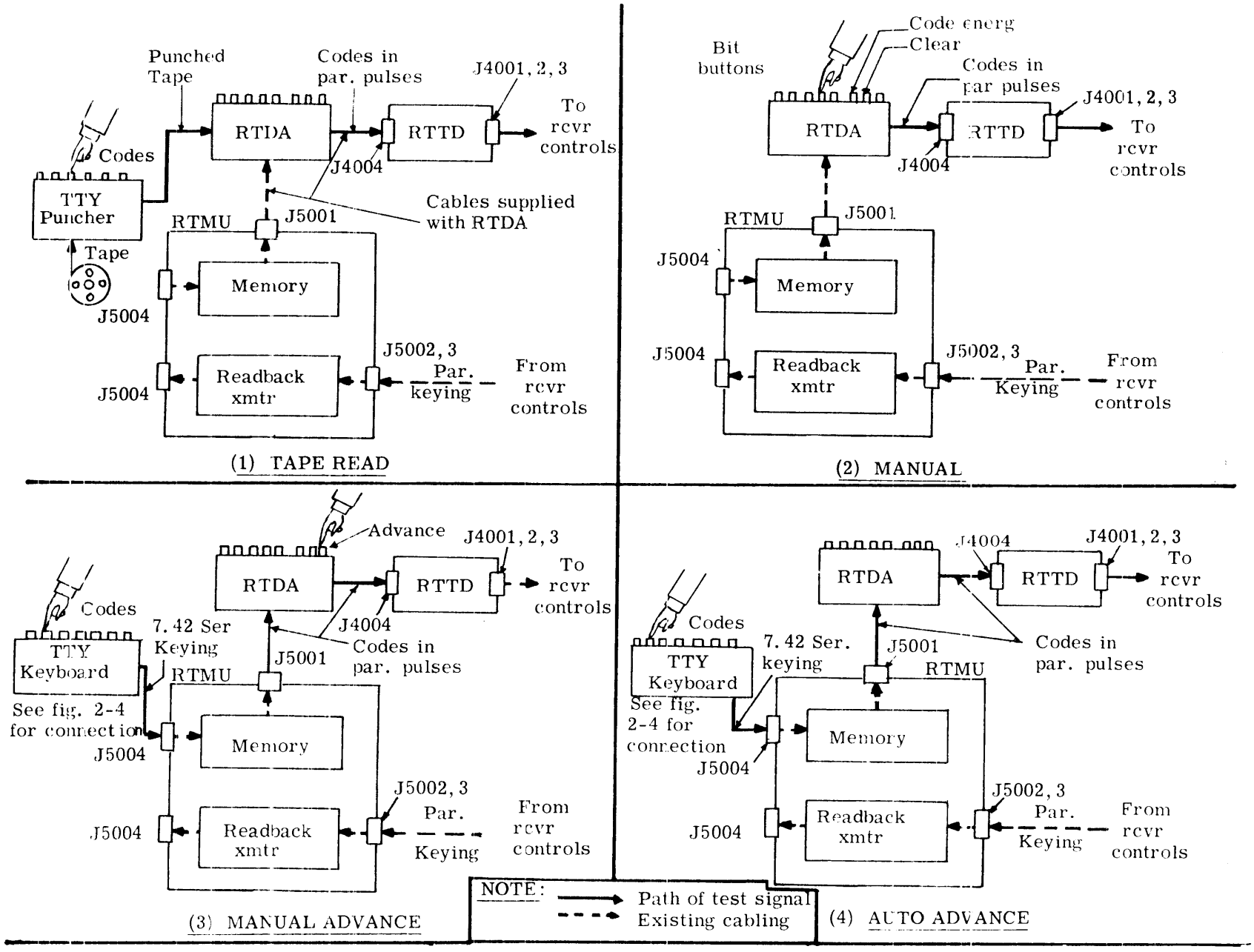


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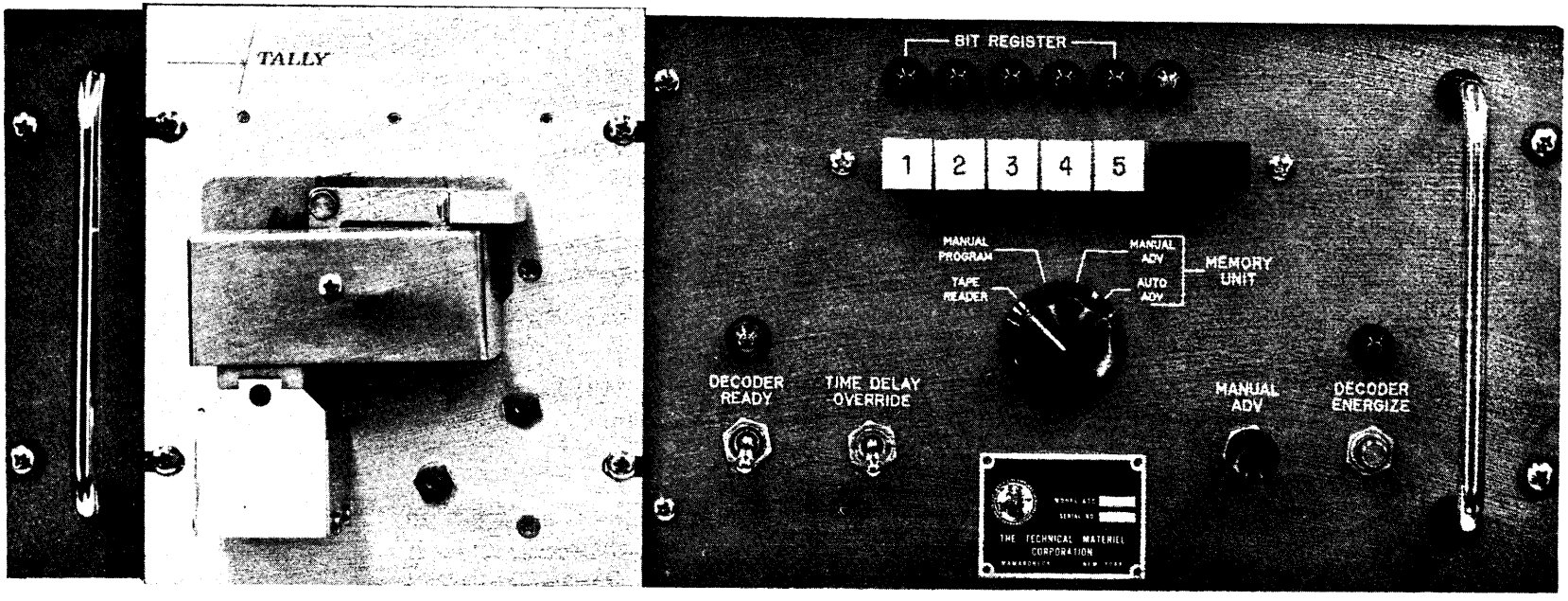
Figure 5-4. Testing TechniMatiC Circuits with RTDA



T101-1

Figure 5-5. Control Panel, TechniMatiC Test Set RTDA

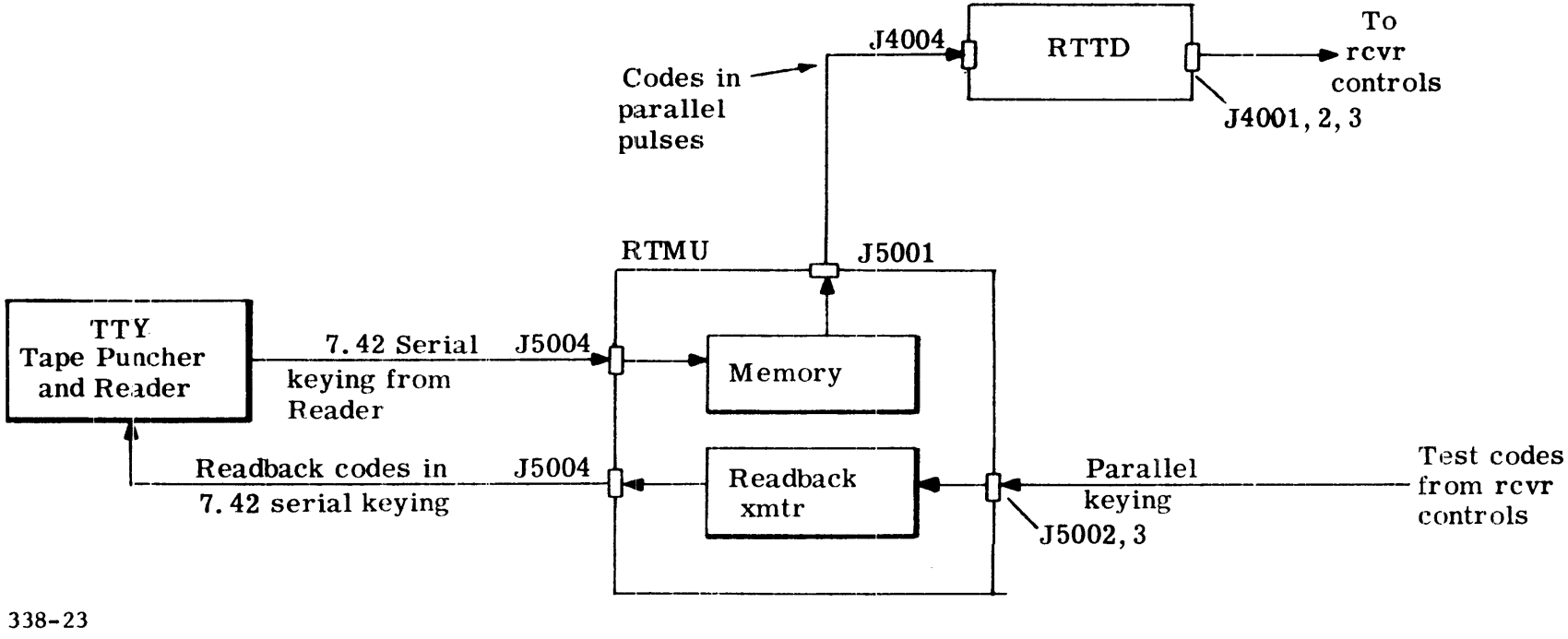


Figure 5-6. Testing TechniMatiC Circuits with TTY Puncher/Reader

SECTION 6
PARTS LIST

6-1. INTRODUCTION

The parts list presented in this section is a cross-reference list of parts identified by a reference designation and TMC part number. In most cases, parts appearing on schematic diagrams are assigned reference designations in accordance with MIL-STD-16. Wherever practicable, the reference designation is marked on the equipment, close to the part it identifies. In most cases, mechanical and electro-mechanical parts have TMC part numbers stamped on them.

To expedite delivery when ordering any part, specify the following:

a. Reference symbol.

b. Description as indicated in parts list.

c. TMC part number.

d. Model and serial numbers of the equipment containing the part being replaced; this can be obtained from the equipment nameplate.

For replacement parts not covered by warranty (refer to warranty sheet in front of manual), address all purchase orders to:

The Technical Materiel Corporation
Attention: Sales Department
700 Fenimore Road
Mamaroneck, New York

PARTS LIST

for

CABINET, ELECTRICAL EQUIPMENT, DDRR-5B, -5B2

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
B9000	FAN, CENTRIFUGAL: dual; 115/230 VAC, current rating 1.2/0.6 amps; single phase, 60 cps; nominal RPM 1,725; black anodize housing.	BL112
C1501	CAPACITOR, FIXED, MICA DIELECTRIC: 510 uuf, ±5%; 500 WVDC; char. C.	CM15C511J03
C1502 thru C1506	Same as C1501.	
C9000	CAPACITOR, FIXED, PAPER DIELECTRIC: 4 uf, ±10%; 370 WVAC.	CP113-1
CP3001	ADAPTOR, CONNECTOR, ELECTRICAL: RF; 1 female contact; teflon dielectric; 50 ohms nom. impedance; max. peak voltage 500 V; bulkhead mounting; QDS to BNC type.	JJ213
FL3001	FILTER, RADIO INTERFERENCE: 0 to 400 cps, 250 VAC/600 VDC, max. current rating 20 amps; 60 db min. attenuation from 150 Kc thru 10 Kmc; 8-32 thd. screw type terminals; 3" square x 16-1/2" long steel case.	AF103
J3001	CONNECTOR, RECEPTACLE, ELECTRICAL: 8 female prong type contacts.	JJ127
J3002	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 female prong type contacts.	JJ120-2
L1501	COIL, RADIO FREQUENCY: fixed; 10.0 uh, ±10%; current rating 1,080 ma DC; molded case.	CL270-10
L1502 thru L1512	Same as L1501.	
MP3001	RETRACTING ASSEMBLY, SPRING	A3517
MP3002 thru MP3009	Same as MP3001.	
MP3010	FILTER, AIR CONDITIONING: replaceable type; medium filtering, steel mesh and frame; o/a dim. 16-7/8" x 7-5/8" x 1/2".	AD103-5

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
MP3011	FILTER, AIR CONDITIONING: replaceable type; medium filtering, steel mesh and frame; o/a dim. 16-1/4" x 6" x 1/2".	AD103-11
P1301	NOT USED	
P1302	CONNECTOR, PLUG, ELECTRICAL: 1 male contact; voltage rating 500 V peak; nom. impedance 50 ohms; bayonet polarization; twist lock; BNC crimp type. Part of W3008.	PL244-1
P1303	Same as P1302. Part of W3012.	
P1304	Same as P1302. Part of W3009.	
P1305	CONNECTOR, PLUG, ELECTRICAL: 14 round number 16 male contacts, straight type. Part of W3034.	PL212-1
P1306	NOT USED	
P1307	Same as P1302. Part of W3017.	
P1308 thru P1311	NOT USED	
P1312	Same as P1302. Part of W3017.	
P1313 thru P1315	NOT USED	
P1316	CONNECTOR, PLUG, ELECTRICAL: with hood; 37 male contacts, removeable crimp pin style; current rating 5 amps at 500 V RMS; connector shape polarization; steel cadmium plate, clear chromate finish. Part of W3014.	JJ313-3H
P3001	Same as P1305. Part of W3014.	
P3001-1	NOT USED	
P3001-2	CONNECTOR, PLUG, ELECTRICAL: 8 male prong type contacts; o/a dim. 1-7/16" lg. x 11/16" wide x 1-1/4" high. Part of W3038.	PL116-1
P3002	CONNECTOR, PLUG, ELECTRICAL Part of W3038.	PL106-1

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
P3003 thru P3007	NOT USED	
P3008-1	Same as P1302. Part of W3006.	
P3008-2	Same as P1302. Part of W3007.	
P3009	Same as P1302. Part of W3008.	
P3010	NOT USED	
P3011	NOT USED	
P3012	Same as P1302. Part of W3009.	
P3013	Same as P1302. Part of W3018.	
P3014-1	Same as P1302. Part of W3010.	
P3014-2	Same as P1302. Part of W3003.	
P3015	NOT USED	
P3016	NOT USED	
P3017	Same as P1302. Part of W3012.	
P3018	Same as P1302. Part of W3011.	
P3019 thru P3021	NOT USED	
P3022	CONNECTOR, PLUG, ELECTRICAL: 11 female contacts, rated at 2 amps max.; 1,800 V RMS at sea level; phosphor bronze, gold over silver plate; key polarization; alumium anodized, green case. Part of W3013.	PL247-1S
P3023	Same as P3022. Part of W3036.	
P3024	Same as P3022. Part of W3036.	
P3025	Same as P3022. Part of W3013.	
P3026	Same as P3022. Part of W3026.	
P3027	Same as P3022. Part of W3013.	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
P3028	Same as P3022. Part of W3036.	
P3029	Same as P3022. Part of W3013.	
P3030	Same as P3022. Part of W3036.	
P3031	Same as P3022. Part of W3013.	
P3032	Same as P3022. Part of W3036.	
P3033	Same as P3022. Part of W3013.	
P3034	CONNECTOR, RECEPTACLE, ELECTRICAL: with hood; 25 female contacts, removeable crimp pin style, rated for 5 amps at 500 V RMS; connector shape polarization. Part of W3014.	JJ310-2H
P4001-1	CONNECTOR, RECEPTACLE, ELECTRICAL: with hood; 37 female contacts, removeable crimp pin style, rated for 5 amps at 500 V RMS; connector shape polarization. Part of W3014.	JJ310-3H
P4001-2	Same as P1302. Part of W3022.	
P4002-1	Same as P1316. Part of W3013.	
P4002-2	Same as P1302. Part of W3020.	
P4003-1	Same as P1316. Part of W3001.	
P4003-2	Same as P1305. Part of W3021.	
P4004	Same as P1316. Part of W3041.	
P4005	NOT USED	
P4006	NOT USED	
P4007	CONNECTOR, PLUG, ELECTRICAL: 2 female contacts, straight type, rated for 10 amps at 250 V; polarized; twist lock type; midget size, brown bakelite. Part of W3004.	PL176
P4008	Same as P1302. Part of W3006.	
P4009	NOT USED	
P4010	Same as P1302. Part of W3003.	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
P5000	Same as P1302. Part of W3016.	
P5001-1	Same as P1305. Part of W3015.	
P5001-2	Same as P1316. Part of W3041.	
P5002-1	Same as P1302. Part of W3023.	
P5002-2	Same as P1316. Part of W3036.	
P5003-1	Same as P1302. Part of W3019.	
P5003-2	Same as P1316. Part of W3037.	
P5004	CONNECTOR, PLUG, ELECTRICAL: with hood; 25 male contacts, removeable crimp pin style, rated for 5 amps at 500 V RMS; connector shape polarization; steel cadmium plate, clear chromate finish. Part of W3038.	JJ313-2H
P5005	NOT USED	
P5006	Same as P4007. Part of W3032.	
P6201	CONNECTOR, PLUG, ELECTRICAL: 14 round number 16 female contacts, straight type. Part of W3035.	PL212-2
P6202	Same as P1302. Part of W3019.	
P6203	Same as P1302. Part of W3034.	
P6204	Same as P1302. Part of W3025.	
P6205	Same as P1302. Part of W3017.	
P6206	Same as P1302. Part of W3018.	
P6207	Same as P1302. Part of W3022.	
P6208	Same as P1302. Part of W3020.	
P6209	Same as P1302. Part of W3016.	
P6210 thru P6216	NOT USED	
P6217	Same as P3022. Part of W3037.	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
P6218	Same as P3022. Part of W3001.	
P6219-1	Same as P3022. Part of W3037.	
P6219-2	Same as P3022. Part of W3001.	
P6219-3	Same as P3022. Part of W3037.	
P6219-4	Same as P3022. Part of W3001.	
P7001	Same as P1302. Part of W3024.	
P7002	Same as P1302. Part of W3010.	
P7003	Same as P1302. Part of W3011.	
P7004	Same as P1302. Part of W3028.	
P7005	Same as P1302. Part of W3030.	
P7006	NOT USED	
P7007	NOT USED	
P7008	Same as P1302. Part of W3025.	
P7009	Same as P1302. Part of W3023.	
P7010	CONNECTOR, PLUG, ELECTRICAL: 24 round number 20 male contacts, straight type. Part of W3026.	PL212-3
P7011	Same as P1302. Part of W3027.	
P7012	Same as P1302. Part of W3029.	
P7013	NOT USED	
P7014-1	Same as P3022. Part of W3037.	
P7014-2	Same as P3022. Part of W3001.	
P7014-3	Same as P3022. Part of W3037.	
P7014-4	Same as P3022. Part of W3001.	
P7200	Same as P1302. Part of W3027.	
P7201	Same as P1302. Part of W3029.	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
P7202	Same as P1302. Part of W3028.	
P7203	Same as P1302. Part of W3030.	
P8001	Same as P4007. Part of W3031.	
P8002	CONNECTOR, PLUG, ELECTRICAL: 2 prong male; polarized; current rating 10 amps at 250 V, 15 amps at 125 V; midget size, twist lock type; black bakelite. Part of W3033.	PL177
P8003	NOT USED	
P8004	NOT USED	
P8005	Same as P6201. Part of W3026.	
P8006	Same as P6201. Part of W3021.	
P8007	Same as P6201. Part of W3034.	
P8008	Same as P1305. Part of W3035.	
P8009	Same as P6201. Part of W3015.	
P8010	Same as P6201. Part of W3034.	
P9001 thru P9015	NOT USED	
P9016	Same as P1302. Part of W3005.	
TB3001	TERMINAL BOARD, BARRIER: 14 number 6-32 thd. x 1/4" long binder head machine screws; black phenolic body.	TM100-14
TB3002	TERMINAL BOARD, BARRIER: 8 number 6-32 thd. x 1/4" long binder head machine screws; black phenolic body.	TM100-8
TB3003	TERMINAL BOARD, BARRIER: 4 number 6-32 thd. x 1/4" long binder head machine screws; black phenolic body.	TM100-4
TB9000	TERMINAL BOARD, BARRIER: 2 number 6-32 thd. x 1/4" long binder head machine screws; black phenolic body.	TM102-5

CABINET, ELECTRICAL EQUIPMENT, DDRR-5B -5B2

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
W3001	WIRING HARNESS, BRANCHED, ELECTRICAL: consists of 6 connectors, P4003-1, P6218, P6219-2, P6219-4, P7014-2, P7014-4.	CA912
W3002	LEAD, ELECTRICAL: consists of 54" length of 25/32 wire, insulation sleeving, 2 solderless terminal lugs.	CA412-34-54.00
W3003	CABLE ASSEMBLY, ELECTRICAL: RF; consists of 12 foot length black coaxial cable, RG174/U, 2 connectors, P3014-2, P4010.	CA480-3-12F
W3004	CABLE ASSEMBLY, ELECTRICAL: AC power; consists of 180" lengths rubber sheathed cable, 3 solderless type terminal lugs, 1 connector, P4007.	CA696-2
W3005	CABLE ASSEMBLY, ELECTRICAL: RF; consists of 97" lengths black coaxial cable, RG174/U, 2 connectors, P3001-1, P9016.	CA480-3-97
W3006	Same as W3003. Consists of P3008-1, P4008.	
W3007	CABLE ASSEMBLY, ELECTRICAL: RF; consists of 11 foot length black coaxial cable, RG174/U, 2 connectors, P1307, P3008-2.	CA480-3-11F
W3008	CABLE ASSEMBLY, ELECTRICAL: RF; consists of 112" lengths black coaxial cable, RG174/U, 2 connectors, P1302, P3009.	CA480-3-112
W3009	Same as W3007. Consists of P1304, P3012.	
W3010	Same as W3003. Consists of P3014-1, P7002.	
W3011	Same as W3003. Consists of P3018, P7003.	
W3012	Same as W3008. Consists of P1303, P3017.	
W3013	WIRING HARNESS, BRANCHED, ELECTRICAL: consists of various lengths and colors of number 22 wire, insulation sleeving, 7 connectors, P3022, P3025, P3027, P3029, P3031, P3033, P4002-1.	CA910
W3014	WIRING HARNESS, BRANCHED, ELECTRICAL: consists of various lengths and colors of number 22 wire, insulation sleeving, 3 connectors, P1316, P3034, P4001-1.	CA909

CABINET, ELECTRICAL EQUIPMENT, DDRR-5B, -5B2

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
W3015	CABLE ASSEMBLY, ELECTRICAL: interconnect; consists of various lengths and colors of number 16, 20 and 22 MWC wire, 81" length insulation sleeving, 2 connectors, P5001-1, P8000.	CA687-2
W3016	CABLE ASSEMBLY, ELECTRICAL: RF; consists of 90" length black coaxial cable, RG174/U, 2 connectors, P5000, P6209.	CA480-3-90
W3017	Same as W3008. Consists of P1312, P6205.	
W3018	Same as W3007. Consists of P3013, P6206.	
W3019	CABLE ASSEMBLY, ELECTRICAL: RF; consists of 77" length black coaxial cable, RG174/U, 2 connectors P5003-1, P6202.	CA480-3-77
W3020	Same as W3005. Consists of P4002-2, P6208.	
W3021	CABLE ASSEMBLY, ELECTRICAL: interconnect; consists of various lengths and colors of number 16, 20, and 22 wire, 76" length of insulation sleeving, 2 connectors, P4003-2, P8006.	CA687-1
W3022	Same as W3005. Consists of P4001-2.	
W3023	Same as W3005. Consists of P5002-1, P7009.	
W3024	Same as W3008. Consists of P6203, P7001.	
W3025	Same as W3008. Consists of P6204, P7008.	
W3026	CABLE ASSEMBLY, ELECTRICAL: interconnect; consists of various lengths and colors of number 20 MWC wire, 78" length of insulation sleeving, 2 connectors, P8005, P7010.	CA686-1
W3027	CABLE ASSEMBLY, ELECTRICAL: RF; consists of 72" length black coaxial cable, RG174/U, 2 connectors, P7011, P7200.	CA480-3-72
W3028	Same as W3027. Consists of P7004, P7202.	
W3029	Same as W3027. Consists of P7012, P7201.	
W3030	Same as W3027. Consists of P7005, P7203.	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
W3031	CABLE ASSEMBLY, ELECTRICAL: AC power; consists of 72" length rubber sheathed cable, 3 solderless type terminal lugs, 1 connector, P8001.	CA696-1
W3032	CABLE ASSEMBLY, ELECTRICAL: AC power; consists of 108" length rubber sheathed cable, 3 solderless terminal lugs, 1 connector, P5006.	CA696-3
W3033	CABLE ASSEMBLY, ELECTRICAL: AC power; consists of 54" length rubber sheathed cable, 2 solderless type terminal lugs, 1 connector, P8002.	CA706-1
W3034	WIRING HARNESS, BRANCHED, ELECTRICAL: consists of various lengths and colors of number 16, 18, and 22 MWC wire, insulation sleeving, 4 connectors, P1305, P3001, P8007, P8010.	CA704
W3035	WIRING HARNESS, BRANCHED, ELECTRICAL: consists of various lengths and colors of number 18 and 22 MWC wire, insulation sleeving, 2 connectors, P6201, P8008.	CA914
W3036	WIRING HARNESS, BRANCHED, ELECTRICAL: consists of various lengths and colors of number 26 LWC wire, insulation sleeving, 7 connectors, P3023, P3024, P3026, P3028, P3030, P3032, P5002-2.	CA927
W3037	WIRING HARNESS, BRANCHED, ELECTRICAL: consists of various lengths and colors of number 26 LWC wire, insulation sleeving, 6 connectors, P5003-2, P6217, P6219-1, P6219-3, P7014-1, P7014-3.	CA929
W3038	WIRING HARNESS, BRANCHED, ELECTRICAL: consists of various lengths and colors of number 22 MWC wire, insulation sleeving, 3 connectors, P3001-2, P3002, P5004.	CA934
W3039	LEAD, ELECTRICAL: consists of 34" length number 3/8 wire, black insulation sleeving, 2 solderless type terminal lugs.	CA412-36-34.00
W3040	Same as W3002.	

CABINET, ELECTRICAL EQUIPMENT, DDRR-5B, -5B2

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
W3041	CABLE ASSEMBLY, ELECTRICAL: consists of 2 connectors, P4004, P5001-2.	CA923

SECTION 7

RACK WIRING DATA

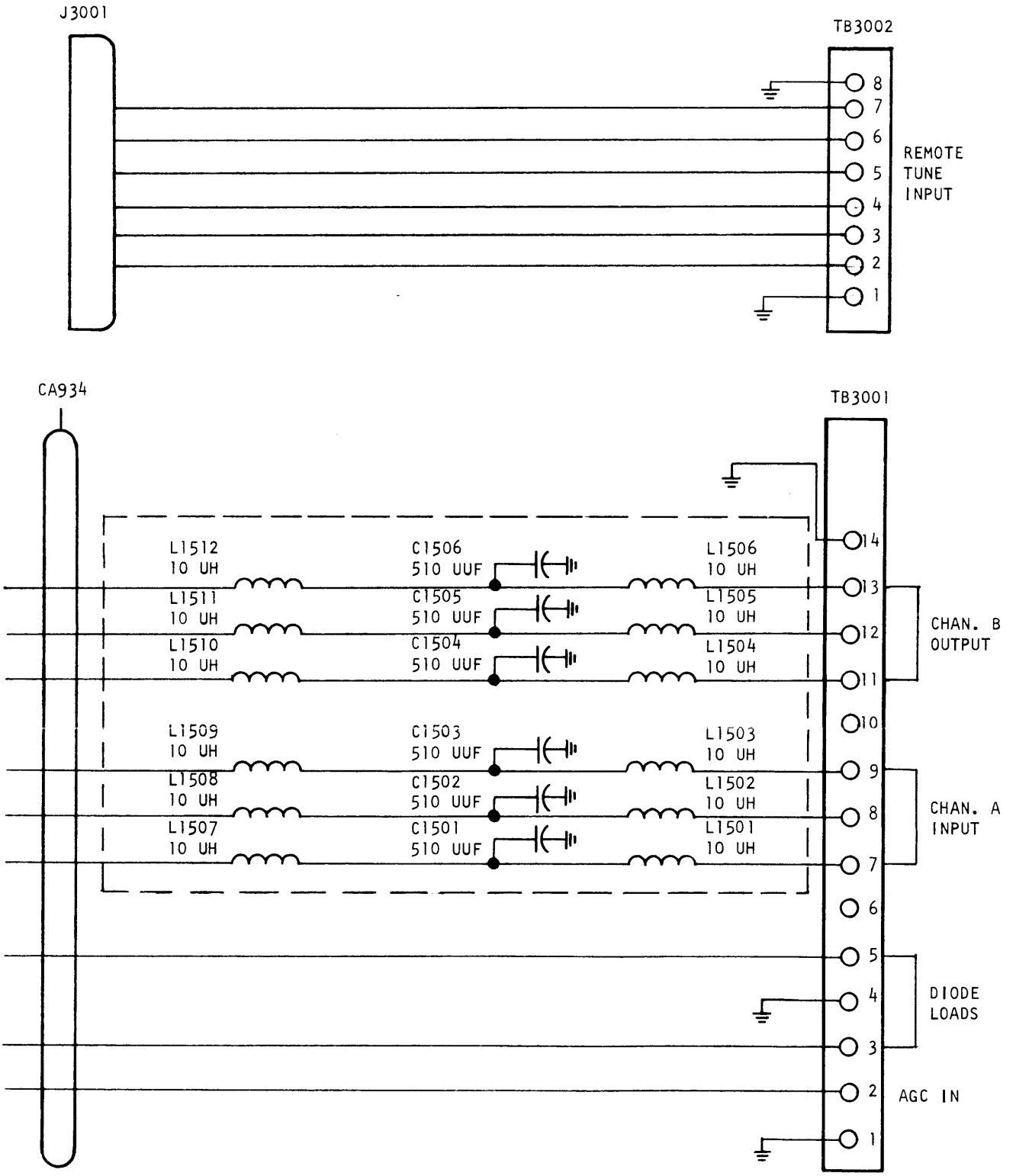


Figure 7-1. Schematic Wiring, Audio Filter Panel A3860

TABLE 7-1. WIRE RUN LIST, CABLES, DDRR-5B

CABLE	FROM:- CONNECTOR PIN		TO:- CONNECTOR PIN		WIRE GAUGE	WIRE COLOR	S* US
CA-686-1 (Ref: DWG CA-686 Rev. C)	HFP-1 P8005	B	HFP-1 P8005	V	24	Grey	US
		V	HFAR-1 P7010	P	20	WH/BLK	US
		U		B	20	WH/GRN	US
		K		K	20	Red	US
		a		R	20	WH/RED	US
		L		L	20	Black	US
		E		E	20	Brown	US
		F		F	20	WH/BRN	US
		S		A	20	Yellow	US
		R		D	20	WH/YEL	US
		M		C	20	Blue	US
		N		H	20	WH/BLU	US
CA-686-1	HFP-1 P8005	P	HFAR-1 P7010	J	20	Orange	US
CA-687-1 (Ref: DWG CA-687 Rev. C)	HFP-1 P8006	L	HNF-1 P4003-2	L	20	Black	US
		J		J	22	Green	S
		K		K	22	Red	US
		E		E	16	Brown	US
		F		F	16	WH/BRN	US
		A		A	20	Grey	US
		B		B	20	WH/Grey	US
		H		H	20	Violet	US
		C		C	20	Blue	US
		P		P	20	WH/BLK	US
		R	HNF-1 P4003-2	R	20	White	US
	HFP-1 P8006 SHLD	J	HFP-1 P8006	L	SHIELD TERMINAL		--
CA-687-1	HNF-1 P4003-2SHLD	J	HNF-1P4003-2	L	SHIELD TERMINAL		--
CA-687-2 (Ref: DWG CA-687 Rev. C)	HFP-1 P8009	L	AFC-3 P5001-1	L	20	Black	US
		J		J	22	Green	S
		K		K	22	Red	US
		E		E	16	Brown	US
		F		F	16	WH/BRN	US
		A		A	20	Grey	US
		B		B	20	WH/Grey	US
		H		H	20	Violet	US
		C		C	20	Blue	US
		P		P	20	WH/BLK	US
		R	AFC-3 P5001-1	R	20	WHITE	US
	HFP-1 P8009 SHLD	J	HFP-1 P8009	L	SHIELD TERMINAL		--
CA-687-2	AFC-3P5001-1SHLD	J	AFC-3 P5001-1	L	SHIELD TERMINAL		--

* S= shielded. US= unshielded

TABLE 7-1. WIRE RUN LIST, CABLES, DDRR-5B (CONT)

CABLE	FROM:- CONNECTOR PIN		TO:- CONNECTOR PIN		WIRE GAUGE	WIRE COLOR	S US
CA-696-1	AF-103 FL3001	OUT	HFP-1 P8001	1	16	GREEN	US
CA-696-1	AF-103 FL3001	OUT	HFP-1 P8001	2	16	WHITE	US
CA-696-1	AF-103 FL3001	GND	HFP-1 P8001	GND	16	BLACK	US
CA-696-2	AF-103 FL3001	OUT	RTTD-1 P4007	1	20	GREEN	US
CA-696-2	AF-103 FL3001	OUT	RTTD-1 P4007	2	20	WHITE	US
CA-696-2	AF-103 FL3001	GND	RTTD-1 P4007	GND			
CA-696-3	AF-103 FL3001	OUT	RTMU-1 P5006	1	20	GREEN	US
CA-696-3	AF-103 FL3001	OUT	RTMU-1 P5006	2	20	WHITE	US
CA-696-3	AF-103 FL3001	GND	RTMU-1 P5006	GND	20	BLACK	US
CA-704	HFP-1 P8010	D	HFRR-2 P1305	D	16	WH/BRN	US
		R		R	16	BROWN	US
		C		C	22	BLUE	US
		P		P	22	WH/OR	US
		B		B	16	WH/GRY	US
		A		A	18	GREY	US
		F		F	16	WH/BRN	US
		E		E	16	BROWN	US
		K		K	22	RED	US
		H		H	22	VIOLET	US
		M		M	22	YELLOW	S
		L		L	22	BLACK	US
	HFP-1 P8010	J	HFRR-2 P1305	J	22	GREEN	S
	HFP-1 P8007	H	HFSR-1 P3001	H	16	WH/BRN	US
		P		P	22	ORANGE	US
		F		F	16	WH/BLU	US
		L		L	16	BLACK	US
		E		E	16	BROWN	US
		R		R	22	WH/BLU	US
		K		K	22	RED	US
		C		C	22	BLUE	US
		D		D	16	WH/BRN	US
		B		B	16	BROWN	US
	HFP-1 P8007	A		A	16	BROWN	US
	HFRR-2 P1305	N		N	22	WH/BLK	US
CA-704	GND ON RACK		HFSR-1 P3001	J	18	WHITE	US

(Ref: DWG CA-696 Rev. D)

(Ref: DWG CA-704 Rev. E)

TABLE 7-1. WIRE RUN LIST, CABLES, DDRR-5B (CONT)

CABLE	FROM:- CONNECTOR PIN		TO:- CONNECTOR PIN		WIRE GAUGE	WIRE COLOR	S US
CA-706-1	HFP-1 P8002		AX-390 TB9000	2	} 2-wire AC cable		
CA-706-1	HFP-1 P8002		AX-390 TB9000	3			
CA-909	RTTD-1 P4001	1	HFRR-2 P1316	1	22	GRY/YEL/OR	US
		2		20	22	GRY/YEL/YEL	US
		3		2	22	GRY/YEL/GRN	US
		4		21	22	GRY/YEL/BLU	US
		5		3	22	WHITE	S
		6		22	22	GRY/GRN/YEL	US
		7		4	22	GRY/GRN/GRN	US
		8		23	22	GRY/GRN/BLU	US
		9		5	22	RED	US
		10		24	22	BLACK	US
		11		6	22	WHT/OR/OR	US
		12		25	22	WHT/YEL/OR	US
		13		7	22	WHT/OR/GRN	US
		14		26	22	WHT/YEL/GRN	US
		15		8	22	VIOLET	US
		16		11	22	WHT/YEL/YEL	US
		17		34	22	WHT/YEL/BLU	US
		18		36	22	GRY/VI/OR	US
		19		17	22	GRY/VI/YEL	US
		20		18	20	WH/GRY	US
		21		35	22	WHITE	US
		22	HFRR-2 P1316	37	20	WH/BLK	US
		23	HFSR-1 P3034	1	22	BLACK	US
		24		14	22	WH/BRN/OR	US
		25		2	22	WH/BRN/YEL	US
		26		15	22	WH/BRN/GRN	US
		27		3	22	WH/BRN/BLU	US
		28		16	22	WH/BRN/VI	US
		29		4	22	GRY/BRN/OR	US
		30		17	22	GRY/BRN/YEL	US
		31		5	22	GRY/BRN/GRN	US
		32		18	22	GRY/BRN/BLU	US
CA-909	RTTD-1 P4001	33	HFSR-1 P3034	6	22	GRY/BRN/VI	US

(Ref: DWG CA-706 Rev. B)

(REF: DWG CA-909 Rev. B)

TABLE 7-1. WIRE RUN LIST, CABLES, DDRR-5B (CONT)

CABLE	FROM:- CONNECTOR PIN		TO:- CONNECTOR PIN		WIRE GAUGE	WIRE COLOR	S US
CA-909	RTTD-1 P4001	34	HFSR-1 P3034	19	22	WH/BRN/RED	US
		35	HFSR-1 P3034	7	22	WH/GRY/GRY	US
		36	HFSR-1 P3034	20	22	WH/BLU	US
	RTTD-1 P4001	37	HFRR-2 P1316	9	22	WH/BLK/BLK	US
	HFSR-1 P3034	8		16	22	WH/YEL	US
		21		30	22	WH/RED/OR	US
		9		12	22	WH/RED/YEL	US
		10		31	22	WH/RED/GRN	US
		22		13	22	WH/RED/BLU	US
		23		32	22	WH/BLU/OR	US
		11		14	22	WH/BLU/YEL	US
		24		33	22	WH/BLU/GRN	US
	HFSR-1 P3034	12	HFRR-2 P1316	15	22	WH/BLU/BLU	US
	RTTD-1 P4001	SHLD 5	RTTD-1 P4001	6		SHIELD TERMINAL	--
CA-909	HFRR-2 P1316	SHLD 3	HFRR-2 P1316	22		SHIELD TERMINAL	--
CA-910	RTTD-1 P4002	19	HFSR-1 P3025	A	22	WH/RED/OR	US
		37		B	22	WH/RED/YEL	US
		18		C	22	WH/RED/GRN	US
		36		D	22	WH/RED/BLU	US
		17	HFSR-1 P3025	E	22	BLACK	US
		35	HFSR-1 P3027	A	22	GRY/RED/OR	US
		16		B	22	GRY/RED/YEL	US
		34		C	22	GRY/RED/GRN	US
		15		D	22	GRY/RED/BLU	US
		33	HFSR-1 P3027	E	22	BLACK	US
		14	HFSR-1 P3029	A	22	GRY/OR/OR	US
		32		B	22	GRY/OR/YEL	US
		13		C	22	GRY/OR/GRN	US
		31		D	22	GRY/OR/BLU	US
		12	HFSR-1 P3029	E	22	BLACK	US
		30	HFSR-1 P3031	A	22	WH/OR/OR	US
		11		B	22	WH/OR/YEL	US
		29		C	22	WH/OR/GRN	US
		10		D	22	WH/OR/BLU	US
	RTTD-1 P4002	28	HFSR-1 P3031	E	22	BLACK	US
	HFSR-1 P3025	F	HFSR-1 P3033	A	22	YELLOW	US
	HFSR-1 P3025	H	HFSR-1 P3033	B	22	BLUE	US
	RTTD-1 P4002	3	HFSR-1 P3025	J	22	WH/YEL	US
	RTTD-1 P4002	4	HFSR-1 P3022	A	22	WH/BLK/BLK	US
CA-910	RTTD-1 P4002	22	HFSR-1 P3022	B	22	BLACK	US

(Ref: DWG CA-910 Rev. B)

TABLE 7-1. WIRE RUN LIST, CABLES, DDRR-5B (CONT)

CABLE	FROM:- CONNECTOR PIN		TO:- CONNECTOR PIN		WIRE GAUGE	WIRE COLOR	S US
CA-912	RTTD-1 P4003	19	HFIR-1 P6219-2	A	22	WH/YEL/OR	US
		37		B	22	WH/YEL/YEL	US
		18		C	22	WH/YEL/GRN	US
		36		D	22	WH/YEL/BLU	US
		28	HFIR-1 P6219-2	E	22	BLACK	US
		14	HFIR-1 P6219-4	A	22	WH/GRN/OR	US
		32		B	22	WH/GRN/YEL	US
		13		C	22	WH/GRN/GRN	US
		31		D	22	WH/GRN/BLU	US
		4	HFIR-1 P6219-4	E	22	BLACK	US
		9	HFIR-1 P6218	A	22	GRY/BLU/OR	US
		27		B	22	GRY/BLU/YEL	US
		8		C	22	GRY/BLU/GRN	US
		26		D	22	GRY/BLU/BLU	US
		7		E	22	BLACK	US
		3		M	22	WH/BLU/OR	US
		22		L	22	WH/BLU/YEL	US
		12	HFIR-1 P6218	J	22	BLACK	US
		35	HFAR-1 P7014-4	A	22	GRY/YEL/OR	US
		16		B	22	GRY/YEL/YEL	US
		34		C	22	GRY/YEL/GRN	US
		15		D	22	GRY/YEL/BLU	US
		17	HFAR-1 P7014-4	E	22	BLACK	US
		30	HFAR-1 P7014-2	A	22	GRY/GRN/OR	US
		11		B	22	GRY/GRN/YEL	US
		29		C	22	GRY/GRN/GRN	US
		10		D	22	GRY/GRN/BLU	US
CA-912	RTTD-1 P4003	23	HFAR-1 P7014-2	E	22	BLACK	US
CA-914	HFP-1 P8008	F	HFIR-1 P6201	F	18	WH/BRN	US
		E		E	18	BROWN	US
		D		D	18	BROWN	US
		C		C	18	WH/BRN	US
		L		L	22	BLACK	US
		P		P	22	BLACK	US
		H		H	22	VIOLET	US
		K		K	22	BLUE	US
		A		A	22	WH/BLU	US
		B		B	22	RED	US
		M		M	22	GREEN	S
CA-914	HFP-1 P8008	R	HFIR-1 P6201	R	22	BLACK	US

(Ref: DWG CA-912 Rev. B)

(Ref: DWG CA-914 Rev. A)

TABLE 7-1. WIRE RUN LIST, CABLES, DDRR-5B (CONT)

CABLE	FROM:- CONNECTOR PIN		TO:- CONNECTOR PIN		WIRE GAUGE	WIRE COLOR	S US
CA-914	HFIR-1 P6201	M	A3860 TB3001	2	22	GREEN	S
	HFAR-1 E7000	1		3	22	ORANGE	S
		2		9	22	RED	S
		3	A3860 TB3001	8	22	YELLOW	S
		4	HSS-3 TB1501	7	22	BLUE	S
		10	HSS-3 TB1501	2	22	WH/BLU	S
	HFAR-1 E7000	11	HSS-3 TB1501	3	22	BLACK	US
	HFAR-1 E7001	1	A3860 TB3001	5	22	ORANGE	S
		2		13	22	RED	S
		3		12	22	YELLOW	S
		4	A3860 TB3001	11	22	BLUE	S
		10	HSS-3 TB1501	1	22	BLUE	S
	HFAR-1 E7001	11	HSS-3 TB1501	3	22	BLACK	US
	HFP-1 P8008 SHLD	M	HFP-1 P8008	R		SHIELD TERMINAL	--
	HFIR-1 P6201 SHLD	M	HFIR-1 P6201	R		SHIELD TERMINAL	--
	HFIR-1 P6201 SHLD	M	HFIR-1 P6201	L		SHIELD TERMINAL	--
	HFAR-1 E7000	ALL SHLDS	HFAR-1 E7000	11 GND		SHIELD GROUND	--
	HFAR-1 E7001	ALL SHLDS	HFAR-1 E7001	11 GND		SHIELD GROUND	--
CA-914	A3860 TB3001	ALL SHLDS	A3860 TB3001	14		SHIELD GROUND	--
CA-923	RTMU-1 P5001	9	RTTD-1 P4004	7	20	BLACK	S
		3		16	20	WH/BLK	S
		2		27	20	WH/GRY	S
		21		24	22	WH/BLU/YEL	US
		20		15	22	WH/GRN	US
		4		34	22	RED	US
		5		19	22	GREY	US
		6		37	22	WH/RED/RED	US
		7		18	22	BLUE	US
		22		35	22	YELLOW	US
		23		8	22	VIOLET	US
		24		36	22	WH/BRN	US
		25		17	22	WH/RED/YEL	US
		26		12	22	WH/BRN/OR	US
		8		6	22	WH/OR	US
		1		33	22	WH/YEL	US
		27		25	22	WH/OR/OR	US
CA-923	RTMU-1 P5001	28	RTTD-1 P4004	26	22	WH/RED/YEL	US

(Ref: DWG CA-923 Rev. A)

TABLE 7-1. WIRE RUN LIST, CABLES, DDRR-5B (CONT)

CABLE	FROM:- CONNECTOR PIN		TO:- CONNECTOR PIN		WIRE GAUGE	WIRE COLOR	S US
CA-923	RTMU-1 P5001 SHLD	9	RTMU-1 P5001	30	SHIELD TERMINAL		--
	SHLD	3	RTMU-1 P5001	30			--
	RTMU-1 P5001 SHLD	2	RTMU-1 P5001	30			--
	RTTD-1 P4004 SHLD	7	RTTD-1 P4004	30			--
	RTTD-1 P4004 SHLD	16	RTTD-1 P4004	30			
CA-923	RTTD-1 P4004 SHLD	27	RTTD-1 P4004	30	SHIELD TERMINAL		--
CA-927	HFSR-1 P3032	A	RTMU-1 P5002	1	26	WHITE	US
		B		2	26	WH/BLK	US
		C		3	26	WH/BRN	US
		D		4	26	WH/RED	US
		E		5	26	WH/OR	US
		F		6	26	WH/YEL	US
		H		7	26	WH/GRN	US
		J		8	26	WH/BLU	US
		K		9	26	WH/VI	US
	HFSR-1 P3032	L		10	26	WH/GRY	US
	HFSR-1 P3024	A		11	26	BROWN	US
		B		12	26	RED	US
		C		13	26	ORANGE	US
		D		14	26	YELLOW	US
	HFSR-1 P3024	E		15	26	WHITE	US
	HFSR-1 P3026	A		16	26	GREEN	US
		B		17	26	BLUE	US
		C		18	26	VIOLET	US
		D		19	26	GREY	US
	HFSR-1 P3026	E		37	26	WHITE	US
	HFSR-1 P3028	A		36	26	WH/BRN	US
		B		35	26	WH/RED	US
		C		34	26	WH/OR	US
		D		33	26	WH/YEL	US
	HFSR-1 P3028	E		32	26	WHITE	US
	HFSR-1 P3030	A		31	26	WH/GRN	US
		B		30	26	WH/BLU	US
		C		29	26	WH/VI	US
		D		28	26	WH/GRY	US
	HFSR-1 P3030	E		27	26	WHITE	US
	HFSR-1 P3023	A		26	26	WH/BRN	US
CA-927	HFSR-1 P3023	B	RTMU-1 P5002	25	26	WHITE	US

(Ref: DWG CA-927 Rev. B)

TABLE 7-1. WIRE RUN LIST, CABLES, DDRR-5B (CONT)

CABLE	FROM:- CONNECTOR PIN		TO:- CONNECTOR PIN		WIRE GAUGE	WIRE COLOR	S US
CA-929	HFAR-1 P7014-1	A	RTMU-1 P5003	6	26	WHITE	US
		B		7	26	BLUE	US
		C		8	26	VIOLET	US
		D		9	26	GREY	US
	HFAR-1 P7014-1	E		10	26	WHITE	US
	HFAR-1 P7014-3	A		16	26	WH/GRN	US
		B		17	26	WH/BLU	US
		C		18	26	WH/VI	US
		D		19	26	WH/GRY	US
	HFAR-1 P7014-3	E		20	26	WHITE	US
	HFIR-1 P6219-3	A		11	26	WH/BRN	US
		B		12	26	WH/RED	US
		C		13	26	WH/OR	US
		D		14	26	WH/YEL	US
	HFIR-1 P6219-3	E		15	26	WHITE	US
	HFIR-1 P6219-1	A		1	26	BROWN	US
		B		2	26	RED	US
		C		3	26	ORANGE	US
		D		4	26	YELLOW	US
	HFIR-1 P6219-1	E		5	26	WHITE	US
	HFIR-1 P6217	A		26	26	GREEN	US
		B		27	26	BLUE	US
		C		28	26	VIOLET	US
		D		29	26	GREY	US
		E		30	26	WHITE	US
		J		25	26	WHITE	US
		M		21	26	ORANGE	US
CA-929	HFIR-1 P6217	L	RTMU-1 P5003	23	26	BROWN	US
CA-934	A3860 P3001	2	RTMU-1 P5004	1	22	BROWN	US
		3		4	22	ORANGE	US
		4		5	22	YELLOW	US
		5		9	22	GREEN	US
		6		12	22	VIOLET	US
	A3860 P3001	7	RTMU-1 P5004	13	22	GREY	US
	RTMU-1 P5004	2	A3862 P3002	1	22	RED	US
CA-934	RTMU-1 P5004	10	A3862 P3002	2	22	BLUE	US

(Ref: DWG CA-929 Rev. A)

(Ref: DWG CA-934 Rev. B)