GENERAL ELECTRIC COMPANY
DRIVE SYSTEMS PRODUCT DEPARTMENT
SALEM, VA. 24153

INSTRUCTIONS GEK-28673

SPEEDTRONIC* CONTROL

CALIBRATOR HANDBOOK

4th Edition June 23, 1978

* Trademark of General Electric Company

GENERAL ELECTRIC

CONTENTS

INTRODUCTION

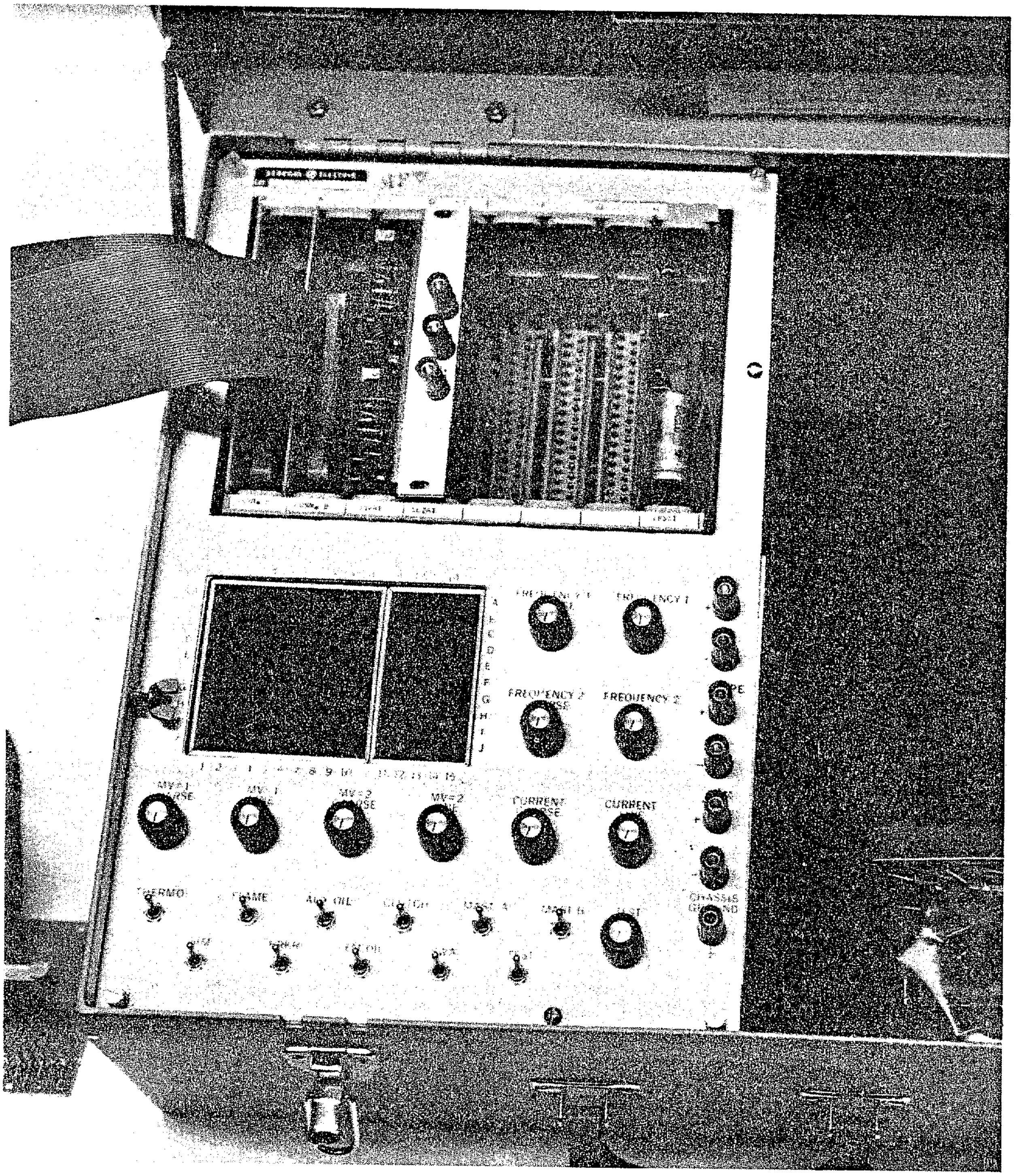
The SPEEDTRONIC* Control calibrator provides a convenient method of accessing important variables within a SPEEDTRONIC* control system and supplying signals to the panel to simulate the input from sensors external to the panel. The calibrator patch board and the two connectors which plug between the SPEEDTRONIC* control "page" and calibrator are the means for reading out and inputing signals to the control. The calibrator is dedicated to the SPEEDTRONIC* controls by its plug-in feature and by the fact that it is powered by the control to which it is connected. Its signal sources are universal types however; (such as millivolt, variable frequency, current and voltage) which may be used to calibrate special circuits that may be part of-a particular SPEEDTRONIC* control application.

These instructions cover the calibrator and how it may be used to calibrate a SPEEDTRONIC* control system. The actual procedure for calibrating and the settings are contained in the Control Specifications. The System Elementary drawing is also needed for calibrating. The interconnection between the calibrator and the control system is shown on the 42 series sheets of the System Elementary.

On the last sheet of this publication is a patchboard layout showing points on the patchboard which are generated within the calibrator. The System Instruction book will be useful for both general information about the system and specific information about each piece of equipment and should be referred to in the event trouble-shooting, changes, or repair need be accomplished.

This calibrator may be used to calibrate any Mark I or Mark II Speedtronic* control panel. The calibrator is presently in its 3rd revision, but changes have been minor. For revision variations, refer to Section III, Revision Variation Definition.

* Trademark of General Electric Company



SPEEDTRONIC* CONTROL CALIBRATOR

ICF37009

See Revision Variations Section III

I. FEATURES

A. PHYSICAL

The calibrator is packaged in a carrying case with additional space available for a digital voltmeter and frequency counter. It is connected to the SPEEDTRONIC* control panel by means of 2 connector cables which plug into slots "A" and "B" in the calibrator and 2 slots on the "page" designated "CALIBRATOR TEST" and "AUX TEST" respectively. Each connector cable contains 51 wires.

The circuits for power supply, signal sources etc. are built on DIRECTOMATIC* II cards and plugged into the card slot rack along with the connector cables A and B. Card Slot C contains SVFA on which the circuits for the 2 variable frequency oscillators are built. Card Slot D contains SCZA on which the 2 millivolt sources and voltage/current source are built. The EPSS card in slot E contain a -50VDC to -12VDC power supply.

B. SIGNAL SOURCES

1. The millivolt source is designed to simulate low level signals such as turbine exhaust thermocouples over a range 0-50MV with FINE adjustment of ± 3 MV.
   a. There are two sources.
   b. Their respective power is derived each from one of the 3 KHZ power oscillators in the SPEEDTRONIC* page.
   c. Outputs are available on patchboard (MVA, C4 and C5; MVB, C6 and C7).

* Trade Mark of General Electric Co.

I. FEATURES - (continued)

B. SIGNAL SOURCES - (continued)

a. "SW" switch can be used to switch each source to either position on the patchboard.

SWITCH DOWN MV#1 AT MVA; MV#2 AT MVB

SWITCH UP MV#2 AT MVA; MV#1 AT MVB

This allows the two sources to be set up at convenient end points, for instance, when calibrating gain and offset on the temperature amplifier.

e. Circuit details: IC3600SCZA

2. The two Variable Frequency sources are 10 to 11 volt peak to peak variable from 15 HZ to 12.5 KHZ Sine wave (66.7 millisec. to 80.0 microsec). The sources may be used to simulate a speed signal from a "pulse tach" magnetic pick-up in order to calibrate pulse rate to analog circuit and speed control loop.

a. Fine adjustment ± 250HZ.

b. Output available on patchboard

(FREQ #1 at C1 and FREQ #2 at C10 with respect to ACOM)

c. Circuit is powered by IC3600EPSS MINUS 50V TO MUNUS 12V converter unless MINUS 12 VOLT supply is available in SPEEDTRONIC* control in which case MINUS 50V is not available; it also requires plus 12V supply from SPEEDTRONIC* control.

d. Circuit details IC3600SVFA.

I. FEATURES - (Continued)

B. SIGNAL SOURCES - (Continued)

3. The Standard voltage sources are approximately 6 volts and 20 millivolts. The actual values will be recorded on the IC3600SCZA card on which the terminal binding posts are located. These standard sources may be used to calibrate instruments such as voltmeter or scope.

4. The combination CURRENT/VOLTAGE source makes available a current and a voltage to simulate pressure transmitters, etc.

a. With 50 volt bus available in control:

current, 0-50ma (500Ω MAX load); voltage 0-34VDC

With only 12 volt bus available in control:

current, 0-50ma (50 Ω MAX load); voltage 0-11VDC

b. Sources are adjustable by coarse and fine pots marked "current".

c. On Patchboard:

Voltage source located D2

Current source located C2

To read current with voltmeter connect C2, (positive) to D2 across precision resistor (10 mv/ma).

d. Circuit details IC3600SCZA

5. There are two switches, a resistor pot configuration and a resistor configuration.

a. SW9 s.p.s.t. switch could be used as a logic level switch DCOM = "0" ; P12V = "1" ; or contact closure to P28V. (patchboard points F9 and F10).

I. **FEATURES** - (Continued)

B. SIGNAL SOURCES - (Continued)

5. (Continued)

b. SW10 s.p.d.t. switch could be used to switch the voltmeter between the two overtemperature channels to facilitate simultaneous calibration. (patchboard points J1, J2, and J3).

c. Pot and resistor configuration may be used to set up a test voltage or with 3KHZ oscillator to make a test vibration signal.

d. Resistor configuration may be used to simulate flame and no flame condition of impedance expected from detectors to "Ball park" the detector sensitivity prior to starting. The 10K connected between P12V and "VERY FAST" counter rate will speed up the digital setpoint counter for calibrating purposes, on some panels.

6. There are 7 sequence switches which may be used to simulate points in the start-up mode. Certain portions of the control are operable only when the turbine has come up to a given point during start-up. Some or all of these switches may be wired in a given application if they are needed in order to calibrate the unit. Refer to sheet 42 of the elementary for switch usage.

IMPORTANT: These switches normally must be turned off {down) when starting up or running the turbine with the calibrator connected.

FEATURES - (Continued)

C. PATCHBOABD

The patchboard layout is shown on the final sheet of this publication (fold out). Patchboard points are connected to circuitry within the calibrator such as sources, test switches, and components; or jacks along the right side of the calibrator to allow hook up of instruments; or through the connector cable to the SPEEDTRONIC* page. The points on the patchboard which are wired through the connector to the SPEEDTRONIC* page are shown in The System Elementary for the specific control on the 42 series sheets.

The 10 x 10 section of the patchboard, points Al by J10, are connected to the SPEEDTRONIC* page through "Conn A", the "calibrate test" connector, and the remaining 5 x 10 section, points All by J15, are connected by "Conn B", the "Aux test" connector.

1' On the layout sheet the pin numbers to which the input/output are connected appear as the small number in the lower left hand corner of each block.

I. FEATURES - (Continued)

C. PATCHBOARD - (Continued)

2. The "calibrate test" connector and the "auxiliary test" connector is shown on the 42 series sheets of the system elementary for each unit. These sheets name and reference the point in the circuit to which the point is connected - if it is used.

3. To facilitate working from the system elementary to the calibrator for a particular point, the coordinates on the patchboard are given adjacent to each point in the system elementary.

11. TYPICAL CALIBRATION

A. GENERAL

Once power is applied *after* preliminary checkout, the unit is ready for calibration. Plug in the calibrator and check that proper power is available at the patchboard points Al thru A6, and 3KHZ power oscillators A9 and A10 (refer to patchboard layout - - - of the turbine control elementary).

1. Necessary Connections for SPEEDTRONIC* Calibrator

   Connector "A" from calibrator should be connected to "calibrate test card slot" on SPEEDTRONIC* page.

   Connector "B" should be connected to "Aux. Test Card Slot" on SPEEDTRONIC* page.

   Refer to job elementary to determine location of these two card slots (normally shown on sheet 42 of elementary).

2. Additional Instrumentation

   Other instruments that can be supplied with the calibrator are:

   Digital Voltmeter 4 Digits (3½ Digits)

   Counter 20Hz - 80MHz 7 Digits

   In additional to the SPEEDTRONIC* calibrator, other devices that can be used to calibrate or troubleshoot are:

   Multi Meter - 20,000 Ohms/Volt

   Such as - Triplett Model 630

   or Simpson Model 270

   Oscilloscope - (for troubleshooting only)

   Such as - Tektronix 453

SPEEDTRONIC* Protective Logic Test Aid Module - catalog #277A6557G1.

II. TYPICAL CALIBRATION - (Continued

A. GENERAL - (Continued)

3. References:

a) Instruction Book - Comprehensive information, one lines, locations of adjustments.

b) Job elementary diagram - Circuit, pin numbers, card location, pot. identification.

c) Turbine Control Specifications - Design and application parameters, device settings, calibration procedure.

4. Techniques and Procedures

a) Use a voltmeter to determine logic level of signal.

"0" = OV to .4V (High threshold "0" up to 1.5v)

"1" = 4.75V to 12V

b) Definition of Range, Span, Zero, Offset, Gain

Given: Exhaust temperature variation of 300° and 1000° which produces signals of 1.83 MV and 23.41 MV;

Signal span = 23.41 MV - 1.83 MV = 21.58 MV

Signal range = 1.83 MV to 23.41 MV

Signal zero or offset = 1.83 MV

If this signal is amplified to 1.0V and 4.5V,

II. TYPICAL CALIBRATION - (Continued-

A. GENERAL - (Continued)

4. (Continued)

output span = 4.5V - l.w = 3.5V

Output range = l.W 4.5V

Output zero or offset = l.W

$$\text{Amplifier gain} = \frac{\text{Output span}}{\text{Input span}}$$

$$= \frac{3.5V}{21.58MV} = .1624 \frac{V}{Mv}$$

c) Adjusting "zero" and "gain" of an amplifier (ZERO: OFFSET)

Theoretically you should adjust the gain first, then adjust the zero because gain affects zero and zero does not affect gain. However, since many amplifiers are not perfect and since you want to start in the right "ball park", an easier and more practical method is as follows:

Using the values in the example (b) above:

1. Apply 1.83MV to input.
2. Adjust zero for 1.0V output.
3. Apply 23.41 MV to input.
4. Adjust gain for 4.5 output.

II. TYPICAL CALIBRATION - (Continued)

A. GENERAL - (Continued)

4. (Continued)

c) (Continued)

5. Apply 1.83 MV to input.

Note : Because of the gain adjust, the zero has moved. .

6. Readjust zero for 1.0V output.

7. Apply 23.41 MV to input.

8. Readjust gain for 4.5 output.

Note : The amount of readjustment decreased with each adjustment.

9. Repeat 1 to 8 until no readjustment is necessary.

d) "Nulling" or "balancing" the summing junction.

1. Within the stable operating range of an operational amplifier, the sum of all currents to the summing junction is zero.

2. Many of the amplifiers used herein have integrating feedbacks. This means that, if the net current to the summing junction is negative, the output volts will continue to rise and conversely, a net positive summing junction current will cause the output volts to continue to decrease. When the summing junction current is zero, the output will stop integrating and the volts will remain constant.

II. TYPICAL CALIBRATION - (Continued)

A. GENERAL - (Continued)

4. (Continued)

d) (Continued)

3. A voltmeter on the output of the amplifier can be used to determine when the integration stops. However, an easier method is to use the function indicating lights. For example, consider the temperature control card STKA and we want to set the isothermal base reference to 1000°F.

a) Input an exhaust temp. signal of 1000°F. (4.5V @ pin 17)

b) Quickly rotate and counter rotate base reference pot. R95 so that temperature control indicating light goes on and off. (Note: Pot. movement causes amplifier to integrate voltage up or down. Light driver is voltage sensitive; above 28V = Light out and below 28V = Light on). As you rotate and counter rotate and the light goes on and off, reduce the amount of excursion until the light just stays on. Set the pot. at the midpoint of this minimum excursion.

c) The summing junction is now "nulled" for this particular setting.

II. TYPICAL CALIBRATION - (Continued)

A. GENERAL - (Continued)

4. (Continued)

e) Inputs and Outputs

1. Frequently, the Control Specification will refer to pin numbers on various cards, for monitoring, logic forcing, or even signal insertion. This does not mean that you should work on that pin; on the contrary, you should avoid working on the pin itself. Rather, you should refer to the pin and the card on the Turbine Control elementary and, if possible, determine some more appropriate point, on the same point in the circuit as the pin, but physically more accessible. For example, the point may be available on the calibrator patchboard; it may be available on a card front; it may be an incoming signal with isolation LED indication; it may be the output of a SLEH element which has LSD indication and is forcible from its front; it may be the output of a STDC element which has LED indication.

2. Logic Forcing

   The SLEH element can be forced to a "1" or "O" from the front. All elements may be forced "O" on the outputs, but must never be forced to "I.".

   i.e. You may jumper any logic signal to D-COM (to force "O") but must never jumper a signal to P12V or P5V to force "1".

II. TYPICAL CALIBRATION - (Continued)

B. SIGNAL SOURCES

The signal source outputs appear on the patchboard so that they may be connected to any other point on the patchboard by jumpering with the miniature plugs supplied with the calibrator. Sources may be accessed for use into points not on the patchboard by patching them to large jacks such as "SCOPE", "DVM", or "CTR". These jacks will accept standard "BANANA" plugs or may be wired to by clamping the wire under terminal binding post.

1. MILLIVOLT for thermocouple simulation may be accomplished 3 ways:

   a. If a cold junction compensation network is available for the particular type of thermocouple to be simulated (such a J type Iron-Constantan; K type Chromal-alumal), it may connected with the proper thermocouple wire between the source and the T. C. amplifier. Standard thermocouple tables can be used to convert from the temperature desired to the'millivolts which must be measured.

   b. If the cold junction compensation network is not available the above method will work provided the ambient temperature is measured and difference between ambient and 32°F (which is the reference used in the tables) is subtracted from the table value of millivolts for the particular temperature desired to simulate.

II. TYPICAL CALIBRATION - (Continued)

B. SIGNAL SOURCES - (Continued)

1. c. If a temperature indicator such as the one on the SPEEDTRONIC* control panel is available the temperature may be read directly. The amplifiers and trips may then be set without measuring millivolts .

C. SAMPLE CALIBRATION PROCEDURE

The following is a brief description of the steps required to use the calibrator; as one example let us consider the case where the overspeed trip points are to be checked. The actual detail is defined in the Turbine Control Specification; the following is only a description of how to find your way around:

1. Calibrator must be plugged into the panel
2. The panel must be powered up.
3. Refer to the Turbine Control Elementary Index, sheet A00, and determine which sheet the "Overspeed Protection" is located on.
4. Refer to the Overspeed Protection circuit in the Turbine Control Elementary
5. Refer to the Turbine Control Specification for the details on settings and procedure.
6. The control specification will typically say "insert a speed signal of X frequency to the Overspeed Protection Card, pins y, z."
7. Refer to the elementary Overspeed Protection circuit and look for a cross reference to sheet 42B or 42C.
8. Follow the cross reference to sheet 42B or 42C and determine the corresponding calibrator patchboard location; one position

per Overspeed Protection card. The return is via A-COM on Patchboard G1 thru G-10.

9. Refer to sheet 42D of the elementary, the patchboard layout. Pick out a frequency source - C1 or C10.

10. Jumper the frequency source to the patchboard position of step 8. The return (COM) is taken care of internally.

11. For monitoring, jumper E1 to the frequency source and F1 to A-COM (ie. G1). This puts the frequency signal on test jacks CTR (+) and (-); These test jacks will accept a standard plug for frequency monitoring with a counter.

12. Adjust the frequency with the "COURSE" and "FINE" Frequency adjusting Potentiometer on the Calibrator; The potentiometers are clearly labeled.

13. Cheek the Overspeed Protection function as defined in the Turbine Control Specification.

III. REVISION VARIATION DEFINITION

The calibrator is presently in its 4th revision. Changes have been minor and have been made to make the calibrator more versatile. The revision number is not on the nameplate, but the revision of any particular calibrator is readily apparent from the following:

REVISION 1: The original form used nomenclature on the switches as illustrated on sheet 3. Also it has seven test jacks on the right hand side of sheet 3.

REVISION 2: Added two test jacks, AUX (+), (-), wired to patchboard points E2, F2 respectively and spaced all test jacks to take a standard size plug.

REVISION 3: The switch designations were changed from names to switch numbers, i.e. SW1,2 etc. Note that the switch numbers on the calibrator drawings were changed to facilitate a left to right flow of switch numbers. This change allows any one switch to be used for different functions from one panel to another. The switch's function is defined on sheet 42 of the panel elementary.

The switch numbering is as follows:

SW1	SW2	SW3	SW4	SW5	SW6
o	o	o	o	o	o
	SW7	SW8	SW9	SW10	
	o	o	o	o	

In addition to the change in switch nomenclature, 12 additional wire runs from the panel to the patchboard have been added as follows:

connector A: pins 49, 51

connector B: pins 1, 2, 23, 24, 27, 28, 29, 30, 50, 51

This further increases the capability of the calibrator. Your calibrator will have these extra runs if it has switch numbers on the nameplate; it will not have these runs if the switches have names as illustrated on sheet 3.

Any panel may be calibrated with any calibrator with the following reservations limitations:

(a) Switch designation may be confusing, but are defined above.

(b) The 3.2 interconnecting wires defined above will not be on revisions 1 and 2 and may be a problem when a Mark II Industrial panel is to be calibrated with a revision 1 and 2 calibrator. This limitation may be identified by referring to the 42 series sheets of the panel elementary.
A modification kit is available to take care of limitations (a) and (b) where needed.

(c) The voltage/current source on IC3600SCZA, Rev. A is not capable of providing a 50 MA pressure signal when used on a Mark 11 panel. (It's O.K. on Mark I). If this signal is required for a Mark II panel, a Revision B must be obtained.

REVISION 4: The "TEST" pot RH11 was changed from a 1 turn 100K to a 10 turn 10K.

SIGNAL DEFINITION AND LOCATION

SYMBOL STD. ALT.	NAME	CONN A PIN NO.	PATCH BOARD LOCATION
	POWER SUPPLIES		
DCOM	DIGITAL COMMON	1	A4
ACOM	ANALOG COMMON	2	G1 - G10
P50	POSITIVE 50 VOLTS	24	A1
P28	POSITIVE 28 VOLTS	23	A2
P12	POSITIVE 12 VOLTS	27	A3
N12	NEGATIVE 12 VOLTS	29	AS
N50	NEGATIVE 50 VOLTS	30	A6
OSCA	OSCILLATOR A 3KC 8.4 RMS (LVDT.)	26	A9
OSCB	OSCILLATOR B 3KC 8.4 RMS (LVDT)	28	A10
	CALIBRATOR SIGNALS		
	VARIABLE FREQUENCY OUTPUT 1		C1
	VARIABLE FREQUENCY 1 - EXTERNAL CONTROL (SIMULATION)		11
	VARIABLE FREQUENCY OUTPUT 2		C10
	VARIABLE FREQUENCY 2 - EXTERNAL CONTROL (SIMULATION)		12
PSIM	CURRENT SOURCE (0-50MA)		C2
	VOLTAGE SOURCE (0-34V, SUPPLY 50V; 0-8, SUPPLY 12V		D2
	CURRENT SOURCE-EXTERN CONTROL (SIMULATION)		14
MVA+	MILLIVOLT SOURCE		C4
MVA-			C5
MVB+	MILLIVOLT SOURCE		C6
MVB-			c7

NOTE
MVA = MV1 WITH SWITCH SW-1 DOWN
MVB = MV2 WITH SWITCH SW-1 DOWN
MVA = MV2 WITH SWITCH SW-1 UP
MVB = MV1 WITH SWITCH SW-1 UP

MV1C	MILLIVOLT SOURCE 1 - EXTERNAL CONTROL (SIMULATION)		13

3EA1, 4QA3, 3SA1, 2520

REV. 1 11/20/70 JAL	REV. 4	REV. 5	PRINTS TO 3EA1 4QA3, 3SA1, 2520	APPROVALS SHE(P) CB	GENERAL ELECTRIC	ELEMENTARY DIAGRAM CALIBRATOR
REV. 2 8/4/71 Returned P.H.	ISSUED Nov. 10, 1970			FIRST MADE FOR	INDUSTRY CONTROL DEPT.	1C4988A100
REV. 3 BU925MP JAJ 3/6/73	MADE BY J. LAVOIE			I.C. NO.	SALEM, VA. U.S.A.	CONT. ON SH. 3.2 SH. NO. 3.1

13, 2520

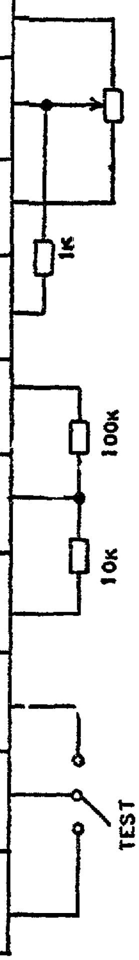
PLUG BOARD

CONN. B SIGNALS

	A	B	C	D	E	F	G	H	I	J
15	42	43	31	32	14	9	7	21	26	15
14	40	41	48	49	33	13	6	20	25	12
13	38	39	46	47	28	17	5	19	35	11
12	36	37	44	45	27	16	4	18	34	10
11	1	2	22	24	29	3	8	30	50	51

CALIBRATOR AND CONN. A SIGNALS

	A	B	C	D	E	F	G	H	I	J
10	OSC B 28	35	FRQ2	CONN. B 23	47	SW9 41	ACOM 2	16		PCW
9	OSC A 26	34		10	25	SW9 39	ACOM 2	15		PW
8		20		9	3		ACOM 2	14		PCCW
7		18	MVB	8			ACOM 2	13		PRI
6	N50 30	51	MVB +	7	DVM +	DVM	ACOM 2	12		R100
5	N12 29	49	MVA -	6			ACOM 2	11		RCOM
4	DCOM 1	19	MVA +	5	SCOPE +	SCOPE -	ACOM 2		CURR C	R10
3	P12 27	17	22	4			ACOM 2		MV1 C	SW DN
2	P28 23	31	PS1:1	CURR S	AUX +	AUX -	ACOM 2		FRQ2 C	SW C
1	P50 24	33	FRQ1		CTR +	CTR -	ACOM 2	21	FRQ1 C	SW UP



CONNECTOR PIN NO S SHOWN IN BLOCK

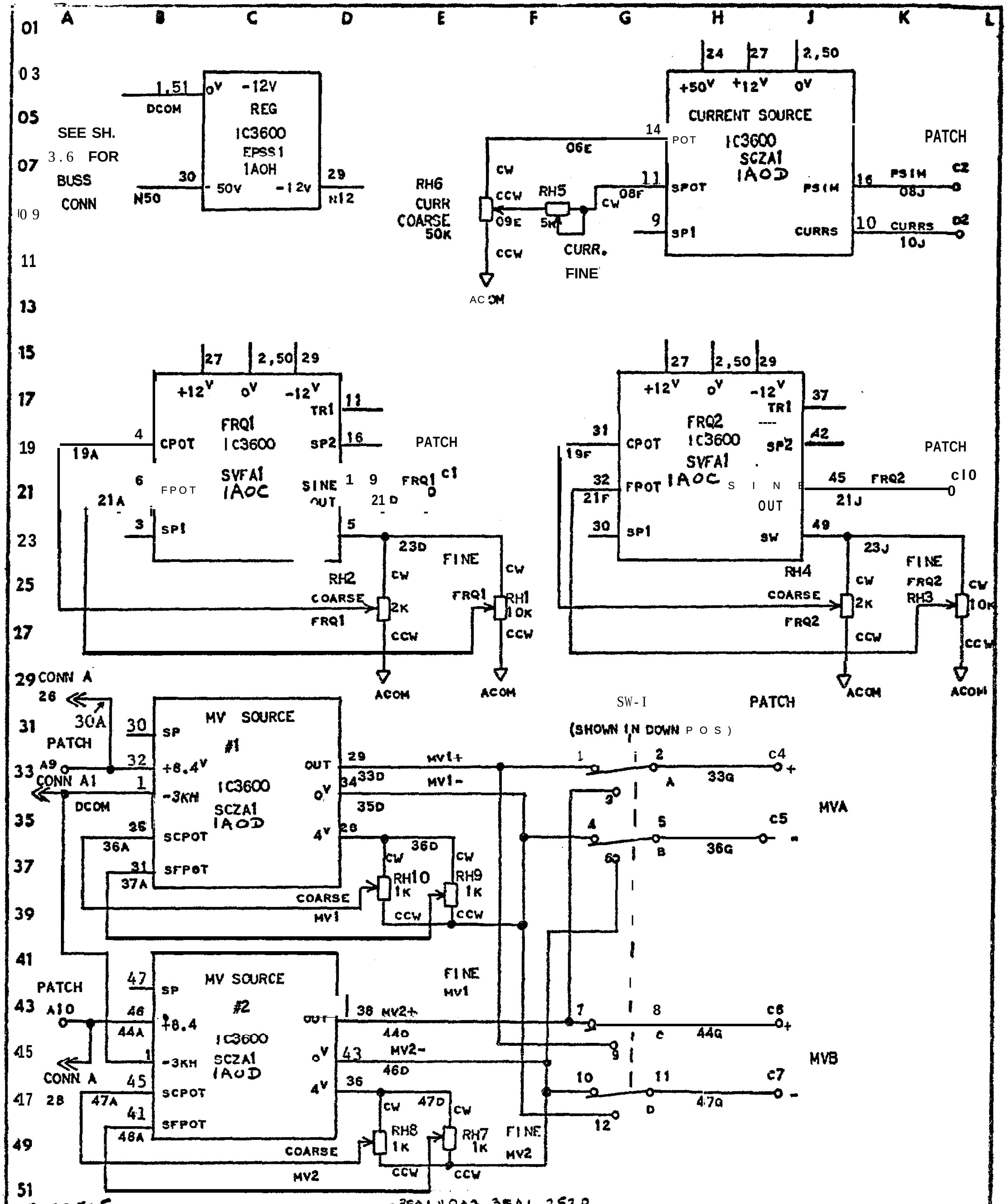
3EA1, 4QA3, 35A1, 2520

REV. 1 ... 11/2/...	REV. 4 EZR 5/11/72 ...	REV. 5 ... 3-9-73	PRINTS TO 3EA1 4QA3, 35A1, 2520	APPROVALS
REV. 2 DMH 8/4/71	ISSUED Nov. 10, 1970			FIRST MADE FOR
REV. 3 EZR 1/25/71 ...	MADE BY J. LAVOIE			I.C NO.

GENERAL ELECTRIC
INDUSTRY CONTROL DEPT.
SALEM, VA. U.S.A.

ELEMENTARY DIAGRAM
CALIBRATOR
1C4988A100
CONT. ON SH. 3.3 SH. NO. 3.2

13 2520

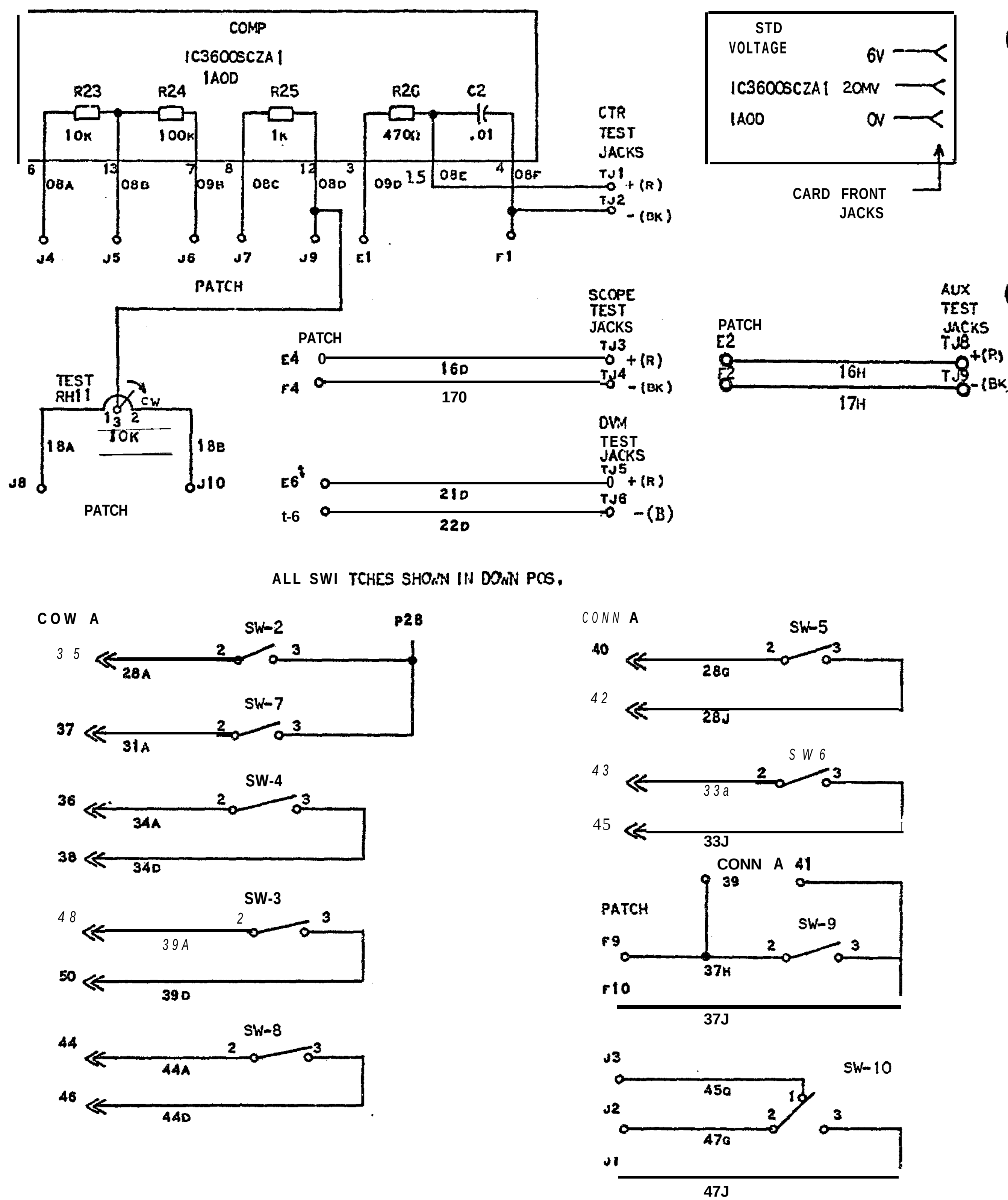


BU925NE

3EA1, 4QA3, 35A1, 2520

REV. 1 XA7 1/2/70	REV. 4	REV. 5	PRINTS TO 3EA1 4QA3, 35A1, 2520	APPROVALS YA7	GENERAL ELECTRIC	ELEMENTARY DIAGRAM CALIBRATOR
REV. 2 E.JR BU925BE	ISSUED NOV. 10, 1970			FIRST MADE FOR	INDUSTRY CONTROL DEPT. SALEM, VA. U.S.A.	1C4988A100
REV. 3 BU925HP JAF 3-9-73	MADE BY J. LAVOIE			I.C. NO.		CONT. ON SH. 3.4 SH. NO. 3.3

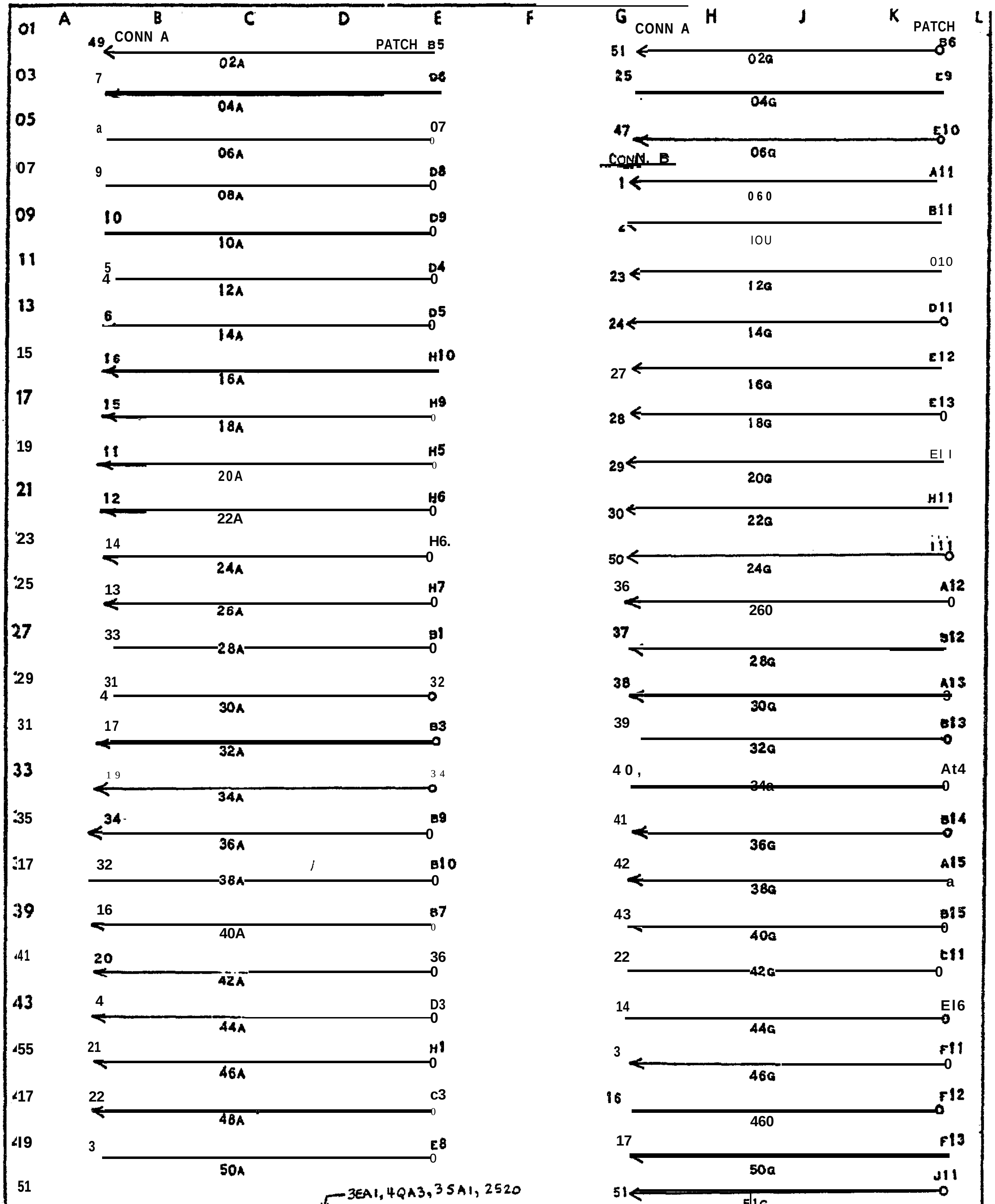
13,2520



3EA1, 4QA3, 35A1, 2520

REV. 1 1/26/70	REV. 4 BU925HP 3-9-73	REV. 5	PRINTS TO 3EA1 4QA3, 35A1, 2520	APPROVALS	GENERAL ELECTRIC INDUSTRY CONTROL DEPT. SALEM, VA. U.S.A.	ELEMENTARY DIAGRAM CALIBRATOR
REV. 2 BU925	ISSUED Mar. 10, 1970			FIRST MADE FOR		C4988A100
REV. 3 /72 BU925DW	MADE BY J. LAVOIE			I.C. NO.		CONT. ON SH. 3.5 SH. NO. 3.4

13 2520



REV. 1 JK 11/20/70	REV. 4	REV. 5	PRINTS TO 3EA1, 4QA3, 35A1, 2520	APPROVALS	**GENERAL ELECTRIC** INDUSTRY CONTROL DEPT. SALEM. VA. U.S.A.
REV. 2 8/2/71	ISSUED Nov. 10, 1970			FIRST MADE FOR	ELEMENTARY DIAGRAM CALIBRATOR
REV. 3 BU92SHP JAF 3-9-73	MADE BY J. LAVOIE			I.C. NO.	1C4988A'00 CONT. ON SH 3,6 SH. NO. 3.5

CONN. B		PATCH
13	04A	F14
9	06A	F15
44	08A	C12
45	10A	D12
46	12A	C13
47	14A	D13
48	16A	C14
49	18A	D14
8	20A	G11
4	22A	G12
5	24A	G13
6	26A	G14
7	28A	G15
31	30A	G15

CONN. B		PATCH
18	04F	H12
19	06F	H13
20	08F	H14
21	10F	H15
34	12F	I12
35	14F	I13
25	16F	I14
26	18F	I15
10	20F	J12
11	22F	J13
12	24F	J14
15	26F	J15
32	26f	D15
33	30F	E14

BUSSES

CONN. A		PATCH	CARD	CARD		
2	ACOM	G1 THRU G10	C2	02	ACOM	TO POTS ON SH. 3.3
1	DCOM	A4	H1	D1		
24	P50	A1	D24			
23	P28	A2				TO SW ON SH 3.4
27	P12	A3	C27	D27		
25	N12	A5	C29	H29		
30	N50	A6	H30			

3EA1, 4QA3, 3SA1, 2520

REV. 1 JGA 11/20/70	REV. 4	REV. 5	PRINTS TO 3EA1 4QA3 3SA1, 2520	APPROVALS JGA	GENERAL ELECTRIC	ELEMENTARY DIAGRAM CALIBRATOR
REV. 2 DMH 8/12/71	ISSUED NOV. 10, 1970			FIRST MADE FOR	INDUSTRY CONTROL DEPT.	1C4988A100
REV. 3 E.J.C. 1-25-72 B45258	MADE BY J. LAVOIE			I.C. NO.	SALEM, VA. U.S.A.	CONT. ON SH 3.20 SH. NO. 3.6

13.2520

PURPOSE

Is to provide a convenient, fast and accurate method for checking and calibrating Speedtronic Panels. It is packaged in a carrying case and is electrically connected with ribbon cables. It provides frequency signals to calibrate the speed controls, millivolt signals for the temperature controls, voltage or current signals for the pressure sensors, precision voltage references for calibrating instruments, and control signals are made available for monitoring.

The equipment has been designed to provide a turbine simulate function within the present housing with a minimum of change.

PARTS

1. Connectors - two card and ribbon cables with fifty one wires are used to connect the Speedtronic page with the calibrator. Each cable will be six feet long. The A connector (red) is used primarily for the Calibrator asd its signals while the B connector (bluc) is used primarily for monitoring speedtronic signals.

2. Directomatic 2 card rack - an eight card slot sack is provided. The two left most slots are provided to accept the connector cards of the ribbon cable. Three slots are for the IC3600SVFA, SCZA, and EPSS cards. Three slots are provided, without receptacles, as space for future options.

   a) IC3600SVFA voltage to frequency convertor. This card is used in conjunction with the Frq. pots to generate variable frequency sine waves. There are two circuits on a card.

   See the card application notes for more information.

   b) IC3600SCZA calibrator signal source. This card contains three different types of circuit. These are:

   1 - one standard voltage source - 3 card front jacks are provided for meter calibration.
   2 - one voltage and current source.
   3 - two millivolt sources.

   See the card application notes for more information.

   c) IC3600EPSS --50V to -12V regulator. This card converts -50V to -12V DC. It is only necessary when -12V is not available in the system. The card does not have to be removed from its slot when the -50V is not present.

3. Patchboard - There are two patchboards used in the equipment. One is a one hundred pin (10X10) Vector patchboard; the other, a fifty pin (10X5) Vector patchboard. The 10X10 is used primarily for calibrator applications and the 10X5 for monitoring speedtronic control signals. A quantity of piggyback type patch plugs ate provided for patching.

3EA1, 4QA3, 35A1, 2520

REV. 1 11-10-70	REV. 4	REV. 5	PRINTS TO 3EA1 4QA3, 35A1, 2520	APPROVALS	GENERAL ELECTRIC	ELEMENTARY DIAGRAM Calibrator Application Info.
REV. 2 1/25/71	ISSUED Nov. 10, 1970			FIRST MADE FOR	INDUSTRY CONTROL DEPT.	IC4988A100
REV. 3 3-9-73	MADE BY J.A. Finch			I.C. NO.	SALEM, VA. U.S.A.	CONT. ON SH. 3.21 SH. NO 3.20

13.1510

4. Potentiometera - eleven two watt potentiometer8 are provided for use with the voltage to frequency convertors, millivolt sources, voltage, source and test functions. They are single turn pots and full counter clockwise is the minimum position.

5. Switches - ten miniature size switches are provided for sequence simulation, thermocouple transfer and test function. All switch toggles in the up position (toward the card rack) provides a closed circuit.

6. Test Jacks - four pairs of miniature binding posts are provided to accomodate digital voltmeters, counters and oscilloscopes.

7. Storage - space is provided for two small instruments, instruction book and connector cables.

8. Enclosure - is similar to a suitcase and hinged such that it is stable in the open position.

9. Chassis Ground is brought to a Jack *(Green)* which can be connected to Earth Ground.

FUNCTIONS

1. Monitor - the fifty pin patch board A11 ⟶ J15 is provided to monitor Speedtronic signals. The procedure is to patch the desired signal to a test jack where it can be instrumented.

2. Two variable frequency oscillators are contained in the IC3600SVFA card. The circuits are used with four pots to achieve a variable frequency output. By addit ion of a signal conditioning card, it is possible to achieve voltage control.

3. A variable voltage source with a. ten ohm shunt is provided. It is capable of operating from either a +50V supply or a +12V supply. It can be controlled from an external voltage signal for the simulate opt ion.

4. The Standard voltages are precision voltage references for calibrating instruments. The two voltages are nominally +6 volts and +20 mv; the actual values are recorded on the card front during card test. All calibration must be done at the jacks on the card front to avoid voltage drops.

5. Two millivolt sources are provided which are adjustable from O-50 millivolts with 1 ohm output impedance floating with respect to the system. Provision is made for voltage control of mv output. for the simulate option.

3EA1, 4QA3, 35A1, 2520

REV. 1 104 11-1?-70	REV. 4	REV. 5	PRINTS TO 3EA1 4QA3, 35A1, 2520	APPROVALS	GENERAL ELECTRIC INDUSTRY CONTROL DEPT. SALEM, VA. U.S.A.	ELEMENTARY DIAGRAM Calibrator Application Info.
REV. 2	ISSUED Nov. 10, 1970			FIRST MADE FOR		IC4988A100
REV. 3 BU925HP 3/9/73	MADE BY J.A. Finch			I.C. NO.		CONT ON SH 3.22 SH. NO 3.21

6. Switches are provided to accomplish the sequence simulation.

POWER

All power is supplied to the Calibrator from the Spaedtronic Panel via the ribbon connectors. DCOM has been used as power common and ACOM used as signal common.

OPERATING CHECK OF ELECTRONICS

A. Install A connector in proper Speedtronic slot.

B. 1. Check to see that the necessary DC buses are present.
   2. Check to see that the 8.4V 3KH voltages are present. (use Signal, Definition and Location chart to determine proper points).

C. Millivolt Source -
   1. Put SW1 switch in the down position.
   2. Put millivoltmeter from MVA+ to MVA- by patching E6 to C4 and F6 to C5.
   3. Turn MV1-coarse pot from one end to the other. MV meter should vary between OV and at least +50MV.
   4. Set output at 25 mv with MV1 coarse.
   5. Turn MV1 fine pot from one end to the other. MV meter should vary at least 3 mv from the 25 mv reading.
   6. Put SW1 switch in the up position.
   7. Millivoltmeter should read OV from MVA+ to MVA-. (No control from MV1 Knob)
   8 Put millivoltmeter from MVB+ to MVB- by patching E6 to C6; F6 to C7 and C5. (Remove E6 to C4 and F6 to C5 and C5 to GS) .
   9. Meter should read 25 mv ± 3 mv.
   10. Put SW1 switch in down position.
   11. Turn MV2-coarse pot from one end to the other. W meter should vary-between OV and at least i-50 mv.
   12. Set output at 25 mv with W2 coarse.
   13. Turn MV2 fine pot from one end to the other. MV meter should vary at least 3 mv from the 25 mv reading.
   14. Put, SW1 switch in the up position.
   15. Millivoltmeter should read 25 mv ± 3 mv (same reading as step 5). (No Control, From MV2 Knob)

D. Current Source -
   1. Patch C2 to E6 and G1 to F6.
   2. Monitor between +DVMA and -DVMA at the test jacks with a voltmeter.
   3. Vary Curr. Coarse from one end of the pot to the other. Voltage should vary between OV and at least 34V when +50V DC is present.
      Voltage should vary between OV and at least 8V when only +12V DC is present.

3EA1, 4QA3, 35A1, 2520

REV. 1 ... 11-20-70	REV. 4	REV. 5	PRINTS TO 3EA1 4QA3, 35A1, 2520	APPROVALS	GENERAL ELECTRIC	ELEMENTARY DIAGRAM Calibrator Application Info.
REV. 2 BU925HP 3-9-73	ISSUED Nov. 10, 1973			FIRST MADE FOR	INDUSTRY CONTROL DEPT.	IC4988A100
REV. 3	MADE BY J. A. Finch			I.C. NO.	SALEM. VA. U.S.A.	CONT. ON SH 3.23 SH. NO 3.22

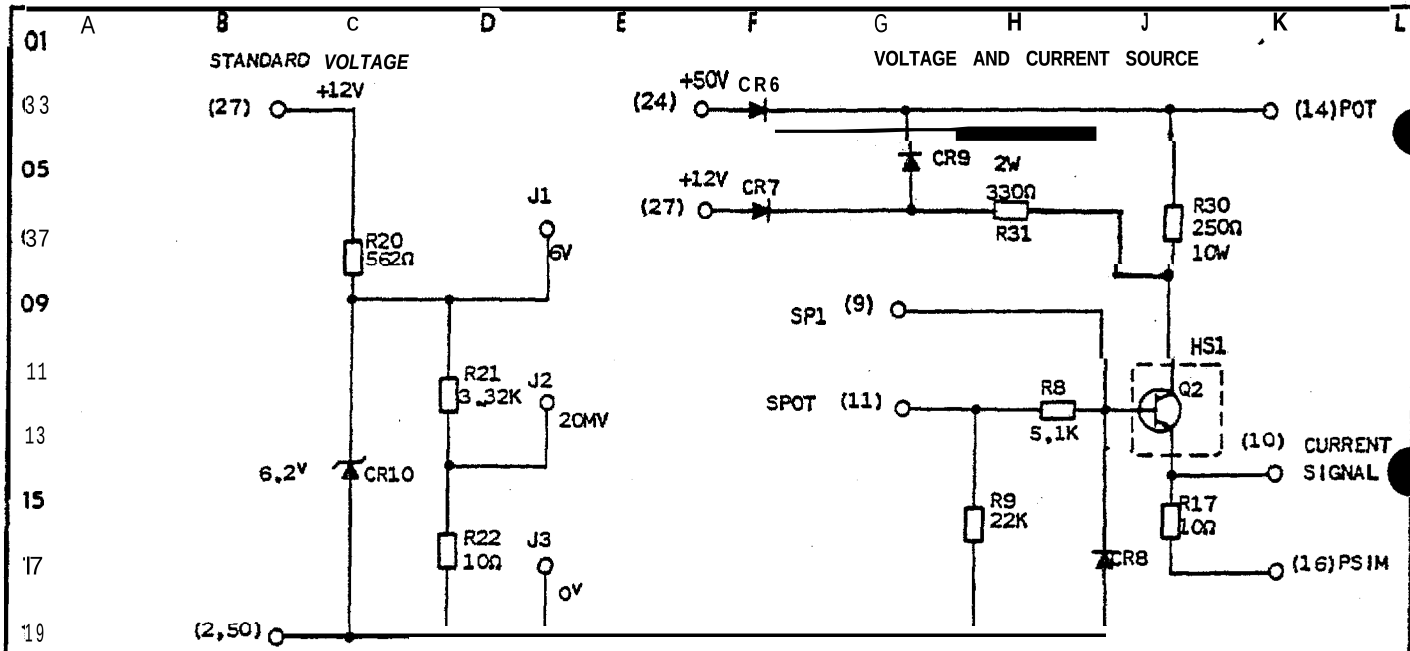
13. 2520

E. Voltage co Frequency Convertor •

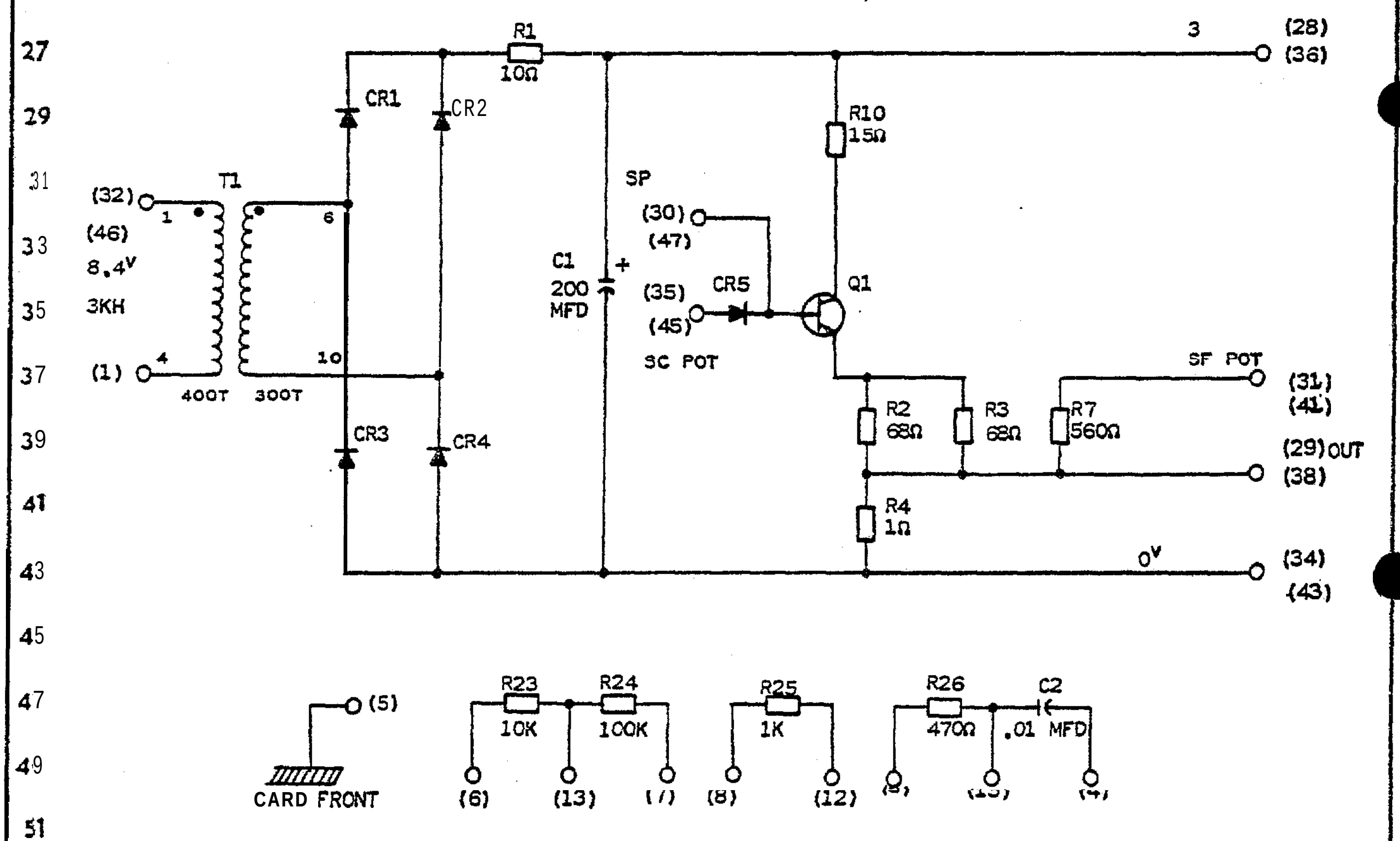
1. Patch c 1 to E4 and G1 0 to F4.
2. Monitor FRQ1 with oscilloscope at Scope A test jacks. A 10 to 11 volt peak to peak variable frequency 15HZ to 12.5KHZ Sine Wave will be observed. (It is necessary to vary coarse pot to start wave).
3. Vary FRQ1 coarse from one end of the pot to the other. Frequency should vary from at teast 15HZ to 12.5KH2 (66.7MS To 80.0 microsec. period).
4. Set frequency at 6KHZ (167 microsec period). Vary FRQ1 fine from one end of the pot to the other. The frequency should change approx. 250 HZ.
5. Monitor FRO2 with oscilloscope . Remove Cl to E4, install C10 to E4. A 10 to 11 volt peak to peak variable frequency 15HZ to 12.5KHZ Sine wave will be observed.
6. Vary FRQ2 coarse from one end of the pot to the other. Frequency should vary from at least 15HZ to 12.5KHZ (66.7MS To 80.0 microsec. period).
7. Set frequency at 6KHZ (167 microsec. period). Vary FRQ2 fine from one end of the pot to the other. The frequency should change approximately 250 Hz.

3EA1,4QA3,3SA1,2S20

REV. 1 JAF 11-20-70	REV. 4	REV. 5	PRINTS TO 3EA1 4QA3, 3SA1 2S20	APPROVALS JAF	GENERAL ELECTRIC	ELEMENTARY DIAGRAM Calibrator Application Info.
REV. 2	ISSUED Nov. 10, 1970			FIRST MADE FOR	INDUSTRY CONTROL DEPT.	IC4988A100
REV. 3	MADE BY J.A.Finch			I.C. NO.	SALEM, VA. U.S.A.	CONT. ON SH. 4.0 SH. NO. 3.23



CR5 - 68A8200P1
CR10 - 68A7238P1
Q1 - 2N2714 - 68A7373P8
Q2 - 2N5320 - 68A7711P1
CR1-4,6-8 - 68A7250P1
MILLIVOLT SOURCE (2 CIRCUITS PER CARD)



REV. 1 SBH REV. 8 1/3/72	REV. ISSUED 9-2-70.	PRINTS TO 6T DL1 6V P6A	APPROVALS FIRST MADE FOR I.C. NO. 1338	GENERAL ELECTRIC INDUSTRY CONTROL DEPT. SALEM, VA. U.S.A.
REV. 2	MADE BY JH SMITH			ELEMENTARY DIAGRAM CALIBRATOR SIGNAL SOURCE
REV. 3				IC3600SCZA1 CONT. ON SH. 3.1 SH. NO. 3.0

APPLICATION NOTES - IC3600SCZA

THIS CARD CONTAINS THREE DIFFERENT TYPES OF CIRCUIT; THESE ARE:

A. ONE STANDARD VOLTAGE SOURCE
8. ONE VOLTAGE AND CURRENT SOURCE
C. TWO MILLIVOLT SOURCES

A. STANDARD VOLTAGE SOURCE

THIS CONSISTS OF IWO VOLTAGE SOURCES WHICH CAN BE USED FOR CALIBRATING INSTRUMENTS. THE SOURCES ARE NOMINALLY 6 VOLTS AND 20 MILLIVOLTS. THE PRECISE VALUE AT ROOM TEMPERATURE WILL BE RECORD&D ON THE CARD. THE VOLTAGES ARE DERIVED FROM THE 12^V D.C. BUS BY MEANS OF A REFERENCE DIODE CR10 AND A RESISTANCE BRIDGE. THE NOMINAL 6 VOLTS WILL BE A MIN. OF 5.9 VOLTS AND A MAX. OF 6.5 VOLTS AT 25° C. THE VARIATION OF VOLTAGE WITH TEMPERATURE CHANGE IS .65 MV./$^\circ$C. THE 20 MV. NOMINAL OUTPUT WILL BE .3% ± 2% OF THE NOMINAL 6^V OUTPUT. THE RECORDED 6 VOLT VALUE WILL BE MEASURED WITH A .05% METER OR BETTER.

INPUTS: $+12^V$ D.C. PIN 2 7 10 MA,
OUTPUTS: $+6.2^V$ D.C. J1 +20 W. D.C. J2

THE OUTPUTS SHOULD BE MONITORED WITH INSTRUMENTS WHICH HAVE HIGH INPUT IMPEDANCES.

B. VOLTAGE AND CURRENT SOURCE

THIS IS A VOLTAGE SOURCE WHICH IS CAPABLE OF DELIVERING 0 TO 35 VOLTS AND 0 TO 50 MA. (50^V BUSS)

IT CAN BE CONTROLLED FROM AN EXTERNAL VOLTAGE SIGNAL FOR THE SIMULATE OPTION.

IN THE CALIBRATE MODE, THE SPOT TERMINAL IS CONNECTED TO A PAIR OF POTENTIOMETERS AS SHOWN IN FIG. 1, COARSE AND FINE CONTROL OF THE OUTPUT IS PROVIDED BY THE TWO

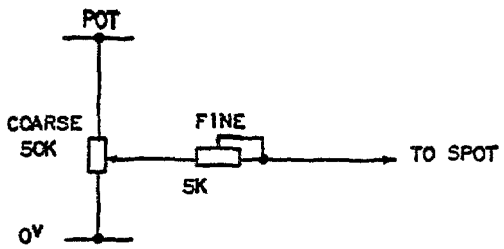


FIG. 1 - POTENTIOMETER ARRANGEMENT FOR VOLTAGE AND CURRENT SOURCE.

POTS. THE PSIM OUTPUT IS A CURRENT LIMITED EMITTER FOLLOWER. THE SPOT INPUT IS ALSO USED FOR THE SIMULATE OPTION.

THE BUS VOLTAGE FOR THE CIRCUIT HILL BE EITHER $+50^V$ OR $+12^V$. WHEN THE $+12^V$ IS THE BUS THE DEVICE WILL BE EQUIVALENT TO 0 TO 11^V WORKING THROUGH 260Ω. THE APPLICATION IS SUCH THAT WHEN THE $+50^V$ IS NOT PRESENT, THE HIGHER VOLTAGE OUTPUT IS NOT REQUIRED,

THE CURRENT SIGNAL PROVIDES ABILITY TO READ VOLTAGE DROP ACROSS R17.

INPUTS; $+50^V$ 55 MA NOMINAL, 190 MA MAX PIN 24 OUTPUTS: CURRENT SIG PIN 10
$+12^V$ 46 MA MAX PIN 27 PSIM PIN 16
SPOT PIN 11

REV. 1	REV. 4	REV. 5	PRINTS TO 1338	APPROVALS	GENERAL ELECTRIC	ELEMENTARY DIAGRAM
REV. 2	ISSUED 9-23-70		DL1, PSA	FIRST MADE FOR	INDUSTRY CONTROL DEPT.	CALIBRATOR SIGNAL SOURCE
REV. 3	MADE BY J. H. SMITH		6T, 6V	I.C. NO.	SALEM, VA. U.S.A.	IC3600 SCZA1 CONT ON SH 3.2 SH. NO. 3.1

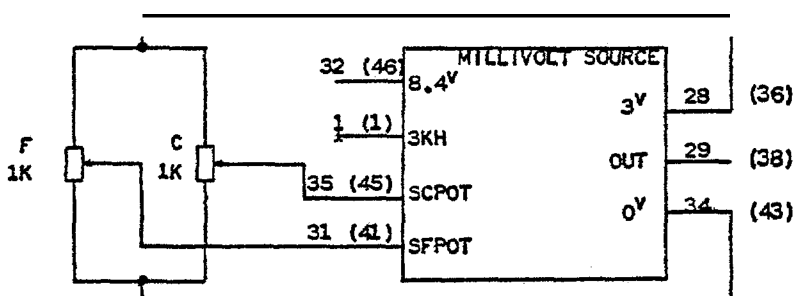
C. MILLIVOLT SOURCE (2 CIRCUITS PER CARD)

ADJUSTABLE FROM 0-50 MILLIVOLT WITH 1 OHM OUTPUT IMPEDANCE, FLOATING WITH RESPECT TO THE SYSTEM. PROVISION IS MADE FOR VOLTAGE CONTROL OF MILLIVOLT OUTPUT FOR SIMULATE OPTION.

THE MILLIVOLT SOURCE DERIVES ITS POWER FROM THE LVDT OSCILLATOR. INPUT VOLTAGE LEVEL IS 8.4^V; FREQUENCY 3 KH, THE MAX. CURRENT DRAWN IS 150 MA RMS. THE A.C. VOLTAGE IS RECTIFIED AND FILTERED. AN EMITTER FOLLOWER IS USED TO CONTROL THE VOLTAGE ACROSS A RESISTANCE DIVIDER.. THE OUTPUT IS A PORTION Of THIS DIVIDER. THE SC POT INPUT IS CONNECTED To SLIDE OF A 1K POTENTIOMETER WHICH IS CONNECTED BETWEEN THE 3^V AND 0^V. IT PROVIDES THE COARSE ADJUSTMENT OF ME OUTPUT. SC POT IS ALSO USED FOR THE SIMULATE CONTROL. THE SLIDE Of A 1K POTENTIOMETER IS CONNECTED TO SFPOT; THE POTENTIOMETER IS CONNECTED BETWEEN 3^V AND 0^V. THIS PROVIDES THE FINE ADJUSTMENT FOR THE OUTPUT.

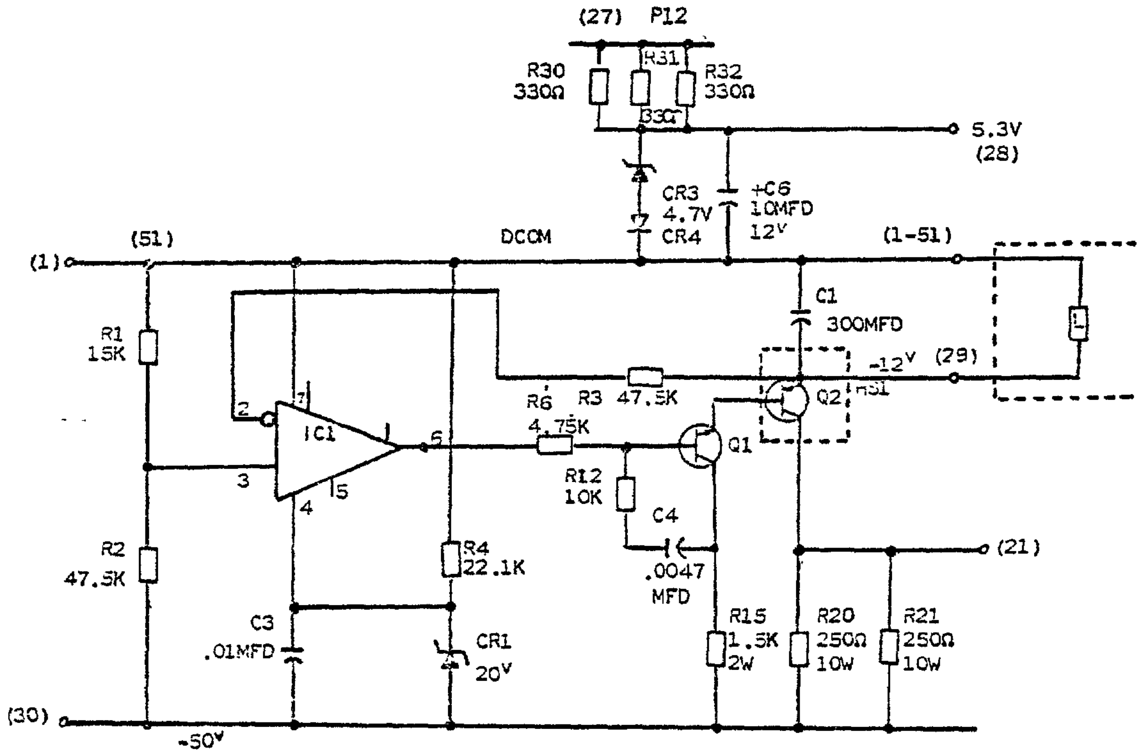
INPUTS:	8.4^V, 3KH	PIN 32, (46)	OUTPUT:	OUT PIN 29, (38)
	SCPOT	PIN 35, (45)		3^V PIN 28, (36)
	se	PIN 30, (47)		
	SFPOT	PIN 31, (41)		

CONNECTION FOR CALIBRATOR IS AS SHOWN BELOW:



D. FOUR RESISTORS AND A CAPACITOR ARE MOUNTED ON MIS CARD WHICH ARE USED IN CONJUNCTION WITH THE CALIBRATOR....... .

REV. 1	REV. 4	REV. 5	PRINTS TO DL1	APPROVALS D.J.M.	GENERAL ELECTRIC	ELEMENTARY DIAGRAM CALIBRATOR SIGNAL SOURCE
REV. 2	ISSUED 9-23-70.		P6A, 1338	FIRST MADE FOR	INDUSTRY CONTROL DEPT.	IC3600SCZAI
REV. 3	MADE BY J H SMITH		6T, 6V	I.C. NO.	SALEM, VA. U.S.A.	CONT. ON SH. FL ON FILE SH. NO. 3.2



IC1 - MC 1741 - 7672P1

Q1 - 2N4249 - 68A7355P1

Q2 - 2N4899 - 68A7720P1

CR3 4 . N - 68A8202P052

CR4 - 68A7250P1

APPLICATION NOTES

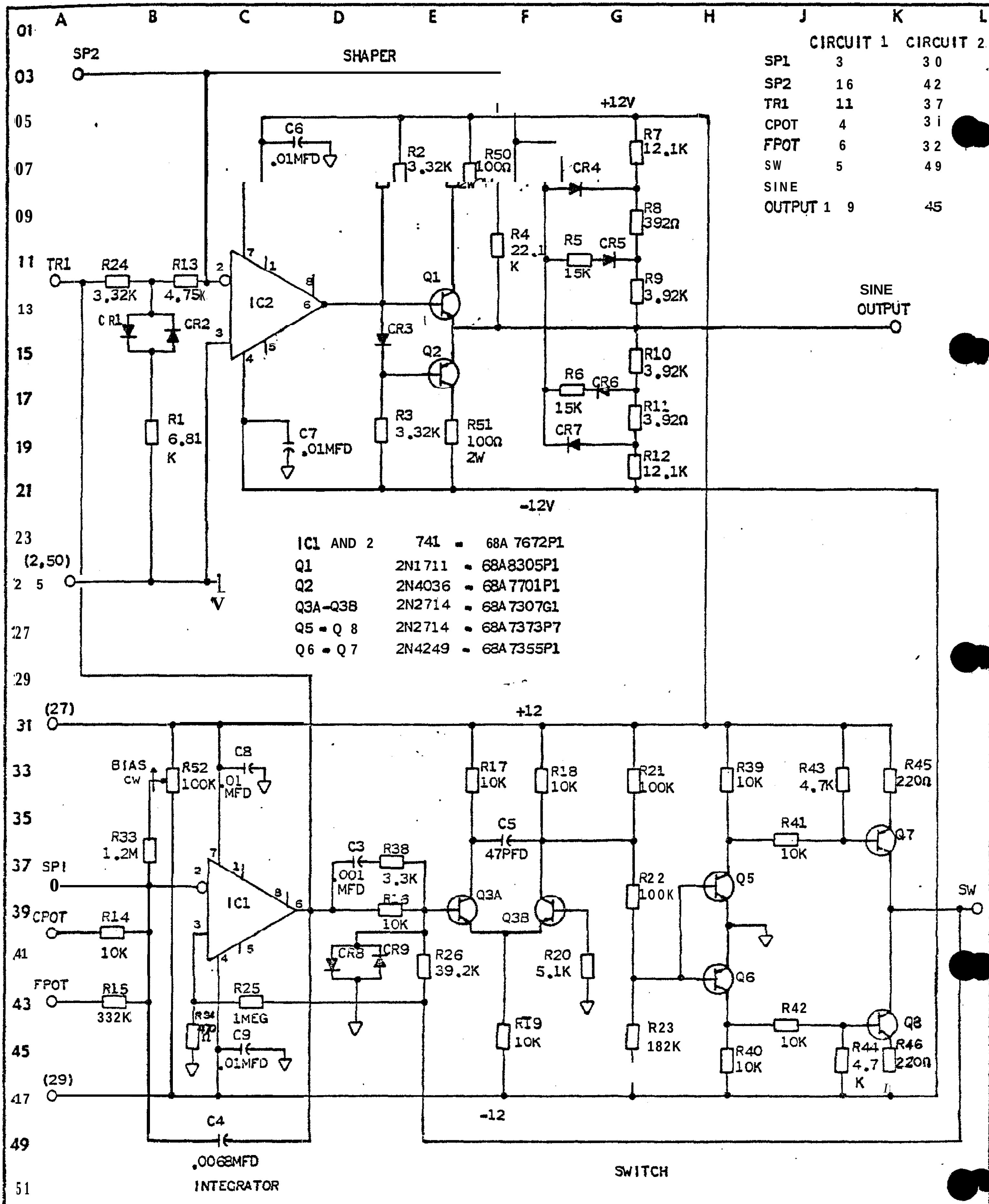
THIS CIRCUIT CONVERTS -50^V D.C. TO -12^V D. C. BY MEANS OF A VOLTAGE CONTROLLED SHUNT REGULATOR. A SHUNT TRANSISTOR IS CONTROLLED BY A VOLTAGE SENSING MICROELECTRONIC OPERATIONAL AMPLIFIER. A ZENER SUPPLY CAPABLE OF 60 MA. PROVIDES 5.3' FOR INTEGRATED CIRCUITS.

INPUTS :	+ 12^V O.C. PIN 27 70 MA. MAX
	- 50^V D.C. PIN 30 300 MA. MAX
OUTPUTS :	$-12^V \pm .1^V$ PIN 29 250 MA. MAX
	$+5.3^V \pm 5\%$ PIN 26 60 MA. MA MAX
REGULATION:	-12^V D.C. $\pm .03^V$ FROM 10 MA. TO 250 MA.
RIPPLE:	LESS THAN 10MV P-P ON -12^V SUPPLY

THIS CARD MUST BE MOUNTED IN THE LAST USABLE CART) SLOT IN ME CARD ROW OR LEAVE SPACE FOR 2 CARDS IN THE CARD ROW.

FORM IC 2219 (3-66)

REV. 1	REV. 2	CP CHAUSSE	GENERAL ELECTRIC INDUSTRY CONTROL DEPT. SALEM, VA. U.S.A.
		FIRST MADE FOR REQ.	ELEMENTARY DIAGRAM -50^V TO -12^V REGULATOR
MADE BY R. M. CKENBUSS		IC NO.	IC3600EPSS1
			CONT ON SH FL. — 3.0



	CIRCUIT 1	CIRCUIT 2
SP1	3	30
SP2	16	42
TR1	11	37
CPOT	4	3 i
FPOT	6	32
SW	5	49
SINE OUTPUT 1	9	45

IC1 AND 2	741	68A 7672P1
Q1	2N1711	68A8305P1
Q2	2N4036	68A7701P1
Q3A-Q3B	2N2714	68A7307G1
Q5 - Q 8	2N2714	68A7373P7
Q 6 - Q 7	2N4249	68A7355P1

ISSUED 9-10-70

GENERAL ELECTRIC
INDUSTRY CONTROL DEPT.
SALEM VA. U.S.A.

ELEMENTARY DIAGRAM
VOLTAGE TO FREQ. CONN.
IC3600SVFA1
CONT ON SH 3.1 SH 3.0

FORM IC 2390 (08-68)

APPLICATION NOTES

FUNCTION: THIS CIRCUIT IS USED IN THE SPEEDTRONIC CALIBRATOR/SIMULATOR. IT CAN ACCEPT A VOLTAGE VIA A SIGNAL CONDITIONER CR USE ITS OWN SWITCH OUTPUT VIA AN EXTERNAL POTENTIOMETER TO CONTROL A FIXED MAGNITUDE VARIABLE FREQUENCY SINE WAVE OUTPUT. THE SINE WAVE IS USED TO SIMULATE THE OUTPUT OF A MAGNETIC PICKUP WHICH IS THE SPEED SIGNAL FOR THE TURBINE SHAFT. WHEN USED IN THE CALIBRATOR THE OUTPUT FREQUENCY IS CONTROLLED BY A POTENTIOMETER; WHEN USED IN THE SIMULATOR THE OUT FREQUENCY IS CONTROLLED BY A D.C. VOLTAGE VIA A SIGNAL CONDITIONER,

CIRCUIT DESCRIPTION:

THE CIRCUIT CAN BE BROKEN DOW INTO FOUR PART-S:

1. INTEGRATOR
2, SWITCH-HYSTERESIS
3 . SHAPER
4. SIGNAL CONDITIONER

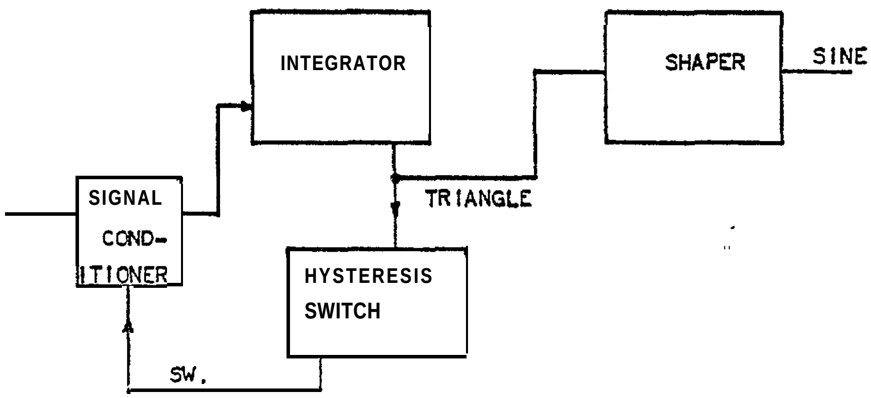


FIG. 1 - BLOCK DIAGRAM

THE INTEGRATOR IS A MICROELECTRONIC OPERATIONAL AMPLIFIER. IT WILL INTEGRATE ITS INPUT UNTIL THE OUTPUT CAUSES THE HYSTERESIS SWITCH TO OPERATE. AT THIS TIME THE INTEGRATOR INPUT WILL REVERSE POLARITY AND BEGIN INTEGRATING IN THE OPPOSITE DIRECTION UNTIL THE HYSTERESIS SWITCH IS SWITCHED BACK TO ITS ORIGINAL CONDITION, THE RESULT IS THE GENERATION OF A TRIANGULAR WAVE AT THE INTEGRATOR OUTPUT. THE FREGUENCY IS CONTROLLED BY VARYING THE MACNITUDE CF THE CURRENT I MO THE INTECRATOR INPUT, THIS IS DONE BY MWNS OF A POTENTIOMETER IN THE SWITCH OUTPUT OR 6-f MEANS OF AN EXTERNAL CURRENT SOURCE FED THRU A PA IR OF DIODE SWITCHES WHICH ARE CONTROLLED BY THE HYSTERESIS SWITCH OUTPUT.

THE INTEGRATOR OUTPUT IS FED INTO A SHAPER WHICH IS AN OPERATIONAL AMPLIFIER WITH VARIABLE GAIN. THE GAIN IS REDUCED AT THREE DISTINCT LEVELS. TWO ARE ATTAINED BY VARYING THE FEEDBACK RESISTANCE THE OTHER BY VARYING THE INPUT RESISTANCE. THE RESULT OF THESE GAIN CHANGES IS A ROUNDING OF THE TRIANGLE WAVE FEAK AND A STEEPENING OF THE ZERO CROSSOVERS TO AI-i-A IN A SINE WAVE.

CIRCUIT CHARACTERISTICS:

1. POWER INPUT +12V 100 MA WITH 100Ω LOAD
   -12V 100 MA WITH 100Ω LOAD

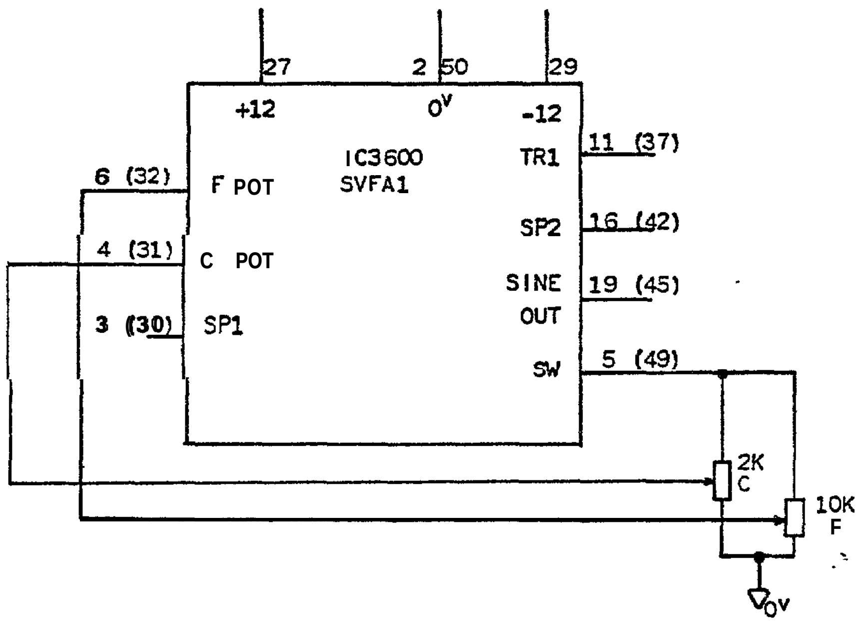
2. SIGNAL INPUT: VIA POTENTIOMETER OR DIODE SWITCHES 0→1.0 MA VARIES THE FREQUENN FROM 0 TO APPROX . 12 KHZ.

REV. 1	REV 4	REV 5	PRINTS TO ·-1 DL1	APPROVALS	GENERAL ELECTRIC	ELEMENTARY DIAGRAM VOLTAGE TO FREQUENCY CONV
REV 2	ISSUED 9-10-70		·-36 PGA	SPEED GRAPHIC	INDUSTRY CONTROL DEPT.	IC3600SVFA1
REV 3	MADE BY DL PEARSON		1338	IC NO	SALEM, VA. U.S.A.	CONT ON SH 3.2 SH NO 3.1

3. SINE WAVE OUTPUT:

VOLTAGE - 10V P-P OR 3.53 RMS.
CURRENT - 140 MA P-P OR 49.5 MA RMS
(WITHOUT CHANGE IN OUTPUT VOLTAGE LEVEL)
FREQUENCY-CONTINUOUSLY VARIABLE FROM 0 TO12 KHZ
LOWEST USEABLE FREQUENCY - 15 HZ.

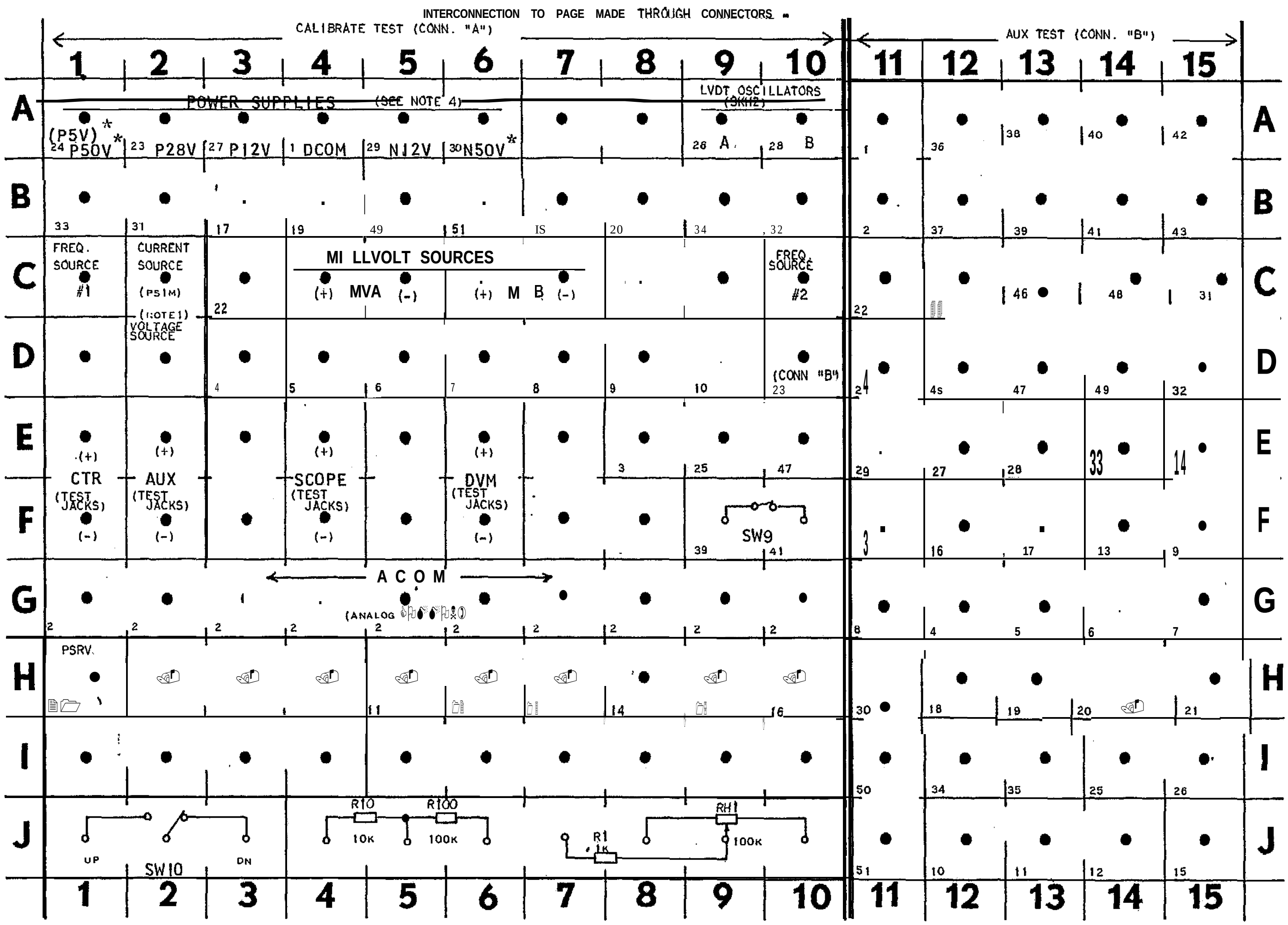
CALI BRATOR HCQKUP:



REV. 1	REV. 4	REV. 5	PRINTS TO CVL-1 DL1	APPROVALS D.J.M.	GENERAL ELECTRIC	ELEMENTARY DIAGRAM VOLTAGE TO FREQUENCY CONV
REV. 2	ISSUED 9-10-70		53-36 PGV	FIRST MADE FOR KEEDTRONIC	INDUSTRY CONTROL DEPT.	C 3600SVFA1
REV. 3	MADE BY DL PEARSON		2 520 1338	IC. NO	SALEM. VA. U.S.A.	CONT ON SH FL. SH NO 3.2

NOTES -

1. CURRENT MAY HE MEASURE,, BY DVM FROM D2 (+) TO C2 (-), 1 MA = 10MV
2. SWITCH "SW1" WILL CONNECT EITHER MV SOURCE TO EITHER PATCH POINT
   SW DOWN = MVA TO MV1, MVB TO MV2
   SW. UP MVA TO MV2, MVB TO MV1
3. CONNECTOR PIN NO'S ARE SHOWN IN LOWER LEFT OF EACH BLOCK
4. MARK 1 HAS BOTH P50V AND N50V BUT MARK II HAS ONLY P5V IN PLACE OF THESE TWO. (*)



ELEMENTARY DIAGRAM
CALIBRATOR PATCH BOARD LAYOUT

SH. NO.

GEK-28673

CONT. ON SH.

GENERAL ELECTRIC
DRIVE SYSTEMS DEPT.
SALEM, VA. U.S.A.

APPROVALS | FIRST MADE FOR REQ. | I. C. NO.

PRINTS TO

REV. 1 | REV. 2 | ISSUED | MADE BY

REV.3 | REV.4 | REV.5

FORM 244A9738P1 (9-20-71)

‘DRIVE SYSTEMS PRODUCT DEPARTMENT
SALEM, VA. 24153

GENERAL ELECTRIC

8-78 (1M)