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PRELIMINARY

TECHNICAL MANUAL

for

RTMU-41C/RTTD-5

TRANSMITTER REMOTE

CONTROL SYSTEM

THE TECHNICAL MATERIEL CORPORATION

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SECTION 1

GENERAL INFORMATION

1-1. SCOPE.

This technical manual describes a remote control system for a transmitter. The system consists of a Model RTMU-41C Signal Data Converter-Storer, a Model RTTD-5 Transmitter Decoder and connecting cabling. This remote control package is often shipped as an accessory to be added to an existing transmitter or, as in some cases, added to the transmitter in the factory.

1-2. PURPOSE OF EQUIPMENT.

The remote control system gives the transmitter the capability of being tuned, loaded and operated from a remote control source by existing teletype communication linkages. Teletype codes (see table 1-2) sent from the remote control site, contain frequency determining codes to set the frequency control unit in the exciter, to control the transmitter high voltage and to adjust carrier suppression. A readback system furnishes essential data back to the remote operator in teletype codes (see table 1-4); frequency settings are read back, including settings of the high voltage and carrier suppression controls, transmitter "tuning/ready/fault" status, H.V. overload alarm and various other data required to monitor the transmitter. Included in the data are checks to ascertain that the transmitter has been set properly for a remote tuning or if it is on manual override for a local tuning.

1-3. DESCRIPTION OF EQUIPMENT.

a. SIGNAL DATA CONVERTER-STORER, MODEL RTMU-41C - The RTMU receives the coded tuning message and stores each code, as it arrives, in a memory section. When the "transmitter tune" code is received at the end of the message, the RTMU releases the message, code-by-code, to the RTTD for processing. The RTMU has a self-contained power supply.

b. TRANSMITTER DECOEER, MODEL RTTD-5 - The RTTD receives the codes from the

RTMU and moves transmitter controls accordingly. Included in this circuitry is a signal exchange between the code processing equipment and the transmitter automatic tuning section to ascertain proper sequencing between the two. The RTTD also contains the readback scanning and transmission section. This unit has a self-contained power supply.

TABLE 1-1. TECHNICAL SPECIFICATIONS

Tuning code input:	5-bit codes in 7.42 serial teletype transmission pattern. Works from a 20ma to 60ma neutral or polar teletype current loop at 45 baud speed.
Readback code output:	5-bit codes in serial teletype wet (mercury) contact keying from polar relay. Codes in 5-level up to 8-level* transmission pattern with 45 baud speed.
Power supply requirements:	115/230 VAC, 50/60 cps, single phase. ? watts average consumption during tuning cycle.

* In 6-, 7-, or 8-level transmission, code is contained in first 5 bits.

TABLE 1-2. REMOTE TUNING INPUT CODES

CHARACTER RECEPTION ORDER*	ADDRESSAL FUNCTION	ACTION FUNCTION	5-BIT CODE	CCIT CHARACTER
1	Transmitter Selector		2 codes (see table 1-3)	
2	CHGR 10 MHz switch		11000	A
3		0	01000	Line Feed
		1	00100	Space
		2	01100	I
		3	00010	Carriage Return
4	CHGR 1 MHz switch		10100	S
5		0	01000	Line Feed
		1	00100	Space
		2	01100	I
		3	00010	Carriage Return
		4	01010	R
		5	00110	N

* Except for the first and 18th 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.

TABLE 1-2. (CONT)

CHARACTER RECEPTION ORDER	ADDRESSAL FUNCTION	ACTION FUNCTION	5-BIT CODE	CCIT CHARACTER
5 (cont)		6	01110	C
		7	00001	T
		8	01001	L
		9	00101	H
6	CHGR 100 KHz switch		11100	U
7		0-9	Same as 5th character	
8	CHGR 10 KHz switch		10010	D
9		0-9	Same as 5th character	
10	CHGR 1 KHz switch		11010	J
11		0-9	Same as 5th character	
12	CHGR 0.1 KHz switch		10110	F
13		0-9	Same as 5th character	
14	CMRA CARRIER SUPPRESSION switch		11110	K
15		0 DB	01000	Line Feed
		3 DB	00100	Space
		6 DB	01100	I

TABLE 1-2. (CONT)

CHARACTER RECEPTION ORDER	ADDRESSAL FUNCTION	ACTION FUNCTION	5-BIT CODE	CCIT CHARACTER
15 (cont)		20 DB	00010	Carriage Return
		30 DB	01010	R
		FULL	00110	N
16	Transmitter H.V. on/off		10001	Z
17		on	01000	Line Feed
		off	00100	Space
18	Transmitter tune		10000	E
*	Clear		01111	V

* Clear code, received at any time before "Transmitter Tune", will delete codes from RTMU memory.

TABLE 1-3. REMOTE TUNING INPUT CODES, EQUIPMENT SELECTION

EQUIPMENT SELECTED		5-BIT CODE	CCIT CHARACTERS
RTMU	A	10101	Y
	B	10110	F
	C	11010	J
	D	11001	W
	E	10011	B
RTTD	1	00010	Carriage Return
	2	01010	R
	3	01100	I
	4	01000	Line Feed
	5	00100	Space
	6	01101	P
	7	00101	H
	8	00011	O
	9	00111	M
	10	01011	G

SECTION 2

INSTALLATION

(To be supplied)

TTY LOOP CHART	
LOOP CURRENT	R =
60 ma.	220 Ω, 1W
20 ma.	680 Ω, 1W

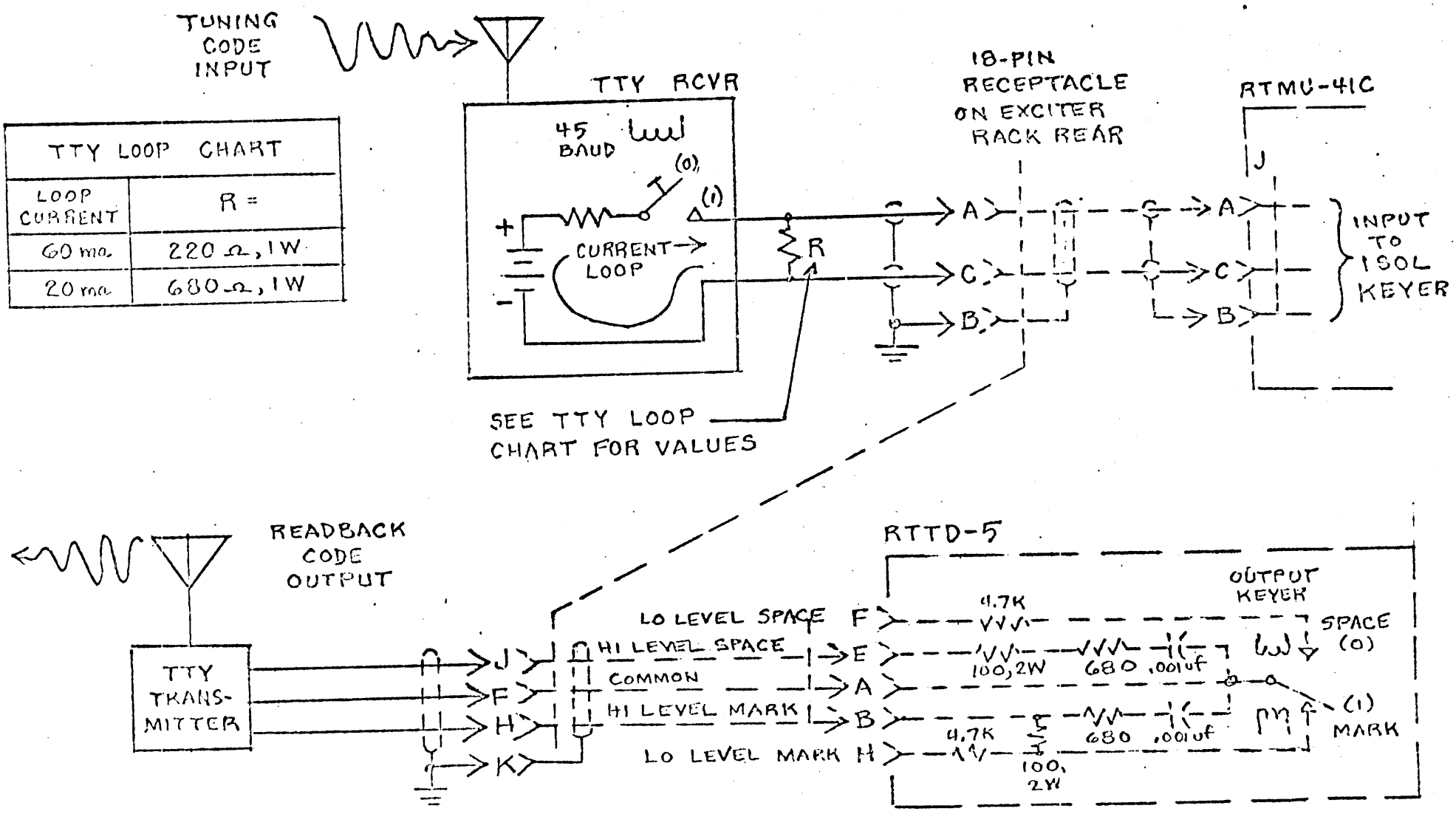

FIGURE 2-1. TELETYPE CONNECTION WIRING DETAILS

SECTION 3

OPERATOR'S SECTION

3-1. INTRODUCTION.

For remote control of the transmitter, a teletype code generator and a readback indicator (working from teletype codes) are required at the remote control site. Tables 1-2 and 1-3 list the necessary teletype codes for transmitter control. Table 1-4 lists readback codes generated from the transmitter. A specially designed code generator (programmer) may be used for transmitter control, with the control board keys marked to match transmitter controls; or a standard CCIT teletype code generator may be used, referring to tables 1-2 and 1-3 for corresponding keyboard letters. In the same manner, a readback indicator with displays and marking appropriate for the transmitter may be used or standard CCIT teletype, receiving equipment can be employed, referring to figure 5-1 and tables 5-1 through 5-7. Generally, the specifically designed programmers and readback indicators are used in normal operation of the transmitter, for the sake of direct reading and expediency; teletype equipment is used mainly for testing and checking the transmitter at the transmitter site.

3-2. FUNCTIONAL OPERATION.

Refer to figure 1-2. Equipment added to the transmitter (to give it the remote-tuning capability) is shown in heavy lines. The RTMU-41C Signal Data Converter-Storer accepts teletype tuning codes from the remote control site and stores them momentarily until the "E" code (ending the message) arrives. The codes are then drawn out of the memory, one-by-one, and into the RTTD-5 Transmitter Decoder. As each code is drawn out, the RTTD sends a positioning signal to a trasmitter control and the control moves to the prescribed position. When all the controls have been positioned, automatic tuning occurs in the transmitter linear power amplifier section in the same manner as for local automatic tuning. A transmitter selector code at the beginning of the message

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enables an array of up to 50 transmitters to operate from one teletype line. Specifically, the remote codes select a transmitter, set up the frequency, carrier suppression, and high voltage switching. Frequency codes are for the 10 MHz, 1 MHz, 100 KHz, 10 KHz, 1 KHz and 0.1 KHz components in the 2.000 to 32.000 MHz frequency desired; the codes act to move these selector switches on the CHGR unit in order to initiate automatic tuning of the power amplifier. The carrier suppression code acts to position the CMRA CARRIER SUPPRESSION selector switch. The HV (high voltage) on/off code acts to ensure that the high voltage is set properly to cut in at the proper tune/operate point in the automatic tuning.

The RTTD unit also functions as a control readback scanner and transmitter. The readback section specifically reads out the six frequency component settings on the CHGR, the H.V. on/off condition from the H.V. and main power relays on TCP Linear Amplifier Control Panel, and the setting of the CMRA CARRIER SUPPRESSION switch. Included in the readback is transmitter tuning status, an H.V. overload warning and information to ensure that the transmitter is properly prepared for a remote tuning. A tuning/ ready/ fault signal apprizes the remote operator of the progress (or status) of the remote tuning phase occuring in the transmitter. When the "ready" signal is received, another remote tuning message may be sent; the "tuning" signal indicates that the message will not be accepted. The "fault" signal indicates that the automatic tuning has failed to synchronize with the CHGR 1-mc standard and a re-cycling of the tuning phase is necessary. The H.V. overload warning indicates that an overload trip has occurred. An "equipment selected" signal indicates to the remote operator that the transmitter selector code has opened the memory input of the selected transmitter and that the succeeding codes will be stored. A remote/local signal indicates the position of the RTTD REMOTE/LOCAL front panel switch; if the switch is in LOCAL position, a remote tuning is not possible. Likewise, a "memory power" on/off signal indicates whether or not the RTMU memory is receiving power and able to accept the message.

Readback is a continuous cycling of teletype codes.

3-3. REMOTE CONTROL PROCEDURE.

a. GENERAL - A local presetting of certain controls on the transmitter front panel is necessary in order that a remote tuning can take place. Preset controls per tables 3-1 and 3-2. At this time, it is determined what mode (SSB, ISB, etc.) is to be used. This mode should be noted so that the remote operator can make the appropriate CARRIER SUPPRESSION adjustment in the tuning message to follow. After the controls are preset, the remote operator should (a) scan the readback indicator to check the present frequency and carrier suppression settings and (b) check the "remote/local" and "memory power on/off" signals; these signals should read "remote" and "on" respectively. When it is determined that a new frequency and/or carrier suppression point is required, the tuning message may be sent. The readback indicator may then be used again to ascertain that the controls have positioned as programmed. A more specific procedure is described in the following paragraph.

b. TUNING PROCEDURE - Refer to tables 1-2 and 1-3. Each message to a transmitter must include the two "transmitter selector" codes for that transmitter. The RTMU unit is wired to accept a specific pair of codes (A-E letter and 1-10 numeral). Follow these two with a pair of codes to select and position each control, using the "character reception " order shown in table 1-2. An "addressal function" code selects the control; an " action function" positions it.

NOTE

It is not necessary to send all the codes in table 1-2; the message need only include those controls that require changing.

The CARRIER SUPPRESSION code pair should be appropriate for the transmission mode (see table 3-3). If the H.V. readback indicates "off", include an H.V. "on" code pair as the last control code. Then end the message with the "transmitter tune" code (teletype E); this initiates the transfer of codes from the RTMU memory

into the Decoder.

If, at any time, an error is made in the message, (before the "transmitter tune" code is sent) existing codes stored in the RTMU memory may be cleared out by sending the "clear" code and a corrected message started without first sending the transmitter selector codes again. However, since the control code storage capacity for the RTMU memory is for 15 pairs, an error can usually be corrected by simply including the corrected pair of codes anywhere in the message.

c. SAMPLE TUNING - The following procedure is for an example in which it is necessary to re-tune transmitter "A1" (preset for 4-channel ISB) to 23.6251 MHz with a carrier suppression of 30 db. Readback is indicating 19.5436 MHz, Carrier Suppression "Full", "Ready", "Memory Power On", REMOTE/LOCAL switch at REMOTE, but H.V. power "off". Program message as follows (using "Code" or "CCIT Equivalent" columns only if specific programmer is not available):-

Sending Order	Code	CCIT Equivalent	Significance
1	10101	Y	Selects "A" block of 10
2	00010	Carriage Return	Selects transmitter "1".
3	11000	A	Selects 10 MHz control
4	01100	I	Positions above for "2"
5	10100	S	Selects 1 MHz control
6	00010	Carriage Return	Positions above for "3"
7	11100	U	Selects 0.1 MHz control
8	01110	C	Positions above for "6"
9	10010	D	Selects 0.01 MHz control
10	01100	I	Positions above for "2"
11	11010	J	Selects 0.001 MHz control
12	00110	N	Positions above for "5"
13	10110	F	Selects 0.0001 MHz control
14	00100	Space	Positions above for "1"

Sending Order	Code	CCIT Equivalent	Significance
15	11110	K	Selects CARRIER SUPPRESSION control.
16	01010	R	Positions above for "30DB"
17	10001	Z	Selects H.V. control
18	01000	Line Feed	Positions above for "ON"
19	10000	E	Transmitter tune command

c. READBACK MONITORING - If a "fault" signal appears in the readback after a tuning, the automatic tuning procedure may be re-cycled by sending another message (preceded by the two transmitter selection codes) containing any one of the six frequency digits repeated and followed by the "E" tune command code. This code action parallels that of the reset button located in the RTTD front panel FAULT light, used for maintenance checks. The equipment selected "yes" code should appear in the readback when the second transmitter selector code is sent and the "no" code should appear when the "tune command" code is sent. If the H.V. overload warning continues to appear in succeeding attempts at remote tuning, the transmitter should be examined for the cause of the trouble. If at any time, the "remote" signal changes to "local", this is an indication that remote control is being overridden at the transmitter site (see paragraph 3-4, MANUAL OVERRRIDE). Likewise, a "memory power off" signal indicates a disabling and override of the remote control. In either of the last two cases, however, the readback from the RTTD continues and, if a local tuning is taking place, a "tuning" signal will be included in the readback, together with the new frequency and carrier suppression settings. When tuning is complete, the remote operator will see a "ready" readback. However, the "local/remote" and "memory power" readbacks should be checked again before attempting another remote tuning.

Readback will continue as long as the RTTD POWER switch is at ON position; with the switch OFF, the readback ceases.

3-4. MANUAL OVERRIDE.

The transmitter may be placed in manual override of the remote control system at any time. However, during a remote tuning it is advisable to wait for the mechanical action to stop in the linear amplifier servo motor. This will be evident from a "sync" indication at the amplifier.

To place transmitter in manual override, set RTTD REMOTE/LOCAL switch at LOCAL. This is the only control necessary for switchover between remote and local operation. All other controls should remain as shown in table 3-1, in order to simplify the switchover. When the local tuning is concluded and it is desired to bring the transmitter back to remote control capability, set REMOTE/LOCAL swtich back to REMOTE.

TABLE 3-1. PRESETTING OF CONTROLS FOR REMOTE OPERATION

STEP	MODULE	OPERATION
1	All	Start with all POWER switches in their OFF positions.
2	CHGR	Set RF OUTPUT control fully ccw. Set POWER switch at STANDBY. STANDBY lamp will light. Set MHz switches for 15.0000 MHz*.
3	CMRA	Determine mode of transmission and, referring to table 3-2, set CHANNEL PRIORITY controls accordingly. Set controls for unused channels at "0".
4	CMRA	Set POWER switch at ON. If there is no audio coming into the system, STANDBY lamp will light. If audio is being introduced, POWER lamp will light.
5	CHGR	Set POWER switch at ON. Check to ensure that CHGR RF output level is at approximately 100 mw. To do this, set METER switch at RF and observe MONITOR meter. If the reading is under this figure, refer to checkout and adjustment procedure in the Installation section of the transmitter manual. The CHGR shipped with a transmitter is adjusted properly at the factory; however, a replaced CHGR may need the adjustment.
6	TCP	Set MAIN POWER circuit breakers at ON, and allow approximately one minute for the filament timer to activate.
7	TCP	Set XMTR TUNING switch at AUTO and SERVO switch at ON.
8	SWCA	Set the two POWER LIMIT controls (under SWR meter) for desired output. The control on the left is for minimum output; the control on the right is for maximum output.
9	SWCA	Set RF GAIN control fully ccw.
10	TCP	Set HIGH VOLTAGE switch at ON.
11	RTTD	Set POWER switch at ON and set REMOTE/LOCAL switch at REMOTE.
12	RTMU	Set POWER switch at ON.
13	AX633	Set ALARM ON/OFF switch at ON.

TABLE 3-2. CHANNEL PRIORITY CONTROL PRESETTINGS, CMRA

MODE OF TRANSMISSION	CONTROL	SETTING
1 Channel SSB	A1 or B1	100
2 Channel ISB*	A1 or B1	50
4 Channel ISB*	A1, A2, B1, and B2	25
AME	A1 or B1	50
AM	A1 and B1	30
CW (Keyed Carrier)	A1, A2, B1, and B2	0
Tone CW, FSK, FAX*	A1	50
	A2, B1, and B2	0

* If one channel of an ISB transmission is to be used for FSK or FAX, set the priority control of the channel containing the single-tone modulation at 25 (for 2 channel ISB), or at 12.5 (for 4 channel ISB).

TABLE 3-3. CARRIER SUPPRESSION SETTINGS

MODE OF TRANSMISSION	SETTING
CW (Keyed carrier telegraphy)	0 DB
AME	3 DB
SSB or two-channel ISB with reduced carrier	20 DB
AM	6 DB
Four-channel ISB with reduced carrier	30 DB
SSB or ISB with suppressed carrier; tone CW, FSK. or FAX	FULL

SECTION 4

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

This section contains a description of the operation of the transmitter remote code receiving equipment (i.e.: RTMU-41C, RTTD-5, and control lines to units in the exciter and amplifier frames) at a functional level.

4-2. GENERAL (figure 4-1).

In remote operation of the transmitter, teletype codes sent by the remote operator serve to set the CHGR frequency controls in the exciter so that the automatic tuning of the linear power amplifier may take place. In addition, there are on/off codes for the remote control of the amplifier high voltage and codes for adjustment of the CMRA CARRIER SUPPRESSION at the exciter stage. Included are signal exchanges between this equipment and the amplifiers to ascertain that the proper sequences occur in the automatic tuning. Signal lines involved in the remote control system are symbolized in heavy lines in figure 4-1.

Readback of transmitter control psoitions and tuning status is generated by the readback section. The readback is also in the form of teletype code. Broken lines in figure 4-1 represent readback signal lines.

All circuitry is solid state, employing binary logic components and contained on printed circuit plug-in assemblies. "A" numbers in figure 4-1 are the circuit designations of the assemblies.

4-3. CODE ENTRY (figure 4-1)

Tuning codes enter the transmitter by way of isolation keyer A1 in the RTMU Signal Data Converter-Storer. The 5-bit binary codes are made up of pulses of current from a standard keyed teletype current loop and include a "start" pulse at the beginning and a "stop" pulse at the end. Isolation keyer A1 keys a logic voltage in the input of clock timing circuit A2 and also serves to isolate the code inputs of an array of transmitters working from a common teletype loop.

Clock timing circuit A2 converts the serial pulse (single line) code input to a parallel pulse code output with a line for each bit in the 5-bit code. The five bits of the code then pass through parallel shift register A3 on the way to integrated shift register A7, where they become stored in a "memory".

The "start" pulse in each code triggers the movement of that code into the memory. This pulse starts a clock in clock timing circuit A2 and clock pulses pace the shift-register in A3. When the shift-register shifts out to the end, it generates a "stop" pulse, stopping the clock.

A3 and gating circuit A4 serve to analyze the codes for three particular types of code: (1) transmitter selector, (2) "clear", and (3) "E" code. The transmitter selector code is a 2-code combination at the beginning of the message that (via stunt relay K1) effectively unlocks the input to the RTMU memory at A2, thereby allowing the rest of the codes to become stored. The "clear" code, if received at any time during the message, will result in a "clear" signal to the memory via shift timing circuit A6, dumping any existing codes out of the memory section. The "E" code, signifying the end of the message, serves to energize the code processing section in Transmitter Decoder RTTD-5 (see paragraph 4-4). Another effect of the correct transmitter selector code is to issue a "stunt" signal from the energized stunt relay K1 to the other transmitters in the common teletype loop, closing their memory sections to any succeeding codes in that tuning message. The energized K1 relay also generates an "equipment selected " readback (see paragraph 4-7).

4-4. "E" CODE INTO RTMU (figure 4-1).

When the "E" signal arrives at shift timing circuit A6, (a) it generates a "start tune" signal from a 4 and (b) it starts a clock in A6. The clock proceeds to send out a series of regularly timed "shift" pulses to integrated shift-register A7. At the same time instance, the "start tune" signal acts upon RTTD time delay relay K1 to ensure that it is in its normal (no fault) position. In this position,

there is continuity for a "tune lockup" circuit (located in RTTD stepping switch gating circuit A5) used in the ensuing code transfer. A "memory advance" pulse is then generated from A5 generating a "delay pulse" from RTMU shift timing circuit A6. Meanwhile, the continuous series of shift pulses to RTMU A7 is shifting the parallel code bits in the memory section towards the output of this section. When the first code arrives at the RTMU output, a "monitor pulse" is generated back to A4 and to A6 to stop the clock. To release the first code to the RTTD it is necessary for A4 to receive both monitor pulse and the end of the long delay pulse. (Duration of the delay pulse is designed to allow for the extreme condition in which there is only one code in the message and it must travel the entire length between input to output.) When both of these signals have been received, the first code is shifted out of the RTMU and into the RTTD. At this point, a reciprocating action starts between the RTTD and the RTMU, in which codes are drawn out of the RTMU's memory by successive "memory advance" signals from the RTTD. A more detailed account of this follows in the next paragraph.

4-5. CODE TRANSFER ACTION (figure 4-1).

When the first code enters a BCD decoder section in RTTD drive input gating circuit A4, the reciprocating action starts. Referring to table 1-2, Remote Tuning Input Codes, codes intended to select a transmitter control starts with a "1" as bit #1 and codes intended to position the control start with a "0". If bit #1 is a "1" in the first code, the tune lockup circuit (in A5) enables an SCR gate control (#1) in A5 to supply power to a master stepping switch, A9. This switch moves to a position from the code, thus connecting the RTTD control position signal output to a particular exciter control. When the switch has stopped moving, it sends a "switch homed" signal back to SCR gate control #1 and this responds by sending the second "memory advance" signal back to RTMU shift timing circuit A6 for the next code. During the transfer cycle of each

code, RTMU A6 issues a "decoder inhibit" signal to RTTD SCR gate control #1 to prevent it (the gate) from supplying power to the master stepping switch while the code is being transferred from the RTMU memory to the RTTD BCD decoder.

The second code drawn out has a "0" for bit #1 and will position the selected exciter control. With bit #1 polarity a "0", SCR gate control #2 (also in RTTD A5) supplies power to the selected exciter stepping switch control drive. The positioning signal is received by the exciter stepping switch via the BCD decoder and via the position of the master stepping switch (positioned by the first code). When the exciter switch has homed, the second "switch homed" signal is send back to RTTD SCR control gate #2 and it sends back the third "memory advance" signal to RTMU to draw out the third code. This procedure is repeated until all codes have been drawn out of the memory.

At the start of the code transfer, the time delay circuit sends back a "memory inhibit" signal to the clock in RTMU clock timing circuit A2. This is to prevent the clock from starting from another tuning message while stepping switches are moving.

4-6. FREQUENCY TUNING (figure 4-1).

When the 18-position master stepping switch receives the final code (E) in the message, this code sends it to position #18, the last stop in its complete revolution. (The first seven positions select exciter controls). As it travels through position #8, a ground pulse is extended to an H.V. (high voltage) on/off control logic circuit in H.V. transmitter logic circuit A6. Meanwhile (from position #8) bits #2 and #3 of the H.V. positioning code have arrived at A6 from the BCD decoder and bit #1 (a "0") has also arrived. In accordance with the on/off code, A6 sends a control signal to an H.V. on/off relay on transmitter control panel TCP, via an H.V. on/off relay (K2) in the RTTD.

A readback from the TCP transmitter main power control also furnishes

additional information to logic circuit A6. This is to prevent an H.V. "on" signal to the transmitter H.V. control when the main power circuit breaker has been turned off locally.

The master stepping switch movement in the RTTD triggers the automatic tuning system in the linear amplifier. While the master stepping switch is moving through its exciter switch positions (1-7) a ground is extended to RTTD tune relay K3, energizing it. The energized K3 latches relays in RF Control and Indicator, Model SWCA, to prevent an automatic frequency tuning during the exciter switch-positioning phase. When the master stepping switch leaves position #7, the ground is removed, K3 de-energizes, sending the "tune" signal, and the SWCA switches unlatch. This allows the transmitter automatic tuning to take place, from the prepositioning information previously set up on the CHGR MHz component switches.

A time delay circuit in the RTTD shuts off the amplifier automatic tuning search action in the event of a fault (or failure to synchronize). Ordinarily, (when no fault occurs) a tune/operate relay located in the linear amplifier SWCA unit, goes into "operate" condition when searching is finished and synchronization is reached. This disconnects a ground signal from the time delay circuit, disabling it. If a fault occurs, however, searching continues and the time setting (60 seconds) for the time delay circuit runs out, tripping time delay relay K1 into its "fault" condition. K1 then (a) de-energizes a relay in SWCA-3K, (b) breaks the tune lockup continuity in the RTTD, (c) shuts off the -30v power supply to the master stepping switch and stepping switches through the exciter, (d) lights a FAULT lamp on the RTTD control panel and (e) sends a FAULT readback to the remote operator. In this event, a remote-controlled recycling of the automatic tuning can be initiated by sending another message with one frequency digit repeated and the "E". This causes the master stepping switch to make another complete revolution and sends another "start tune" signal to the time delay circuit, resetting the time delay relay (K1) to

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its normal position. The master stepping switch, in its new revolution, sends another "tune" signal to the SWCA and a new tuning cycle starts.

The transmitter tuning can also be recycled locally by pushing in the RTTD FAULT light. A reset button, built into the light, generates a signal at the time delay circuit paralleling that of the remote "start tune" signal. Automatic tuning then recycles in the same manner as for remote control.

A "long ground" signal from the master stepping switch provides (a) another link in the tune lockup continuity and (b) an ensurance that the transmitter high voltage relays are in their reset condition. This ground appears from the switch during its travel through positions #1 to 15, holding the tune lockup circuit in. The same ground acts, through a H.V. reset relay in the TCP module, to keep high voltage switched back in, in the ~~vent~~ event of a previous overload condition.

4-7. READBACK SYSTEM (figure 4-1).

Inputs into the readback system originate from exciter module control positions and various relays in the linear amplifier automatic tuning system; these signals are scanned by the readback circuitry in the RTTD and sent out in serial teletype form to the remote operator. The 5-bit codes represent specific information as shown in table 1-4. Some codes contain more than one source of information (i.e. a control position and some status information) worked into the five bits. The tuning/ready/fault status is read in bit #1 polarities in two successive codes.

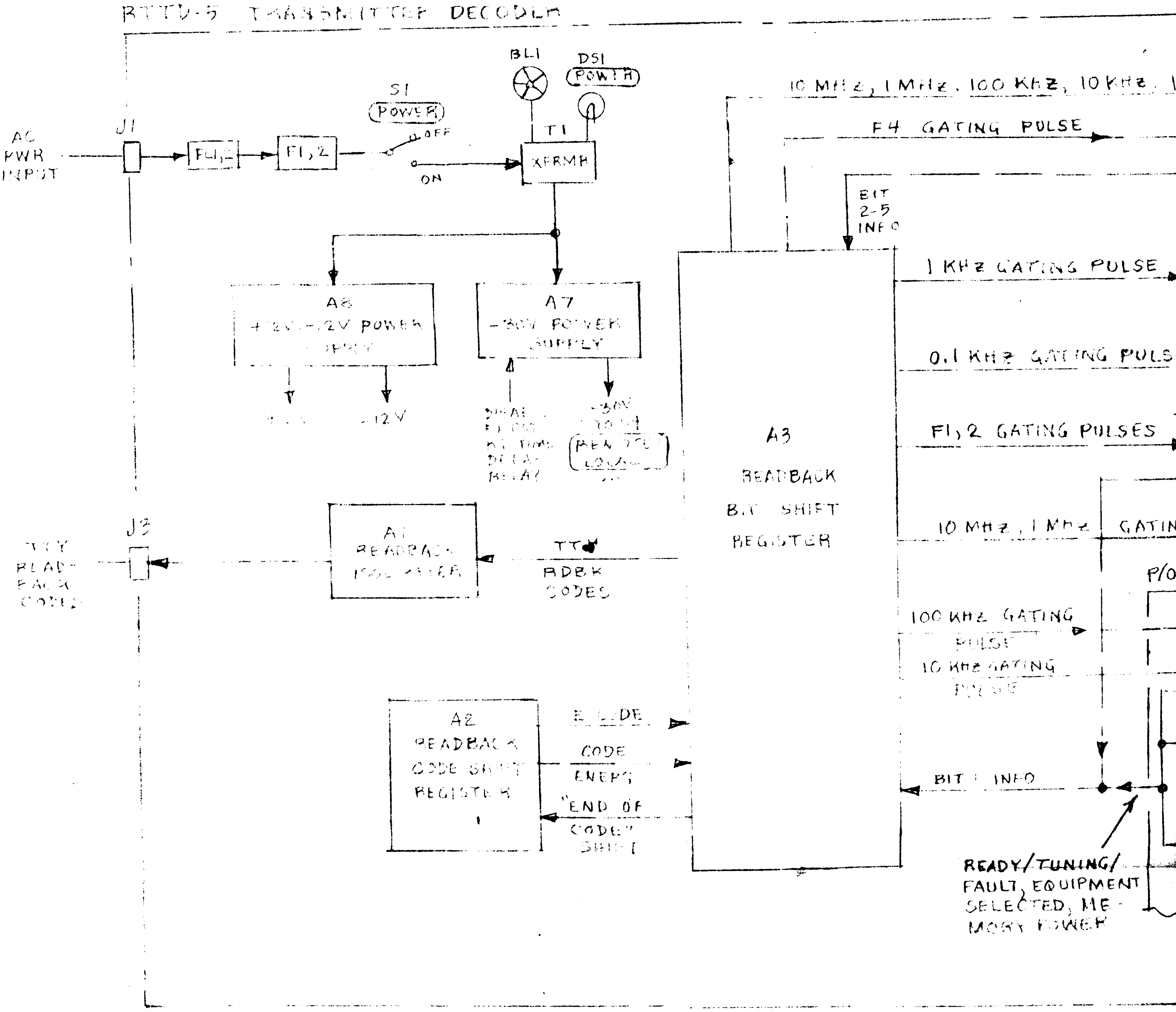
Control position readouts for the CHGR MHz switches and the CMRA CARRIER SUPPRESSION switch is contained in bits #2-5 of their codes. The 4-bit code is set up by a readback wafer on the control, next to the stepping switch drive wafer Readout of each code is generated by a gating pulse issuing from readback bit shift register A3 to that particular wafer. The bits arrive at A3 in parallel pulse form and are then shifted out in serial pulse form, via isolation.

keyed A1, for transmission to the remote operator. At the end of each code, A3 sends a shift signal to readback code shift register A2 and A2 responds by sending the energization pulse necessary for the next code readout (see "character transmission order" column, table 1-4).

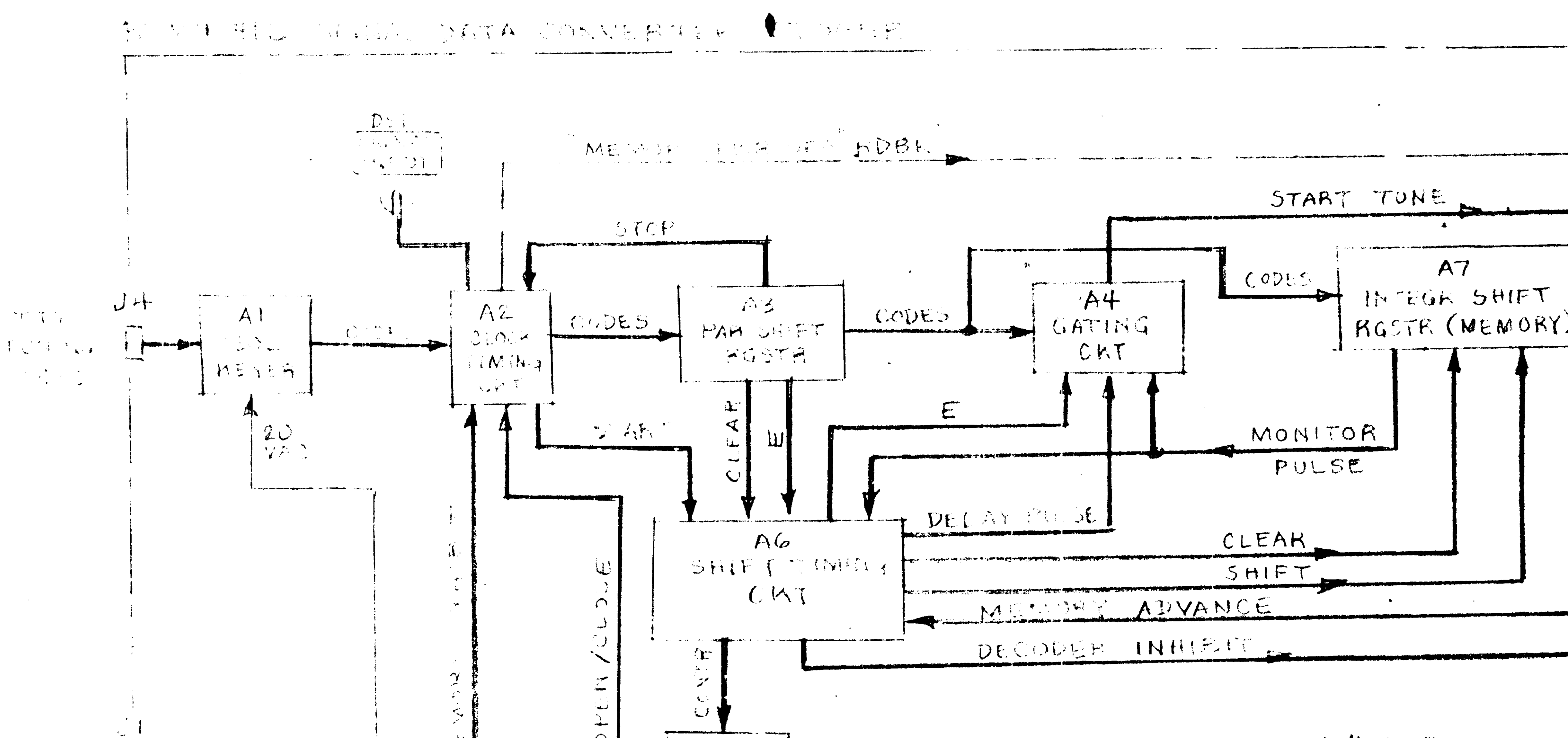
In each of the CHGR control readouts, the same gating pulse that energizes the bit #2-5 readout also energizes a bit #1 readout from information elsewhere in the transmitter. The two successive gating pulses from A3 for the 10 MHz and 1 MHz controls also issue to a transmitter tuning status logic circuit for readout of the tuning/ready/fault code. This circuit has three continual sources of information: (1) the tune/operate relay in the SWCA, (2) tune process on/off information from the tune lockup circuit in A5 and (3) fault/no fault from time delay relay K1. The output is a bit #1 polarity (for two successive codes) to A3 The 100 KHz gating pulse reads out the "equipment selected" information from RTMU stunt relay K1. The 10 KHz gating pulse reads out the "memory power on/off" signal from RTMU clock timing circuit A2. The 1 KHz gating pulse presents information as to the position of the RTTD REMOTE/LOCAL switch. The 0.1 KHz gating pulse reads out an alarm/no alarm signal from the H.V. overload relay in the TCP unit. Following these pulses are nine more gating pulses issuing from A3 (F1 through F9). Only three of these are used in this particular transmitter, however; these are F1, F2 and F4. F1 and F2 successive pulses enter an H.V. status readback logic circuit in H.V. transmitter logic circuit A6 to read out the H.V. status of the transmitter. Inputs to this circuit are the on/off status of the main power relay as well as that of the H.V. realy in the TCP unit. These two codes contain information, in bit #1 only; bits #2-5 are not used. F4 then serves only to read out the CMRA CARRIER SUPPRESSION readback wafer for bits #2-5 of the last code.

An "E" code (10000) is permanently set up in the circuitry of readback code shift register A2. This code is automatically sent out as the first code in each readback cycle and serves to reset the readback indicator circuitry at the remote operations site.

It may be seen that the readback section operates independently of the remote control section and will continue to transmit as long as power is applied to the RTTD. The only connection between the two sections is a common sharing of "transmitter main power on/off" information by the H.V. on/off control and H.V. status readback logic circuit in RTTD A6.



TRANSMITTER DECODER
AC PWR INPUT
J1
S1
POWER
OFF
ON
BL1
DS1
POWER
T1
XFRMR
A8
+12V -12V POWER
-12V
A7
-30V POWER SUPPLY
-30V
A3
READBACK
BIT SHIFT
REGISTER
10 MHz, 1 MHz, 100 KHz, 10 KHz
F4 GATING PULSE
BIT 2-5 INFO
1 KHz GATING PULSE
0.1 KHz GATING PULS
F1, 2 GATING PULSES
10 MHz, 1 MHz
GATIN
P/O
100 KHz GATING PULSE
10 KHz GATING
J3
TTY READ-BACK CODES
A1
READBACK
TTY
RDBK CODES
A2
READBACK
CODE SHIFT
REGISTER
CODE
ENERG
"END OF CODE"
BIT INFO
READY/TUNING/ FAULT, EQUIPMENT SELECTED, MEMORY POWER



DATA CONVERTER
J4
A1
KEYER
20 VAC
A2
CLOCK
TIMING
CODES
STOP
A3
PAR SHIFT
RGSTR
CODES
A4
GATING
CKT
CODES
A7
INTEGR SHIFT
RGSTR (MEMORY)
START TONE
CLEAR
E
E
MONITOR
PULSE
A6
SHIFT TIMING
CKT
DELAY PULSE
CLEAR
SHIFT
ADVANCE
DECODER INHIBIT
OPEN/CLOSE

KHz, 1 KHz OR KHz GATING PULSES

ULSE

PULSE

ULSES

BIT 1 INFO
(REMOTE/LOCAL, HV ON/OFF, HV OVLD)

GATING PULSES

P/O A+ DRIVE INPUT GATING

TUNING/READY/
FAULT
STATUS

XMTR
TUNING
STATUS
LOGIC

TUNE/OPER
INFO

IN TUNE
PROC

FAULT/
NO FAULT

EQUIP
SELECTED

MEMORY
PWR OFF

MENT

R

HV ON/OFF
STATUS

P/O A6

REMOTE/LOCAL

HV OVLD

S4
REMOTE
LOCAL

F4

HV STATUS
RDBK
LOGIC

MAIN PWR ON/OFF

HV ON/OFF

-30V
FROM
A7 P/S

-30V TO EXCI

-30V
DISABLE
TO A7

-30V
TO A9
MASTER
STEP SW

TIME DELAY DISABLE

LOCKUP
CONT

RESET

K1
TIME
DELAY
RELAY

LOCKUP
CONT

TO
SCR
GATES

DS2
(FAULT)

ENABLE

RESET
BUTTON
(P/O FAULT
LIGHT)

P/O
A5

P/O A6

START TUNE

MEMORY
INHIBIT

TUNE LOCKUP
&
TIME DELAY

BIT 1

HV POS

HV ON/OFF
CONTROL
LOGIC

CONTR

K2
HV ON/OFF
RELAY

MAIN PWR ON/OFF

LONG GND

BIT 1

P/O A4

POS 8
GND

POS
1-15
GND

POS 1-7
GND

K3
TUNE
RELAY

"TUNE

CODES
(BITS 1-5)

BITS
2-5

BCD
DECODER

POSITION
SIGNALS

P/O A9
MASTER
STEPPING
SWITCH

SIGNALS TO INDICATE
SELECTED STEP SWS

PWR

PWR

BIT
1

P/O A5

"SW
HOMED"
SIGNAL

SCR
GATE
CONTROL
#1

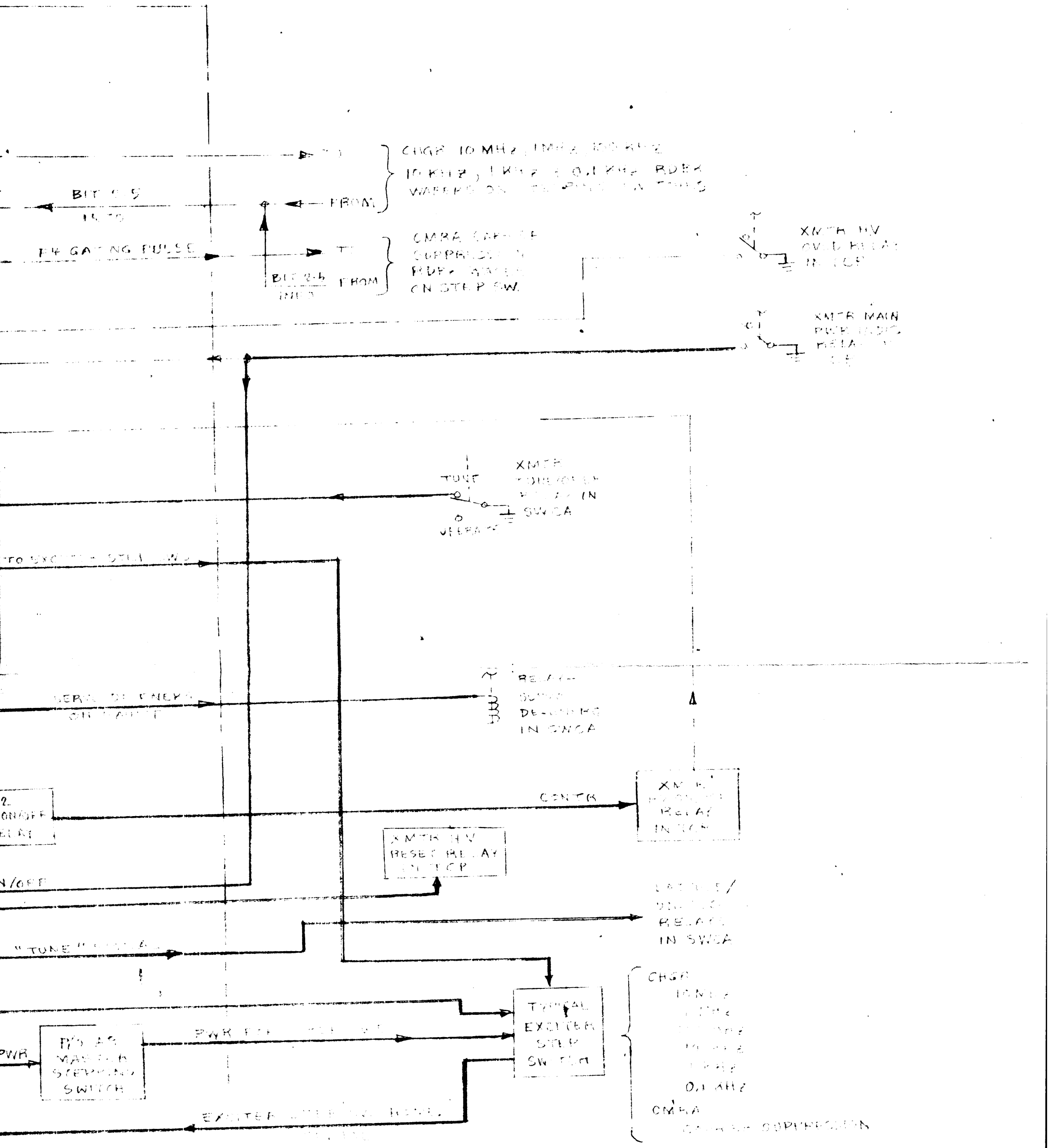
SCR
GATE
CONTROL
#2

P/O A5

LOCKUP
CONT
FROM K1

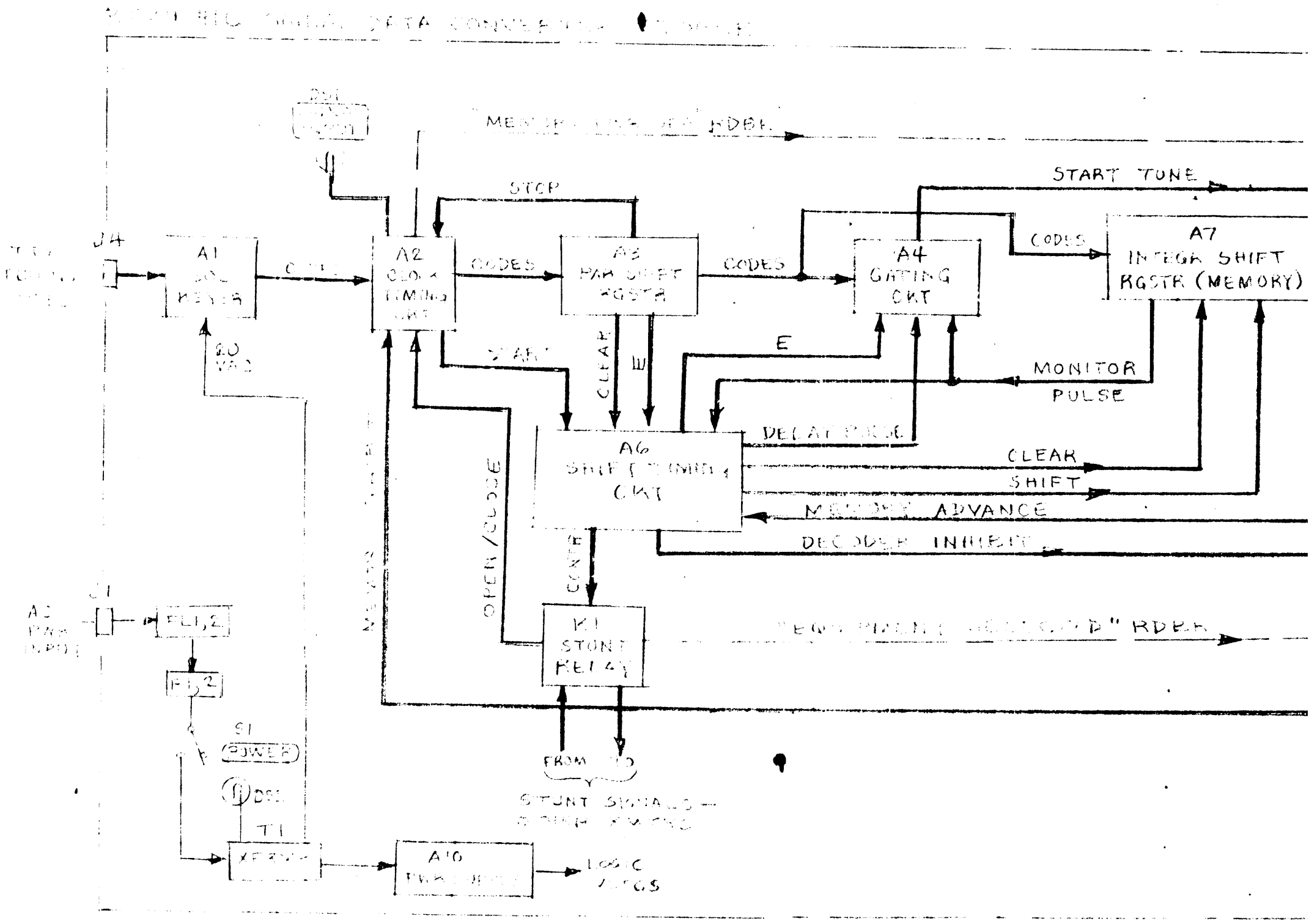
LOCKUP
CONT
FROM K1

BIT 1 INFO


FROM
BIT 2-5
INTO
FROM
BIT 2-5
INTO
FROM
CONTR
XMTR MAIN
RELAY
IN SWGA
TUNE
XMTR
IN SWGA
RELAY
IN SWGA
CONTR
XMTR H.V.
RESET RELAY
SWITCH
"TUNE"
P/O A5
MASTER
SWITCH
TYPICAL
EXCITER
STEP
SWITCH
CHGR
10 MHz
1 MHz
100 KHz
10 KHz
1 KHz
0.1 KHz
CMRR
SUPPRESSION
P/O A5

LEGEND

FAULT, EQUIPMENT SELECTED, ME- MORY POWER



MENT
E
R

RESET BUTTON (P/O FAULT LIGHT)

P/O A5

TIME DE

LOCKOUT CONT

RESET

K1 TIME DELAY RELAY

CONT

GATES

DS2 (FAULT)

ENABLE

P/O A6

BIT 1

HV POS

HV ON/OFF CONTROL LOGIC

CONTR

K2 HV ON/OFF RELAY

START TUNE

TUNE LOCKOUT & TIME DELAY

MEMORY INHIBIT

MAIN PWR ON/OFF

LONG GND

BIT 1

P/O A4

POS 8 GND

POS 1-7 GND

K3 TUNE RELAY

"TUN

POS 1-15 GND

P/O A9 MASTER STEPPING SWITCH

SIGNALS TO [illegible] SELECTED STEP SWS

PWR

SHIFT MEMORY

CODES (BITS 1-5)

BITS 2-5

BCD DECODER

POSITION SIGNALS

BIT

P/O A5

PWR

"SW HOMED" SIGNAL

SCR GATE CONTROL #1

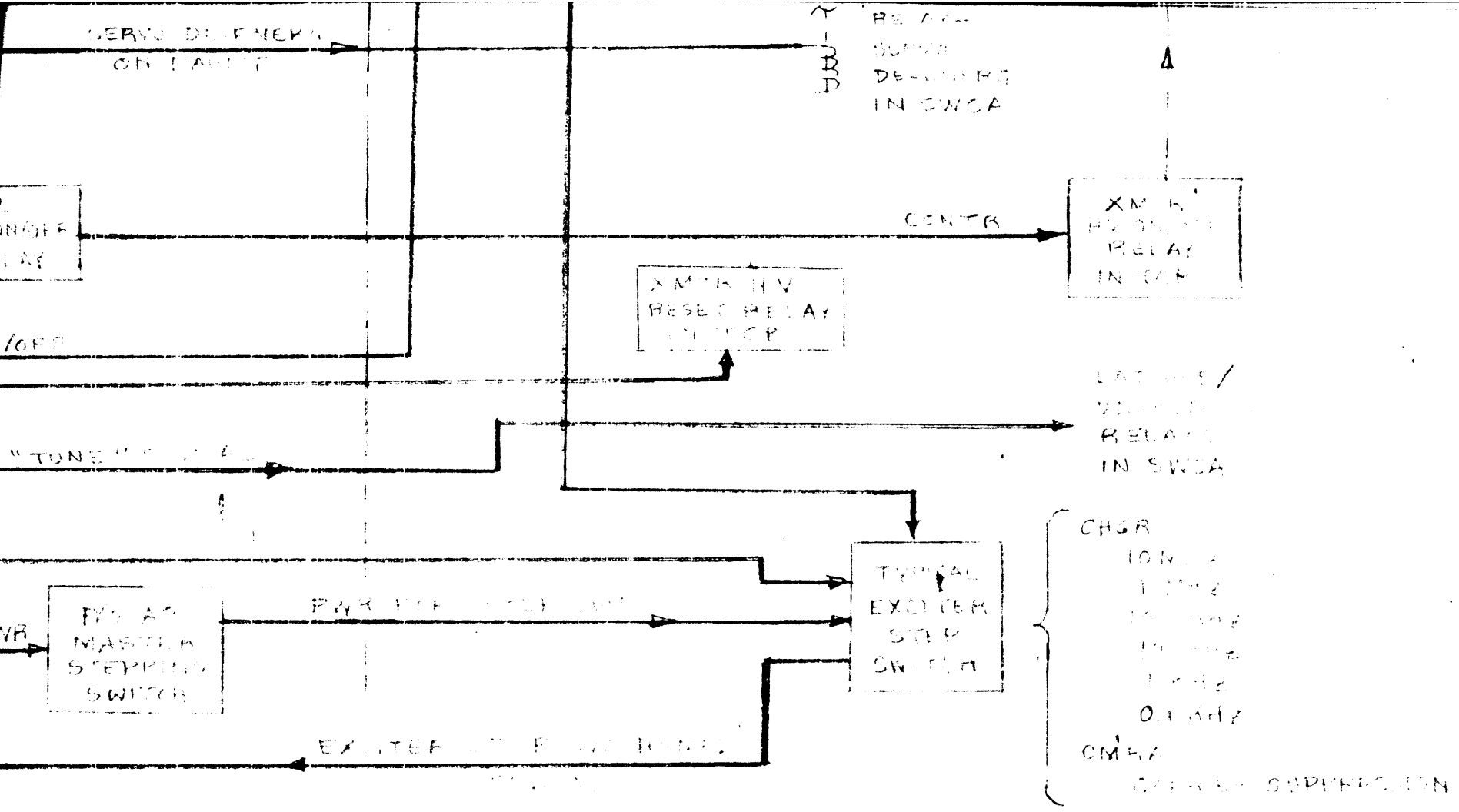
SCR GATE CONTROL #2

P/O A5

LOCKUP CONT FROM K1

BIT 1 INFO

LOCKUP CONT FROM K1



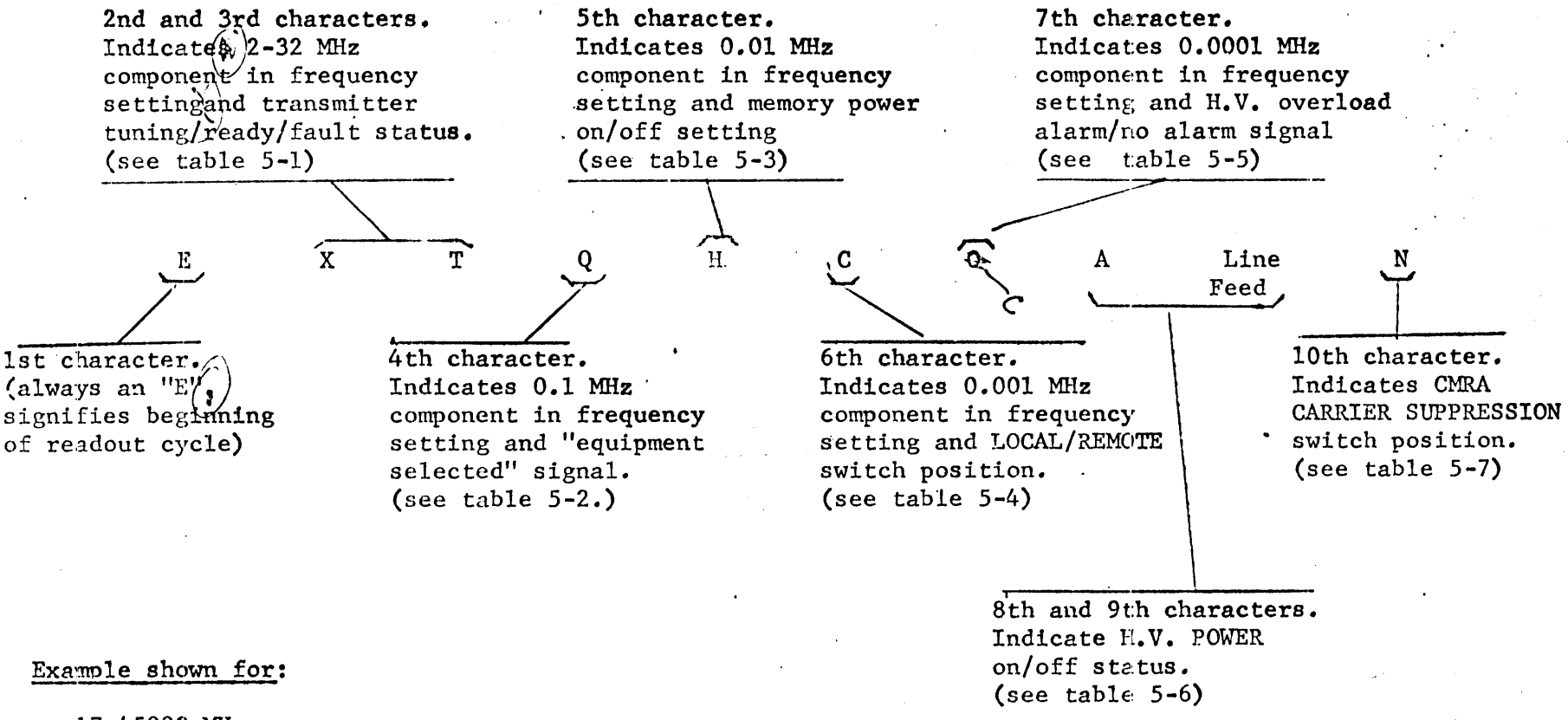
LEGEND:

FIGURE 4-1. FUNCTIONAL BLOCK DIAGRAM TRANSMITTER REMOTE CONTROL SYSTEM

SECTION 5

MAINTENANCE

(Text to be supplied)



Example shown for:

17.45883 MHz
Ready
Equipment Selected
Memory Power on
REMOTE/LOCAL switch at REMOTE
H.V. power on
CARRIER SUPPRESSION switch at FULL

Figure 5-1. Teletype Code Readback Translation

TABLE 5-1. 2nd and 3rd Characters in Readback

Frequency Component	Tuning Status	2nd Char. Code Bits	2nd Char. Code CCIT	3rd Char. Code Bits	3rd Char. Code CCIT
2 MHz	Tuning	01111	V	11011	Figures
3 MHz				10011	B
4 MHz				11101	Q
5 MHz				10101	Y
6 MHz				11001	W
7 MHz				10001	Z
8 MHz				11110	K
9 MHz		01111	V	10110	F
10 MHz		00111	M	11111	Letters
11 MHz				10111	X
12 MHz				11011	Figures
13 MHz				10011	B
14 MHz				11101	Q
15 MHz				10101	Y
16 MHz				11001	W
17 MHz				10001	Z
18 MHz				11110	K
19 MHz		00111	M	10110	F
20 MHz		01011	G	11111	Letters
21 MHz				10111	X
22 MHz				11011	Figures
23 MHz				10011	B
24 MHz				11101	Q
25 MHz				10101	Y
26 MHz				11001	W
27 MHz				10001	Z
28 MHz				11110	K
29 MHz		01011	G	10110	F
30 MHz		00011	O	11111	Letters
31 MHz		00011	O	10111	X
32 MHz	Tuning	00011	O	11011	Figures
2 MHz	Ready	11111	Letters	01011	G
3 MHz				00011	O
4 MHz				01101	P
5 MHz				00101	H
6 MHz				01001	L
7 MHz				00001	T
8 MHz				01110	C
9 MHz		11111	Letters	00110	N
10 MHz		10111	X	01111	V
11 MHz				00111	M
12 MHz				01011	G
13 MHz				00011	O
14 MHz				01101	P
15 MHz				00101	H
16 MHz				01001	L
17 MHz				00001	T
18 MHz				01110	C
19 MHz	Ready	10111	X	00110	N

TABLE 5-1. 2nd and 3rd Characters in Readback (cont)

Frequency Component	Tuning Status	2nd Char. Code Bits	2nd Char. Code CCIT	3rd Char. Code Bits	3rd Char. Code CCIT
20 MHz	Ready	11011	Figures	01111	V
21 MHz				00111	M
22 MHz				01011	G
23 MHz				00011	O
24 MHz				01101	P
25 MHz				00101	H
26 MHz				01001	L
27 MHz				00001	T
28 MHz				01110	C
29 MHz		11011	Figures	00110	N
30 MHz		10011	B	01111	V
31 MHz		10011	B	00111	M
32 MHz	Ready	10011	B	01011	G
2 MHz	Fault	11111	Letters	11011	Figures
3 MHz				10011	B
4 MHz				11101	Q
5 MHz				10101	Y
6 MHz				11001	W
7 MHz				10001	Z
8 MHz				11110	K
9 MHz		11111	Letters	10110	F
10 MHz		10111	X	11111	Letters
11 MHz				10111	X
12 MHz				11011	Figures
13 MHz				10011	B
14 MHz				11101	Q
15 MHz				10101	Y
16 MHz				11001	W
17 MHz				10001	Z
18 MHz				11110	K
19 MHz		10111	X	10110	F
20 MHz		11011	Figures	11111	Letters
21 MHz				10111	X
22 MHz				11011	Figures
23 MHz				10011	B
24 MHz				11101	Q
25 MHz				10101	Y
26 MHz				11001	W
27 MHz				10001	Z
28 MHz				11110	K
29 MHz		11011	Figures	10110	F
30 MHz		10011	B	11111	Letters
31 MHz		10011	B	10111	X
32 MHz	Fault	10011	B	11011	Figures

TABLE 5-2. 4th Character in Readback

0.1 MHz Component	Equipment Selected	Code Bits	Code CCIT
0	yes	11111	Letters
1	↑	10111	X
2	↑	11011	Figures
3	↑	10011	B
4	↑	11101	Q
5	↑	10101	Y
6	↑	11001	W
7	↑	10001	Z
8	↑	11110	K
9	yes	10110	F
0	no	01111	V
1	↓	00111	M
2	↓	01011	G
3	↓	00011	O
4	↓	01101	P
5	↓	00101	H
6	↓	01001	L
7	↓	00001	T
8	↓	01110	C
9	no	00110	N

TABLE 5-3. 5th Character in Readback

0.01 MHz Component	Memory Power	Code Bits	Code CCIT
0	off	11111	Letters
1	↑	10111	X
2	↑	11011	Figures
3	↑	10011	B
4	↑	11101	Q
5	↑	10101	Y
6	↑	11001	W
7	↑	10001	Z
8	↑	11110	K
9	off	10110	F
0	on	01111	V
1	↓	00111	M
2	↓	01011	G
3	↓	00011	O
4	↓	01101	P
5	↓	00101	H
6	↓	01001	L
7	↓	00001	T
8	↓	01110	C
9	on	00110	N

TABLE 5-4. 6th Character Readback

0.001 MHz Component	LOCAL/REMOTE switch position	Code Bits	Code CCIT
0	LOCAL	11111	Letters
1		10111	X
2		11011	Figures
3		10011	B
4		11101	Q
5		10101	Y
6		11001	W
7		10001	Z
8		11110	K
9	LOCAL	10110	F
0	REMOTE	01111	V
1		00111	M
2		01011	G
3		00011	O
4		01101	P
5		00101	H
6		01001	L
7		00001	T
8		01110	C
9	REMOTE	00110	N

TABLE 5-5. 7th Character Readback

0.0001 MHz Component	H. V. Overload Alarm	Code Bits	Code CCIT
0	alarm	11111	Letters
1		10111	X
2		11011	Figures
3		10011	B
4		11101	Q
5		10101	Y
6		11001	W
7		10001	Z
8		11110	K
9	alarm	10110	F
0	no alarm	01111	V
1		00111	M
2		01011	G
3		00011	O
4		01101	P
5		00101	H
6		01001	L
7		00001	T
8		01110	C
9	no alarm	00110	N

TABLE 5-6. 8th and 9th Characters in Readback

H. V. POWER on/off condition	8th Char. Code Bits	8th Char. Code CCIT	9th Char. Code Bits	9th Char. Code CCIT
ON	11000	A	01000	Line Feed
OFF	01000	Line Feed	11000	A

TABLE 5-7. 10th Character in Readback

CMRA CARRIER SUPPRESSION sw. pos.	10th Char. Code Bits	10th Char. Code CCIT
0 DB	01111	V
3 DB	01101	P
6 DB	01110	C
20 DB	00111	M
30 DB	00101	H
FULL	00110	N