INSTRUCTION MANUAL

COMPUTER OF AVERAGE TRANSIENTS
CAT ACCESSORIES
SERIES 600

EXECUTIVE SALES OFFICE
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INTRODUCTION

1.0 GENERAL

The Series 600 accessories have been designed for use with the MNEMOTRON Computer of Average Transients (CAT). They provide the CAT with additional features which greatly expand its capabilities and operation. The following list outlines the current Series 600 accessories with a brief description of their functions. (See figures 1–1, 1–2.)

This manual includes operating instructions of all Series 600 accessories, theory, maintenance, and associated information necessary for their use. The MNEMOTRON Division of Technical Measurement Corporation provides complete service and repair facilities to meet any contingency not covered in this instruction manual. Contact Service Department, 441 Washington Avenue, North Haven, Connecticut, for appropriate information.

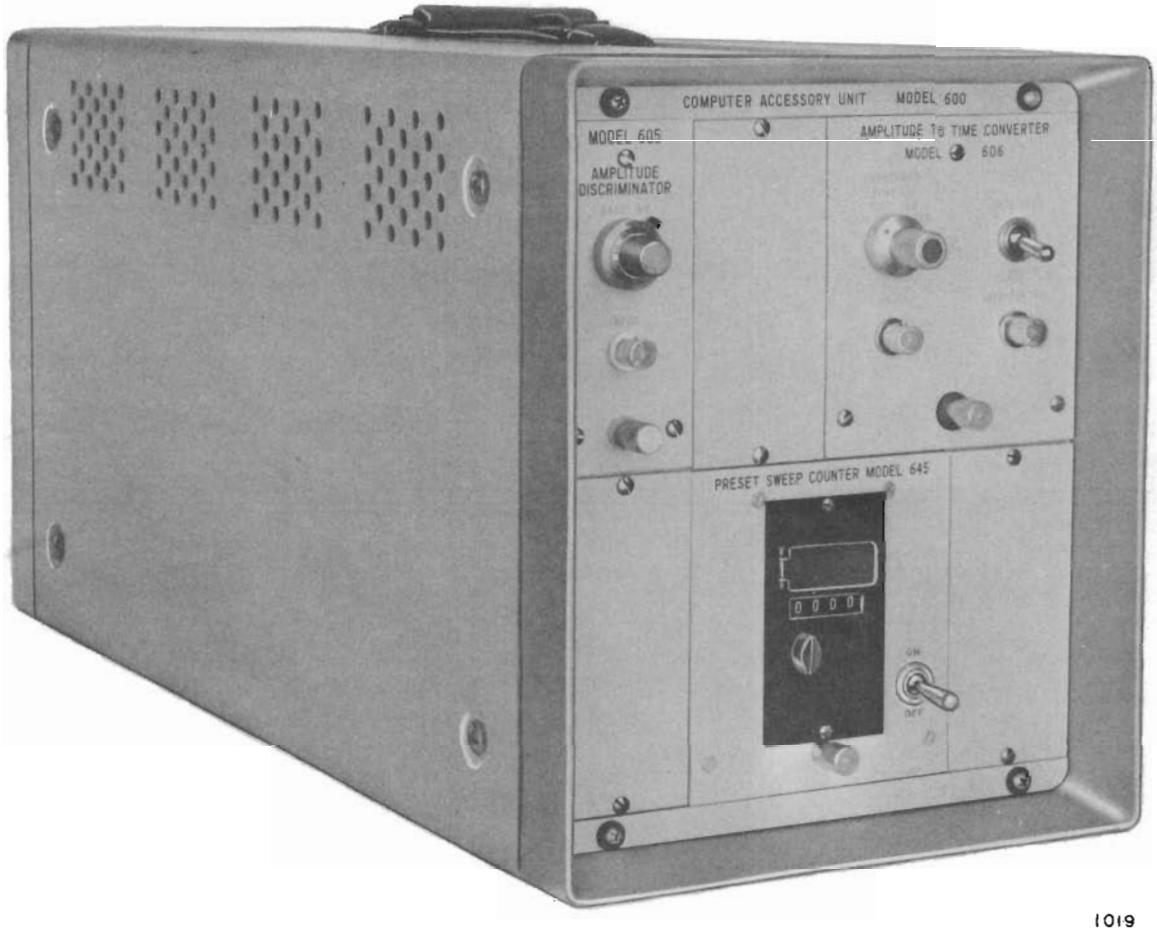

Figure 1–1. Series 600 CAT Accessory Cabinet showing Model 605 Amplitude Discriminator, Model 606 Amplitude-to-Time Converter, and Model 645 Preset Sweep Counter.

SERIES 600 ACCESSORIES

Model No.	*Name*	*Function*
600	CAT ACCESSORY CABINET	Houses Series 600 Accessories. Contains internal power supply for all connected accessories Provides for all necessary connections to CAT and ancillary equipment.
605	AMPLITUDE DISCRIMINATOR	Contains adjustable baseline voltage selector. Transmits a pulse to CAT when preselected baseline amplitude is exceeded, followed by a pulse when voltage drops below preset amplitude.
606	AMPLITUDE-TO-TIME CONVERTER	Sorts input signals from 0.5 to ten volts into 400 memory addresses. The CAT receives this programmed data and deposits one count into an address proportional to the amplitude of the input signal.
620	READOUT CONTROL (retrace suppressor)	Eliminates visible traces on associated X-Y plotters when more than one trace is utilized.
635	MEMORY RESET UNIT	Permits manual reset of any memory quarter in the CAT.
645	PRESET SWEEP COUNTER	Permits manual selection of number of CAT analysis sweeps and terminates operation when preset number has been reached. Electromechanically displays sweep numbers downward from preselection to 0000.
646	PRESET SWEEP COUNTER	Permits manual selection of number of CAT analysis sweeps and terminates operation when preset number has been reached. Electronically display sweep numbers upward from zero to preselected number.

CABLES

3-BNC Cables	Connections from:
(Used only with Models 605 & 606)	J601 to CAT J101
(Used only with Models 605 & 606)	J602 to CAT J107
(Used only with Model 606)	J603 to CAT J103
1-Cable	Connections from J103 to CAT J110, J111, J112
1-Cable	Connections from J109A to CAT J109
1-Cable	3-wire connection to AC power

1.1 DESIGN FEATURES

1.1.1 CAT ACCESSORY CABINET, MODEL 600

PORTABILITY—Provides a convenient carrying case less than 1 cubic foot in size. With its full complement of units the cabinet weighs less than 35 lbs.

FLEXIBILITY—All accessories may be plugged into any cabinet position for proper CAT operation. Every unit, regardless of size, will mate with any cabinet connector. This permits a wide choice of accessory applications without the necessity of storing the modules when not specifically in use.

NOTE

One exception, the Preset Sweep Counter, Model 646 must be positioned in the upper portion of the cabinet when used with MNEMOTRON Model 520 Type-Punch-Read Control Unit.

COMPATIBILITY—The 600 cabinet connects directly to the CAT and requires no intermediate equipment. External output equipment is connected to the 600 cabinet rather than the CAT.

INTEGRATION—All functions of the various accessories are completely operational within the 600 cabinet. A power supply integral to the unit provides all required operating voltages. Plug-in type connectors automatically supply all necessary voltages and signals when accessory units are inserted in the 600 cabinet. Cabinet connectors are keyed to identical connectors in the CAT. The mating of cabinet and CAT assures foolproof interconnection and ease of cabling.

1.1.2 SERIES 600 ACCESSORIES

COMPACTNESS—Series 600 accessories have been designed to minimum space requirements. This permits as many CAT accessory applications as possible within one 600 cabinet.

TRANSISTORIZATION—The modules are completely transistorized. All components are mounted on printed circuit boards to insure reliable operation under rugged environmental conditions.

PLUG-IN CARDS—Plug-in circuit board cards are used throughout the units, providing simple replacement when necessary.

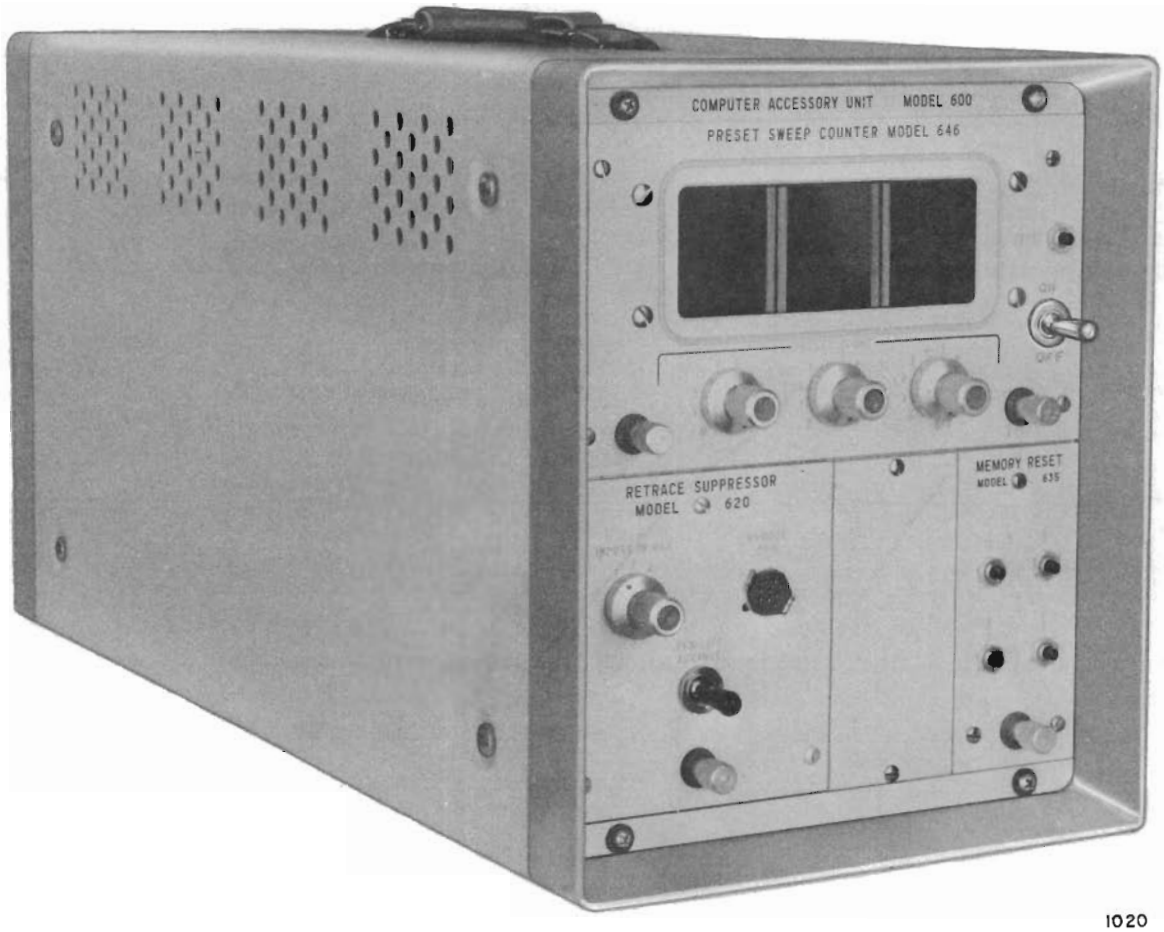

Figure 1–2. Series 600 CAT Accessory Cabinet showing Model 620 Readout Control, Model 635 Memory Reset Unit, and Model 646 Preset Sweep Counter.

1.2 SPECIFICATIONS

1.2.1 ELECTRICAL CHARACTERISTICS

1.2.1.1 CAT Accessory Cabinet

Input Voltage	105–125 VAC, 50–400 cps 210–250 VAC (on request)
Maximum Power Input	Approximately 25 Watts

1.2.1.2 Amplitude Discriminator

Input Voltage (maximum)	10 Volts, Single Ended
Input Impedance	33,000 Ohms
Baseline Range	Linear over +200 Millivolts to +10 Volts

1.2.1.3 Amplitude-to-Time Converter

Input Signal Voltage (maximum)	10 Volts
Input Signal Impedance (minimum)	10,000 Ohms
Gate Input Voltage (maximum)	50 Volts
Gate Input Impedance (minimum)	5000 Ohms
Range of Operation	Linear over +500 Millivolts to +10 Volts

Gate Frequencies (pps)	8500	5500	3300	1500
CONVERSION TIME Control (μs)	62.5	125	250	500
Signal Amplitude (maximum volts)	1.25	2.5	5	10

Address Advance Rate	800,000 pps
Minimum Rise Time	1 Volt per Microsecond

1.2.1.4 Readout Control (Retrace Suppressor)

Pen Lift Control	Single Pole Double Throw Contact Switch

1.2.2 PHYSICAL DIMENSIONS

Table 1–1 lists the physical dimensions for the Series 600 accessories.

TABLE 1–1 PHYSICAL DIMENSIONS

Model No.	*Height (in.)*	*Length (in.)*	*Width (in.)*	*Weight (lbs.) Approx.*	*Unit Space*
600	10	21	8-1/2	22	8 provided
605	4-1/2	11-1/2	2	1	1
606	4-1/2	11-1/2	4	1.5	2
620	4-1/2	11-1/2	4	1.5	2
635	4-1/2	11-1/2	2	1	1
645	4-1/2	11-1/2	4	2	2
646	4-1/2	11-1/2	8	5	4

SECTION II
OPERATING INSTRUCTIONS

2.0 GENERAL

This section contains operating instructions and checkout procedures for the Model 600 Accessory Cabinet. Paragraph 2.2 and figures 1–1, 1–2, 2–1 and 2–2 detail controls, indicators, and connectors for all Series 600 accessories.

2.1 PREOPERATION INSPECTION

2.1.1 UNPACKING

All units of the Series 600 accessories are carefully packed into shipping containers at the factory. No special instructions are required to unpack the units, but extreme caution should be taken not to damage any instruments. Containers should be stored until checkout has been completed in case reshipment is necessary.

2.1.2 VISUAL INSPECTION

After the equipment has been unpacked, perform a thorough visual inspection. Make certain that all knobs and connectors are secure and that there is no external damage.

Loosen four fasteners on each side cover. Thoroughly inspect exposed wiring and plug-in cards for obvious damage.

NOTE

Do not remove more than one card at a time. Replace removed card before removing another.

CAUTION

Do not remove or replace any cards with power on. Before removal make certain POWER switch is at OFF position.

2.2 CONTROLS, INDICATORS, AND CONNECTORS (See figures 1–1, 1–2, 2–1, and 2–2.)

The following paragraphs outline the controls, indicators and connectors for the Series 600 CAT accessories.

2.2.1 CAT Accessory Cabinet (See figure 2–1.)

S101 POWER Switch—Switches external AC power to accessory cabinet.

J104 PUNCH Connector—Used only with Model 646 Preset Sweep Counter. Connects output of Model 646 through the cabinet to the MNEMOTRON Model 520 Control Unit. Provides for punching on paper tape the number of sweeps as indicated on the 646. (See table 3–2 for pin connections.)

J111 ACCESSORY Connector — Connected internally to TO CAT connector (J103). Permits START, DISPLAY, READOUT, STOP, and RESET functions to be remotely operated. (See table 3–6 for pin connections.)

J112 ACCESSORY Connector — Connected internally to TO CAT connector (J103). Permits remote use of MNEMOTRON Model 562 and 592 Preset Sweep Counters. (See table 3–7 for pin connections.)

J110 ANALOG Connector—Connected internally to TO CAT connector (J103). Permits use of X-Y plotter and strip-chart recorder. Transmits arithmetic and address data in analog form (1 to 100mv). (See table 3–5 for pin connections.)

J102 Male Plug—Connects CAT Accessory Cabinet to external 105–125 VAC, 50–400 cps power source. (210 to 250 VAC on request.)

J101 Convenience Outlet—Connects cabinet's input power to external instrumentation.

F1 Fuse—Contains 1/2 ampere slo-blo fuse to protect cabinet from AC overload. (1/4 ampere fuse for 210–250 VAC operation.)

J601 ADDR RESET Jack—Connects 600 Series accessories to CAT RESET BNC jack (J101). CAT will deposit one count in appropriate address and reset memory address to zero when a pulse is applied. CAT PROGRAM switch (S103) must be in either H or D position.

J602 EXT TRIG Jack—Connects 600 Series accessories pulse to CAT EXT TRIG. BNC jack (J107). Starts a new sweep when a pulse is applied. CAT TRIGGER switch (S8) must be in EXT. position. For interval histogram (interval distribution curves) operation J602 is connected to J101 at CAT. PROGRAM switch (S103) must be at H position.

J603 EXT. ADD. ADV. Jack—Connects 600 Series accessories address advance to CAT ADDR. ADV. BNC jack (J103). CAT addresses are advanced one ordinate when a pulse is applied. The CAT ANALYSIS TIME switch (S2) must be in the EXT. position. Maximum applicable pulse rate is 20,000 pps for CAT PROGRAM switch (S103) in C position and 800,000 pps for D or H positions.

J604 NOT USED

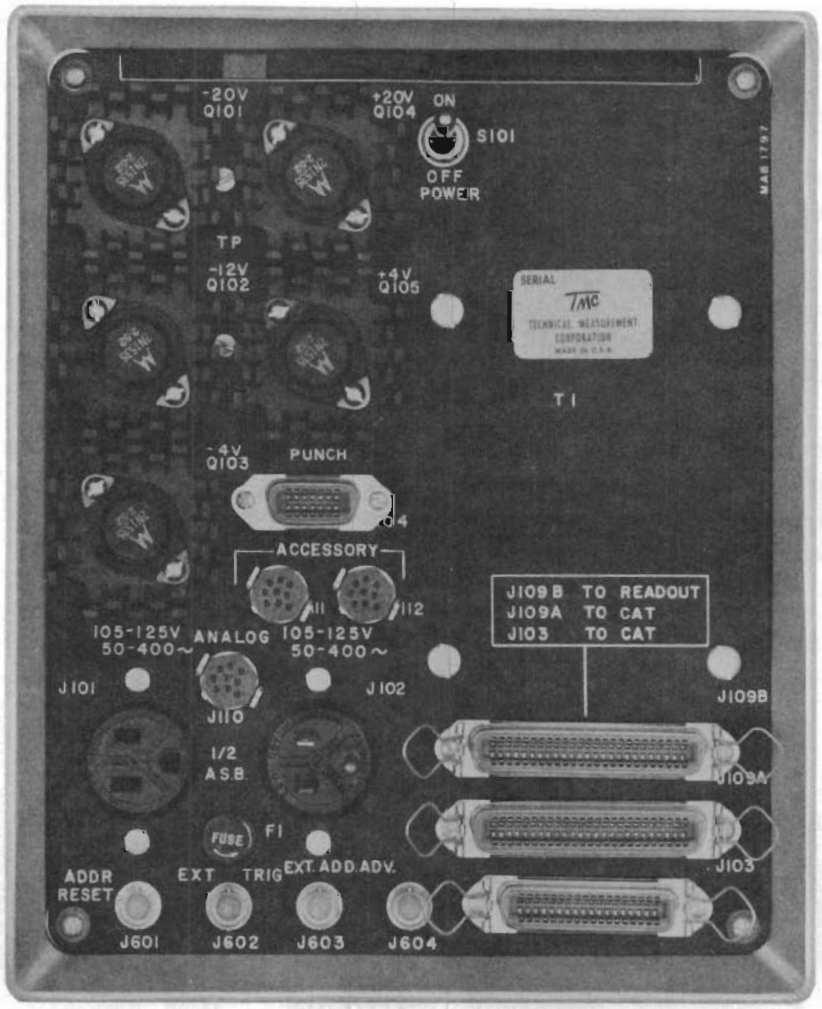

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Figure 2–1. Model 600 CAT Accessory Cabinet, Rear View.

J109B TO READOUT Connector—Connected internally to TO CAT connector (J109A). For use with ancillary MNEMOTRON readout equipment; Model 500 Printer, Model 510 Typewriter-Drive Unit, Model 520 Type-Punch-Read Control Unit. Transmits arithmetic and address data in BCD form. (See table 3–4 for pin connections.)

J109A TO CAT Connector—Connects cabinet to CAT DATA connector (J109). Receives arithmetic and address data in BCD form for operation of 600 accessories and external readout equipment through cabinet connector to READOUT (J109B). (See table 3–3 for pin connections.)

J103 TO CAT Connector—Connects cabinet to CAT ANALOG connector (J110) and ACCESSORY connectors (J111, J112). Receives arithmetic and address data in analog form for operation of X-Y plotter and strip-chart recorder. Permits external use of control functions as well as self contained MNEMOTRON Models 562 and 592 Preset Sweep Counters. Connections are made through cabinet ANALOG connector (J110) and ACCESSORY connectors (J111, J112). (See tables 3–1, 3–5, 3–6, 3–7 for pin connections.)

S46 Switch (See figure 2–2.)—Bypass switch for use when cabinet utilizes MNEMOTRON Model 620 Readout Control. Switch must be in A position for proper operation. Switch at B position bypasses 620 operation.

S47 Switch (See figure 2–2.)—Bypass switch for use when cabinet utilizes MNEMOTRON Model 620 Readout Control signal operation. Switch at B position bypasses 620 operation.

2.2.2 AMPLITUDE DISCRIMINATOR (See figure 1–1.)

BASELINE Vernier—Sets the baseline amplitude (200 mv to 10 volts). Outer scale indicates volts from one to ten. Inner scale contains one volt reading in 0.02 gradations.

With CAT PROGRAM switch (S103) at H position, and J602 connected to CAT J101, an address reset pulse will be generated when the signal exceeds the baseline voltage. One count will be deposited in the appropriate memory address before reset. New sweep will automatically be started.

With PROGRAM switch at D position, J601 connected to CAT J101, and J602 connected to CAT J107, a pulse supplied through J602 when signal exceeds baseline voltage will start a sweep.

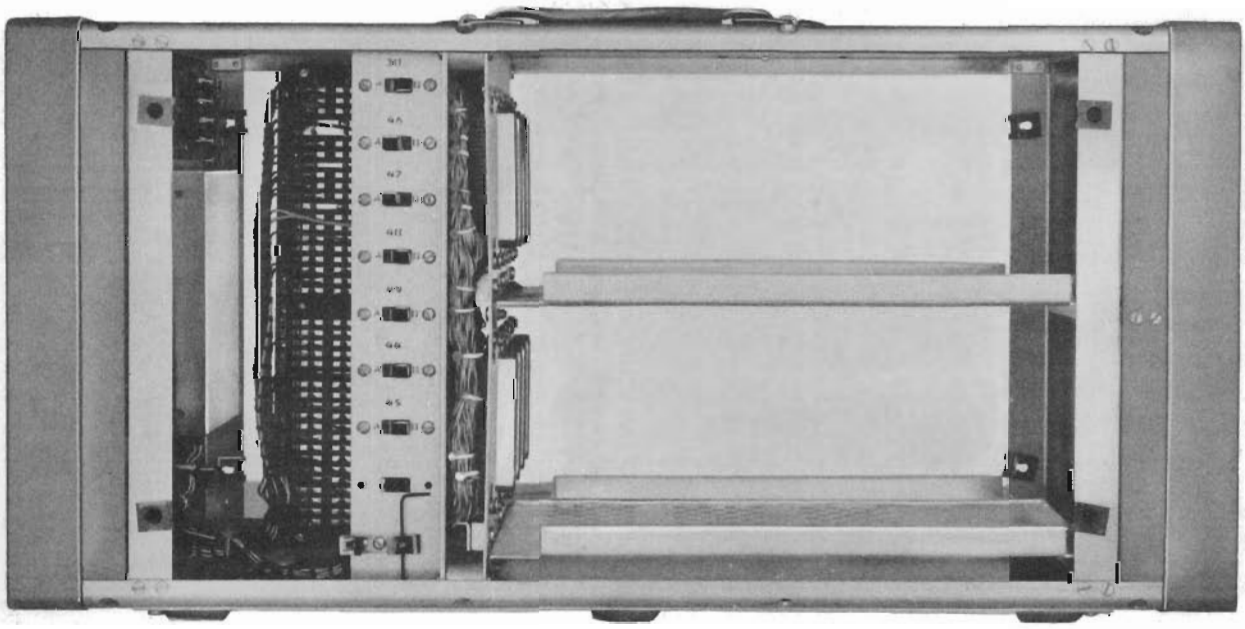

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Figure 2–2. Model 600 CAT Accessory Cabinet, Side View.

A pulse through J601 when signal falls below baseline voltage will deposit one count in the appropriate address and reset memory address to zero.

INPUT Jack—Receives external signals for time and amplitude related CAT processing. Input impedance is 33,000 ohms.

2.2.3 AMPLITUDE-TO-TIME CONVERTER (See figure 1–1.)

CONVERSION TIME Selector Switch—Provides for the selection of 62.5, 125, 250, 500 microseconds conversion times to permit higher pulse repetition rates.

SIGNAL IN Jack—Receives external signals for amplitude-to-time related CAT processing. Input impedance is 10,000 ohms.

GATE IN Jack—Receives external gate pulses when GATE CONTROL switch is at the EXT position. Input impedance is 5000 ohms.

GATE OPEN/EXT. Switch—Permits the use of either the internal gate control circuit integral to the module or an external gate control.

2.2.4 READOUT CONTROL (RETRACE SUPPRESSOR) (See figure 1–2.)

INPUTS IN USE Selector Switch—Provides for the selection of 1, 2, or 4 inputs to match the INPUTS IN USE switch (S1) at the CAT.

REMOTE PEN Connector—Contacts are provided for remote operation of X-Y plotter pen.

PEN LIFT/ADVANCE Switch—Permits X-Y plotter pen to start new sweep after Readout Control has stopped operation at end of sweep. Operates single pole double throw contacts to REMOTE PEN connector.

2.2.5 MEMORY RESET UNIT (See figure 1–1.)

1/4, 2/4, 3/4, 4/4 Pushbuttons—Permit manual reset of indicated memory sweep quadrants of the CAT.

2.2.6 PRESET SWEEP COUNTER (ELECTRO-MECHANICAL) (See figure 1–1.)

Counter Dials—Permit manual setting of the module to preselected number of CAT sweeps.

Sweep Indicator—Mechanically displays number of preset sweeps manually positioned by the counter dials. During operation, notes the number of sweeps remaining until preselection sweep number has been attained.

Counter Knob—Must be depressed and turned 90 degrees before preset sweep number can be introduced into module. Can be again depressed without turning to repeat sweep number already inserted.

ON/OFF Switch—Permits manual control of module.

2.2.7 PRESET SWEEP COUNTER (ELECTRONIC) (See figure 1–2.)

Sweep Display—Electronically displays sweep number from zero to preselected number.

PRESET COUNT Selector Switches—Permit manual setting of desired number of CAT sweeps.

RESET Button—Permits manual reset of counter.

ON/OFF Switch—Permits manual control of module.

2.3 PREPARATION FOR USE AND OPERATION

2.3.1 INTERCONNECTION PROCEDURE (See figure 2–3.)

To connect the Series 600 accessories to the CAT, proceed as follows:

a. Attach BNC cable from ADDR RESET jack (J601) to CAT ADDR. RESET jack (J101). (Used only with Models 605 and 606.)

b. Attach BNC cable from EXT TRIG jack (J602) to CAT EXT TRIG. jack (J107). (Used only with Models 605 and 606.)

c. Attach BNC cable from EXT ADD. ADV. jack (J603) to CAT ADDR. ADV. jack (J103). (Used only with Model 606.)

d. Position Amphenol connector at TO CAT (J103), making certain properly marked connectors at the opposite end are mounted on CAT ANALOG (J110) and ACCESSORY (J111, J112) positions.

e. Attach cable from TO CAT connector (J109A) to CAT DATA connector (J109).

f. Attach CAT power cable from CAT male plug (J108) to 600 cabinet convenience outlet (J101).

g. Attach Series 600 power cable male plug (J102) to 105–125 VAC, 50–400 cps power source.

h. Refer to individual modules for interconnection procedure.

2.3.2 STARTING AND STOPPING PROCEDURE

Starting and stopping the Series 600 accessories unit is accomplished by switching the POWER switch (S101) to the ON or OFF position.

2.3.3 OPERATING PROCEDURE

Operating procedures for individual modules are detailed in the Instruction Manuals which accompany the unit.

2.4 CHECKOUT PROCEDURES

Checkout procedures for the Series 600 CAT accessories are detailed in the Instruction Manuals which accompany the unit.

Procedures determining the operational parameters of the Series 600 accessories are vital to their successful use. All modules are checked by the manufacturer, but subsequent handling may dictate the advisability of performing checkout procedures. When such procedures are performed, follow the steps as outlined in the sequence outlined. When equivalent equipment is used, make certain the signals are identical to those set out in the applicable paragraphs. Modules which do not perform adequately after careful checkout analysis should be returned to the manufacturer for service.

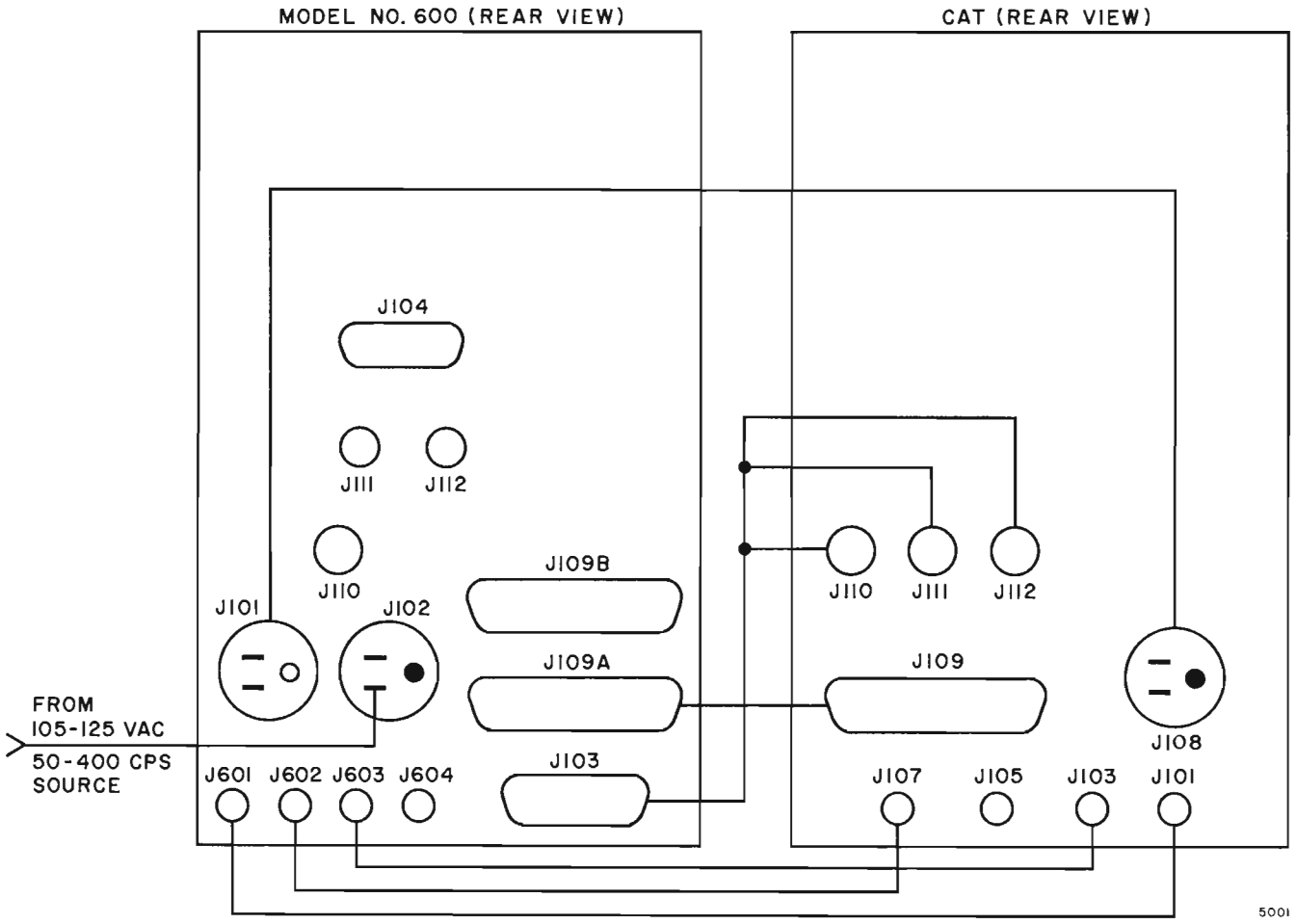


Figure 2–3. Series 600 Interconnection Diagram to CAT.

SECTION III
THEORY OF OPERATION

3.0 GENERAL

The following paragraph outlines the theory of operation for the Model 600 Cabinet. Theory of Operation for individual modules is detailed in the Instruction Manuals which accompany the units. Any unit may be used with the Model 600 CAT Accessory Cabinet in any position. However, when a remote MNEMOTRON Model 520 Type-Punch-Read control is used, the Model 646 Preset Sweep Counter module must be positioned in the upper position of the cabinet.

All modules having no front panel input jacks use the cabinet for connections to the CAT or ancillary equipment. The cabinet, therefore, provides the necessary input and output signals utilized by the accessory modules.

3.1 MODEL 600 CAT ACCESSORY CABINET

(See Drawing Nos. B2316, SCB1708, SCB1709, and Tables 3–1 through 3–8.)

The CAT Accessory Cabinet contains internal connections for all accessory modules and power supplies to supply all necessary operating voltages. Tables 3–1 through 3–8 detail all internal pin connections. Two plug-in printed circuit boards and a transformer plus five power transistors mounted on the rear panel comprise the Model 600 power supplies.

Operating potentials for the Series 600 accessories consist of +20, −20, +4, −4, −26, and −12 volts. AC voltages from the transformer are utilized by the Filter/Rectifier Card SCB1709 where they are rectified and filtered. The resultant dc voltages are fed to the Power Supply Regulator Card SCB1708 and transmitted to the accessory modules.

The −4, −12, and −20 volt supplies are each maintained by controlling the amount of current that passes through a series-regulating power transistor. Each power transistor is controlled by an emitter follower driver, which in turn is controlled by a two-transistor differential amplifier that provides an error-sensing signal.

The +4 and +20 volt supplies are also maintained by controlling the amount of current that passes through a series-regulating power transistor. Each power transistor is controlled directly by a two-transistor differential amplifier that provides an error-sensing signal.

All supply voltages are referenced to one another, with the +4 volt supply serving as the base reference. Series-regulating power transistors for each supply voltage are mounted on the rear panel of the unit. The transistor associated with each supply is identified by lettering on the rear panel.

The power supply transformer is protected by a 1/2 ampere Slo-Blo fuse which is located on the Model 600 rear panel. Other fuses are contained on the power supply regulator card (SCB1708); these are in the following supply voltage lines. (See table 3–8.)

TABLE 3–1 J1 THROUGH J8 (INTERNAL CONNECTORS)

Model No.	*Pin No.*	*Signal*	*Internal Connections**
600	1	−20 volts	1709–PC3–1
600	2	−12 volts	PC3–2
600	3	−4 volts	PC3–3
600	4	Chassis ground	PC3–4
600	5	+4 volts	PC3–6
600	6	+20 volts	PC3–7
600	7	−26 volts (unregulated)	1709–PC3–8
620	8	Null detector rush (NDR) To CAT	J110–F, J103–6 and TP1–1
	9	Readout flip-flop (+) (RFF+) High level	J110–H, J103–7 and TP1–2
	10	External stop Remote	J103–11, J111–A and TP1–3
	11	External readout Remote	J103–12, J111–B and TP1–4
	12	External display Remote	J103–14, J111–D, and TP1–5
	13	External accumulate	J103–16, J111–F and TP1–6
635	14	Memory reset	J103–18, J111–J and TP1–7
635	15	Display flip-flop (−) (DFF−)	J103–19, J111–K and TP1–8
645, 646	16	Stop To CAT	J103–21, J112–A and TP1–9
645, 646	17	Ordinate 20	J103–23, J112–C and TP1–10
645, 646, 606	18	Accumulate flip-flop (+) (AFF+) From CAT	J103–26, J112–F and TP1–11
635, 620	19	Address Decade −1 (units) From CAT	J109A, B −34 and TP1–12
635, 620	20	Address Decade −8 (units) From CAT	J109A, B −37 and TP1–13
635, 620	21	Address Decade −1 (tens) From CAT	J109A, B −38 and TP1–14
635, 620	22	Address Decade −8 (tens) From CAT	J109A, B −41 and TP1–15
635, 620	23	Scale of four −1 (hundreds)	J109A, B −42 and TP1–16
635, 620	24	Scale of four −2 (hundreds)	J109A, B −43 and TP1–17
	25	Read trigger	S1–1, J109A–30
	26	Read trigger	S1–2, J109B–30
620	27	Print trigger From CAT	S2–1, J109A–46
620	28	Print trigger From CAT	S2–2, J109B–46
620	29	Address Advance To CAT From READOUT	S3–1, J109A–47
620	30	Address Advance To CAT From READOUT	S3–2, J109B–47
	31	Shift trigger	S4–1, J109A–48
	32	Shift trigger	S4–2, J109B–48
	33	Write-in trigger	S5–1, J109A–49
	34	Write-in trigger	S5–2, J109B–49
	35	None	S6–1, J109A–44
	36	None	S6–2, J109B–44
	37	None	S7–1, J109A–45
	38	None	S7–2, J109B–45
605, 606	39	Address reset To CAT	J601–1
605, 606	40	External trigger To CAT	J602–1
606	41	External address advance To CAT	J603–1
	42	None	FB–42 (Terminal board)
	43	None	FB–43
	44	None	FB–44
	45	None	FB–45
	46	None	FB–46
	47	None	FB–47
	48	None	FB–48
646	49	6.3 volts ac	T1–7 (transformer)
646	50	6.3 volts ac	T1–8 (transformer)

*All lines from J1 through J8 tie to terminal board FB before proceeding to other connections.

TABLE 3–2 J104 PUNCH AND J9 (INTERNAL)
Used only with Model 646 Preset Sweep Counter

J104 and J9 Pins (Respective pins are connected together)	*Signal*	*Output*	*Circuit Connection (Model 646)*
1	$2^{\bar{0}}$	1	PC3–E
2	$2^{\bar{1}}$	2	PC3–H
3	$2^{\bar{2}}$	4	PC3–R
4	$2^{\bar{3}}$	8	PC3–V
5	$2^{\bar{0}}$	1	PC5–E
6	$2^{\bar{1}}$	2	PC5–H
7	$2^{\bar{2}}$	4	PC5–R
8	$2^{\bar{3}}$	8	PC5–V
9	$2^{\bar{0}}$	1	PC7–E
10	$2^{\bar{1}}$	2	PC7–H
11	$2^{\bar{2}}$	4	PC7–R
12	$2^{\bar{3}}$	8	PC7–V
13	None		None
14	Ground		PC1–B

TABLE 3–3 CABINET PIN FUNCTIONS
J109A TO CAT

Pin No.		*Signal*	*Internal Connection*
1	1 } 10^0	CAT Arithmetic register outputs	Connector to respective pins of J109B, and not used by the Series 600 accessory units.
2	2		
3	4		
4	8		
5	1 } 10^1		
6	2		
7	4		
8	8		
9	1 } 10^2		
10	2		
11	4		
12	8		
13	1 } 10^3		
14	2		
15	4		
16	8		
17	1 } 10^4		
18	2		
19	4		
20	8		
21	1 } 10^5		
22	2		
23	4		
24	8		
25	−100 volts		
26	S11) Shift		
27	S12)		
28	S13) inputs		
29	S14)		

TABLE 3–3 CABINET PIN FUNCTIONS
J109A TO CAT (CONT'D)

Pin No.	*Signal*	*Connection*
30	Read trigger	S1–1, J1 thru J8–25
31	None	None
32	Blank (from Model 522)	J109B–32
33	Ground	J109B–33
34	1 (10^0) CAT Address Register outputs	J109B–34, J1 thru J8–19
35	2 (10^0)	J109–35
36	4 (10^0)	J109–36
37	8 (10^0)	J109B–37, J1 thru J8–20
38	1 (10^1)	J109B–38, J1 thru J8–21
39	2 (10^1)	J109–39
40	4 (10^1)	J109–40
41	8 (10^1)	J109B–41, J1 thru J8–22
42	1 (10^2)	J109B–42, J1 thru J8–23
43	2 (10^2)	J109B–42, J1 thru J8–24
44	None	S6–1, J1 thru J8–35
45	None	S7–1, J1 thru J8–37
46	Print trigger	S2–1, J1 thru J8–27
47	Address advance	S3–1, J1 thru J8–29
48	Shift trigger	S4–1, J1 thru J8–31
49	Write-in trigger	S5–1, J1 thru J8–33
50	Chassis ground	J109B–50, TP1–18

TABLE 3–4 J109B TO READOUT

Refer to J109A for all J109B pins not described here

Pin No.	*Signal*	*Connection*
30	Read trigger	S1–2, J1 thru J8–26
44	None	S6–2, J1 thru J8–36
45	None	S7–2, J1 thru J8–38
46	Print trigger	S2–2, J1 thru J8–28
47	Address advance	S3–2, J1 thru J8–30
48	Shift trigger	S4–2, J1 thru J8–32
49	Write-in trigger	S5–2, J1 thru J8–34
50	Chassis ground	J109A–50

TABLE 3–5 J110 ANALOG

Pin No.	*Signal*	*Connection*
A	Recorder ground, X-terminal (RXG)	J103–1
B	Recorder X-signal (RX+), +100 mv	J103–2
C	Recorder Y-signal (RY+), +100 mv	J103–3
D	Recorder Y-signal (RY+), +100 mv	J103–4

TABLE 3–5 J110 ANALOG (CONT'D)

Pin No.	*Signal*	*Connection*
E	Ground. To be connected to the frame of the X-Y plotter. X and Y servo amplifier should be floating.	J103–5
F	Null detector rush (NDR)	J103–6, J1 thru J8–8, TP1–1
H	Readout flip-flop (RFF+); high level	J103–7, J1 thru J8–9, TP1–2
J	−26 volts, unregulated	J103–8
K	Not used	J103–9

TABLE 3–6 J111 ACCESSORY (Remote Control)

Pin No.	*Signal*	*Connection*
A	External stop	J103–11, J1 thru J8–10, TP1–3
B	External readout	J103–12, J1 thru J8–11, TP1–4
C	Not used	J103–13
D	External display	J103–14, J1 thru J8–12, TP1–5
E	Ground	J103–15
F	External accumulate	J103–16, J1 thru J8–13, TP1–6
H	+4 volts	J103–17
J	Memory reset	J103–18, J1 thru J8–14, TP1–7
K	Display flip-flop (DFF−)	J103–19, J1 thru J8–15, TP1–8

TABLE 3–7 J112 ACCESSORY (For Model 562 Preset Sweep Counter)

Pin No.	*Signal*	*Connection*
A	Stop	J103–21, J1 thru J8–16, TP1–9
B	Not used	J103–22
C	Ordinate 20	J103–23, J1 thru J8–17, TP1–10
D	+20 volts	J103–24
E	Ground	J103–25
F	Accumulate flip-flop (AFF+)	J103–26, J1 thru J8–18, TP1–11
H	+4 volts	J103–27
J	−4 volts	J103–28
K	−26 volts, unregulated	J103–29

TABLE 3–8 FUSES

Reference No.	*Rating*	*Card and Pin No.*
F1	1/4 Amp, −20 V	1708–28
F2	1/4 Amp, −12 V	1708–31
F3	1/2 Amp, −4 V	1708–34
F4	1 Amp, +4 V	1708–37
F5	1/4 Amp, +20 V	1708–40

SECTION IV
MAINTENANCE

4.0 GENERAL

The Series 600 CAT accessories operate in conjunction with both external laboratory equipment and the MNEMOTRON CAT. Maintenance of the accessories, therefore, will be limited solely to their operation and service. This section attempts to local ize maintenance problems in the stated three broad areas. For maintenance instructions concerning ancillary equipment or the CAT consult appropriate Instruction Manuals.

4.1 BASIC TROUBLE SHOOTING

4.1.1 GENERAL PROCEDURES

When any accessory module fails to operate properly, proceed as follows:

a. Check interconnection procedures in paragraph 2.3.1 making certain all connections are secure.

b. Check knurled positioning knob for tightness.

c. Make certain module front panel does not overlap contiguous panels.

d. Remove right side cover and check all applicable plug-in units for correct mating of male and female connectors.

e. With vtvm, at side of cabinet, with reference to chassis (ground), check:

1) J1–1 for −20 volts.
2) J1–2 for −12 volts.
3) J1–3 for −4 volts.
4) J1–5 for +4 volts.
5) J1–6 for +20 volts.

f. If any voltage readings are absent, check appropriate fuse on cabinet power supply card SCB1708. Replace if necessary. Refer to table 3–8.

g. Perform checkout procedures indicated in paragraph 2–4.

4.1.2 ACCESSORY MODULES

If individual modules fail to operate, trouble shooting procedures are detailed in Instruction Manuals which accompany the specific units.

4.2 DISASSEMBLY AND ASSEMBLY PROCEDURE

4.2.1 REMOVAL OF SIDE PANELS

To remove side panels, unscrew four captive fasteners and slip off plates.

4.2.2 REMOVAL OF MODULE

To remove module, unscrew knurled knob and carefully withdraw unit.

4.3 SERVICE INSTRUCTIONS

4.3.1 GENERAL

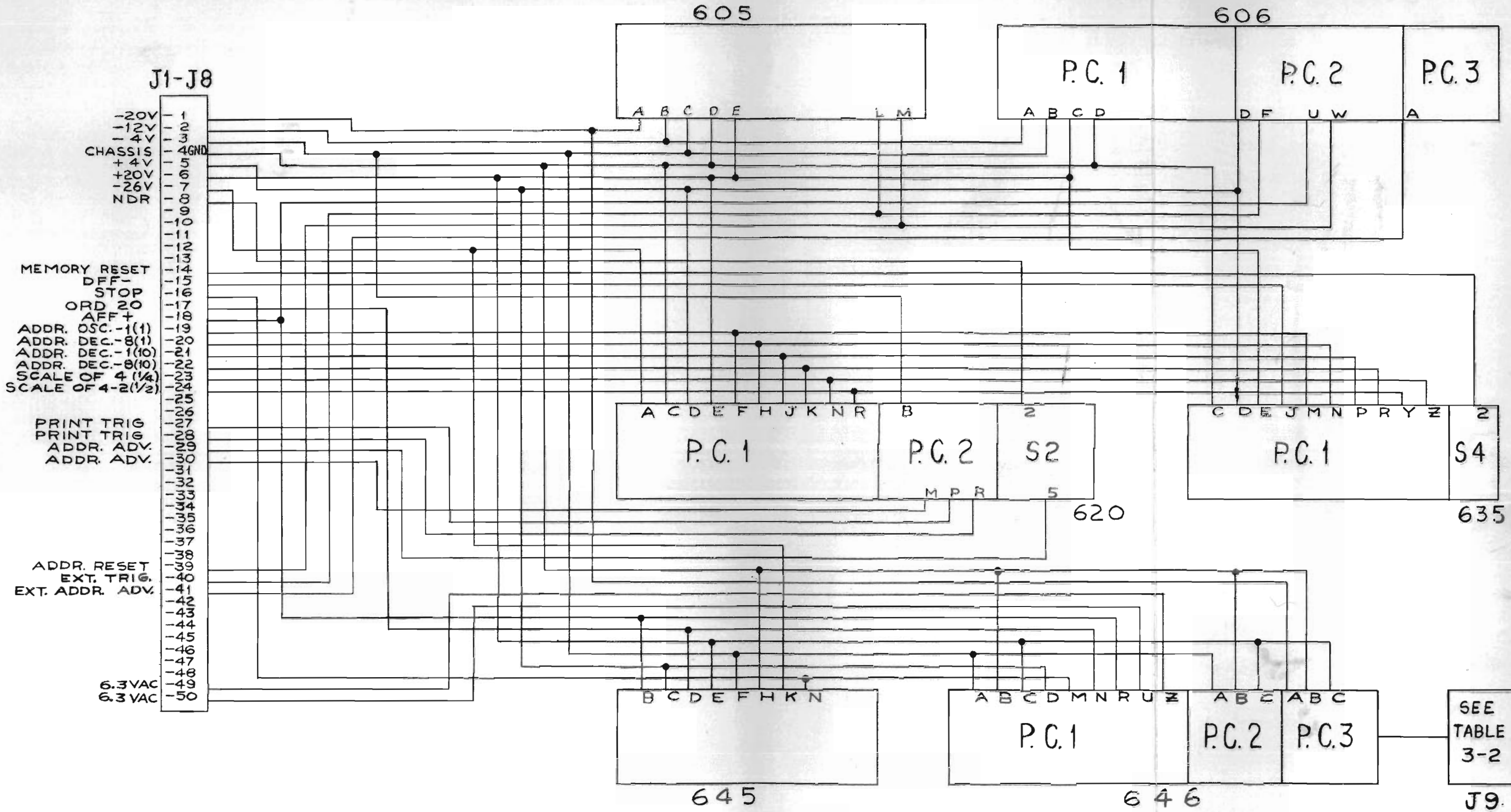
Merely returning the inoperative module does not supply sufficient information for adequate servicing. CAT malfunction charts are included at the rear of the manual. Their use enables service personnel to diagnose the problem and quickly repair the module or communicate the other areas which might be involved. In addition to the chart, please set down the control positions at the module and your laboratory equipment. Refer to the manufacturer of that equipment, the model number, and name of the equipment. A detailed account of the operational parameters of the instrumentation involved will assure prompt service and marked savings in time and expense in the application of the equipment.

4.3.2 SHIPPING INSTRUCTIONS

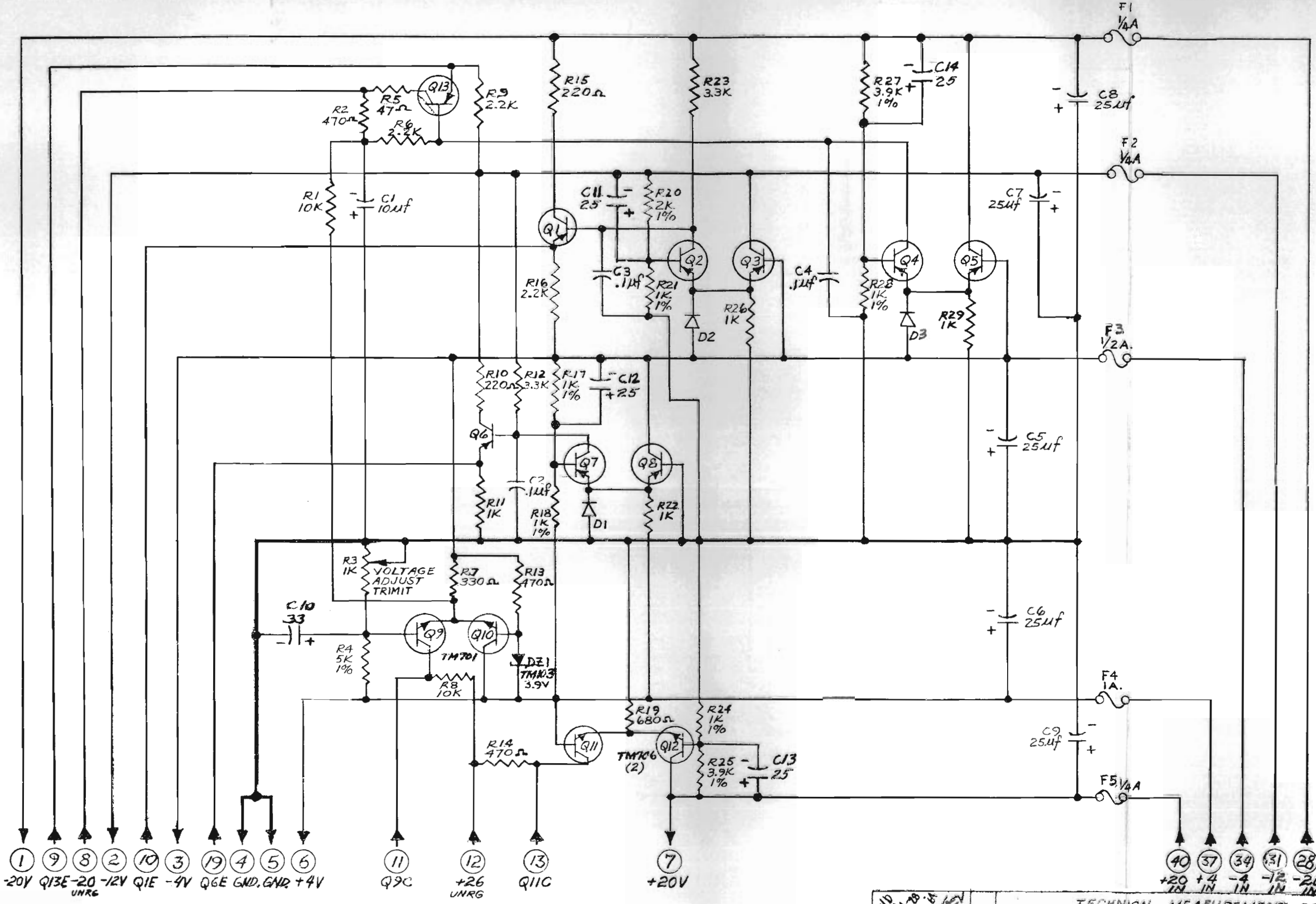
Before the unit may be returned for service an authorized return tag must be received from the service department.

When the unit is prepared for shipment to the factory, the module must be securely packed in the original carton with the blue return authorization tag attached to the exterior of the carton. If the original carton has been misplaced, the service department will send a new one.

Upon receipt of a new plug-in card the defective card should immediately be returned in the new card container to the service department.



REVISION	TECHNICAL MEASUREMENT CORPORATION NORTH HAVEN, CONN. U.S.A.		
	MODEL: M600	PC. NO.	ACCESSORY INTERCONNECTION DIAGRAM
	DRAWN: W.R. Antonacci 6-24-63	CHKD.: 6-24-63	APPD.:
			DRAWING NO. B2316



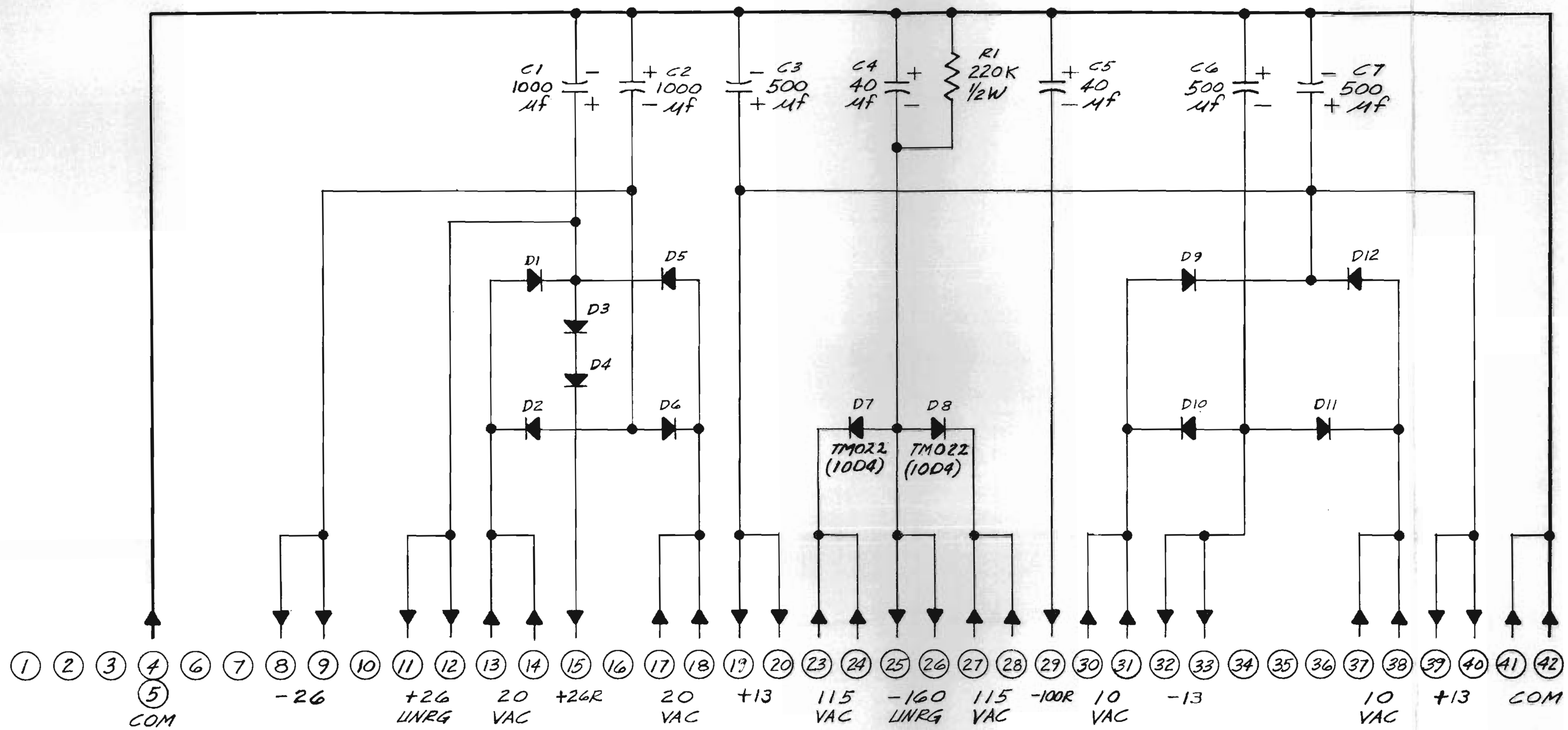
NOTES. —

1- REF. SEE DWG. ASB1708 FOR COMPONENTS ASSEMBLY.
2- ALL DIODES ARE TM001 UNLESS OTHERWISE SPECIFIED.
3- ALL CAPACITORS ARE μf
4- ALL TRANSISTORS ARE TM300 UNLESS OTHERWISE SPECIFIED.
5- ALL RESISTORS ARE 1/4W. 10% UNLESS OTHERWISE SPECIFIED.
6- ALL FUSES ARE 1/4A UNLESS OTHERWISE SPECIFIED.
7- LAST COMP. REF Nº. DIODES D3, CAPACITORS C14, TRANSISTORS Q13, RESISTORS R29, FUSES F5, ZENER DZ 1.

LAST CHANGE NO.	REVISION
A	ADDED C10 C11 C12 C13 C14

TECHNICAL MEASUREMENT CORPORATION
NORTH HAVEN, CONN. U.S.A.

MODEL	PC. NO.	POWER SUPPLY REGULATOR			
522	22	DRAWN: R.I.COLE 4-26-62	CHKD.: 7-2-62	APPD.: GEV 7-10-62	DRAWING NO. SCB 1708



NOTE:-
1. REF. SEE DWG. ASB 1709 FOR COMP. ASS'Y
2. ALL DIODES ARE TM021 (10D2) UNLESS OTHERWISE SPECIFIED.
3. LAST COMPONENT REF. No.
A. RESISTOR - R1
B. CAPACITOR - C7
C. DIODE - D12

B #1021	D7, D8 WAS 1N1695. NOTE #2 WAS "ALL DIODES ARE 1N1692" ETC. L.M. 5-13-63	GEV
A #150	PINS 19 & 20 WAS +6; PINS 39 & 40 WAS +6; PINS 32 + 33 WAS -6 (RK-10464)	GEV
REVISION		

TECHNICAL MEASUREMENT CORPORATION
NORTH HAVEN, CONN. U.S.A.

MODEL	PC. NO.	POWER SUPPLY FILTER/RECTIFIER		
522	23	DRAWN: D. COBURN 5-8-62	CHKD.: H.K. 6-19-62	APPD.: GEV 7-2-62
				DRAWING NO. SCB 1709

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LIST OF ILLUSTRATIONS

MODEL 605
AMPLITUDE DISCRIMINATOR

1 INTRODUCTION

The Model 605 Amplitude Discriminator is designed to operate with the MNEMOTRON Computer of Average Transients (CAT). The module consists of an adjustable baseline voltage selector which permits CAT operation to be related to specific voltage amplitude inputs. The 605 transmits a pulse to the CAT when preselected baseline amplitude is exceeded and pulse when the voltage drops below the preset amplitude. (See figure 1.)

2 SPECIFICATIONS

Input Voltage (Maximum)	10 volts, single ended
Input Impedance	33,000 ohms
Baseline Range	Linear over +200 millivolts to +10 volts
Height	4-1/2 inches
Length	11-1/2 inches
Width	2 inches
Weight	1 pound approximately

3 OPERATING INSTRUCTIONS

3.1 To use the Amplitude Discriminator to obtain interval histograms (interval distribution curves), proceed as follows:

a. Check connections detailed in paragraph 2.3.1 in the Series 600 Instruction Manual with the following exceptions:

1) Remove BNC cable from J601.

2) Connect BNC cable from J602 to CAT J101.

b. Connect input signals under investigation to INPUT BNC jack at front panel of module.

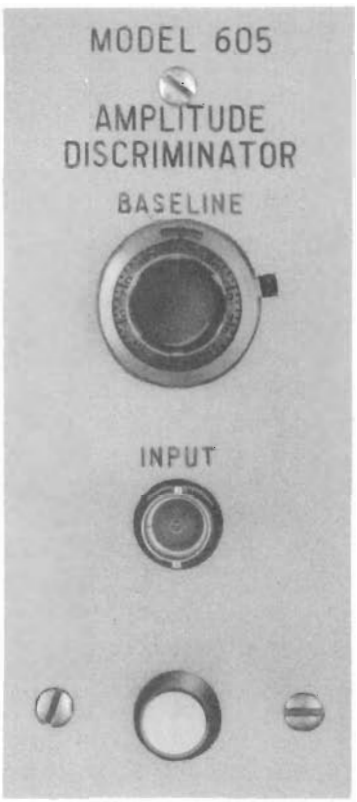
c. Set BASELINE vernier at desired amplitude.

d. Set CAT PROGRAM switch (S103) at H position.

e. Set the VERT SIZE control (R5) at CAL.

f. Set the INPUTS IN USE switch (S1) at 1.

g. Set the PRE ANALYSIS DELAY control (R6/S10) at 0.



1016

Figure 1. Model 605 Amplitude Discriminator, Front View.

h. Set the TRIGGER switch (S8) at EXT.

i. Set the ANALYSIS TIME SEC. switch (S2) at .5.

j. Set the VERT RANGE switch (S3) at TEST.

k. Set the ADD/SUB switch (S4) at ADD.

l. Set the TEST/USE switch (S5) at USE.

m. Press CAT DISPLAY pushbutton (SL2).

n. Press CAT RESET pushbutton (S7).

o. The module is ready for use to obtain interval histograms.

3.2 To use the Amplitude Discriminator to obtain dwell time histograms (distribution curves), proceed as follows:

a. Check connections detailed in paragraph 2.3.1 in the Series 600 Instruction Manual.

b. Connect input signals under investigation to INPUT BNC jack at front panel of module.

c. Set BASELINE vernier at desired amplitude.

d. Set CAT PROGRAM switch (S103) at D position.

e. Set CAT front panel controls as indicated in paragraph 3.1, steps e through l.

f. Press CAT DISPLAY pushbutton (SL2).

g. Press CAT RESET pushbutton (S7).

h. The module is ready for use to obtain dwell time histograms.

4 CHECKOUT PROCEDURE

Procedures determining the operational parameters of the Series 600 accessories are vital to their successful use. All modules are checked by the manufacturer, but subsequent handling may dictate the advisability of performing checkout procedures. When such procedures are performed, follow the steps as outlined in the sequence outlined. When equivalent equipment is used, make certain the signals are identical to those set out in the applicable paragraphs. Modules which do not perform adequately after careful checkout analysis should be returned to the manufacturer for service.

To check out the Amplitude Discriminator, proceed as follows:

a. Perform interconnection procedure outlined in paragraph 2.3.1, Series 600 Instruction Manual.

b. At CAT, set PROGRAM selector switch at D.

c. Set TRIGGER switch at EXT.

d. Set ANALYSIS TIME SEC. at .25.

e. Set VERT. RANGE at TEST.

f. Set INPUTS IN USE switch at 1.

g. Depress DISPLAY pushbutton.

h. Depress RESET pushbutton.

i. Using a Hewlett-Packard Model 202A low frequency function generator or equivalent, apply a symetrical square wave zero to +5 volts in amplitude and 4 cycles per second to INPUT jack at the module.

j. Set BASELINE vernier at 4 volts.

k. At CAT, depress START pushbutton and allow data to accumulate for approximately five minutes.

l. Depress DISPLAY pushbutton.

m. Counts should appear at approximately address 20.

$$\frac{t}{\text{addr}} = \frac{ta}{400}$$

Where: t = Time (1/2 square wave)

ta = Analysis time switch setting

$$\frac{0.125}{\text{addr}} = \frac{0.25}{400}$$

$$\text{addr} = \frac{400 \times 1.25}{0.25}$$

$$\text{addr} = 200$$

5 THEORY OF OPERATION

5.1 INTERVAL HISTOGRAM OR INTERVAL DISTRIBUTION CURVE (See SCB1815.)

The CAT PROGRAM switch (S103) is at H position and J602 is connected to CAT J101. The Amplitude Discriminator starts the CAT sweep when an input signal (200 mv to +10 volts) exceeds the voltage setting manually positioned at the BASELINE vernier scales of the module. The next time the signal exceeds the voltage setting, an address reset pulse is generated and supplied to the CAT. This causes the CAT to deposit one count in an address whose number is proportional to the interval between the two instants of time in which the voltage setting was exceeded. CAT sweep operation is reset to the zero address and another sweep is automatically started.

Setting the vernier scales applies a balance potential at the transistor Q1, above which the transistor will not conduct. An input signal more positive than the vernier setting, turning off Q1, turns on Q2, turns off Q3, and turns on Q4. The collector of Q4, rising to a positive potential, provides an address reset pulse to the CAT.

5.2 DWELL TIME HISTOGRAM OR DWELL TIME DISTRIBUTION CURVE (See SCB1815.)

The CAT PROGRAM switch (S103) is at D position. The Amplitude Discriminator starts the CAT sweep when an input signal (200 mv to +10 volts) exceeds the voltage setting manually positioned at the BASELINE vernier scales of the module. When the input signal falls below the vernier setting, the CAT deposits one count in an address whose number is proportional to the length of time the signal exceeded the setting. CAT sweep operation is reset to the zero address.

Setting the vernier scales applies a balance potential at the transistor Q1, above which the transistor will not conduct. An input signal more positive than the vernier setting, turning off Q1, turns on Q2, turns off Q3, and turns on Q4. The collector of Q4, rising to a positive potential, provides a trigger pulse to the CAT. This starts the CAT sweep operation.

When the input signal falls below the Q1 balance potential level, the transistor conducts once again. This turns off Q2, turns on Q3, turns off Q4, and turns on Q5. The collector of Q5, rising to a positive potential, provides the pulse to the CAT which allows it to deposit one count in the memory position addressed at that instant of time. It also permits the CAT to reset the sweep to the zero address.

6 TROUBLE SHOOTING PROCEDURE

To trouble shoot the Amplitude Discriminator, proceed as follows:

a. At ancillary equipment, make certain input signal is more positive than BASELINE vernier setting.

b. If module still fails to operate, remove cables at J601, J602, J603.

c. With oscilloscope, check signal at J602 and J601 for positive spike of 3 volts occurring each 0.25 second interval.

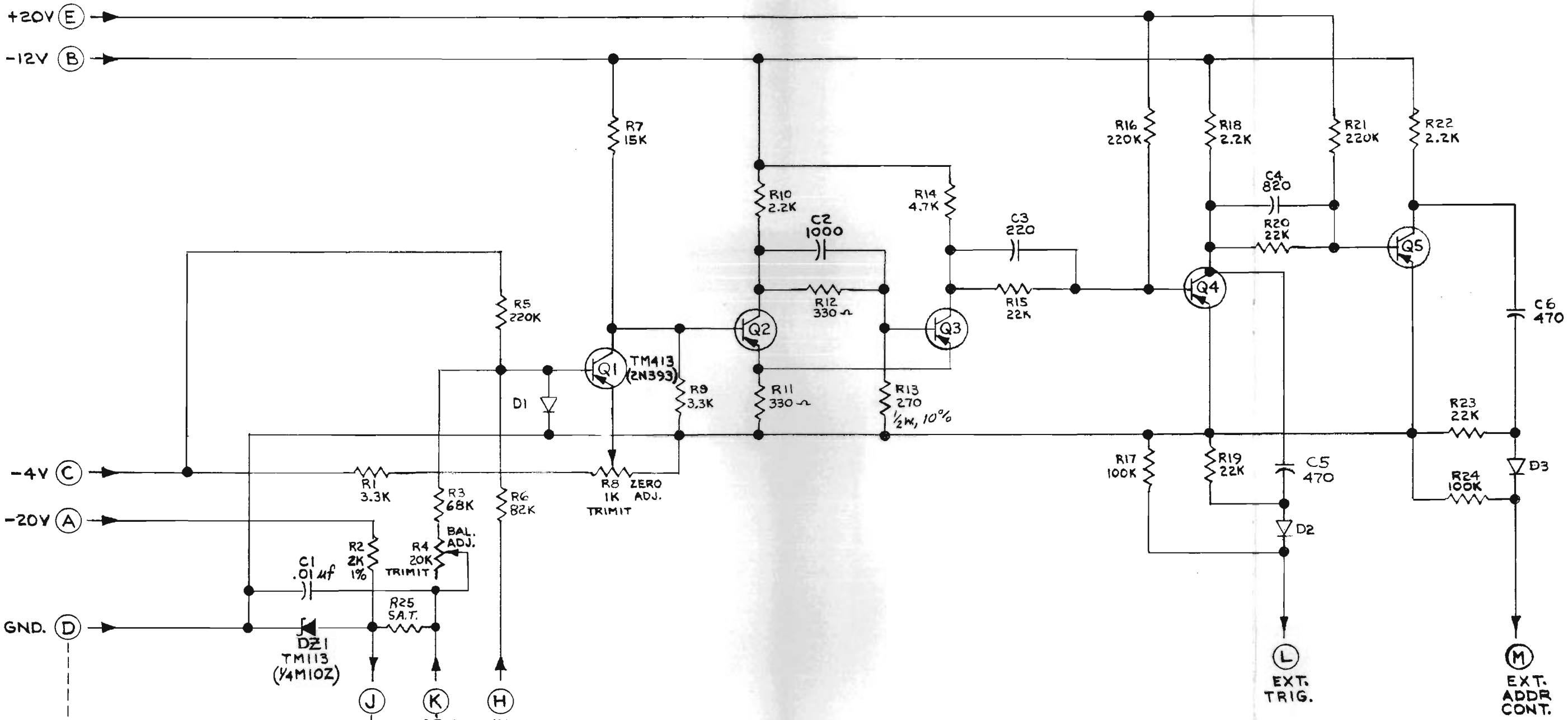
d. If either signal is missing, remove module and return for service. Refer to paragraph 4.3 of Series 600 Instruction Manual for service instructions.

e. If both positive signals are present, check J601 and J602 cables for continuity.

f. If cables are O.K., CAT is inoperative. Refer to CAT Instruction Manual for proper procedures.

NOTES: ——

1-REF. SEE ASB1815 FOR COMPONENT ASSEMBLY.
2-ALL TRANSISTORS ARE TYPE TM300 (2N404) UNLESS OTHERWISE SPECIFIED.
3-ALL RESISTORS ARE ¼W, 10%, UNLESS OTHERWISE SPECIFIED.
4-ALL CAPACITORS ARE μf UNLESS OTHERWISE SPECIFIED.
5-ALL DIODES ARE TYPE TM001 (IN34AG) UNLESS OTHERWISE SPECIFIED.
6-LAST COMPONENT REFERENCE Nº:
TRANS. Q5
CAP. C6
RES. R25
DIODE D3
ZENER DIODE DZ1



REVISION	
B	NOTE 6, RES. R25 WAS R24, R3 WAS 33K, R5 WAS 220K, R6 WAS 82K, ADDED R25 S.A.T.
A	C2, 2K, 1% RESISTOR WAS C3, 5K, 1%

TECHNICAL MEASUREMENT CORPORATION
NORTH HAVEN, CONN. U.S.A.

MODEL	PC. NO.
605	

DISCRIMINATOR

DRAWN:	CHKD.:	APPD.:	DRAWING NO.
R.I.COLE 10/13/62	10-24-62	U.H. 10/24/62	SCB 1815

SKB 1398

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LIST OF ILLUSTRATIONS

MODEL 606
AMPLITUDE-TO-TIME
CONVERTER

1 INTRODUCTION

The Model 606 Amplitude-to-Time Converter is designed to operate with the MNEMOTRON Computer of Average Transients (CAT). The module sorts input pulses from 0.5 to ten volts in 400 CAT memory addresses. The CAT receives programmed data and deposits one count into an address proportional to the amplitude of the input signal. (See figure 1.)

2 SPECIFICATIONS

Input Signal Voltage (maximum)	10 volts
Input Signal Impedance (minimum)	10,000 ohms
Gate Input Voltage (maximum)	50 volts
Gate Input Impedance (minimum)	5000 ohms
Range of Operation	Linear over +500 millivolts to +10 volts

Gate Frequencies (pps)	8500	5500	3300	1500
CONVERSION TIME Control (μs)	62.5	125	250	500
Signal Amplitude (maximum volts)	1.25	2.5	5	10

Address Advance Rate	800,000 pps
Height	4-1/2 inches
Length	11-1/2 inches
Width	4 inches
Weight	1.5 pounds (approximately)

3 OPERATING INSTRUCTIONS

To use the Amplitude-to-Time Converter, proceed as follows:

a. Check connections detailed in paragraph 2.3.1, Series 600 Instruction Manual.

b. Connect input signals under investigation to SIGNAL IN BNC jack at module.

c. Set CONVERSION TIME control at desired position. Refer to paragraph 2.

d. To process pulses with rise times of at least 1 volt per microsecond, set GATE OPEN/EXT. switch at GATE OPEN position.

e. To sample analog signals, set GATE OPEN/EXT. switch at EXT position and apply external gate signal to GATE IN jack on front panel.

f. Set CAT PROGRAM switch at D position.

g. Set the VERT SIZE control (R5) at CAL.

h. Set the INPUTS IN USE switch (S1) at 1.

i. Set the PRE ANALYSIS DELAY control (R6/S10) at 0.

j. Set the TRIGGER switch (S8) at EXT.

k. Set the ANALYSIS TIME SEC. switch (S2) at EXT.

l. Set the VERT RANGE switch (S3) at TEST.

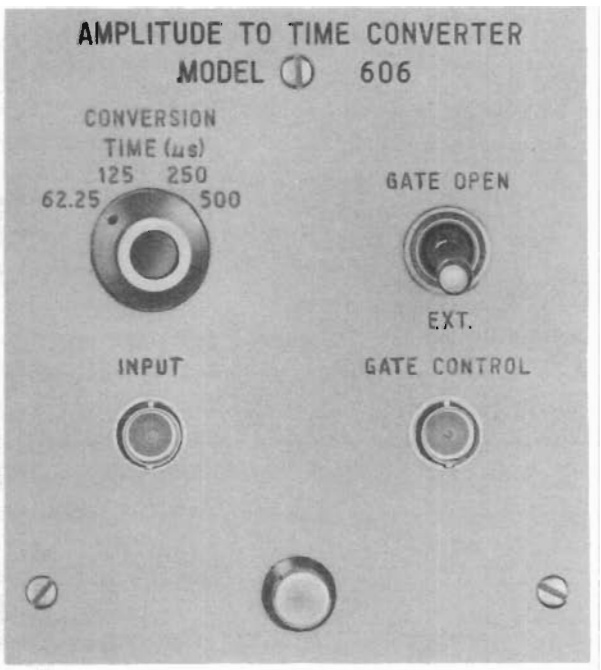

Figure 1. Model 606 Amplitude-to-Time Converter, Front View.

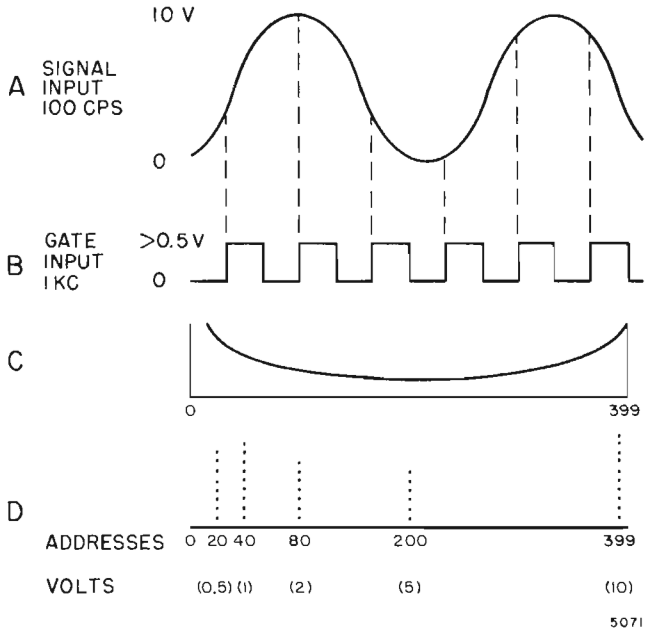

Figure 2. Model 606 Amplitude-to-Time Converter, Signal Diagrams.

m. Set the ADD/SUB switch (S4) at ADD.

n. Set the TEST/USE switch (S5) at USE.

o. Press CAT DISPLAY button (SL2).

p. Press CAT RESET button (S7).

q. The Amplitude-to-Time Converter module is now ready for use.

4 CHECKOUT PROCEDURE

Procedures determining the operational parameters of the Series 600 accessories are vital to their successful use. All modules are checked by the manufacturer, but subsequent handling may dictate the advisability of performing checkout procedures. When such procedures are performed, follow the steps as outlined in the sequence outlined. When equivalent equipment is used, make certain the signals are identical to those set out in the applicable paragraphs. Modules which do not perform adequately after careful checkout analysis should be returned to the manufacturer for service.

To check out the Amplitude-to-Time Converter, proceed as follows:

a. Perform interconnection procedure outlined in paragraph 2.3.1, Series 600 Instruction Manual.

b. At CAT, set PROGRAM selector switch at D.

c. Set TRIGGER switch at EXT.

d. Set ANALYSIS TIME switch at EXT.

e. Set VERT. RANGE at TEST.

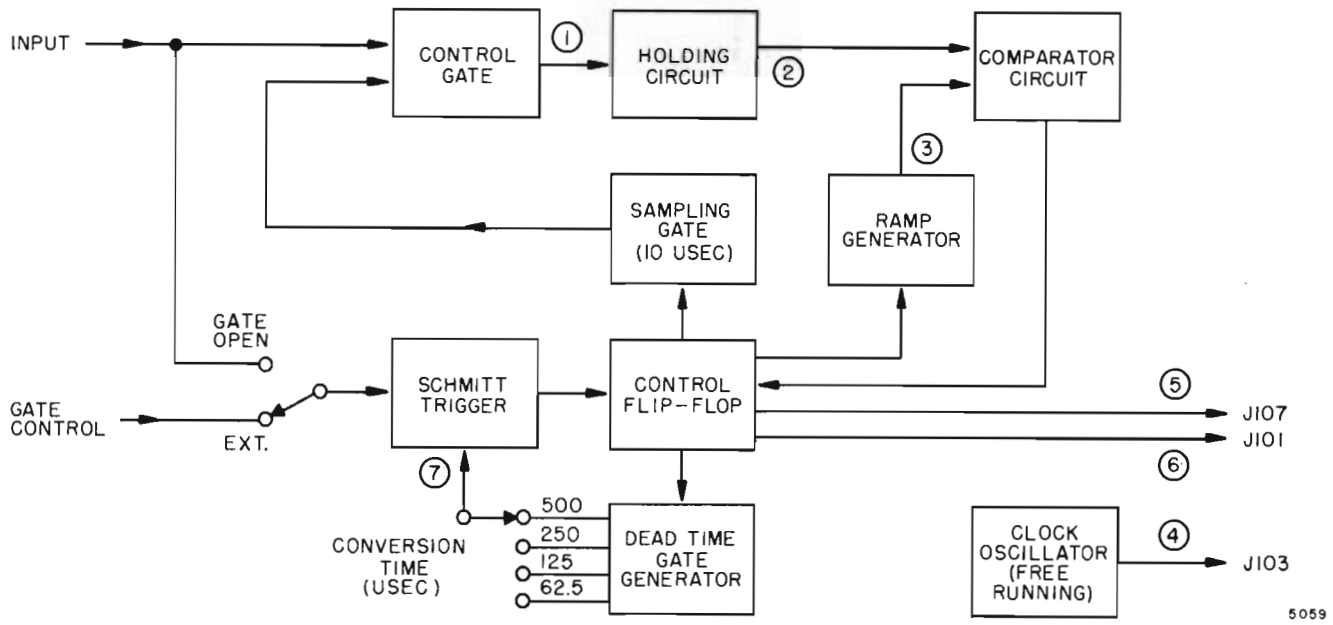

Figure 3. Model 606 Amplitude-to-Time Converter, Block Diagram.

f. Set INPUTS IN USE at 1.

g. Depress DISPLAY pushbutton.

h. Depress RESET pushbutton.

i. At module, set GATE OPEN/EXT. switch at EXT.

j. Set CONVERSION TIME selector switch at 500μs.

k. Using a Hewlett-Packard Model 202A low frequency Function Generator or equivalent, apply a sine wave 0.5 to +10 volts in amplitude and 100 cycles per second to SIGNAL IN jack at the module. (See figure 2A.)

l. Using the calibrated output of a Tektronix Model 531 oscilloscope or equivalent, apply 1 kc pulses of a least 1/2 volt amplitude to GATE IN jack. (See figure 2B.)

m. At CAT, depress START pushbutton and allow data to accumulate for approximately five minutes.

n. Depress DISPLAY pushbutton. Observe display as indicated in figure 2C.

o. Depress RESET pushbutton.

p. Remove ancillary equipment at module SIGNAL IN and GATE IN jacks.

q. At module, set GATE OPEN/EXT. switch at GATE OPEN.

r. Apply 10 volt calibrated scope output to SIGNAL IN jack.

s. At CAT, depress START pushbutton.

t. Switch scope output slowly to 5 volts, 2 volts, 1 volts, and 0.5 volts.

u. Depress DISPLAY pushbutton. Observe display as indicated in figure 2D. Height of dots on CRT depend on the duration of individual signal levels applied to the input.

5 THEORY OF OPERATION

5.1 GENERAL

The 606 Amplitude-to-Time Converter allows for the analysis of signals on the basis of their amplitude and makes a histogram or distribution curve of the frequency of occurence of these amplitudes. It either accepts pulses directly from some external source, or samples the amplitude of an analog signal at the instant a gating pulse is supplied. To accomplish the latter, an external pulse generator is required to provide a gating signal.

5.2 DIRECT PULSE INPUT (See SCB1816.)

For the analysis of pulses fed directly to the SIGNAL IN jack of the Model 606, the GATE OPEN/EXT. switch should be in the GATE OPEN position. Referring to figure 3, the pulses are passed through the control gate. The incoming pulse is then fed to a holding circuit which maintains or "holds" it at the peak amplitude. In addition, the input pulse also operates a Schmitt trigger circuit which in turn triggers a control flip-flop initiating a number of events simultaneously. A trigger pulse is fed directly to J107 of the CAT which starts an analysis sweep. An oscillator or clock emits pulses at a 800 kc rate and goes to J103 of the CAT. These

clock pulses advance the addresses of the CAT from 0 to 399 at a rate of 1.25 microseconds per address (500μsecs for all 400 addresses). Simultaneously a ramp function is started which rises linearly from zero to 10 volts maximum in 500μsecs. After completion of each conversion the holding circuit is reset to zero volts.

In order to assure proper operation, a dead-time gate generator is provided so that pulses spaced too close together will not interfere with the conversion process. Thus, the Schmitt trigger is gated "off" for a period of time equal to the time required for the ramp function to reach its maximum. This dead-time may be adjusted by means of a front panel CONVERSION TIME control between 62.5 microseconds and 500 microseconds in four steps. This feature allows the operator to select the optimum parameters in the compromise between amplitude range and pulse frequency since these two parameters are inversely related.

For example, if the maximum amplitude range is between 500 mv and +10 volts, the dead-time required would be 500 microseconds (plus an additional 50 microseconds memory cycle time).

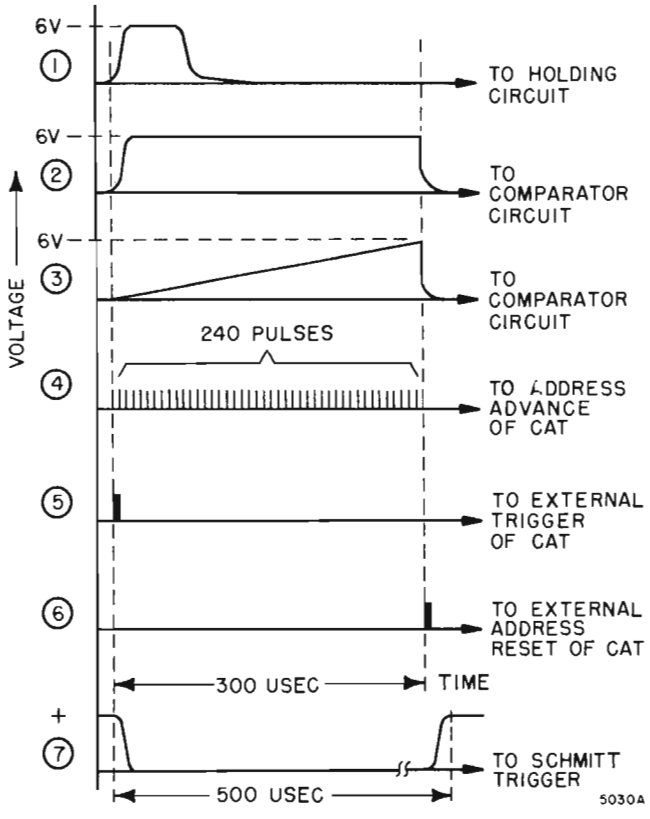

Figure 4. Model 606 Amplitude-to-Time Converter, Direct Pulse Input Signals.

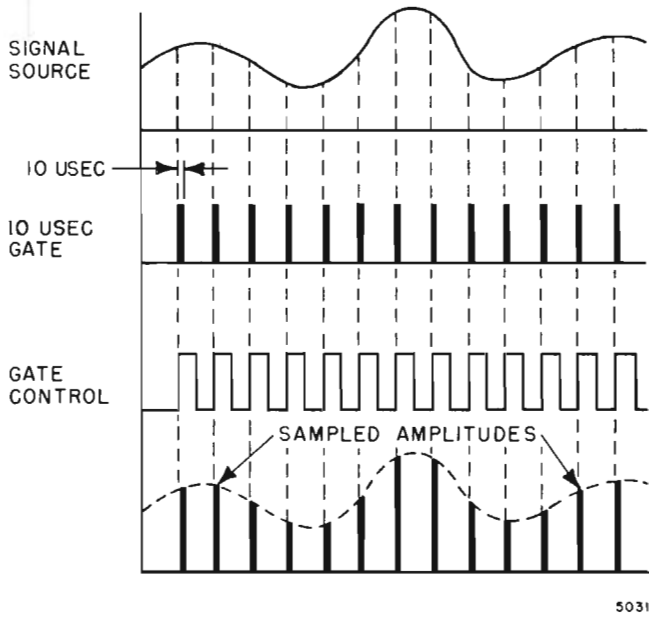

Figure 5. Model 606 Amplitude-to-Time Converter, External Control Input Signals.

Therefore, the maximum pulse repetition frequency would be approximately 1500 pulses per second. However, if the amplitude range is 500 mv to +5 volts, the only 300 microseconds dead-time would be required and thus allow an approximate maximum pulse repetition frequency of 3300 pulses per second.

The ramp voltage function is fed to a voltage comparator circuit along with the voltage "stored" in the holding circuit. When the ramp voltage equals the stored voltage another pulse is emitted. This is fed to J101 of the CAT and causes a single count to be added to and stored in the memory location being addressed at that instant of time. Therefore, a count has been stored in an address whose number is proportional to the amplitude of the input pulse.

In summary, referring to figures 3 and 4, the control gate is left open and the input pulse is fed to the holding circuit (1) and charges this circuit to the pulse peak amplitude (2). At the same time, this pulse fires the Schmitt trigger and the control flip-flop. The control flip-flop initiates the ramp (3), the trigger pulse (5), and sets the dead-time gate which inhibits firing of the Schmitt for a fixed preselected period of time (7). When the amplitudes from the ramp and holding circuits are equal, an address reset pulse is generated (6). The clock pulses appear as signal (4).

5.3 EXTERNAL CONTROL INPUT

For the amplitude analysis of analog signals, the analog signal is fed to the input. Sampling or gating pulses are fed to the GATE CONTROL input and the switch is placed in the EXT. position. The operation is identical to that of direct pulse inputs, except now the gate input fires the Schmitt trigger directly. The succeeding control flip-flop causes a sampling gate generator to open the control gate for ten microseconds after receiving the input gate pulse. The holding circuit therefore sees the amplitude of the analog input signal for a duration of ten microseconds. Figure 5 shows the signals as they appear at various points during Model 606 analog analysis operation.

6 TROUBLE SHOOTING PROCEDURE

To trouble shoot Amplitude-to-Time Converter, proceed as follows:

a. For externally gated signals, remove cables at J601, J602, J603.

b. Perform checkout procedures, paragraph 4, steps a. through o.

c. With oscilloscope, check signal at J601 for positive pulse of 3 volts with varying frequencies.

d. Check signal at J602 for 3 volts at approximately 1 kc frequency.

e. Check signal at J603 for 3 volts at approximately 800 kc frequency.

f. If any signals are missing, return module for service. See paragraph 4.3 of Series 600 Instruction Manual for service information.

g. If pulses are present, check J601, J602, J603 cables for continuity.

h. If cables are O.K., CAT is inoperative. Refer to CAT Instruction Manual for proper procedures.

i. For direct pulse input signals, perform checkout procedure, paragraph 4, steps q. through t.

j. Repeat steps c. through h. of this paragraph, except that the frequency in step c. will be 1 kc.

PC 1
INPUT CIRCUITS

PC 3
800 KC OSC. & RAMP GEN.

-12V
-4V
IN
GND
+20V
+4V

TP INPUT
TP RAMP
TP 800KC

TRIM CAP

EXT TRIG
CLOCK INPUT
EXT. GATE OPEN
EXT. ADDR. CONT.
T.P. Q6C
AFF +
EXT. ADDR. RDY.

DEAD TIME
3000 pf
.0047 uf
.01 uf
.01 uf
.014f

PC 2
CONTROL CIRCUITS

USED ON		
NEXT ASS'Y.	MODEL TYPE	QTY. REQD.
	606	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON –
DECIMALS ± —
FRACTIONS ± —
ANGLES ± —
MATERIAL —
FINAL PROTECTIVE FINISH —

AMPLITUDE TO TIME CONVERTER

DRAWN	W.P. SHOTWELL	11-1-63
CHKD.	D.C.	11-14-63
APPD.	J.Y.	11-15-63

TECHNICAL MEASUREMENT CORPORATION
441 WASHINGTON AVE.
NORTH HAVEN, CONN.

SCALE —

DRAWING NO. SCC 1816

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MODEL 620
READOUT CONTROL

1 INTRODUCTION

The Model 620 Readout Control (Retrace Suppressor) is designed to operate with the MNEMOTRON Computer of Average Transients (CAT). The module eliminates visible return traces on associated X-Y plotters. (See figure 1.)

2 SPECIFICATIONS

Pen Lift Control	Single Pole Double Throw Contact Switch
Height	4-1/4 inches
Length	11-1/2 inches
Width	4 inches
Weight	1.5 pounds (approximately)

3 OPERATING INSTRUCTIONS

To use the Readout Control, proceed as follows:

a. Check connections detailed in paragraph 2.3.1, Series 600 Instruction Manual.

b. Connect X-Y plotter pen lift connections to REMOTE PEN connector. (A-B normally closed contacts, B-C normally open contacts)

c. Connect X-Y plotter inputs connections to ANALOG connector (J110). (See table 3-5, Series 600 Instruction Manual for pin connections)

d. Set CAT PLOT/PRINT switch (S6) at PLOT.

e. Set INPUTS IN USE switch to position matching the number of inputs at CAT INPUTS IN USE switch (S1).

f. Set PLOT TIME control (R102) at rear of CAT to desired position.

g. Press CAT READOUT button (SL3).

NOTE

When used with MNEMOTRON Model 520 Type-Punch-Read Unit, set switches S46 and S47 at A position and set CAT PLOT/PRINT switch (S6) at PRINT.

h. The Readout Control module is now ready for use.

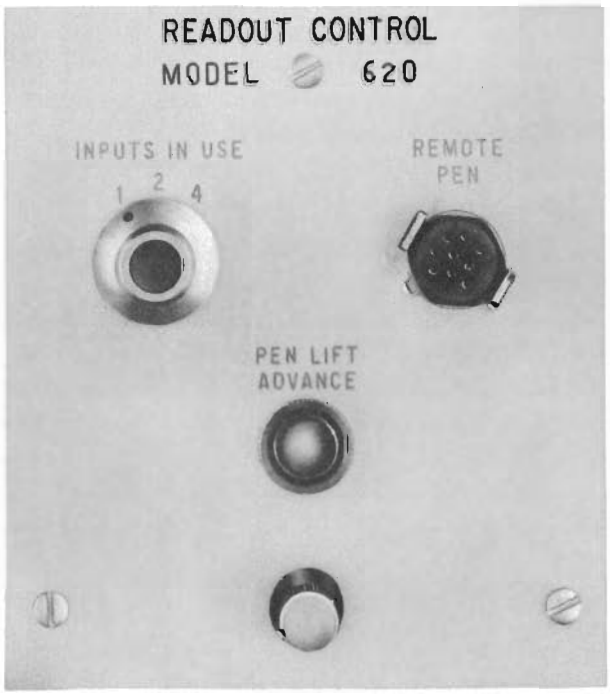


Figure 1. Model 620 Readout Control, Front View.

4 CHECKOUT PROCEDURE

Procedure determining the operational parameters of the Series 600 accessories are vital to their successful use. All modules are checked by the manufacturer, but subsequent handling may dictate the advisability of performing checkout procedures. When such procedures are performed, follow the steps as outlined in the sequence outlined. When equivalent equipment is used, make certain the signals are identical to those set out in the applicable paragraph. Modules which do not perform adequately after careful checkout analysis should be returned to the manufacturer for service.

To check out the Readout Control, proceed as follows:

a. Perform interconnection procedure outlined in paragraph 2.3.1, Series 600 Instruction Manual.

b. Check correct connections from X-Y plotter to module REMOTE PEN connector. (A-B normally closed, B-C normally open).

c. Set CAT and module INPUTS IN USE switches at 1.

d. At CAT, set PLOT/PRINT switch at PLOT.

e. Adjust X-Y plotter per CAT instruction manual.

f. Depress READOUT pushbutton.

g. Observe plotter pen action. At rear of CAT, adjust PLOT TIME control for smooth operation (approximately at mid-position).

h. When readout is completed, press and release PEN LIFT/ADVANCE switch.

i. Set INPUTS IN USE switches at 2.

j. Depress READOUT pushbutton.

k. Observe CRT and X-Y plotter. Plot should stop at end of first trace.

l. Press and hold PEN LIFT/ADVANCE switch. Pen should lift and move to left of plotter.

m. Release switch when pen is at beginning of new trace. Second trace should commence and stop when trace is ended.

n. Press and hold switch. Pen should lift and move to left of plotter and CAT STOP lamp should light.

o. Repeat steps i. through n. for four inputs in use.

5 THEORY OF OPERATION

(See SCB1685, SCB1686.)

The Readout Control stops CAT readout operation at each 100th address when there are four inputs in use and each 200th address when there are two inputs in use. The Readout Control can be used with either an X-Y plotter or MNEMOTRON Model 520 Type-Punch-Read Control Unit. When CAT readout has stopped, manual operation of the PEN LIFT/ADVANCE switch at the module lifts the pen on the X-Y plotter and allows it to proceed to the starting position of the next trace without inking the paper. On release of the switch, the CAT resumes operation for another 100 or 200 addresses.

With four inputs in use, 100 addresses are sensed by the module when No. 9 in units decade and No. 9 in the tens decade provide a positive signal (at address 99). This positive signal turns off two transistors. The second transistor, not conducting, permits the by-pass of +20 volts to complete a circuit through the PEN LIFT/ADVANCE switch. This stops the address advance pulse oscillator in the CAT. This oscillator output normally advances the CAT sweep one address per pulse.

When the PEN LIFT/ADVANCE switch is operated, it feeds one positive pulse through switch S47 on the side of the 600 CAT Accessory Cabinet. The pulse advances the CAT one address. The switch also supplies +20 volts which still inhibits the pulse oscillator. Pen lift contacts raise the recorder pen while the recorder carriage moves to the start of the second trace. When the PEN LIFT/ADVANCE switch is released, after the recorder is at the new starting position, the CAT is at address 100 and the decade signal is negative. Therefore, the transistors are turned on so that normal sweep operation can be resumed. The procedure reoccurs at address 199, 299, and 399.

With two inputs in use, a signal representing one hundred addresses is included in the decade signal. Therefore, the sweep will not stop at the address 99 because the negative one hundred signal allows the transistors to remain on. However, at address 199, the one hundred signal is positive so that the overall signal is positive. The same procedure occurs as before and repeats at the address 399. With one input in use, the plotting operation will stop at address 399.

Provision has been made in the Model 620 Readout Control for stopping the MNEMOTRON Model 520 Type-Punch-Read Control Unit (digital) operation at ordinates of, 99, 199, 299, and 399 with four inputs, as well as 199 and 399 with two inputs. With CAT PLOT/PRINT switch (S6) at PRINT position and READOUT button (SL3) depressed, the 520 can be controlled by the module and restarted by holding the PEN LIFT/ADVANCE

switch, then releasing it. This allows manual insertion of a code on the tape before each new trace.

CAUTION

When using the Model 620 Readout Control with MNEMOTRON 520 Unit, caution should be exercised NOT to hold the PEN LIFT/ADVANCE switch too long. Prolonged application of the switch will cause continuous printing at the tape position address at which it has been stopped.

In 520 operation, the identical decade signals used for the analog plotter, transmit a positive signal at the address 99 (based on the inputs in use) to turn off transistor Q1 and turn on transistor Q2. (See SCB1685.) This provides a forward bias on a diode (D2) which can then pass a positive pulse to set toggle configuration Q3 and Q4. This allows −12 volts to appear at the emitter Q6. The emitter follower at −12 volts stops the readout operation since the necessary level ground signal has been interrupted. When the PEN LIFT/ADVANCE switch is operated, the signal through S47 (at A position) of the cabinet advances the CAT to the start of the next memory section and resets toggle Q3, Q4 turning on the following transistor Q5. This provides the emitter follower with a ground potential and readout operation is resumed.

6 TROUBLE SHOOTING PROCEDURE

To trouble shoot Readout Control, proceed as follows:

a. If plotter pen does not stop at end of trace but immediately starts new retrace, make slight adjustments to CAT PLOT/TIME control.

b. If plotter pen still does not stop at end of trace:

1) Check S46 switch at cabinet for A position.

2) Check continuity of cable from 600 Cabinet J103 to CAT J110 connector. Refer to table 3–5, Series 600 Instruction Manual, for connections.

3) Check continuity of cable to CAT J109. Refer to table 3–3, Series 600 Instruction Manual.

4) If cables are O.K., module or CAT is inoperative. Refer to paragraph 4.3 for service instruction for the module or CAT Instruction Manual.

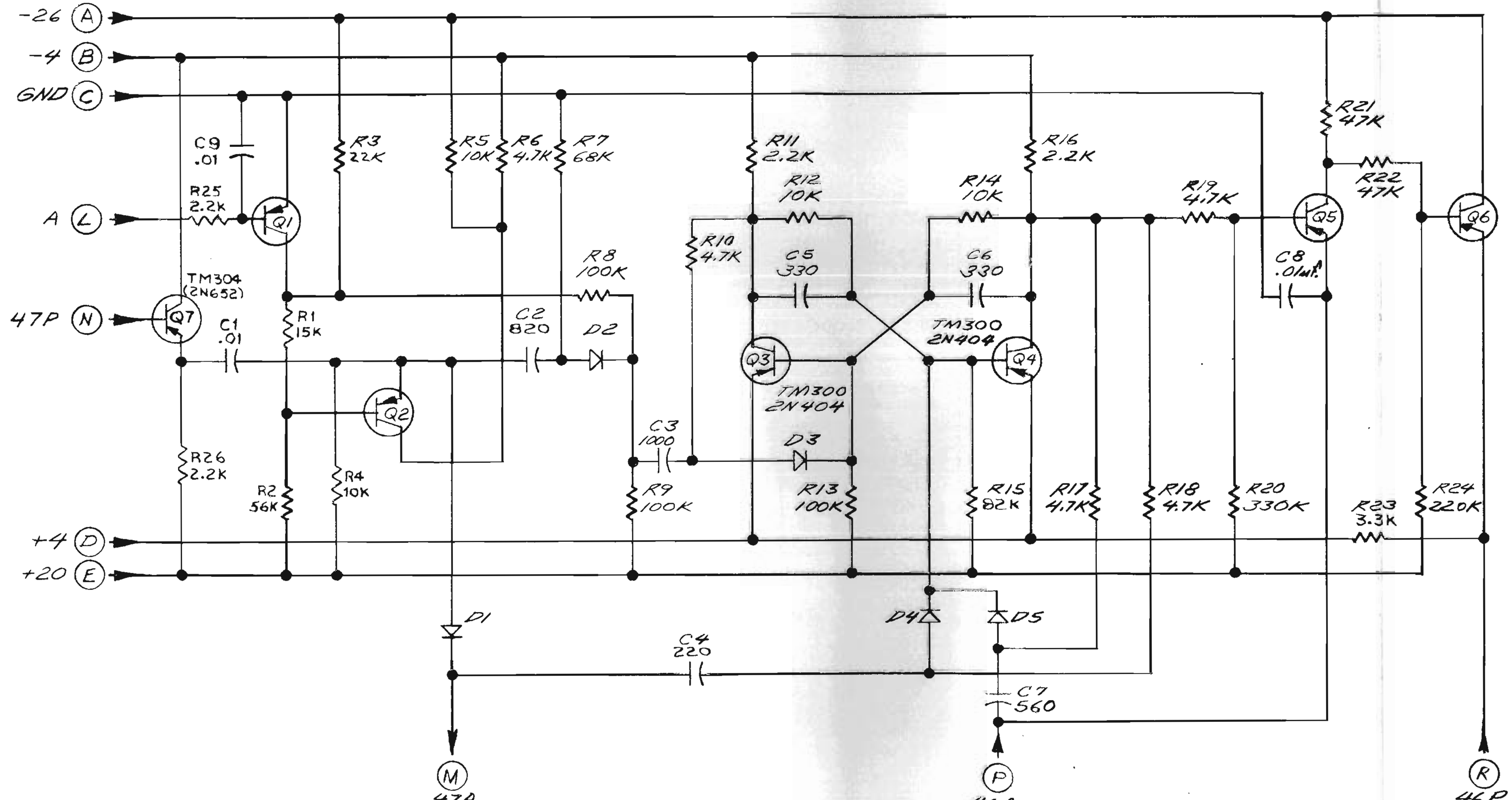
c. If pen does not lift when PEN LIFT ADVANCE switch is held, check connection from REMOTE connector at module to X-Y plotter.

d. Make certain proper switch contacts are used for pen lift operation at both units (A-B are normally closed, B-C are normally open).

e. If everything checks out correctly, refer to recorder Instruction Manual.

NOTES:

1.—REF: SEE DWG. ASB1685 FOR COMP. ASS'Y.
2.—ALL CAPACITORS ARE PF UNLESS OTHERWISE SPECIFIED.
3.—ALL RESISTORS ARE ¼W., 10%.
4.—ALL DIODES ARE TM002 (1N281).
5.—ALL TRANSISTORS ARE (TM309, 2N398) UNLESS OTHERWISE SPECIFIED.
6.—LAST COMP. REF. NO.'S:
CAPACITORS – C9 DIODES – D5
RESISTORS – R26 TRANSISTORS – Q7



REVISION	
D	R3 WAS 10K GE Pn. 10-9-63
C	CHANGED TITLE FROM RETRACE SUPPRESSOR D.Y.C. 7-19-63 V.H.
B	RESISTOR R4(10K) WAS CONNECTED TO -4, IS NOW CONN. TO +20. W.R.A. 7-16-63 V.H.
A	SEE REVISION NOTICE V.H. D.A.A. 6-26-63

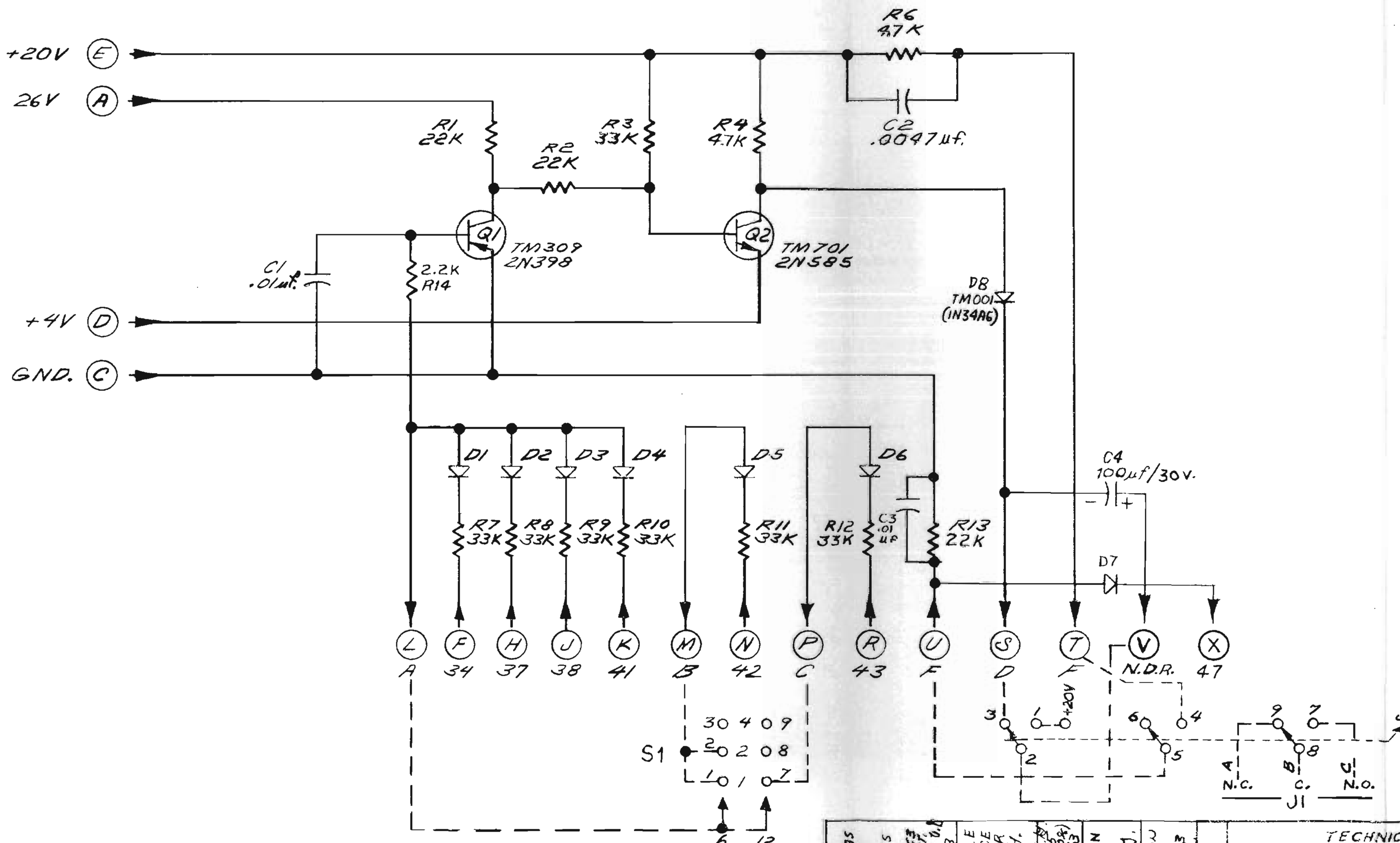
TECHNICAL MEASUREMENT CORPORATION
NORTH HAVEN, CONN. U.S.A.

MODEL	PC. NO.	
620	2	READOUT CONTROL 1

DRAWN:	CHKD.:	APPD.:	DRAWING NO.
W. FEHRING 1-11-63	H.R. 1-17-63	V.H. 1/18/63	SCB 1685

SKB 1368-2

NOTES:
1.-REF: SEE DWG. ASB1686 FOR COMP. ASSY.
2.-ALL RESISTORS ARE ¼W., 10% UNLESS OTHERWISE SPECIFIED.
3.-ALL DIODES ARE (TM002, 1N281) UNLESS OTHERWISE SPECIFIED.
4.-LAST COMP. REF. NO.'S:
CAPACITORS — C4
RESISTORS — R14 (OPEN NO. R5)
DIODES — D8
TRANSISTORS — Q2



E	C2 (.0047µf) WAS 470 PF. ADDED D8 NOTE 4 DIODES D8 WAS D7 RELOCATED C3 .01µf FROM BET. PIN U & PIN T. WAB 10-21-63
D	CHANGED TITLE FROM RETRACE SUPPRESSOR C.Y.O. J.H. 7-19-63
C	REMOVED R5 (8K ½W, 10%) C.Y.O. 7-12-63
B	SEE REVISION NOTICE N.R.A. 6-27-63 J.H.
A	SEE REVISION NOTICE N.R.A. 5-21-63
	REVISION

TECHNICAL MEASUREMENT CORPORATION
NORTH HAVEN, CONN. U.S.A.

MODEL	PC. NO.		
620	1	READOUT CONTROL 2	
DRAWN: W. FEHRING 1-14-63	CHKD.: 1-17-63	APPD.: J.H. 1/18/63	DRAWING NO. SCB 1686

SKB1368-1

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MODEL 635
MEMORY RESET UNIT

1 INTRODUCTION

The Model 635 Memory Reset Unit is designed to operate with the MNEMOTRON Computer of Average Transients (CAT). The module permits the manual reset of individual memory quarters in the Cat. (See figure 1.)

2 SPECIFICATIONS

Height	4-1/2 inches
Length	11-1/2 inches
Width	2 inches
Weight	1 pound (approximately)

3 OPERATING INSTRUCTIONS

To use the Memory Reset Unit, proceed as follows:

a. Check connections detailed in paragraph 2.3.1, Series 600 Instruction Manual.

b. Press CAT DISPLAY button (SL2).

c. The Memory Reset module is now ready for use.

4 CHECKOUT PROCEDURE

Procedures determining the operational parameters of the Series 600 accessories are vital to their successful use. All modules are checked by the manufacturer, but subsequent handling may dictate the advisability of performing checkout procedures. When such procedures are performed, follow the steps as outlined in the sequence outlined. When equivalent equipment is useed, make certain the signals are identical to those set out in the applicable paragraphs. Modules which do not perform adequately after careful checkout analysis should be returned to the manufacturer for service.

To check out the Memory Reset Unit, proceed as follows:

a. Perform interconnection procedure outlined in paragraph 2.3.1, Series 600 Instruction Manual.

b. At CAT, set INPUTS IN USE switch at 4.

c. Set INPUTS modulator switches at ON.

d. Set TRIGGER switch at INT.

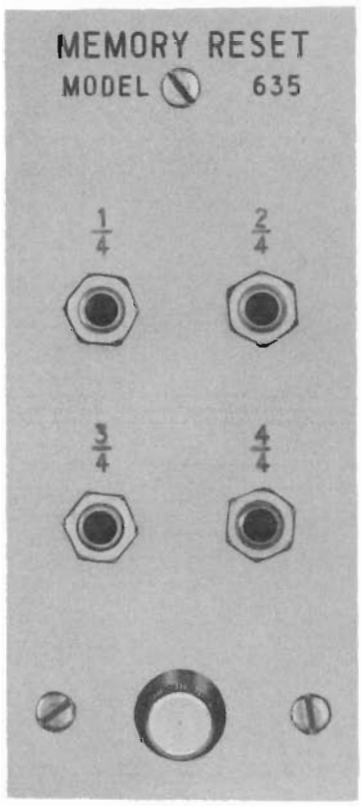


Figure 1. Model 635 Memory Reset Unit, Front View.

e. Set VERT. RANGE switch at 10^8

f. Depress START pushbutton and allow data to accumulate for approximately ten seconds.

g. Depress DISPLAY pushbutton.

h. Position each input on CRT by VERT. POS. controls so that all four traces are visible.

i. At module, depress 1/4 pushbutton. Trace should reset for 1st sweep quadrant. Trace will set to its zero (reset) position.

j. Repeat step i. for 2/4, 3/4, 4/4 pushbuttons.

5 THEORY OF OPERATION

(See figures 2, 3, and SCB1813.)

The Memory Reset Unit permits the operator to erase the data in any memory quadrant of the CAT without disturbing the data stored in the remaining quadrants. This is accomplished by reset pushbuttons located on the front panel of the module.

The Model 635 accessory utilizes No. 9 in the units decade and No. 9 in the tens decade of the CAT. In addition, four polarity combinations are automatically supplied by the CAT to denote specific sweep quadrants. These occur at addresses 100, 200, 300, 0. They are designated as the 1/4 signal and the 1/2 signal and are listed in table 1.

TABLE 1 SWEEP QUADRANT POTENTIALS

Quadrant	*1/4 Signal*	*1/2 Signal*
1st	negative	negative
2rd	positive	negative
3rd	negative	positive
4th	positive	positive

To reset the individual traces of the CAT, it is necesary to sense each quadrant as it is being swept at the display oscillator rate. Four lines 1/4 (quarters) and its complement $\overline{1/4}$, and 1/2 (halves) and its complement $\overline{1/2}$ are needed to give four possible combinations. Knowing these combinations, it is possible to decode these lines and select any one of four conditions.

Because, as A, figure 3 indicates, these lines change level at addresses 0, 100, 200, and 300, it becomes necessary to advance these signals in time by one address. (See B, figure 3.) This is done as follows: at the address 399 the 1/4 line being positive, forward biases diode D1 so that the decoded address 99 signal (occurring actually at 399) passes through, setting switching circuit I as indicated in B, figure 3, (A1 and B1 from addresses 399 to 99).

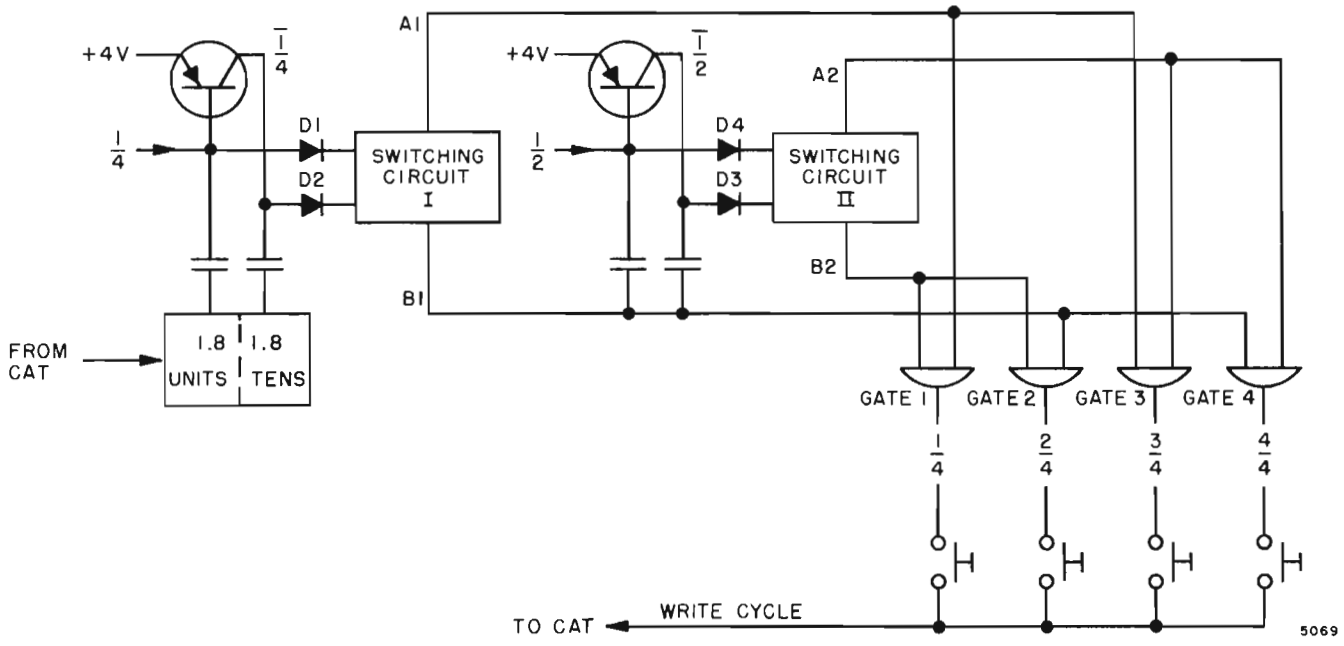


Figure 2. Model 635 Memory Reset Unit, Block Diagram.

When address 99 is reached (1/4 negative) the $\overline{1/4}$ signal now forward biases diode D2 (D1 back biased) so that the decoded 99 signal sets switching circuit I to its opposite condition. (See B, figure 3, address 99 to 199.) In this manner a 1/4 (B1) signal and a $\overline{1/4}$ (A1) signal is generated that leads the actual 1/4 and $\overline{1/4}$ signals by one address.

A similar operation is performed on the 1/2 line except that the pulse used to change the state of the switching circuit II is a carry pulse from switching circuit I, i,e., whenever B1 goes positive. See B, figure 3. In summary, the lines 1/4, $\overline{1/4}$, 1/2, and $\overline{1/2}$ are used only to steer the address 99 pulse and the carry pulse to the proper transistor in the individual switching circuits.

A1 and B2, both being at ground potential during the first quarter only transmit a ground potential through gate I, which inhibits the write cycle when the 1/4 pushbutton is depressed. This erases the stored information during this time only.

While the CAT is sweeping through the second quarter, B1 and B2 are both negative, therefore when the 2/4 pushbutton is depressed, information in the 2nd trace will be erased.

A similar condition occurs for the 3/4 and 4/4 pushbutton. Since the four lines (A1, B1, A2 and B2) can never have the same polarity combination for more than one sweep quadrant, there can never be a ground potential at two pushbuttons during the same quadrant operation.

6 TROUBLE SHOOTING PROCEDURE

If module is inoperative after checkout procedure has been performed, return unit for service. Refer to paragraph 4.3 of Series 600 Instruction Manual for service procedure.

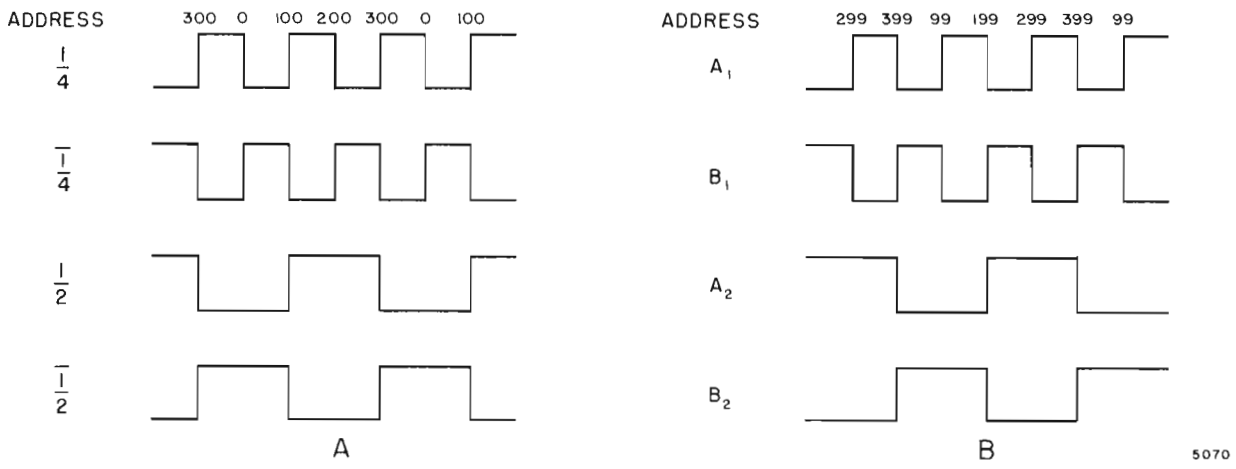
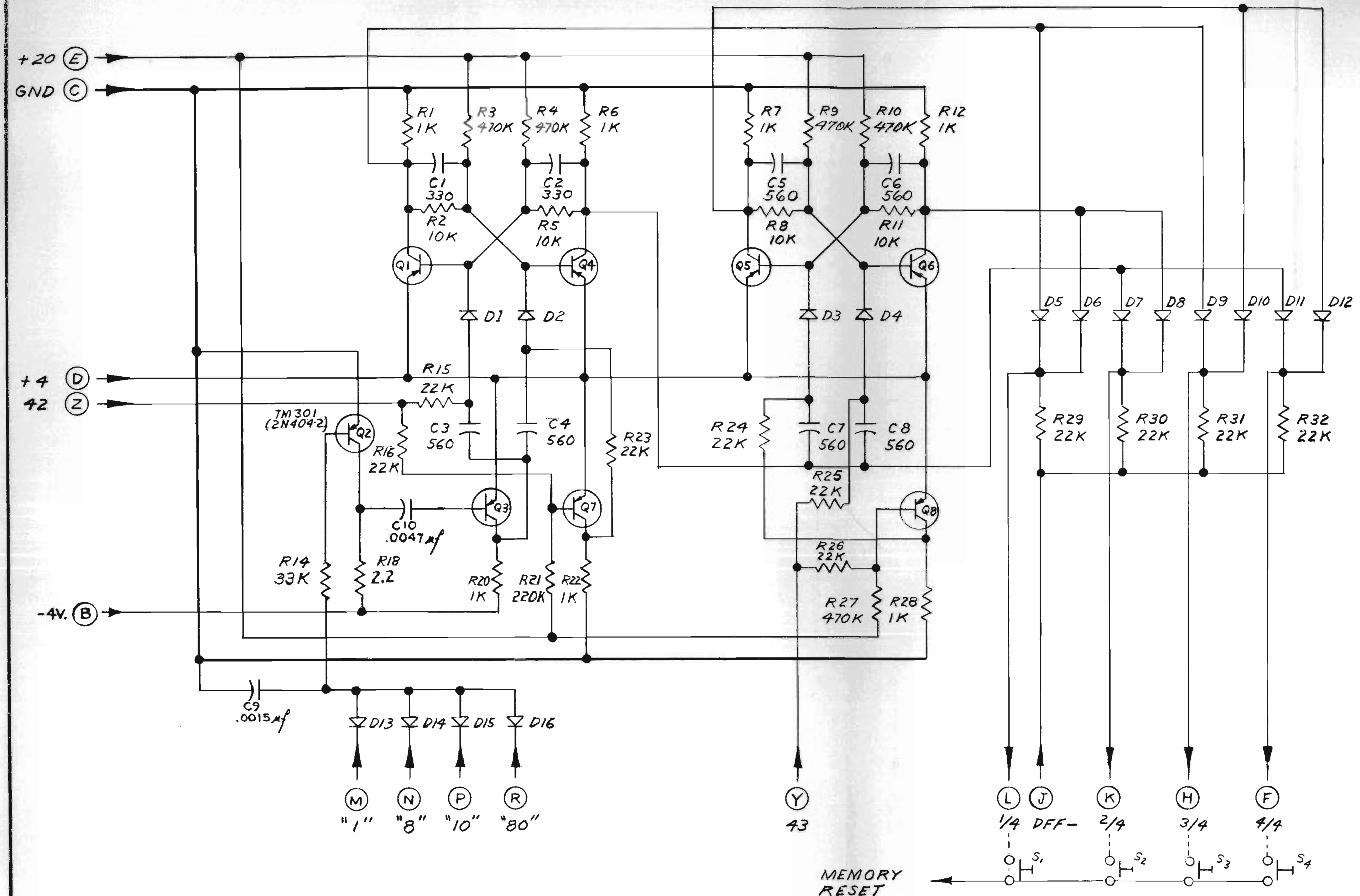


Figure 3. Model 635 Memory Reset Unit, Signal Diagram.



NOTES:

1. REF. SEE ASB-1813 FOR COMP. AS
2. ALL RESISTORS ARE 1/4W ± 10
3. ALL CAPACITORS ARE Pf, UNLE OTHERWISE SPECIFIED
4. ALL DIODES ARE TM001 (1N34
5. ALL TRANSISTORS ARE TM30 (2N404), UNLESS OTHERWISE SPECIFIED
6. LAST COMP. REF. NO'S:
   RESISTORS – R32 (OPEN NOS. R13, R17, R
   CAPACITORS – C10
   DIODES – D16
   TRANSISTORS – Q8

REVISION	
D 1248	SEE REVISION NOTICE. WAB 10-22-63
C 1161	SEE REVISION NOTICE. 7-16-63
B 1101	R9, R10 470K WERE 1K, R13 470K WAS 330K, R14 47K WAS 22K, R17 33K WAS 22K
A 1048	R13 WAS 470K. C5 & C6 WERE 330pf. R9 & R10 WERE 470K. 5/21/63

TECHNICAL MEASUREMENT CORPORATION
NORTH HAVEN, CONN. U.S.A.

MODEL	PC. NO.	MEMORY RESET			
635		DRAWN: EJB 10-16-62	CHKD.: 10-22-62	APPD.: 12/14/62	DRAWING NO. SCB-1813

SKB 1477

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MODEL 645
PRESET SWEEP COUNTER
(ELECTROMECHANICAL)

1 INTRODUCTION

The Model 645 Preset Sweep Counter (electromechanical) is designed to operate with the MNEMOTRON Computer of Average Transients (CAT). The module permits manual selection of number of CAT analysis sweeps and terminates operation when preset number has been reached. The unit electromechanically displays sweep numbers downward from preselection to 0000. (See figure 1.)

2 SPECIFICATIONS

Height	4-1/2 inches
Length	11-1/2 inches
Width	4 inches
Weight	2 pounds (approximately)

3 OPERATING INSTRUCTIONS

NOTE

Model 645 is used only with CAT PROGRAM switch (S103) at C position.

To use the electromechanical Preset Sweep Counter, proceed as follows:

a. Check connections detailed in paragraph 2.3.1, Series 600 Instruction Manual.

b. Connect input signals under investigation to CAT input connections J1, J2, J3, J4.

c. Press CAT DISPLAY pushbutton (SL2).

d. Press CAT RESET pushbutton (S7).

e. Set CAT ANALYSIS TIME selector switch at 62.5 or slower. (Do not use at 31.25 position)

f. Depress counter knob and turn 90 degrees to introduce preselected numbers.

g. Open door and manually set counter dials to desired sweep count.

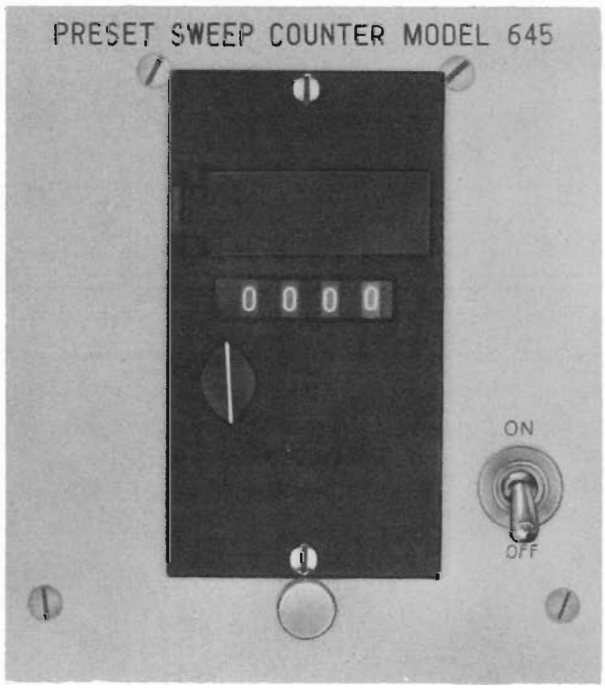
h. Return counter knob to original position.

i. The electromechanical Preset Sweep Counter is ready for use. The unit will start to operate when the first address sweep enters the 20th address.

j. Module will reset and preselected number will reappear when counter knob is depressed without turning.

NOTE

No analysis operation can be initiated until counter is reset.



1010

Figure 1. Model 645 Preset Sweep Counter, Front View.

4 CHECKOUT PROCEDURE

Procedures determining the operational parameters of the Series 600 accessories are vital to their successful use. All modules are checked by the manufacturer, but subsequent handling may dictate the advisability of performing checkout procedures. When such procedures are performed, follow the steps as outlined in the sequence outlined. When equivalent equipment is used, make certain the signals are identical to those set out in the applicable paragraphs. Modules which do not perform adequately after careful checkout analysis should be returned to the manufacturer for service.
To check out the electromechanical Preset Sweep Counter, proceed as follows:

a. Perform interconnection procedure outlined in paragraph 2.3.1, Series 600 Instruction Manual.

b. At CAT, set PROGRAM switch at C.

c. Set TRIGGER switch at INT.

d. Set ANALYSIS TIME switch at 1.0.

e. At module, set counter dials at 20. Refer to operating procedure.

f. At CAT, depress START pushbutton. Counter dial should count down to 0000 at one second intervals. At 0000, CAT operation should cease. At CAT, START lamp should extinguish and STOP lamp should light.

5 THEORY OF OPERATION

(See SCB1814.)

The electromechanical Preset Sweep Counter starts operating when the module receives the sharply defined pulse signal which marks the 20th ordinate of each sweep. The pulse triggers a one-shot multivibrator to produce a negative going pulse. This pulse turns on a driver transistor energizing the counter coil to register one count. The process is repetitive until the mechanical counter arrives at zero from the number set at the sweep indicator.
When the display counter reaches zero, a switch is actuated. The normally open contacts of the switch close, applying a positive signal to turn on a transistor. This transistor, acting as a switch, transmits a stop signal to the CAT which inhibits further sweep operation.

6 TROUBLE SHOOTING PROCEDURE

To trouble shoot the electromechanical Preset Sweep Counter, proceed as follows:

a. If numbers do not move on mechanical counter as CAT is sweeping, return module for service. Refer to paragraph 4.3 of Series 600 Instruction Manual for instructions.

b. If CAT does not sweep when START pushbutton is depressed, depress RESET pushbutton at module.

c. If CAT still does not operate, module is inoperative. Return for service.

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MODEL 646
PRESET SWEEP COUNTER
(ELECTRONIC)

1 INTRODUCTION

The Model 646 Preset Sweep Counter (electronic) is designed to operate with the MNEMOTRON Computer of Average Transients (CAT). The module permits manual selection of number of CAT analysis sweeps and terminates operation when preset number has been reached. The unit electronically displays sweep numbers upward from zero to preselected number. (See figure 1.)

2 SPECIFICATIONS

Height	4-1/2 inches
Length	11-1/2 inches
Width	8 inches
Weight	5 pounds (approximately)

Figure 1. Model 646 Preset Sweep Counter, Front View.

3 OPERATING INSTRUCTIONS

NOTE

Model 646 is used only with CAT PROGRAM switch (S103) at C position.

To use the electronic Preset Sweep Counter, proceed as follows:

a. Check connections detailed in paragraph 2.3.1, Series 600 Instruction Manual.

b. Connect input signals under investigation at CAT input connectors J1, J2, J3, J4.

c. Press CAT DISPLAY pushbutton (SL2).

d. Press CAT RESET pushbutton (S7).

e. Manually position PRESET COUNT selector switches to desired sweep count.

f. Electronic Preset Sweep Counter is ready for use. The unit will start to operate when the first address sweep enters the 20th address.

g. To repeat an analysis run, RESET button must be depressed.

4 CHECKOUT PROCEDURE

Procedures determining the operational parameters of the Series 600 accessories are vital to their successful use. All modules are checked by the manufacturer, but subsequent handling may dictate the advisability of performing checkout procedures. When such procedures are performed, follow the steps as outlined in the sequence outlined. When equivalent equipment is used, make certain the signals are identical to those set out in the applicable paragraphs. Modules which do not perform adequately after careful checkout analysis should be returned to the manufacturer for service.

To check out the electronic Preset Sweep Counter, proceed as follows:

a. Perform interconnection procedure outlined in paragraph 2.3.1, Series 600 Instruction Manual.

b. At CAT, set PROGRAM switch at C.

c. Set TRIGGER switch at INT.

d. Set ANALYSIS TIME switch at 1.0.

e. At module, depress RESET pushbutton.

f. Set PRESET COUNTER selector switches at 020.

g. At CAT, depress START pushbutton. Module display should indicate number of sweeps while they are occurring. When preselected number is reached (020), CAT operation should cease. At CAT, START lamp should extinguish and STOP lamp should light.

h. Observe module display. Display number and PRESET COUNTER selector switch positions should be the same.

5 THEORY OF OPERATION

5.1 GENERAL

The electronic Preset Sweep Counter uses binary coded decimal logic. Input pulses are supplied to three decades giving the counter a maximum count capacity of 999. The decimal numbers are displayed on the front panel of the module and the CAT stops operation when the preselected number of sweeps has been obtained. After CAT operation has ceased, the module is manually reset, and a new number of sweeps can be selected.

5.2 BINARY LOGIC DISCUSSION

Binary logic is used in the Model 646 module operation. Briefly, it permits the choice of combinations which cannot be duplicated among all the combinations used in a specific application. In the electronic Preset Sweep Counter operation, any required combination must provide a positive voltage potential before the electronics will operate correctly. This takes place when the PRESET COUNT selector switches stop CAT operation at a preselected number and when a number is displayed on the three decade display windows.

A basic binary coded decimal unit consists of four transistor flip-flop circuits. Each circuit always operates with one transistor conducting while its opposite number is off. The flip-flop may only change its state (reverse transistor action) when triggered by a positive pulse. A positive pulse is used in the Model 646 application. In the four flip-flop configuration under discussion, the output of one flip-flop provides the trigger for the input of the next one. Referring to figure 2, the external reset pulse resets each circuit to its initial state or zero combination. The first positive input pulse changes the polarity of the first flip-flop. Since the output (2^0) of this is at a negative potential, the following circuits remain in their initial state. At the second positive input pulse, the first flip-flop changes state, its output is positive thereby changing the state of the second circuit whose output (2^1) becomes negative. As a result, the following circuits remain in their former state. At the third positive pulse, the change of state of the first flip-flop produces a negative output and all the following circuits remain static. At the fourth input pulse, the output of the first flip-flop becomes positive changing the state of the second flip-flop, whose output also becomes positive. This changes the state of the third flip-flop to a negative output (2^2) which cannot affect the state of the fourth circuit. The next, fifth pulse, again produces

a negative output at the first flip-flop which cannot change the state of the following circuits. The sixth input pulse changes the state of both the first and second flip-flop. The second flip-flop at negative output does not affect the following circuits. The seventh pulse again repeats the odd combination and no circuit following the first can be affected. The state of every flip-flop is changed with the eighth incoming positive pulse. This occurs when the output of the first flip-flop becomes positive causing the second flip-flop output to become positive, which causes the third flip-flop output to become positive, thereby changing the state of the fourth flip-flop to a negative output (2^3). Obviously the ninth pulse at negative output repeats the odd pulse pattern. Since four binary flip-flops can result in sixteen possible non-recurring combinations, the tenth pulse must return all flip-flops to a zero state. This is done with a gate G which is introduced to prevent a carry pulse from the first flip-flop from changing the state of the second flip-flop. Instead, this carry pulse is passed directly to one side of the fourth flip-flop, resetting it to its zero state. This gate closes when the output of the fourth flip-flop is positive.

At the ninth input pulse the first and fourth flip-flops have a positive output while the second and third flip-flops are at their zero reset state. When the tenth pulse is applied to the first and indirectly fourth flip-flop changing them to their zero state, the condition of all circuits is at zero. Resetting the fourth flip-flop results in a positive output which produces a carry pulse into the next higher decade. The foregoing series of combinations transforms the positive input pulses to binary coded decimal form. With proper connections to each half of the flip-flop as indicated in figure 2, a positive potential is applied to associated decoding circuits denoting the decimal number when the pulse representing that number has been applied to the first decade. For example: To decode decimal number 1, the No. 1 gate must receive four output signals from the binary circuits. These signals must all be positive. At the first input pulse referring to the pulse sequence truth table in figure 2, this is the result of the output from 2^0, 2^1, 2^2, 2^3. It represents a unique condition that occurs only after the first positive input pulse is applied to the decade. Similar unique conditions exist for all decimal numbers (0 to 9) used in the module.

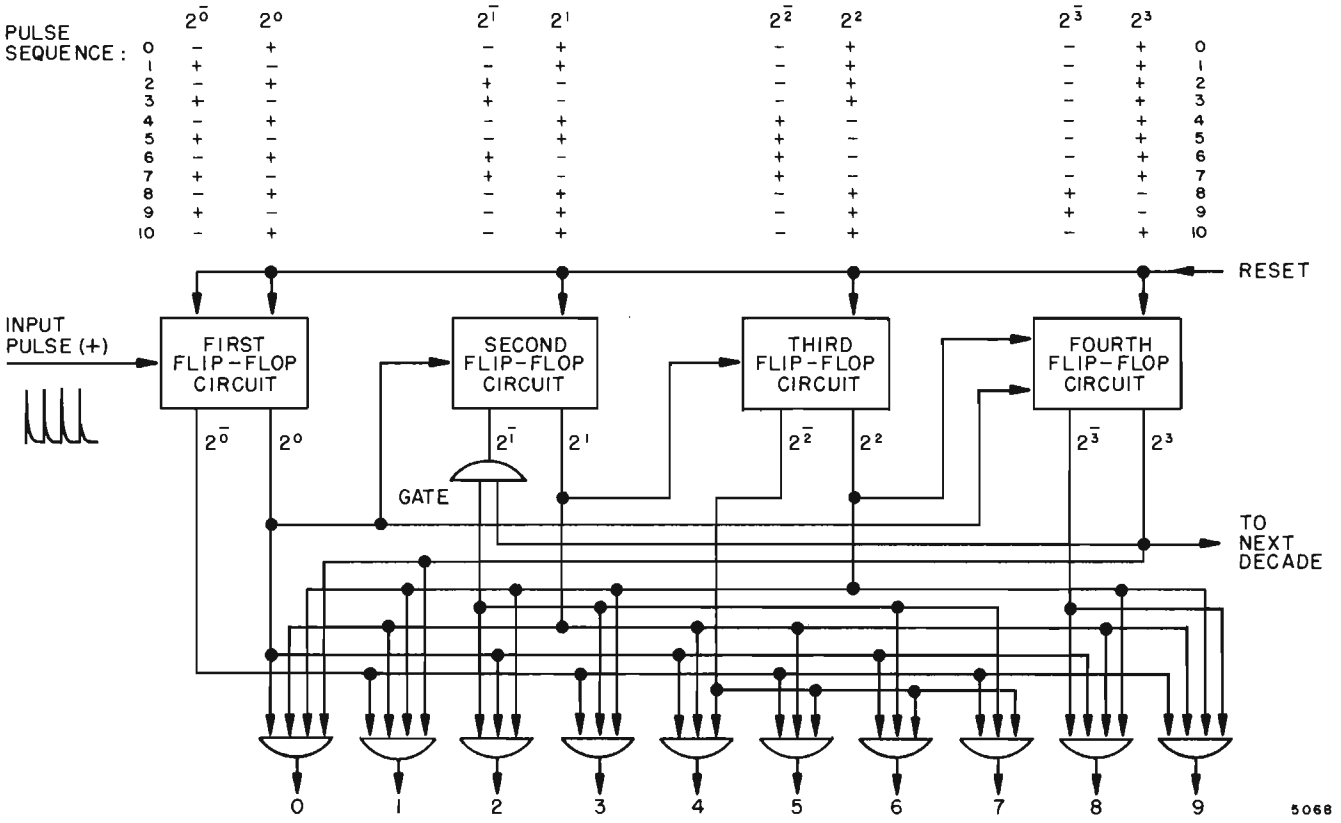


Figure 2. Model 646 Preset Sweep Counter, Binary Logic Diagram.

5.3 ELECTRONIC PRESET SWEEP COUNTER CIRCUIT THEORY (See figure 3 and SCB1807, SCC1808, SCB1809.)

The electronic Preset Sweep Counter is manually set for the desired number of sweeps by positioning the PRESET COUNT selector switches for the desired units, tens, and hundreds. When the number of CAT sweeps has reached this value, the CAT is put into the stop mode. The module must be manually reset for further CAT operation.

When the CAT is operating, refer to figure 3, the module receives sharply defined positive pulses at the 20th address of each sweep. This turns off one transistor, turns the following transistor on, and provides a positive signal pulse to the units decade binary flip-flop circuit. The binary signal combinations produce a positive output for applicable decimal numbers. (See figure 2.) The output of the first decade (units) supplies the input to the next decade (tens). The output of the second decade (tens) supplies the input to the next decade (hundreds).

The lamp circuits are fed from a filtered −6.3 volt power supply integral to the unit. The correct combination of binary outputs transmit a positive potential to the appropriate lamp driver circuit, thus

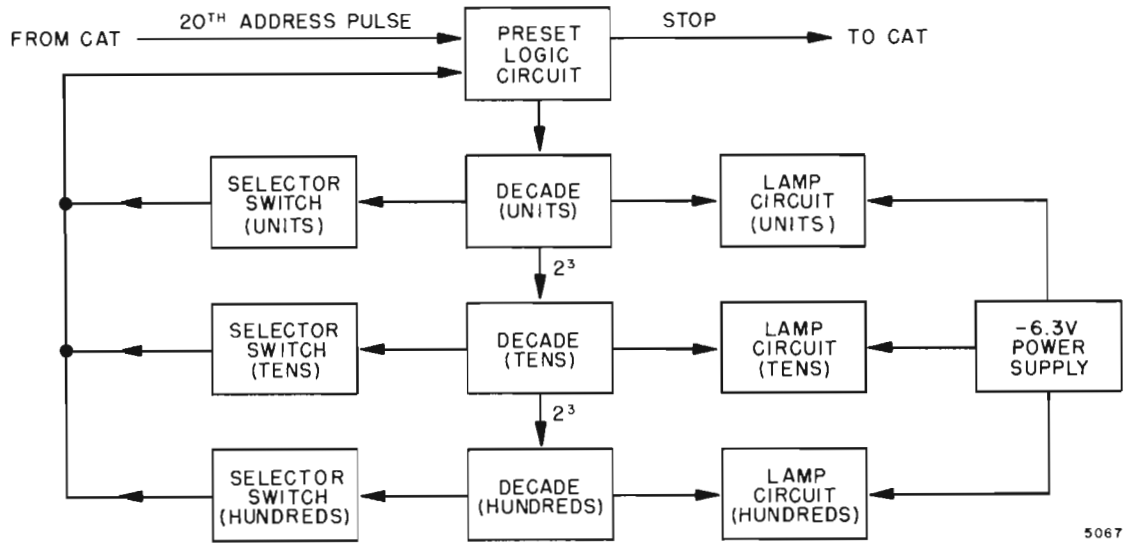


Figure 3. Model 646 Preset Sweep Counter, Block Diagram.

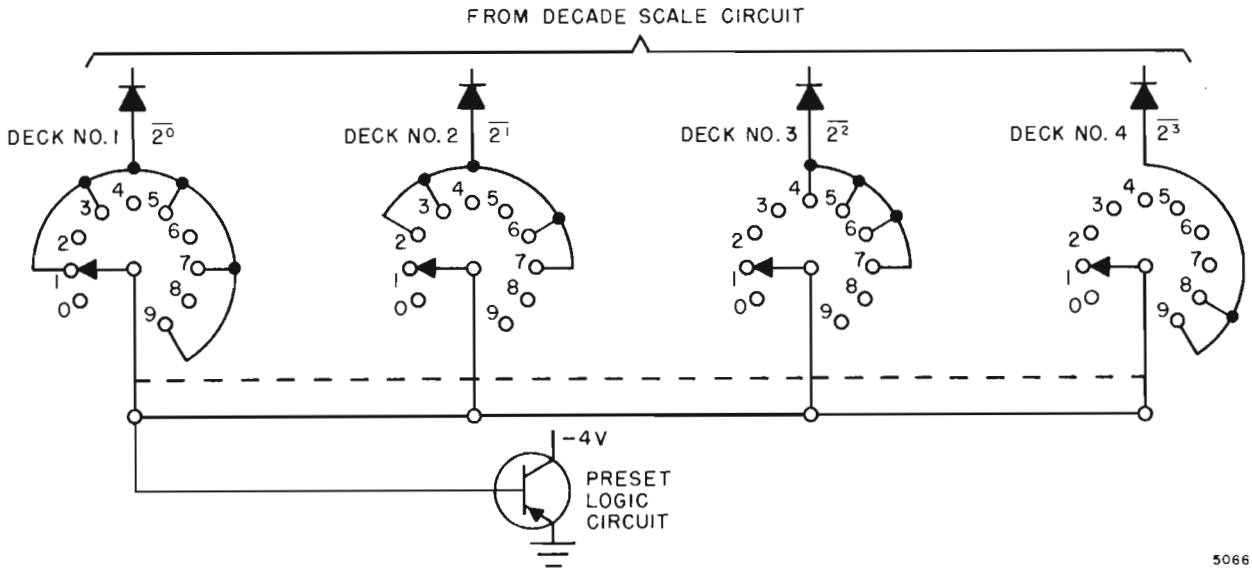


Figure 4. Model 646 Preset Sweep Counter, Decade Switch Positions.

completing the −6.3 volt circuit and lighting the applicable lamp. The CAT sweep number will be visible on the three numerical decade displays at the Preset Sweep Counter front panel. No two numbers can be lighted at the same time on the same decade display.

Each decade switch set at its desired number permits a positive signal to pass through the contacts. (See figure 4.) Thus, a transistor is turned off and its following transistor is turned on. This provides a ground potential to the stop circuits at the CAT. The circuit, now at ground, provides a path to stop CAT operation at the preselected number of sweeps. Reset is accomplished manually at the module by depressing the RESET button thereby applying −4 volts directly to the reset lines of the decades.

6 TROUBLE SHOOTING PROCEDURE

To trouble shoot the electronic Preset Sweep Counter, proceed as follows:

a. If CAT does not sweep when START pushbutton is depressed, depress RESET pushbutton at module.

b. If CAT still does not operate, module is inoperative. Return for service. Refer to paragraph 4.3 of Series 600 Instruction Manual for instructions.

c. If a number in the front panel display does not light, check lamp and replace if necessary. See figure 5, and refer to replacement procedure in paragraph 7.

7 LAMP REPLACEMENT FOR MODEL 646

To replace lamp, proceed as follows:

a. Determine lamp positions by referring to figure 5.

b. Detach rear cover of appropriate decade by removing screw at top and bottom, being extremely careful not to damage wiring.

c. Remove and replace with No. 47 lamp.

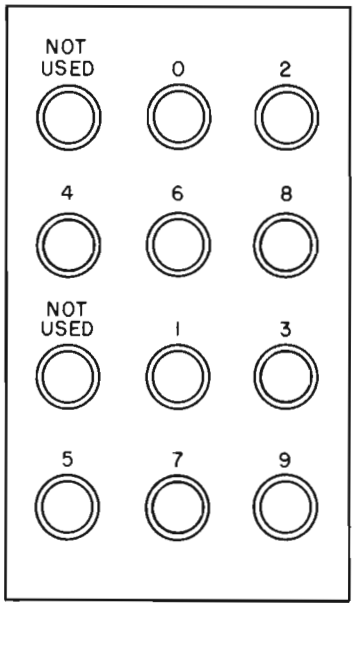
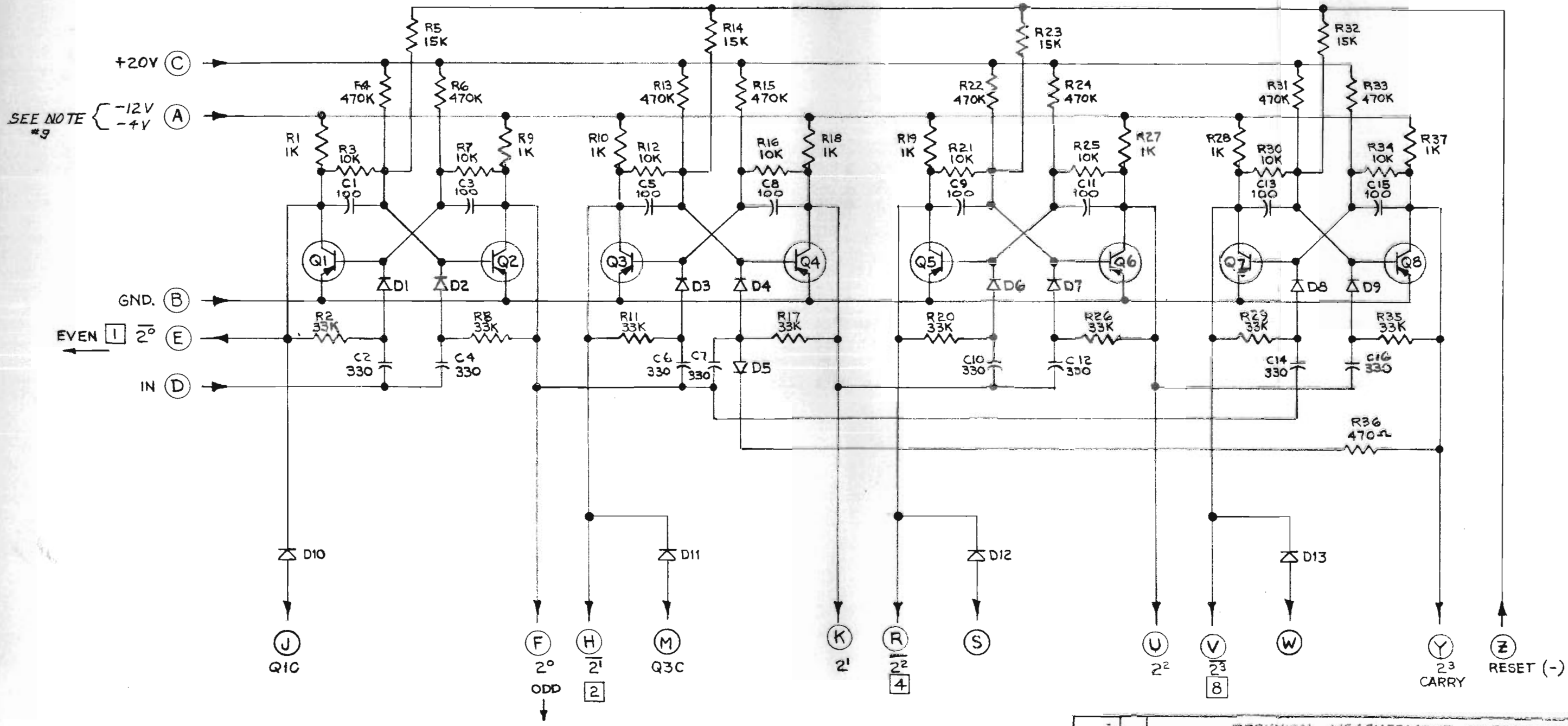


Figure 5. Model 646 Preset Sweep Counter, Lamp Replacement Diagram.

9. WHEN 646 IS USED PIN (A) IS -12V.
WHEN 592 IS USED PIN (A) IS -4V.

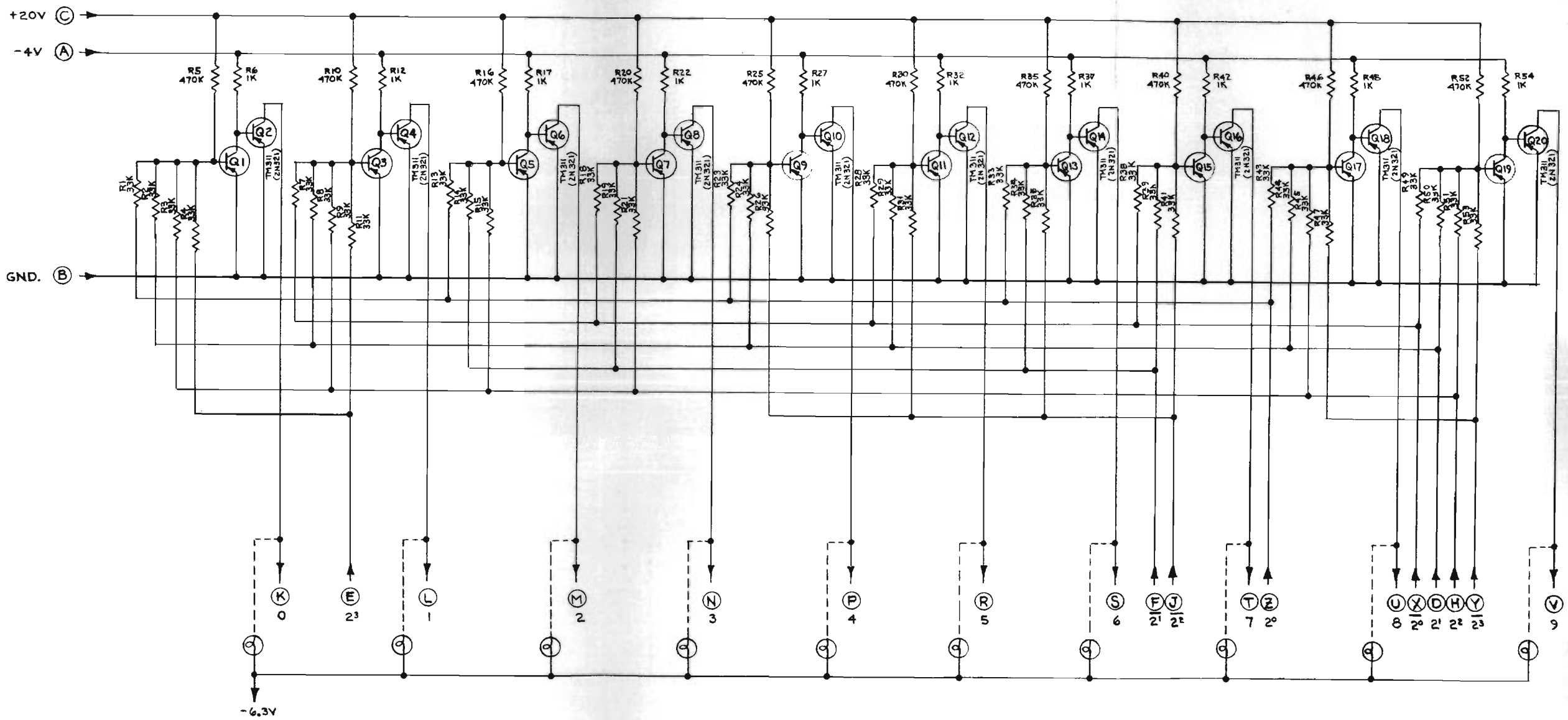
NOTES:
1-REF. SEE ASB1807 FOR COMPONENT ASSEMBLY.
2-Nº. IN BOXES ARE CODES FOR PAPER TAPE OUTPUT.
3-Nº. LISTED IN EXP. FORM ARE FOR LAMP DRIVER DECODER.
4-ALL TRANSISTORS ARE TM300 (2N404)
5-ALL RESISTORS ARE ¼W, 10%.
6-ALL CAPACITORS ARE pf.
7-ALL DIODES ARE TM001 (IN34AG)
8-LAST COMP. REF. Nº.:
TRANS. Q8
CAP. C16
RES. R37
DIODE D13



REVISION		TECHNICAL MEASUREMENT CORPORATION NORTH HAVEN, CONN. U.S.A.				
A SEE REVISION NOTICE U.H. 2-27-63		MODEL	PC. NO.	SCALE OF 10		
		646	3,5,7			
		592	1,2,3,4	DRAWN: R.I. COLE 10-15-62	CHKD.: 10-24-62	APPD.: U.H. 10/24/62	DRAWING NO. SCB1807

SKB 1464

NOTES:
1- REF. SEE DWG. ASB1808 FOR COMPONENT ASSEMBLY.
2- ALL TRANSISTORS ARE TYPE TM300 (2N404) UNLESS OTHERWISE SPI
3- ALL RESISTORS ARE ¼ W, 10 %.
4- LAST COMPONENT REFERENCE NO.: —
TRANS. Q20 RES. R54



USED ON		
NEXT ASS'Y	MODEL TYPE	QTY. REQD.
1737	646	3

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON –
DECIMALS ±
FRACTIONS ±
ANGLES ±
MATERIAL
FINAL PROTECTIVE FINISH

8 TO 10 LINE DEC. & LAMP DR.

DRAWN R.I. SOLE	10-13-62
CHKD.	10-24-62
APPD. U.B.	10/24/62

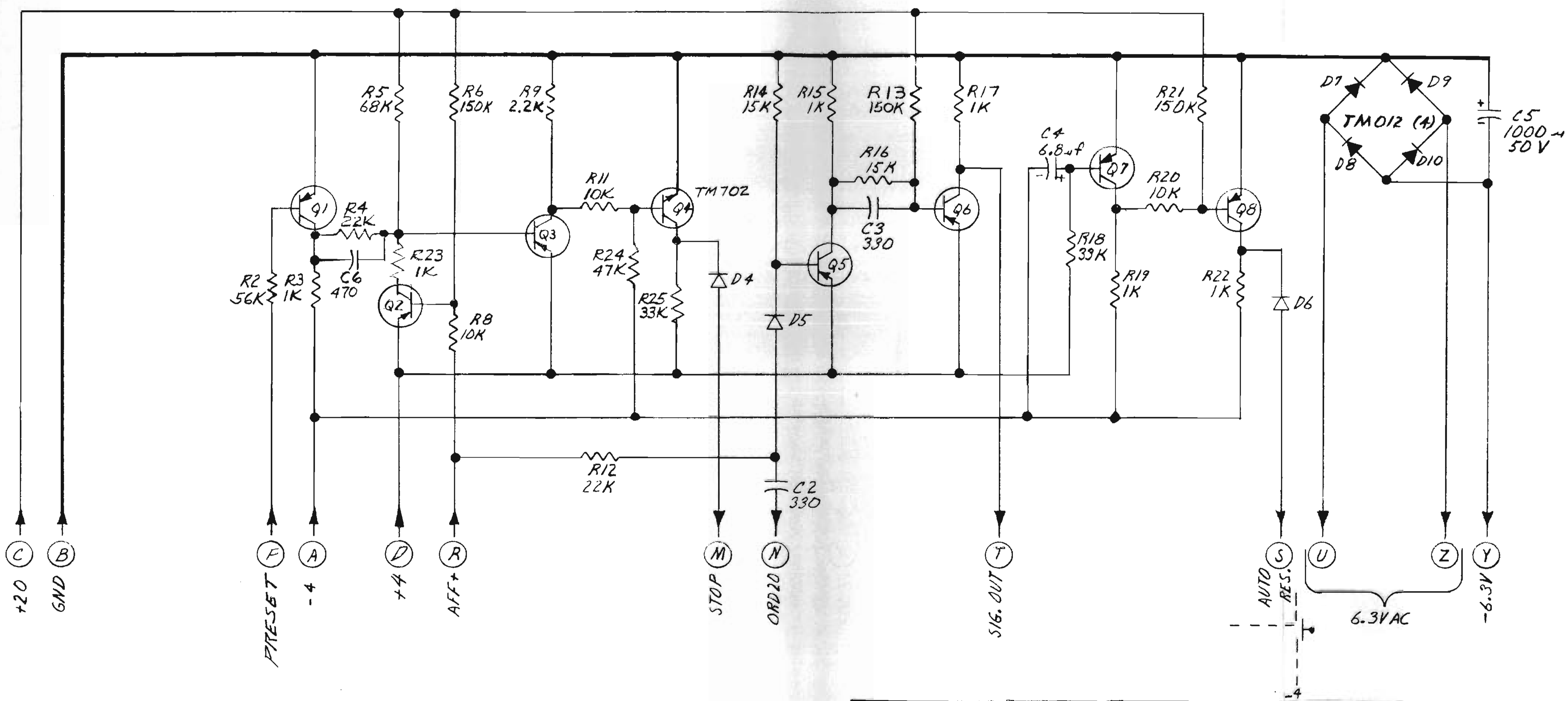
TECHNICAL MEASUREMENT CORPORATION
441 WASHINGTON AVE.
NORTH HAVEN, CONN.

SCALE

DRAWING NO.
SCC 1808

SKB15

NOTES:
1. REF. SEE DWG. AS FOR COMPONENT ASSEMBLY.
2. ALL CAPACITORS ARE pf UNLESS OTHERWISE SPECIFIED.
3. ALL RESISTORS ARE ¼ W, 10 %.
4. ALL DIODES ARE TM 001 UNLESS OTHERWISE SPECIFIED.
5. ALL TRANSISTORS ARE TM 300 UNLESS OTHERWISE SPECIFIED.
6. LAST COMPONENT REF. NO'S.
TRANSISTORS Q8
RESISTORS R25 (OPEN No's R7, R10, R1)
DIODES D10 (OPEN NO.'S D1, D2, D3)
CAPACITORS C6 (C1 OPEN)



REVISION	
D 1428	R6 150K WAS 470K, R21 150K WAS 470K, R13 150K WAS 100K. REMOVED MFG'S No'S AS PER MEMO; DSD 12-5-63 A.B. 12-6-63 V.H.
C 1296	ADDED R13 (100K) RES. O.E.M. 10-3-63 V.B.
B 1087	SEE REVISION NOTICE V.B. W.R.F. 6-25-63
A 941	SEE REVISION NOTICE. 3-19-63. V.B.

TECHNICAL MEASUREMENT CORPORATION
NORTH HAVEN, CONN. U.S.A.

MODEL	PC. NO.				
646	1	PRESET LOGIC & POWER SUPPLY			
		DRAWN: A.H.Z. 10-15-62	CHKD.: 10-22-62	APPD.: V.B. 10/24/62	DRAWING NO. SCB 1809

SKB 1441 A

GLOSSARY OF TERMS

A system of alphabetical, numerical and arithmetic symbols is used to designate each functional signal. Each designation tells as much as possible in three or four coded symbols about each signal and its functional duty.

The most common symbols are + and — (plus and minus). When preceding the designator, the reference used is the chassis ground of the instrument. When following, the sign indicates the slope of the leading edge of the observed signal.

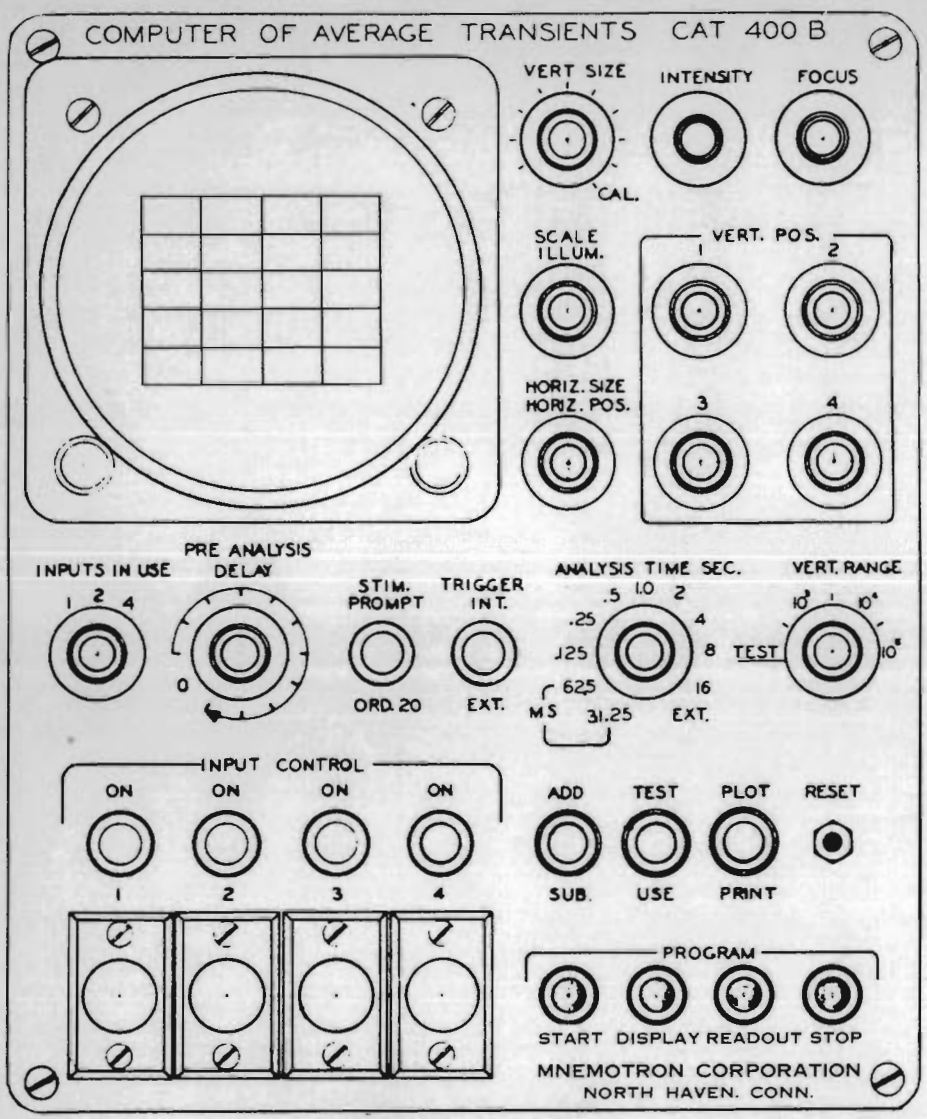
The computer logic circuits use voltages or currents to indicate alternative signals. To indicate signals of negation, the Boolean Algebra designation for "not" is used in conjunction with the symbol. For example 2^3 indicates 2 to the third power, while $\overline{2^3}$ indicates absence of two to the third power.

NOTATIONS

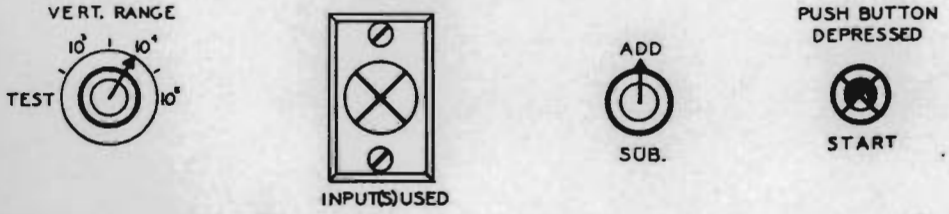
—13	Power Supply Potential
+13	Power Supply Potential
—12	Power Supply Potential
+20	Power Supply Potential
+4	Power Supply Potential
—4	Power Supply Potential
—22	Power Supply Potential
+26V	Unregulated Voltage
—26V	Unregulated Voltage
160V	Unregulated Voltage
—100V	Regulated Voltage
100G	100 Channel Gate
200G	200 Channel Gate
"0" IN	Carry Input to Arithmetic Decade — (complement of "1" IN)

ALPHABETICAL EXPRESSIONS

A	Address Register
A(Numeral)	Analog Inputs
A out	Analog Current Output
ACPB	Accumulate Pushbutton
AD	Analog-to-Digital
ADA1	Address Add 1
ADV	Address Advance from Printer
AFF	Accumulate Flip-Flop
AIC	Analog Current Common
AOF+	Address Overflow
AR	Address Reset
ARA1	Arithmetic Add 1
ARR	Arithmetic Reset
ASPH	Add-Sub Pulse Height
AS-T	Add-Sub Time
AST	Astigmatism (CRT)
AUTO 2-4	Automatic Storage in Halves or Quarters
BCD	Binary Coded Decimal
C	Collector Connection
CCW	Counter Clockwise
CFF	Control Flip-Flop
COM	Common (Ground) Connection
CRT	Cathode Ray Tube
CRTB	Cathode Ray Tube Blanking
CW	Clockwise
D(Numeral)	Digit, # Weight of #
DA	Digital-to-Analog
DEL. 1	Delay 1
DEL. 2	Delay 2
DFF	Display Flip-Flop
DPX	Deflection Plate X Axis
DPY	Deflection Plate Y Axis
DSID	Display Indicator
DSPB	Display Pushbutton
DT1—, DT2—	Delay Time
E	Emitter Connection (An Internal Connection)
EN2 O.F.	Enable 200 Overflow
EN4 O.F.	Enable 400 Overflow
ESC +	Enable Storage Cycle
EXT. TRIG.	External Trigger
F(Numeral)	Finish of Winding of Transformers
FF	Flip-Flop Circuit
FIN	Fast Input
GFF	Gross Flip-Flop
GI	Current Ground
GND	Ground Potential
GRTR	Gross Trigger
HI-V	High Negative Voltage to CRT
HV	High Voltage
HVPS	High Voltage Power Supply
IA1—	Inhibit Accumulate
I	Indicator (Lamp)
I(Numeral)	Sense Inhibit Current
ΣI	Summation Currents
IA2—	Inhibit Accumulate
INA	Input to 4X5 Decoder
INB	Input to 4X5 Decoder
INHB	Inhibit
INHS	Inhibit Trigger Shaper
ISC	Current Select Centering
ISD	Intermediate Significant Digit
ISI	Intermediate Significant Integer
J	Jack
LSD	Least Significant Digit
LSI	Least Significant Integer
MB	Memory Busy
MBSY	Memory Busy
MCS+	Memory Channel Selection
ML	Memory Location (Trigger)
MLG	Memory Location Gate
MOD. No. 1	Modulator No. 1
MP	Memory Plane
MR	Memory Register
MRS	Manual Reset
MSD	Most Significant Digit
MSI	Most Significant Integer
NC	No Connection
NDR	Null Detector Rush Signal
ORD 20	Address 20
PGC—	Test Pulse Generator Control (—4V when operating)
PGG	Test Pulse Generator Ground
PGS—	Test Pulse Generator Signal Output
PLSW	Plot Switch (To Ground)
PPSW	Print-Plot Switch
PS	Power Supply
Q(Numeral)	Transistor Number
Q^n	Quadrant Selector
R	Resistor
RAFF	Ready Accumulate Flip-Flop
RDID	Readout Indicator
RDPB	Readout Pushbutton
RES	Reset
RFF	Readout Flip-Flop
RL	Load Resistor
RMEP	Rear Memory End Plane
RTL	Resistor-Transistor Logic
RWFF	Read-Write Flip-Flop
RX	Recorder X Signal
RXG	Recorder X Ground
RY	Recorder Y Signal
RYG	Recorder Y Ground
RB+	Recorder Busy
RZ—	Recognize Zero
S	Switch
SC (Numeral)	Selective Centering — Quadrant No. Address 0-99, 100-199, etc. Storage Cycle Busy (Test Format)
SIG-2	Automatic Routing Signal (halves)
SIG-4	Automatic Routing Signal (quarters)
SIN	Slow Input
SL	Switching Lamp
SM	Silver Mica (capacitor)
SOC+	Start of Conversion
STID	Stop Indicator
STIM. IN	Stimulus In
STPB	Stop Pushbutton
SUBT	Subtract Time
T	Turns (Potentiometers)
T(Numeral)	Transfer
TAA	Trigger Address Advance
TAR	Trigger Address Reset
TP	Test Point
TR	Transformer
TRD	Trigger Read
TRR	Trigger Read Retard
TS 101	Terminal Strip No. 101
TWRT	Trigger Write
VAC	Volts Alternating Current
VDC	Volts Direct Current
WRT	Write Pulse
X	Horizontal Axis
XC	X Axis Centering
XFR	Transfer
XFS	X Full Scale for Plotter Calibration
XGC	X Gain Control
XGG	X Gain Ground
Y	Vertical Axis
YIN	Y Axis In
YGG	Y Gain Ground
YGS	Y Axis Gain Signal

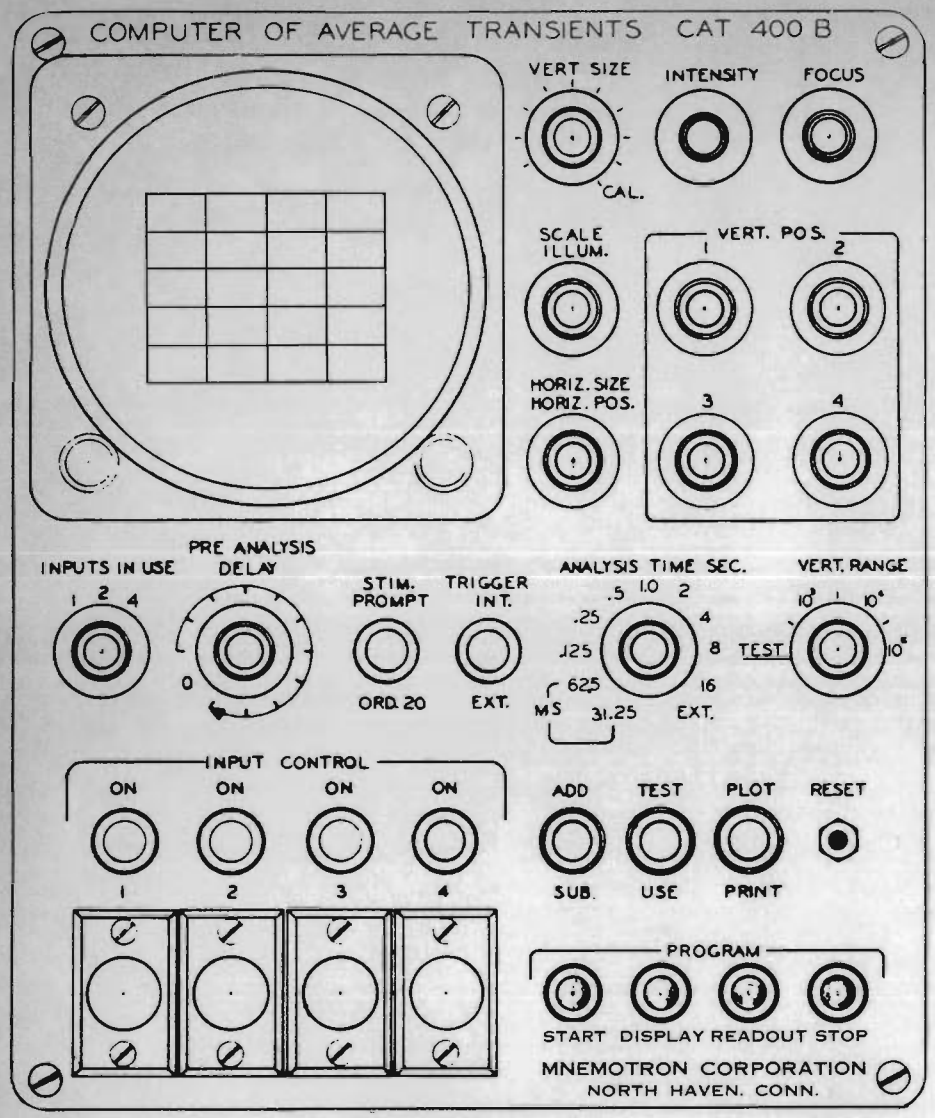


MARKING EXAMPLE



PLEASE MARK POSITION OF CONTROLS AT WHICH MALFUNCTION OCCURS BY PLACING AN ARROW IN THE APPROPRIATE DIRECTION AS SHOWN IN EXAMPLE, DESCRIBE MALFUNCTION BELOW

DESCRIPTION OF MALFUNCTION



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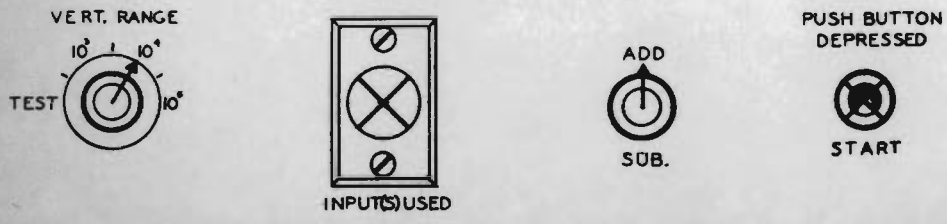

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DESCRIPTION OF MALFUNCTION