NACOM II MASTER

TECHNICAL MANUAL

for

TRANSMITTER DECODER MODEL RTTD-5A

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, CANADA

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NOTICE

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

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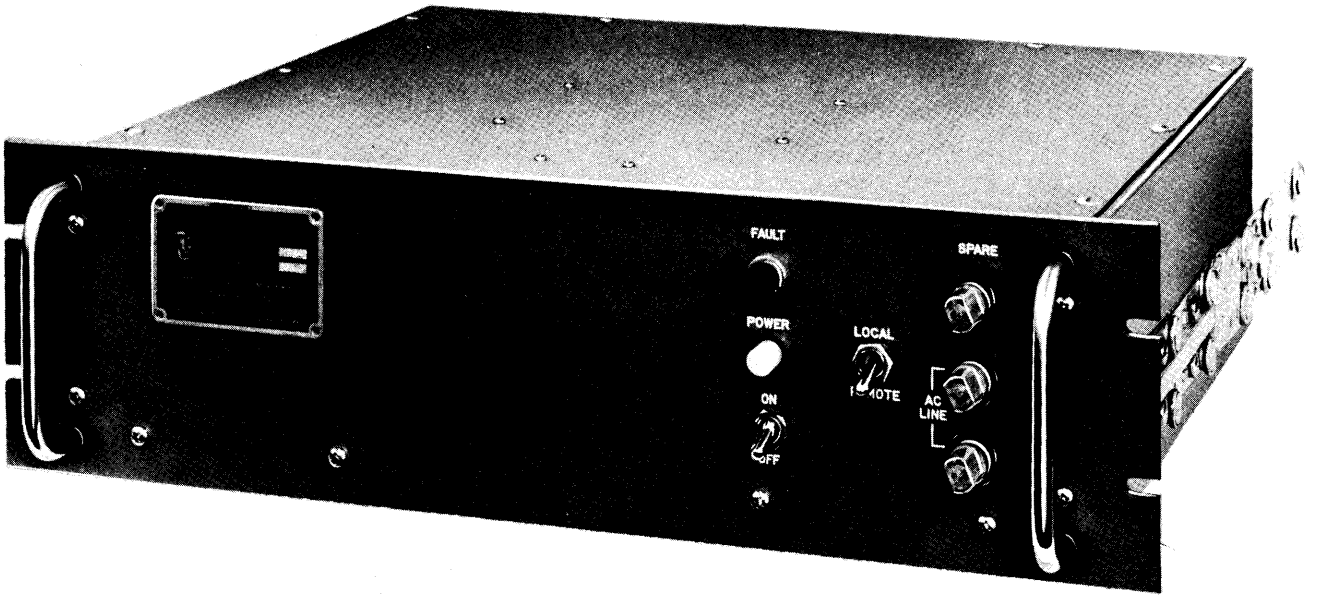

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Figure 1-1. RTTD-5A Transmitter Decoder

SECTION I
GENERAL INFORMATION

1-1. GENERAL DESCRIPTION

a. Functional Description - Transmitter Decoder, Model RTTD-5A, is used in a remote-controlled transmitter and has two basic functions. These are:

(1) Decoding remote tuning instructions

(2) Readback to remote operator.

(a) Decoding Remote Instructions - The RTTD-5A receives a series of 5-bit tuning instruction codes in parallel-pulse form and translates them into positioning signals for stepping switches located on the transmitter controls. This circuitry also includes two reciprocal signal interchange systems: one for drawing the input codes out of a memory in associated equipment, and another for synchronizing the code processing with an automatic tuning system in the transmitter.

(b) Readback to Remote Operator - The RTTD-5A includes a scanning and transmitting circuit for reading back transmitter control positions and transmitter tuning status to the remote operator. This information is sent to a shift register scanner and readback transmitter, issuing the readback in the form of serial teletype code keying.

b. Physical Description - The RTTD-5A (see figures 1-1 and 2-2) is constructed to serve as a 19-inch rack-mounted unit. All circuitry is solid state, employing negative binary logic components and mounted on plug-in printed circuit cards and assemblies. Standardized integrated circuits are used wherever applicable. The front panel is 19 inches wide x 5-1/4 inches high x 3/16 inches thick and is finished in light gray enamel. The chassis extends 14-3/4 inches behind the panel. The complete RTTD-5A unit weighs approximately 32.5 pounds.

1-2. DESCRIPTION OF PLUG-IN CARDS

Table 1-1 is a list of printed circuit plug-in cards used in the RTTD-5A. Cards having the same TMC part numbers may be interchanged. Power circuitry design includes a short-proofing feature to prevent damage.

TABLE 1-1. PLUG-IN CARD COMPLEMENT

Card Circuit Symbol	Function	TMC Part No.
A1	Output Keyer, Readback	A4516
A2	Code Shift-Register, Readback	A4785
A3	Bit Shift-Register Readback (45 Baud)	A4518
A4	Drive Input Gating Ckt.	A4737
A5	Stepping Switch Gating Ckt.	A4821
A6	H.V. Transmitter Logic	A4784
A7	Power Supply, -30V	A4602
A8	Power Supply, +12V & -12V	A4601
A9	Master Stepping Switch Gating Ckt.	AX5027
A10	Gating Ckt.	A4786

1-3. REFERENCE DATA

Table 1-2 lists quick-reference technical data on the RTTD-5 Transmitter Decoder. This table includes nominal specification figures defining the unit.

TABLE 1-2. TECHNICAL SPECIFICATIONS RTTD-5A

Instruction code input:	5-bit codes in parallel voltage pulse form, 0 to -10V (0V equals a logical 0, -10V equals a logical 1).
Control positioning signal output:	Sequential switching connections for -30V drive power.
Readback inputs:	Control positions: 4-bit and 2-bit codes in parallel switching form.
Transmitter status:	Switching signals and overload readback.
Readback outputs:	5-bit codes in serial teletype dry contact keying. Codes are 5-level with an 8-level* transmission pattern at 45 baud.
Power Supply requirements:	115/230 VAC, 50/60 cps, single phase. 65 watts average consumption during tuning cycle.
Overall dimensions:	5-1/4 inches high x 19 inches wide x 17 inches deep.
Weight:	32.5 lbs.

*In start-stop 8-level transmission, code is contained in first five bits.

SECTION II
INSTALLATION

2-1. UNPACKING AND HANDLING

Inspect the RTTD-5A packing case for possible damage when it arrives at the operating site. With respect to damage to the equipment for which the carrier is liable, the Technical Material Corporation will assist in describing methods of repair and the furnishing of replacement parts.

2-2. POWER REQUIREMENTS

The RTTD-5A leaves the factory wired to operate from a 115-VAC 50/60-cps, single-phase source. The unit can be rewired for a 230-VAC, 50/60-cps, single-phase source by jumping connections to place the two sections of the transformer primary coil (see figure 2-1) in series with one another across the 230 volts. When performing this change, maintain the 115-VAC connection across the blower as shown in figure 2-1, by using one half of the primary coil.

2-3. INSTALLATION REQUIREMENTS

a. General - When the RTTD-5A unit arrives as a part of a specific remote-controlled transmitter system, specific instructions for installing this module are included in Section 2 of the transmitter system manual. The following text, therefore, is to be used only if the unit has been obtained as a separate item for making up a transmitter system not contracted for.

Capabilities of the RTTD-5A depend on associated equipment (i.e., transmitter, code feeding equipment, etc.). The RTTD-5A is designed to function specifically in the GPTR series of transmitters, working from the RTMU-4( ) series Signal Data Converter-Storers for code input.

b. Mechanical Installation - The unit may be mounted by its front panel with or without accompanying drawer slides. The drawer slides for the RTTD-5A are tilt-lock type and are shipped with the unit when specified on order.

To install drawer proceed as follows, referring to figures 2-2 and 2-3:

(1) Pull center section of rack-mounted slide section out until it locks in an extended position.

(2) Position internal part (RTTD-5A mounted) of slide in tracks of the external section and ease RTTD-5A into rack until release buttons engage holes in track.

(3) Make cable connection as required at rear panel of RTTD-5A (see table 2-1). Include ground jumper connections to rack structure.

(4) Depress release buttons and slide component completely into rack.

c. Electrical Installation - Table 2-1 lists all of the electrical connectors on the RTTD-5A and their functions. Figure 2-4 shows connector locations. Included in table 2-1 are part numbers for the connectors and for their mating plugs (included in shipment when the RTTD-5A is ordered alone). Remove diodes from A2 per station requirements in accordance with the equipment selection chart on figure 7-3.

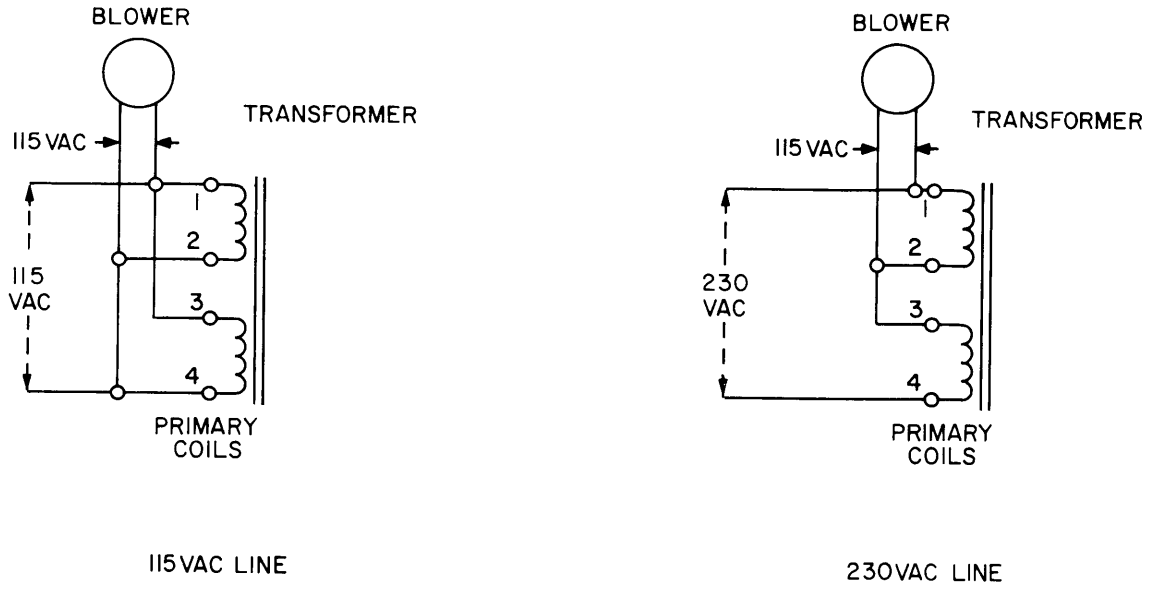

Figure 2-1. 230 VAC and 115 VAC Transformer Wiring

TABLE 2-1. ELECTRICAL CONNECTIONS TO RTTD-5A

Receptacle Ref Designation	Function	Receptacle Type and Part No.	Mating Plug Type and Part No.
J1	115/230 VAC line voltage input.	MS3102A16S5P	MS3106A16S5S
J2	Code input from associated memory feed. Signal exchange between RTTD-5A and memory.	18-pin, male fixed screwlock, receptacle shell and mtg. plate. #JJ333-18PFS34	18-pin, female, rotating screwlock, plug shell and hood. #JJ333-18SRS12
J3	Readback output	9-pin, male, fixed screwlock, receptacle shell and mtg. plate. #JJ333-9PFS34	9-pin, female, rotating screwlock, plug shell and hood. #JJ333-9SRS12
J4	Stepping switch selection output to transmitter controls.	50-pin, male, fixed screwlock, receptacle shell and mtg. plate. #JJ333-50PFS34	50-pin, female, rotating screwlock, plug shell and hood. #JJ333-50SRS12
J5	Output to transmitter amplifier controls and readback and auto tune signal exchange.	Same as J2	Same as J2
J6	Positioning output to transmitter exciter controls and readback signal exchange.	50-pin, female, fixed screwlock, receptacle and mtg. plate. #JJ333-50SFS34	50-pin, male, rotating screwlock, plug shell and hood. #JJ333-50PRS12

DIMENSIONS IN INCHES

WEIGHT = 32.5 LBS.

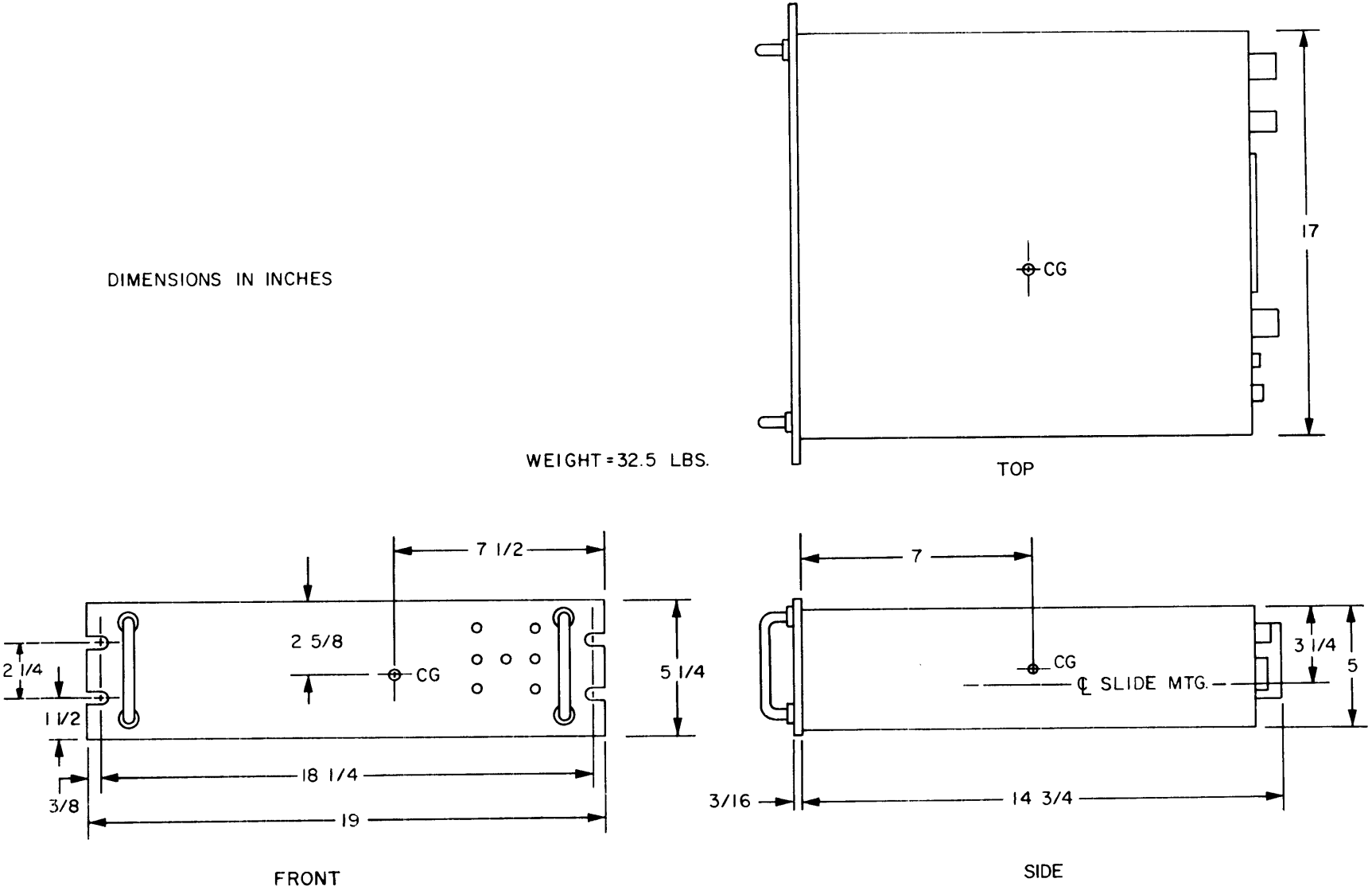

Figure 2-2. RTTD-5A Outline Dimensions

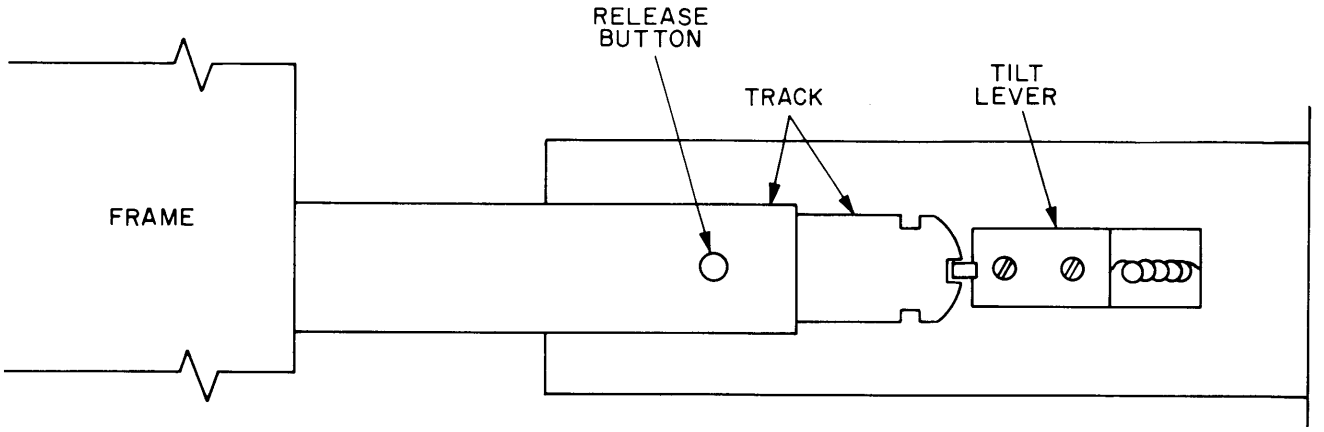

Figure 2-3. Slide Mount Details

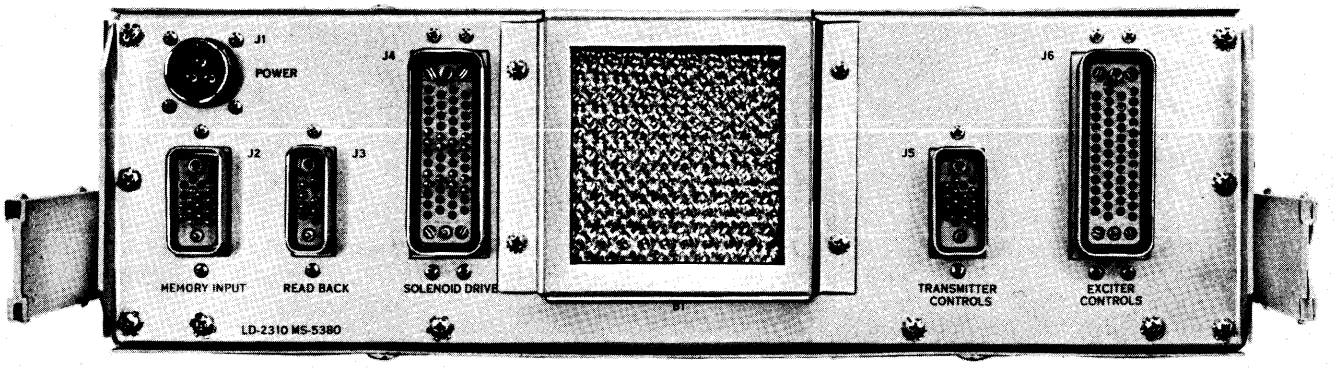

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Figure 2-4. RTTD-5A Rear Panel

2-4. INSPECTION AND ADJUSTMENT

a. Test Equipment - The test equipment required for inspection and adjustment of the RTTD-5A are listed in table 2-2.

b. Initial Checkout - To perform an initial checkout of the RTTD-5A proceed as follows:

(1) Preliminary Electrical Test

(a) Ensure that plug is removed from power connector J1.

CAUTION

Plug must be removed from power connector J1. Failure to do so will result in serious damage to VOM.

(b) Connect VOM across pins A and C of J1. Meter should indicate no continuity.

(c) Set primary power ON/OFF switch S2 to ON. Meter should indicate continuity (approximately 4 ohms).

(d) Set primary power ON/OFF switch S2 to OFF and remove VOM.

(e) Replace plug to J1.

TABLE 2-2. TEST EQUIPMENT REQUIRED

Equipment	Manufacturer and Part No.
VOM	Simpson Model 260, or equivalent
Frequency Counter	Hewlett-Packard 5244, or equivalent
Oscilloscope	Tektronix Model 541A
Teletypewriter	45.45 Baud, 7.42 unit code
D.C. Loop Supply	Station Battery

(2) Power Supply Voltage Checks

(a) Remove cards A1, A2, A3, A4, A5, A6, A9 and A10.

(b) Set primary power ON/OFF switch S2 to ON. Power lamp DS1 lights.

(c) Monitor test points on cards A7 and A8 as indicated below with oscilloscope. The ripple present on any test point should not exceed 20 millivolts peak-to-peak.

A7, TP-30V	-30V ± 3V
A8, TP+12V	+12V ± 1V
A8, TP-12V	-12V ± 1V

(d) Check power distribution by measuring the following points for voltages and grounds.

Connector	PIN		
	+12 VDC	-12 VDC	Ground
XA1	-	4	A, 2, 1, 22
XA2	20	4	A, 2, 1, 22
XA3	20	4	A, 2, 1, 22
XA4	20	4	A, 2, 1, 22
XA5	20	4	A, 2, 1, 22
XA6	20	4	A, 2, 1, 22
XA9	-	4	L
XA10	-	B	2

(e) Set primary power ON/OFF switch S2 to OFF and remove oscilloscope.

(f) Replace cards A1, A2, A3, A4, A5, A6, A9 and A10.

(3) Timing Checks.

(a) Set primary power ON/OFF switch S2 to ON.

(b) Connect one end of a jumper wire to ground.

(c) Connect the other end of the jumper to TP13 of A5. Observe time elapsed from application of ground to TP13 and the lighting of FAULT lamp DS2. If time elapsed is not approximately 60 seconds, adjust R5 of A5 as described in paragraph 2-4c(2).

(d) Remove jumper.

(e) Connect frequency counter to TP3 of A3. Counter should indicate 44 ±0.5 milliseconds. If counter reading is incorrect adjust R1 of A3 as described in paragraph 2-4c(1).

(f) Remove counter and set primary power ON/OFF switch S2 to OFF.

(g) Connect teletypewriter and dc loop supply to RTMU-4( ).

(h) Initiate a program, using table 4-1, via teletypewriter and observe corresponding equipment response. Observe teletypewriter printer to ensure that readback data confirms program.

c. Adjustments - The following paragraphs provide procedures to set the output band rate and the time delay of the RTTD-5A fault circuit.

(1) A3 Time Generator (Clock) Adjustment - To adjust the baud rate of the RTTD-5A readback, adjust R1 of A3 as follows:

(a) Connect frequency counter to TP3 of A3.

(b) Set primary power ON/OFF switch S2 to ON.

(c) Adjust R1 until frequency counter reads 44 ±0.5 milliseconds.

(d) Disconnect and remove frequency counter.

(2) A5 Fault Time Delay Adjustment - To adjust the time delay of the RTTD-5A fault circuit, adjust R5 of A5 as follows:

(a) Ensure primary power ON/OFF switch S2 is set to OFF.

(b) Pull card A5 out of its socket. Place card on an extender card and replace in its socket.

(c) Connect one end of a jumper wire to ground.

(d) Set primary power ON/OFF switch S2 to ON.

(e) Connect the other end of a jumper to pin Y of A5 and observe the time elapsed between the application of ground and the lighting of FAULT lamp DS2. This time should be approximately 60 seconds. If time delay is incorrect, adjust R5 and push FAULT switch/lamp S2/DS2 to reset circuit and observe time elapsed between actuation of FAULT switch and lighting of FAULT lamp. Repeat as necessary until time delay is approximately 60 seconds.

(f) Set primary power ON/OFF switch S2 to OFF.

(g) Remove jumper and extender card.

SECTION III
OPERATOR'S SECTION

3-1. FUNCTIONAL OPERATION

The RTTD-5A Transmitter Decoder functions as an energizer for transmitting controls in a remote-controlled transmitter. The decoder also contains scanning and transmitting circuits for the readback of transmitter control positions and transmitter overload conditions to the remote operator.

In remote tuning, a series of 5-bit codes, containing tuning information, are sent to the RTMU-41A Signal Data Converter-Storer from a remote control site. These codes become stored in the RTMU-41A until the receipt of a "tune" code, contained at the end of the message. The RTMU-41A then sends a signal to the RTTD-5A and a reciprocating action is set up in which the codes are drawn out of the RTMU-41A memory one-by-one and into the transmitter decoder. Control positioning signals from the transmitter decoder then move transmitter exciter controls to their prescribed positions via stepping switch drives on the controls. Among the exciter controls are frequency determining controls for the entire transmitter; when these have been moved into position, an automatic tuning of the transmitter amplifier stages occurs from sensing circuits in the amplifier.

A control position readback scanner and transmitter is included in the RTTD-5A to serve as a check for the remote operator. This circuit receives control position information from the transmitter exciter and amplifier, and overload information, from the transmitter overload protection circuitry. This data, received in parallel coded form, is sent out to the RTMU-41A in a standard teletype serial pulse pattern. The output is in dry-contact keying form and requires a teletype loop current as linkage to the remote control station or to terminal equipment for rf transmission. A continuous cycling of codes is started by applying power to the RTTD-5A. In addition to control position information, the readback transmitter also issues transmitter tuning status information. Specific information output varies with specific input from the transmitter.

A tune lockup section includes a time delay circuit that de-energizes the transmitter automatic tuning in the event of a fault (a failure of the automatic tuning to synchronize with the exciter frequency determining controls). The remote operator is notified by a "fault" readback and he may recycle the automatic tuning by sending another message containing the equipment identification code followed by the "tune" code. Locally, a fault is indicated by the lighting of the FAULT switch/lamp on the RTTD-5A front panel. The operator of the RTTD-5A may also initiate recycling after a fault. This is accomplished by depressing the FAULT switch/lamp.

A REMOTE/LOCAL switch on the front panel enables a manual override of the remote control system, at the same time allowing the readback to the remote operator to continue. The LOCAL position disconnects power to the stepping switch drives and signal interchange between the RTTD-5A and automatic tuning circuitry, while maintaining the operational status of the decoder readback section.

3-2. OPERATING PROCEDURES

Since the RTTD-5A functions as an automatic tuning device, there are no operating procedures, as such, for the transmitter decoder other than setting the POWER switch to the ON position for readback and the REMOTE/LOCAL switch to REMOTE for remote control of the transmitter. The LOCAL position of the switch enables a manual override of the transmitter. Figure 3-1 and table 3-1 provide descriptions of the RTTD-5A controls and indicators.

3-3. OPERATOR'S MAINTENANCE

Local maintenance for the RTTD-5A consists of an occasional inspection of fuses and the weekly cleaning of the blower air filter. Front panel AC LINE fuses (see figure 3-1) provides notification of a short in the a-c power section. A light in the fuse holder cap indicates a blown fuse; a SPARE fuse holder with a spare fuse cartridge is located on the front panel. The power supply circuitry beyond the a-c input includes an a-c short-proof feature, that protects circuit components should a short occur across one of the power supply outputs. Before replacing the fuse cartridge, pull out the RTTD-5A on its drawer slides and inspect the POWER switch wiring and transformer for possible causes of a short. The blower air filter should be cleaned every week using a soap based solvent.

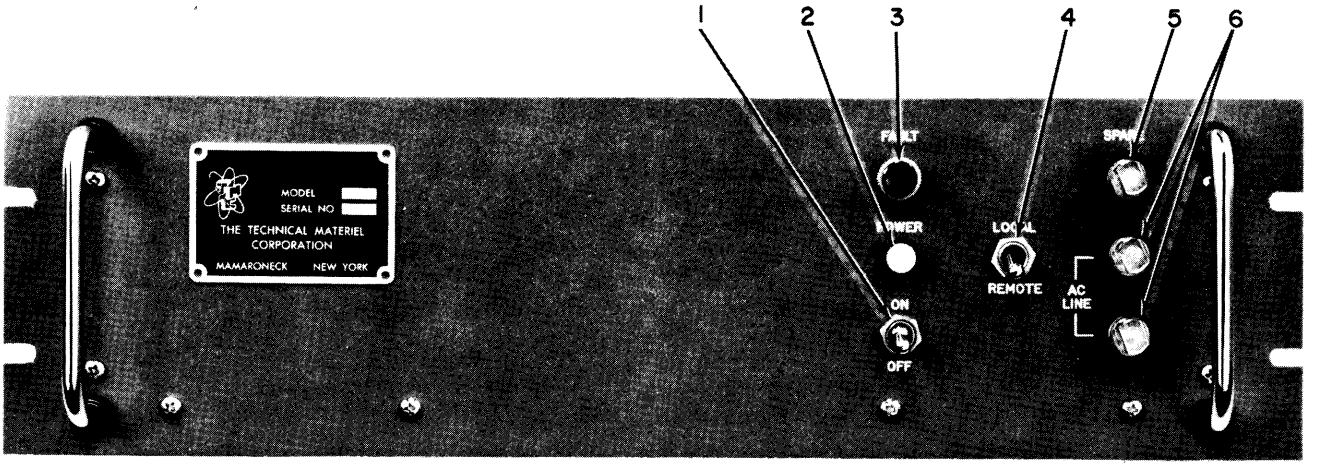

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Figure 3-1. RTTD-5A Controls and Indicators

TABLE 3-1. RTTD-5A CONTROLS AND INDICATORS

Figure 3-1	Control or Indicator	Function
1	ON/OFF Switch S2	Connects power to the decoder enabling the readback circuits when set to ON.
2	POWER Indicator Lamp DS1	Lights white when switch S1 is set to ON to indicate that primary power is being supplied to the decoder.
3	FAULT Switch/Lamp S3/DS2	Lights red to indicate improper tuning of transmitter. FAULT switch/lamp initiates recycling of tuning when depressed.
4	LOCAL/REMOTE Switch S4	Enables decoder circuits to tune transmitter when set to REMOTE. In LOCAL, only the readback circuits are energized.
5	SPARE Fuse	Used to replace a blown a-c line fuse.
6	AC LINE Fuses	Protect the power supply circuits from excessive current draw.

SECTION IV

TROUBLESHOOTING

4-1. LOGICAL TROUBLESHOOTING

a. Introduction - When adequate historical data on the type of trouble encountered by the operator is not available, there are four steps to be taken in logical troubleshooting procedures. These are: symptom recognition, symptom elaboration, listing probable faulty functional sections, localizing the trouble to the faulty printed circuit card and localizing the trouble to the faulty component.

b. Symptom Recognition - When it becomes noticeable that a function or a normal operation of the RTTD-5A is not operating properly, a functional analysis of the transmitter system, before any corrective steps are started, will help localize the problem, saving much time and effort. The technician should investigate the possibility that the difficulty could be from a source outside of the RTTD-5A.

c. Symptom Elaboration - After it has been determined that the RTTD-5A is at fault, the symptom should be examined more closely. In order to bring the malfunction to a point where the trouble can be more clearly understood, the remote control station or local teletypewriter keyboard should be employed to further create those operational conditions, which will emphasize or increase the malfunction symptoms, to such a degree that the faulty stage of operation can be identified.

d. Listing Probable Faulty Functional Section - The RTTD-5A divides into five functional sections (see paragraph 4-2). With the knowledge of the symptoms, reference to paragraph 4-2 should assist isolation to the faulty section or sections.

e. Localizing the Trouble to the Faulty Printed Circuit Card - Each functional section consists largely of plug-in printed circuit cards. Spare plug-in cards, when available, should be substituted for suspect cards to reduce troubleshooting time. Use of the troubleshooting chart, table 5-2, the overall function description and input-vs. -output test included in paragraphs 4-2 and 4-3 will isolate the trouble to the faulty card or assembly.

f. Localizing the Trouble to the Faulty Circuit - Once the trouble has been isolated to the faulty card or assembly, the final step is to identify and repair the faulty component, wire, printed conductor or connection. This is accomplished by utilizing the printed circuit card troubleshooting tables (tables 5-3 through 5-4), circuit card descriptions (paragraph 4-3) and timing charts (figures 5-1 through 5-5).

4-2. OVERALL FUNCTIONAL DESCRIPTION

a. Introduction - Figure 4-1, RTTD-5A Servicing Block Diagram, depicts the major functional sections in the Decoder. The RTTD-5A divides into five functional sections:

Decoder Section

Automatic Tuning Signal Exchange Section

Tune Lockup and Time Delay Section

Readback Section

Power Supply Section.

The following paragraphs described each section in terms of major assemblies and cards as shown in figure 4-1.

b. Decoder Section - The decoder section, comprised of a binary decoder in the drive input section of gating circuit card A4, master stepping switch S1 and gating circuit card A9, stepping switch gating circuits A5, and H.V. on-off section of H.V. on-off transmitter readback logic card A6, translates tuning codes into energizing signals for the transmitter controls. Codes, from the remote operator, are sent to the RTMU-41A Signal Data Converter-Storer where they are stored until the end of the tuning message. At the end, a "tune" code is sent and this causes the RTMU-41A memory to issue a "start tune" signal. This signal acts through the tune lockup and time delay circuit in A5 (see paragraph 4-2d) to ensure that time delay relay K1 is in its no fault condition (relay K1 de-energized). In this position, continuity is provided by a tune lockup circuit used in the ensuing code transfer. The "start tune" signal also causes the RTTD-5A to generate a "memory inhibit" signal which is sent to the RTMU-41A.

The RTMU-41A memory then sends the first code to the RTTD-5A. Bit 1 of the coded message is sent to card A5 and bits 2 through 5 to the BCD decoder in card A4. The coded messages consists of a 5 bit character representing the control to be tuned (control selector character) and a character representing the position to which the control is to be set (control positioner character). The level of bit 1 of each character determines whether a character is a control selector or control positioner. Bit 1 of a control selector is always a "1" while bit 1 of a control positioner is always a "0". Tuning of any of the transmitter controls is accomplished as follows. First the RTMU-41A memory unit sends a

control selector to the RTTD-5A. Bit 1 of the control selector causes the master stepping switch to go to a position by providing ground to one end of the stepping switch solenoid via the stepping switch gating circuits A5 and A9 SCR gate #1. Bits 2 through 5 of the control selector character are sent to the A4 binary decoder to furnish positioning information for A9-S1. The decoder is now set up to send tuning data, in the form of a control positioner character to the transmitter. The master stepping switch, when it has stopped, sends a signal (master NH) to card A5 causing it to generate a "memory advance" signal which is sent to the RTMU-41A. The RTMU-41A then sends a control positioner character. Bit 1 of the control positioner word is a "0". Bit 1 enables a gate in card A5 to switch on SCR gate #2 and switch off SCR gate #1. SCR gate #2 enables the selected transmitter stepping switch via the master stepping switch in the RTTD-5A. A 2 thru 5 Bit code moves the transmitter stepping switch to the programmed position. Another memory advance signal is then generated. This cycle is repeated for a maximum of 32 codes. After the last code pair has been transferred to the RTTD-5A, the RTMU-41A sends a "tune" signal to the decoder. The "tune" signal resets the master stepping switch to the home position (position 18), preparing the RTTD-5A for acceptance of a subsequent tuning cycle.

c. Automatic Tuning Signals - After the six frequency (MHz) codes have positioned the switches on the frequency control unit, an exchange of signals takes place between the transmitter automatic tuning section and the RTTD-5A. These signals ensure a proper sequencing of automatic tuning phases in a remote control operation. While master stepping switch A9 is moving through positions 1 to 6 (positioning frequency control switches) A9 extends a ground to tune relay K3, energizing it. The energized K3 extends a ground to latch several relays in the automatic tuning section, preventing an automatic tuning action at this time. When A9 proceeds past position 6, K3 de-energizes, sending a signal to these relays and allowing the automatic tuning to start. Automatic tuning action is again inhibited in position 11. As A9 moves through positions 10 and 11, a ground pulse is sent to the H.V. on-off section in H.V. on-off transmitter readback logic circuit A6. At positions 10 and 11 bits 1, 2 and 3 of the remote H.V. on/off code are also connected to this logic circuit. If bit 1 is a "0" (for a control positioner code) and bits 2 and 3 contain "H.V. on" information, and if a readback signal from the transmitter indicates that the main power is switched on, the logic output to H.V. on-off relay K2 is a ground, positioning this relay into its "on" condition. K2 then sends an "on" control signal to a transmitter H.V. on/off relay. The converse occurs if bits 2 and 3 contain "H.V. off" information. During the entire code transfer phase (positions 1-15 of A9) a "long ground" signal provides a continuity link of a tune lockup circuit (see paragraph 4-2d) and resets a transmitter H.V. reset relay in the event of a previous overload.

d. Tune Lockup and Time Delay - The tune lockup and time delay section in stepping switch gating circuit A5 provides continuity for the stepping switch movement in the code transfer phase, shut-down of transmitter tuning circuits in case of a "fault" and a means of remote resetting (or re-cycling) of automatic tuning after a "fault". The "start tune" signal (as previously described in paragraph 4-2b) works through the tune lockup circuit to ensure that the time delay relay is reset (or positioned in its normal "no fault" condition). In this position, K1 supplies a link in the tune lockup continuity. Simultaneously a time delay circuit is set for a duration of 60 seconds. In a normal tuning, frequency synchronization, tuning and loading adjustments are reached within 30 seconds (maximum). When tuning is completed the transmitter tune/operate relay is energized to tune, removing a ground input signal from the time delay circuit. The time delay circuit is then disabled, should a fault occur, however, synchronization is not reached and searching continues, with the tune/operate relay remaining in its "tune" position. After 60 seconds, the time delay circuit trips relay K1 into its "fault" position. Relay K1 then disables the tuning operation as follows: it shuts off the transmitter search servo, breaks the tune lockup circuit continuity in the RTTD-5A; shuts off the -30V power supply to master stepping switch S1 and all transmitter stepping switches; lights FAULT lamp DS2 on the RTTD-5A front panel, and 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 the equipment identification code and the "E" code. This causes the master stepping switch to make another complete revolution and another "start tune" signal is sent by the RTMU-41A to the time delay circuit, resetting time delay relay K1 to its normal position. The new revolution also causes another signal to the relays in the automatic tuning system and another tuning cycle starts. The tuning may also be recycled at the RTTD-5A, by depressing the FAULT switch/lamp. This 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.

e. Readback Section - The readback section consists of a scanning and transmitting circuit for reading back transmitter control positions, tuning status, overload status and high voltage status to the remote operator. This section consists of code shift register A2, bit shift register A3, output keyer A1, the transmitter tuning status logic section in gating circuit A4 and the H.V. status logic section in H.V. on-off transmitter readback logic circuit A6. Input to the readback section is in the form of 4-bit or 2-bit codes set up on positioned readback wafers and relays in the transmitter. These are scanned, one-by-one, by the readback section and transmitted out of the RTTD-5A as a series of teletype codes.

Each readout is triggered by a gating pulse developed by readback code shift register A2. The first gating pulse developed is the teletype "E"

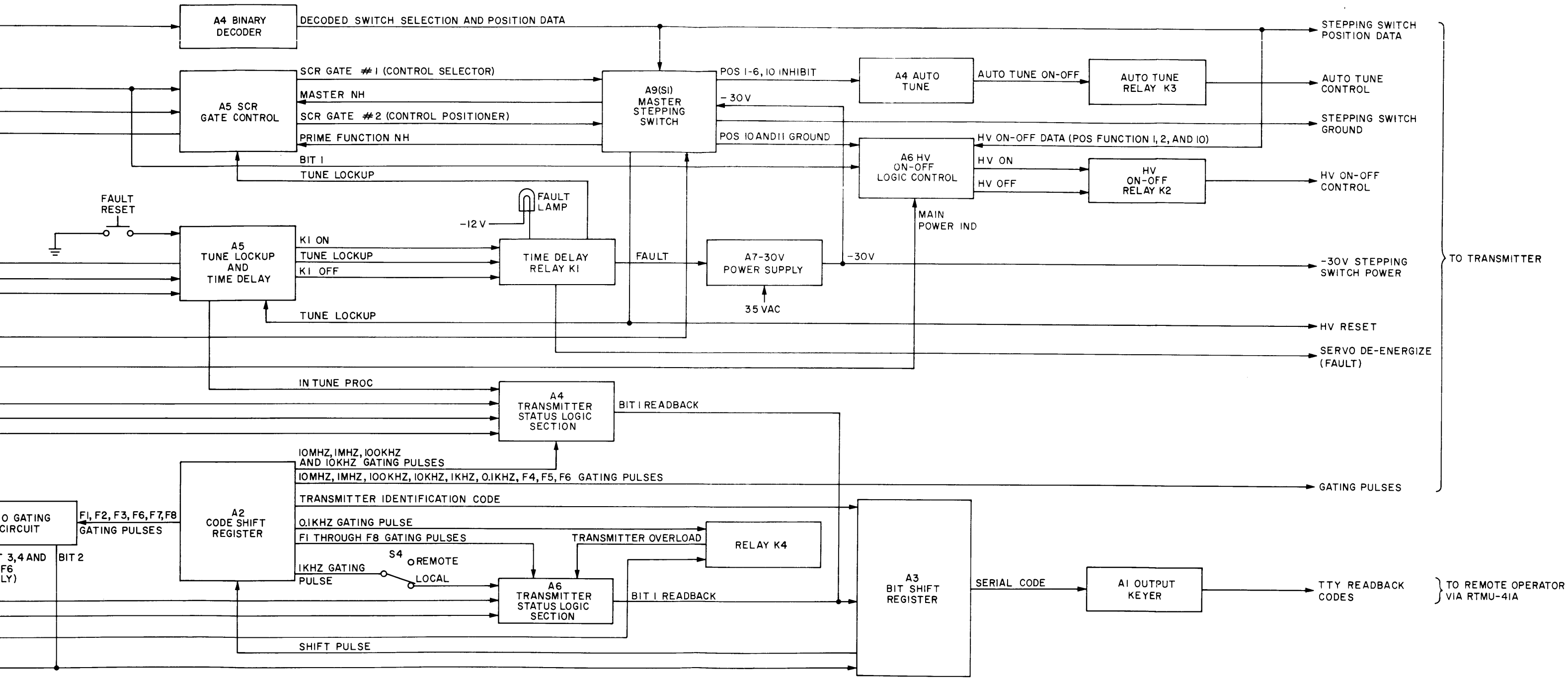
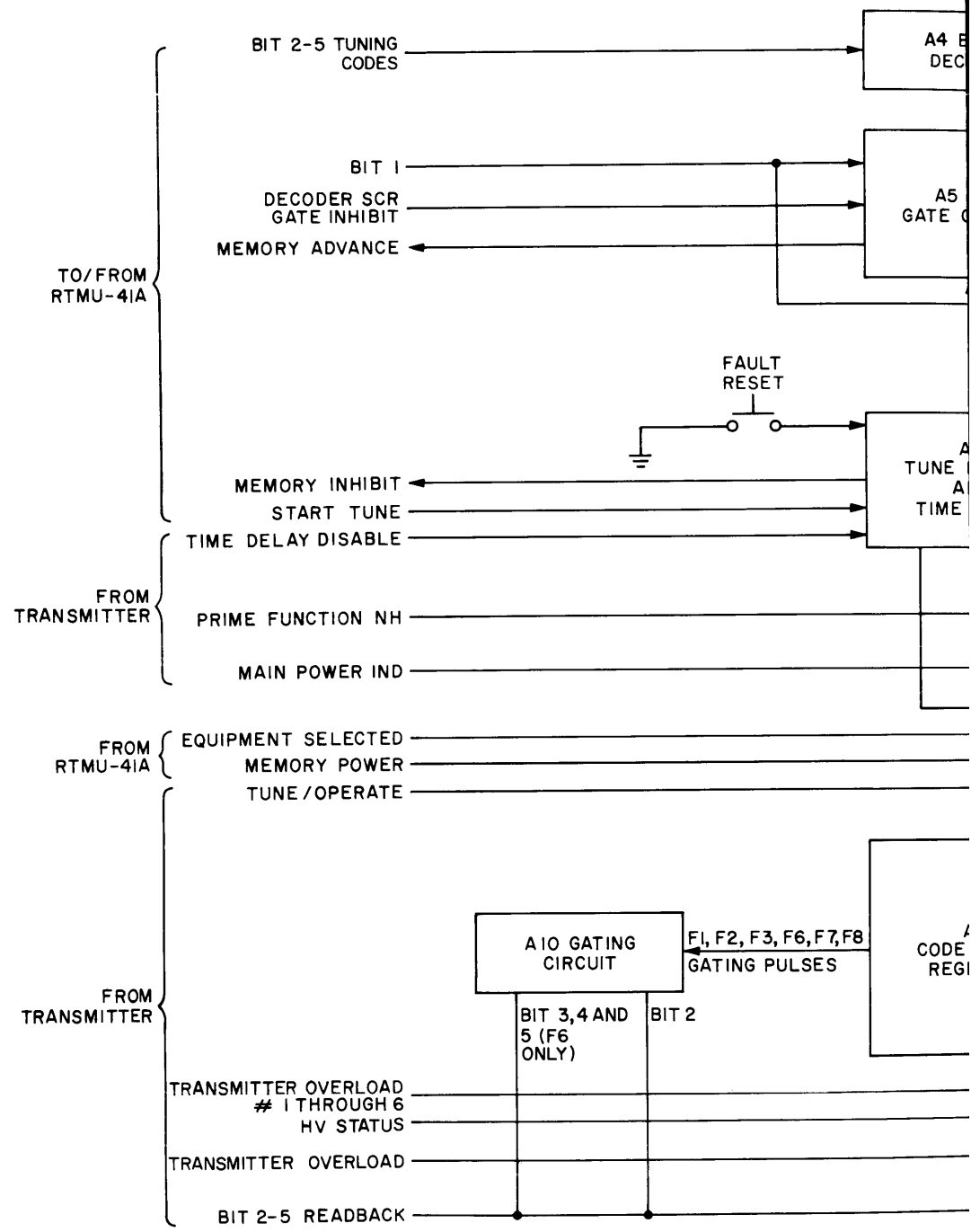


Figure 4-1. RTTD-5A Transmitter Decoder, Servicing Block Diagram


BIT 2-5 TUNING CODES
BIT 1
DECODER SCR GATE INHIBIT
MEMORY ADVANCE
TO/FROM RTMU-41A
FAULT RESET
MEMORY INHIBIT
START TUNE
TIME DELAY DISABLE
FROM TRANSMITTER
PRIME FUNCTION NH
MAIN POWER IND
FROM RTMU-41A
EQUIPMENT SELECTED
MEMORY POWER
TUNE / OPERATE
A10 GATING CIRCUIT
F1, F2, F3, F6, F7, F8 GATING PULSES
FROM TRANSMITTER
BIT 3,4 AND 5 (F6 ONLY)
BIT 2
TRANSMITTER OVERLOAD # 1 THROUGH 6
HV STATUS
TRANSMITTER OVERLOAD
BIT 2-5 READBACK

(1000), permanently set up in shift register A2. This signal is sent out via shift register A3 and readback isolation keyer A1 to the remote tuning station. At the remote station this signal resets the readback indicator for a new readback cycle. After A3 sends the "E" code to A1, it develops a "shift" pulse, which is sent to shift register A2. This "shift" pulse causes A2 to remove the "E" output and shift to the first gating pulse. This action is repeated until all gating pulses have been generated.

The first six readouts triggered by their respective gating pulses are the six MHz frequency selector switches. These readbacks occur in the following order: 10 MHz, 1 MHz, 100 kHz, 10 kHz, 1 kHz and 0.1 kHz. A readback wafer on each switch sets up a four bit code, transmitted as bits 2 through 5 of the readback code, to represent the positioning of the switch. Shift register A3 receives the four bit code in parallel form and converts it to serial form. The serial data is then converted to start/stop eight level pattern teletype output, compatible with various types of teletype linkage equipment.

Each of the MHz readbacks also contain data in bit 1. The MHz gating pulses also enable gates in the transmitter status logic section in A4 and the readback logic section in A6 to provide readouts of other transmitter data. The 10 MHz and 1 MHz gating pulses read out transmitter "tuning/ready/fault" status from A4. Bit 1 level (1 or 0) of these successive codes indicates one of the following three conditions:

	Bit 1	
10 MHz Code	1 MHz Code	Tuning Status
1	0	tuning
0	1	ready
1	1	fault

These outputs are derived from the "in tune proc" signal from the RTTD-5A tune lockup circuit, the "fault/no fault" signal from time delay relay K1 and an input indicating the status of the transmitter tune/operate relay. The 100 kHz gating pulse reads out the "equipment selected" signal from the associated transmitter memory, indicating that the proper transmitter (in a series working from a common tuning message input) has responded and opened its memory from a selector code in the beginning of the message. The 10 kHz gating pulse reads out a "memory power on/off" signal from the memory and/or decoder. The 1 kHz gating pulse reads out the position of the RTTD-5A REMOTE/LOCAL switch. The 0.1 kHz gating pulse reads out part of the VSWR and XMTR overload readout described in the following paragraph. For the bit-1 readouts enabled by the 100 kHz, 10 kHz and 1 kHz gating pulses a "1" indicates an on status and a "0" an off status.

After the MHz codes, nine additional gating pulses are generated by shift register A2. These gating pulses, designated F1 through F9, are used to enable A6 to provide read-outs of transmitter high voltage and overload data. Gating pulse F1 reads out the high voltage on/off readback. Gating pulse F2 reads out VSWR and XMTR overload data as follows, in conjunction with the 0.1 kHz gating pulse:

	Bit 1	
0.1 kHz Code	F2 Code	Overload Status
1	1	VSWR
0	1	XMTR

Gating pulses F3 through F8 read out XMTR overload 1 through 6 data. A "1" for bit 1 of the F1 or any of the F3 through F8 generated readouts indicates an on status and a "0" an off status. Although the readbacks generated by gating pulses F1, F2, F3, F7 and F8 are contained in bit 1, these readbacks are sent out as part of a five bit code. Therefore gating circuit A10 provides a "1" for bit 2 of each of these readbacks to differentiate them from the "E" code.

Gating pulses F4, F5, and F6 also enable four bit readouts in bits 2 through 5. These gating pulses are sent to the the transmitter to set up outputs on the readback wafers of the Mode (F4), Carrier Suppression (F5) and Output Power Level (F6) switches. In addition, gating circuit A10 provides a continuous "1" for bit 5 whenever F6 is present and all ones for bits 2 through 5 of the F6 readback whenever main power in the transmitter is off as indicated by the "main power ind" signal. Since the F9 gating pulse is not used, an all zero readback will appear in its readback slot. Immediately following the F9 readback character the transmitter sends its respective five bit "XMTR selected" code, indicating which transmitter has been providing the readback and ending the 17 character readback cycle.

f. Power Supply Section - The power supply section furnishes reference voltages for the logic circuitry in the RTTD-5A and power voltages for driving master stepping switch S1 and stepping switches throughout the transmitter. The a-c input section consists of receptacle J1, line filters FL1 and FL2, fuses F1 and F2, transformer T1, and POWER lamp DS1. The -30V power supply A7, with associated chassis mounted capacitors C3 and C4, diode CR3 and transistor Q2, supplies -30V to the stepping switches. Should a fault occur -30V is ground controlled via relay K1 removing this voltage from master stepping switch S1 and the transmitter stepping switches. Power supply A8 supplies the +12V and -12V for the logic circuitry. Chassis mounted capacitor C1 and transistor Q1 function in conjunction with A8.

4-3. CIRCUIT CARD DESCRIPTIONS

The following paragraphs provide descriptions of the various circuits in the RTTD-5A. Because of

the complex interaction of the components in the logic circuitry, all descriptions, with the exception of those on the power supplier, have been written on a functional input/output basis. These descriptions, used in conjunction with the schematics contained in Section 7 and the timing charts in Section 5, provide a detailed understanding of all the functions of the cards in the RTTD-5A.

a. Readback Isolation Keyer A1 - (See figure 7-2.) Readback isolation keyer A1 provides a start stop 8-level teletype output at 45 baud. Data is carried in the first five levels only. The teletype output is generated from the "serial code" input from A3. The "serial code" signal is comprised of five bits arranged in serial form. These bits enter A1 through pin V and energize either the mark or space solenoid of the internal keyer relay. A mark output is developed across pins Y and 21 when pin V is at a "1" level with pin V at "0" level, a space output is developed at pins R and U.

b. Readback Code Shift Register A2 - (See figure 7-3.) Readback code shift register A2 develops gating pulses that enable the transmitter readouts and the equipment selected character. These outputs are triggered by the "shift" pulse supplied by A3. Upon the receipt of the first shift pulse (after an "E") the 10 MHz gating pulse is developed at pin R. Each subsequent shift pulse switches the output to the next gating pulse. At the end of each readback cycle the equipment selected code is sent out pins B, C, D and 3. At the initial installation the code for each RTTD-5A is set by removing diodes CR1, CR2, CR3 and/or CR4 as shown on figure 7-3.

c. Readback Bit Shift Register A3 - (See figure 7-4.) Readback bit shift register A3 provides a serial output from parallel input and develops the "shift" at the end of each cycle. The parallel input of five bits of readback data enters the card at pins B, H, 8, 12 and 13. These bits of data are strobed out of the register by a timing circuit. This timing circuit is adjusted during installation to provide the serial output at 45 baud. The bits of data are sent out of the register in serial form through a NOR gate. At the conclusion of each five bit readout character, the "shift" pulse is developed at pin W and sent to card A2 to enable A2 to provide the next gating pulse.

d. Gating Circuit A4 - (See figure 7-5.) Gating circuit A4 is comprised of two sections, a drive input gating section and a transmitter status logic section. The drive input gating section is a binary decoder that decodes information contained in bits 2 through 5 of the tuning message. The decoded "pos func" outputs are sent to master stepping switch A9S1 and to the transmitter tuning controls. The "pos func" output puts A9S1 in the proper position to provide a ground to the transmitter stepping switch, enabling the "pos func" output to also tune the control to the desired position via the transmitter stepping switch. The transmitter status logic section provides the bit 1 readback data carried in the 10 MHz, 1 MHz, 100 kHz, and 10 kHz switch readbacks. The 10 MHz and 1 MHz gating pulses read out the "tuning/ready/fault" readback; the 100 kHz gating pulse reads out the "equipment selected" readback; and the 10 kHz gating pulse reads out the "memory power" readback. Additionally the card provides inversion for the "tune lockup", "decoder SCR inhibit" and "auto tune" signals. A NOR gate is provided at the output to invert the signals.

e. Stepping Switch Gating Circuit A5 - (See figures 7-1 and 7-6.) Stepping switch gating circuit A5 provides time delay, tune lockup and SCR gate control circuits. The time delay circuit provides a 60 second delay before energizing time delay relay K1. This delay is provided to allow sufficient time for the tuning cycle to be completed. Upon receipt of the "start tune" signal at pin T, the time delay circuit is energized. Should tuning be completed in less than 60 seconds the transmitter sends the "time delay disable signal". This signal enters A5 at pin Y, disabling the time delay circuit. Should the tuning cycle exceed 60 seconds (a fault condition), an output is developed across pins V and X that energizes the fault solenoid of relay K1, causing the following to occur: tune lockup circuit continuity is broken, ground is removed from the transmitter servos and ground is applied to A7, removing the -30V output.

The tune lockup circuit provides continuity to enable the unit to operate. A gate in A5 disables the tune lockup circuit should a control positioner tuning phase be initiated with the transmitter in a "ready" condition (indicated by the transmitter status logic section of A4).

The SCR gate control circuit provides signals to switch SCR gates CR1 and CR2 on and off, and provides the memory advance signal. The circuit is enabled by the first tuning character with bit 1 at a "1" level after receipt of the "start tune" signal. When the bit 1 at a "1" level is received a "0" level output is developed at pin B and is applied to SCR CR1. SCR CR1 is then switched on to let A9S1 step to a position determined by A4 "pos func". A9S1 then sends the master not-homed (NH) signal to A5 at pin D. The "master NH" signal removes the output at pin B (switching off CR1) and provides the "memory advance" signal at pin H. Upon receipt of the "memory advance" signal, the RTMU-41A sends the tuning character in which bit 1 is at a "0" level. An output at "0" level is then provided at pin E, switching on SCR CR2 which provides a ground to the transmitter via A9S1. The transmitter then generates the "prime function NH" signal, which is applied to A5 at pin C. This signal removes the output at pin E (switching off CR2) and provides the "memory advance" signal at pin H. The RTMU-41A then sends the next control selector tuning character. This cycle is repeated, as desired, for a maximum of 32 codes.

In addition card A5 generates the "memory inhibit" signal at pin 11 whenever a "start tune" signal is received and maintains the signal until the memory is empty.

f. H.V. On-Off Transmitter Readback Logic Circuit A6 - (See figures 7-1 and 7-7.) H.V. on-off transmitter readback logic circuit A6 is comprised of two sections, a H.V. on-off section and a transmitter status logic section. The H.V. on-off section develops a signal at either pin 8 or pin R that energizes either the H.V. on-off relay K2 on or off solenoid. This section is activated only during the H.V. phase of the tuning cycle (position 10 of A9S1). During the control positioner phase of H.V. control tuning an input appears at pin 15 or pin K of A6, pin 15 being the H.V. on input and pin K being the H.V. off input of the card. The output is then generated at pin 8 or R if the pos 10 and 11 ground signal is present at pin T and switch S4 is set to REMOTE. Should a fault reset be initiated the H.V. on signal would appear at pin 8 during the control selector phase of the cycle. If main power in the transmitter fails or is shut down the input at pin H goes to "0" and, the H.V. on is removed and the H.V. off signal is produced at pin R.

The transmitter status logic section provides bit 1 readbacks for readouts triggered by the 1 kHz, 0.1 kHz and F1 through F8 gating pulses. These gating pulses read out readbacks as follows: the 1 kHz and F2 gating pulses read out VSWR/XMTR overload status; the 0.1 kHz gating pulse is applied through REMOTE/LOCAL switch S4 to read out the local readback, the F1 gating pulse reads out the H.V. on-off readback; and gating pulses F3 through F8 read out the XMTR No. 1 through No. 6 overload readback respectively. A NOR gate is provided at the output.

g. -30V Power Supply A7 - (See figure 7-8.) The -30V power supply A7 develops -30V AC power to drive the decoder and transmitter stepping switches from a 35V AC 60 Hz input. The 35V 60 Hz power enters the card at pins 7, 8, 11 and 12 and is applied to rectifier network CR4. CR4 produces a pulsating dc output which is sent out of the card via pin 21 through a surge limiting network comprised of resistors R7 and R8. The output at pin 21 is fed to a filter/regulator network comprised of externally mounted series/pass transistor Q2 and zener diode regulator CR3 and card-mounted capacitors C1 and C3. These components function to provide the regulated -30V output as follows: Transistor Q2 acts as a series voltage regulator to essentially provide a variable series resistance across the output. Chassis mounted zener diode CR3 maintains a constant voltage on the base of Q2, resulting in a constant voltage output at pins 2 and 3 of the card. Card mounted capacitors C1 and C3 provide a shunt capacitance which filters the output. Additional filtering is provided by chassis mounted C3 and C4. These capacitors provide a high degree of passive filtering.

Resistors R5 and R6 form part of the bias circuit of Q2; resistor R1 is a bleeder resistor, and capacitor C2 is a bypass for RF and switching transients. Board output appears between pins 5, 6, H, and J (hot), and pins 1, 22, A, and Z (ground). Diode CR5 isolates the -30V output at pins H and J from that at pins 5 and 6.

Short proof current limiting is provided by diodes CR2 and CR3 and resistors R2, R3, and R4. Should a short occur across the -30V output, the voltage drop across R2, R3 and R4 would exceed the drop across CR2 and CR3. This would result in a reduction of the forward bias of Q2 which results in a reduction in the output current of Q2. Circuit values are such that the short-circuit equilibrium point falls well within the safe dissipation range of Q2 and all affected circuit components.

The card also functions in the fault mode circuitry. During a fault condition, relay K4 extends a ground to pin B of the card. Diode CR6 then provides this ground to FAULT lamp DS1, causing it to light. The ground from pin B is also extended to one side of R9 via CR1. Since the other side of R9 is connected to the -30V output, a heavy current is drawn through R9, driving Q2 to cut off. With Q2 at cut off output voltage and current drop to values insufficient to actuate master stepping switch S1 and the transmitter stepping switches.

h. +12V, -12V Power Supply A8 - (See figure 7-9.) +12V, -12V power supply A8 develops regulated +12V and -12V power for the various networks and components in the RTTD-5A. The +12V and -12V supplies are provided by separate circuits contained on A8. Each supply is comprised of a rectifier network and a voltage regulator. The +12V section receives an 18VAC input at pins B and 2 of the card. The a-c input is rectified by full-wave bridge rectifier CR1 and applied to pin 3 of voltage regulator Z1 via a surge limiter comprised of resistors R7 and R8. Circuit Z1 is an integral voltage regulator with current limiting and short circuit protection, that functions as an operational amplifier with heavy feedback.

The output of Z1 is applied to the base of driver Q2. Q2, in conjunction with resistor R1, forms a divider-bias network for series-pass transistor Q1, which provides the actual regulation. The collector-emitter path of Q1 falls in series with the filtered output of CR1 (filtering is accomplished external to the card by capacitor C1, connected between board pin D and ground). Therefore Q1 acts as a series resistance, varied by Z1, via Q2 with the voltage output ultimately regulated by Z1.

Resistors R4 and R5 form a voltage divider network that provides an error input to Z1. This error input is applied as a feedback input to pin 6 of Z1. Within Z1 the error input is compared, in a differential amplifier, with a reference voltage. The output of this amplifier is the output of Z1 that is applied to the base of Q2. Capacitor C4, connected between terminals 6 and 7 of Z1 is part of an internal frequency compensation network, to prevent oscillation at high frequencies and/or transient "ringing". Capacitor C1 bypasses stray pickup, and resistor R9 is an output bleeder. Resistor R10 and capacitor C3 are part of a DC reset circuit, that is not used. Capacitor C7, connected between pin 5 of Z1 and ground is a bypass capacitor that reduces the noise level in the internal voltage reference of Z1.

Current limiting is accomplished by a switchback limiter comprised of a section within Z1 and resistors R6, R2 and R3. A switchback limiter differs from a normal limiter in that it reduces current flow to a small fraction of the maximum output, while a normal limiter reduces current only to the maximum design value. Output current creates a voltage drop across R6. This drop would appear between pins 1 and 8 of Z1 except that during normal operation another voltage drop appears across the voltage divider comprised of R2 and R3. These voltage drops cancel each other out and enable the power supply to function normally. Should a short circuit occur, however, R2 and R3 would effectively be in parallel across the output, reducing the drop across them to near zero. The heavy current through R6 then causes a relatively large drop across R6 which would appear between pins 1 and 8 of Z1. This current limiting input causes Z1 to reduce the forward bias on Q1 until the output current is reduced to approximately 0.5 a. In addition resistors R2 and R3 provide a preload output of approximately 20 ma to ensure that a load will always be present on the output of the regulator.

The -12V section functions in the same manner as the +12V section with the following exceptions: the -12VDC series-pass is mounted on a heat sink on the rear of the chassis and is connected to the card via pins 12 (emitter), 14 (collector) and 20 (base); the surge limiter is comprised of resistors R19 through R22; due to polarity inversion the current limiting voltage divider (corresponding to R2 and R3 in the +12V section), comprised of resistors R16 and R17 is connected between the junction of R14 and R15 and the surge limiter.

i. Master Stepping Switch A9S1 and Gating Circuit A9 - (See figures 7-1 and 7-10.) Master stepping switch A9S1 and gating circuit A9 supply ground to the transmitter stepping switches during the tuning cycle. At the initiation of a tuning cycle SCR gate CR1 is switched on providing a ground at pin W and a "pos func" signal is applied to one of the following pins: 3, B, C, D, E, F, H, J, M, N, P, S, T, V, X or 20. The ground at pin W enables the stepping switch solenoid to move the switch through its positions until the position that the "pos func" signal corresponds to is reached. SCR CR1 is then switched off by the "master NH" signal (generated from "pos func" input) and SCR CR2 is switched on providing a ground at pin U. Ground is then supplied to the transmitter stepping switch via A9S1 (rear). The transmitter stepping switch next sends the "prime function NH" signal. This signal switches off CR2 and the master stepping switch is ready for the next tuning command. Their cycle can be repeated for a maximum of 32 codes.

In positions 1 through 6 and 11, a "1" level signal is provided at pin 5 of A9 to energize K3, inhibiting automatic tuning within the transmitter. In positions 10 and 11 a "0" level signal is provided at pin 6 of A9 to enable the H.V. on-off section of A6. A9S1 also provides a link in the tune lockup and time delay circuit at pin 1 in all its positions except home position (16 pins on sw).

j. Gating Circuit A10 - (See figures 7-1 and 7-11.) Gating circuit A10 provides various bits of data in the F1, F2, F3, F6, F7 and F8 generated readbacks. A "0" for bit 2 of any of these readbacks is provided at pin L whenever any of the above gating pulses are present. During the F6 generated readback (output power level) a "0" is also provided for bits 3, 4 and 5 when main power is off. Additionally, the card holds the solenoids of relays K2, K3 and K4 in the unenergized state with "1" level outputs at pins C, D and A and a "0" at pin 14.

TABLE 4-1. REMOTE TUNING INPUT CODES

Character Reception Order	Addressal Function	Action Function	5-BIT Code	CCIT Character
1	RTMU-41A Selector	A	10101	Y
		B	10110	F
		C	11010	J
		D	11001	W
		E	10011	B
	RTTD-5A Selector	1	00010	Carriage Return
		2	01010	R
		3	01100	I
		4	01000	Line Feed
		5	00100	Space
2	CHGR 10 MHz switch		11000	A
3		0	01000	Line Feed
		1	00100	Space

Note

Except for the first and tune 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.

		2	01100	I
		3	00010	Carriage Return
4	CHGR 1 MHz switch		10100	S
		0	01000	Line Feed
5		1	00100	Space
		2	01100	I
		3	00010	Carriage Return
		4	01010	R
		5	00110	N

Table 4-1. Remote Tuning Input Codes (Continued)

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 MODE SELECTION switch	MODE	11110	K
15		CW	01000	LF
		PTT	00100	SP
		VOX	01100	I
		NORM	00010	CR
16	CMRA CARRIER SUPPRESSION switch		10001	Z
17		0 DB	01000	Line Feed
		3 DB	00100	Space
		6 DB	01100	I
		20 DB	00010	Carriage Return
		30 DB	01010	R
		FULL	00110	N

Table 4-1. Remote Tuning Input Codes (Continued)

Character Reception Order	Addressal Function	Action Function	5-BIT Code	CCIT Character
18	TRANSMITTER OUTPUT POWER switch	Output Power	11001	W
19		Power Level 1	01000	LF
		Power Level 2	00100	SP
		Power Level 3	01100	I
		Power Level 4	00010	CR
20	Transmitter H.V. on/off		10101	Y
21		on	01000	Line Feed
22	Fault reset		11101	Q
23		Fault reset	01000	Line Feed
24	Transmitter tune		10000	E
*	Clear			

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

TABLE 4-2. REMOTE TUNING READBACK OUTPUT CODES

Character Transmission Order	Control or Condition	Position Indicated	Code Bits 1	Code Bits 2345
1	To reset remote readback indicator panel for new cycle		1	0000
2	CHGR 10 MHz switch	0		1111
		1		0111
		2		1011
		3		0011
		4		1101
		5		0101
		6		1001
		7		0001
		8		1110
		9		0110
	Transmitter "tuning/ready/ fault" status	*	*	
3	CHGR 1 MHz switch	0-9, same as CHGR 10 MHz switch		
	Transmitter "tuning/ready/ fault" status	*	*	
4	CHGR 100 kHz switch Equipment selected	0-9, same as CHGR 10 MHz switch		
		selected	1	
		not selected	0	
5	CHGR 10 kHz switch Memory power	0-9, same as CHGR 10 MHz switch		
		on	1	
		off	0	
6	CHGR 1 kHz switch RTTD LOCAL/REMOTE switch	0-9, same as CHGR 10 MHz switch		
		LOCAL	1	
		REMOTE	0	
7	CHGR 0.1 kHz switch VSWR and XMTR overload	0-9, same as CHGR 10 MHz switch		
		**	**	
		**	**	
8	High Voltage	on	1	1000
		off	0	1000
9	VSWR and XMTR overload	**	**	1000
		**	**	1000

*Readback of transmitter tuning status is contained in bit #1 of codes #2 and #3 combined:-

Code #2 (Bit #1)	Code #3 (Bit #1)	Status
1	0	tuning
0	1	ready
1	1	fault

**Readback of XMTR and VSWR overload status is contained in bit #1 of Codes #7 and #9 combined:-

Code #7 (Bit #1)	Code #9 (Bit #1)	Status
1	1	VSWR
0	1	XMTR

Table 4-2. Remote Tuning Readback Output Codes (Continued)

Character Transmission Order	Control or Condition	Position Indicated	Code Bits 1	Code Bits 2345
10	XMTR overload #1	on	1	1000
		off	0	1000
11	CMRA MODE SELECTION switch	CW		1111
		PTT		0111
		VOX		1011
		NORM		0011
	XMTR overload #2	on	1	
		off	0	
12	CMRA CARRIER SUPPRESSION switch	0 DB		1111
		3 DB		0111
		6 DB		1011
		20 DB		0011
		30 DB		1101
		FULL		0101
	XMTR overload #3	on	1	
		off	0	
13	TRANSMITTER OUTPUT POWER switch	off		1111
		1		0111
		2		1011
		3		0011
		4		1101
	XMTR overload #4	on	1	
		off	0	
14	XMTR overload #5	on	1	1000
		off	0	1000
15	XMTR overload #6	on	1	1000
		off	0	1000
16	Not used	none	0	0000
17	XMTR Selected	1	0	1110
		2	0	0110
		3	0	1010
		4	0	0010
		5	0	1100
		6	0	0100

SECTION V
MAINTENANCE

5-1. PREVENTIVE MAINTENANCE

The following paragraphs describe procedures to inspect, check and clean the components of the RTTD-5A. In general, preventive maintenance provides a basis for recognizing future probable causes of equipment malfunction in the early stages of deterioration. Many such causes are apparent to the senses of sight, touch and smell. Therefore, by adhering to a stringent program of preventive maintenance, involving periodic inspection and checks, the most probable causes of equipment malfunction can be avoided, thereby minimizing equipment downtime and the possibility of compromising important schedules.

a. Inspection and Test - The following paragraphs describe equipment inspection and tests to be performed on a weekly basis.

(1) General Inspection - A thorough visual inspection of an assembly or component for signs of deterioration prior to failure can save test and troubleshooting time resulting from complete breakdown. Table 5-1 presents a weekly inspection checklist for the RTTD-5A.

TABLE 5-1. WEEKLY INSPECTION ROUTINE

Assembly or Subassembly	Check
Line Power Cord	Check three-wire line power cord for cracks, nicks or fraying.
Main Chassis Assemblies	1. Check underside of chassis for dirt and dust.
	2. Check all inter-connector wiring for nicks, cracks or fraying.
	3. Check all printed circuit boards for cracks; check components for looseness and evidence of deterioration from possible overheating.
	4. Check printed circuit board jacks for tightness against chassis.
	5. Check ground connections for security.
Front and Rear Panels	1. Check panel for general cleanliness.
	2. Check all toggle switches for smooth positive action.
	3. Check indicator faces for cracks.
	4. Check cleanliness of blower air filter.

(2) Functional Test - Perform the checkout procedure for the RTTD-5A outlined in Section 2, paragraph 2-4b, on a weekly basis.

b. Cleaning Instructions - In general, the RTTD-5A should be cleaned once a week, using a soft camel's hair brush, forced air pressure of not more than 20 psi and a suitable cleaning agent such as trichlorethylene or methychloroform.

WARNING

When using toxic solvents, make certain that adequate ventilation is provided; prolonged or repeated breathing of the vapor shall be avoided. Avoid prolonged or repeated contact with skin. Flammable solvents shall not be used on energized equipment or near other equipment from which a spark may be received.

CAUTION

Trichlorethylene contains a paint removing solvent; avoid contact with painted surfaces.

Remove dirt or grease from wiring and chassis surfaces using cleaning solvent; dry with compressed air. Remove dust from printed circuit boards using a soft camel's hair brush. Blow out accumulated dust from inaccessible areas of chassis using forced air.

5-2. TROUBLESHOOTING

Troubleshooting data for the RTTD-5A are contained in tables 5-2 through 5-4. Table 5-2 is an overall troubleshooting table used to localize the trouble to the faulty printed circuit card. Tables 5-3 and 5-4 and figures 5-1 through 5-6 provide detailed troubleshooting procedures to identify the faulty component.

When instructed to send a tuning message to the RTTD-5A, inputs are to be simulated by a teletypewriter (TTY keyboard). Each message must be preceded by the proper selection codes for the RTMU-41A and RTTD-5A being addressed. Individual pins of the card are to be checked with the suspect card on an extender card.

a. Usage of Timing Charts - Timing charts (figures 5-1 through 5-5) are categorized by sections involving binary logic. Each line represents a test point time variance between two voltage values and all lines are plotted against a common time base for comparison. Test points are arranged from top to bottom in normal order of checking (from input to output) of a section.

Using time bases A and B of the oscilloscope, check test points in pairs (the test point and the one directly below it on the chart) at coinciding pulse edges (voltage changes). This comparison check will reveal, by reference to the P/C board logic/schematic in section 7, the logic network/component to be replaced. To make a measurement, set the oscilloscope for an external triggering mode, with a negative triggering slope and level for a negative-going change and a positive triggering slope and level for a positive-going change. The exact shape of the pulse edge is not an important factor in troubleshooting the binary logic sections. Very often, different attenuator lines into the oscilloscope will produce pulse shape distortions that are not present in the equipment being tested. The critical fact is whether or not the expected voltage changes occur in the polarities and coincidences as indicated on a common time base.

TABLE 5-2. TROUBLESHOOTING

Step	Trouble	Probable Cause	Remedy
1	No output. ON/OFF indicator DS1 does not light, blower does not operate. Fuse indicator lit.	Blown fuse.	Replace fuse
2	No output. ON/OFF indicator DS1 does not light, blower does not operate.	Defective filter.	Check continuity through line filters FL1 and FL2. Replace either if continuity is broken.
		Defective switch S2.	Check continuity of switch S2. If continuity is broken with switch in ON position, replace switch S2.
		Defective transformer T1.	Check for 35 VAC between terminals 7 and 8 and check for 18 VAC between terminals 9 and 10 and 11 and 12. If either output is not present, replace transformer T1.
3	Blower does not operate	Defective blower B1.	Replace blower B1.
4	FAULT switch/lamp, S3/DS2 lights and cannot be reset	Defective FAULT switch/lamp S3/DS2.	Check for continuity through switch S3 contacts 3 and 6 with switch depressed. If continuity is broken replace FAULT switch/lamp S3/DS2.
		Defective time delay relay K1.	Check for voltage across pins 5 and 10 of K1. If voltage is present, replace relay K1.

Table 5-2. Troubleshooting (Continued)

Step	Trouble	Probable Cause	Remedy
4 (cont)		Defective time delay circuit in Stepping Switch Gating Circuit card A5.	Address decoder via teletypewriter. Check for voltage at pins V and X of card A5 after 60 seconds. If voltage is not present troubleshoot A5 in accordance with figure 5-4.
5	FAULT switch/lamp, S3/DS2 has to be continuously reset.	Defective time delay circuit in Index Gating Circuit card A5.	Troubleshoot A5 in accordance with figure 5-4.
6	No tuning data received by transmitter and no readback data received at remote tuning station.	Defective +12V, -12V Power Supply card A8.	Check for +12V output at pins F, H, J and K of A8. Check for -12V output at pins V, W, X and Y of A8. If either output is not present, troubleshoot A8 in accordance with table 5-4.
		Defective transformer T1.	Check for 18 VAC between pins 9 and 10 and 11 and 12. If either voltage is not present, replace T1.
7	No tuning data received by transmitter. Readback loop functioning normally.	Defective -30V Power Supply card A7.	Check for -30V output at pins 5 and 6 of A7. If -30V is not present, troubleshoot A7 in accordance with table 5-3.
		Defective Transformer T1.	Check for 35 VAC output between pins 7 and 8. If voltage is not present, replace T1.
		Defective Master Stepping Switch A9S1	Send a sample tuning message via the teletypewriter. Observe Master Stepping Switch A9S1 during decoding of message . Check that S1 steps through positions. Check continuity of wafer C of S1. Check for outputs alternating at pins 7 and 8 of card A9 as switch A9S1 steps through its positions. If A9S1 fails to step or continuity through wafer C is broken, or outputs at pins 7 and/or 8 are not present, troubleshoot A9S1 and A9 in accordance with timing charts.
		Defective SCR CR1 or CR2.	Send a sample tuning message via the teletypewriter. Check for alternating grounds at the cathodes of CR1 and CR2. If ground is not present at the cathode of CR1 or CR2, replace the defective SCR.
		Defective Master Stepping Switch Gating Circuit card A5.	Send a sample tuning message via the teletypewriter. Check outputs at pins B, E, H, J and 11 in accordance with figure 5-4. If any of the outputs are not present when all necessary inputs are present, troubleshoot A5 in accordance with figure 5-4.
		Defective Drive Input Gating section of card A4.	Send a sample tuning message via the teletypewriter. Check outputs at pins T, U and Y of A4. If outputs are not present, troubleshoot A4 in accordance with figure 5-5.

Table 5-2. Troubleshooting (Continued)

Step	Trouble	Probable Cause	Remedy
7 (cont)		Defective time delay relay K1.	Address decoder via the teletypewriter. Check for energizing voltage at contacts 1 and 9 of K1. Check continuity of contacts 4 and 7. If voltage is present across contacts 1 and 9, and continuity is broken between contacts 4 and 7, replace relay K1.
		Defective LOCAL/ REMOTE switch S4.	Check continuity of S4-B and S4-C in REMOTE position. If continuity of either set of contacts is broken, replace S4.
8	Transmitter cannot be tuned exactly as programmed by the remote operator.	Defective Drive Input Gating section of card A4.	Send a sample tuning message via the teletypewriter. Monitor bit 1 as received at pin 14 of card A5 while checking outputs at pins 5, 3, F, 8, 10, L, 11, 13, W, 12, 14, 18, 17, 15, 9 and 6 of A4. (These points must be tested in the exact sequence listed above.) A "1" should be observed at pin 5 of A4 concurrent with the receipt of the first bit 1 at a "1" level. Upon the receipt of the next bit 1 = "1" the "1" at pin 5 of A4 will disappear and a "1" level will be measured pin 3. The "1" will appear, in turn, at each pin of A4 listed above until it reaches pin 6. If all necessary inputs are present and any of the applicable pins of A4 do not go to a "1" level, troubleshoot A4 in accordance with figure 5-3.
9	Automatic tuning circuit of transmitter not inhibited during tuning of MHz switches.	Defective relay K3.	Apply a ground signal to pin 3 of K3. If relay K3 does not energize, replace relay K3.
		Defective master stepping switch S1.	Send a sample tuning message via the teletypewriter. Check for ground at pin 5 of A9 as S1 steps through positions 1-6 and in position 11. If ground is not present in these positions troubleshoot S1 and A9 in accordance with the timing charts.
10	No readback data received at remote station. Tuning circuit operating normally.	Defective Isolation Readback Keyer card A1.	Monitor A1 inputs and outputs. If outputs are not present or are incorrect, replace relay K1 of A1.
		Defective Readback Shift Register card A3.	Send a sample tuning message via the teletypewriter. Check for "shift" pulse at pin W and "serial code" data at pin V. If either data are not generated, troubleshoot A3 in accordance with figure 5-2.
		Defective Readback Code Shift Register card A2.	Send a sample tuning message via the teletypewriter. Check for "shift" input pulse at pin 2. If shift signal is present

Table 5-2. Troubleshooting (Continued)

Step	Trouble	Probable Cause	Remedy
10 (cont)			and no output gating pulses are produced, troubleshoot A2 in accordance with figure 5-1.
11	Readback data are missing for one of transmitter controls or conditions.	Defective Readback Code Shift Register card A2.	Send a sample tuning message via the teletypewriter. Observe test points as shown in figure 5-1. If any of the outputs are incorrect, troubleshoot A2 in accordance with figure 5-1.
12	A bit of data is incorrect.	Defective Readback Shift Register card A3.	Send a sample tuning message via the teletypewriter. Check that A3 output at pin V is in accordance with figure 5-2. If any of the outputs are incorrect, troubleshoot A3 in accordance with figure 5-2.
13	Bit 1 readback data incorrect.	Defective Gating Circuit card A4.	Send a sample tuning message via the teletypewriter. Check for data at output of A4 at pin 16 using figure 5-3. If pin 16 is incorrect, troubleshoot A4 in accordance with figure 5-3.
		Defective H.V. On-Off Transmitter Readback Logic card A6.	Send a sample tuning message via the teletypewriter. Check for data at output of A at pin 19 using figure 5-5. If pin 19 is incorrect, troubleshoot A4 in accordance with figure 5-5.
		Defective code shift register A2.	Send a sample tuning message via the teletypewriter. Check for constant "1" level signal at pin 11 of A2. If pin 11 is incorrect, troubleshoot A2 in accordance with figure 5-1.

TABLE 5-3. -30V POWER SUPPLY A7 TROUBLESHOOTING

Step	Trouble	Probable Cause	Remedy
1	No output at pins 5 and 6.	Defective rectifier network CR4.	Replace CR4.
2	Output does not hold relatively stable (at -30V).	Regulator network comprised of C1, C2, C3, CR1, CR2, CR3, CR5, CR6, R1 through R9 and externally mounted C3, C4, CR3 and Q2 defective.	Troubleshoot regulator network.

TABLE 5-4. +12V, -12V POWER SUPPLY A8 TROUBLESHOOTING

Step	Trouble	Probable Cause	Remedy
1	No +12V output.	Defective rectifier network CR1.	Replace CR2.
2	No -12V output.	Defective rectifier network CR2.	Replace CR1.
3	+12V output varies excessively.	Defective regulator network comprised of C1, C3, C4, C7, R1 through R10, Q1, Q2 and Z1.	Troubleshoot regulator network.
4	-12V output varies excessively.	Defective regulator network comprised of C2, C5, C6, R11 through R22, Q3, Z2 and externally mounted Q1.	Troubleshoot regulator network.

5-3. ADJUSTMENTS

Refer to paragraph 2-4c for all RTTD-5A adjustments.

5-4. REPAIR OF PRINTED CIRCUITRY

a. Introduction - Repair of the chassis-mounted circuitry follows standard laboratory procedures. Repair of printed circuit cards and card receptacle wiring, however, require the special tools and techniques as outlined here. Section 6, Parts List, lists all replaceable parts and their circuit symbol numbers. These symbol numbers are shown on the figures provided in Section 7.

Note

Replacement of parts on the printed circuit boards requires the special tools described in paragraph 5-4b through d.

b. Replacement of Parts - When replacing a part on a board, it is necessary to remove the old part from the board with a desoldering tool. The use of a desoldering tool allows removal of solder from pin connections without damaging the board (the Unger model 270 desoldering kit is recommended for use). Soldering the new part to the board is done pin-by-pin with conventional methods.

c. Checking Printed Circuit Conductors - Breaks in the conducting strip (foil) on a printed circuit board can cause permanent or intermittent trouble. In many instances, these breaks will be so small that they cannot be detected by the naked eye. These invisible cracks (breaks) can be located only with the aid of a powerful magnifying glass.

To check out and locate trouble in the conducting strips of a printed circuit board, set up a multimeter (one which does not use a current in excess of 1 ma) for making point-to-point resistance tests, using needle probes. Insert one point into the conducting strip, close to the end of terminal, and place the other probe on the terminal or opposite end of the conducting strip. The multimeter should indicate continuity. If the multimeter indicates an open circuit, drag the probe along the strip (of if the conducting strip is coated, puncture the coating at intervals) until the multimeter indicates continuity. Mark this area; then use a magnifying glass to locate the fault in the conductor.

CAUTION

Before using an ohmmeter for testing a circuit containing transistors or other voltage-sensitive semi-conductors, check the current it passes under test on all ranges. DO NOT use a range that passes more than 1 ma.

d. Repair of Printed Conductors - If the break in the conductor strip is small, lightly scrape away any coating covering the area of conducting strip to be repaired. Clean the area with a firm-bristly brush and approved solvent. Then repair the cracked or broken area of the conducting strip by flowing solder over the break. Considerable care must be exercised to keep the solder from flowing onto an adjacent strip.

If a strip is burned out, or fused, cut and remove the damaged strip. Connect a length of insulated wire across the breach or from solder-point to solder point.

After the repairs are completed, clean the repaired area with a stiff brush and solvent. Allow the board to dry thoroughly, and then coat the repaired area with an epoxy resin or similar compound. This coating not only will protect the repaired area, but will help to strengthen it.

CAUTION

After repairs, check the board for solder drippings; they may cause shorts.

Frequently, a low-resistance leakage path will be created by moisture and/or dirt that has carbonized onto the phenolic board. This leakage can be detected by measuring the suspected circuit with a multimeter. To overcome this condition, thoroughly clean the carbonized area with solvent and a stiff brush. If this does not remove it, use a scraping tool (spade end of a solder-aid tool or its equivalent) to remove the carbon, or drill a hole through the leakage path to break the continuity of the leakage. When the drilling method is used, be careful not to drill into a part mounted on the other side.

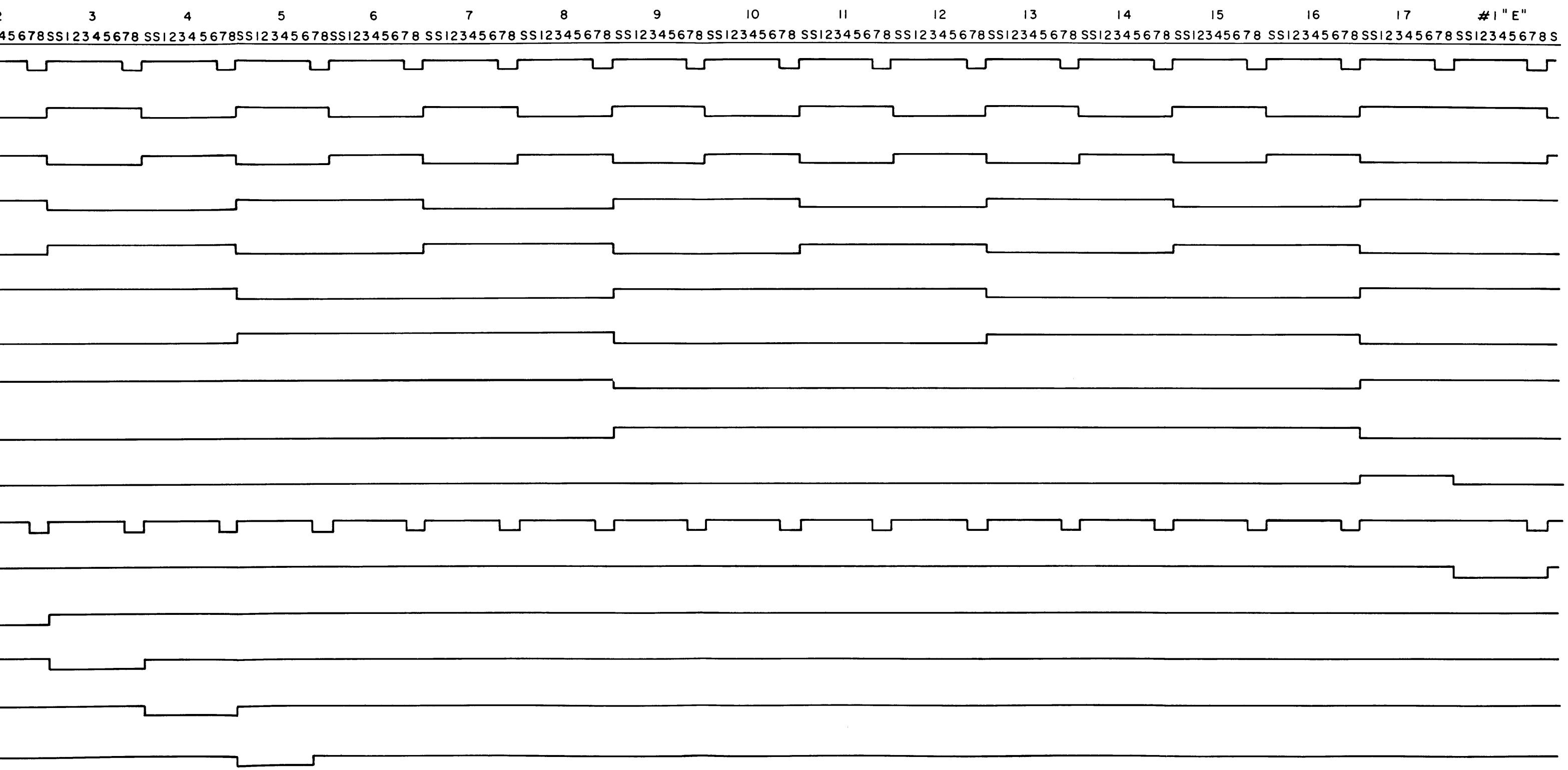
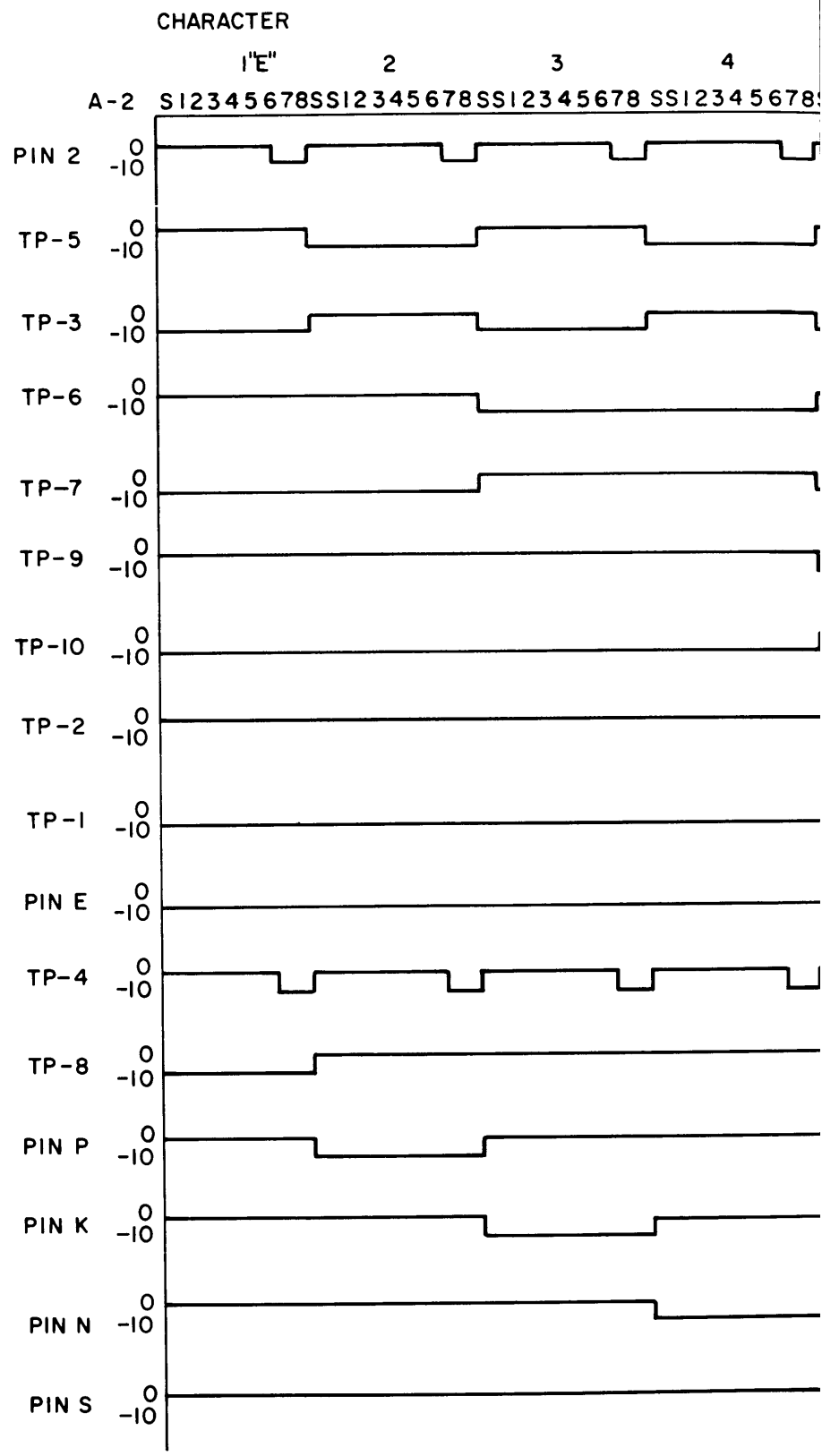


Figure 5-1. Code Shift Register A2, Timing Diagram


CHARACTER
1"E"
2
3
4
A-2 S12345678SS12345678SS12345678 SS12345678
PIN 2
TP-5
TP-3
TP-6
TP-7
TP-9
TP-10
TP-2
TP-1
PIN E
TP-4
TP-8
PIN P
PIN K
PIN N
PIN S
0
-10

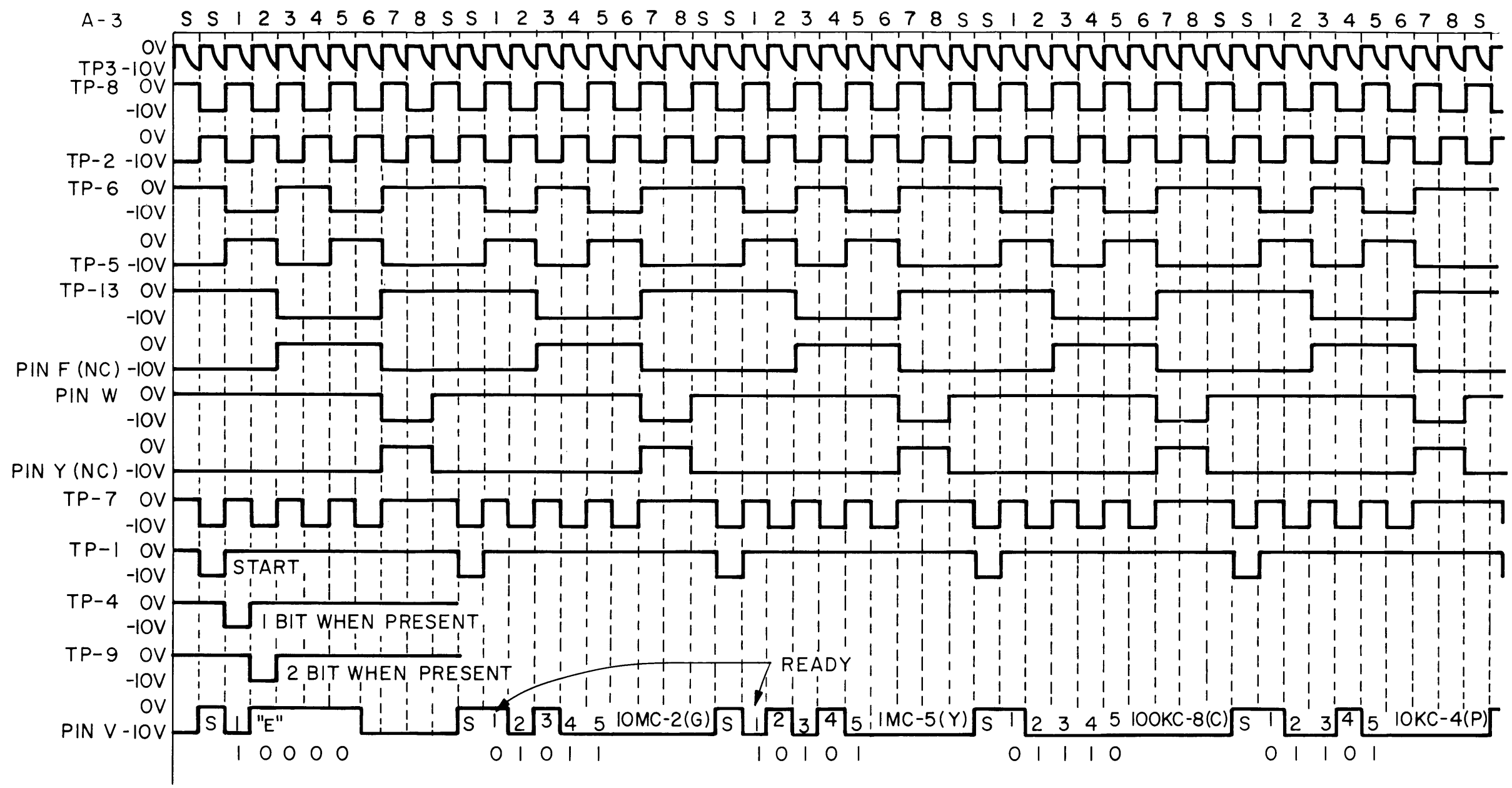
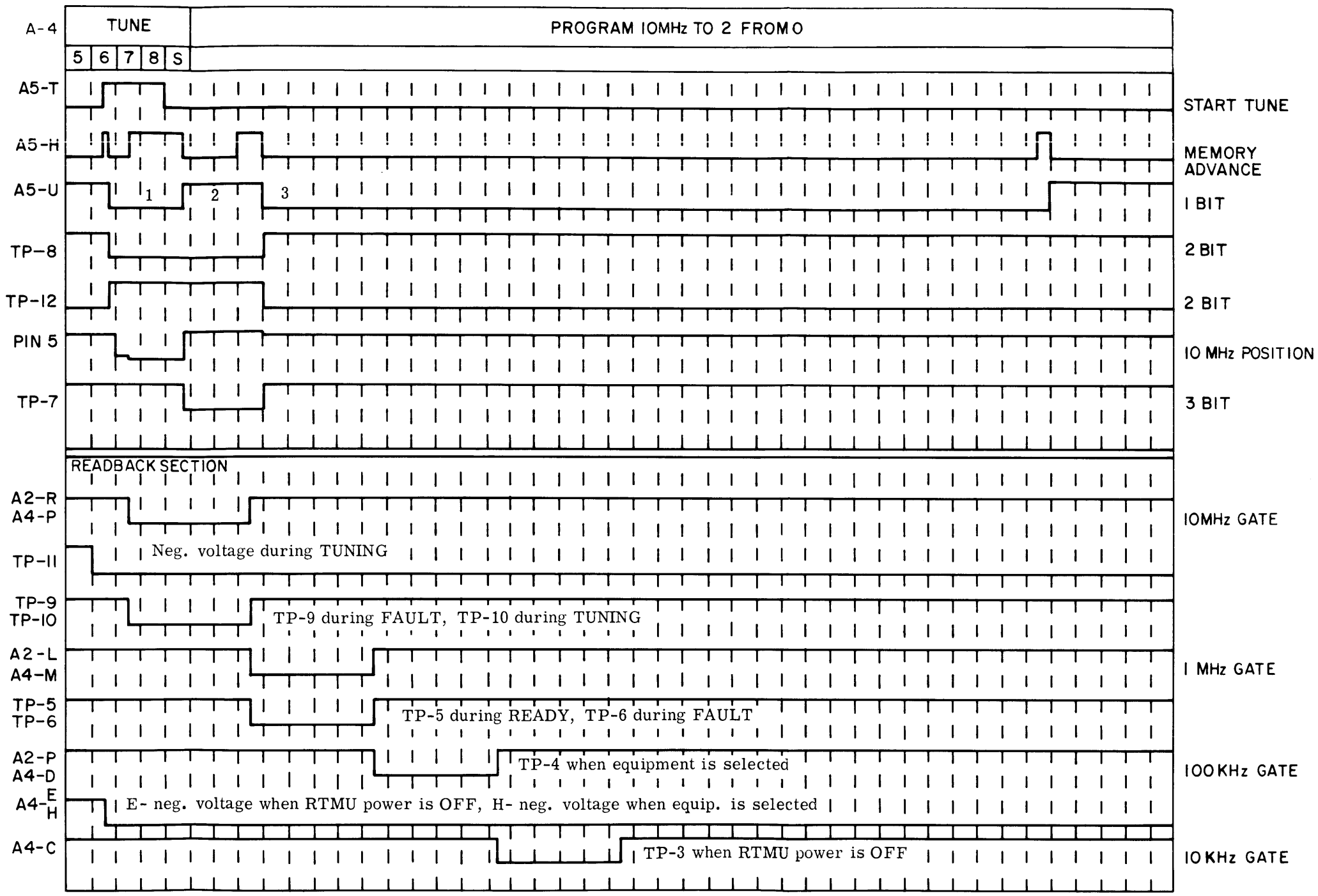


Figure 5-2. Bit Shift Register A3, Timing Diagram

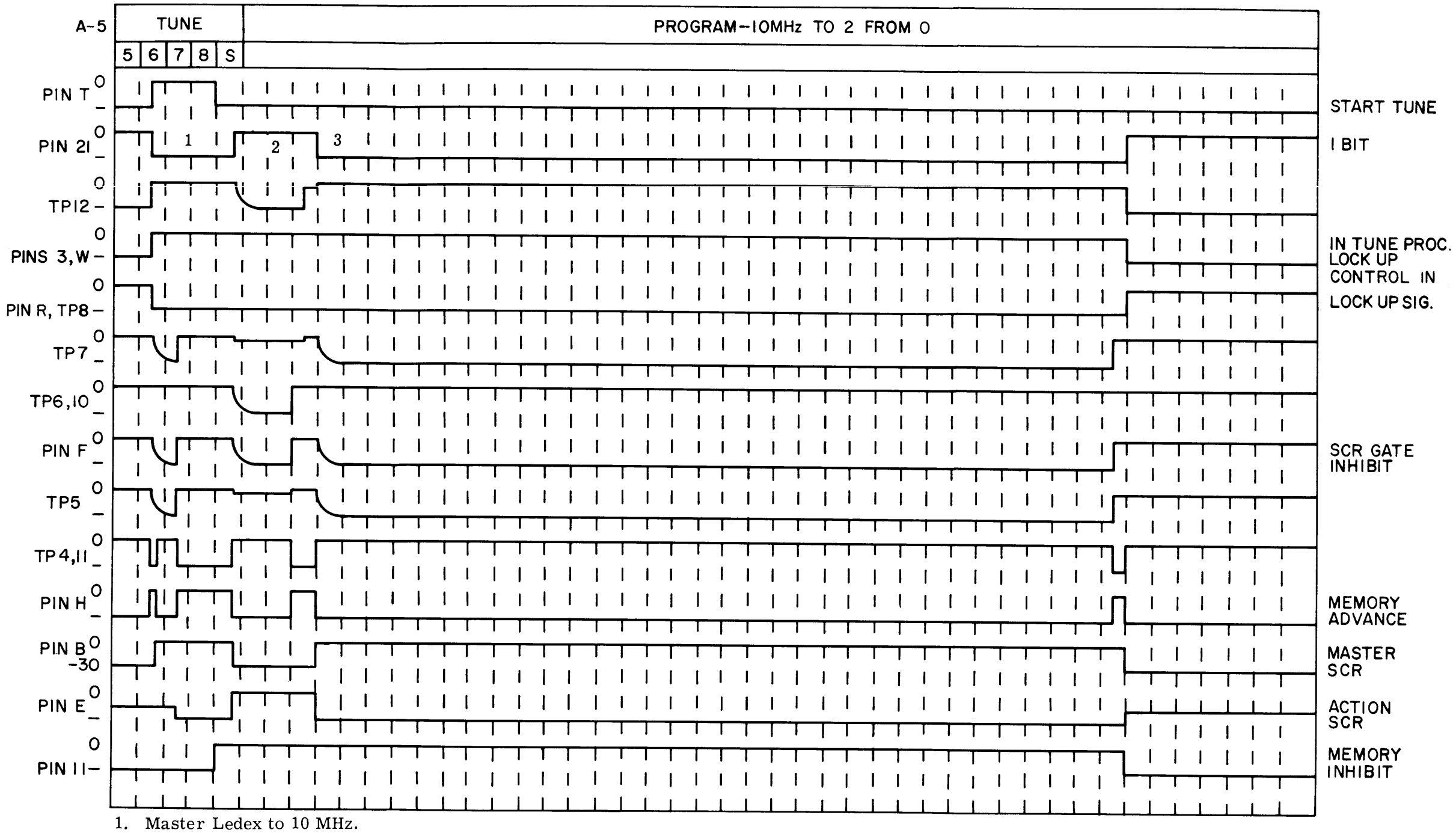
NOTE:
THE GRID LINES SUBSEQUENT TO THE TUNE CHARACTER, AND IN THE ENTIRE READBACK SECTION ARE PROVIDED FOR REFERENCE ONLY. THE WAVEFORMS IN THESE AREAS WILL VARY IN ACCORDANCE WITH THE PROGRAM.



1. Master Ledex to 10 MHz.
2. 10 MHz switch from 0 to 2.
3. Master Ledex to HOME.

Figure 5-3. Gating Circuit A4, Timing Diagram

TE:
THE GRID LINES SUBSEQUENT TO THE TUNE CHARACTER ARE PROVIDED FOR REFERENCE ONLY. THE WAVEFORMS IN THIS AREA WILL VARY IN ACCORDANCE WITH THE PROGAM

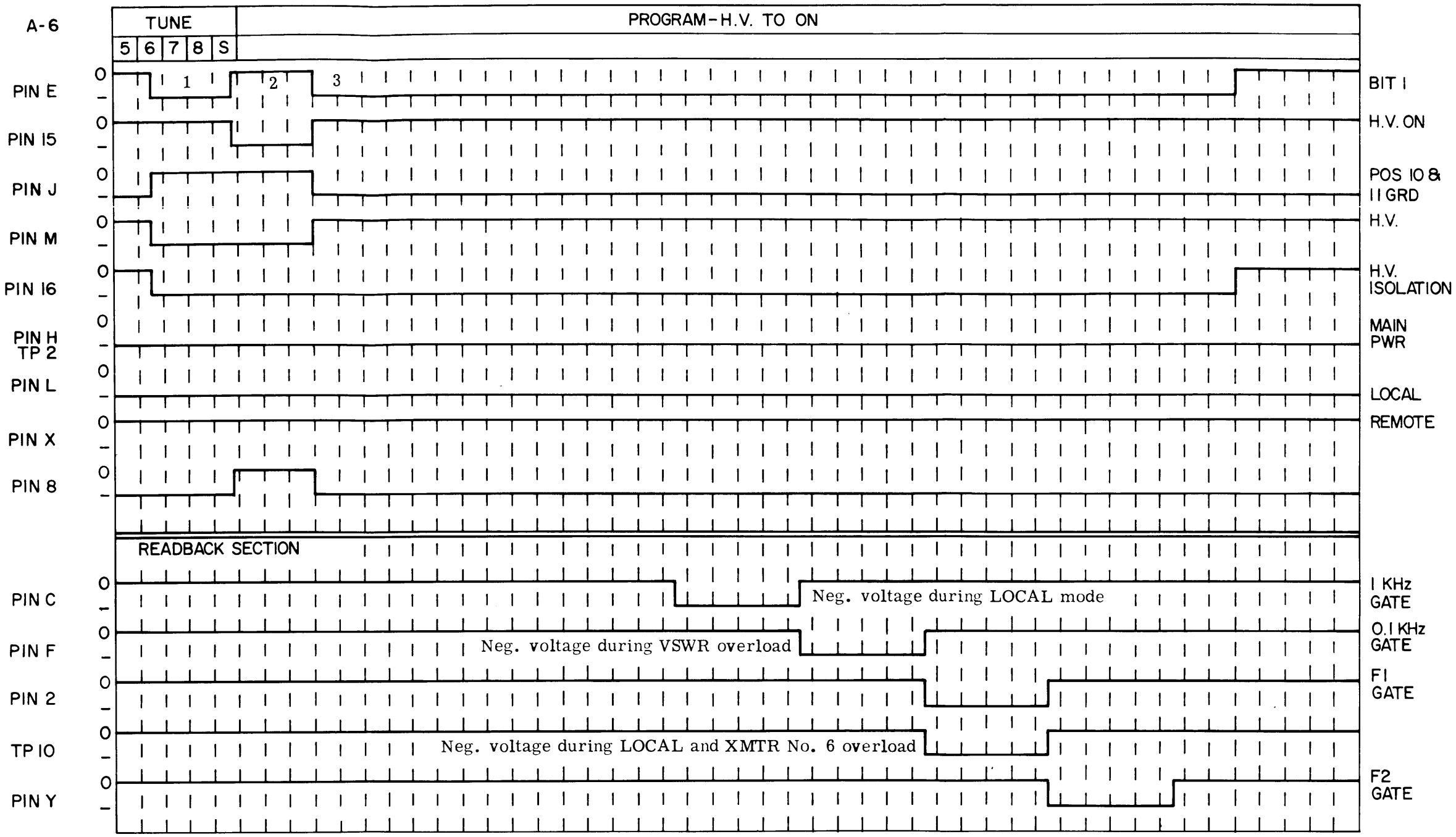


1. Master Ledex to 10 MHz.
2. 10 MHz switch from 0 to 2.
3. Master Ledex to HOME.

Figure 5-4. Stepping Switch Gating Circuit A5, Timing Diagram

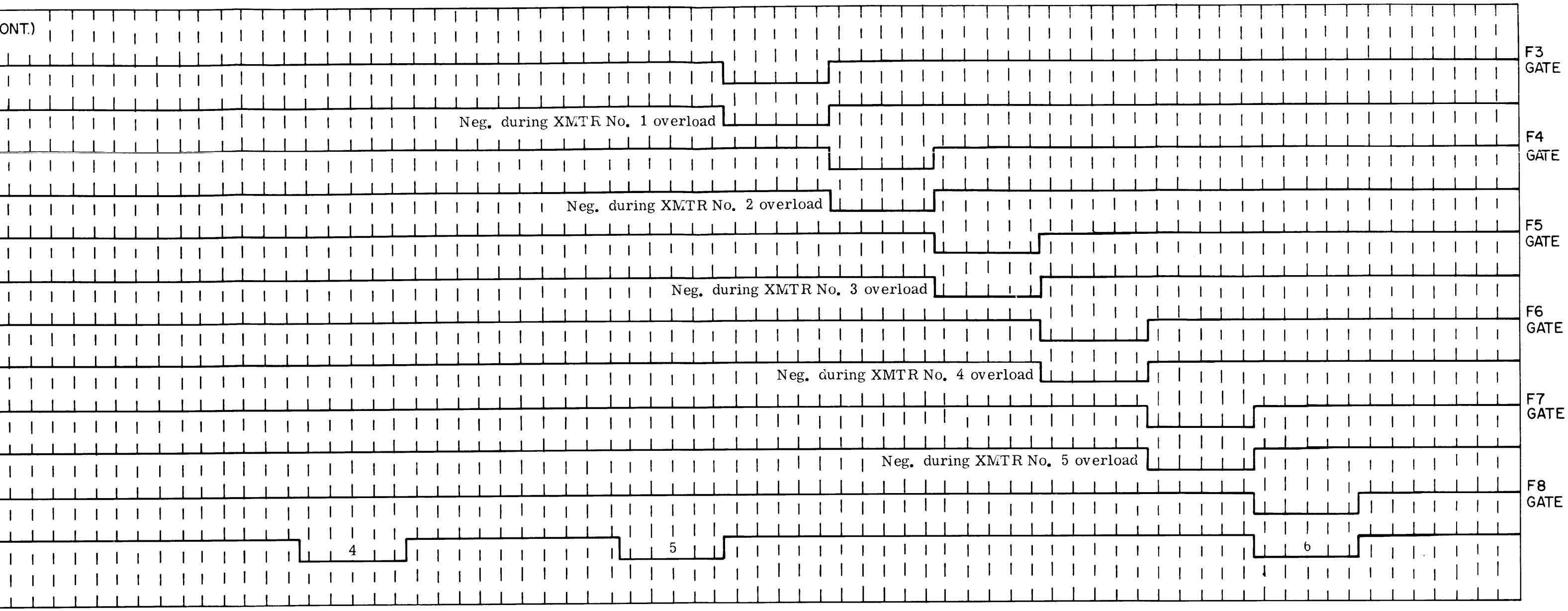
NOTE:

THE GRID LINES SUBSEQUENT TO THE TUNE CHARACTER, AND IN THE ENTIRE READBACK SECTION ARE PROVIDED FOR REFERENCE ONLY. THE WAVEFORMS IN THESE AREAS WILL VARY IN ACCORDANCE WITH THE PROGRAM.



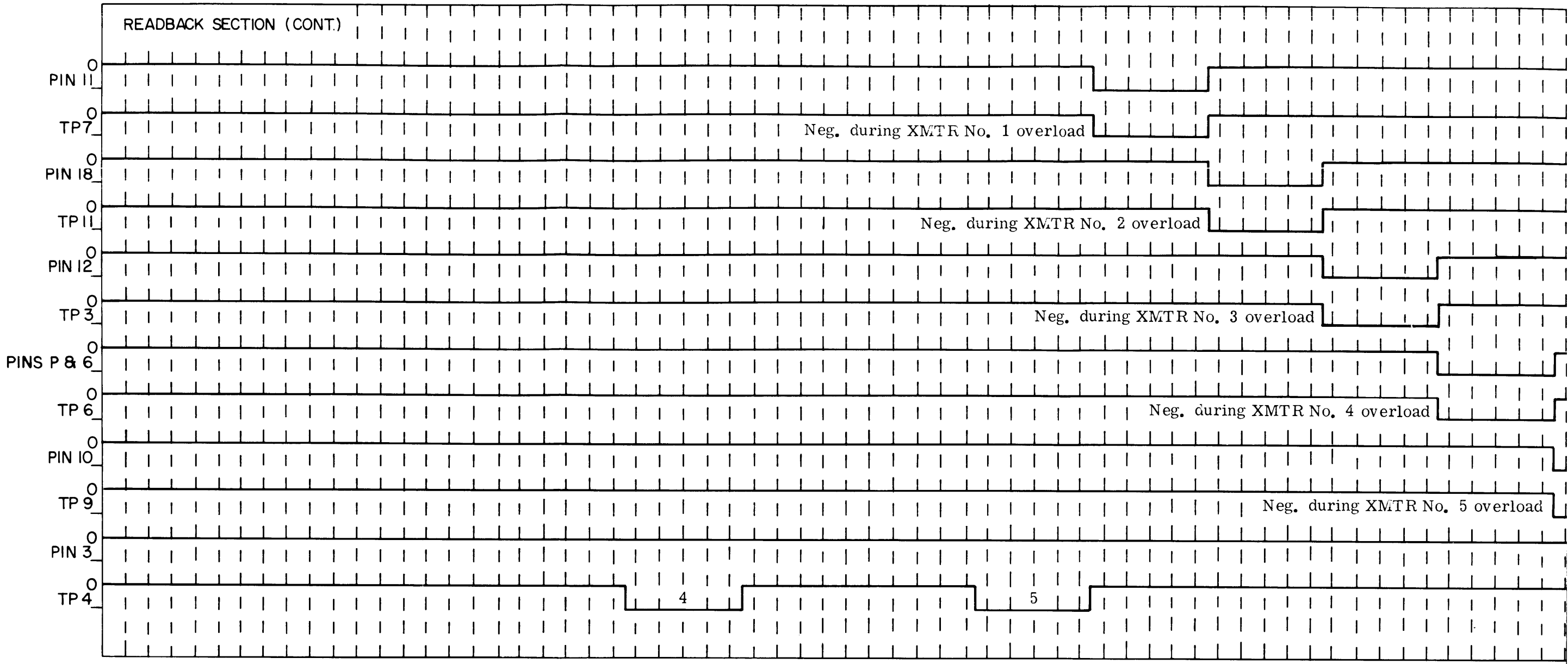
1. Master Ledex to High Voltage.
2. High Voltage switch to ON.
3. Master Ledex to HOME.

Figure 5-5. H.V. On-Off Transmitter Readback Logic Circuit A6, Timing Diagram (Sheet 1 of 2)



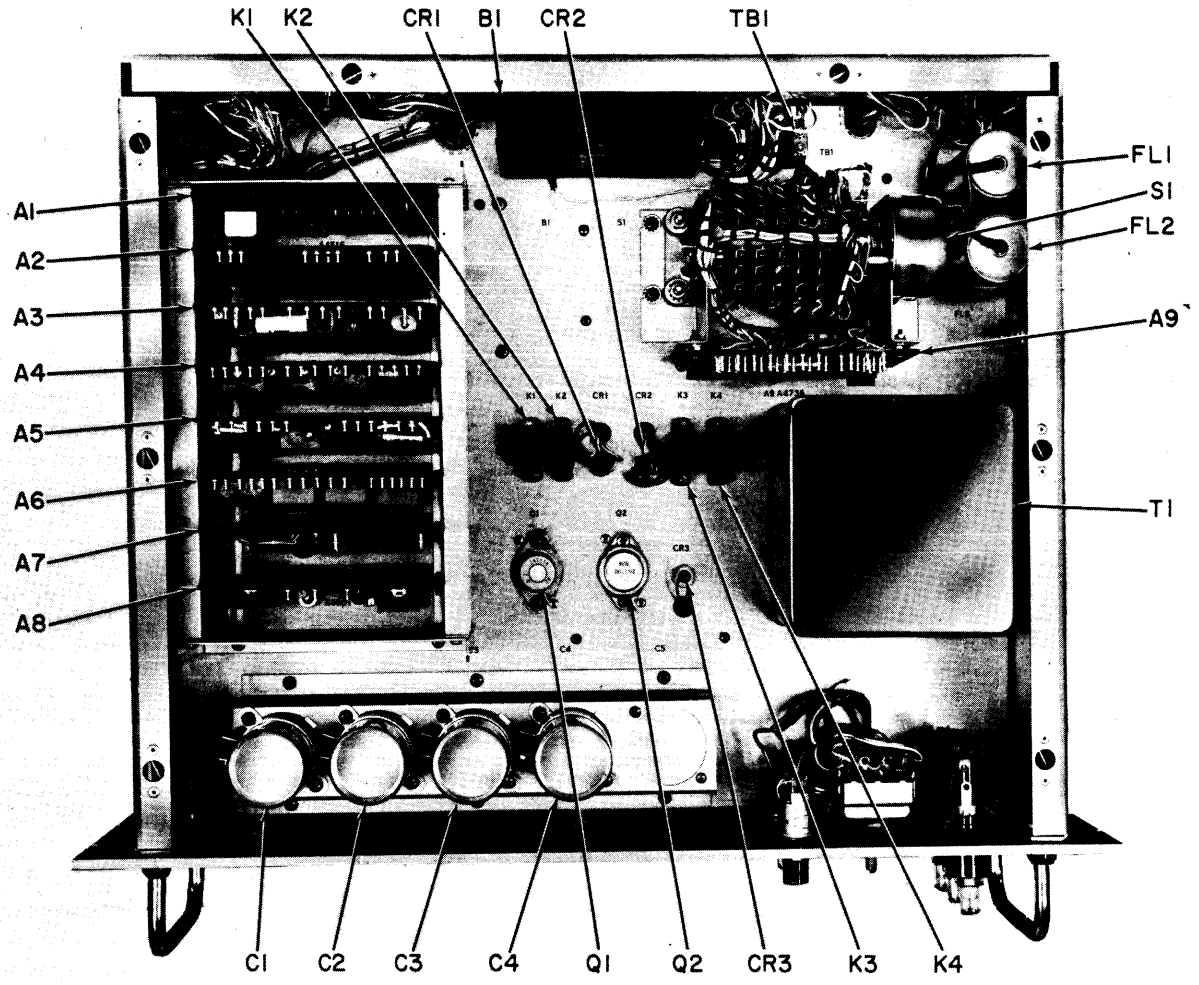
LOCAL mode.
SWR overload.
XMTR No. 6 overload.

Figure 5-5. H.V. On-Off Transmitter Readback Logic Circuit A6, Timing Diagram (Sheet 2 of 2)



4. Neg. during LOCAL mode.
5. Neg. during VSWR overload.
6. Neg. during XMTR No. 6 overload.

Figure 5-5. H.V. On-Off Transmitter Readback



68 11.12-9

Figure 5-6. RTTD-5A Major Component Location Diagram, Top View

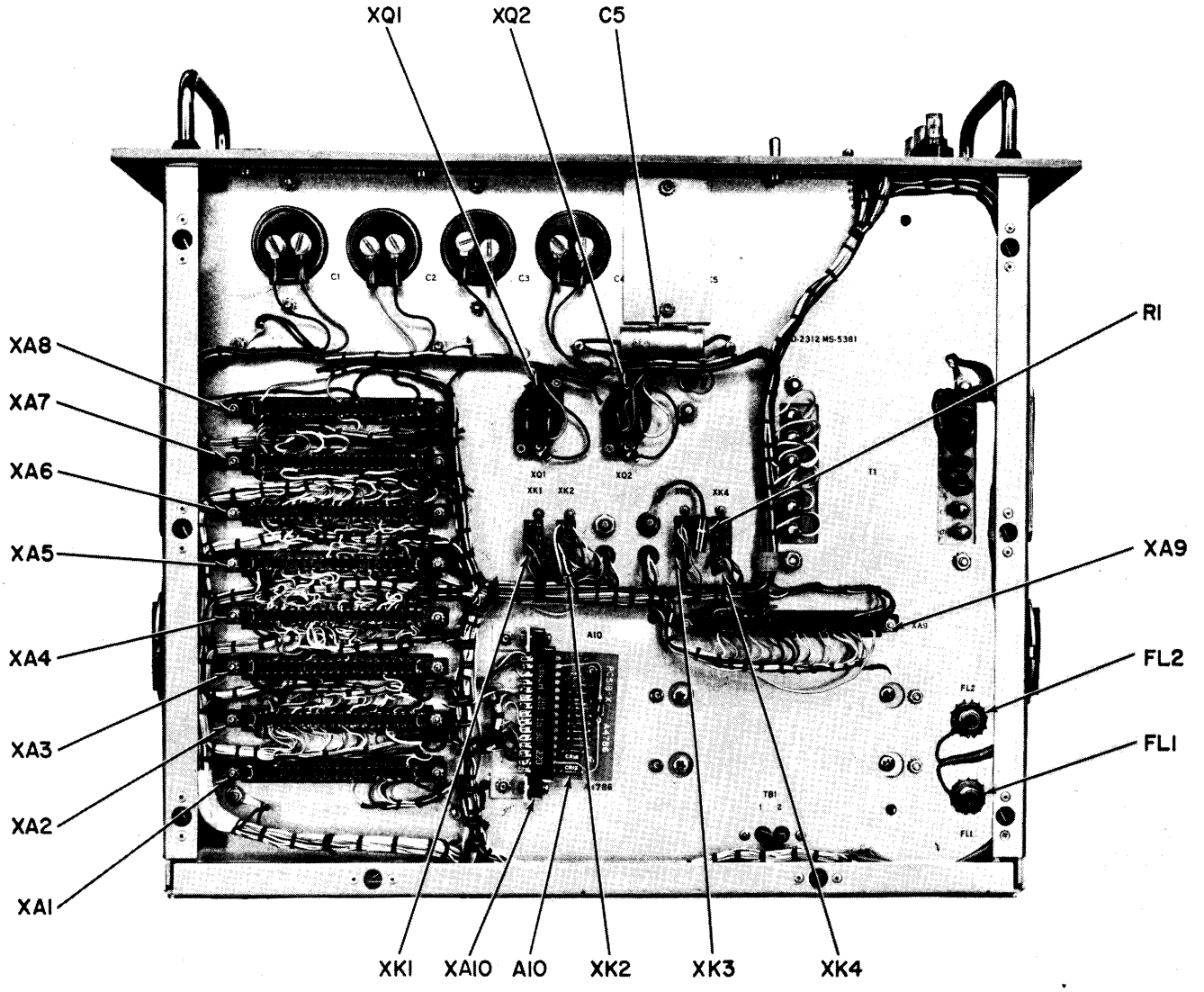


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Figure 5-7. RTTD-5A Major Component Location Diagram, Bottom View

SECTION VI
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 practical, 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 (for component parts of printed circuit boards order as shown in the following example: A-4516-C1).

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

The following is a list of the major assemblies and subassemblies of the RTTD-5A and the page on which it's parts list is located.

RTTD-5A CHASSIS MOUNTED COMPONENTS

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A1	P/C BOARD: output keyer, readback	A4516
A2	P/C BOARD: code shift register, readback	A4785
A3	P/C BOARD: bit shift register, readback	A4518
A4	P/C BOARD: drive input gating circuit	A4737
A5	P/C BOARD: step sw. gating circuit	A4821
A6	P/C BOARD: H.V. on/off xmtr readback	A4784
A7	P/C BOARD: power supply, -30v	A4602
A8	P/C BOARD: power supply, +12v, -12v	A4601
A9	STEPPING SWITCH ASSY:	AX5027
A10	GATING CIRCUIT	A4786
B1	FAN, AXIAL: 115 VAC, 50/60 Hz, 45 CFM	BL128-1
C1	CAPACITOR, FIXED, ELECT: 2600 uf, 50 WVDC	CE112-6P
C2	Same as C1	
C3	Same as C1	
C4	Same as C1	

RTTD-5A CHASSIS MOUNTED COMPONENTS (Continued)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C5	CAPACITOR, FIXED, ELECT: 150 uf	CE119-350-75
CDS1	LIGHT, INDICATOR: translucent white lens for T 1-3/4 lamp base	TS-153-12
CDS2	LIGHT, INDICATOR: translucent red lens for T 1-3/4 lamp base	TS-153-12
CR1	SEMICONDUCTOR DEVICE, DIODE	2N1776A
CR2	Same as CR1	
CR3	SEMICONDUCTOR DEVICE, DIODE	1N2989RB
DS1	LAMP, INCAND: Single contact, T-1-3/4 base, 28v a-c or d-c	BI-110-7
DS2	LAMP, INCAND: Single contact, T-1-3/4 base, 28v a-c or d-c	BI-110-10
F1	FUSE, CARTRIDGE TYPE: 3 amps	FU102-3.0
F2	Same as F1	
FL1	FILTER, RF: 5 amps, 600 vdc, 250 vac @ 60 Hz	FI-105-1
FL2	Same as FL1	
J1	CONNECTOR, RECEPTACLE: MIL Type	MS3102A16SP5P
J2	CONNECTOR, RECEPTACLE: 18-pin, male, removable pins	JJ333-18PFS34
J3	CONNECTOR, RECEPTACLE: 9-pin, male, removable pins	JJ333-9PFS34
J4	CONNECTOR, RECEPTACLE: 50-pin, male, removable pins	JJ333-50PFS34
J5	Same as J2	
J6	CONNECTOR, RECEPTACLE: 50-pin, female, removable pins	JJ333-50SF34
K1	RELAY, ARM: polarized, DPDT	RL181-1
K2	Same as K1	
K3	Same as K1	
K4	Same as K1	
MP1	FILTER, AIR	AD102-4
Q1	TRANSISTOR	2N3055
Q2	Same as Q1	
R1	RESISTOR, FIXED, COMP: 1.5K ± 5% 2W	RC42GF152J
S1	Not used	
S2	SWITCH, TOGGLE: DPST, MIL Type	ST22K
S3	LIGHT/SWITCH ASSY: w/red lens	SW503-381
S4	SWITCH/TOGGLE: 4PDT	ST109-8
T1	TRANSFORMER, POWER	TF381
TB1	TERMINAL BD, BARRIER: 2-post, 6-32 thd	TM100-2
XA1	CONNECTOR, RECEPTACLE: P/C board, 22 double-sided female contacts	JJ319-22DFE
XA2	Same as XA1	

RTTD-5A CHASSIS MOUNTED COMPONENTS (Continued)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
XA3	Same as XA1	
XA4	Same as XA1	
XA5	Same as XA1	
XA6	Same as XA1	
XA7	Same as XA1	
XA8	Same as XA1	
XA9	Same as XA1	
XA10	Same as XA1	
XDS1	LIGHT, INDICATOR: translucent white lens for T 1-3/4 lamp base	TS-153-5
XF1	FUSE HOLDER, LAMP INDICATING	FH104-3
XF2	Same as XF1	
XK1	RELAY SOCKET	TS-191-S2
XK2	Same as XK1	
XK3	Same as XK1	
XK4	Same as XK1	
XQ1	TRANSISTOR SOCKET	TS-166-1
XQ2	Same as XQ1	

A1, OUTPUT KEYER A4516

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	CAPACITOR, FXD, MICA: .001 uf ±1%, 500 WVDC	CM111F102J1
C2	Same as C1	
CR1	SEMICONDUCTOR DEVICE, DIODE	IN4245
CR2	Same as CR1	
K1	RELAY, ARM: SPDT, polarized, mercury wetted contacts	RL-167-1
R1	RESISTOR, FXD, COMP: 470 ohms ±5%, 1/2 watt	RC20GF471J
R2	RESISTOR, FXD, COMP: 680 ohms ±5%, 1/2 watt	RC20GF681J
R3	Same as R2	
R4	RESISTOR, FXD, COMP: 4.7 ohms ±5%, 1/2 watt	RC20GF4R7J
R5	Same as R4	
R6	RESISTOR, FXD, COMP: 100 ohms ±5%, 2 watts	RC42GF101J
R7	Same as R6	

A2, CODE SHIFT REGISTER A4785

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
CR1	SEMICONDUCTOR DEVICE, DIODE: MIL Type	1N914
CR2	Same as CR1	
CR3	Same as CR1	
CR4	Same as CR1	
CR5	Same as CR1	
CR6	Same as CR1	
CR7	Same as CR1	
CR8	Same as CR1	
CR9	Same as CR1	
CR10	Same as CR1	
R1	RESISTOR, FXD, COMP: 1.2K±5%, 1/4 watt	RC07GF122J
R2	RESISTOR, FXD, COMP: 100K±5%, 1/4 watt	RC07GF104J
R3	Same as R2	
R4	Same as R2	
R5	Same as R2	
R6	Same as R2	
TP1	TERM STUD	TE-127-2
TP2	Same as TP1	
TP3	Same as TP1	
TP4	Same as TP1	
TP5	Same as TP1	
TP6	Same as TP1	
TP7	Same as TP1	
TP8	Same as TP1	
TP9	Same as TP1	
TP10	Same as TP1	
Z1	NETWORK, DIG: Flip-flop	NW151
Z2	Same as Z1	
Z3	Same as Z1	
Z4	Same as Z1	
Z5	Same as Z1	
Z6	NETWORK, DIG: Andgate, quad	NW142-44
Z7	Same as Z6	
Z8	Same as Z6	
Z9	Same as Z6	
Z10	NETWORK, DIG: Inverter, quad	NW150-4
Z11	Same as Z10	
Z12	Same as Z10	
Z13	Same as Z10	

A3, BIT SHIFT REGISTER A4518

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	CAPACITOR, FXD, PLASTIC: 3 uf ±5% tol, WVDC	CN112A185J
C2	Same as C1	
CR1	SEMICONDUCTOR DEVICE, DIODE: MIL Type	1N914
CR2	Same as CR1	
L1	COIL, RF, FXD: 1000 uh ±10%	CL275-102
R1	RESISTOR, VAR, WW: 500 ohms ±10%, 1/2 watt	RV121-1-501
R2	RESISTOR, FXD, COMP: 1.2K ±5%, 1/4 watt	RC07GF122J
Z1	NETWORK, DIG: Timing generator	NW152
Z2	NETWORK, DIG: Flip-flop	NW151
Z3	Same as Z2	
Z4	Same as Z2	
Z5	Same as Z2	
Z6	NETWORK, DIG: Andgate, dual	NW141-42
Z7	Same as Z6	
Z8	Same as Z6	
Z9	NETWORK, DIG: Norgate	NW145-61

A4, DRIVE INPUT GATING CKT, A4737

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	CAPACITOR, FXD, CERAMIC: 0.01 uf	CC100-41
C2	Same as C1	
C3	Same as C1	
C4	Same as C1	
C5	Same as C1	
CR1	SEMICONDUCTOR DEVICE, DIODE: MIL Type	1N914
CR2	Same as CR1	
CR3	Same as CR1	
CR4	Same as CR1	
CR5	Same as CR1	
CR6	Same as CR1	
CR7	Same as CR1	
L1	COIL, RF, FXD: 470 uh	CL275-471
L2	Same as L1	
L3	Same as L1	
L4	Same as L1	
L5	Same as L1	
R1	RESISTOR, FXD, COMP: 1.2K±5%, 1/4 watt	RC07GF122J

A4, DRIVE INPUT GATING CKT, A4737 (Continued)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R2	Same as R1	
R3	Same as R1	
R4	Same as R1	
R5	Same as R1	
R6	Same as R1	
R7	RESISTOR, FXD, COMP: 10K±5%, 1/4 watt	RC07GF103J
R8	Same as R7	
R9	Same as R7	
R10	Same as R7	
R11	Same as R1	
R12	Same as R1	
TP1	TERM STUD	TE-127-2
TP2	Same as TP1	
TP3	Same as TP1	
TP4	Same as TP1	
TP5	Same as TP1	
TP6	Same as TP1	
TP7	Same as TP1	
TP8	Same as TP1	
TP9	Same as TP1	
TP10	Same as TP1	
TP11	Same as TP1	
TP12	Same as TP1	
TP13	Same as TP1	
TP14	Same as TP1	
TP15	Same as TP1	
Z1	NETWORK, DIG: Complementary emitter follower, dual	NW147-2
Z2	Same as Z1	
Z3	NETWORK, DIG: Inverter, quad	NW150-4
Z4	NETWORK, DIG: Andgate, quad	NW142-24
Z5	Same as Z4	
Z6	NETWORK, DIG: Norgate	NW145-61
Z7	Same as Z3	
Z8	NETWORK, DIG: Andgate, quad	NW142-44
Z9	Same as Z8	
Z10	Same as Z9	
Z11	Same as Z10	

A5, STEPPING SWITCH GATING CIRCUIT A4821

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	CAPACITOR, FXD, ELECT: 4.7 uf, 35 WVDC	CE123-475-35B$
C2	Same as C1	
C3	CAPACITOR, FXD, CERAMIC: .01 uf, 25 WVDC	CC100-41
C4	CAPACITOR, FXD, ELECT: 100 uf, 20 WVDC	CE123-107-20$2
C5	Same as C3	
C6	Same as C3	
CR1	SEMICONDUCTOR DEVICE, DIODE: MIL Type	1N914
CR2	Same as CR1	
CR3	Same as CR1	
CR4	Same as CR1	
CR5	Same as CR1	
CR6	Same as CR1	
CR7	Same as CR1	
CR8	SEMICONDUCTOR DEVICE, DIODE: MIL Type	1N4245
CR9	Same as CR1	
CR10	Same as CR8	
CR11	Same as CR1	
CR12	Same as CR1	
CR13	SEMICONDUCTOR DEVICE, DIODE: MIL Type	1N965B
CR14	Same as CR1	
CR15	Same as CR1	
L1	COIL, RF, FXD: 470 uh ±10%	CL275-471
L2	Same as L1	
L3	Same as L1	
L4	Same as L1	
L5	Same as L1	
Q1	TRANSISTOR: MIL Type	2N3013
Q2	Same as Q1	
Q3	Same as Q1	
Q4	TRANSISTOR: MIL Type	2N492A
Q5	Same as Q1	
R1	RESISTOR, FXD, COMP: 1.2K ±5%, 1/4 watt	RC07GF122J
R2	Same as R1	
R3	RESISTOR, FXD, COMP: 2.2K ±5%, 1/4 watt	RC07GF222J
R4	Same as R3	
R5	RESISTOR, VAR, COMP: 1 MEG	RV127-1-105
R6	RESISTOR, FXD, COMP: 3.3K ±5%, 1/4 watt	RC07GF332J
R7	RESISTOR, FXD, COMP: 15K ±5%, 1/4 watt	RC07GF153J
R8	RESISTOR, FXD, COMP: 2.7K ±5%, 1/4 watt	RC07GF272J
R9	Same as R1	

A5, STEPPING SWITCH GATING CIRCUIT A4821 (Continued)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R10	Same as R8	
R11	RESISTOR, FXD, COMP: 1K ±5%, 1/4 watt	RC07GF102J
R12	RESISTOR, FXD, COMP: 220 ohms ±5%, 1/4 watt	RC07GF221J
R13	Same as R1	
R14	Same as R1	
R15	RESISTOR, FXD, COMP: 22K ±5%, 1/4 watt	RC07GF223J
R16	Same as R1	
R17	Same as R1	
TP1	TERM STUD	TE-127-2
TP2	Same as TP1	
TP3	Same as TP1	
TP4	Same as TP1	
TP5	Same as TP1	
TP6	Same as TP1	
TP7	Same as TP1	
TP8	Same as TP1	
TP9	Same as TP1	
TP10	Same as TP1	
TP11	Same as TP1	
TP12	Same as TP1	
TP13	Same as TP1	
Z1	NETWORK, DIG: Inverter, quad	NW150-4
Z2	NETWORK, DIG: Andgate, dual	NW141-42
Z3	Same as Z1	
Z4	Same as Z1	
Z5	Same as Z2	
Z6	NETWORK, DIG: Nandgate, dual	NW144-22
Z7	NETWORK, DIG: Complimentary emitter follower, dual	NW147-2
Z8	NETWORK, DIG: Inverter, dual	NW150-2

A6, H.V. ON/OFF XMTR RDBK CKT A4784

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	CAPACITOR, FXD TANT: 2 uf ± 10%	CX118E2N60C1
CR1	SEMICONDUCTOR DEVICE, DIODE:	1N914
CR2	Same as CR1	
CR3	Same as CR1	
CR4	Same as CR1	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
CR5	Same as CR1	
CR6	Same as CR1	
CR7	Same as CR1	
CR8	Same as CR1	
CR9	Same as CR1	
CR10	Same as CR1	
CR11	Same as CR1	
CR12	Same as CR1	
CR13	Same as CR1	
CR14	Same as CR1	
CR15	Same as CR1	
CR16	Same as CR1	
CR17	Same as CR1	
CR18	Same as CR1	
CR19	Same as CR1	
CR20	Same as CR1	
CR21	Same as CR1	
CR22	Same as CR1	
CR23	Same as CR1	
CR24	Same as CR1	
CR25	Same as CR1	
CR26	Same as CR1	
CR27	Same as CR1	
CR28	Same as CR1	
CR29	Same as CR1	
CR30	Same as CR1	
CR31	SEMICONDUCTOR DEVICE, DIODE:	1N965B
Q1	TRANSISTOR: MIL Type	2N3013
Q2	Same as Q1	
R1	RESISTOR, FXD, COMP: 1.2K ±5%, 1/4 watt	RC07GF122J
R2	Same as R1	
R3	Same as R1	
R4	RESISTOR, FXD, COMP: 22K ±5%, 1/4 watt	RC07GF223J
R5	Same as R4	
R6	RESISTOR, FXD, COMP: 220K ±5%, 1/4 watt	RC07GF224J
R7	RESISTOR, FXD, COMP: 470K ±5%, 1/4 watt	RC07GF474J
R8	Same as R1	
R9	Same as R1	
R10	Same as R1	
R11	Same as R1	

A6, H.V. ON/OFF XMTR RDBK CKT A4784 (Continued)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R12	Same as R1	
R13	Same as R1	
R14	Same as R1	
R15	Same as R1	
R16	Same as R1	
R17	Same as R4	
TP1	TERM STUD	TE-127-2
TP2	Same as TP1	
TP3	Same as TP1	
TP4	Same as TP1	
TP5	Same as TP1	
TP6	Same as TP1	
TP7	Same as TP1	
TP8	Same as TP1	
TP9	Same as TP1	
TP10	Same as TP1	
TP11	Same as TP1	
TP12	Same as TP1	
TP13	Same as TP1	
TP14	Same as TP1	
TP15	Same as TP1	
TP16	Same as TP1	
TP17	Same as TP1	
Z1	NETWORK, DIG: Inverter, quad	NW150-4
Z2	NETWORK, DIG: Nandgate, dual	NW144-22
Z3	Same as Z2	
Z4	Same as Z2	
Z5	Same as Z1	
Z6	NETWORK, DIG: Norgate	NW145-61
Z7	Same as Z2	

A7, -30V POWER SUPPLY A4602

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	CAPACITOR, FXD, ELECT: 20 uf, 50 WVDC	CE105-20-50
C2	CAPACITOR, FXD, CERAMIC: .1 uf GMV, 500 WVDC	CC100-28
C3	Same as C2	
CR1	SEMICONDUCTOR DEVICE, DIODE	1N4245
CR2	Same as CR1	
CR3, CR6	Same as CR1	
CR4	RECTIFIER BRIDGE: 200 PIV, plastic case, 4-wire lead mounted	DD143-27
CR5	SEMICONDUCTOR DEVICE, DIODE: MIL Type	1N4721
R1	RESISTOR, FXD, COMP: 1.2K ±5%, 2 watts	RC42GF122J
R2	RESISTOR, FXD, WW: 1 ohm, 5 watts	RR114-1W
R3	Same as R2	
R4	Same as R2	
R5	RESISTOR, FXD, WW: 500 ohms, 5 watts	RR114-500W
R6	Same as R5	
R7	Same as R2	
R8	Same as R2	
R9	RESISTOR, FXD, COMP: 10 ohms ±5%, 1 watt	RC32GF100J

A8, +12V, -12V POWER SUPPLY, A4601

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	CAPACITOR, FXD, ELECT: 4.7 uf, 25 WVDC	CE123-475-35B2
C2	Same as C1	
C3	CAPACITOR, FXD, ELECT: 100 uf, 20 WVDC	CE123-107-20$2
C4	CAPACITOR, FXD, MICA: 47 pf ±2%, 300 WVDC	CM111F470G5S
C5	Same as C4	
C6	CAPACITOR, FXD, ELECT: .1 uf	CC100-41
C7	Same as C6	
CR1	RECTIFIER BRIDGE	DD130-200-1.5
CR2	RECTIFIER BRIDGE	DD143-27
Q1	TRANSISTOR: MIL Type	2N1485
Q2	TRANSISTOR: MIL Type	2N4036
Q3	Same as Q2	
R1	RESISTOR, FXD, COMP: 68 ohms ±5%, 1/2 watt	RC20GF680J
R2	RESISTOR, FXD, COMP: 56 ohms ±5%, 1/2 watt	RC20GF560J
R3	RESISTOR, FXD, COMP: 560 ohms ±5%, 1/2 watt	RC20GF561J
R4	RESISTOR, FXD, FILM: 2.7K ±5%, 1/2 watt	RN60D2711D

A8, +12V, -12V POWER SUPPLY, A4601 (Continued)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R5	RESISTOR, FXD, FILM: 18K ±5%, 1/2 watt	RN60D18021D
R6	RESISTOR, FXD, WW: 3 ohms, 5 watts	RR114-3W
R7	RESISTOR, FXD, COMP: 1.0 ohm, ±5%, 1/2 watt	RC20GF1R0J
R8	Same as R7	
R9	RESISTOR, FXD, COMP: 270 ohms, ±5%, 1 watt	RC32GF271J
R10	RESISTOR, FXD, COMP: 2.7K ±5%, 1/2 watt	RC20GF272J
R11	RESISTOR, FXD, COMP: 1.2K ±5%, 1/2 watt	RC20GF122J
R12	RESISTOR, FXD, FILM: 18K ±5%, 1/2 watt	RN60D18021D
R13	Same as R4	
R14	RESISTOR, FXD, WW: 1 ohm, 5 watts	RR114-1W
R15	Same as R1	
R16	Same as R2	
R17	RESISTOR, FXD, COMP: 360 ohms, ±5%, 1/2 watt	RC20GF361J
R18	RESISTOR, FXD, COMP: 270 ohms, ±5%, 2 watts	RC42GF271J
R19	Same as R7	
R20	Same as R7	
R21	Same as R7	
R22	Same as R7	
Z1	INTEGRATED CIRCUIT, VOLTAGE REGULATOR	LM200VR104
Z2	Same as Z1	

A9, MASTER STEPPING SWITCH ASSY AX5027

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	CAPACITOR, FXD, TANT: 2 uf	CX118E2N6001
C2	Same as C1	
CR1	SEMICONDUCTOR DEVICE, DIODE: MIL Type	1N914
CR2	Same as CR1	
CR3	Same as CR1	
CR4	Same as CR1	
CR5	Same as CR1	
CR6	Same as CR1	
CR7	Same as CR1	
CR8	Same as CR1	
CR9	Same as CR1	
CR10	Same as CR1	
CR11	Same as CR1	
CR12	Same as CR1	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
CR13	Same as CR1	
CR14	Same as CR1	
CR15	Same as CR1	
CR16	Same as CR1	
CR17	SEMICONDUCTOR DEVICE, OVERVOLTAGE ABSORBER	DD111-1
CR18	Same as CR1	
CR19	SEMICONDUCTOR DEVICE, DIODE, MIL Type	1N4245
CR20	Same as CR1	
R1	RESISTOR, FXD, COMP: 1.2K ±5%, 1/4 watt	RC07GF122J
TP1	TERM STUD	TE-127-8
TP2	Same as TP1	
TP3	Same as TP1	
TP4	Same as TP1	
TP5	Same as TP1	
TP6	Same as TP1	
TP7	Same as TP1	
TP8	Same as TP1	
TP9	Same as TP1	
TP10	Same as TP1	
TP11	Same as TP1	
TP12	Same as TP1	
TP13	Same as TP1	
TP14	Same as TP1	
TP15	Same as TP1	
TP16	Same as TP1	
TP17	Same as TP1	
TP18	Same as TP1	
TP19	Same as TP1	
TP20	Same as TP1	
TP21	Same as TP1	
TP22	Same as TP1	
TP23	Same as TP1	
TP24	Same as TP1	
TP25	Same as TP1	
TP26	Same as TP1	
TP27	Same as TP1	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
CR1	SEMICONDUCTOR DEVICE, DIODE: MIL Type	1N4245
CR2	Same as CR1	
CR3	Same as CR1	
CR4	SEMICONDUCTOR DEVICE, DIODE: MIL Type	1N914
CR5	Same as CR4	
CR6	Same as CR4	
CR7	Same as CR4	
CR8	Same as CR4	
CR9	Same as CR4	
CR10	Same as CR4	
CR11	Same as CR4	
CR12	Same as CR4	
CR13	Same as CR4	
CR14	Same as CR1	
S1	SIL SW, DC	SW519

SECTION VII
DRAWINGS

7-1. INTRODUCTION

This section contains schematic and interconnecting data for the RTTD-5A. The following is a list of the diagrams contained in this section.

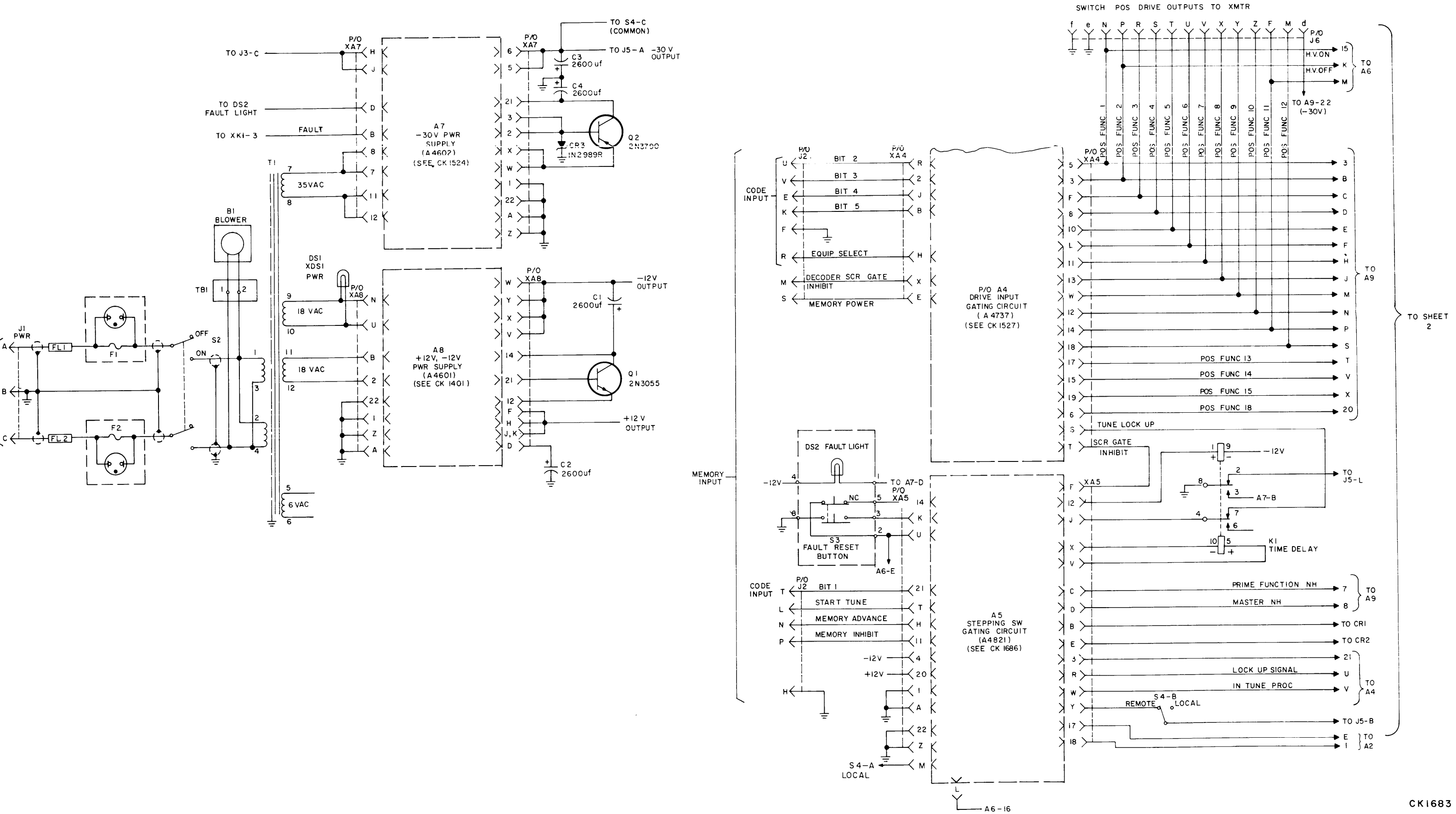


Figure 7-1. RTTD-5A Transmitter Decoder, Interconnection Diagram (Sheet 1 of 2)

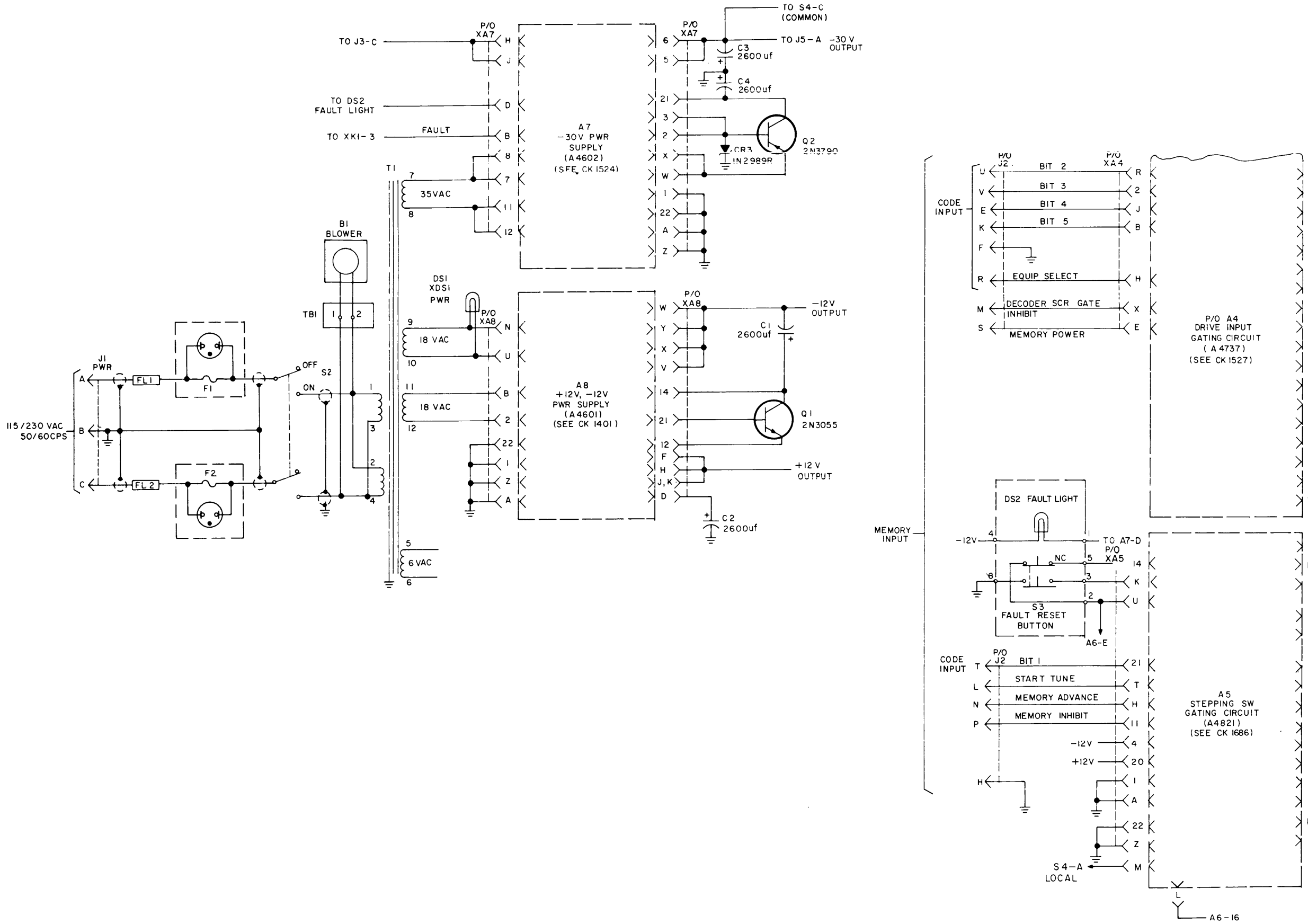


Figure 7-1. RTTD-5A Tra

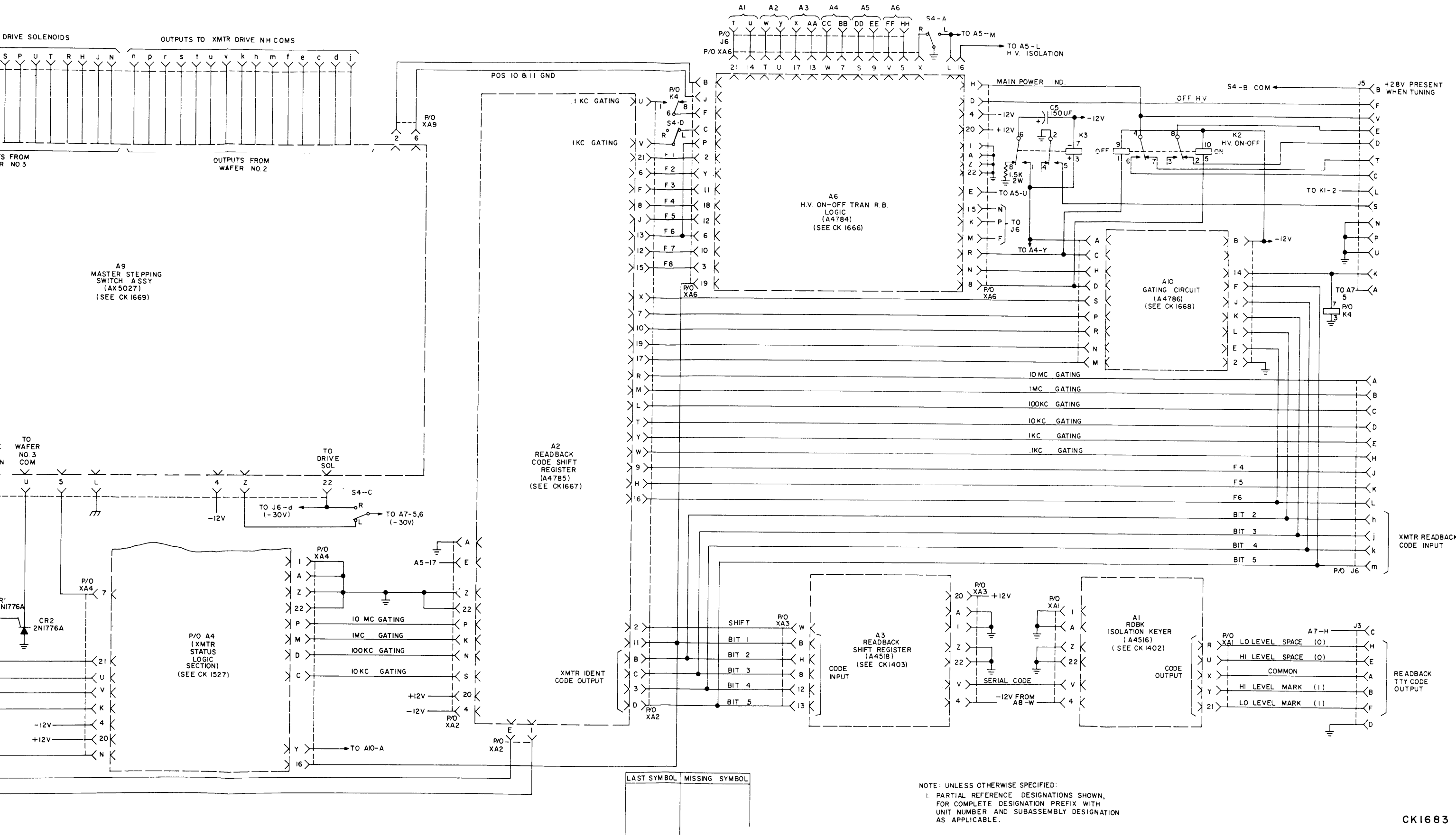
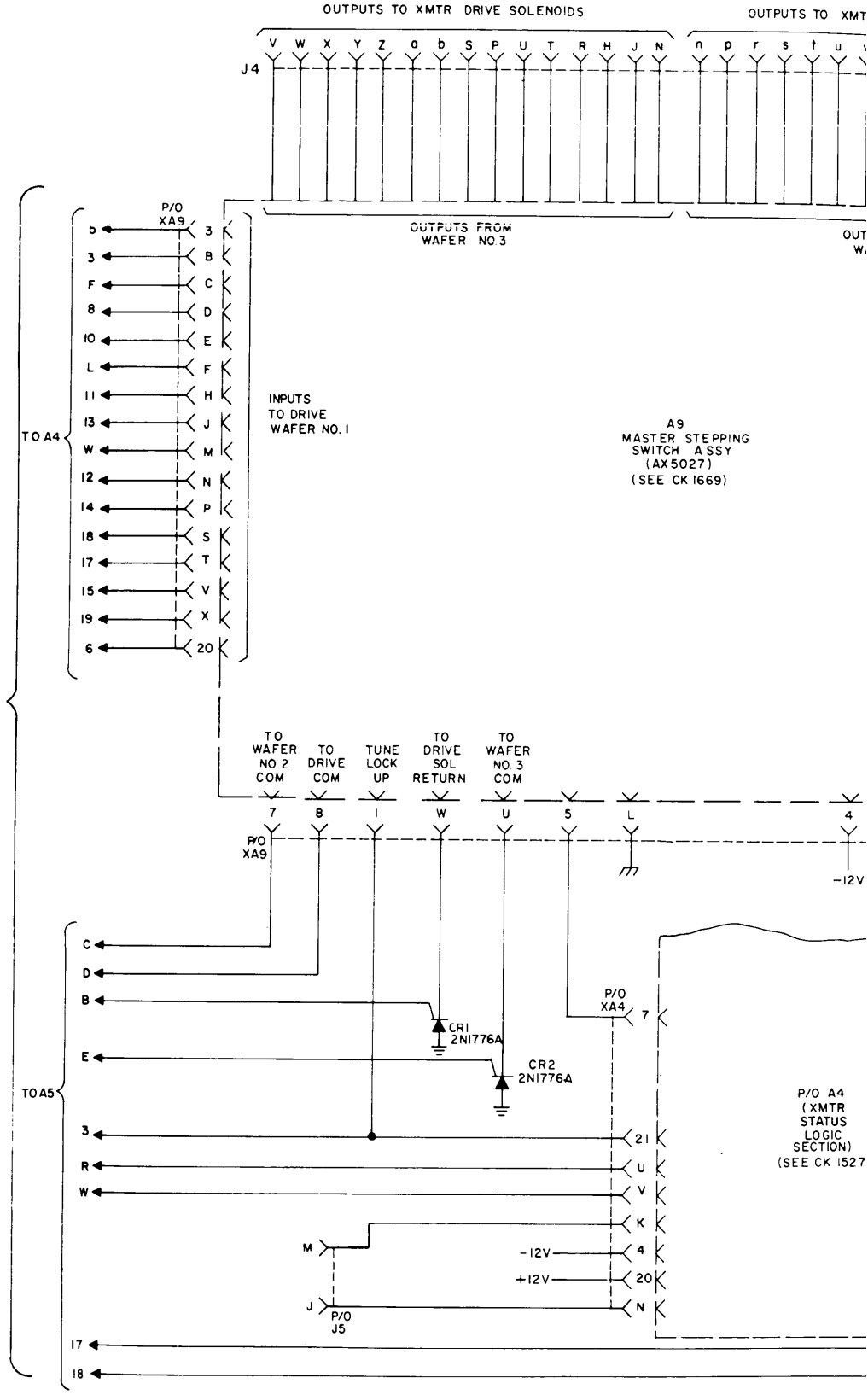
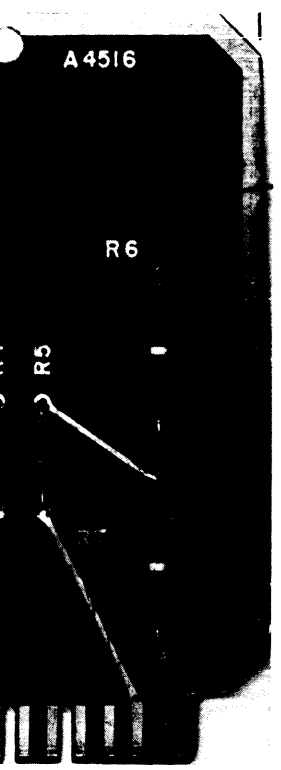
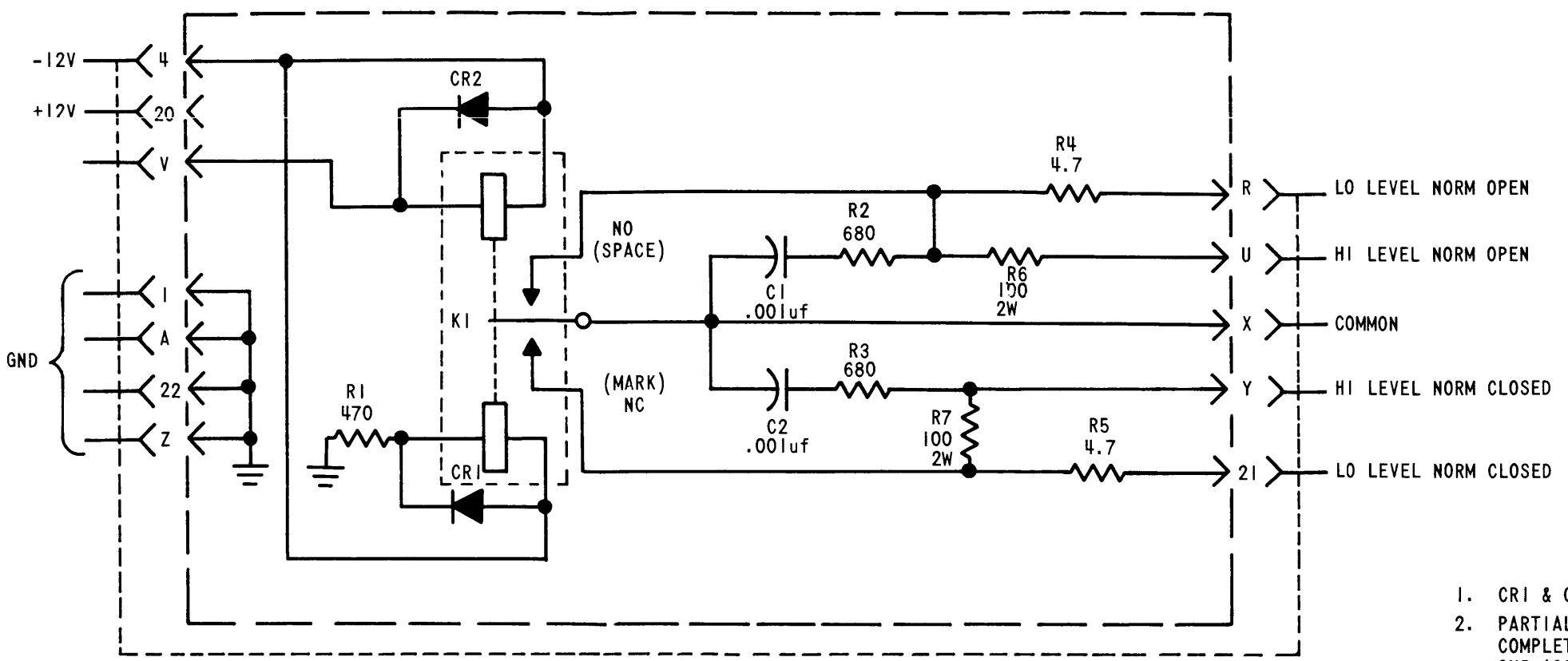


Figure 7-1. RTTD-5A Transmitter Decoder, Interconnection Diagram (Sheet 2 of 2)


OUTPUTS TO XMTR DRIVE SOLENOIDS
OUTPUTS TO XMT
V W X Y Z a b S P U T R H J N n p r s t u
J4
OUTPUTS FROM WAFER NO 3
OUT W
P/O XA9
3 B C D E F H J M N P S T V X 20
5 3 F 8 10 L 11 13 W 12 14 18 17 15 19 6
TO A4
INPUTS TO DRIVE WAFER NO. 1
A9 MASTER STEPPING SWITCH ASSY (AX5027) (SEE CK 1669)
TO SHT 1
TO WAFER NO 2 COM
TO DRIVE COM
TUNE LOCK UP
TO DRIVE SOL RETURN
TO WAFER NO 3 COM
7 8 I W U 5 L 4
P/O XA9
-12V
C D B E
CR1 2N1776A
CR2 2N1776A
TO A5
P/O XA4
7 21 U V K 4 20 N
3 R W M J
-12V
+12V
P/O J5
17 18
P/O A4 (XMTR STATUS LOGIC SECTION) (SEE CK 1527





NOTES

1. CR1 & CR2 ARE TYPE IN4245
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT NUMBER & SUB-ASSEMBLY DESIGNATION(S) AS APPLICABLE

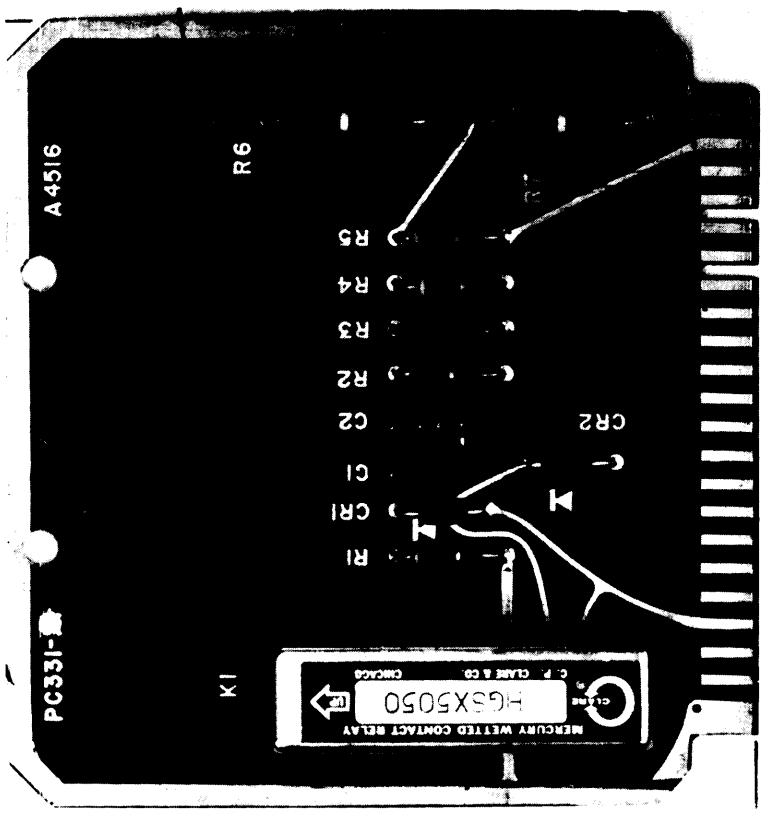
UNLESS OTHERWISE SPECIFIED

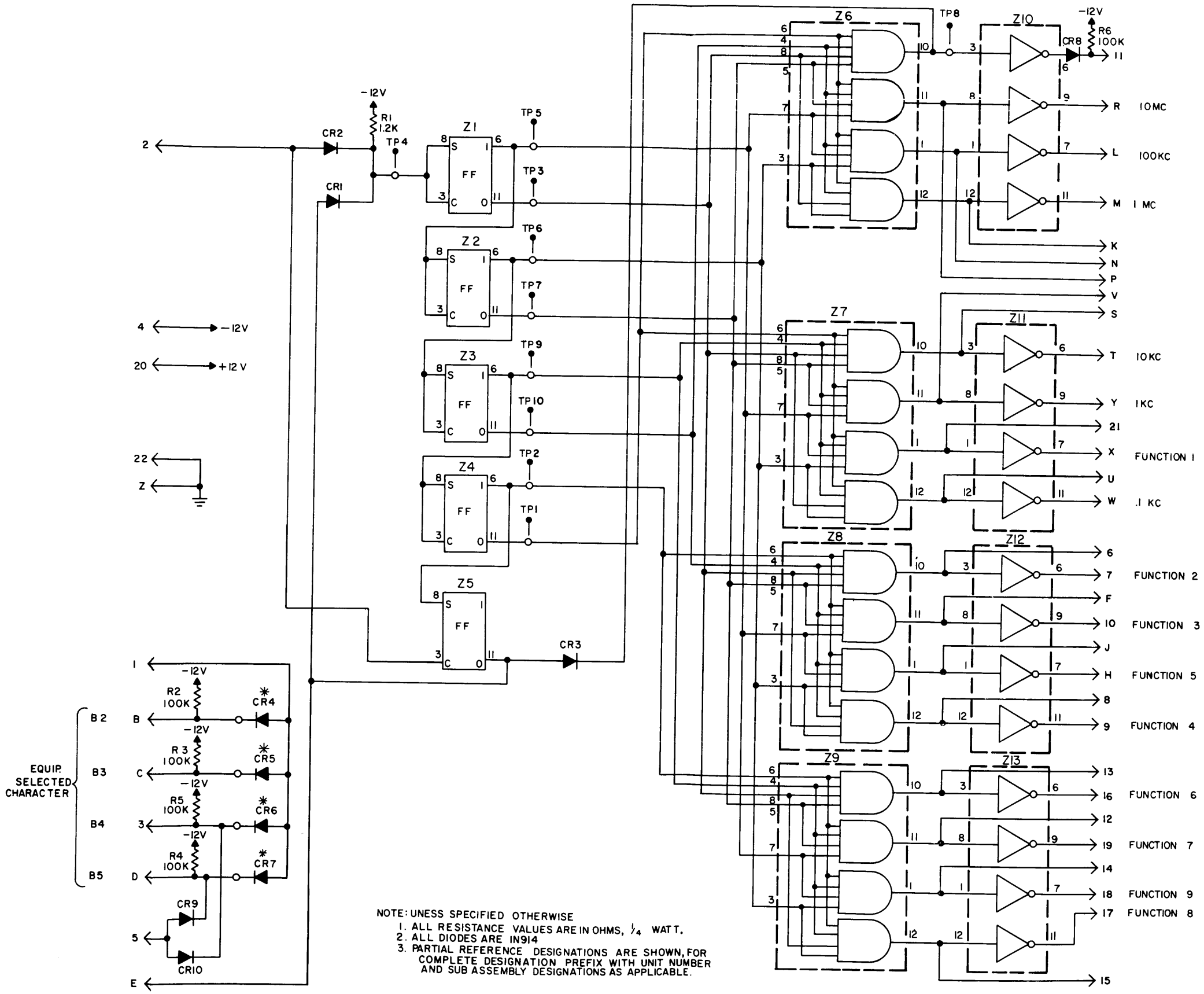
1. ALL RESISTORS ARE IN OHMS, 1/2 WATT

LAST SYMBOLS	MISSING SYMBOLS
C2	
CR2	
K1	
R7	

CK1402

Figure 7-2. Readback Isolation Keyer A1, Schematic Diagram


A4516
R6
R5
R4
R3
R2
C2
CR2
C1
CR1
R1
PC331-
K1
MERCURY WETTED CONTACT RELAY
HGSX5050
C. P. CLARE & CO.
CHICAGO



NOTE: UNESS SPECIFIED OTHERWISE
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 WATT.
2. ALL DIODES ARE IN914
3. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER AND SUB ASSEMBLY DESIGNATIONS AS APPLICABLE.

* FOR EQUIPMENT CODED A THRU E USE THIS CHART FOR DIODE SELECTION

A THRU E -	CR4	CR5	CR6	CR7
1				
2				
3				
4				
5				
6				

LAST SYMBOL	MISSING SYMBOL
CR10	
R6	
TP10	
Z13	

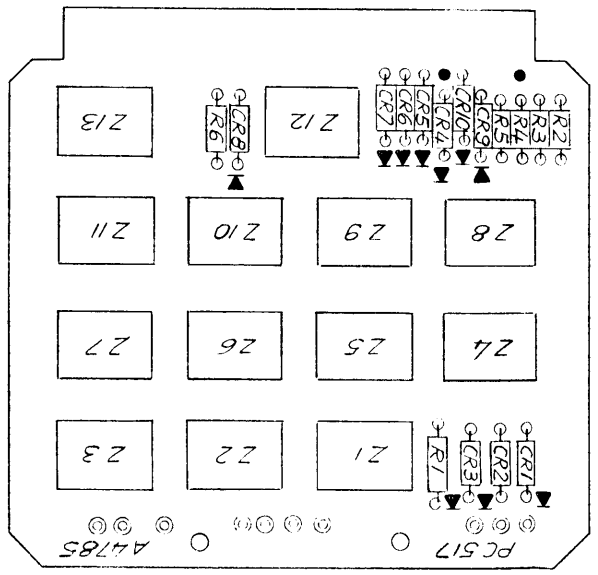
MODULE VOLTAGE & GND CHART			
SYMBOL	PIN CONNECTION		
	+12V	-12V	GND
Z1 THRU Z5	10	2	5
Z6 THRU Z9		2	
Z10 THRU Z13	10		5

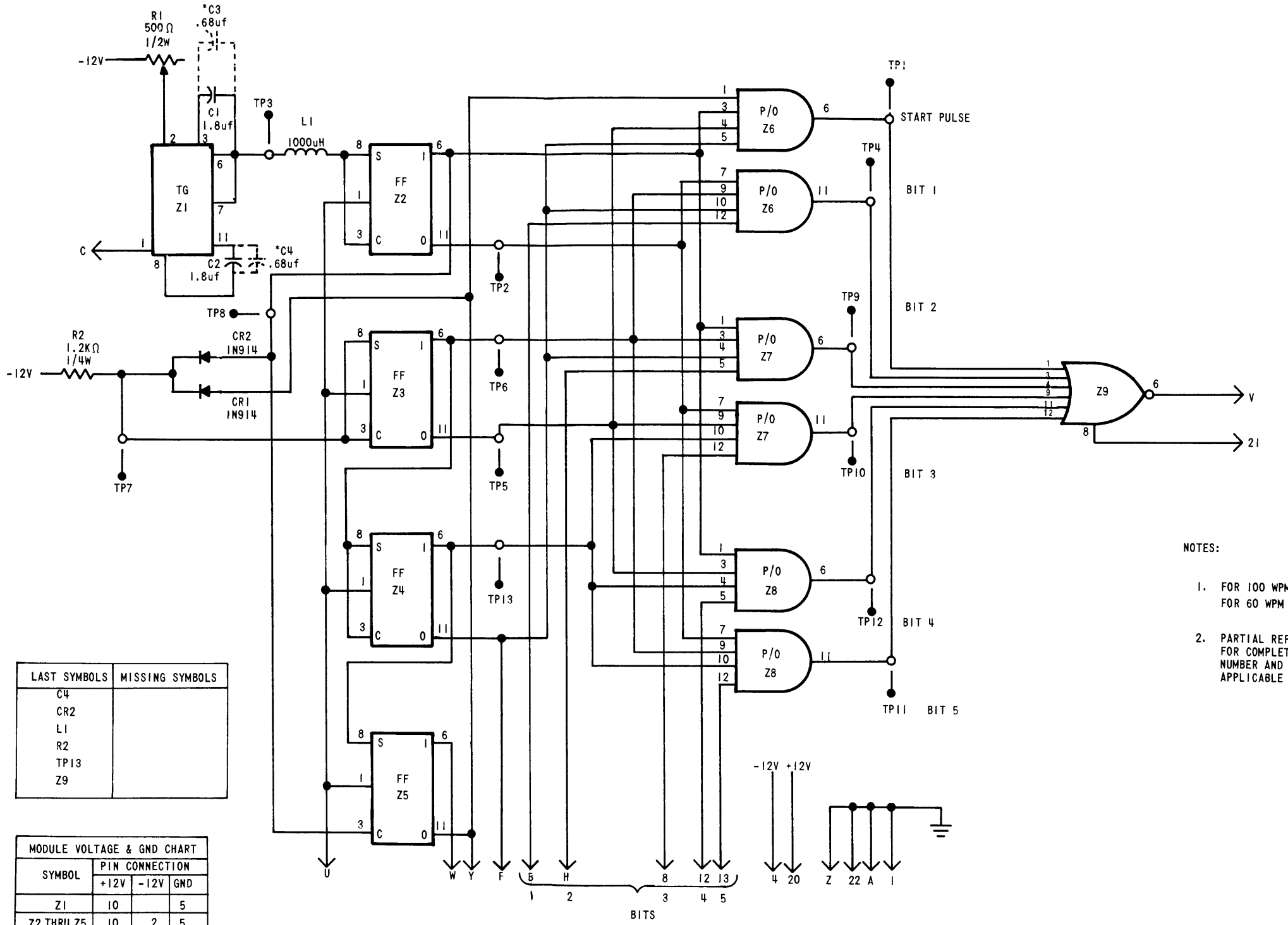
CK1667

Figure 7-3. Readback Code Shift Register A2, Schematic Diagram

EQUIP SELECTED CHARACTER

B2 B3 B4 B5





LAST SYMBOLS	MISSING SYMBOLS
C4	
CR2	
L1	
R2	
TP13	
Z9	

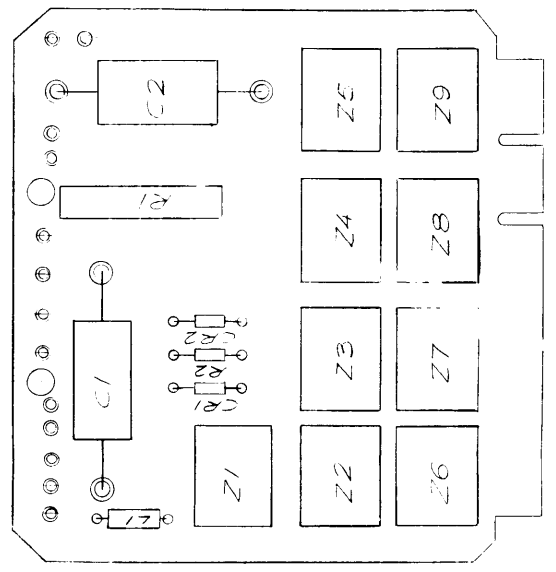
MODULE VOLTAGE & GND CHART			
SYMBOL	PIN CONNECTION		
	+12V	-12V	GND
Z1	10		5
Z2 THRU Z5	10	2	5
Z6,7,8		2	
Z9	10	2	5

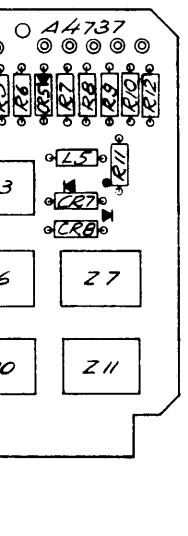
NOTES:

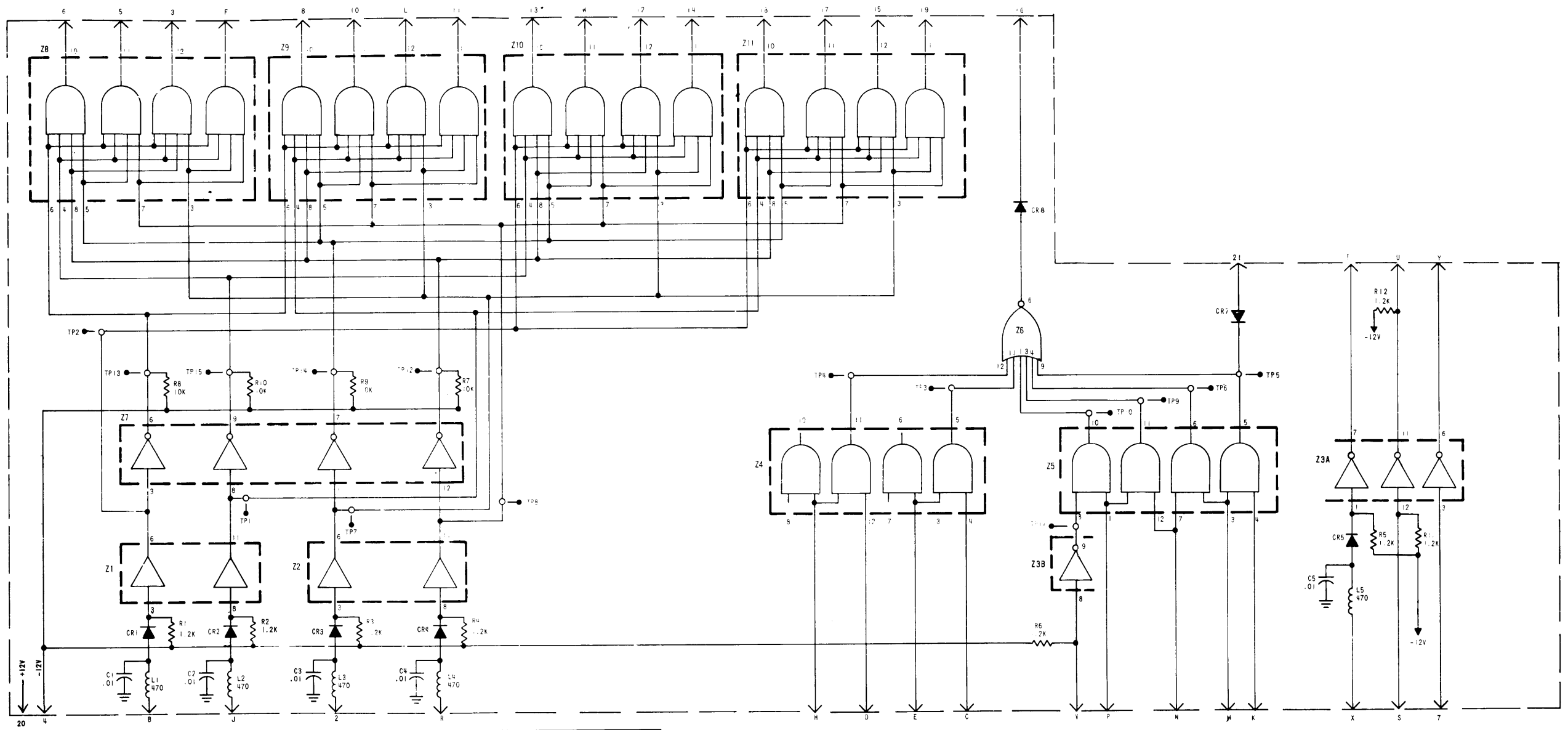
1. FOR 100 WPM OPERATION, DELETE C3 & C4
   FOR 60 WPM OPERATION, ADD C3 & C4
2. PARTIAL REFERENCE DESIGNATION ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT NUMBER AND SUB-ASSEMBLY DESIGNATION(S) AS APPLICABLE

CK1403

Figure 7-4. Readback Shift Register A3, Schematic Diagram


C2
Z5
Z9
J2
Z4
Z8
C1
R3
R2
R1
Z3
Z7
Z1
Z2
Z6
J1





UNLESS OTHERWISE SPECIFIED

1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 WATT
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS
3. ALL INDUCTANCE VALUES ARE IN MICROHENRIES
4. ALL DIODES ARE 1N914

NOTE:

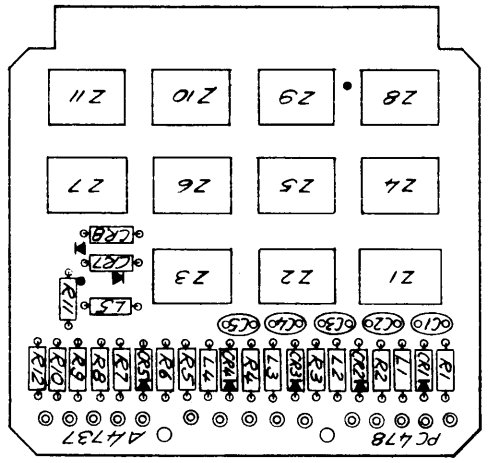
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH UNIT NUMBER AND SUB-ASSEMBLY DESIGNATION(S) AS APPLICABLE

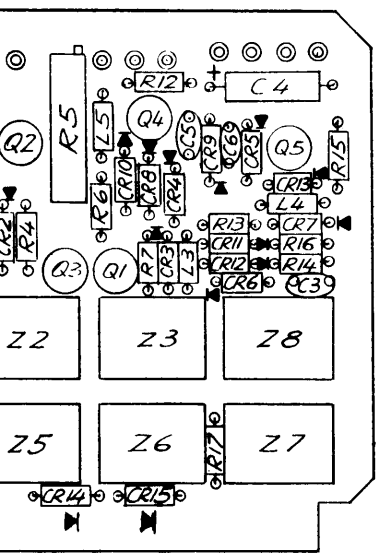
	MODULE VOLTAGE & GND CHART			
		PIN CONNECTIONS		
TMC P/N	SYMBOL	+12V	-12V	GND
NW147-2	Z1,Z2		2	5
NW150-4	Z3,Z7	10		5
NW142-24	Z4,Z5		2	
NW145-61	Z6	10	2	5
NW142-44	Z8 THRU Z11		2	

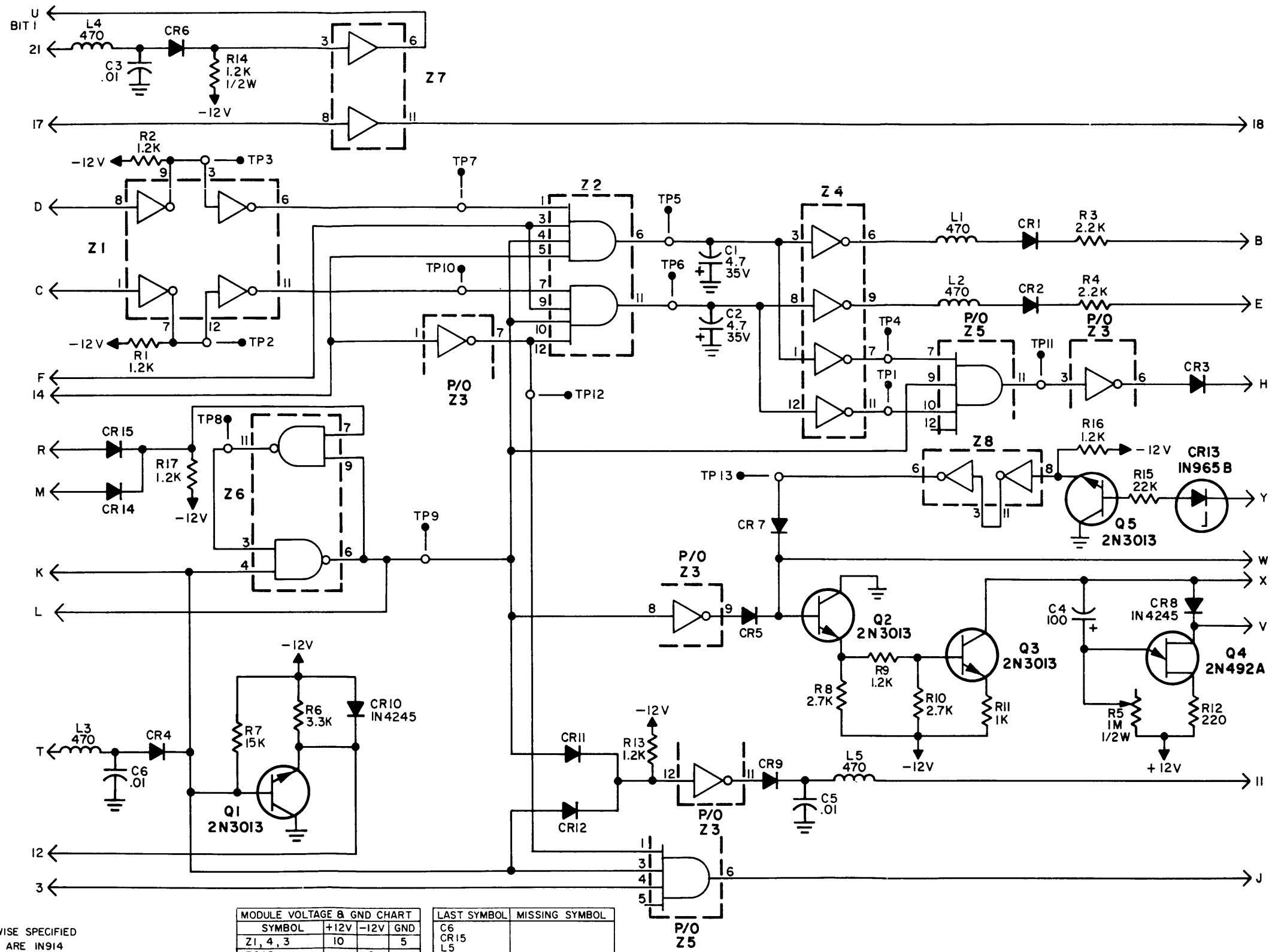
LAST SYMBOL	MISSING SYMBOL
C5	CR6
CR8	
L5	
R12	
TP15	
Z11	

CK1527

Figure 7-5. Gating Circuit A4, Schematic Diagram


PC478
A4737
Z1
Z2
Z3
Z4
Z5
Z6
Z7
Z8
Z9
Z10
Z11
CR7
CR8
L5
R27





UNLESS OTHERWISE SPECIFIED
1. ALL DIODES ARE IN914
2. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 W.
3. ALL CAPACITANCE VALUES ARE IN µµ FARADS.
4. ALL INDUCTANCE VALUES ARE IN µ HENRIES.

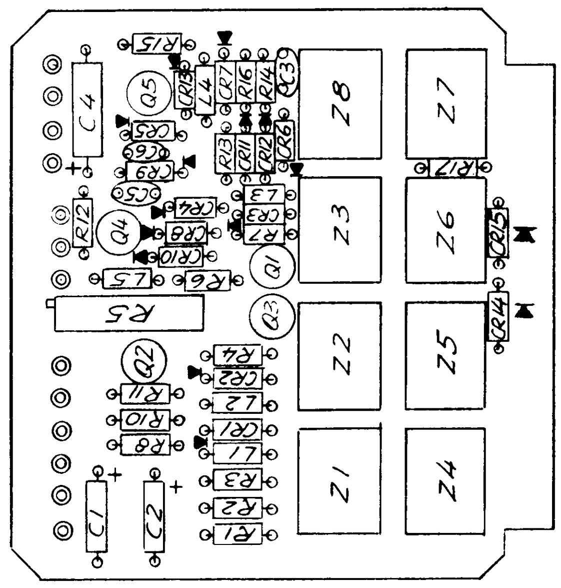
NOTE :
PARTIAL REFERENCE DESIGNATIONS SHOWN, FOR COMPLETE DESIGNATIONS PREFIX WITH UNIT NUMBER AND SUB - ASSEMBLY DESIGNATION(S) AS APPLICABLE.

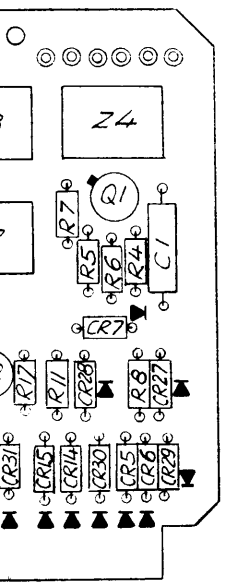
MODULE VOLTAGE & GND CHART			
SYMBOL	+12V	-12V	GND
Z1, 4, 3	10		5
Z2,5		2	
Z6	10	2	5
Z7		2	5
Z8	10	2,9	4,5

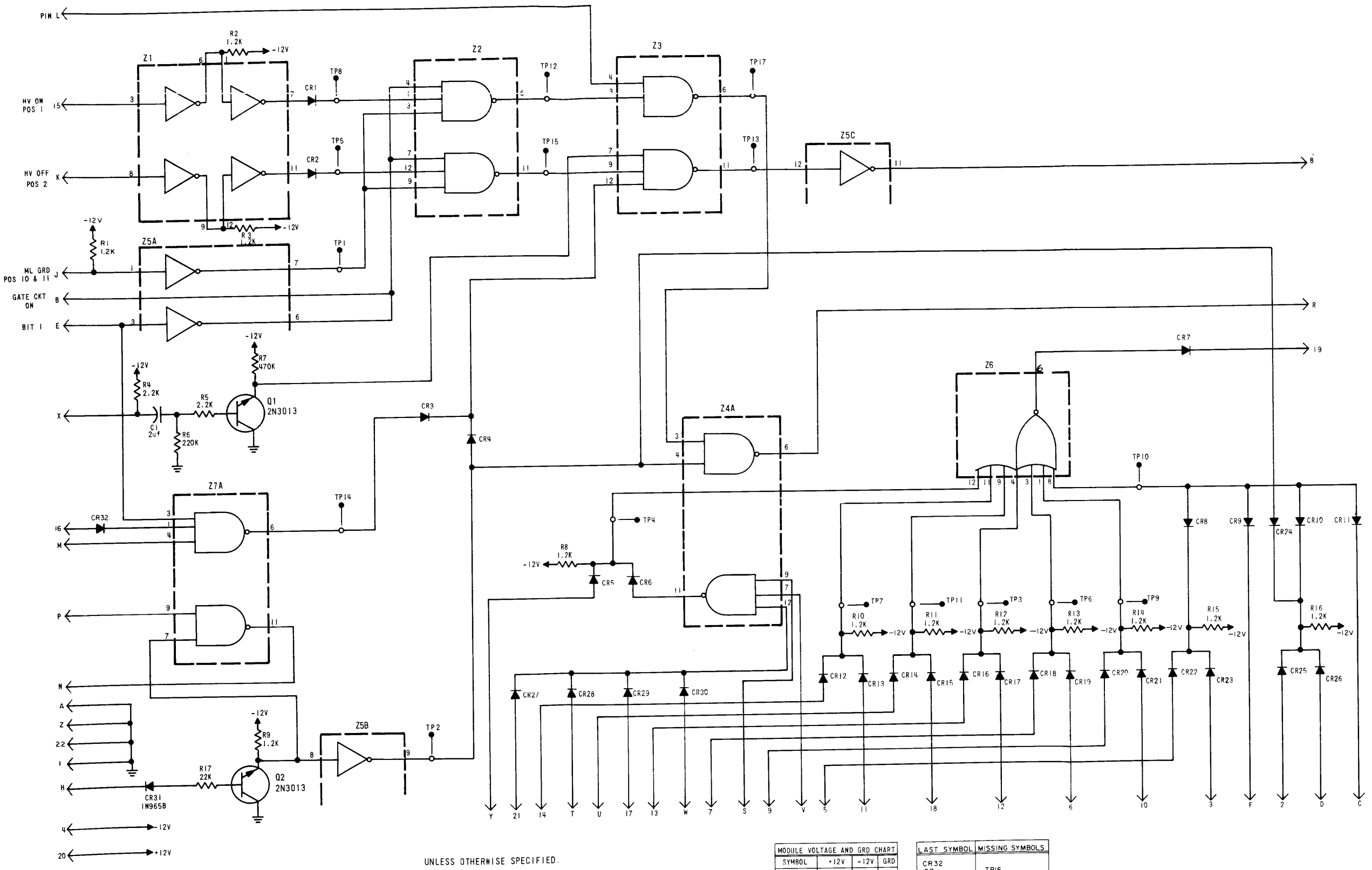
LAST SYMBOL	MISSING SYMBOL
C6	
CR15	
L5	
Q5	
R17	
TP13	
Z8	

CK1686

Figure 7-6. Stepping Switch Gating Circuit A5, Schematic Diagram


Z8
Z7
Z3
Z6
Z2
Z5
Z1
Z4
C4
R5
C1
C2
Q1
Q2
Q4
Q5





UNLESS OTHERWISE SPECIFIED.

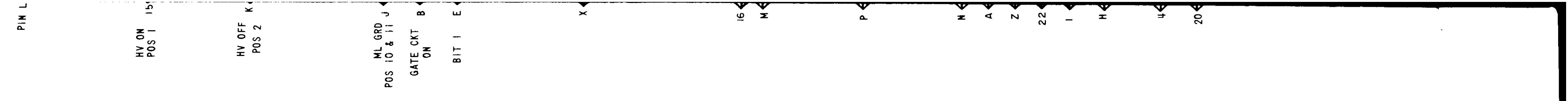
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4W.
2. ALL DIODES ARE IN914

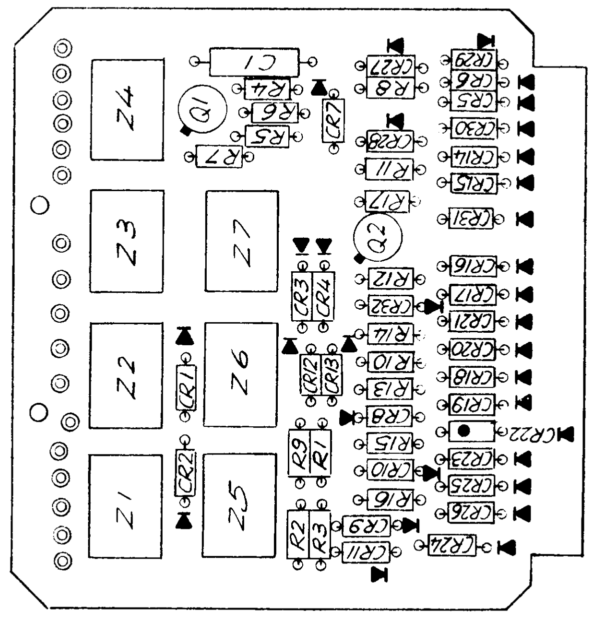
MODULE VOLTAGE AND GRD CHART			
SYMBOL	+12V	-12V	GRD
Z1.Z5	10		5
Z2.3.4.7	10	2	5
Z6	10	2	5

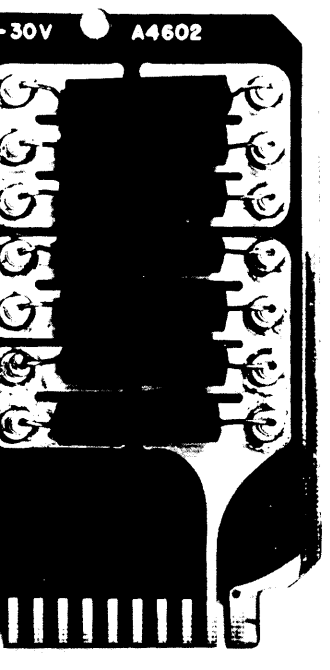
LAST SYMBOL	MISSING SYMBOLS
CR32 Q2 R17 TP17 Z6	TP16

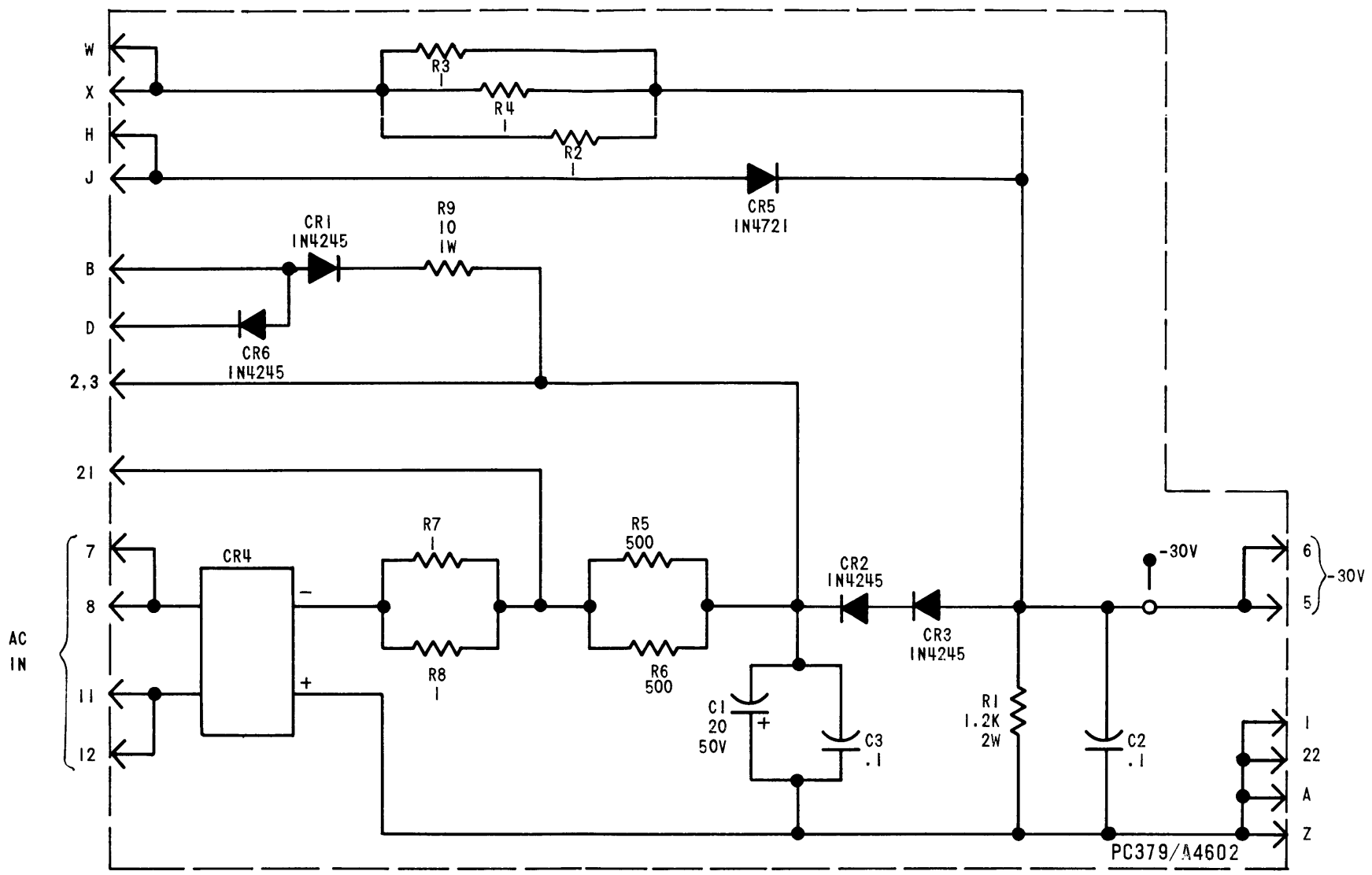
CK1666

Figure 7-7. H.V. On-Off Transmitter Readback Logic Circuit A6, Schematic Diagram


PIN
HV ON
POS 1
HV OFF
POS 2
ML GRD
POS 10 & 11
GATE CKT
ON
BIT 1







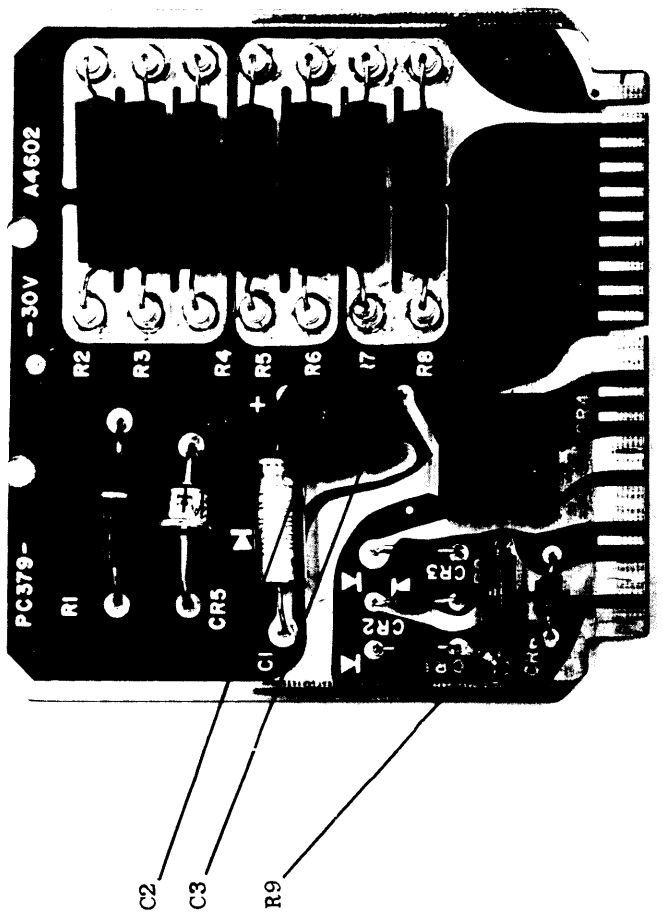
LAST SYMBOL	MISSING SYMBOL
C3	
CR6	
R9	

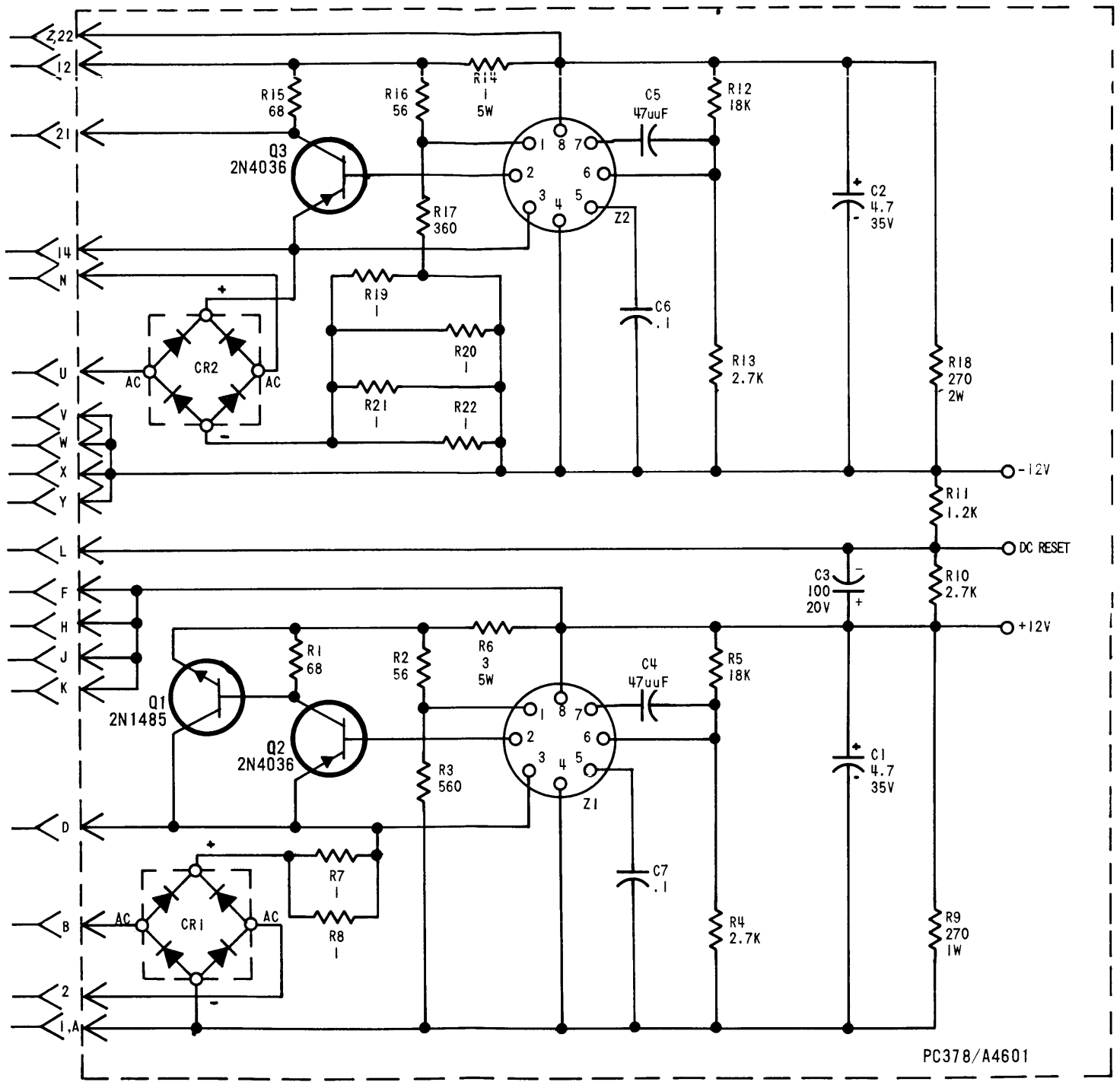
UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTANCE VALUES ARE IN OHMS, 5WATT
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS
3. PARTIAL REFERENCE DESIGNATION ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT NUMBER AND SUB-ASSEMBLY DESIGNATION(S) AS APPLICABLE

CK1524

Figure 7-8. -30V Power Supply A7, Schematic Diagram


A4602
-30V
PC379-
R1
CR5
C1
R2
R3
R4
R5
R6
R7
R8
CR2
CR3
C2
C3
R9



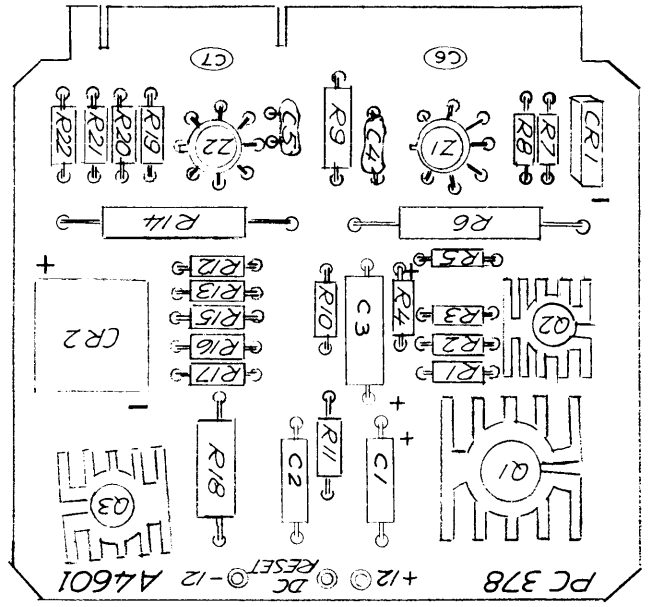
LAST SYMBOLS	MISSING SYMBOLS
C7	
CR2	
Q3	
R22	
Z2	

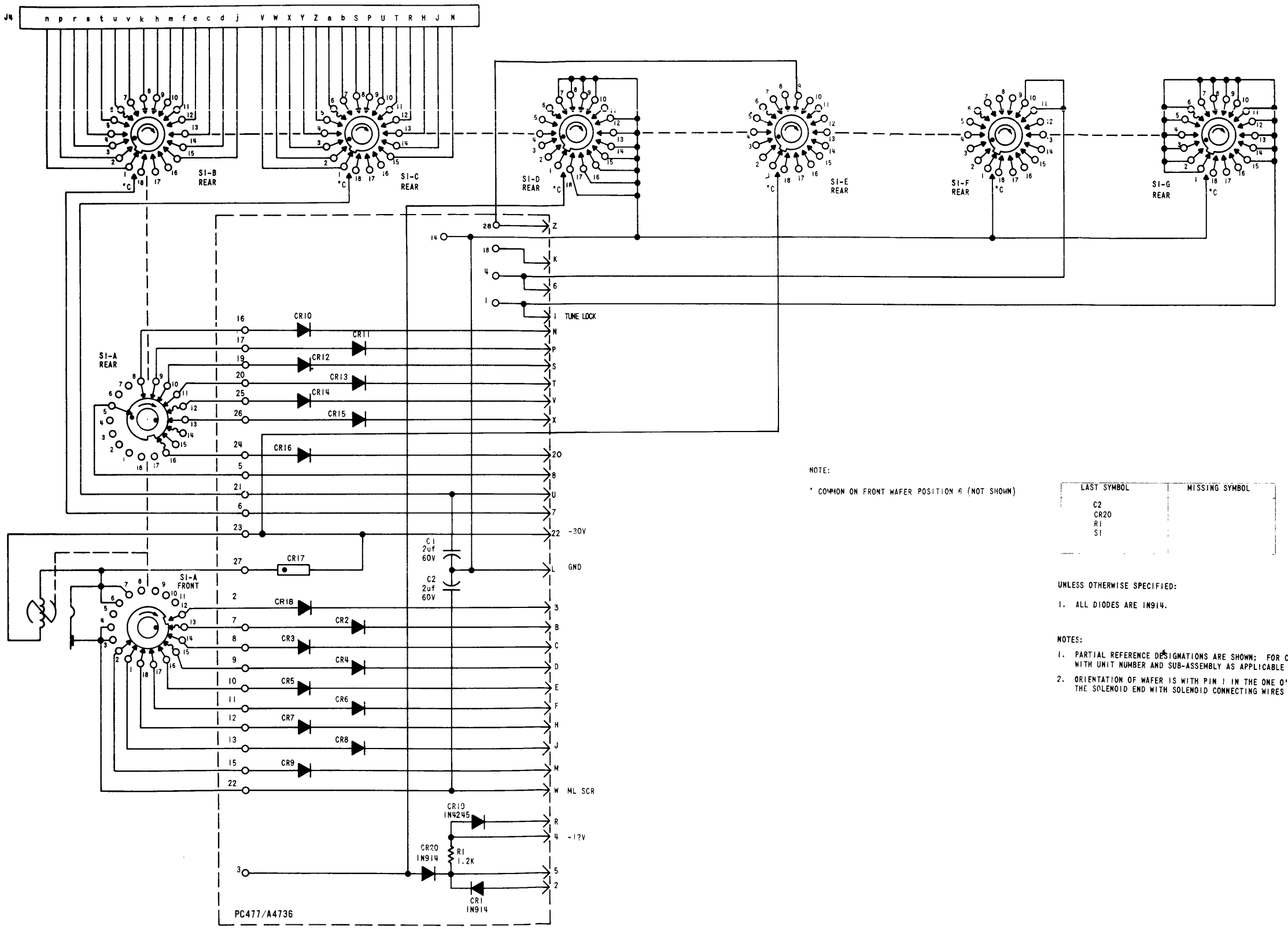
UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTANCE VALUES ARE IN OHMS, 1/2W
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS
3. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT NUMBER AND SUB-ASSEMBLY DESIGNATION(S) AS APPLICABLE

CK1401

Figure 7-9. +12V, -12V Power Supply A8, Schematic Diagram


PC 378
+12
DC RESET
-12
A4601
Q1
Q2
Q3
Z1
Z2
C1
C2
C3
C4
C5
C6
C7
CR1
CR2
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22



NOTE:

* COMMON ON FRONT WAFER POSITION 6 (NOT SHOWN)

LAST SYMBOL	MISSING SYMBOL
C2	
CR20	
R1	
S1	

UNLESS OTHERWISE SPECIFIED:

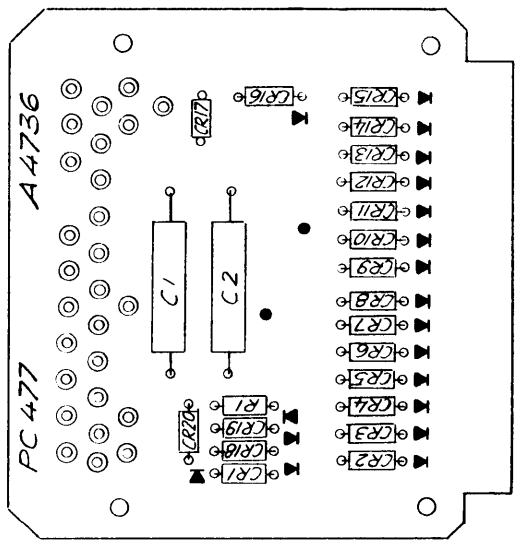
1. ALL DIODES ARE IN914.

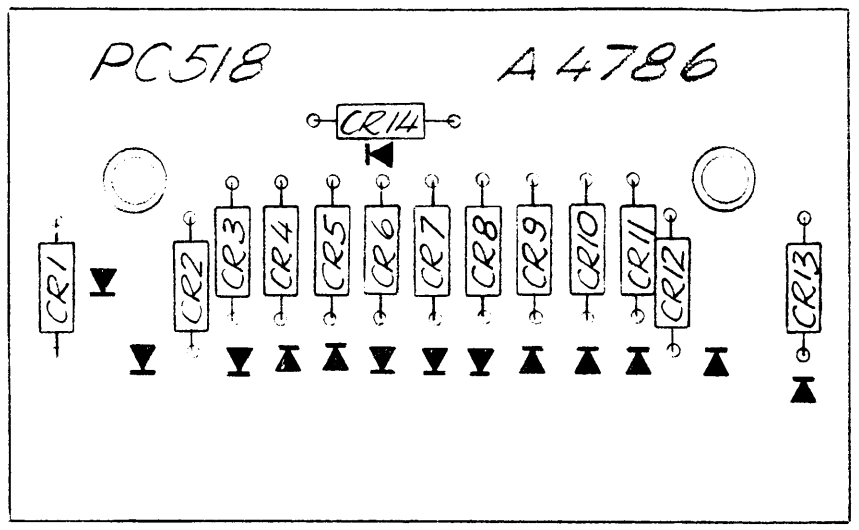
NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATIONS, PREFIX WITH UNIT NUMBER AND SUB-ASSEMBLY AS APPLICABLE
2. ORIENTATION OF WAFER IS WITH PIN 1 IN THE ONE O'CLOCK POSITION AS VIEWED FROM THE SOLENOID END WITH SOLENOID CONNECTING WIRES OR TERMINALS FACING DOWN.

CK1669

Figure 7-10. Master Stepping Switch and Gating Circuit A9, Schematic Diagram


PC 477
A4736
C1
C2
L1
L2
CR1
CR2
CR3
CR4
CR5
CR6
CR7
CR8
CR9
CR10
CR11
CR12
CR13
CR14
CR15
CR16
CR17
CR18
CR19
R1
R2



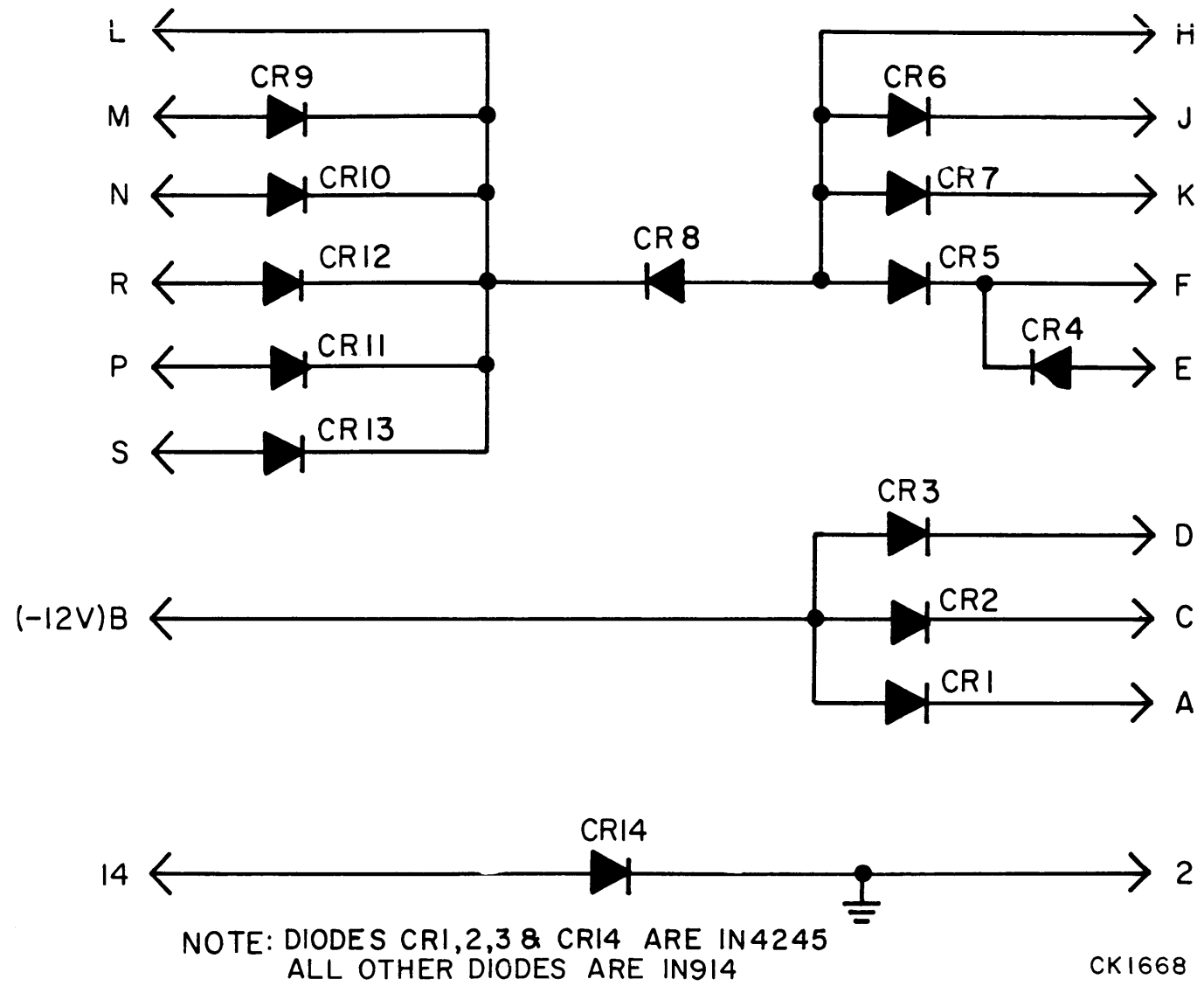


Figure 7-11. Gating Circuit A10, Schematic Diagram