INSTRUCTIONS

MOTOR FIELD CONTROL

331X456AAG01-G04

WARNING

ALWAYS DISCONNECT ALL POWER TO THE DRIVE BEFORE REMOVING OR INSERTING A PRINTED CIRCUIT CARD. FAILURE TO DO SO MAY CAUSE SERIOUS INJURY TO PERSONNEL AND DAMAGE TO THE DRIVE OR DRIVEN MACHINERY.

GEK-24970A **(11/82) 1M** (P)

Introduction

The motor field control is a thyristor controlled power supply intended for use as an adjustable exciter for highly inductive loads. Its primary use is as a motor field supply for use in systems which require operation in the constant horsepower region where the armature voltage is maintained constant and the field is varied. The crossover circuitry that achieves this type of control is an integral portion of this sub-assembly.

The control circuitry includes a current regulator that will reduce the effects of field heating.

An alternate mode of operation is available that permits adjusting the output current (field current) with an external programming signal.

Another separate but related function is the "tachometer monitor" function which is used to reduce the possibilities of overspeed in the event of tachometer circuitry malfunctions, tachometer misconnections, or regulator misoperation.

Due to the flexibility of the circuit, it is necessary to check the elementary diagram of this sub-assembly with the elementary diagram of the system to determine the intended mode of operation. Some of the adjustment potentiometers may not be operative in some of the modes of operation.

Certain of the output points on the terminal board are not committed and they may be connected to various points in the circuit so referring to the actual unit and checking it with the various elementary diagrams is essential.

General Description

The input power terminals are at the top of the three fuses and should be connected to a proper source of three-phase alternating current. The nominal input voltage is as follows:

Sub-Assembly	Card No.	Input Voltage	Output Voltage	Amps
331X456AAG01	193X523ABG03	230V	150	10/13
G02	G04	460V	300	10/13
G03	G05	230V	150	22/25
G04	G06	460V	300	22/25

Groups 2 and 4 may also be used at 230V. Range changing taps are provided to scale the crossover voltage properly for either 240V or 500V on each group.

The circuit is not phase sequence sensitive.

The circuits are designed for 50 Hz/60 Hz. If the input frequency is 60 Hz, there should be a jumper between ZA and ZB. This jumper should be removed for 50 Hz operation.

The field output terminals- are Fl end F2 and are located just below the fuse block with F1 being positive. The designations F1 and F2 are stamped on the printed circuit board for easy identification.

The output is achieved by "2/3 wave" rectification and controlled by a single thyristor. Therefore, the nominal maximum output voltage is 150V or 300V depending on whether the input is 230V or 460V respectively.

The circuits are trimmed so that the output voltage cannot be turned fully off by the crossover voltage or an external field programming signal. The minimum voltage will be 1 to 8 volts for groups 1 and 3 and 1 to 16 volts for groups 2 and 4, when they are operated at their nominal input voltage.

Control power for the sub-assembly is supplied through the finger connections at the bottom of the card. The power requirement is -

Positive 19.9 to 20.1 volts DC on +20 terminal with respect to COM. (approx. 70 ma)

Negative 19.9 to 20.1 volts DC on -20 terminal with respect to COM. (approx. 50 ma)

Adjustments

Frequency:	60 Hz	ZA-ZB	Jumper in
	50 Hz	ZA-ZB	Jumper removed

Current range: For G01 and G02 sub-assemblies, the following jumper conbinations should be used. The current given is the range that may be adjusted by the FMAX potentiometer when below crossover and with no external programming input.

Jumper Pin Connections	FMAX Range Amperes
None	.45 - .90
YB-YD	.68 - 1.36
YA-YB	1.33 - 2.65
YA-YB & YC-YD	2.05 - 4.11
YA-YC	3.75 - 7.5
YA-YC & YB-YD	6.52 - 13.0 *

For group 3 and 4 sub-assemblies the ranges are -

Jumper	FMAX Range (Amperes)
None	.94 - 1.88
YB-YD	1.43 - 2.87
YA-YB	2.73 - 5.45
YA-YB & YA-YD	4.55 - 9.09
YA-YC	6.82 - 13.6
YA-YC & YB-YD	12.9 - 25.7 *

* Upper values beyond thermal rating in normal ambients.

When the jumpers are connected per the above tables, the desired field current may be set with the FMAX potentiometer.

Crossover Voltage: For use as a field supply with armature voltage causing the field to weaken for operation in the constant horsepower region, armature voltage may be brought in on MP and MN where the common mode is rejected by high impedance. Jumpers are provided to select two ranges as given below:

Connection	Crossover Range
PW to PL and NW to NL	215 - 305 volts
PW to PH and NW to NH	430 - 610 volts

With the jumpers connected as given, the exact value of crossover may be set by the CROSS potentiometer.

Crossover action may be modified by a signal on the COMP terminal. Its normal use would be to make the crossover a function of CEMF rather than terminal voltage. A signal proportional to current (IR drop) would be applied to COMP. This signal should be with respect to COM. If COMP is not used, it should be connected to COM. An alternative input for cross-over control is the MFB terminal point. Its input must be referenced to COM and the crossover range will be 4.40 to 6.25 volts.

When MFB is used, it may be necessary to connect pin CF1 to pin CF2 which provides a filtering effect. When MP and MN are used there is a filter already in the circuit,

Minimum field setting: The minimum field may be set with the FMIN potentiometer. It should be set with a crossover signal approximately 3% higher than the value needed to initiate field weakening. This potentiometer is inactive when external field programming is achieved by a signal applied to FCI. FMIN should be set after FMAX since the FMAX setting affects FMIN but not vice-versa.

Field loss setting: The FLOSS potentiometer may be used to adjust the field loss detector. (The field loss output is a voltage on the SYS terminal.) Turning FLOSS fully counter-clockwise will disable the field loss function. An output may still occur on SYS due to operation of the tachometer monitor function.

Tachometer monitor adjustments: The operation of. the tachometer monitor may be adjusted by the SLIM and SCAL potentiometers. See the description of the tachometer monitor function for their function.

Input and output points:

The following terminal board points are available on the 18 point terminal board:

Point	Nomenclature	Function
1		(no connection)
2	MN	Crossover input - see above
3		(no connection)
4	MP	Crossover input - see above
5		(no connection)
6	COMP	Crossover input compensation - see above
7	COM	Common for signal power
8	MFB	Alternate crossover input - see above
9	FP2	Connection to FP2 stab connector - see below
10	FCI	Current programming point - see below
11	-20	Negative signal power input
12	FCR	Diagnostic programming point
13	SFB	Speed feedback input for tach monitor
14	+20	Positive signal power input
15	SYS	Trip signal output
16	FC	Connection to FC stab connector - see below
17	FCM	Connection to FCM pin connector
18	FP1	Connection to FP1 pin connector

Test Posts:

Four test posts are located below the potentiometers

Nomenclature	Function
TA	TACH ALIGN - see tachometer monitor
CM	Signal proportional to field current
TF	Tachometer monitor trip signal
COM	COMMON

Pin connectors:

There are, a number of pin connectors on the printed circuit card, dome are used to make-connections to the power circuitry while others are for range selection, and operating mode modification.

Pin Nomenclature	Function
K12; K23	Synchronizing input to firing circuit (from power)
1G, 1C	Firing pulse output to SCR
PL,PH,NL,NH	Range adjustment for crossover inputs on MP & MN (see above)
CF1, CF2	Connecting filter capacitor if MFB is used as crossover voltage input (see above)
YA,YB,YC,YD	Current range adjustments (see above)
FE	Modifies crossover range. Positive voltage increases crossover, negative decreases crossover, Could also be used as a field economy' input. Negative 20 volts would reduce current to the minimum field value.
ZA, ZB	Input frequency selection connected for 60 HZ, open for 50 Hz
FP2	Connects a signal to terminal board point FP2
FC	Connects a signal to terminal board point FC
FP1	Connects 'a signal to terminal board point FP1
FCM	Connects a signal to terminal board FCM
CM	Signal proportional to field current
FCO	Signal proportional to field current
TAX,TI,TN,TC	Used in selecting tach polarity for tachometer monitor operation
PC	Signal proportional to armature voltage or CEMF. Used to compare with speed feedback signal on SFB when a DC tach is used
AC	Absoluted (negative) signal proportional to armature voltage or CEMF. Used to compare with speed feedback signal on SFB when an AC tach is used.
TS	Used to input a signal proportional to armature voltage or CEMF to compare with SFB for the tach monitor function. Connected to pin DC or pin AC
TA	Signal proportional to the scaled difference between tach and armature voltage or CEMF. Used to monitor the adjustment of the SCAL potentiometer when adjusting the tach-monitor function
SM	Modifies the overspeed adjustment range of the SLIM potentiometer. Normally no connection made

Operation with Crossover Signal

Signals to initiate crossover may be brought in on MP, MN, COMP, MFB as described previously. If MP and MN are used, range selection is made by connecting wires PW and NW to pins PH, PL, NH, and NL as previously described. Pins CF1 and CF2 may be connected to filter the signal if MFB is used. Pin FE could be used to introduce field economy or to modify the crossover range. Current range is scaled using pins YA, YB, YC and YD as previously described. Adjustment sequence is -

1) Adjust FMAX potentiometer with no crossover signals (or operating below crossover).

2) Adjust FMIN. A signal may be applied to FCR (negative) to weaken field. (motor not running) Use only about 3% more signal than required to initiate field weakening. FMIN should be set to allow field to weaken sufficiently to achieve desired top speed.

3) Adjust field loss point. Use a positive voltage on FCR to reduce field below value established by FMIN. Set at desired trip point. Turn FLOSS clockwise and monitor SYS point. If SYS has a voltage on it when FLOSS is fully counter-clockwise, check test post TF. If it has voltage on it, the source-is a tachometer-monitor circuit trip signal. Test post TF can be connected to COM temporarily to eliminate this source of SYS voltage. Set FLOSS and remove connection from TF to COM.

Operation with External Field Programming Signal

In this mode of operation, there should be no connections to MP, MN, COMP and MFB. The taahometer-monitor function would not be usable in this mode. The external programming signal is introduced at FCI. A reduction of one per unit in field current requires approximately 8.7 volts. The adjustment sequence is -

1) Adjust FMAX with no input on FCI.

2) Apply FCI signal and adjust to get proper field current reduction. The field loss function may be used in this mode. Adjust current to trip point with signal on FCI. Turn FLOSS clockwise until SYS voltage'goes high.

Tachometer-Monitor Disabling

Where the tachometer-monitor is not to be used in the system, the proper disabling connections are- connect pin TC to pin TI. No connections to pins TAX, TN and TS.

Tachometer-Monitor Operation

The tachometer-monitor causes a voltage to appear on SYS under the following conditions:

1) SFB input too high, Trip level adjusted by SLIM potentiometer,

2) Armature voltage or CEMF too high in comparison with SFB signal. Alignment is done by use of the SCAL potentiometer. This would also be initiated by a loss of SFB signal.

3) If a DC tachometer-is used and TS is connected to DC, re.versing the polarity of SFB without reversing the armature or CEMF signal will cause a trip signal.

With the system properly adjusted, the voltage on test post TA and for terminal board point connected by connecting a wire to pin TA, should be low when operating at steady state and below crossover. Above crossover a signal could appear on TA without causing a trip. This is normal operation since SFB will continue to increase while armature voltage does not increase. The circuit is designed to accept this lack of equality as a normal operating mode.

If an AC tach is used, the rectified output is used as an input to SFB. In this case, TS is connected to AC which is a negative voltage proportional to armature voltage or CEMF. Other jumper connections are made depending on the polarity of SFB.

SFB Polarity	Connect TAX to
+	TN
	TI

If the TAX to TN connection is used, TI may be connected to TC to increase its gain.

For DC tachometer applications TS is connected to DC. Other connections are made to agree with the relative polarities;

NP to MN or MFB to COM Polarity	SFB Polarity	Connect TAX to --
+	+	TN
+		TI
	+	TI
		TN

External scaling -resistors or adjustments are provrdsd for the SFB input. See the system elementary and instructions.

The adjustment of the SCAL potentiometer should be done with the drive operating at a reasonably high voltage but below crossover. A value of 75% is suggested. Monitor test post TA and adjust the SCAL potentiometer for a voltage of between + .1 and - .1 volts.

The overspeed trip setting is made with the SLIM potentiometer. The procedure varies with different systems and the specific system instructions or operating notes should be consulted.

Fault Indications

As previously described, the SYS point will have a voltage appear if the tach-monitor function is the source or if a-field loss is being indicated. In the power circuit there are two fuses. Failure of the right hand fuse would reduce the current to zero. However, failure of either the left or center fuse would not interrupt field current, but would reduce the maximum available output voltage, This is detected by the circuit and a voltage will appear on SYS.

Field Current Indication

Voltage proportional to field current appears on pins FCO and CM. The voltage should be within ±15% of the values given in the following table:

Jumper Connections	FCO-CM Voltage/Field Current (Volts/Amp) G01, G02	603. G04
None	10.0	4.79
YB-YD	6.6	3.14
YA-YB	3.39	1.65
YA-YB & YC-YD	2.19	.99
YA-YC	1.20	.66
YA-YC & YB-YD	.69	.35

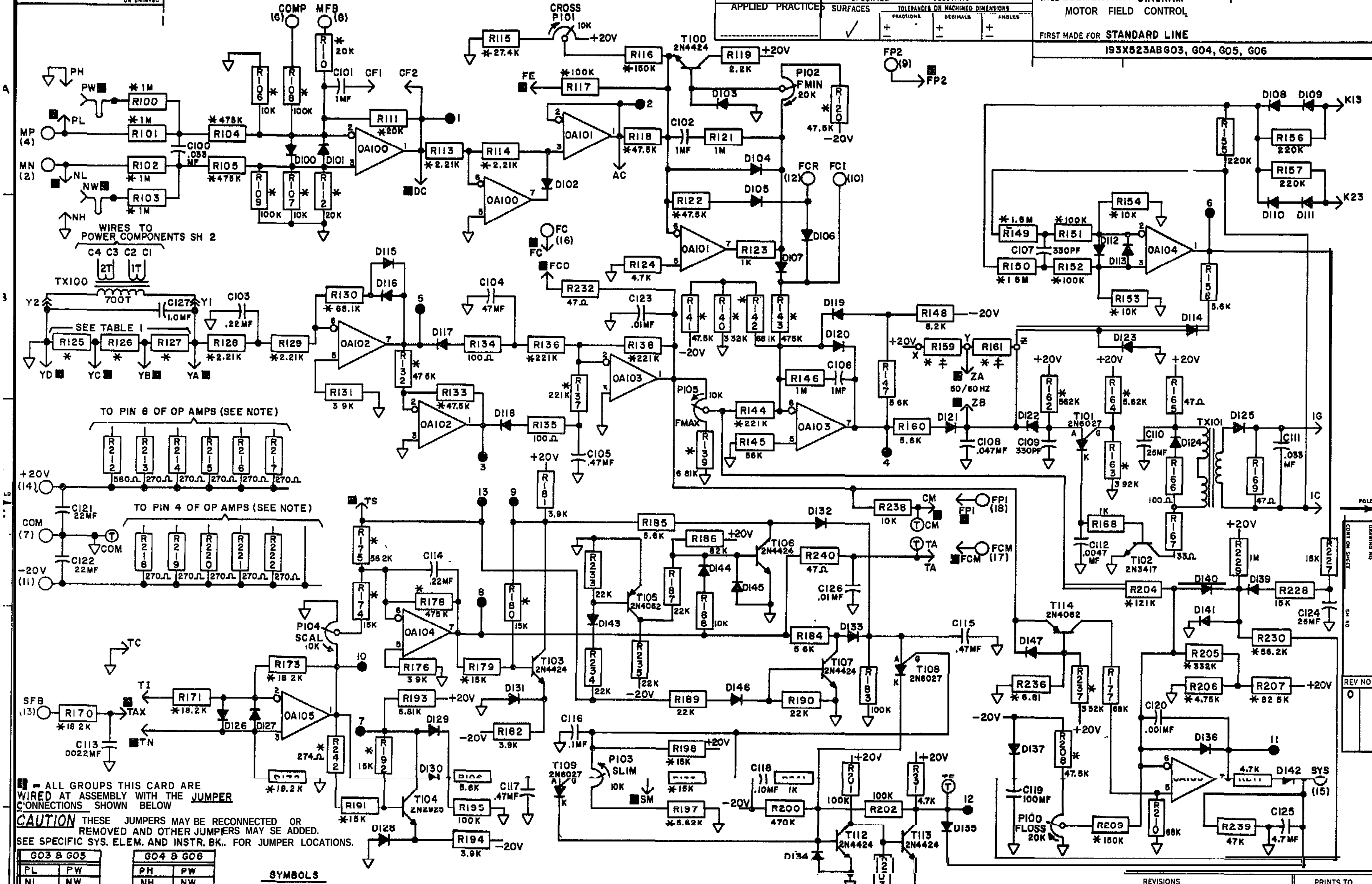
UNLESS OTHERWISE SPECIFIED SEE THE FOLLOWING—

APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS: FRACTIONS	DECIMALS	ANGLES
	✓	±	±	±

TITLE ELEMENTARY DIAGRAM MOTOR FIELD CONTROL

FIRST MADE FOR STANDARD LINE

193X523ABG03, G04, G05, G06



▪ – ALL GROUPS THIS CARD ARE WIRED AT ASSEMBLY WITH THE JUMPER CONNECTIONS SHOWN BELOW

CAUTION THESE JUMPERS MAY BE RECONNECTED OR REMOVED AND OTHER JUMPERS MAY BE ADDED. SEE SPECIFIC SYS. ELEM. AND INSTR. BK. FOR JUMPER LOCATIONS.

G03 & G05	
PL	PW
NL	NW
DC	TS
FE	FP2
YA	YB
YC	YD
FC	FCO
ZA	ZB
TAX	TN
CM	FCM
FPI	SM

G04 & G06	
PH	PW
NH	NW
DC	TS
FE	FP2
YA	YB
YC	YD
FC	FCO
ZA	ZB
TAX	TN
CM	FCM
FPI	SM

SYMBOLS

- ‡ – RESISTOR SELECTED IN TEST.
- → – SELECTOR PIN
- ≺ – FLYING JUMPER
- ○ – TB FINGER
- ● – TEST PAD
- Ⓣ – TEST POST
- * – 1% TEMPERATURE COMPENSATED RESISTOR

TABLE I

	R125	R126	R127
G03	18.2Ω	33.2Ω	100Ω
G04	18.2Ω	33.2Ω	100Ω
G05	10.0Ω	15Ω	47.5Ω
G06	10.0Ω	15Ω	47.5Ω

NOTE:

270Ω RESISTORS CONNECTED TO ± INPUTS OF ALL OP AMPS EXCEPT 560Ω TO PLUS OF OP AMP OA104. NO RESISTOR IN NEG. INPUT OF THAT OP AMP.

No revisions are to be made to this drawing without the specific approval of the Development Engineering Section of the Speed Variator Department

REVISIONS

PRINTS TO	
5B(2)22	5(S)
5D(BK)	AW(BW)
5L(BW)5	JA(CD)
5(QC)B	DS(REP)
5QC(BK)5	
5(TS)50	

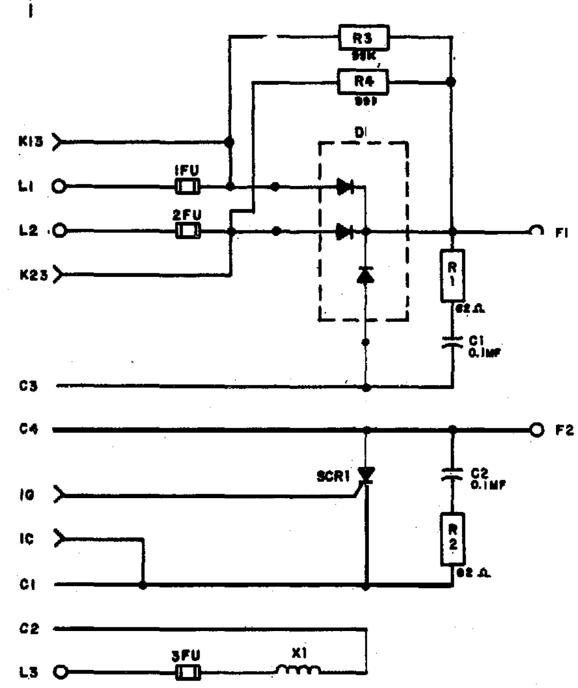
MADE BY R. Goetz APR. 29, 1975 · ISSUED F.R. Baker SEPT. 17, 1975 · APPROVALS · SPEED VARIATOR PROD. DIV. OR DEPT · ERIE, PA. USA LOCATION

GENERAL ELECTRIC

36C764149AB
CONT ON SHEET FL. SH NO. 2

TITLE ELEMENTARY DIAGRAM
MOTOR FIELD CONTROL
FIRST MADE FOR STANDARD LINE
193X523ABG03, G04, G05, G06

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING—
APPLIED PRACTICES | SURFACES ✓ | TOLERANCES ON MACHINED DIMENSIONS: FRACTIONS ± | DECIMALS ± | ANGLES ±



REVISIONS
No revisions are to be made to this drawing without the specific approval of the Development Engineering Section of the Speed Variator Department.

PRINTS TO	
5B(2)22	5(S)
5D(BK)	AW(BW)
5L(BW)5	JA(CD)
5(QC)B	DS(REP)
5QC(BK)5	
5(TS)50	

REV NO. Ø 1

M. Joell APR. 29, 1975
E. Baker SEPT. 17, 1975
SPEED VARIATOR PROD.
ERIE, PA USA

36C764149AB
CONT ON SHEET FL. SH NO 2

Box 8

13

INSTRUCTIONS

GEK-24946C

SIGNAL LEVEL DETECTOR
193X277ACG01, GO2

GENERAL ELECTRIC

INSTRUCTION

SIGNAL LEVEL DETECTOR, 193X277ACG01, GO2

1.0 GENERAL

This instruction provides basic information regarding the subject card. Refer to the system elementary diagrams for information relating to the overall system operation.

2.0 DESCRIPTION

(Test point and tab references are made with respect to the GO1 card and channel A of the GO2 card only).

2.01 This card provides a relay operation and indication when the input voltage exceeds a preset positive and/or negative level.

2.02 Two card versions are available:

G01: one relay channel
G02: two identical relay channels

2.03 The input voltage level at tab 22 to produce a relay pick-up can be adjusted by the "level adj." potentiometer for a voltage range of .1V to 10V measured at test post "TP1." The pick-up level is fixed at 10V ±.15V measured at "TP2." The input voltage at tab 22 should not exceed ±40V.

2.04 The card may be connected for pick-up at either a positive input, a negative input or both:

Positive polarization: Standard
Negative polarization: Connect tab 19 to tab 24.
Non-polarized: Connect tab 19 to tab 21.

2.05 The dropout level is approximately 90% of the pick-up level. By connecting tab 20 to tab 31 (+20V) the dropout level can be adjusted with the "hysteresis" potentiometer for a dropout level from 90% to 98% of the pick-up level.

2.06 The RC time constant of the input filter can be reduced from 20 to 2 milliseconds by connecting tab 23 to tab 22. Additional filtering can be obtained by connecting a capacitor between tab 23 and common (tab 15).

CAUTION

TO AVOID RELAY CHATTERING IT IS ESSENTIAL THAT THE PEAK-TO-PEAK RIPPLE VOLTAGE MEASURED AT "TP2" AT THE PICK-UP LEVEL IS LESS THAN THE HYSTERESIS VOLTAGE.

2.07 The pilot duty rating of the relay interlocks are .3A holding and 1.5A inrush at 115VAC.

3.0 ADJUSTMENTS

3.01 Apply the desired pick-up voltage level at tab 22. Turn the "Level Adj." pot CCW until the relay picks up. Check reverse polarity for non-polarized operation.

3.02 If less than the standard 10% hysteresis is required turn the "hysteresis" pot CW for maximum hysteresis with tab 20 connected to +20V (tab 31). Repeat step 3.01. Reduce the input voltage at tab 22 to the desired dropout level. Turn the "hysteresis" pot CCW until the relay drops out. Increase input filtering to avoid relay chattering if necessary.

4.0 TROUBLESHOOTING

4.01 Check for:

a) Proper input connections.
b) Proper polarity jumpers if required.
c) Proper adjustments as described above.
d) Sufficient filtering at TP2.

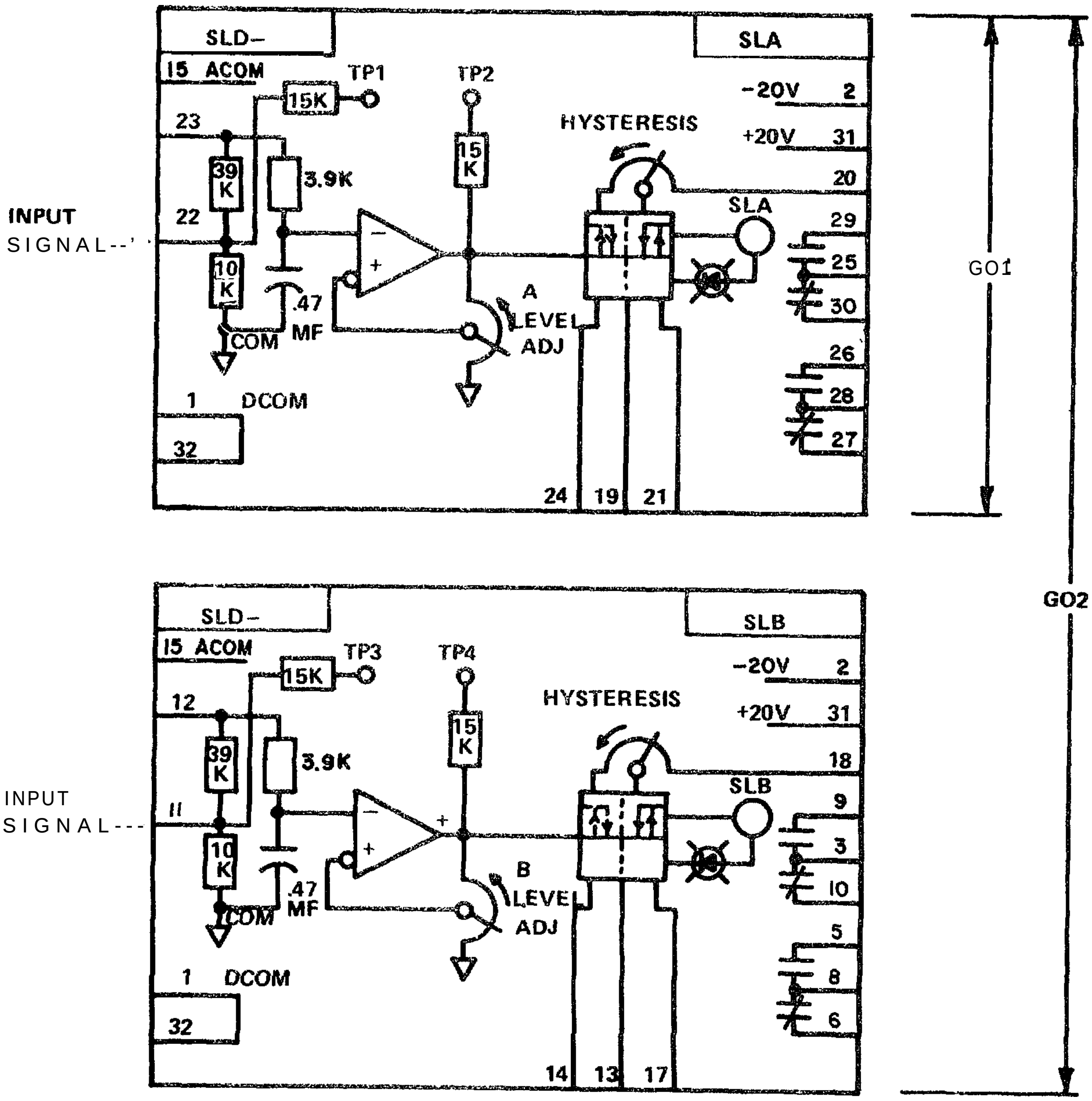
4.02 Check for actual operation of the relay interlocks.

4.03 If card failures are experienced, check for:

a) Excessive voltage (above ±40V) at tab 22.
b) Excessive relay interlock duty.
c) Excessive voltage transients on relay interlock wires. If an interlock is used in another relay coil circuit, the coil should be suppressed. Long wire runs to the relay interlocks should be avoided.

FUNCTIONAL BLOCK DIAGRAM

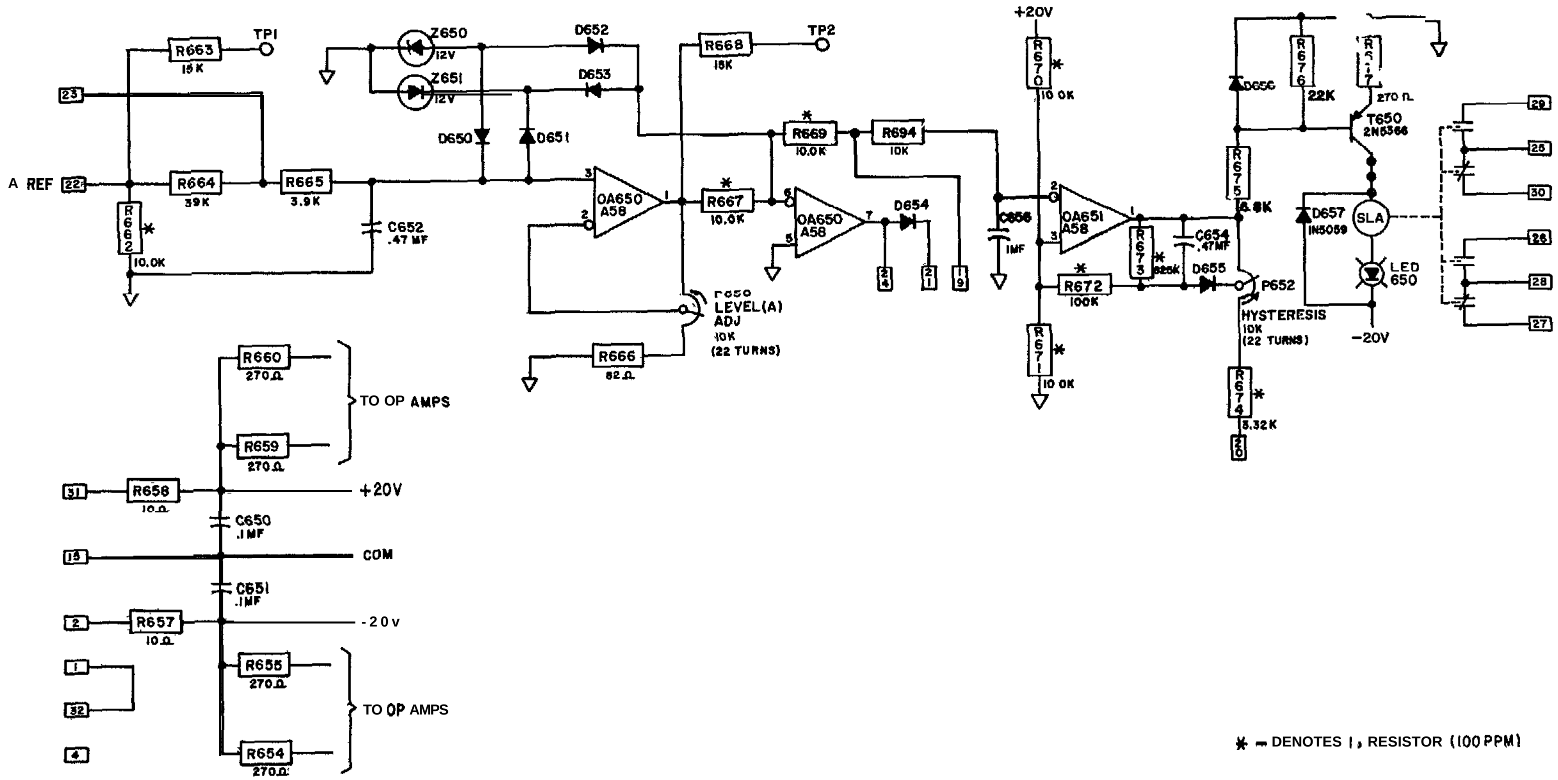
SIGNAL LEVEL DETECTOR



GENERAL ELECTRIC 36C764132AC CONT ON SHEET 2 SH NO 1

TITLE ELEMENTARY DIAGRAM SIGNAL LEVEL DETECTOR

FIRST MADE FOR STANDARD LINE 193X277ACG01



ELEMENTARY DIAGRAM 193X277ACG01

PRINTS TO	
5B(8)M	5J(BW)
5R(2)BW	TS(50)
5L(2)BW	
AW(BW)	
5D(CD)	
JA(CD)	

REVISIONS

No revisions are to be made to this drawing without the specific approval of the Development Engineering Section of the Speed Variator Department

REV NO 0

MADE BY [signature] OCT 18, 1974

SPEED VARIATOR PROD ERIE, PA USA

36C764132AC CONT ON SHEET 2 SH NO 1

GENERAL ELECTRIC

36C764132AC
CONT ON SHEET FL. SH NO 2

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING:

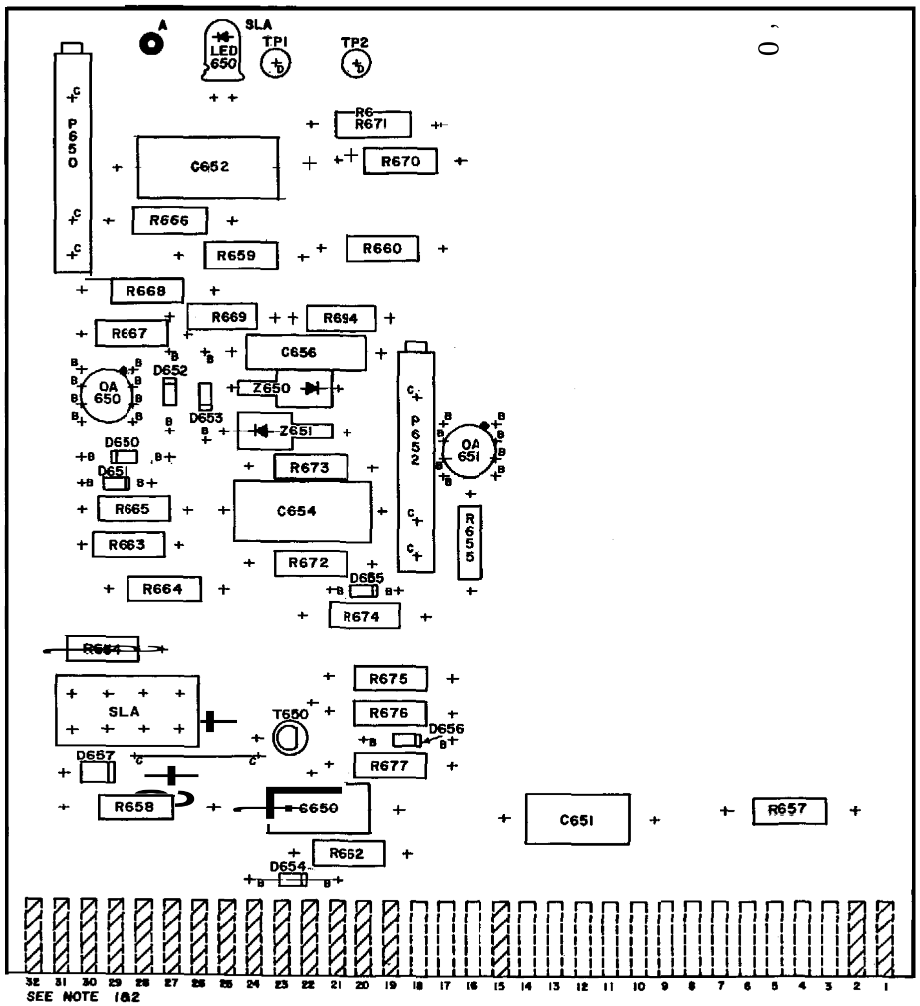
APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS FRACTIONS	DECIMALS	ANG.
718A515	✓	±	±	±

TITLE PRINTED CIRCUIT DIAGRAM
SIGNAL LEVEL DETETCTOR
FIRST MADE FOR STANDARD LINE
193X277AG01

HOLE TABULATION

ALL HOLES .040 DIA. EXCPT THE HOLES TABULATED BEDW

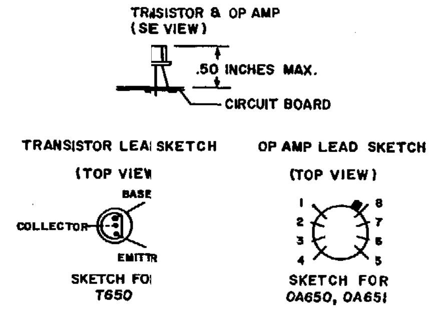
LOC.	DIA.	CAN.
A	.157	1
B	.032	)
C	.052	3
D	.081	2



CARD DIAGRAM 193X277ACG01

NOTES

1. INDICATI TAB NUMBERS CORRESPOND TO MATCHIN RECEPTACLE NUMBERS.
2. CROSS ATCHED TABS INDICATES TABS USED.
3. CARD SE, $5.500^{+.000}_{-.015}$ X $5.130^{+.002}_{-.008}$
4. ALL TRNSISTORS & OP AMPS SHALL BE MOUNTED TO A .50 INCIMAXIMUM ABOVE THE CARD SURFACE AS SHON BELOW.



GROUP	KEY LOCATIONS			
G01	-25	12-13	6-7	

2X	36A353833AB004	1	—
SCALE	REAR ETCHED BOARD DWG.	FRONT SPACE UNIT REQUIREMENT	BACK

REVISIONS

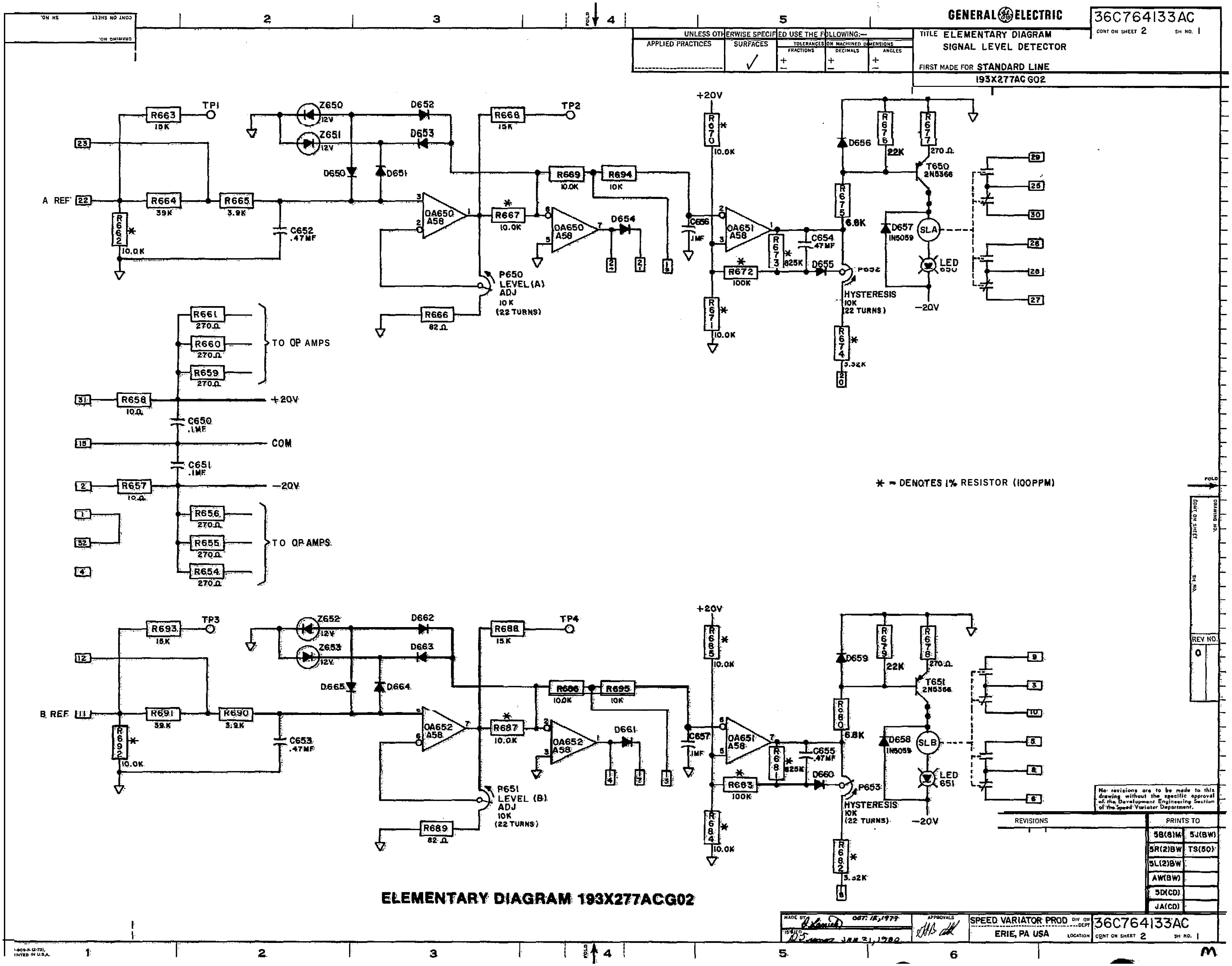
No revisions are to be made to this drawing without the specific approval of the Development Engineering Section of the Speed Variator Department.

PRINTS TO	
5B(8)M	5J(BW)
5R(2)BW	TS(50)
5L(2)BW	
AW(BW)	/
5D(CD)	
JA(CD)	

MADE BY D. Lanich OCT. 18, 1971
ISSUED JAN 2 1972
APPROVALS
SPEED VARIATOR PROD DIV OR DEPT
ERIE, PA USA LOCATION

36C764132AC
CONT ON SHEET FL. SH NO 2

REV NO. 0


GENERAL ELECTRIC
36C764133AC
CONT ON SHEET 2 SH NO. 1
UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING:—
APPLIED PRACTICES
SURFACES
TOLERANCES ON MACHINED DIMENSIONS
FRACTIONS
DECIMALS
ANGLES
TITLE ELEMENTARY DIAGRAM
SIGNAL LEVEL DETECTOR
FIRST MADE FOR STANDARD LINE
193X277AC G02
A REF
B REF
TP1
TP2
TP3
TP4
+20V
-20V
COM
TO OP AMPS
R663 15K
R664 39K
R665 3.9K
R662 10.0K
C652 .47MF
Z650 12V
Z651 12V
D650
D651
D652
D653
OA650 A58
P650 LEVEL (A) ADJ 10K (22 TURNS)
R666 82Ω
R667 10.0K
R668 15K
R669 10.0K
R694 10K
D654
C656 .1MF
OA651 A58
R670 10.0K
R671 10.0K
R672 100K
R673 825K
C654 .47MF
D655
P652
HYSTERESIS 10K (22 TURNS)
R674 3.32K
R675 6.8K
R676 22K
R677 270Ω
D656
T650 2N5366
D657 1N5059
SLA
LED 650
R661 270Ω
R660 270Ω
R659 270Ω
R658 10Ω
C650 .1MF
C651 .1MF
R657 10Ω
R656 270Ω
R655 270Ω
R654 270Ω
✱ = DENOTES 1% RESISTOR (100PPM)
R693 15K
R691 39K
R690 3.9K
R692 10.0K
C653 .47MF
Z652 12V
Z653 12V
D662
D663
D665
D664
OA652 A58
P651 LEVEL (B) ADJ 10K (22 TURNS)
R689 82Ω
R687 10.0K
R688 15K
R686 10.0K
R695 10K
D661
C657 .1MF
R685 10.0K
R684 10.0K
R683 100K
R681 825K
C655 .47MF
D660
P653
HYSTERESIS 10K (22 TURNS)
R682 3.32K
R680 6.8K
R679 22K
R678 270Ω
D659
T651 2N5366
D658 1N5059
SLB
LED 651
ELEMENTARY DIAGRAM 193X277ACG02
REV NO. 0
No revisions are to be made to this drawing without the specific approval of the Development Engineering Section of the Speed Variator Department.
REVISIONS
PRINTS TO
5B(6)M 5J(BW)
5R(2)BW TS(50)
5L(2)BW
AW(BW)
5D(CD)
JA(CD)
MADE BY OCT. 18, 1979
ISSUED JAN 31, 1980
APPROVALS
SPEED VARIATOR PROD
ERIE, PA USA
36C764133AC
CONT ON SHEET 2 SH NO. 1

GENERAL ELECTRIC

36C764133AC CONT ON SHEET FL SH NO 2

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING -

APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS FRACTIONS	DECIMALS	ANGLES
718A515	✓	±	±	±

TITLE PRINTED CIRCUIT DIAGRAM
SIGNAL LEVEL DETECTOR CARD

FIRST MADE FOR STANDARD LINE
193X277ACG02

HOLE TABULATION

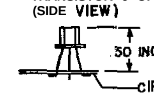
ALL HOLES .040 DIA. EXCEPT THE HOLES TABULATED BELOW

WC.	DIA.	QUAN.
A	.157	2
B	.032	2
C	.052	16
D	.081	4

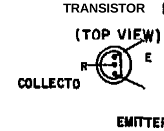
NOTES

1. INDICATED TAG NUMBERS CORRESPOND TO MATCHING RECEPTACLE NUMBERS.
2. CROSS HATCHED TABS INMATES TAGS USED.
3. CARD SIZE, $5.500^{+.000}_{-.015}$ X $5.130^{+.002}_{-.008}$
4. ALL TRANSISTORS & OP AMPS SHALL BE MOUNTED TO A .50 INCH MAXIMUM ABOVE THE CARD SURFACE AS SHOWN BELOW.

TRANSISTOR & OP AMP (SIDE VIEW)

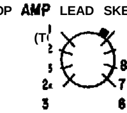


TRANSISTOR LEAD SKETCHES



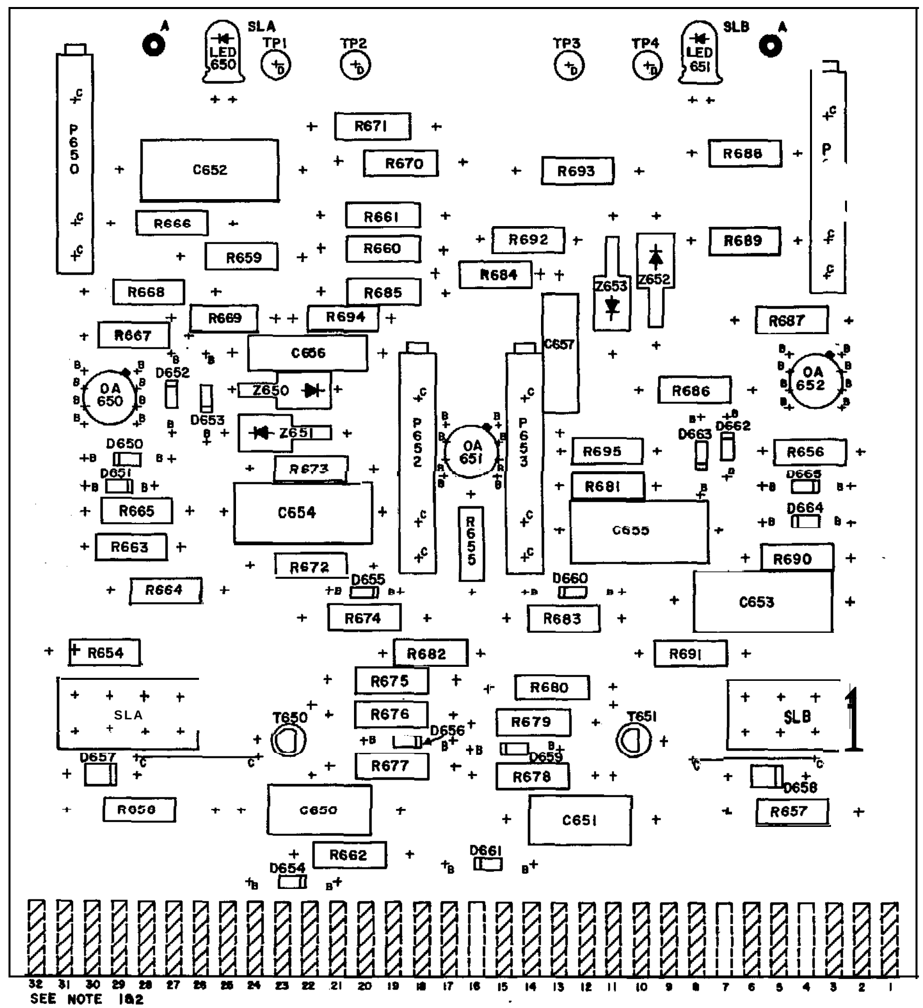
SKETCH FOR T650 T651

OP AMP LEAD SKETCH



SKETCH FOR 01650, OA651, OA652

GROUP	KEY LOCATIONS			
G02	30-31	24-25	12-13	6-7



CARD DIAGRAM 193X277ACG02

2X	36A353833AB004	1	
SCALE	REAR ETCHED BOARD DWG.	FRONT SPACE UNIT	BACK REQUIREMENT

REVISIONS

No revisions are to be made to this drawing without the specific approval of the Development Engineering Section of the Speed Variator Department.

PRINTS TO

5B(8)M	5J(BW)
5R(2)BW	TS(50)
5L(2)BW	
AW(BW)	
5D(CD)	
JA(CD)	

REV NO. 0

MADE BY Dolanich OCT. 12, 1977
ISSUED JAN 21, 1980
SPEED VARIATOR PROD. DIV OR DEPT
ERIE, PA USA LOCATION

36C764133AC CONT ON SHEET FL SH NO 2

GENERAL ELECTRIC COMPANY
SPEED VARIATOR PRODUCTS OPERATION
ERIE, PENNSYLVANIA 16531

GENERAL ELECTRIC

GEK-24946C (9/86) 2M (P)