UNCLASSIFIED

TECHNICAL MANUAL

for

SIGNAL CONTROL UNIT

MODEL SCU-3

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

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TABLE OF CONTENTS

TABLE OF CONTENTS (CONT)

LIST OF ILLUSTRATIONS

LIST OF TABLES

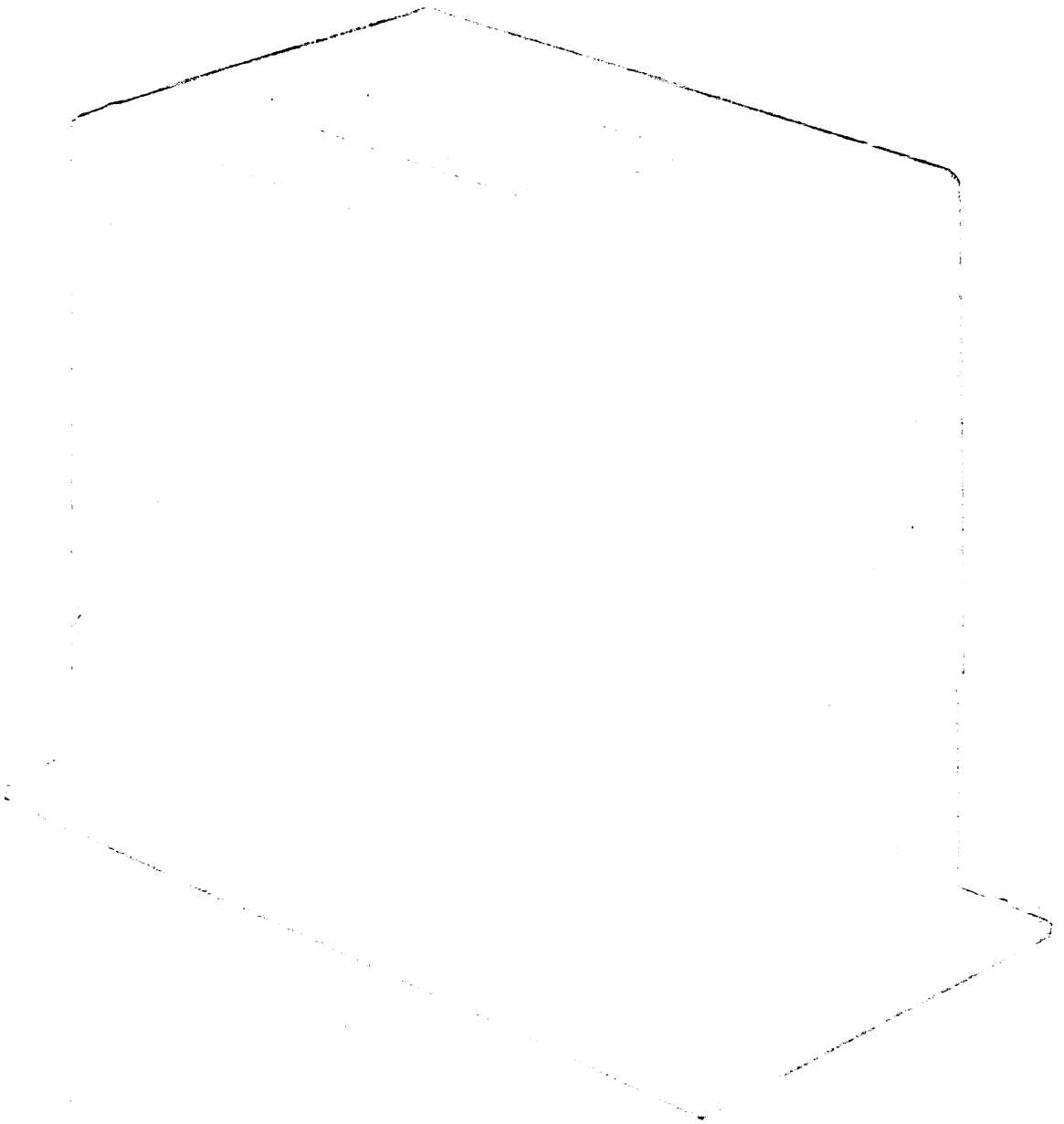


Figure 1-1. Signal Control Unit, Model SCU-3.

SECTION 1

GENERAL DESCRIPTION

1-1. GENERAL

SIGNAL CONTROL UNIT, MODEL SCU-3 (Figure 1-1) is an electronic device used to electrically control the starting and stopping of recording devices, such as teleprinters, tape recorders and ink tape recorders.

1-2. FUNCTIONAL DESCRIPTION

The SCU is designed specifically to prolong the life of drive motors on existing teleprinting machines. The SCU will hold any recording machine in an OFF condition until a signal is received, at which time the machine is instantaneously activated. During a transmission, the SCU will maintain the machine in an ON condition. At the completion of a transmission, when the circuit has been restored to a standby condition, the SCU will automatically stop the recording machine after a predetermined delay, which is adjustable from 10 seconds to 5 minutes.

A feature of the SCU is that it will always fail "safe." The failure of any tube, fuse or other component will automatically release the power relay, which will switch on the recording machine and leave it running until manually switched off. The circuit is so designed that the opening of the signal line will also energize the controlled machine.

1-3. TECHNICAL SPECIFICATIONS

INPUT POWER:	115/230 volts a-c, 50/60 cps, single phase.
CONTROLLED POWER:	Normally 115 volts a-c, 3 amperes.
SIGNAL LINE:	60 ma d-c (can also be supplied for 20 ma d-c).
KEYING SPEED:	Up to 100 words per minute.
PHYSICAL DIMENSIONS:	Unit: 7-inches long x 4-5/8 inches wide Base: 9-inches long x 4-5/8 inches wide Total height with base: 6-5/8 inches
WEIGHT:	7-3/4 lbs.

SECTION 2

INSTALLATION

2-1. INITIAL INSPECTION

Each SCU unit has been thoroughly checked and tested at the factory before shipment. Upon arrival at the operating site, inspect the packing case and its contents immediately for possible damage. Unpack the equipment carefully. Inspect all packing material for parts which may have been shipped as loose items.

With respect to damage to the equipment for which the carrier is liable, the Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

2-2. INITIAL INSTALLATION

Unless otherwise indicated, by an appropriate tag on the equipment, the SCU is factory wired for 115 volts a-c operation and for a signal line current of 60 ma d-c. A power cord, CA103 supplied as a loose item, is to be used for connection of the SCU to a standard a-c outlet.

Installation procedures are as follows:

a. Connect the SCU to an a-c source by means of the supplied power cord CA103. The female connector end is to be attached to the SCU INPUT twist-lock connector J101.

b. Connect signal and control cables to TB101 (figure 2-1).

c. Set toggle switch S101 on.

See Figure 2-1 for detailed interconnection diagram.
See Figure 2-2 for input voltage transformer changeover connections.

CAUTION

Terminal #2 of terminal block TB101 must be positive with respect to terminal #1.

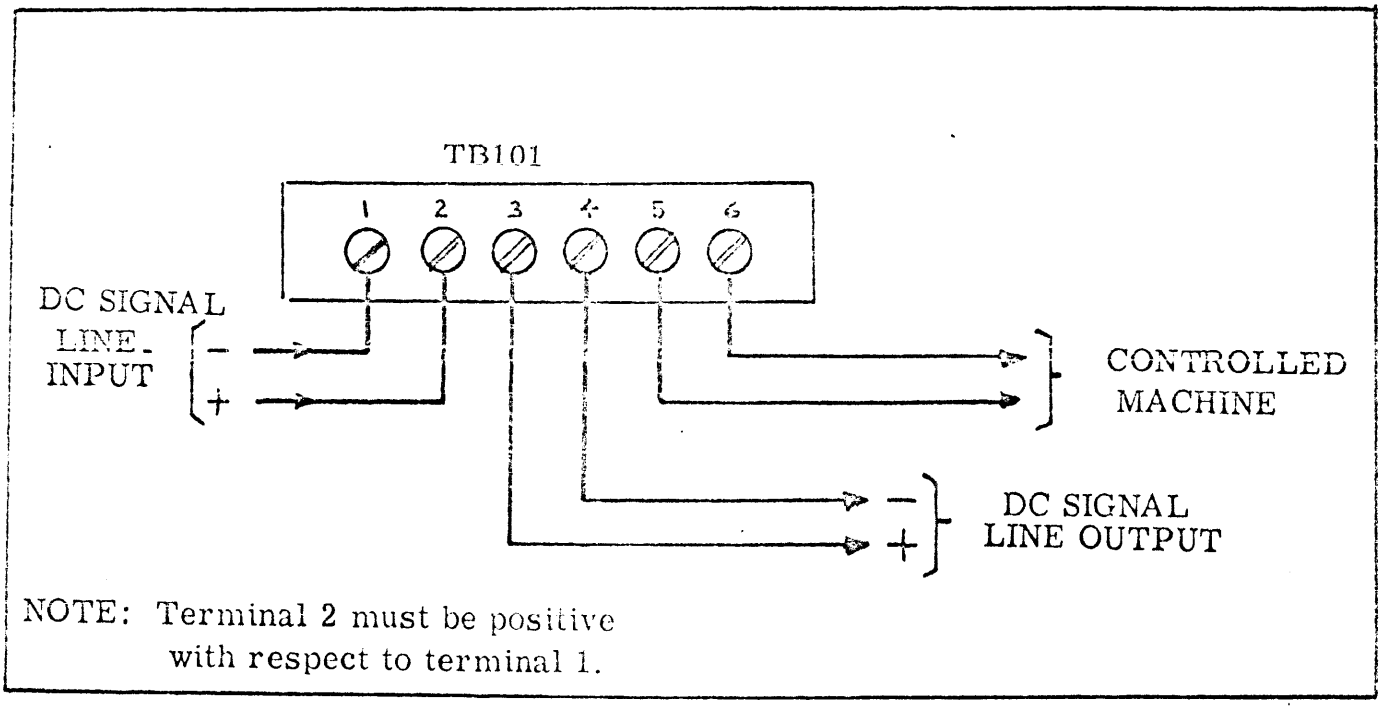


Figure 2-1. Interconnection Diagram

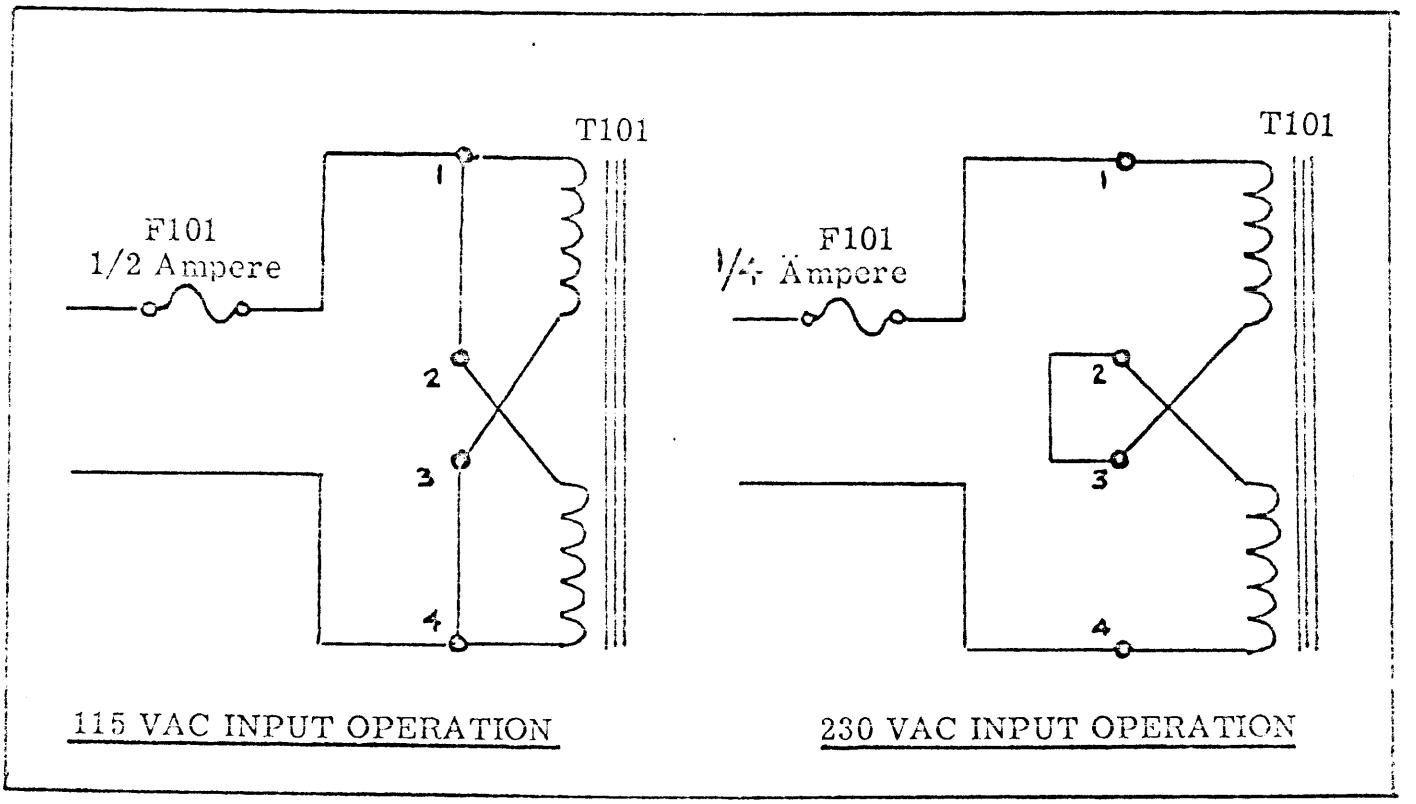


Figure 2-2. Input Voltage Changeover Connections

2-3. INITIAL ADJUSTMENTS

The SCU incorporates a provision for varing the time delay between input signal termination and recording machine shut-off. This time delay may be adjusted to suit various applications. The following steps outline a method of achieving this variable time delay.

a. Connect SCU as described in paragraph 2-2, with all units switched on.

b. Apply a 60 ma d-c signal line current, correctly polarized, to the input terminals 1 and 2 of terminal board TB101.

c. Relay K102 should energize, causing relay K101 to energize and turn on the recording machine.

d. Deenergize relay K102, by removing the d-c signal line current, and note the deenergizing time delay between K102 and K101.

e. Adjust the time delay potentiometer R104 slightly and repeat the above mentioned steps.

f. Keep repeating the above mentioned steps until the desired time delay between input signal termination (deenergizing relay K102) and recording machine shut-off (deenergizing relay K101) is attained.

The above mentioned time delay adjustment of R104 will provide a time delay of from approximately 10 seconds to approximately 5 minutes.

Refer to table 6-2 for detailed test and checkout procedures.

SECTION 3

OPERATOR'S SECTION

3-1. GENERAL

The SCU functions as an automatic switching unit for a recording machine, operating in conjunction with the received signal intelligence. The SCU, connected in series with the recording machine and the input d-c signal intelligence, automatically turns on or activates the recording machine when a signal is received, and turns off or deactivates the recording machine when a signal is not received.

3-2. OPERATOR'S INSTRUCTIONS

Due to the automatic functioning of the SCU, there are no operator's requirements other than the operator's maintenance explained in the following paragraph.

3-3. OPERATOR'S MAINTENANCE

The Operator is required to perform all the necessary precautions to keep the SCU from being inoperative due to environmental or minor fault causing effects.

Therefore, equipment cleanliness and secure interconnections must be maintained. However, should a fault occur, a check of the interconnects and associated equipment levels to the SCU may clear the fault. A check of the protective fuses may also be necessary.

NOTE

Never replace a fuse with one of a higher rating unless continued operation is more important than probable damage to the equipment. If a fuse burns out immediately after replacement, do not replace it a second time until the trouble has been located and corrected.

Table 3-1. Control Functions

CONTROL DESIGNATION	FUNCTION
ON/OFF, toggle switch S101	When switched ON, SCU starts controlled machine only when d-c signal intelligence is received. When switched OFF, SCU automatically starts the controlled machine, unless machine is manually switched off.
R104, screwdriver adjust	Time delay control; adjustable from approximately 10 seconds to approximately 5 minutes. Used to adjust time lag between input d-c signal intelligence ending and controlled machine shut-off.
F101, fuse; cartridge	Input line protective fuse. 1/2 ampere for 115 vac operation, 1/4 ampere for 230 vac operation.
F102, fuse; cartridge	Operating voltage protective fuse, 1/32 ampere slow-blowing.
J101, a-c input receptacle	Twist-lock male connector, to mate with female connector end of a-c cable CA102 for a-c input line voltage to SCU.

SECTION 4

PRINCIPLES OF OPERATION

4-1. INTRODUCTION

When the SCU is connected in series with the d-c line carrying intelligence to a recording machine, a set of contacts in the SCU will automatically control the starting and stopping of the recording machine. During transmission of signal intelligence, the SCU will allow activation of the recording machine and maintains this condition. At the completion of transmission, when the circuit has been restored to "standby" condition, the SCU will open or shut-off the recording machine.

4-2. CIRCUIT DESCRIPTION (see figure 4-1)

The normal condition for operation of the SCU is considered to be at that part of the sequence of operation when no signals are being passed. At this point, a 60 ma d-c line (holding) current is present. In this condition, relay K102 is energized causing contacts 1 and 2 to open, thus removing the negative bias from the grid of relay amplifier V103. This condition causes the plate current of V103 to increase, energizing relay K101 thus opening its microswitch contacts 1 and 2. The remote recording machine, connected across terminals 5 and 6 of TB101, is therefore opened or deactivated.

When an interrupted 60 ma d-c signal is received, at terminal 1 of TB101, relay K102 deenergizes on the first pulse, causing contacts 1 and 2 to close. A negative bias is then applied to the grid of V103

causing the plate current to decrease, thus deenergizing relay K101. The microswitch contacts 1 and 2 of K101 are now closed, thus providing a closed circuit to the remote recording machine connected across terminals 5 and 6 of TB101.

During the process of interrupted pulses on the signal line, the negative bias on V103 is maintained by the charge on capacitor C102.

When the line signal ceases uninterrupted, a holding current is introduced (normal condition) and relay K102 will energize or open. This condition will remain until capacitor C102 discharges through resistors R103 and R104. This CR time constant can be varied by adjustment of time delay potentiometer R104.

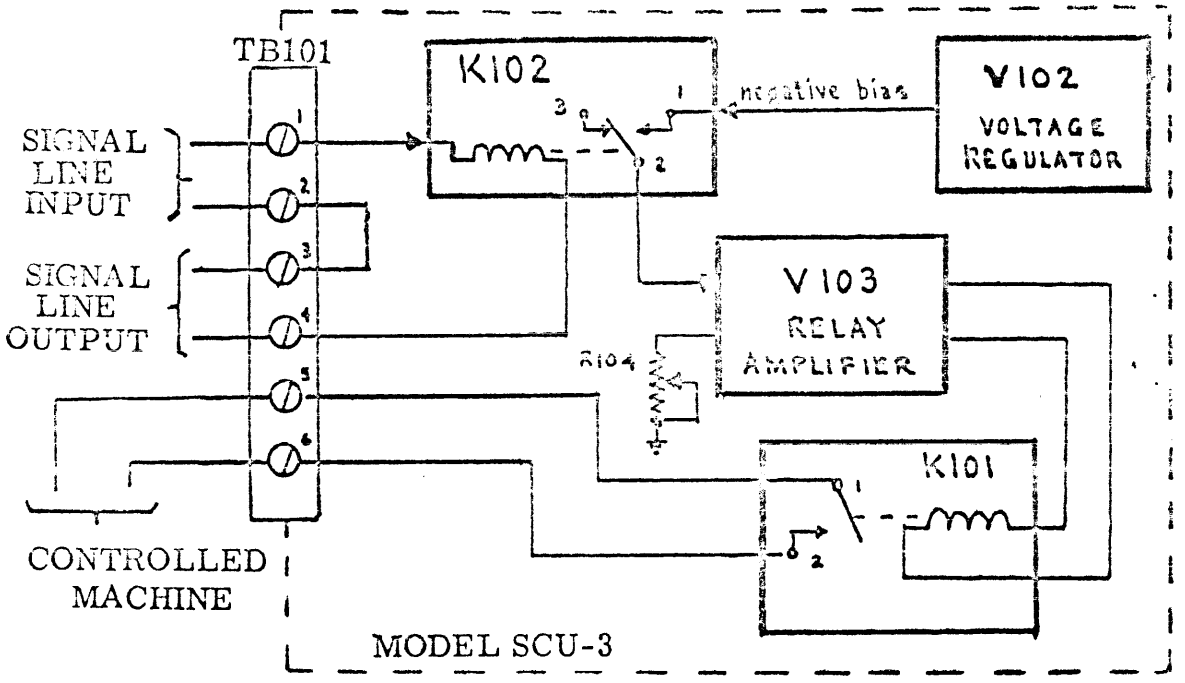


Figure 4-1. Circuit Block Diagram

SECTION 5

TROUBLESHOOTING

5-1. INTRODUCTION

This section explains how to locate and diagnose equipment troubles. By proper use of the various troubleshooting aids provided in this manual, the technician can locate and diagnose the fault at hand.

The following troubleshooting aids are provided.

a. Troubleshooting techniques (paragraph 5-2).

b. Circuit Block Diagram (figure 4-1).

c. Schematic Diagram (figure 8-1).

5-2. TROUBLESHOOTING TECHNIQUES

When a piece of equipment has been operating satisfactorily and suddenly fails, the cause of failure may be due to circumstances occuring at the time of failure or due to symptoms of past failures. Therefore, the first check is to ascertain that proper equipment operating voltages are present and that all fuses and interconnecting cables are in proper functional condition.

If the above mentioned checks fail to locate the fault, the unit dust covers should be removed, and visually checked for burned elements, charring, corrosion, arcing, excessive heat, dirt, dampness or any other harmful condition.

If the fault is still not located, the technician should then proceed with the troubleshooting procedure listed in table 5-1.

Table 5-1. Troubleshooting Procedure

STEP	OPERATION
1	Check for proper signal input level to terminal 1 of TB101. Static condition: steady 60 ma d-c. Operating condition: interrupted current.
2	Check operating condition of tubes V101, V102 and V103.
3	Check condition of relays K101 and K102 for open solenoid or sticking contacts.
4	Check condition of capacitors C101 and C102. If one section of the dual-section capacitor is suspected of being defective, remove the two capacitors from their sockets and replace in reverse, thereby utilizing the spare sections as a substitute or replacement for the suspected or defective capacitor section.
5	Perform continuity check at transformer T101 primary and secondary windings.
6	Perform point to point continuity check of the entire unit circuitry, using schematic diagram for references.

SECTION 6

MAINTENANCE

6-1. INTRODUCTION

Maintenance of the SCU will consist mainly of component replacement and minor touch-up adjustments. When replacing a defective component, care should be exercised in selecting the exact replacement or equivalent component, as listed in Section 7 parts list, and for correct positioning and polarity.

6-2. PREVENTIVE MAINTENANCE

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

b. At periodic intervals, the equipment should be removed from its mounting for cleaning and inspecition. All accessible covers should be removed and the wiring and all components inspected for dirt, corrosion, charring, discoloring or grease. Remove dust with a soft brush or vacuum cleaner. Remove dirt or grease from other parts with any suitable cleaning solvent. Use of carbon tetrachloride should be avoided due to its highly toix effects. Trichlorethylene or methyl chloroform may be used, providing the necessary precautions are observed.

WARNING

When using toxix solvents, make certain that adequate ventilation exists. Avoid prolonged or re-

peated contact with skin. Flammable solvents shall not be used on energized equipment or near any equipment from which a spark may be received. Smoking, "hot work," etc. is prohibited in the immediate area.

CAUTION

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

6-3. CORRECTIVE MAINTENANCE

The two plug-in capacitors C101 and C102 are dual section capacitors having the same value in both sections. Therefore, if either section of these capacitors become defective, the second section may be plugged into the circuit as a replacement.

The relay contacts should be cleaned periodically with an approved type of contact cleaner, while normal precautions should be taken against accumulation of dust and other foreign matter particularly in or near the relay mechanisms.

It should be noted that R105 and CR101 combined with the contact tension setting of relay K102 is designed to prevent relay chattering. Should relay K102 chatter, the contact spring setting should be adjusted to prevent this condition which cause noise and contact wear.

See figure 6-1 for component locations.

NOTE

All setting should be checked with a mark line current of 60 ma, correctly polarized.

Table 6-1. Test Equipment Required

ITEM	MANUFACTURER
Square Wave Generator	Measurements, Model 71 or equivalent
Isolation Keyer	TMC Model ISK or equivalent
DC Power Supply	TMC Model PSP-1 or equivalent
Oscilloscope	Tektronic, Model 543 or equivalent
Multimeter	Simpson, Model 260 or equivalent
One 100 ohm 2 watt resistor	Any manufacturer meeting the necessary specifications.
Watch with sweep second hand	Any manufacturer meeting the necessary specifications.

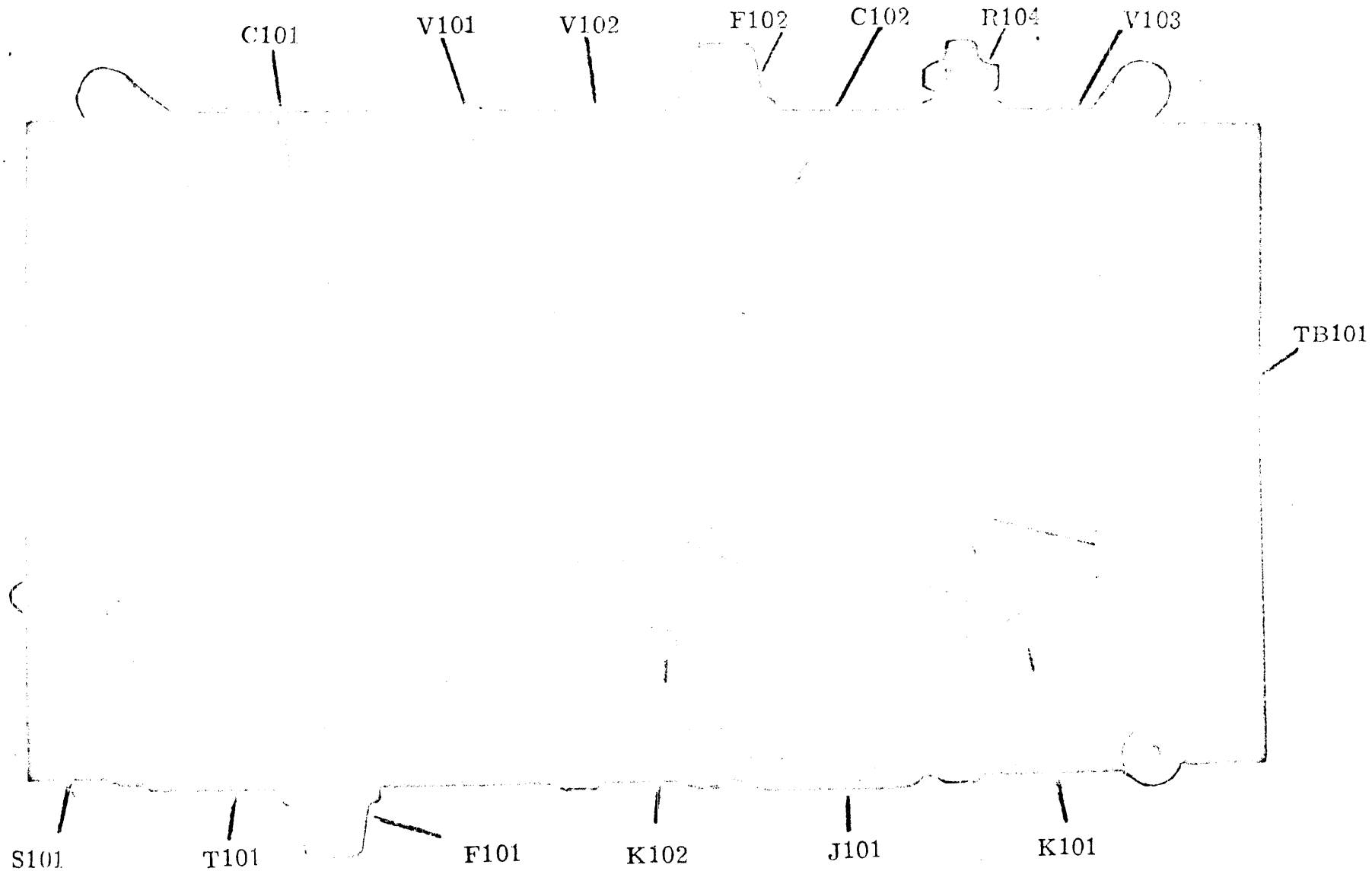


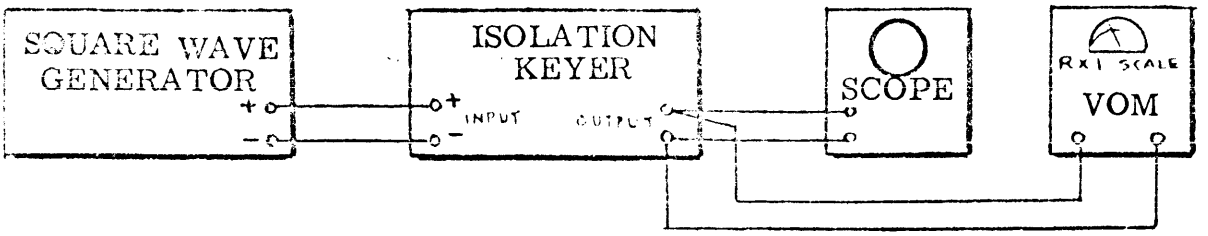
Figure 6-1. Component Locations, Top View

Table 6-2. Test Procedure

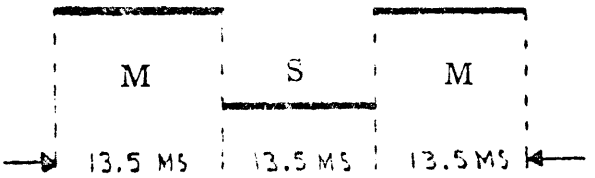
STEP	OPERATION
1	Connect test set-up as shown in figure 6-2a.
2	Set isolation keyer unit mode switch to 50 volts position and apply power to both units.
3	Adjust square wave generator for an output of 38 cps (equivalent to 100 words per minute employing 7.42 unit TTY code).
4	Carefully adjust the threshold control of the isolation keyer unit until the pattern on the oscilloscope indicates equal marks and spaces (time interval of 13.5 ms each). See figure 6-2b. The isolation keyer unit is now set for zero signal bias at 100 WPM keying speed.
5	Connect test set-up as shown in figure 6-2c.
6	Observe for proper polarization of the 60 ma keying circuit and apply power to all units.
7	Place the 60 ma keying circuit on steaky mark (closed) by shorting the isolation keyer unit output terminals with a jumper.
8	Adjust the power supply unit for an output current of 60 ma.
9	Remove jumper from isolation keyer unit output terminals.
10	Set SCU-3 time delay adjust R104 fully counterclockwise for minimum delay.
11	With the square wave generator set for an output of 38 cps (100 wpm), the ohmmeter, connected across terminals 5 and 6 of the SCU-3, should indicate a closed circuit i.e., K101 deenergized.

Table 6-2. Test Procedure (cont)

STEP	OPERATION
12	Short the output terminals of the isolation keyer unit with a jumper, to obtain a steady mark signal. After 10 seconds or less, the ohmmeter connected across terminals 5 and 6 of the SCU-3 should indicate an open circuit i.e., K101 energized and its contacts open.
13	Remove jumper from isolation keyer unit output terminals.
14	With the square wave generator set for an output of 38 cps (100 wpm), relay K101 should deenergize on the first interruption of the steady mark condition and close its contacts. The ohmmeter connected across terminals 5 and 6 of the SCU-3 should indicate a closed circuit.
15	Set SCU-3 time delay adjust R104 fully clockwise for maximum delay.
16	Short the output terminals of the isolation keyer unit with a jumper, to obtain a steady mark signal. After 5 minutes or more, the ohmmeter connected across terminals 5 and 6 of the SCU-3 should indicate an open circuit i.e., K101 energized and its contacts open.
17	Remove jumper from isolation keyer unit output terminals.
18	With the square wave generator set for an output of 38 cps (100 wpm), observe for an oscilloscope pattern as shown in figure 6-2d. Oscilloscope is connected across a 100 ohm resistor connected to terminals 3 and 4 of the SCU-3. The time intervals for the marks and spaces should be approximately equal (within 10%).



a.



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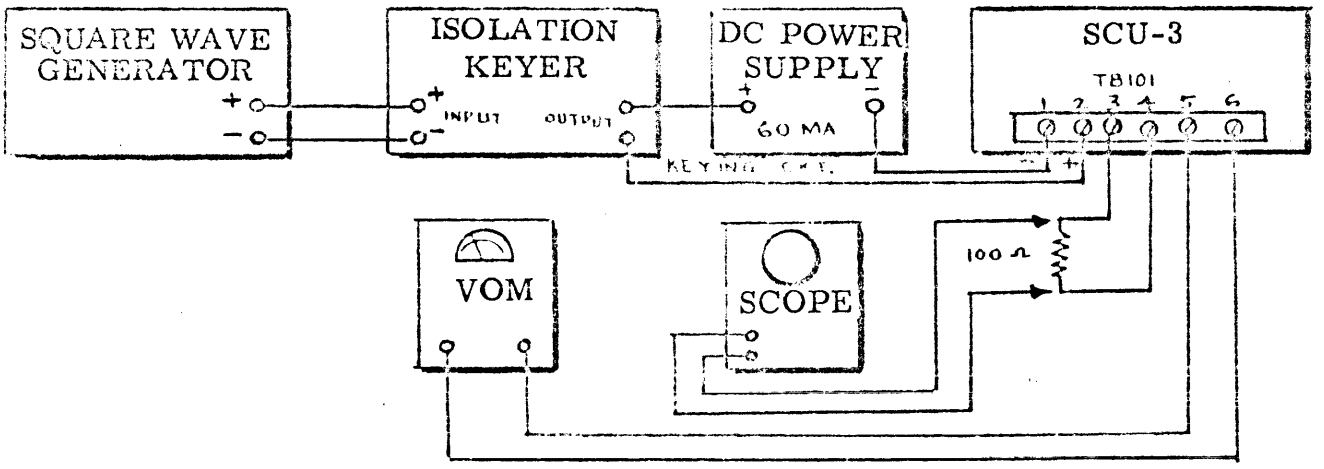

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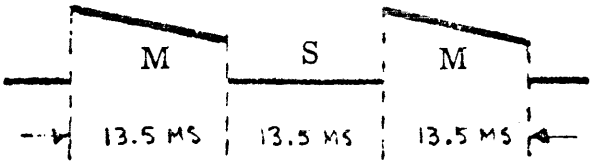

d.

Figure 6-2. Test Set-up Diagrams.

SECTION 7

PARTS LIST

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C101	CAPACITOR: fixed, dry electrolytic, polarized 20 - 20 uf, 450 VDCW.	CE52F200R
C102	Same as C101	
CR101	DIODE: germanium, 1N478.	1N478
F101	FUSE: cartridge, 1/2 amp.	FU-100-.500
F102	FUSE: cartridge, slow-blowing, 1/32 amp.	FU-102-.032
J101	CONNECTOR: receptacle, male twist lock	JJ-100
P101	CONNECTOR: plug p/o W101.	
R101	RESISTOR: fixed, wirewound, 15,000 ohms, 10 watts.	RW-109-36
R102	RESISTOR: fixed, composition, 470 ohms, $\pm$10%, 1/2 watt.	RC20GF471K
R103	RESISTOR: fixed, composition, 100,000 ohms, $\pm$10%, 1/2 watt.	RC20GF104K
R104	RESISTOR: variable, composition, 5 megohms, 2 watts no switch, locking slotted shaft, 5/8 inch shaft, linear taper, 10%.	RV4ATXA505A
R105	RESISTOR: fixed, composition, 100 ohms, $\pm$10%, 1 watt.	RC30GF101K
K101	RELAY: 1 form B microswitch contact, 2000 ohm coil, octal pin plug.	RL-10008
K102	RELAY: type C, .1 form C code 4 contact, 100 ohm coil, octal pin plug.	RL-10009
S101	SWITCH: toggle, DPST, 1 amp, 250 volts.	ST-22K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
T101	TRANSFORMER: power; primary: 110/220 volts 50/60 CPS, single phase; secondary #1: 250-0-250 volts RMS, 35 ma DC; secondary #2: 6.3 volts center tapped at 3 amps; insulated for 1000 volts.	TF-126
TB101	BOARD: terminal, 6 6-3/2 x 1/4 inch binder head machine screws, black bakelite body, with 1/16" bakelite marker plate and 2 clips.	TM-100-6
V101	TUBE: electron, 7 pin miniature.	6X4
V102	TUBE: electron, 7 pin miniature.	OA2
V103	TUBE: electron, 9 pin miniature.	12AU7
W101	CORD ASSEMBLY: power, 6 foot, rubber covered, 2-prong plug one end, female twist-lock receptacle other end.	CA-103-72
XC101	SOCKET: tube, octal.	TS101P01
XC102	Same as XC101	
XF101	HOLDER: fuse.	FH-10001-1
XF102	Same as XF101	
XK101	SOCKET: octal, moulded-in-plate.	TS-121
XK102	Same as XK101	
XV101	SOCKET: tube, 7 pin miniature.	TS102PO1
XV102	Same as XV101	
XV103	SOCKET: tube, 9 pin miniature.	TS103PO1

SECTION 8

SCHEMATIC DIAGRAMS

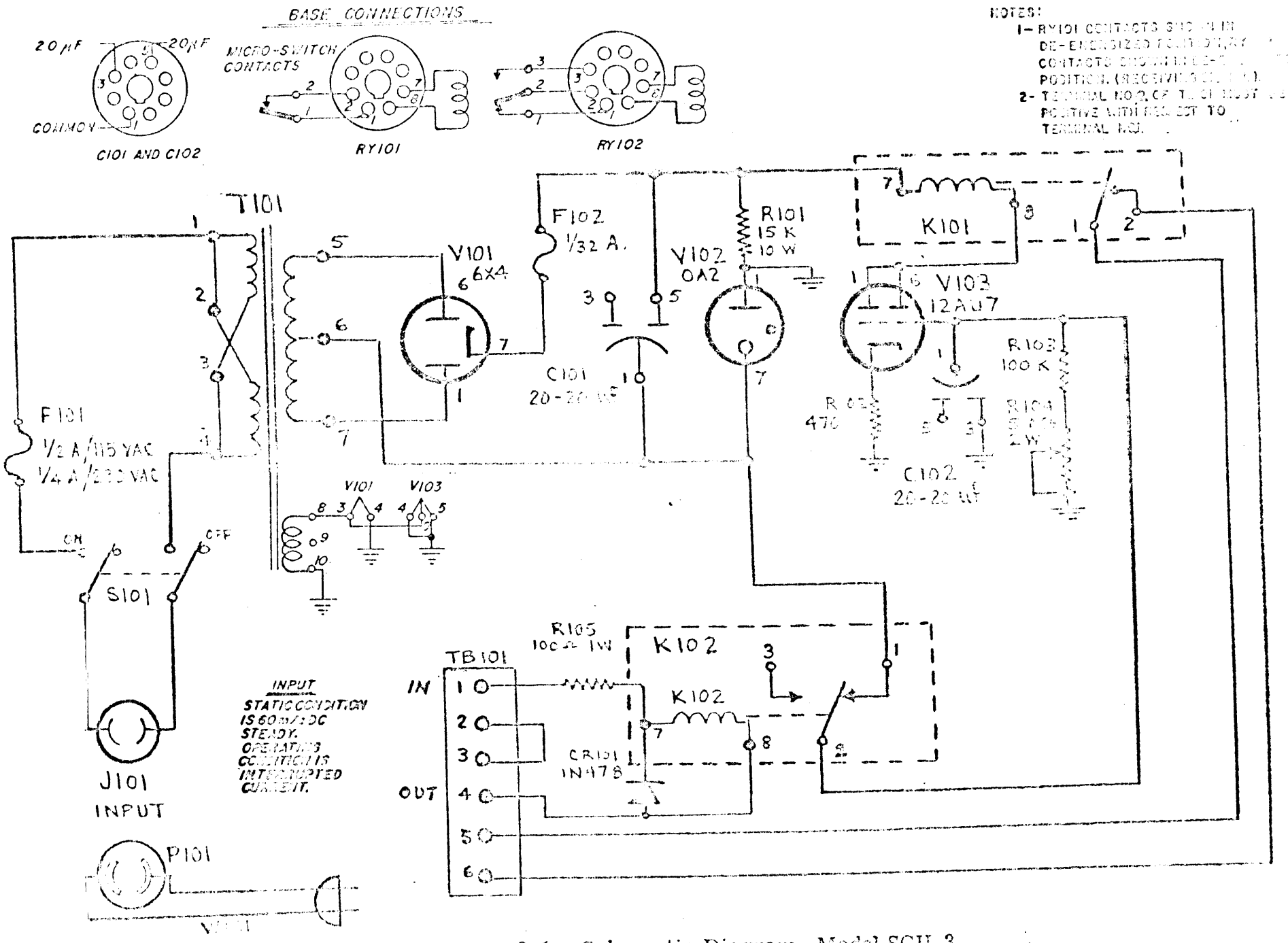

Figure 8-1. Schematic Diagram, Model SCU-3