Model dd 60A

Computer Control Console

Customer Engineering Manual

DATA DISPLAY INCORPORATED
CONTROL DATA CORPORATION

dd 60A

Revised Edition

Any comments concerning this publication
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dd 60A

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INTRODUCTION

The technical manual is for guiding personnel in the use and maintenance of Data Display Model dd 60A. It consists of seven sections in one volume: General Description, Operation, Theory of Operation, Maintenance, Maintenance Aids, Parts Data, and Drawings.

Section I, General Description, gives a brief explanation of the purpose of the dd 60A, its operational characteristics, and physical characteristics.

Section II, Operation, lists all operator controls and their functions, the character repertoire, the function codes, and briefly describes how to program the display equipment.

Section III, Theory of Operation, gives a comprehensive explanation of the display equipment logic, circuits, and functions.

Section IV, Maintenance, describes the periodic and corrective maintenance for the display equipment. This section explains the use of the maintenance aids and drawings. It also contains performance standards which show circuit typical waveform patterns.

Section V, Maintenance Aids, contains the card placement charts, wire tabulations, and printed circuit card figures necessary for locating malfunctions.

Section VI, Parts Data (PPB), contains a complete breakdown of all replaceable parts. Figures at the end of the section illustrate the location of subassemblies and components for complex assemblies.

Section VII, Drawings, contains the schematics and logic drawings that graphically portray the electrical connections within the display equipment.

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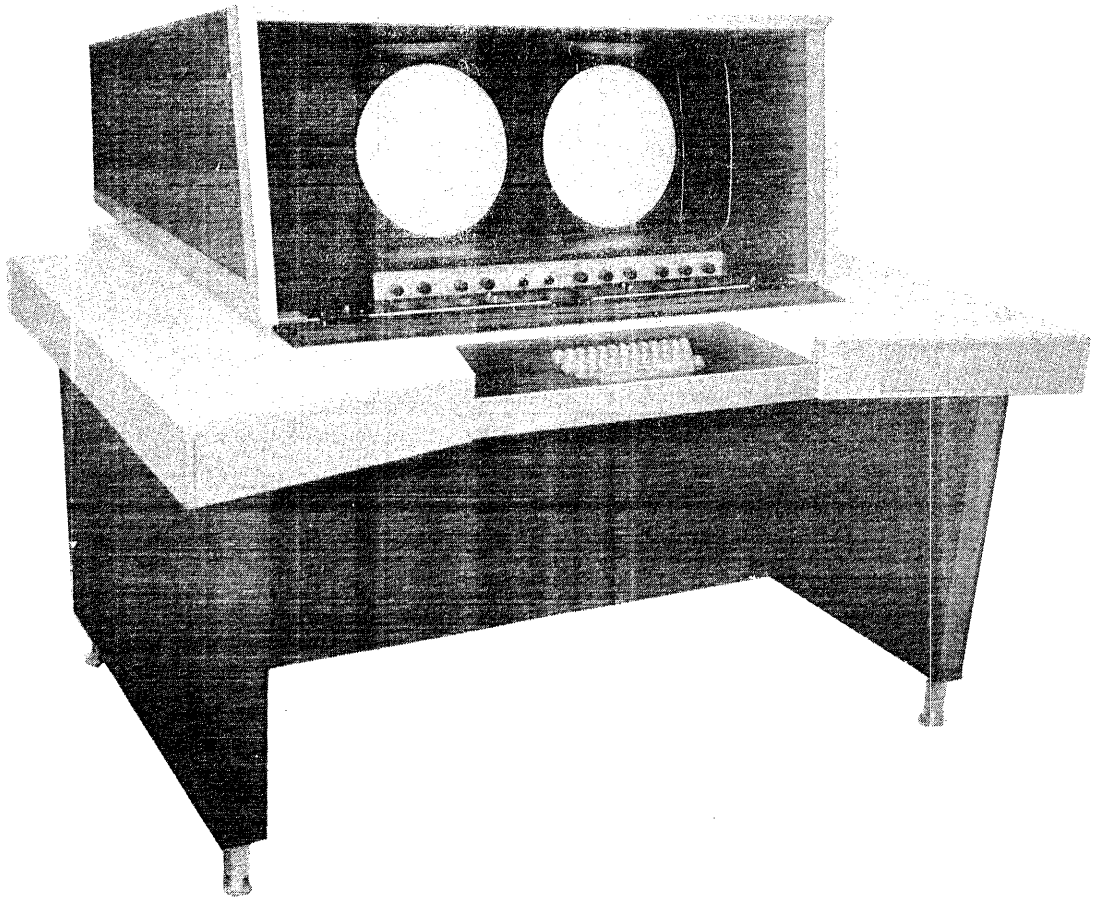


Figure 1-1. dd 60A Display Equipment

Section I

GENERAL DESCRIPTION

The Data Display Model dd 60A Display Equipment (figure 1-1) is an on-line, direct reading cathode ray tube (CRT) input display console. It provides real-time program monitoring in large scale computer operations to present independent computer regenerated displays on two 12-inch CRTs.

OPERATIONAL DESCRIPTION

The dd 60A operates from a source of digital and analog horizontal (X) and vertical (Y) input information. The digital inputs are 9 bits for each of the X and Y digital inputs. An operator, using the keyboard, may type messages for entry to the data source.

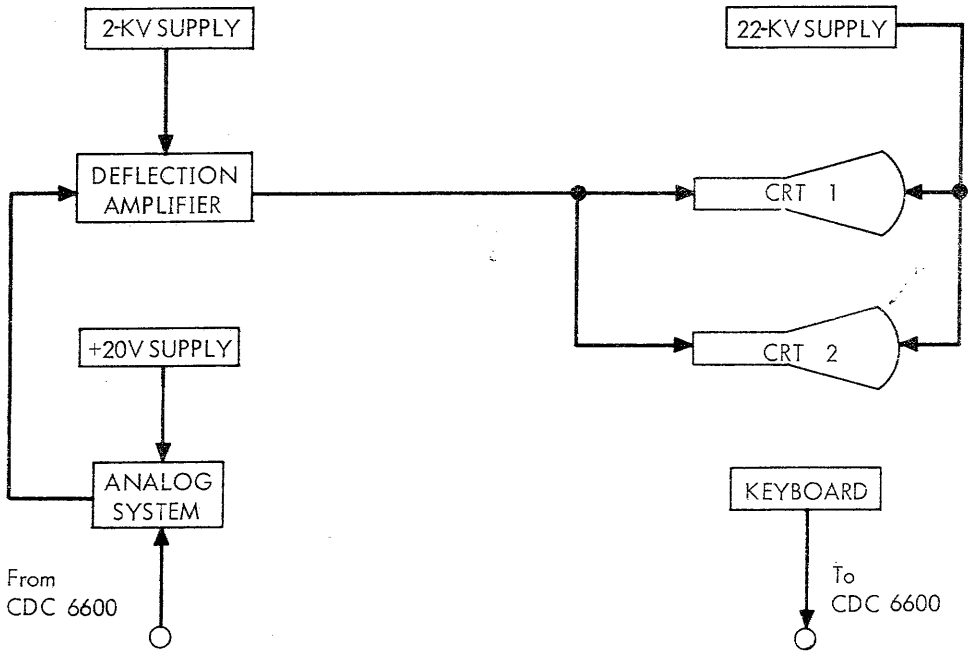


Figure 1-2. Simplified Block Diagram of the dd 60A

A symbol (characters, numbers, symbols, etc.) may occupy a 5 by 7 symbol matrix located on the CRT raster (display area). The raster, 10 by 10 inches, is divided into a 512 by 512 array. Each raster position has an X and Y coordinate designating it individually from the other positions. With the X,Y address equal to 000, the CRT beam will be deflected to the lower left position and with the X,Y address equal to 777_8, the CRT beam will be deflected to the upper right position.

The symbol repertoire and symbol size is determined by external equipment not a part of this Display Console. Two symbol size inputs allow three character sizes.

PHYSICAL DESCRIPTION

The Display Console is 48-1/2 inches high, 51-1/2 inches deep, 60 inches wide and weighs approximately 390 pounds. Formica wings, extending on both sides and in front of the CRT housing, form a desk area. The 12-inch CRTs are mounted in the desk style Display Console which also contains the keyboard and operator controls. The keyboard occupies the desk area directly in front of the CRTs. Two small convenience drawers are located in the wings, one on each side of the keyboard.

Table 1-1 lists the equipment furnished and the accessory equipment not furnished but required for maintenance.

TABLE 1-1. EQUIPMENT REQUIRED

Equipment Furnished
Display Console
Equipment Not Furnished
Oscilloscope — Tektronix 543A, or equivalent.
Dual-Trace Preamplifier — Tektronix, Type CA, or equivalent.
High-Voltage Probe — Simpson No. 0173, 16 KV, or equivalent.
Multimeter — Simpson 269, or equivalent.

Power

The power requirements of the dd 60A are 400 cycles, 3 phases, 4 wires, 208 volts; 60 cycles, single phase, 115 volts; and 400 cycles, single phase, 115 volts.

Cooling

One centrifugal blower cools the Display Console. The blower draws air through a reusable filter.

MAJOR ASSEMBLIES

Table 1-2 lists the major assemblies contained within the Display Console.

TABLE 1-2. dd 60A MAJOR ASSEMBLIES

Two 12-inch CRTs
High-Voltage Divider
Deflection Preamplifier
D/A System Circuitry
2-KV Power Supply
22-KV Power Supply
Plus 20-Volt DC Power Supply
Minus 20-Volt DC Power Supply
Keyboard
Blower Assembly
Focus and Astigmatism Correction Amplifier

Section II

OPERATION

The dd 60A is intended for continuously powered operation whenever a data source is operating. Control words and signals are issued to operate the dd 60A Display Console. This section lists all the controls which govern the equipment and contains procedures for turning the equipment on and off.

CONTROLS

There are three control areas for the operator; one area directly below the two cathode ray tubes (CRTs), a power on/off switch under the desk top on the right hand side, and a keyboard for data entry (figure 2-2 shows the keyboard configuration).

Physical controls on the display provide a means of adjusting the CRTs. Figure 2-1 shows the control panel while table 2-1 explains the functions of each control.

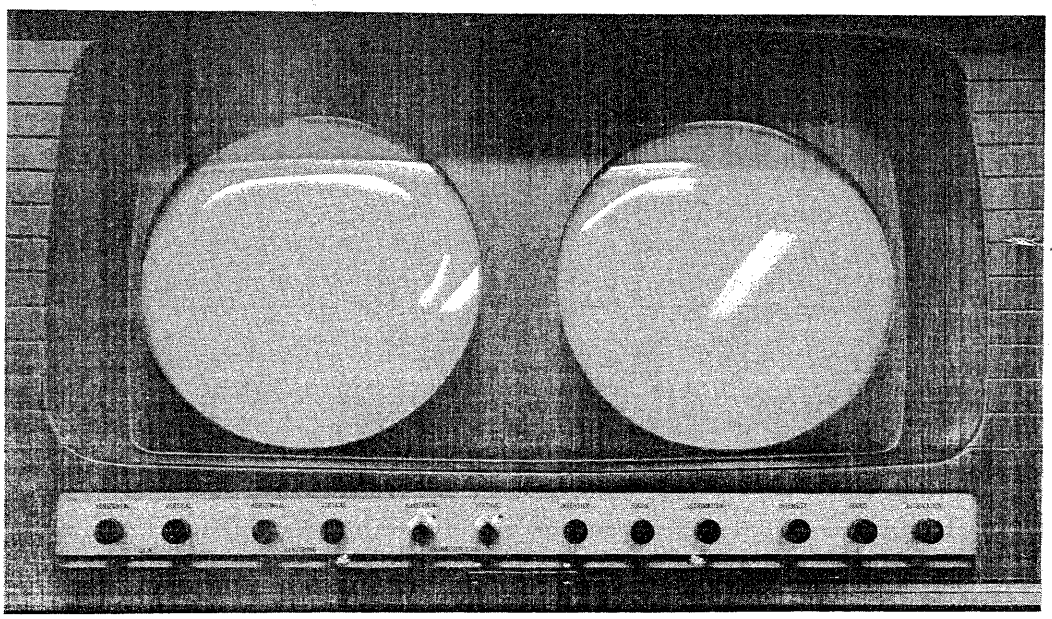


Figure 2-1. Operator Control Panel

NOTE

Three types of controls: FOCUS, INTENSITY, and ASTIGMATISM are separate for each CRT. The remaining controls affect both CRTs equally.

TABLE 2-1. OPERATOR CONTROLS

NAME	TYPE	DESCRIPTION
HORIZONTAL GAIN	POT.	Varies the width of the CRT rasters.
VERTICAL GAIN	POT.	Varies the height of the CRT rasters.
HORIZONTAL CENTERING	POT.	Varies the horizontal locations of the displays on the CRTs.
VERTICAL CENTERING	POT.	Varies the vertical locations of the displays on the CRTs.
HORIZONTAL CHARACTER SIZE	POT.	Varies the width of the symbols about their centers.
VERTICAL CHARACTER SIZE	POT.	Varies the height of the symbols about their centers
INTENSITY (2)	POTs.	Vary the brightness of the CRT display.
FOCUS (2)	POTs.	Obtain the optimum image clarity in the center area of the CRT display.
ASTIGMATISM (2)	POTs.	Obtain the optimum image clarity at the edges of the CRT display area.
POWER On/Off	Butterfly Switch	Applies or disconnects the AC voltages to the Display Console.

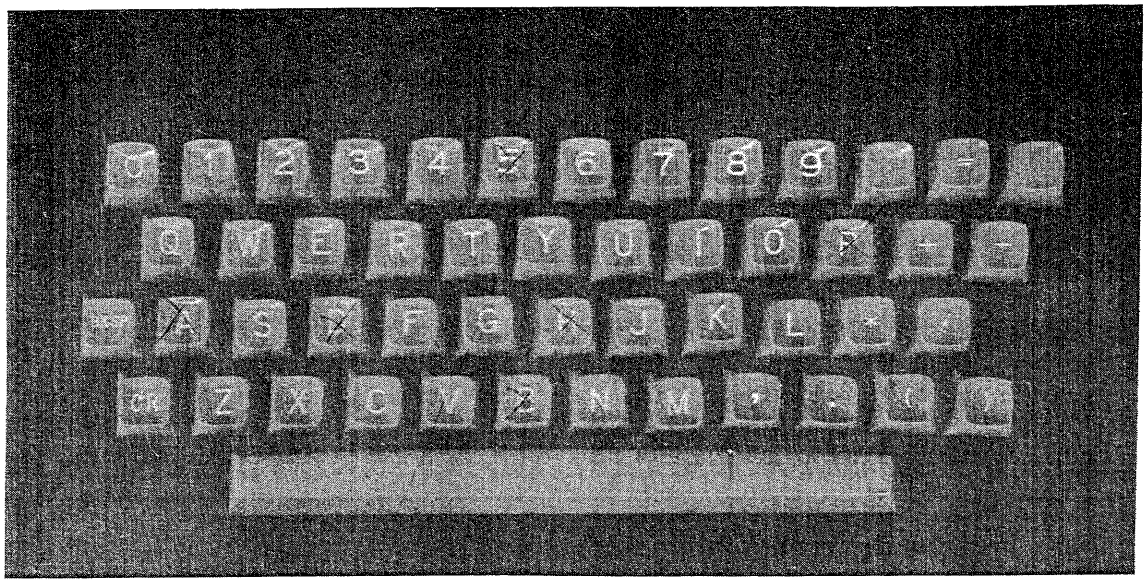


Figure 2-2. Keyboard Configuration

OPERATING PROCEDURES

Turn On Procedure

Rotate both INTENSITY controls fully counterclockwise.

Depress the power on/off switch to on.

CAUTION

Failure to rotate INTENSITY controls fully counterclockwise may result in irreparable damage to the CRTs.

After the 60- to 80-second incorporated time delay has passed, rotate the INTENSITY controls clockwise to obtain proper intensity of the symbols on the CRTs.

Turn Off Procedure

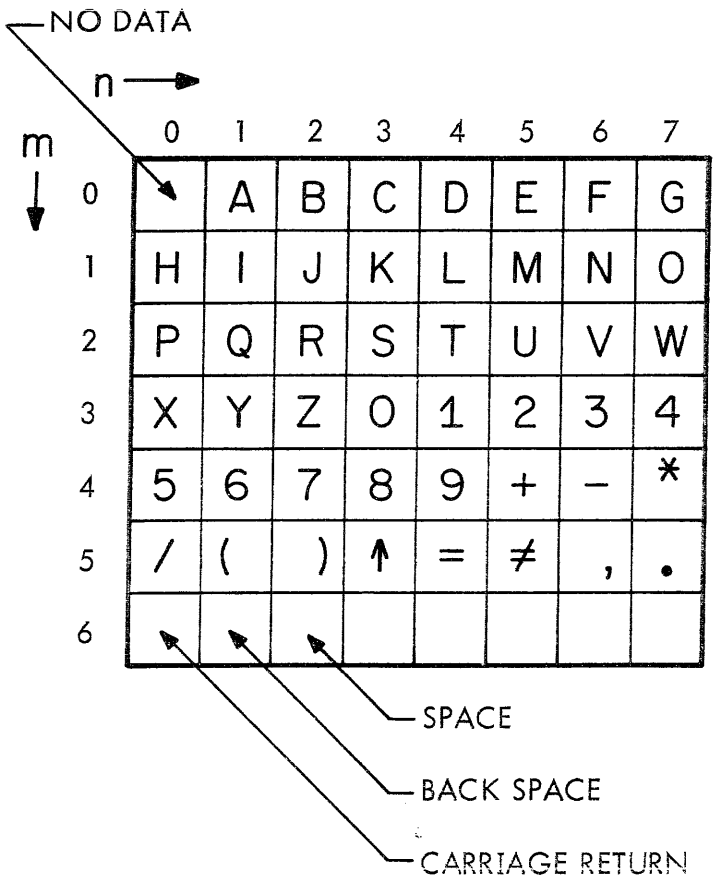
Rotate both INTENSITY controls fully counterclockwise.

Depress the power on/off switch to off.

KEYBOARD CODES

Table 2-2 lists the octal codes corresponding to the keys on the keyboard.

TABLE 2-2. KEYBOARD OCTAL CODES



Section III

THEORY OF OPERATION

The dd 60A Display Equipment exhibits information corresponding to symbol codes contained in data words transferred from a data source such as a computer.

Provision is made for four types of inputs:

1. Nine X (horizontal) and nine Y (vertical) reference position digital inputs.
2. X and Y analog symbol formation values.
3. Analog symbol size control.
4. Analog unblank time information.

The equipment contains two cathode ray tubes (CRTs) for display of logic, four power supplies (two high-voltage and two low-voltage), and circuity for:

1. Digital-to-analog (D/A) X,Y positioning.
2. Blank and unblank control.
3. Amplification of symbol size and formation.

The X,Y digital input circuit switch time requirement is 3 microseconds.

The X,Y digital inputs are interface connections between the display equipment and the reference position digital source. These digital inputs are supplied to the D/A circuitry. The D/A circuitry determines the reference (start) coordinate for symbol logic on the raster of the CRTs.

Analog logic X,Y symbol formation and symbol size control are determined by external equipment and are fed into the display equipment. This logic is amplified and added to, or subtracted from, the symbol position X,Y coordinate. Symbol size and formation logic are amplified and fed into the deflection amplifiers of the CRTs. The display equipment can accept three logic symbol size values (large, medium, and small).

Blanking and unblanking, as well as focus and astigmatism correction, are determined by analog (logic) information sent to the display equipment. These values are amplified and fed to their respective circuitry.

A keyboard, mounted in the desk top of this equipment, provides a means of communicating with the data source. There are eight output lines from the keyboard.

BASIC THEORY AND CIRCUITS

The dd 60A utilizes both D/A and analog circuits. Symbol positioning utilizes D/A while deflection, unblank, symbol formation, and focus correction are analog. D/A converters transform the digital values into analog currents and voltages which, in turn, position the beams of the CRTs.

Digital Circuitry

The basic building blocks are solid-state, transistorized circuits. Solid-state components permit convenient packaging and reduce over-all power requirements. The transistorized circuits operate on conveniently low-voltage levels and have switching times ranging from 25 to 100 nanoseconds. Figure 3-1 shows the delay between the rise and fall time of an input pulse versus the rise and fall time of the pulse output.

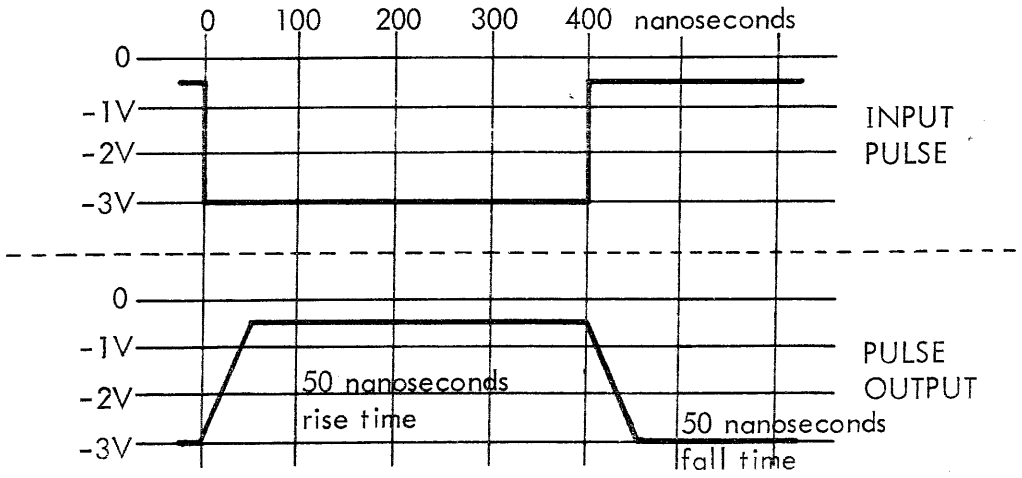


Figure 3-1. Inverter Switching Time

Single Inverter

An inverter operates at two distinct signal or pulse levels, namely -3 volts and -0.5 volts. A -3-volt input to an inverter causes a -0.5-volt output and vice versa. In the display logic, the -3 volts represents a logical 1 and the -0.5 volt represents a logical 0. Figure 3-2 shows the schematic diagram of an inverter.

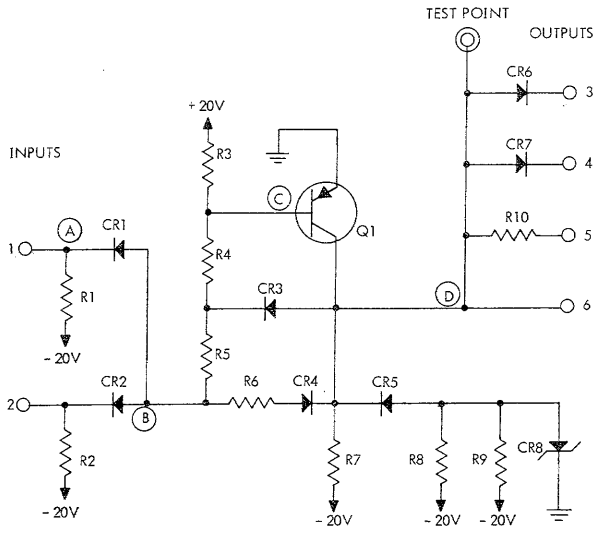


Figure 3-2. Schematic Diagram of An Inverter

The input terminals connect to a voltage divider network through diodes CR1 and CR2. The divider network consists of resistors R3 through R7. Diodes CR1 and CR2 isolate the input terminals from each other. The transistor Q1 controls the inverter circuit.

An input signal of -0.5 volt (point A) results in a close to ground potential at point B, which results in a positive potential on the base of Q1 (point C). Transistor Q1 is cut off. This develops a high-voltage drop across the transistor (because of the high impedance) and less of a voltage drop across R7 resulting in a -3-volt level on the output lines (point D).

A -3-volt potential on either input pin results in a -3-volt potential at point B. A -3-volt potential at point B results in a negative potential on the base of the transistor Q1 (point C). The transistor conducts and this decreases the voltage drop across Q1, putting point D close to ground potential. This produces a greater voltage drop across R7 resulting in a -0.5-volt level on the output line.

Thus, a -3-volt input has resulted in a -0.5-volt output. When the input returns to -0.5 volt, the output returns to -3 volts.

The inverter card has three types of outputs — standard diode (outputs 3 and 4), resistive (output 5), and shorted (output 6).

OR Circuit:

Diodes and resistors at the input of an inverter comprise the OR circuit. The inverter (figure 3-2) has two input OR circuits consisting of R1, CR1, R2, CR2 and involving the voltage divider R3 through R7.

The potential at point B, the common junction of the anodes of the OR diodes, is -0.5 volt (indicating a 0 input) only if both input levels at the cathodes of CR1 and CR2 are -0.5 volt. If either OR input goes to -3 volts (1), the potential at point B then becomes more negative indicating a 1 input. This, in turn, forces the inverter output to -0.5 volt (0).

Figure 3-3 shows two OR inputs, A and B, to the inverter 1222. Arrows touching the outer edges of the rectangle signify the OR function.

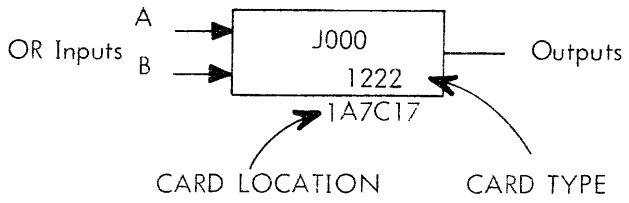


Figure 3-3. Inverter Logic Diagram Symbol

Inverters have variations in their output circuitry. The logic levels are the standard -0.5 volt and -3 volts. Figure 3-4 shows the logic diagram representation of the special circuits.

AND Circuit:

A small circle (figure 3-5) is the logic diagram representation of an AND circuit. A line represents the input to the AND, and an arrow represents the output which goes as an input to a logic element such as an inverter.

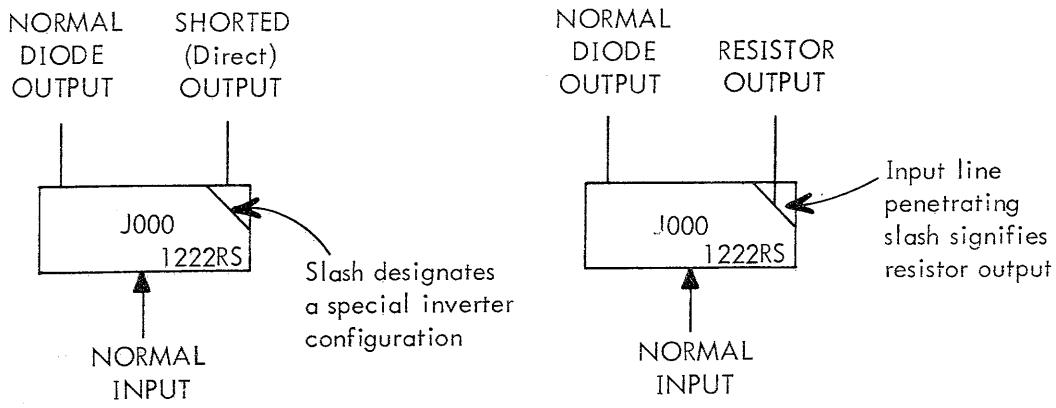


Figure 3-4. Special Logic Diagram Symbols

The AND circuit performs the logical function of tying together up to four inputs, and giving out a -3-volt (1) level when all AND inputs are equal to 3 volts. The diodes of an AND circuit are the output diodes of the inverters feeding it. As many as four diodes, each from different inverters, may be connected in an AND. Tying the common cathode connection of the diodes to the input of an inverter furnishes the remaining elements of the AND circuit. Inputs A, B, and C must all be at -3 volts before the output of the AND goes to -3 volts. If any of the inputs are at -0.5 volts, the cathodes of all three diodes are held at this potential as is the output at D.

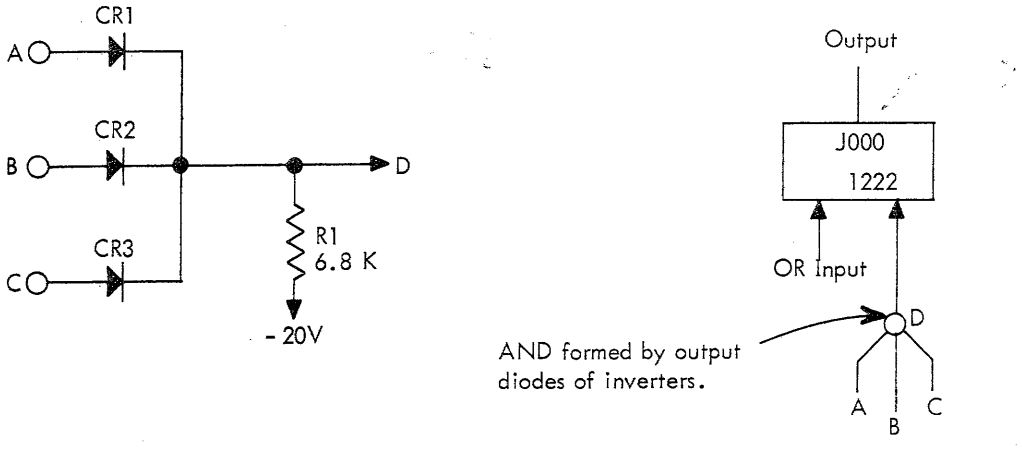


Figure 3-5. AND Circuit

Analog Circuitry

Analog values converted from digital values deflect the beam, control unblank time, focus, etc. Since the deflection system is push-pull, four analog voltages are required to position the beam. These are a push and a pull analog signal generated for X, and a push and a pull analog signal generated for Y.

Figure 3-6 shows typical simplified D/A conversion waveforms, the digital values, and the resulting single analog voltage. The analog output level varies for each of the three binary inputs; ie, input 1 (binary) results in half as much analog voltage as input 2 (binary), and input 2 (binary) results in half as much analog voltage as input 3 (binary).

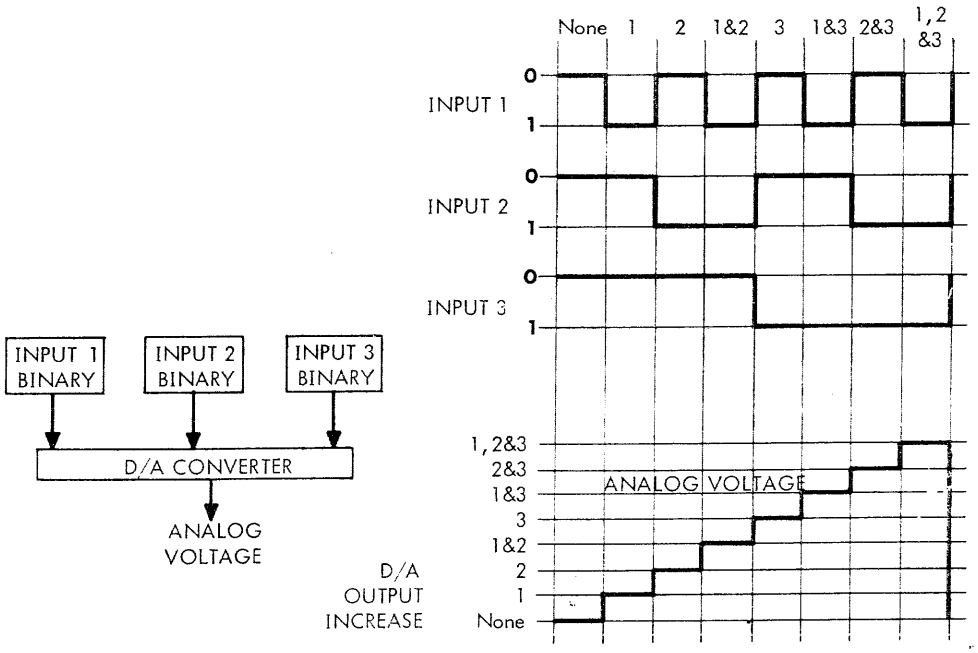


Figure 3-6. Simplified D/A Conversion Waveforms

Each X,Y positioning value generates sufficient X and Y deflection voltages to position the electron beam at a desired CRT raster position. The symbol formation moves the beam in a meaningful manner around the base X,Y position. Each movement of the beam depends upon the sum of the outputs of the two analog sources; positioning and symbol.

X,Y positioning requires two circuits each because of the push-pull method of beam positioning. Four deflection values are necessary and require four identically constructed D/A conversion networks. Each network converts the digital outputs from several digital values to one analog value. Throughout the following discussions only one analog deflection circuit will be described since the other three are identical.

D/A Conversion

D/A converters change one or more binary values into a single current or voltage level. When there are several digital values, such as a register, the most significant bit causes the greatest variation in current flow.

Each D/A network, which converts more than one digital value, utilizes several type 002C D/A converters. The type 002C card schematic is shown in Section V. A type 027 resistor card terminates the outputs of each D/A converter series and outputs one variable value. This is referred to as a D/A converter network. The D/A inputs connect to the outputs of type 619 line terminators.

The type 002C D/A converter card (figure 5-6) has two D/A converter circuits, each having a reference input, a digital input, and an output. Pins 3 and 9 are D/A reference voltage inputs, pins 1 and 7 are digital inputs, and pins 5 and 11 are outputs. Figure 3-7 shows a simplified diagram of the type 002C D/A conversion network. Type 002C D/A converters form the network for base positioning.

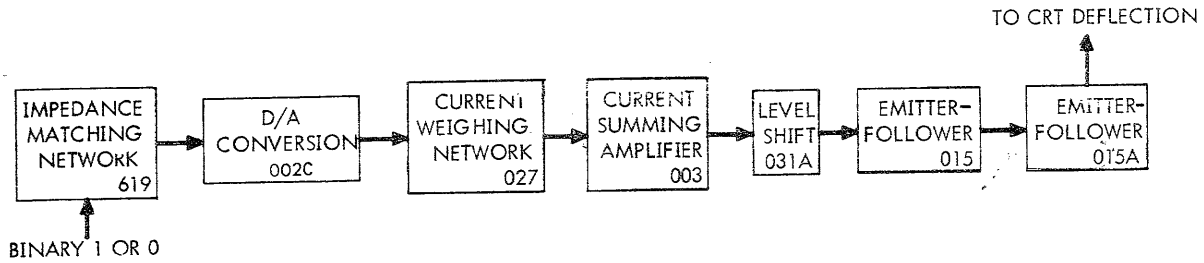


Figure 3-7. D/A Conversion Network

D/A Reference Voltage

Two voltage regulator cards (type 401 and 443 cards) control the analog reference voltage source for the positioning D/A converters. A voltage divider, connected to the regulated 20 volts, furnishes the base voltage source. A potentiometer (POT.) on the 401 regulator card controls the output of the type 443 regulator

card which is 4.7 volts ±0.3 volt. This voltage may be varied depending upon the amount of total deflection necessary from the D/A converters.

Current Summing

The output of the D/A converter network goes to a type 003 current summing card. Four current summing cards are used, two for each of the X and the Y deflection signals. Figure 3-8 shows a simplified D/A summing network.

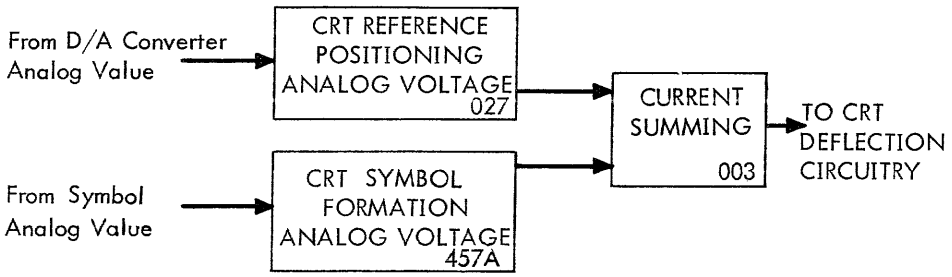


Figure 3-8. D/A Summing Network

The summing takes the algebraic sum of the symbol generator or vector generator currents and base positioning currents and combines them into a single variable current. The output of the current summing card is approximately 4.7 volts. Output variations are caused by increasing or decreasing current flow.

The 003 card drives two cards, an 031A card (figure 5-11) and an 015 card (figure 5-4). The 031A card is a differential amplifier level shift circuit. It converts the 5 volts (003 card output) to -15 volts. The output of the 015A card (figure 5-5) is used for deflection. The 429A card provides for focus and astigmatism correction through the 015A card.

TABLE 3-1. CARD TYPES AND FUNCTIONS

TYPE	FUNCTION
002C	D/A converters used to form or locate the base position.
003	D/A summing network.
015	Emitter-follower amplifier card.

TABLE 3-1. CARD TYPES AND FUNCTIONS (CONT.)

TYPE	FUNCTION
015A	Emitter-follower amplifier card.
016	Standard inverter with six inputs and six outputs.
C19	Emitter-follower with one output resistive, mixes symbol formation and size analog values.
019	Emitter-follower used for current amplification (unblank and focus CRTs).
027	Resistor card used for weighing the D/A analog levels.
029	Differential input deflection preamplifier.
031A	Level shift differential amplifier.
039	Coax cable terminator.
040	Deflection buffer amplifier.
S45	Coax cable terminator.
205	Unblank amplifier.
401	Card with variable output which drives 443 voltage regulator card.
429A	Horizontal and vertical gain control and mixer for automatic focus circuits.
443	D/A 5-volt regulator card (adjust reference levels).
452A	Amplifier.
456A	Analog current modifier with a variable output (deflection level adjustment).
456B	Analog current modifier with a variable output (intensity level adjustment).
457A	Resistor or capacitor cards used for termination or pulse delay.
478	Relay card.
619	Logic line terminator used for voltage level shift and impedance match to a 72-ohm line.

TABLE 3-1. CARD TYPES AND FUNCTIONS (CONT.)

TYPE	FUNCTION
620	Class A amplifier with feed back to match a 72-ohm line and shift reference level.
1021	Logic Inverter.
1222RS	Inverter card; two inputs, and two outputs. Used to split analog symbol size value between symbol size and unblank circuitry.
UA2A	Unblank amplifier

MONITOR

The monitor is that portion of the display equipment containing the CRTs, high voltage supplies, deflection amplifiers and CRTs reference voltage controls. Figure 3-9 is a simplified functional block diagram of the monitor which is located in the upper portion of the display equipment.

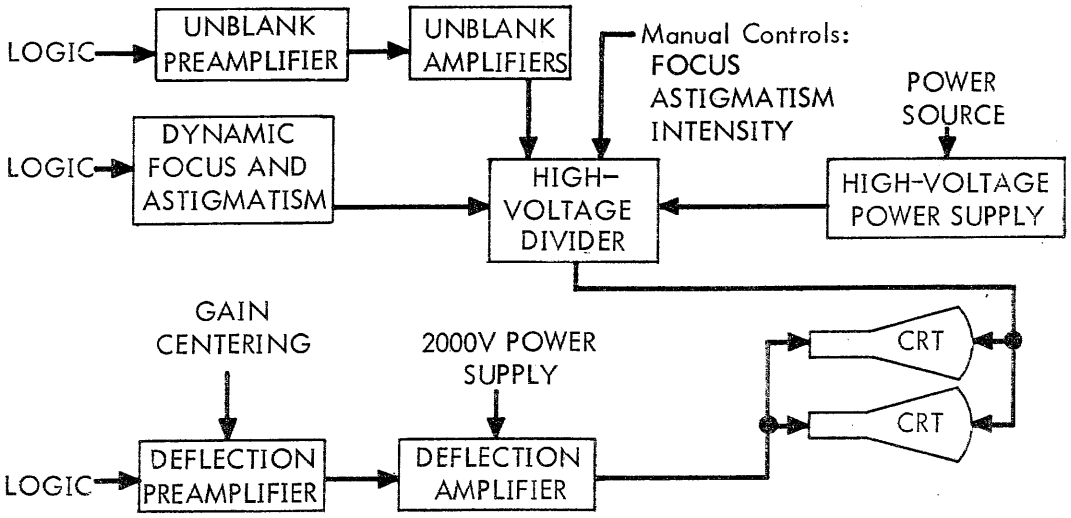


Figure 3-9. Functional Block Diagram of the Monitor

A high-voltage system, unblank circuitry, focus correction, and deflection circuitry control and drive the CRTs. The following paragraphs discuss the 2000-volt (2 KV), the 22,000-volt (22 KV) supplies and the CRT circuitry. The 2-KV supply furnishes the necessary voltages for deflection amplifiers, while the 22-KV supply and high-voltage divider provide high voltage necessary for the CRTs, focus, intensity, and unblank.

Cathode Ray Tubes

Since the CRTs are identical and connected in parallel, only the theory of one will be explained.

The display equipment CRT is electrostatically deflected, ie, changing the potentials on the deflection plates moves the beam (figure 7-12 is a schematic diagram of the CRT and high-voltage divider). The four deflection plates in the tube bend the electron beam so that it is positioned in a meaningful manner. The tube also contains: (1) grids for focus and astigmatism correction and (2) a control grid for turning the beam on and off and varying its intensity.

CRT deflection plates, which are directly coupled to the output of the deflection amplifier (figure 7-13), must be at approximately the same potential as the CRT acceleration electrode to obtain the optimum spot size. Adjustment of the ground reference POT., located on the high-voltage system shield, matches the acceleration potential to that of the deflection amplifier. Adjusting the POT. moves the zero reference point of the voltage divider in either the positive or the negative direction. This, in effect, raises or lowers the accelerator to ground potential, thus, providing a means of obtaining the correct relationship between the deflection plates and the high-voltage circuits.

High-Voltage System

The display equipment CRT requires a total cathode-to-post accelerator voltage of 16 KV, which the high-voltage power supply furnishes. A transformer, selenium rectifiers, and high-voltage capacitors make up the high-voltage power supply. The 16 KV is, in turn, connected across the high-voltage divider which furnishes the different voltages required by the CRT.

Filtering:

A resistance capacitance filter, connected between the positive and negative terminals of the high-voltage divider, reduces the high-voltage ripple to a level low enough to prevent flickering of the CRT image. To compensate for the voltage drop produced by the current passing through the resistive elements of the filter, the high-voltage power supply must provide 1000 to 2000 volts more than the CRT requires.

High-Voltage Divider:

Capacitors and fixed and variable resistors make up the high-voltage divider. Controls on the front panel provide a means of manually adjusting the astigmatism, focus, and intensity voltages. A variable resistor located on the high-voltage divider provides a means of adjusting the relationship between the accelerator voltage and the deflection plates.

The voltage divider network contains several capacitors. Two are used for coupling-in the correction and unblank voltages to the CRT grids. One couples the unblank voltage to the CRT control grid and the other couples in the focus and astigmatism correction voltages. The unblank circuitry operates at the highest difference of potential; ie, the grid is the electrical point in the CRT furthest from the ground potential. The unblank coupling capacitor is the most critical capacitor in the high-voltage divider. A DC restore circuit consisting of a diode and a resistor located between the intensity control and the unblank voltage inputs, tends to return the AC coupled unblank voltage to the level determined by the intensity control POT. In a typical high voltage system, the unblank coupling capacitor will have approximately 5000 to 10,000 volts across it.

Intensity balance between the two CRTs is adjustable. The unblank signal is applied to the center arm of a POT. (R39) located on the high-voltage divider. The two remaining terminals of the POT. are connected, one each, to the two CRT unblank circuits. Adjusting the POT. increases the unblank signal to one CRT and decreases the unblank signal to the other CRT which increases the intensity on one CRT and decreases the intensity on the other CRT.

Unblanking

The unblank levels developed in the unblank control logic determine the voltage level at the output of the unblank amplifier. The output of the unblank amplifier enters the high-voltage divider through the control grid coupling capacitor. The INTENSITY control provides the base control voltage reference which, when

the unblank amplifier is not operating, allows the electron beam to excite the phosphor. The phosphor then emits light at the normal intensity level determined by the setting of the intensity POT. When the unblank amplifier conducts completely, the control voltage is lowered to the point that the beam is not strong enough to cause the phosphor to emit light. Varying the rate of conduction of the unblank amplifier causes a variable intensity by changing the bias on the control grid.

POWER SUPPLIES

The following paragraphs describe the plus and minus 20-volt regulated supplies, 2000-volt (2 KV) supply, and the 22,000-volt (22 KV) supply.

Depressing the ON button applies 60-cycle, 115-volt, single-phase and 400-cycle, 208-volt, 3-phase power to the display equipment. The 115 volts applies input power to the plus and minus 20-volt supplies. The 208 volts applies input power to the 2-KV and 22-KV supplies. The 208 volts immediately energizes the filament transformer in the 2-KV supply which furnishes 6.3 volts to the filaments, a thermal delay, and energizes the filament transformer in the deflection amplifier.

20-Volt Power Supplies

There are two 20-volt regulated supplies in the display equipment. These two supplies furnish power necessary for digital, D/A, and analog circuits. They employ a transistorized regulator (figure 7-10). The supplies are not discussed in detail because they are encased in epoxy and are not repairable. A failure of the supply necessitates complete replacement.

2-KV Power Supply

The 2-KV supply furnishes the voltages necessary for the deflection amplifier and correction voltage circuit (figure 7-9). It consists of two transformers T1 and T2, chokes L1 through L8, diodes CR1 through CR18, the thermal delay relay K2, and the power relay K1.

Initial application of power places 208 volts on the contacts of the deenergized solenoid, and the primary K1 of the filament transformer T1. Also, 20 volts is placed on the holding contact of K1 and the cathode of the type 6N060 delay, K2. K2 imparts a 60- to 80-second delay between application of 208 volts to the

contacts of K1 and the energizing of K1. After the delay elapses, K2 places 20 volts on the field of K2 which energizes it. K2, in turn, places 208 volts on the primary of T2, which is a delta-double-wye transformer. The output from pin 4, summed, is 600 volts while the output from pin 6, summed, is 1400 volts. CR1 through CR12, L1 through L4, and C3 and C4 form the filtering and rectifying network for the 1400 volts. CR13 through CR18, L5 through L8, and C1 and C2 form the rectifying and filtering for the 600 volts.

The 600 volts go directly to the deflection amplifiers. The voltage level at the anodes of CR4, 8, and 12 of the 1400-volt circuit and CR14, 16, and 18 of the 600-volt circuit functions as the base level upon which the voltage potential of the circuit is added. For example, the 600-volt potential across CR13 and CR14 is added to the base level (in this case, ground) placed on the anode of CR14. The result is a 600-volt potential between pin 8 of L8 to ground.

Applying the 600-volt level to the anode of CR4, which has a 1400-volt potential between it and CR1, biases the output at pin 8 of L4 to 2 KV (600 volts + 1400 volts).

22-KV Supply

The 22-KV supply furnishes the high-voltage potential for the CRT high-voltage divider. It requires 120-volt, 400-cycle, single-phase power on the primary. The output of the supply is partially filtered, thus, it requires filtering at the voltage divider.

DEFLECTION

Base deflection involves the positioning of the CRT beam at any one of 512 by 512 raster reference positions. The X,Y coordinates specify the raster base position. D/A converters are weighted such that they convert the binary values to an analog voltage value. The 027 card (figure 5-8) provides a weighting of the respective D/A converters to make a current level for each D/A converter proportional to the power of two associated with the X or Y deflection bits. The 003 card (figure 5-3) sums the current formed by the 027 card, thus, providing one analog level.

Symbol Formation

The symbols are formed by moving the beam around the base beam position in a manner dictated by symbol formation signals generated by the computer.

Section IV

MAINTENANCE

The maintenance procedures for the dd 60A should be performed only by experienced display equipment personnel. Adjustments referred to as factory set or factory adjustments should be made only as a last resort.

Two types of controls are utilized in the dd 60A Display Equipment; normal operator controls and maintenance adjustment controls. The normal operator controls are externally located on the display equipment. The maintenance adjustments are internal and are used only if the display becomes unsuitable or after component replacement.

Maintenance of the display equipment requires both preventive and corrective procedures. Preventive steps consist mainly of cleaning and visual inspection while corrective measures consist of trouble analysis and correction. Performance standards (table 4-2 through 4-7) show oscilloscope waveforms at critical areas.

Section II describes the controls used for normal operation of the display equipment while this section describes the maintenance adjustment controls.

Special Operator Adjustments

The following listed adjustments are available for fine tuning. These controls are located on the front of the display equipment.

Intensity:

Adjust the INTENSITY controls until all programmed displays are visible.

NOTE

Placing INTENSITY controls at too high a level will cause undesired traces on the screen. Likewise, setting the level too low will cause fading of some displays.

Horizontal and Vertical Gain and Centering:

Adjust the GAIN and CENTERING controls until the raster appears square and its corners just touch the edge of the cathode ray tube (CRT) face. This procedure must be performed while adjusting both the GAIN and CENTERING controls.

The GAIN controls increase or decrease the size of the raster around its center while the CENTERING controls move the center point of the raster in respect to the CRT center.

Focus and Astigmatism:

1. Set both FOCUS and ASTIGMATISM controls at the center of their travel.

2. Adjust the FOCUS and ASTIGMATISM controls until the displays are clear and distinct at the center area of the scope.

NOTE

Focus and Astigmatism correction is interacting. It may be necessary to compromise on the quality to gain optimum performance from the other.

TEST EQUIPMENT REQUIRED

Maintenance of the display equipment requires the use of a pulse oscilloscope, a voltmeter with a high-voltage probe, and a high-voltage capacitor.

The oscilloscope should have dual-trace and external-triggering facilities. This allows the comparison of two traces while using a third pulse for a trigger. Signals used within the equipment are usually in the nanosecond range.

High-voltage readings needed for maintaining the high-voltage section require the use of a multimeter and a high-voltage probe. Various other corrective maintenance functions also require the use of a multimeter.

The high-voltage capacitor, when used for coupling the oscilloscope to the high-voltage section, prevents the high voltages from damaging the oscilloscope blocking capacitor.

The following test equipment is recommended for properly maintaining the display equipment.

- Oscilloscope — Tektronix, Model 543A, or equivalent.
- Dual-Trace Preamplifier — Tektronix Type CA, or equivalent.
- Blocking Capacitor — Plastic Capacitors, Inc., OF200-502, .005 microfarad, 20,000 volts.
- Multimeter — Simpson 269, or equivalent.
- High-Voltage Probe — No. 0173, 16 KV, or equivalent.
- X100 Probes (two) — Tektronix, or equivalent.

PERIODIC MAINTENANCE

Preventive maintenance requirements are the dusting of exteriors with a lint-free cloth, cleaning the reusable air filters, visual inspections, and vacuum cleaning. The following periodic inspections should be performed during the recommended periods:

Weekly

1. Remove the reusable air filters and wash them with warm water.
2. Ascertain that the blower is operating.

Quarterly

1. Inspect cables and wiring for connector and connection looseness, insulation breakdown and rips, or any other damage.
2. Check the power supplies and monitor components for leaky capacitors, wire damage, and corrosion. Check all transformers for evidence of bulging, cracking, or leaking.
3. Check all mechanical components for looseness, binding, and damage.
4. Inspect the high-voltage system for insulation breakdown, component damage, and signs of arcing.

5. Clean the air filter and check the blower.
6. Measure the output of the regulated 20-volt supplies. Check for the correct voltages and for excessive noise.

MAINTENANCE ADJUSTMENTS

The following paragraphs give the procedures for maintenance adjustments. These should not be performed except when the display has become unsuitable.

Preparation for Adjustments

CAUTION

Check the intensity of the spot on both CRTs. If it is too high on either screen, turn the respective INTENSITY control down.

Test pattern 1 (figure 4-1) is recommended for display equipment maintenance. It provides a means of ascertaining that the equipment is functioning properly.

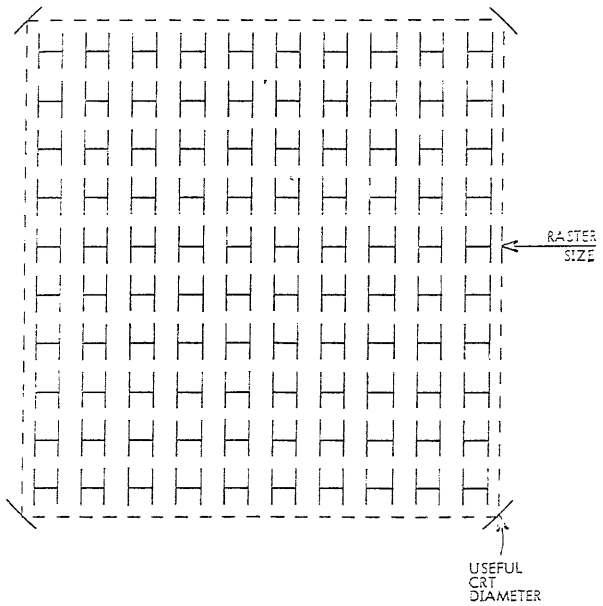


Figure 4-1. Test Pattern 1

NOTE

The number and size of symbols are determined by logic data from an external source and should be programmed into the display.

D/A Reference Voltage Adjustment

NOTE

All potentiometers on the card are numbered top to bottom, POT. 1, POT. 2, POT. 3, and POT. 4 in this text.

Adjustment of the digital-to-analog (D/A) converters is categorized into two groups: (1) reference voltage (4.7 volts ± 0.3 volt) 401 card and 443 card and (2) DC balance adjustments. The reference voltage is a stable regulated voltage supply. Adjustment of the reference voltage will vary the over-all raster size of both CRTs. The DC balance adjustments are used to balance the push-pull output of a D/A converter. This is necessary for best operation of the transistor deflection preamplifiers, final deflection amplifier, and to provide a balanced push-pull signal as an input to the focus-astigmatism correction circuits.

1. Adjust the POT. on the card location 1A6B1 until the voltage on the test point (TP) of the card location 1A6B2 is 4.7 volts ± 0.3 volt.

NOTE

After adjusting the reference voltage, the HORIZONTAL and VERTICAL GAIN controls on the display equipment may need readjustment.

Adjustment of the DC balance is described later in this section.

Deflection Preamplifier and Amplifier Alignment

The purpose of deflection preamplifier-amplifier alignment is to align the horizontal (X) and vertical (Y) axis in a straight X and Y axis line. This alignment corrects the balance of the X and Y push-pull preamplifiers-amplifier which are separate circuits and require separate alignment adjustments.

Program a test pattern (figure 4-1) to determine if the linearity of either the X or the Y axis varies.

To determine if the Y deflection balance is correct, rotate the VERTICAL CENTERING control from fully counterclockwise to fully clockwise. If the pattern becomes compressed at either the top or bottom of the screen, the Y deflection circuitry is out of balance and needs alignment.

To determine if the X deflection balance is correct, rotate the HORIZONTAL CENTERING control from fully counterclockwise to fully clockwise. If the pattern becomes compressed at either the left or right side of the screen, the X deflection circuitry is out of balance and needs alignment.

Deflection Preamplifier Alignment

The deflection preamplifiers are card type 029. Each 029 card has an adjustment POT. which increases or decreases the amount of drive to the deflection amplifier.

Adjust the POT. on the X axis 029 card (location 1A7M1) so that the Hs on the screen are linear left to right. Adjust the POT. on the Y axis 029 card (location 1A7M3) so that the Hs on the screen are linear top to bottom.

Deflection Amplifier Alignment

The deflection amplifier has POTs. and trimmers (variable capacitors) used to fine-tune the amplifier. The trimmers have the greatest effect at the start of the sweeps (X and Y) and the POTs. have the greatest effect for the remainder of the sweeps. These adjustments are located on the amplifier.

Program a display to correspond to test pattern 2 (figure 4-2). Vector A-C is a negative Y and a positive X. Vector E-C is a positive Y and a positive X. Adjust the Y deflection trimmer (1 of figure 4-3) to obtain the straightest line between points E and D. Adjust the Y deflection POT. for the straightest line between points D and C. Adjust the X deflection trimmer to obtain the straightest line between points A and B. Adjust the X deflection POT. for the straightest line between B and C.

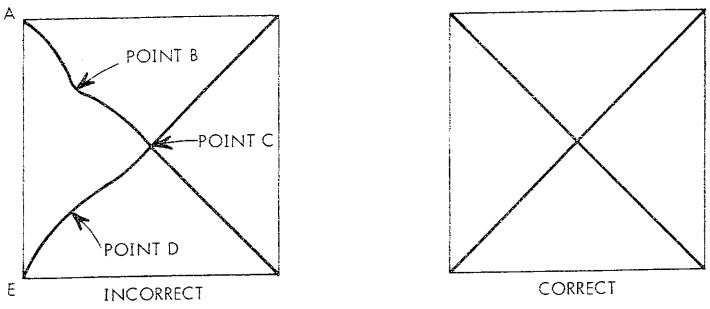


Figure 4-2. Test Pattern 2

Program a display to correspond to test pattern 1 (figure 4-1). Adjust the X trimmer located on the front of the deflection amplifier (2 of figure 4-3) to align the Hs in the lower rows directly under the Hs in the upper rows.

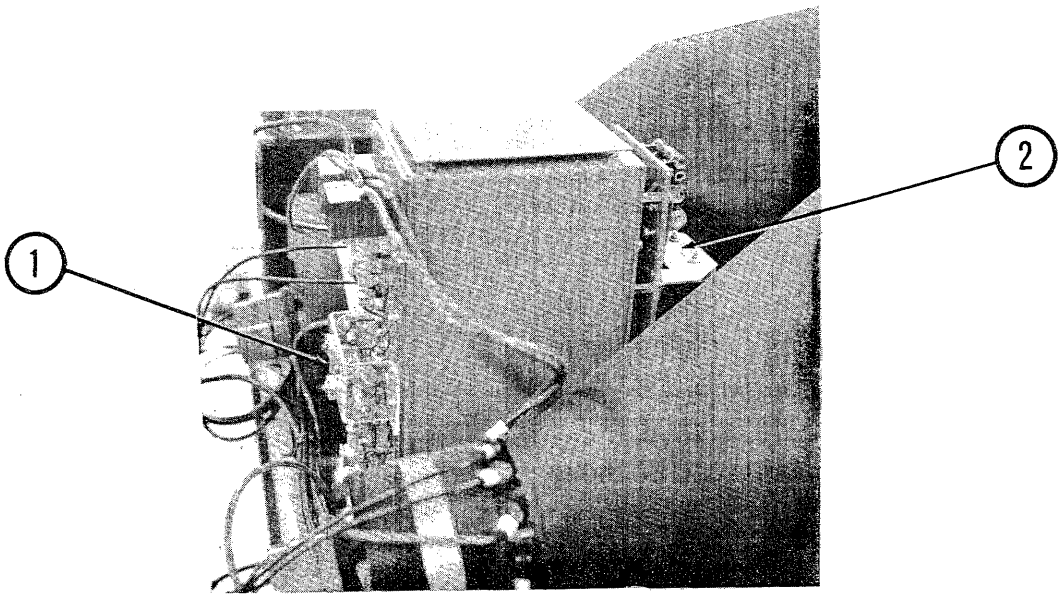


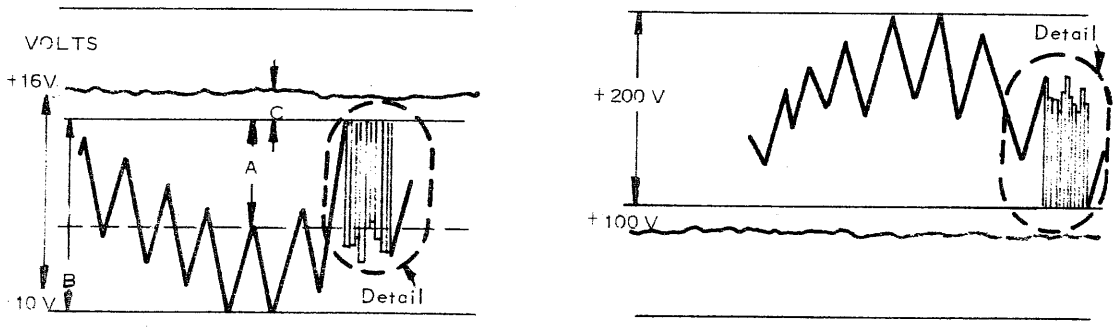
Figure 4-3. Deflection Amplifier

Adjust the Y deflection trimmer, so that the crossbars of the Hs form a straight line left to right.

Focus and Astigmatism Correction

The focus and astigmatism correction procedures make it possible to obtain an optimum display. FOCUS correction accomplishes the over-all focusing while astigmatism correction focuses the beam at the edges of the CRT.

1. Connect the oscilloscope probe to the TP of the 452 card at location 1A7M5 (focus and correction output).
2. Initially set all POTs. on the 429A card at location 1A6C13 to the center of their travel.
3. Program a dot pattern into the Display Console starting at the upper left and going to the lower right. Position the pattern at the center of the scope. Adjust the GAIN controls to give the proper size raster.
4. Adjust POT. 1 (429A card) until 2A = B (figure 4-4).



Type 452A Card Output Focus Amplifier Circuit

Figure 4-4. Approximate Focus and Astigmatism Waveshapes

5. Connect the probe to the focus correction input of the high-voltage divider (1A3TB1-1). Adjust the center POT. (429A card) until the focus volt output B is 200 volts AC peak-to-peak (PP).
6. The ratio of B to C is between 1:13 and 1:17 (figure 4-4). If not, adjust POT. 3 (429A card) until they are of the proper ratio.
7. Connect the probe to the astigmatism input of the high-voltage divider (1A3TB1-2). Set the FOCUS and ASTIGMATISM operator controls at the center of their travel. Adjust R05 (1 of figure 4-5) to obtain the best over-all focus and astigmatism results. This adjustment varies, depending upon the over-all dynamic characteristics of the CRT, and will be between 0 and 65 volts AC PP.

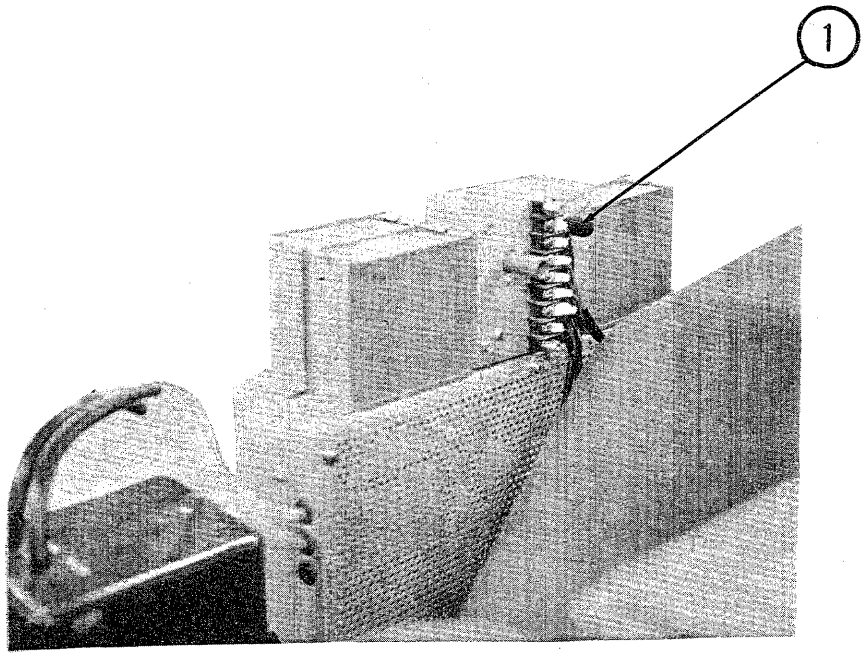


Figure 4-5. Focus and Astigmatism Correction Amplifier

8. Remove the 429A card.
9. Observe the dot test pattern and adjust the FOCUS and ASTIGMATISM operator controls until the dots at the center areas are sharp and round.
10. Observe size and roundness of the dot at the upper left. Turn the FOCUS controls until the upper left corner dot is best.
11. Rotate the ASTIGMATISM controls to obtain the optimum upper left dot. Note the direction of ASTIGMATISM control rotation.

NOTE

Astigmatism and focus adjustments are interacting.

12. Replace the 429A card and refocus the center dot by adjusting the FOCUS and ASTIGMATISM controls. Refocus the upper left dot using the FOCUS controls. Note the direction of FOCUS control movement.

NOTE

If FOCUS controls are turned in the same direction as in step 10, increase the focus correction voltage by turning POT. 2 until the waveshapes amplitude increases slightly. If the FOCUS controls need to be turned in the opposite direction, decrease the amplitude.

Proper adjustment of POT. 2 is indicated when FOCUS controls do not need changing to obtain the sharpest possible spot anywhere between the center and upper left dot as in step 12.

Astigmatism Correction:

NOTE

The voltage output of the 452A card is approximate. Adjust as necessary for best results on the CRT.

1. Adjust the FOCUS and ASTIGMATISM controls to obtain the sharpest dots in the center of the CRT.

NOTE

DO NOT change the FOCUS controls during the next step.

2. Adjust R05 and the front panel ASTIGMATISM controls for the most compatible dots (upper left and center).

DC Balance Adjustment

The following procedures are for checking and adjusting the gain for the symbol D/A amplifiers (456A card).

1. Display test pattern 1 (figure 4-1).
2. Turn the VERTICAL GAIN control toward maximum. The pattern should stay centered (the top should have the same displacement as the bottom). If not, adjust the POTs. R1 and R2 on card type 456A, jack location 1A6C08, to obtain equal displacement.

3. Turn the HORIZONTAL GAIN control toward maximum. The pattern should stay centered (the right side should have the same displacement as the left side). If not, adjust the POTs. R1 and R2 on card type 456A, jack location 1A6C09, to obtain equal displacement.

Symbol Size Adjustment

This adjustment is used for adjusting the size of the large, medium, and small symbols (016 card).

1. Adjust the large symbols to the correct size using the HORIZONTAL and VERTICAL SIZE controls on the operator's panel.
2. Adjust POTs. R1A, R2A, R1C, and R2C on the 016 card (location 1A6B18) for medium symbols so that the medium symbols are half as large as the large symbols.
3. Adjust POTs. R1A, R2A, R1C, and R2C on the 016 card (location 1A6B17) for small symbols so that the small symbols are half as large as the medium symbols.

Symbol Intensity Adjustment

The symbol intensity adjustments place all symbols at the same level of intensity (456B card). Begin the intensity adjustments with the large symbol and adjust for the desired intensity with the operator's INTENSITY controls. Adjust the intensity for each size as listed in table 4-1.

TABLE 4-1. SYMBOL INTENSITY ADJUSTMENTS

SIZE	CRT	LOCATION
1. Over-all	Left (V1)	POT. R2A on 1A6C20
2. Over-all	Right (V2)	POT. R2A on 1A6C23
3. Large	Left (V1)	POT. R2D on 1A6C20
4. Large	Right (V2)	POT. R2D on 1A6C23
5. Medium	Left (V1)	POT. R2B on 1A6C20
6. Medium	Right (V2)	POT. R2B on 1A6C23
7. Small	Left (V1)	POT. R2C on 1A6C20
8. Small	Right (V2)	POT. R2C on 1A6C23

Symbol Shaping

NOTE

Symbol shaping adjustments made for the convenient size symbols selected above will apply to all symbol sizes. Adjustment of basic symbol shapes is considered a factory adjustment.

1. Generate all symbols or a representative group of symbols in a convenient size.
2. Adjust trimmer capacitor —

   C1 (location 1A6C03) and C1 (located on chassis 1A7) for X symbol adjustment.
   C2 (location 1A6C03) and C2 (located on chassis 1A7) for Y symbol adjustment.

NOTE

Final deflection amplifier adjustments may affect symbol shaping. This adjustment may require retouching of shaping trimmers.

Unblank Adjustments

1. Generate test pattern 1 (figure 4-1) or a convenient test pattern.
2. Observe the symbols on the display raster (left CRT) and adjust the POT. on the 205 card, location 1A7M7, for best symbol appearance with respect to the unblank points of the symbols.
3. Adjust the POT. on the 205 card, location 1A7M9, for the best symbol appearance on the right CRT with respect to the unblank points of the symbols.

Intensity Balance Adjustment

WARNING

The intensity balance POT., located on the high-voltage divider, has a potential on the POT. shaft

WARNING (Cont.)

of approximately 6 KV. To adjust this POT., use a screwdriver with a plastic or insulated handle and shaft.

A modulation POT. (R39) located on the high-voltage divider is adjusted for equal intensity on both of the CRTs. POT. R13 on the high-voltage divider is a coarse intensity adjustment which increases or decreases the intensity of both CRTs equally. These POTs. normally do not need adjustment except when a CRT is replaced. The adjustment procedure is listed below.

1. Remove all input display data and signals.
2. Rotate POT. R13 on the high-voltage divider fully counterclockwise (minimum intensity).
3. Rotate both of the operator INTENSITY controls fully clockwise (maximum intensity).
4. Adjust R13 until the spots are just visible on both CRTs.
5. Adjust modulation POT. R39 (using insulated screwdriver) on the high-voltage divider to obtain equal intensity on both CRTs.

The intensity adjustments are correct when both CRTs have equal intensity and the spots are just visible with the operator INTENSITY controls fully clockwise.

PERFORMANCE STANDARDS

The performance standards shown in tables 4-2 through 4-7 present sample waveshapes, signals, and levels for electrical parts and assemblies used in the dd 60A. All photographs were taken during the display of a full raster of symbols. Following is the oscilloscope preparation procedure which is the same for all tables unless otherwise noted:

1. The oscilloscope used is a Tektronix Type 543A with a Type CA dual-trace preamplifier. The probe is a Tektronix times (x) 10.
2. The oscilloscope settings are:

   TIME BASE: TRIGGERING MODE/TRIGGER SLOPE - AC INT +
   HORIZONTAL DISPLAY: NORMAL (X 1)

POWER ON: On Position
VARIABLE TIME/CM: 2 m. sec

3. The preamplifier settings are:

AC/DC: AC
MODE: ALTERNATE
A: VARIABLE VOLTS control to .2
POLARITY: NORMAL (+)

NOTE

There may be some slight difference between waveshapes viewed on different equipments. The photographs in this section are based on inputs from a dd 51A Display Equipment.

TABLE 4-2. D/A CONVERTER NETWORK PERFORMANCE STANDARD

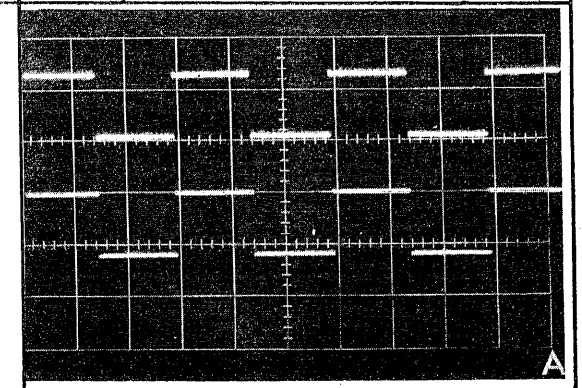
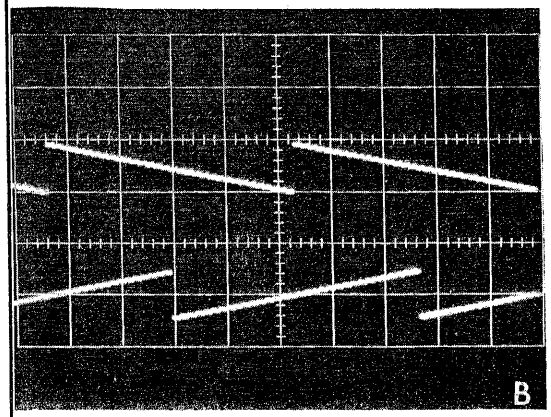
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTING AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
1.	Adjust TIME BASE STABILITY and TRIGGERING LEVEL as necessary TIME/CM 100 micro-sec.	Probe A to A6 Jack A01-pin 7 Probe B to pin 11 (002C card in/out)	Full Raster Display	
2.	TIME/CM to 2 milli-sec.	Probe A to Jack B10 Probe B to Jack B09 (003 card outputs)		

TABLE 4-3. SYMBOLS D/A PERFORMANCE STANDARD

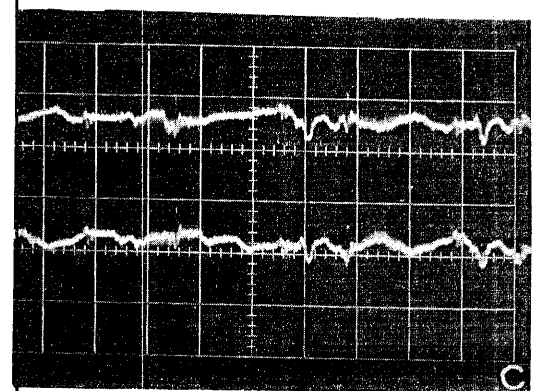
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
1.	TIME/CM to 2 micro-sec. VOLT/CM to .05 (using a X10 probe)	Probe A to Jack B20 pin 5 Probe B to Jack B20 pin 11 (C19 card outputs)		

TABLE 4-4. LINE DRIVER PERFORMANCE STANDARD

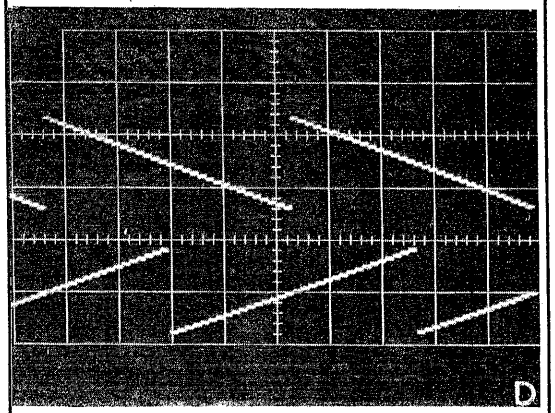
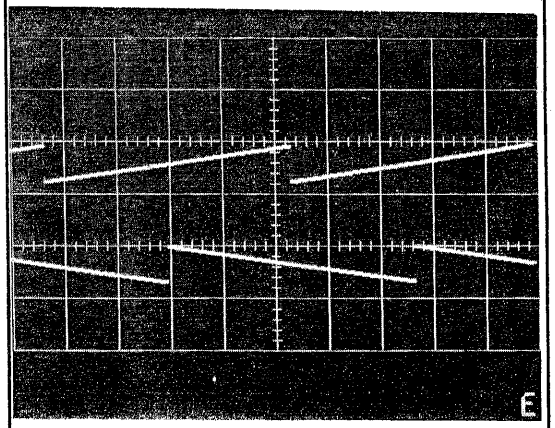
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
1.	TIME/CM to 2 milli-secs. VOLT/CM to .5	Probe A to Jack B05 TP C Probe B to Jack B05 TP D (015 vertical output)		
2.	TIME/CM to 10 micro-sec. VOLT/CM to 2	Probe A to Jack B05 TP B Probe B to Jack B05 TP A (015 hori-zontal out-put)		

TABLE 4-4. LINE DRIVER PERFORMANCE STANDARDS (CONT.)

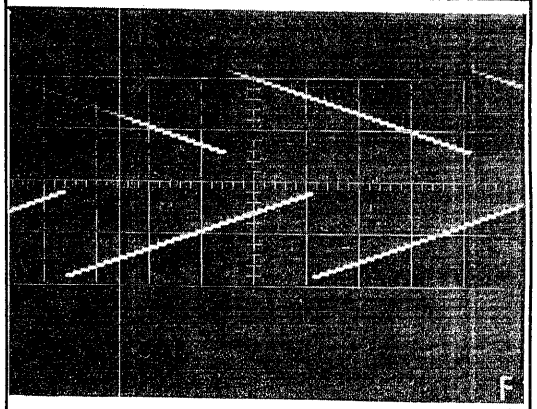
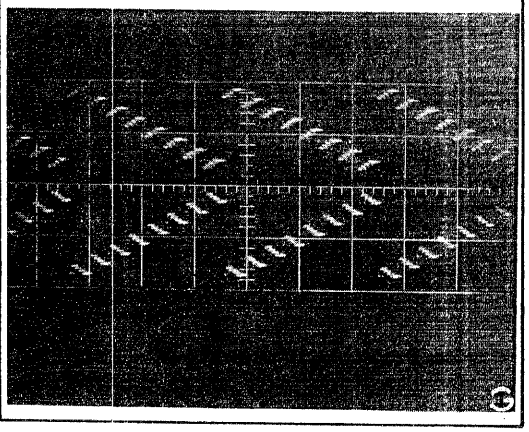
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTING AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
3.	TIME/CM to 2 milli-secs.	Probe A to Jack B11 TP D Probe B to Jack B11 TP C (015A vertical deflection out)		
4.	TIME/CM to 100 microsecs. VOLT/CM to 2	Probe A to Jack B11 TP B Probe B to Jack B11 TP A (015A horizontal deflection out)		

TABLE 4-5. FOCUS AND ASTIGMATISM PERFORMANCE STANDARD

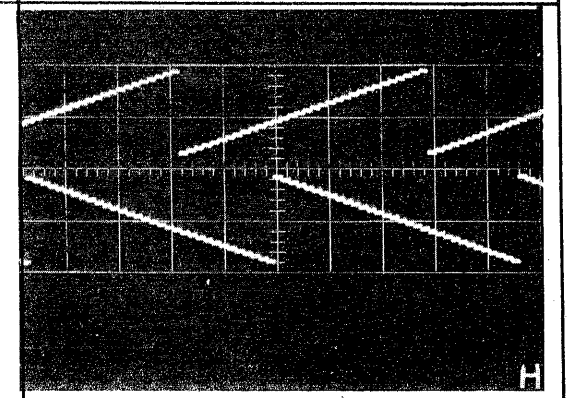
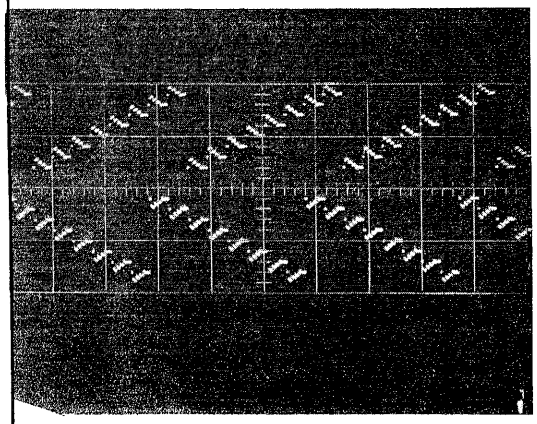
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
1.	TIME/CM to 2 milli-secs. VOLT/CM to 2	Probe A to TP C of C19 Probe B to TP D of C19 (019 output 429A input)		
2.	TIME/CM to 100 microsecs.	Probe A to TP A of C19 Probe B to TP B of C19 (019 output 429A input)		

TABLE 4-5. FOCUS AND ASTIGMATISM PERFORMANCE STANDARDS (CONT.)

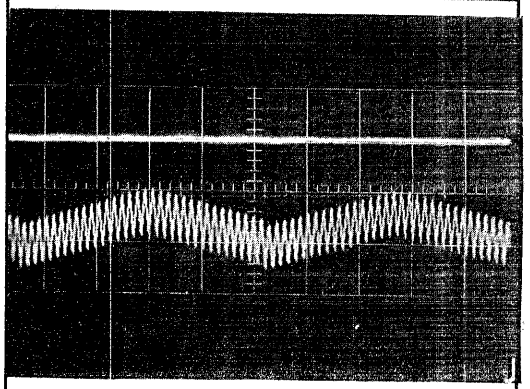
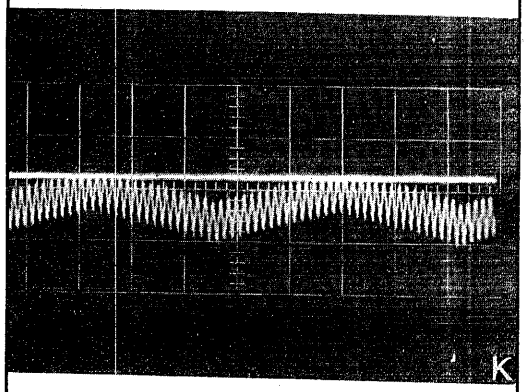
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
3.	TIME/CM to 2 milli-secs. VOLT/CM to 0.5	Probe A to TP A of C13 (429A out)		
4.		Probe A to TP A of B12		

TABLE 4-5. FOCUS AND ASTIGMATISM PERFORMANCE STANDARDS (CONT.)

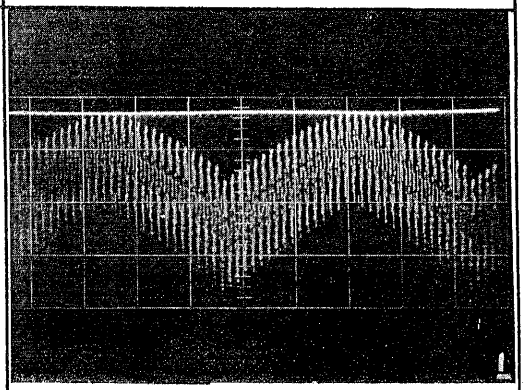
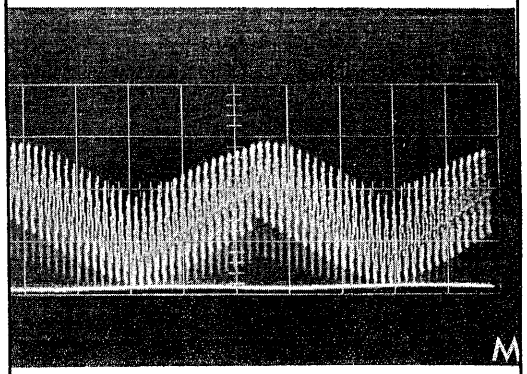
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS OF OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
5.	VOLT/CM to 1	Probe A to TP A of 7M5 (452A output)		
6.		Probe A to TB1-1 of F/A amplifier (astigmatism output)		

TABLE 4-5. FOCUS AND ASTIGMATISM PERFORMANCE STANDARDS (CONT.)

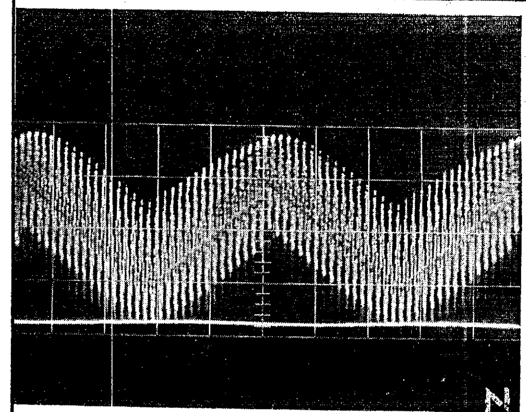
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS OF OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
7.	VOLT/CM to 100	Probe A to TB1-2 of F/A amplifier (focus output)		

TABLE 4-6. DEFLECTION AMPLIFIER PERFORMANCE STANDARDS

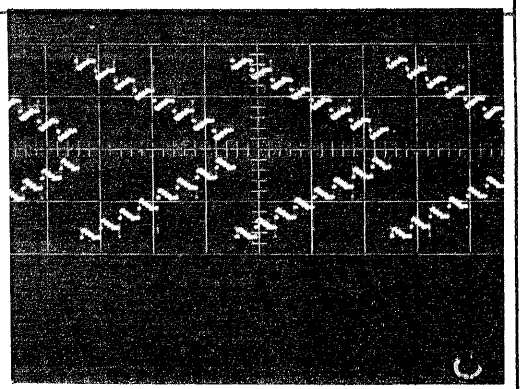
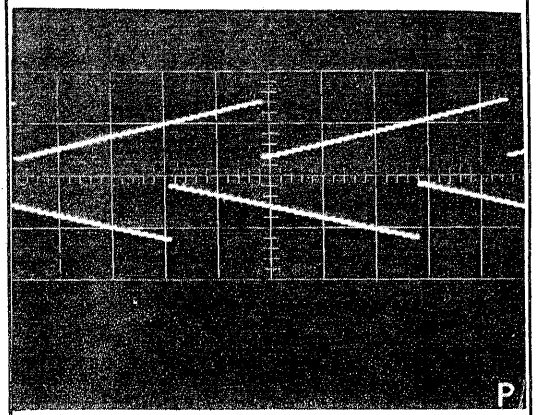
WARNING The following steps require testing with high voltage				
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS OF OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
1.	TIME/CM 100 micro-secs. VOLT/CM to 5 Attach a 2 KV Probe	Connect Probe A to Deflection Amplifier terminal E2		
2.	TIME/CM 2 milli-secs.	Connect Probe A to Deflection Amplifier terminal E3 Connect Probe B to Deflection Amplifier terminal E4		

TABLE 4-7. UNBLANK PERFORMANCE STANDARD

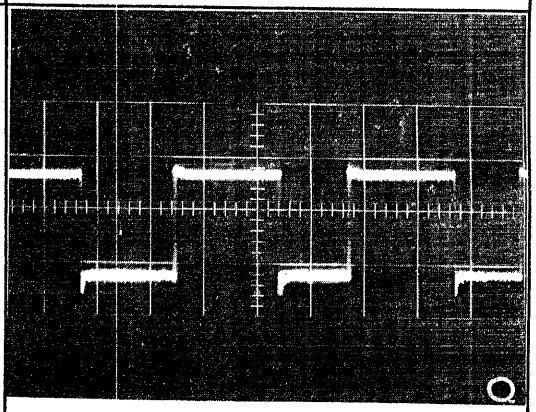
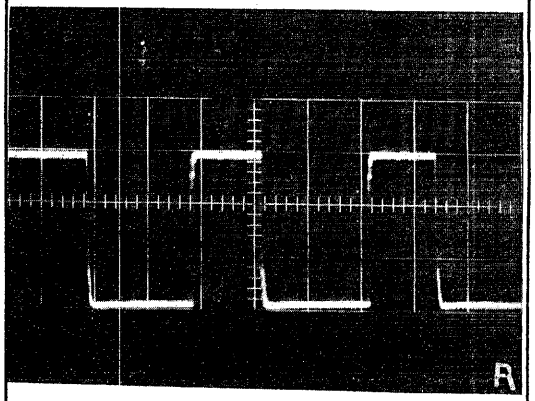
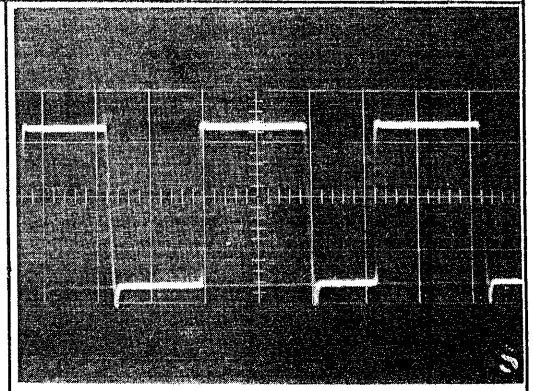
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
1.	TIME/CM to 2 micro-secs. VOLT/CM to 0.5	Connect Probe A to TP A of A7M6 (S45 card)		
2.	VOLT/CM to 1	Connect Probe A to TP A of A7M7 (205 card)		

TABLE 4-7. UNBLANK PERFORMANCE STANDARDS (CONT.)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
3.	VOLT/CM to 5	Connect Probe A to TB1-6 of Assembly 1A3 (High Voltage Divider)		

CORRECTIVE MAINTENANCE

Two methods of corrective maintenance are used on the display equipment. The first is realignment of controls and/or adjustment controls. The second is the detection, isolation, and replacement of a malfunctioning component.

Replacement of a component may necessitate use of adjustment procedures in addition to the component replacement. Section VI, Parts Data, contains a parts breakdown for all major assemblies.

Maintenance Aids

Section VII contains the schematic and logic diagrams for the equipment. Each logic block portrays a circuit on a circuit card. Section V contains the jack assignments which show the card locations and the card diagrams which show the card schematics and physical layouts.

Trouble Analysis

Digital computer trouble-shooting techniques will apply for most troubles. Constant or solid failures may be easily diagnosed, while it may be necessary to use voltage margins, frequency margins, temperature variations, and vibration (applied with caution) in isolating intermittent conditions.

WARNING

The high-voltage system uses lethal voltages. Take extreme caution when checking voltages and components within the high-voltage system.

General:

One condition that is not usually attributable to a logic fault is degradation of the display image in the form of jitter. The most frequent cause of jitter is amplifier unblance in the CRT circuitry; ripple in the regulated 20-volt power supplies is another possible cause, as is the presence of excessive subharmonic frequency components in the 400-cycle power. In addition, any noise source near the D/A converters will cause jitter; an oscilloscope probe on a D/A converter card TP is an example.

A typical failure of a deflection amplifier or preamplifier manifests itself in shrinkage or nonlinearity of the raster and poor symbol formation. The complete failure of an X amplifier or preamplifier will result in a vertical line only, while failure of a Y amplifier or preamplifier causes a horizontal line only. Extraneous lines among the symbols or absence of a display on the CRT generally indicates a failure in the unblank circuitry or its driving logic. Complete lack of display with the INTENSITY controls at maximum usually indicates failure of the CRT high-voltage supply.

CAUTION

Should only a bright spot appear on the CRT, immediately turn down the INTENSITY control. Otherwise, the electron beam will burn through the phosphor.

High-Voltage System:

A systematic analysis of trouble in the high-voltage system will usually result in quick isolation. If no voltage is present, turn power off and check the high-voltage supply fuse.

CAUTION

DO NOT, under any circumstance, overfuse this supply. If the fuse is blown, replace it with an identical fuse and continue with the analysis.

Turn the power on. If the second fuse blows immediately, there may be trouble in the high-voltage supply or a short circuit in the high-voltage system. Disconnect the power supply from the voltage divider, install a new fuse, and turn the power supply on. If the fuse blows, the power supply is defective and needs to be replaced.

WARNING

Discharge the outputs of the high-voltage supply before touching it.

If the fuse does not blow, a secondary fault has occurred and the trouble lies in the voltage divider or filter. It is possible, in high-voltage circuits, for a short circuit to occur which cannot be measured with an ohmmeter. It may be necessary to reconnect the equipment, place it in a dark area, install a new fuse, turn on the power and watch the high-voltage system for arcs. Since a high-voltage short circuit usually will create a visible arc, the eye and ear can easily detect breakdowns that otherwise would be difficult and time-consuming to pinpoint with a vacuum tube voltmeter or an oscilloscope.

The voltages indicated on schematic prints of the equipment are averages, and do not represent the exact voltages of a specific serial number equipment. Recording the voltages on equipment, when the equipment is operating properly, and noting these voltages in the individual equipment logs and on the diagrams will serve as an invaluable maintenance tool. This will furnish an accurate guide if the equipment should ever fail.

Component Replacement and Repair

Reference to the wiring and schematic diagrams is necessary to replace failed components within the display equipment. The drawings, located in Section VII, show the location of subassemblies within the major assemblies. Tabulated parts lists in Section VI, associated with callouts on the drawings, show the part number and designation of the respective parts.

Soldering:

It is necessary to observe different rules when soldering within the high-voltage section than while soldering in other circuits. It is essential that no pips be left on a solder joint, ie, little sharp points drawin up toward the hot iron from a cool joint. Just before the iron is withdrawn, touch it with solder again to give it a coating of flux allowing the completion of a smooth rounded joint.

WARNING

The CRTs must be handled carefully since they are dangerous to the person and expensive to replace. Avoid jarring, scratching, or thermal shock.

The following procedures apply whenever a CRT is to be removed:

WARNING

Turn off the display equipment before touching the CRT or its connections and clamp.

1. Disconnect the CRT base socket and all connecting wires.
2. Remove the screws that fasten the tube shield to the main frame (do not unfasten the CRT neck clamp).
3. Remove the CRT and tube shield, place the CRT and shield face down on a soft surface to prevent scratching the face, and loosen the CRT neck clamp.
4. Slide the tube shield up and over the CRT neck.
5. Place the CRT in the original carton or equivalent packing.

The following procedures apply when a CRT is installed. The shield should be installed as soon as possible after removing the CRT from its packing.

1. Remove the CRT from the packing container and place it face down on a soft pad to prevent scratching the face.
2. Place the tube shield up and over the neck of the CRT. Be sure the accelerator post is aligned with the appropriate slot in the shield.
3. Tighten the CRT neck clamp taking care not to crack the neck.
4. Install the tube shield and CRT in the main frame, refasten the strap at the rear, and replace the four front panel-to-shield screws.
5. Connect the wires and socket to the CRT. The signal and power interconnection diagram shows the wire connections.
6. Turn on the equipment, display test pattern 1, and make necessary focus and astigmatism adjustments until the symbols are satisfactory (refer to the focus and astigmatism adjustment procedures).

If the test pattern is not straight horizontally, it may be necessary to rotate the CRT. To straighten the display, perform the following procedures:

1. Place a piece of masking tape under, and even with, a horizontal row of symbols.

2. Turn off the display equipment.
3. Loosen the CRT neck clamp so the CRT can be rotated.
4. Place two or more pieces of filament tape at the edges of the face of the CRT. Hold the ends of the tape, and rotate the tube until the masking tape placed below the horizontal row of symbols is parallel with the desk top.
5. Tighten the CRT neck clamp and reassemble the equipment.

NOTE

If the previous procedures do not work, it will be necessary to disassemble the CRT assembly, pull the CRT out, and rotate it.

The shield around the CRT is designed to prevent stray magnetic and electric fields from causing jitter. A display which jitters in some locations but not in others may be reacting to field-caused jitter.

Section V

MAINTENANCE AIDS

This section contains the aids necessary for adequate maintenance of the display equipment. The aids are; (1) jack assignments which show the location of each logic card, (2) wire tabulations which show the wiring connections between the cable connectors and the logic card jacks, and (3) circuit card figures which show the physical configuration of each circuit card used, its part number, and schematic diagram. Table 5-1 lists the fuses used in the equipment and their specifications.

TABLE 5-1. FUSE SPECIFICATIONS

Fuse	Rating (Amperes)	Type	Location
F1	6-1/4	Slo Blow	1A6
F2	6-1/4	Slo Blow	1A6
F3	6-1/4	Slo Blow	1A6
F4	4	Slo Blow	1A6
F1	0.75	Regular	1A5
F2	1.5	Regular	1A5

JACK ASSIGNMENT LIST

The jack assignments (tables 5-2 and 5-3) are a sequential tabulation of jack numbers. Their primary function is to indicate the type of card at each location (if any) and, when possible, give the logic symbol of each logical element on the card and its association with a test point (TP).

TABLE 5-2. dd 60A JACK ASSIGNMENTS, ASSEMBLY 1A6 ANALOG CHASSIS

JACK NUMBER	ROW A				ROW B				ROW C			
	CARD TYPE	TEST POINT A	TEST POINT B	TEST POINT C	CARD TYPE	TEST POINT A	TEST POINT B	TEST POINT C	CARD TYPE	TEST POINT A	TEST POINT B	TEST POINT C
01	002C		Y117		401		Y119					
02	002C		Y116		443		Y118					
03	002C		Y115						C1-C2			
04	619	Y015	Y016	Y017								
05	002C		Y114		015		Y404					
06	002C		Y113		031A		Y400		1021	J018		J019
07	002C		Y112		027		Y203					
08	619	Y012	Y013	Y014	027		Y202		456A		Y512	
09	002C		Y111		003		Y303		456A		Y510	
10	002C		Y110		003		Y302		457A		Y511	
11	002C		Y109		015A		Y401		457A		Y513	
12	619	Y009	Y010	Y011	015A		Y405		019		Y402	
13	002C		Y108		003		Y301		429A		Y403	
14	002C		Y017		003		Y300		1222RS	J002		J003
15	002C		Y106		027		Y201		1222RS	J000		J001
16	619	Y006	Y007	Y008	027		Y200		1222RS	J006		J007
17	002C		Y105		016	Y507		Y506	1222RS	J004		J005
18	002C		Y104		016	Y505		Y504	1222RS	J009		J008
19	002C		Y103		C19		Y509		1222RS	J010		J011
20	619	Y003	Y004	Y005	C19		Y508		456B		Y515	
21	002C		Y102		619	Y022	Y023		1222RS	J013		J012
22	002C		Y101		619	Y020	Y021	Y024	1222RS	J014		J015
23	002C		Y100		620		Y018		456B		Y514	
24	619	Y000	Y001	Y002	620		Y019		019	Y517		Y516

TABLE 5-3. dd 60A JACK ASSIGNMENTS, ASSEMBLY 1A7 ANALOG PREAMPLIFIER

JACK NUMBER	ROW A				ROW				ROW			
	CARD TYPE	TEST POINT A	TEST POINT B	TEST POINT C	CARD TYPE	TEST POINT A	TEST POINT B	TEST POINT C	CARD TYPE	TEST POINT A	TEST POINT B	TEST POINT C
01	029											
02	039											
03	029											
04	040											
05	452											
06	S45											
07	205											
08	S45											
09	205											
10	040											

WIRE TABULATIONS

The wire tabulations (tables 5-4 and 5-5) show the individual wiring connections between the card jack pins and the connector plug pins by numerical and alphabetical designations.

TABLE 5-4. ANALOG CHASSIS POWER WIRING

ORIGIN Assembly 1A6				DESTINATION				
CARD JACK		CONNECTOR		ASSEMBLY NUMBER	CARD JACK		CONNECTOR	
Location	Pin Number	Number	Jack		Location	Pin Number	Number	Jack
(Ground)		J04	A	1A6	All Jacks	14		
					C8	4		
					C8	8		
					C9	4		
					C9	8		
					C13	9		
					C18	2		
					C18	8		
					C19	2		
					C19	8		
					C21	2		
					C21	8		
					C22	2		
					C22	8		
All Jacks	14			1A6	(Ground)		J04	A
(-20V)		J04	B	1A6	All Jacks	13		
All Jacks	14			1A6	(-20V)		J04	B
(+20V)		J04	C	1A6	All Jacks	15		

J01 and J02 described here are special connectors, eg, they are plugs with the center or insulating portion removed. A multiple coaxial cable containing 18 individual coaxial passes through these plugs. Since these lines pass through the plugs, the plug pin numbers are not on the wire tabulation chart but the lines are color coded and identified by these codes. The destination columns give the lines internal chassis connection, ie, assembly number, card jack number, chassis location, and card jack pin number.

TABLE 5-5. ANALOG CHASSIS COAXIAL LINE WIRING

ORIGIN		DESTINATION			ORIGIN		DESTINATION		
Assembly 1A6		Card Jack			Assembly 1A6		Card Jack		
Connector Number	Line Color Code	Assembly Number	Location	Pin Number	Connector Number	Line Color Code	Assembly Number	Location	Pin Number
J01	90	1A6	A16	9	J02	98	1A6	B21	1
	91			6		99			6
	92			1		900		B22	6
	93		A20	9		901			1
	94			6		903		B24	1
	95			1		904			9
	96		A24	9		905		B23	1
	97			6		906			9
	98			1					
	99		A04	9		Shield		B23	5
	900			6				B23	7
	901			1				B24	5
	902		A08	9				B24	7
	903			6					
	904			1					
	905		A12	9					
	906			6					
	907			1					
	908		B22	9					

CIRCUIT CARDS

A schematic diagram and assembly layout appears on each card type figure. The assembly layout shows where each component is physically located on the circuit card. Each figure gives the part number of the circuit card assembly. Use this number and the card type when referring to parts data or when ordering a replacement card.

Figure 5-1 shows a typical circuit card schematic and associated card layout. Item 1 points out resistor R1, both on the schematic and the card drawing. Item 2 points out diode CR1, in a similar manner.

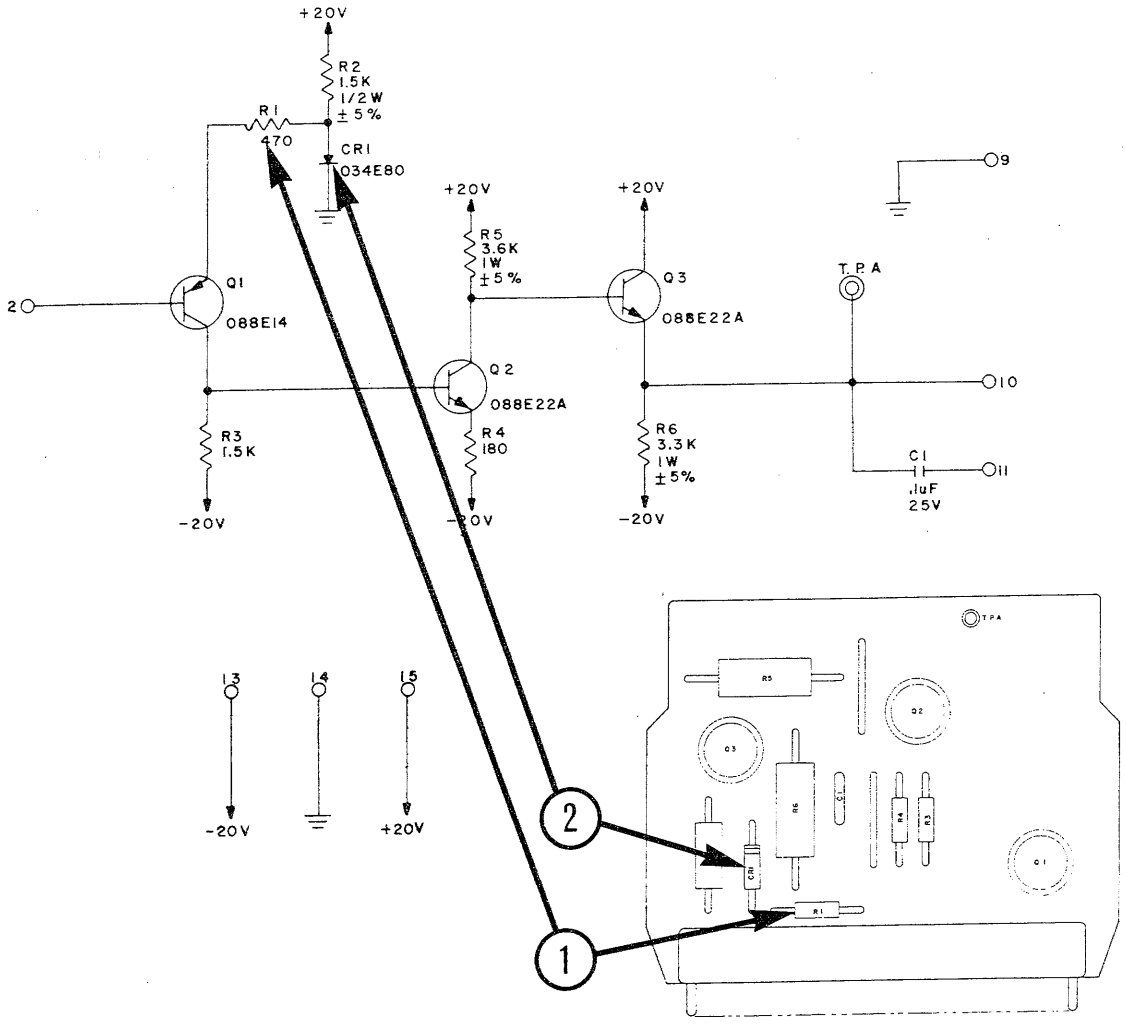
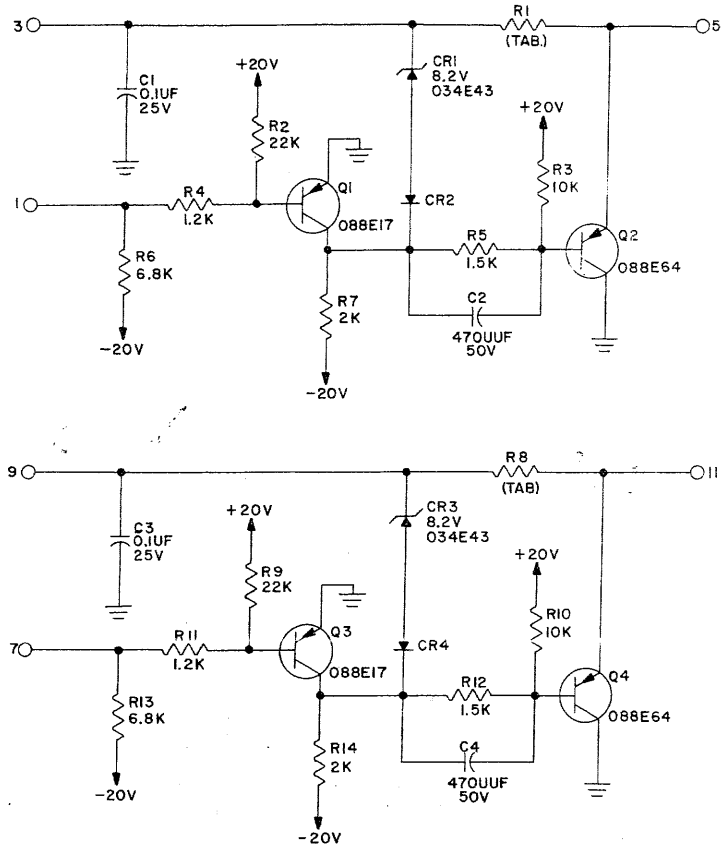
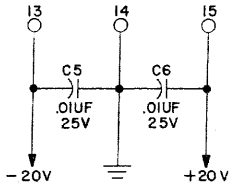


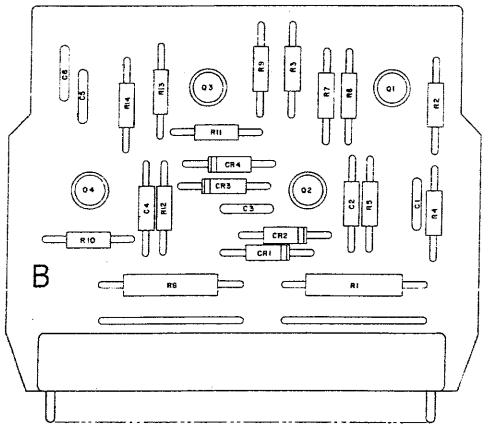
Figure 5-1. Circuit Card Identification



TABULATION OF RESISTOR R1,R8

IDENT. NO.	BIT NO.	R1, R8	TOL.	TEMP. COEF.
002C-9	10	2.5 K	.05%	25
	9	2.5K	.05%	25
002C-7	8	2.5K	.1%	25
	7	2.5K	.1%	25
002C-5	6	2.5K	.5 %	50
	5	2.5K	.5%	50
002C-3	4	2.5K	1%	150
	3	2.5 K	1%	150
002C-1	2	2.7K	5%	
	1	2.7K	5%	
	0	2.7K	5%	





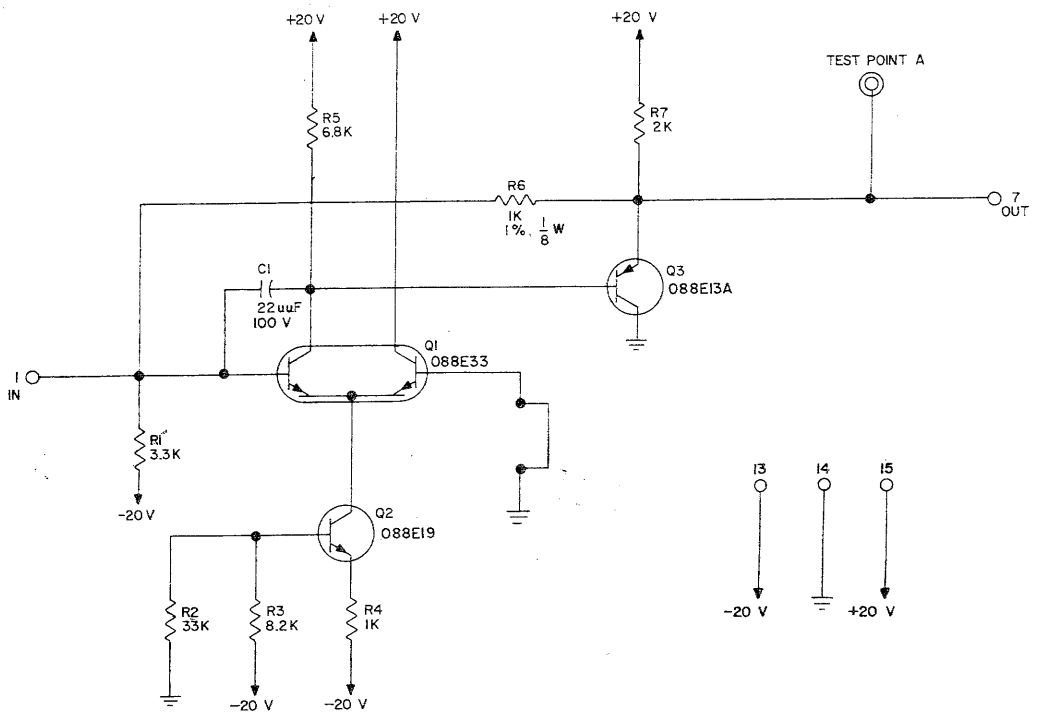
D/A Converter (Positioning +5V)

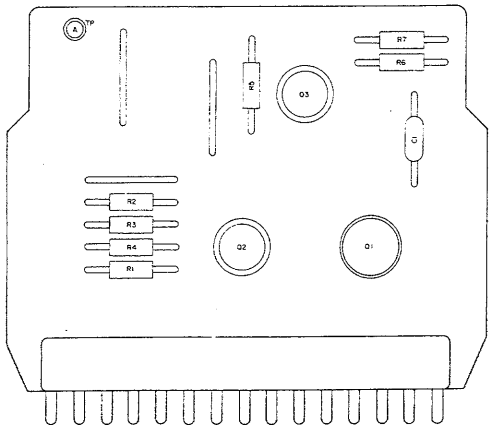
REV. A/B

PART NO. 107199

CARD TYPE **002C (W)**

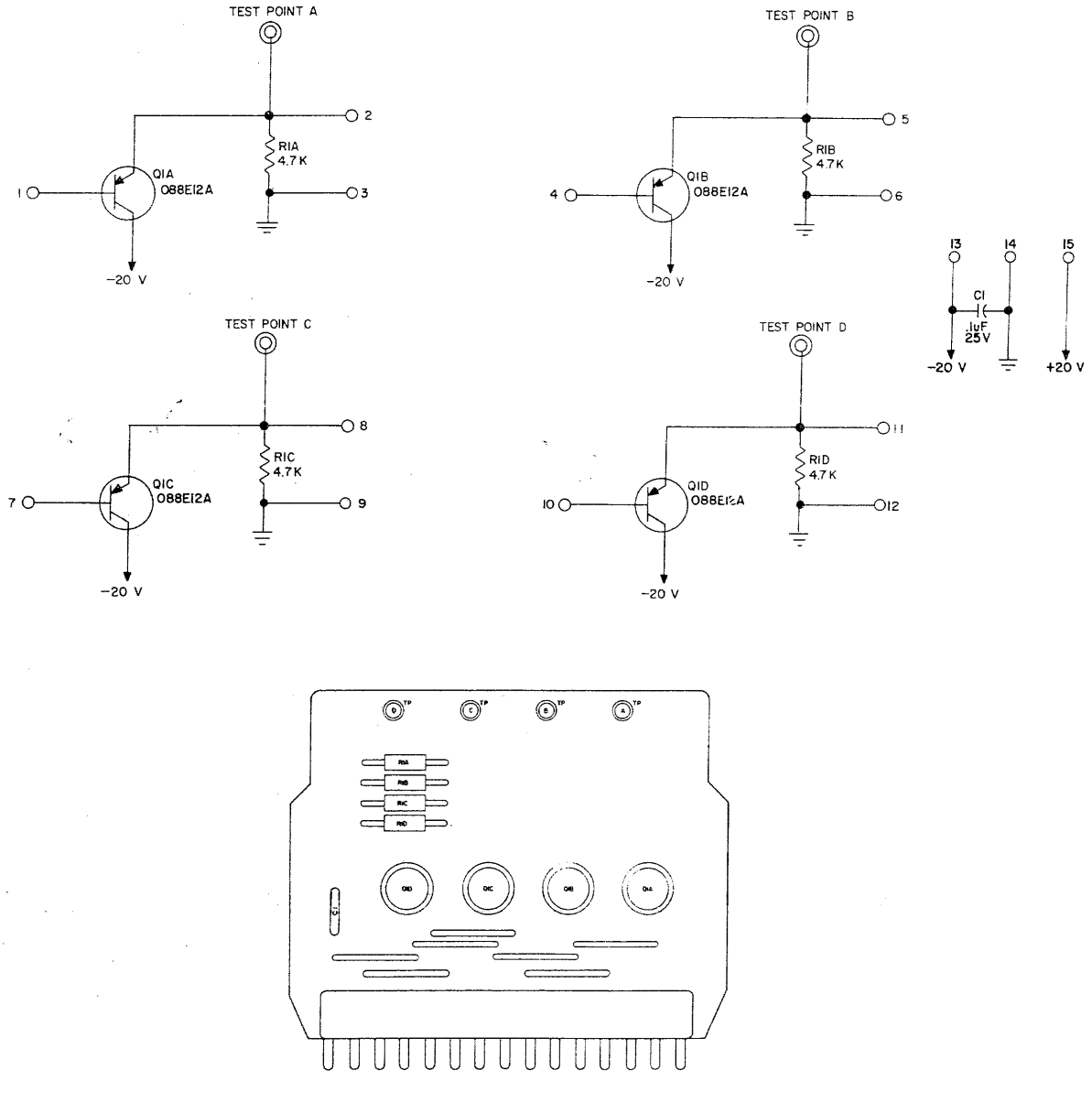
Figure 5-2





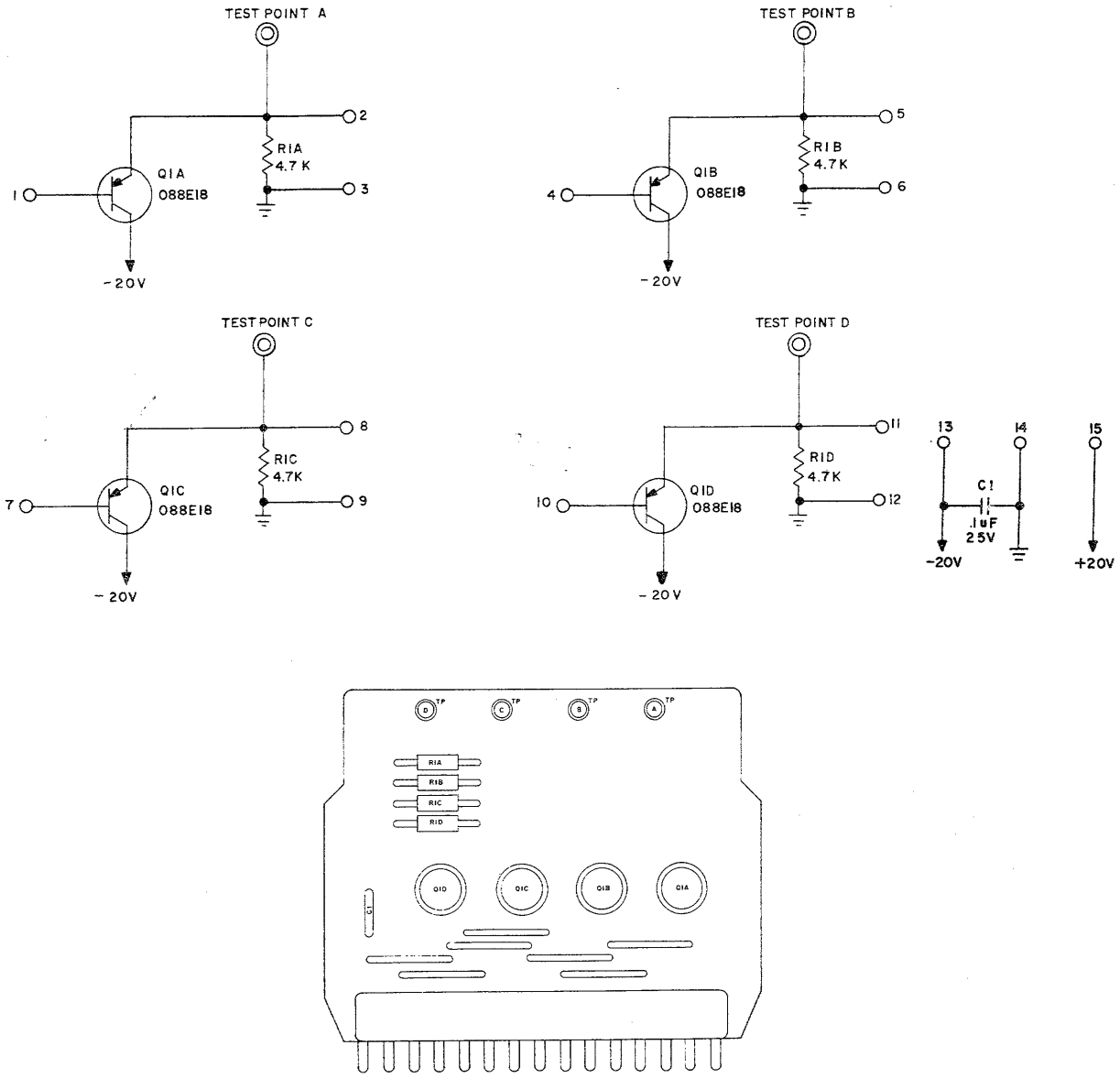
D/A Current Summing Amplifier
REV.
PART NO. 106351
CARD TYPE **003 (W)**

Figure 5-3



Line Driver, Emitter Follower, 100 MW
REV. -/A
PART NO. 106334
CARD TYPE **015 (W)**

Figure 5-4



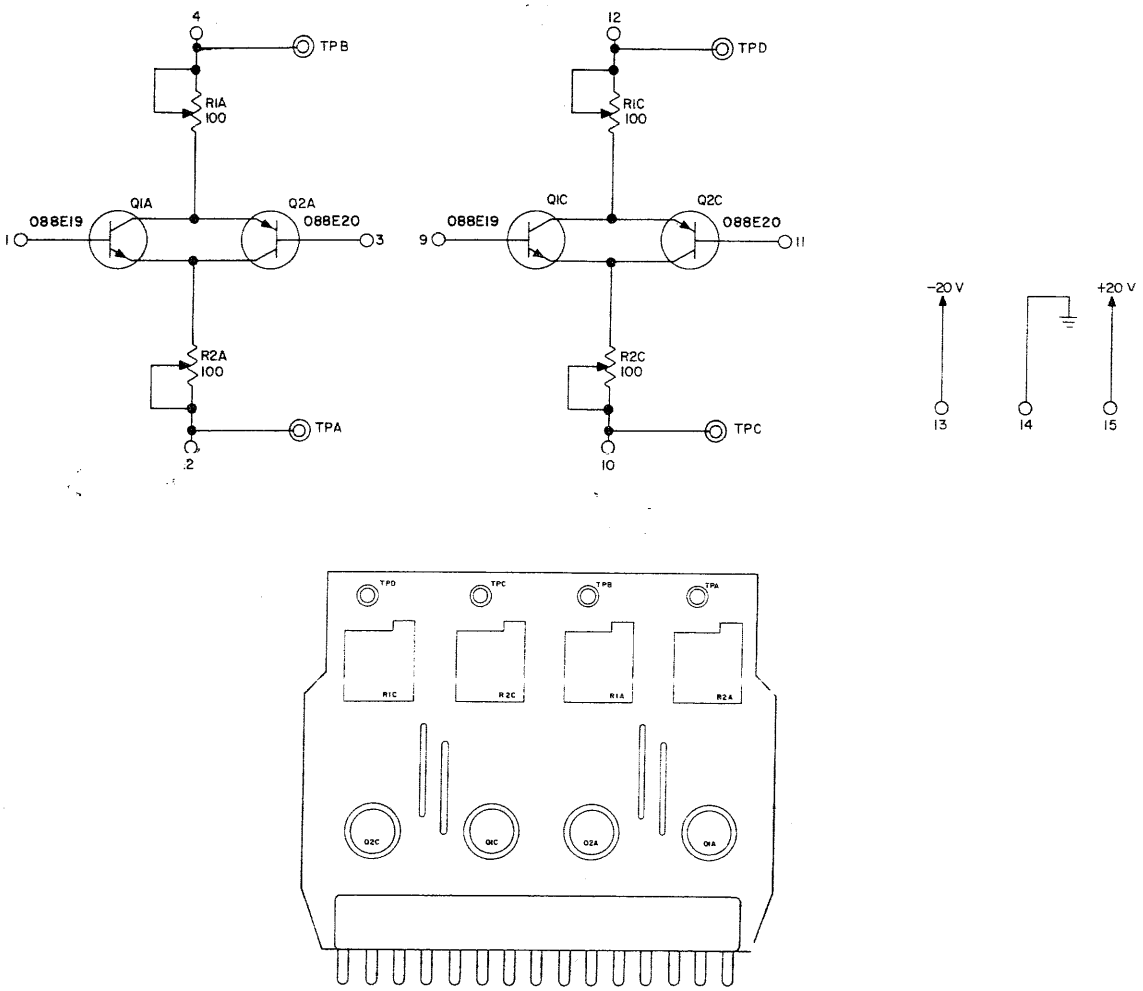
Line Driver, Emitter Follower, 400 MW

REV. -/A

PART NO. 106337

CARD TYPE **015A (W)**

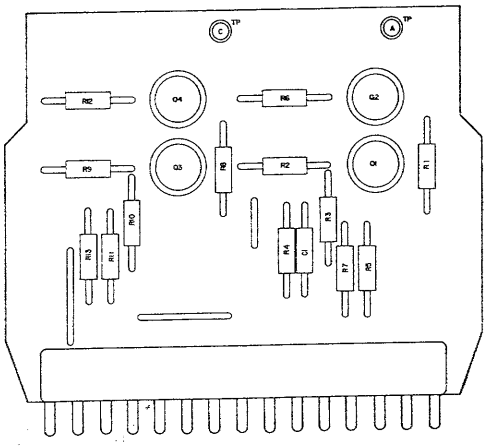
Figure 5-5

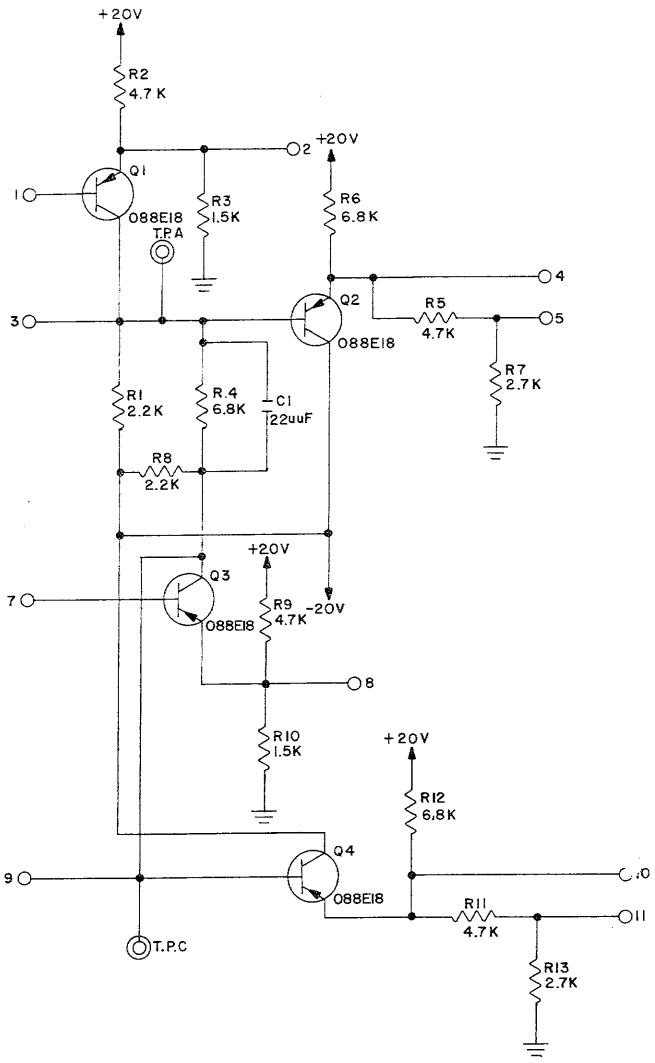


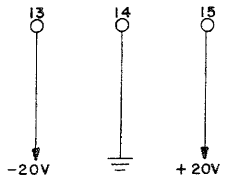
Character Size Control (Attenuator)

REV.
PART NO. 106785
CARD TYPE **016 (W)**

Figure 5-6







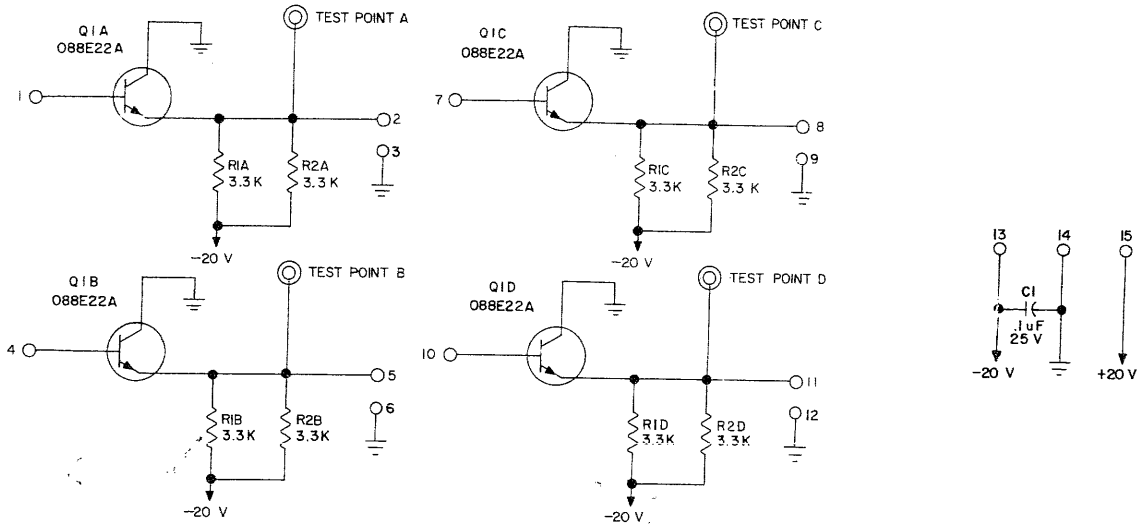
Current Summing Amp. (Symbol Smoothing)

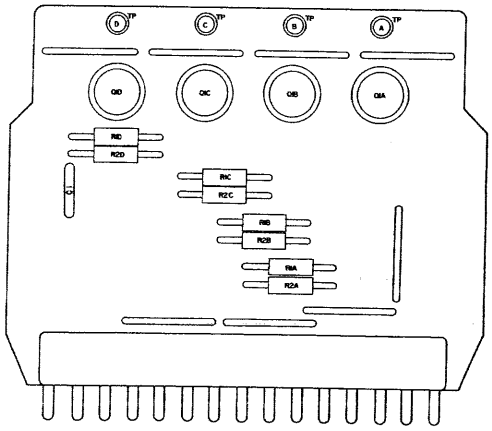
REV.

PART NO. 106780

CARD TYPE **C19 (W)**

Figure 5-7





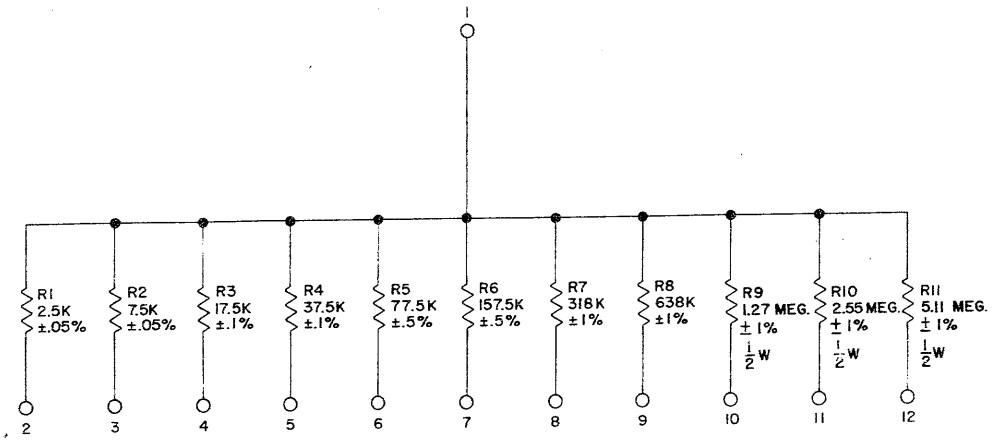
Line Driver, Emitter Follower

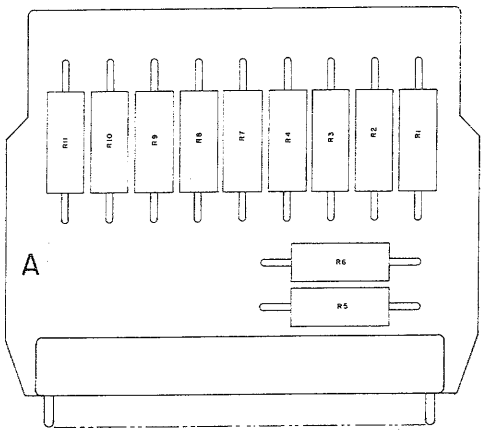
REV. A/A

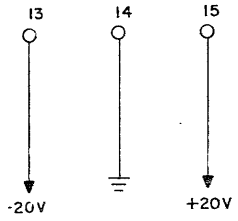
PART NO. 106343

CARD TYPE **019 (W)**

Figure 5-8







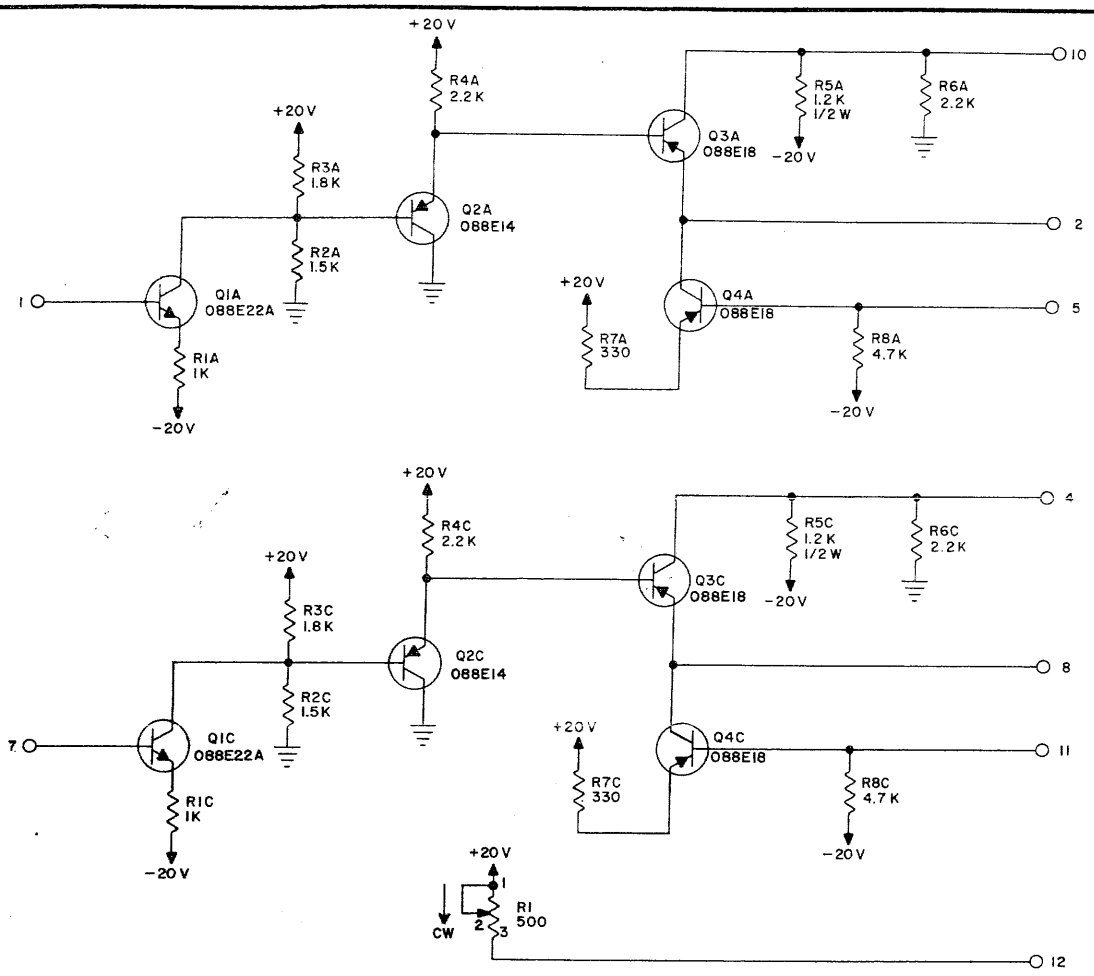
D/A Resistor Network

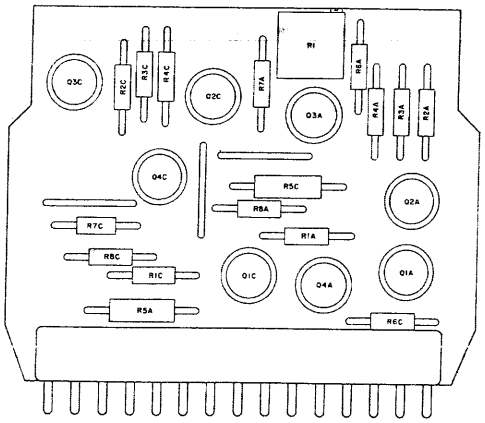
REV. B/B

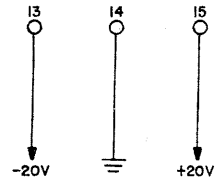
PART NO. 106354

CARD TYPE **027** (W)

Figure 5-9



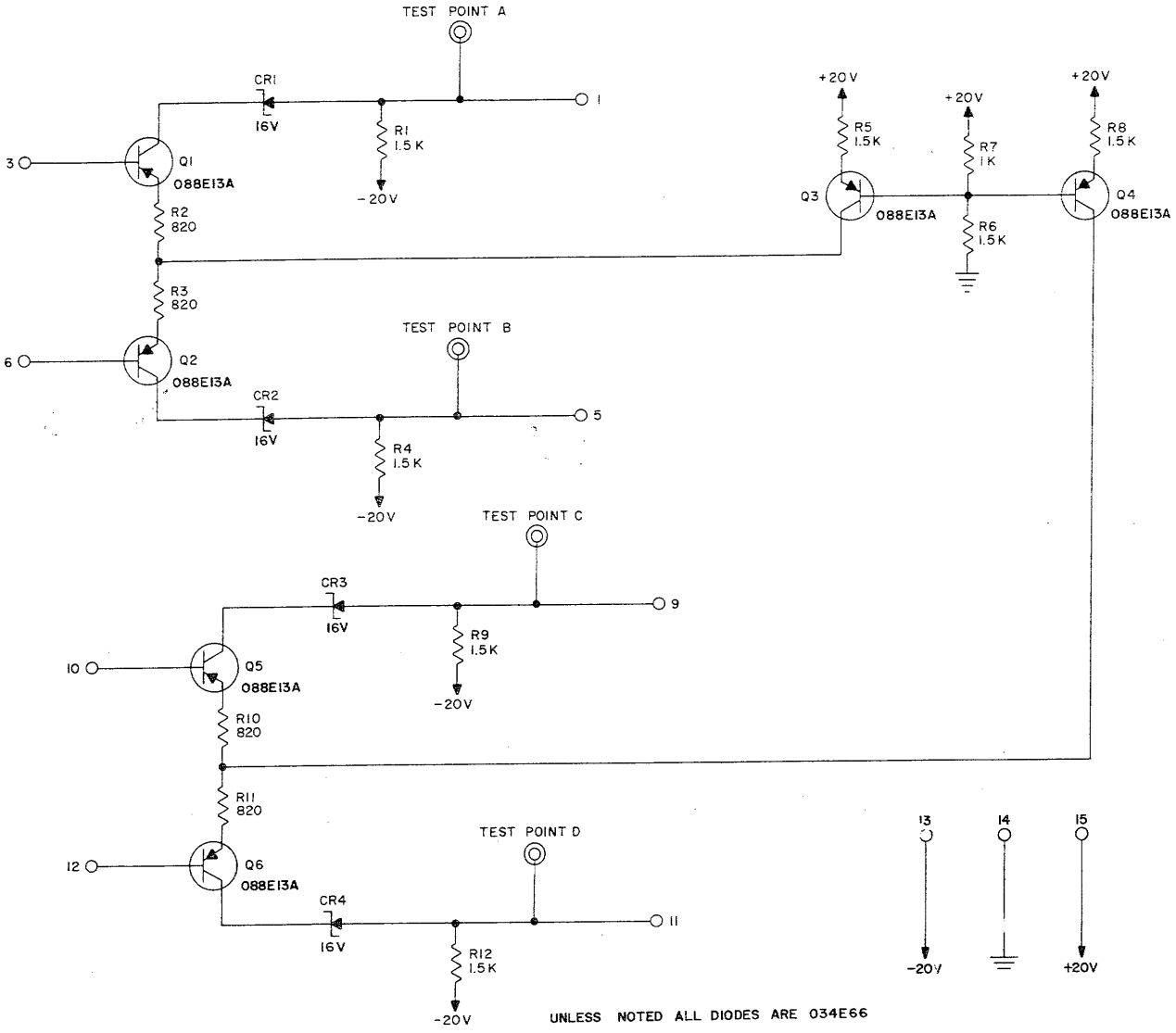


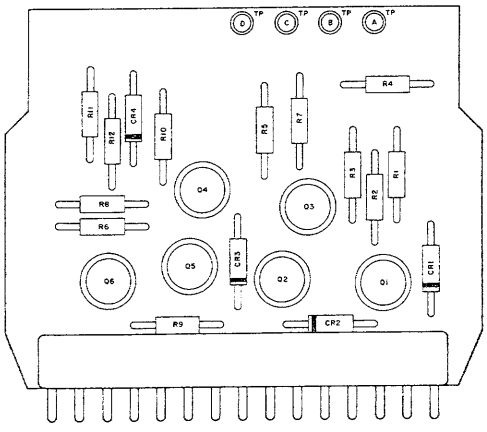


Deflection Pre-amplifier

REV.
PART NO. 107084
CARD TYPE **029 (W)**

Figure 5-10





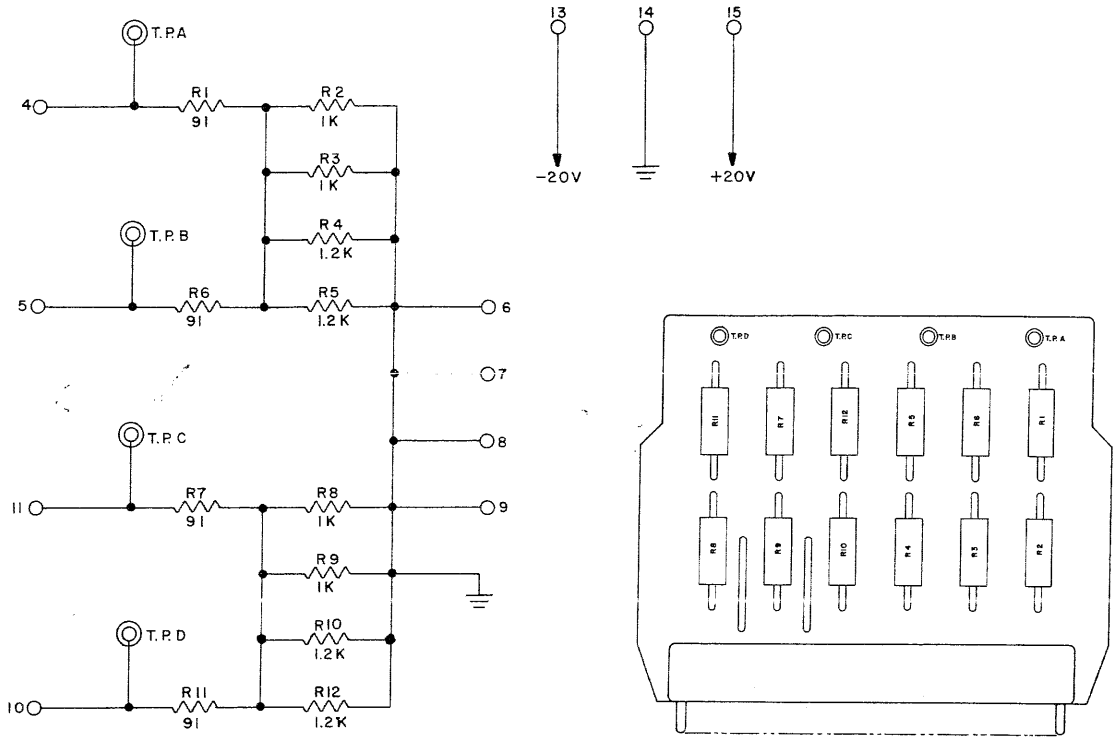
Level Shift Differential Amp

REV.

PART NO. 106798

CARD TYPE **031A (W)**

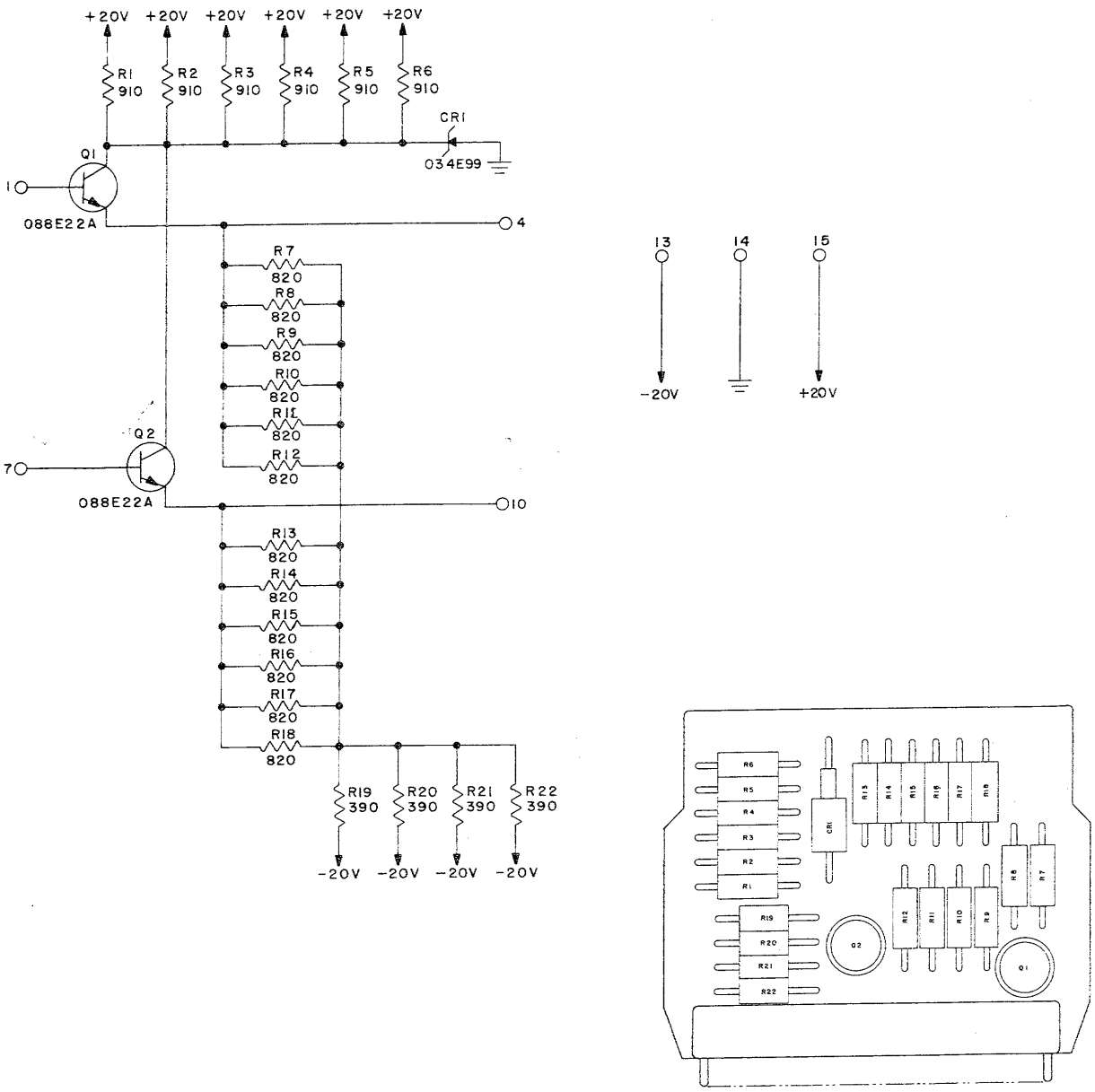
Figure 5-11



Resistor Network (Deflection)

REV.
PART NO. 107107
CARD TYPE **039** (W)

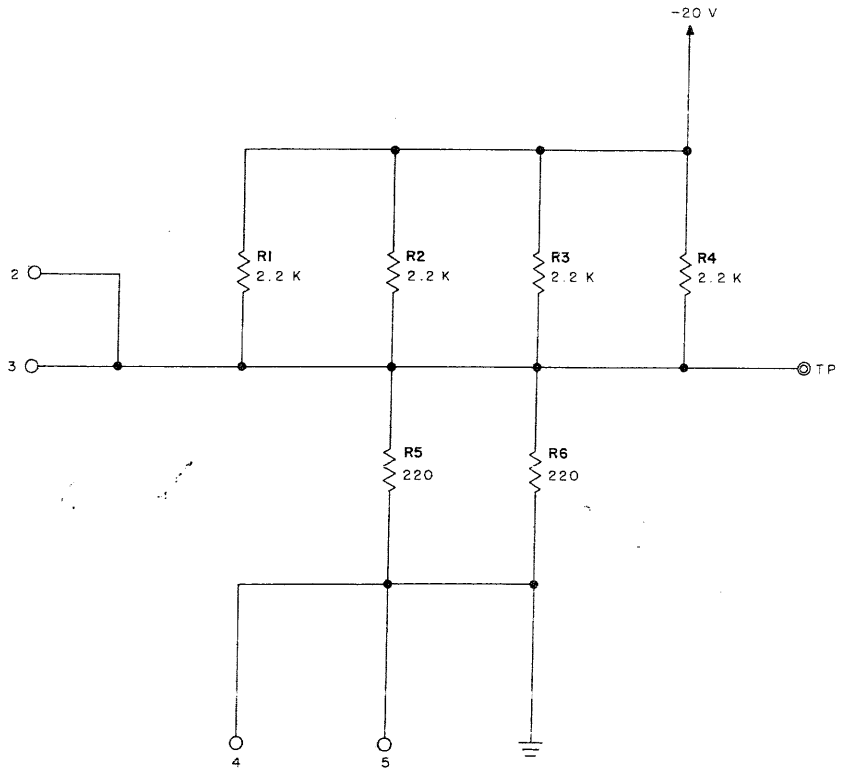
Figure 5-12

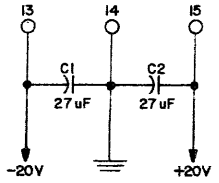


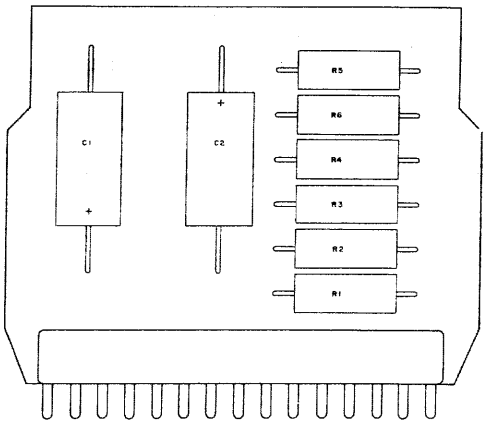
Deflection Buffer Amplifier

REV.
PART NO. 107299
CARD TYPE **040 (W)**

Figure 5-13



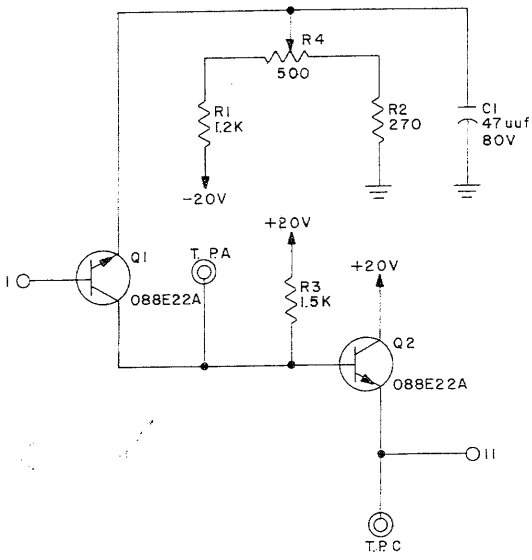


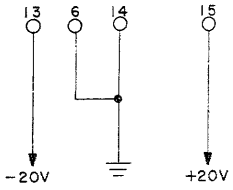


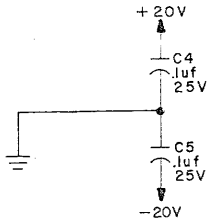
Line Terminator

REV.
PART NO. 106599
CARD TYPE **S45 (W)**

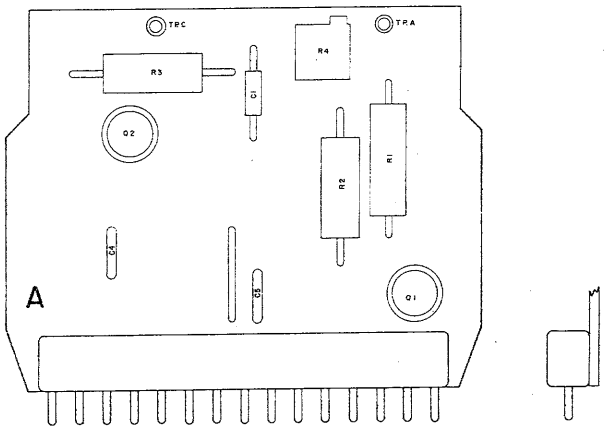
Figure 5-14





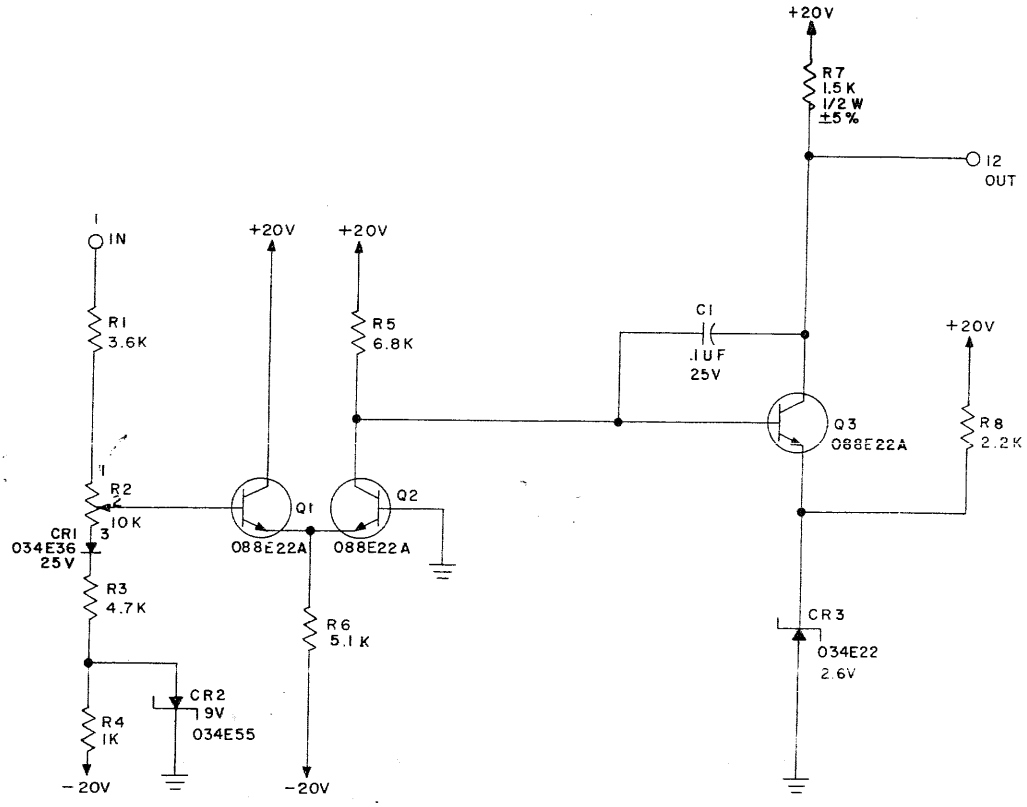


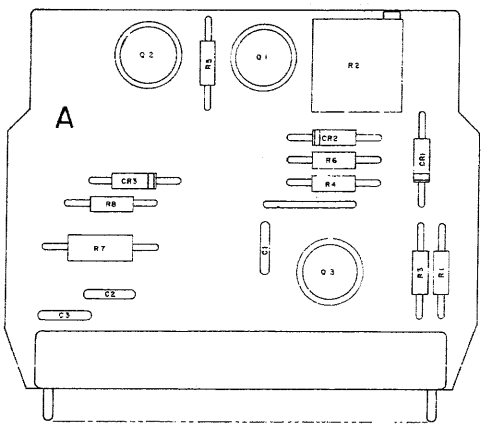
205
106809

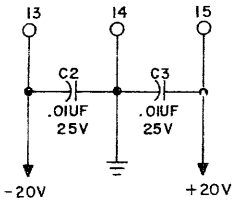


Unblank Preamplifier
REV. A/A
PART NO. 106811
CARD TYPE **205 (W)**

Figure 5-15

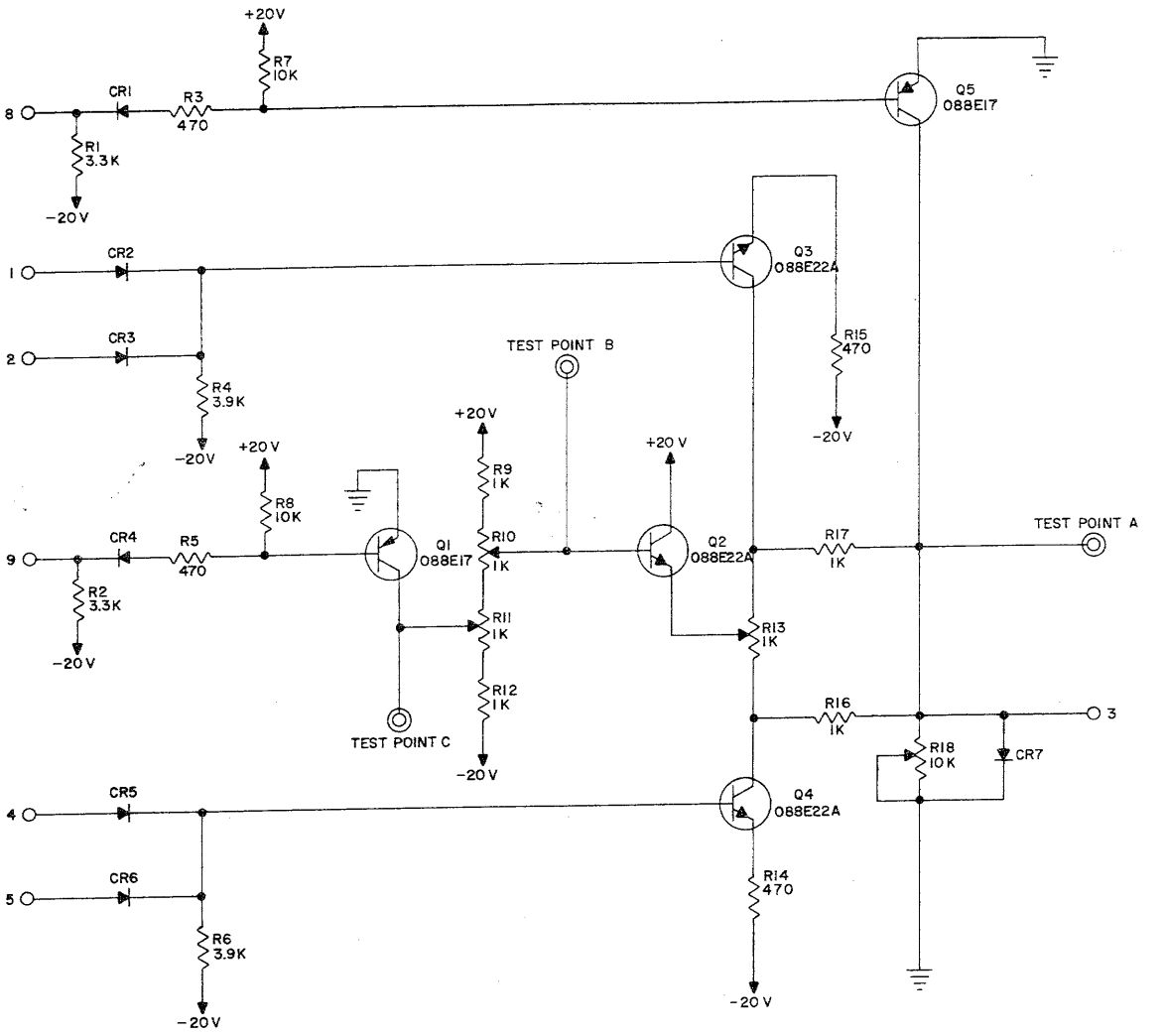


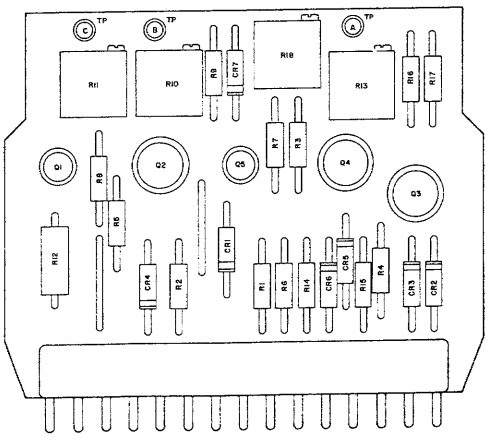




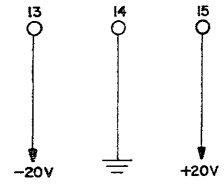
DC Regulator Amplifier
REV. A/A
PART NO. 106357
CARD TYPE **401 (W)**

Figure 5-16





UNLESS NOTED ALL DIODES ARE 034E80



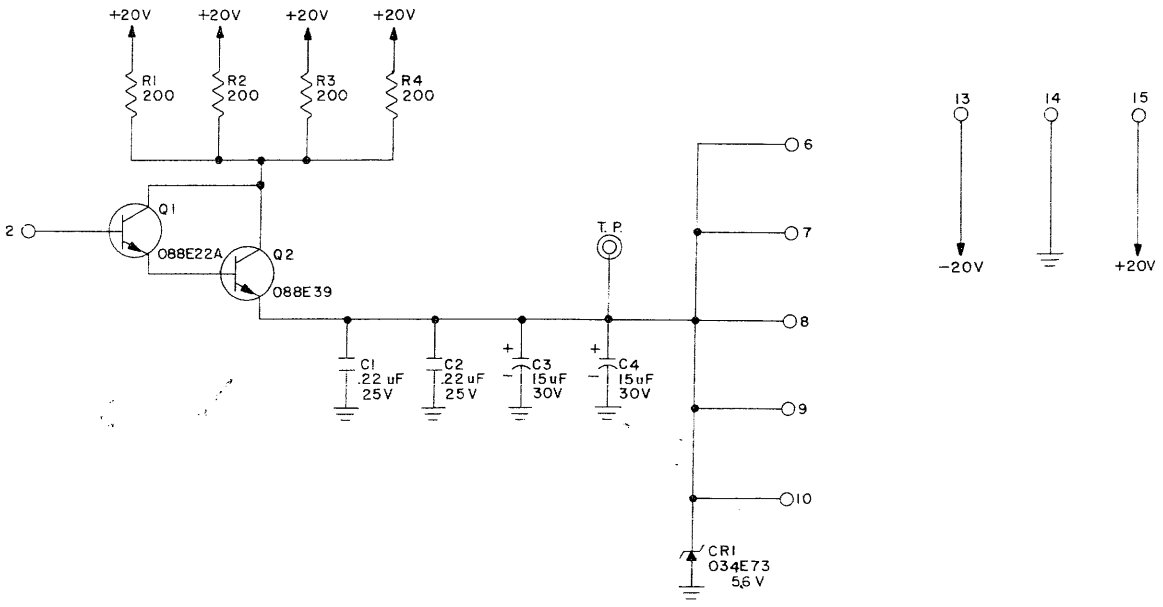
Focus & Astig., Vert/Horiz Mixer

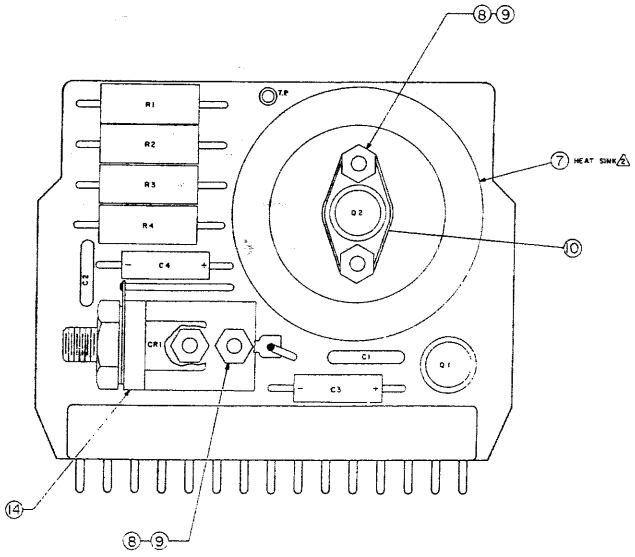
REV.

PART NO. 106795

CARD TYPE **429A (W)**

Figure 5-17

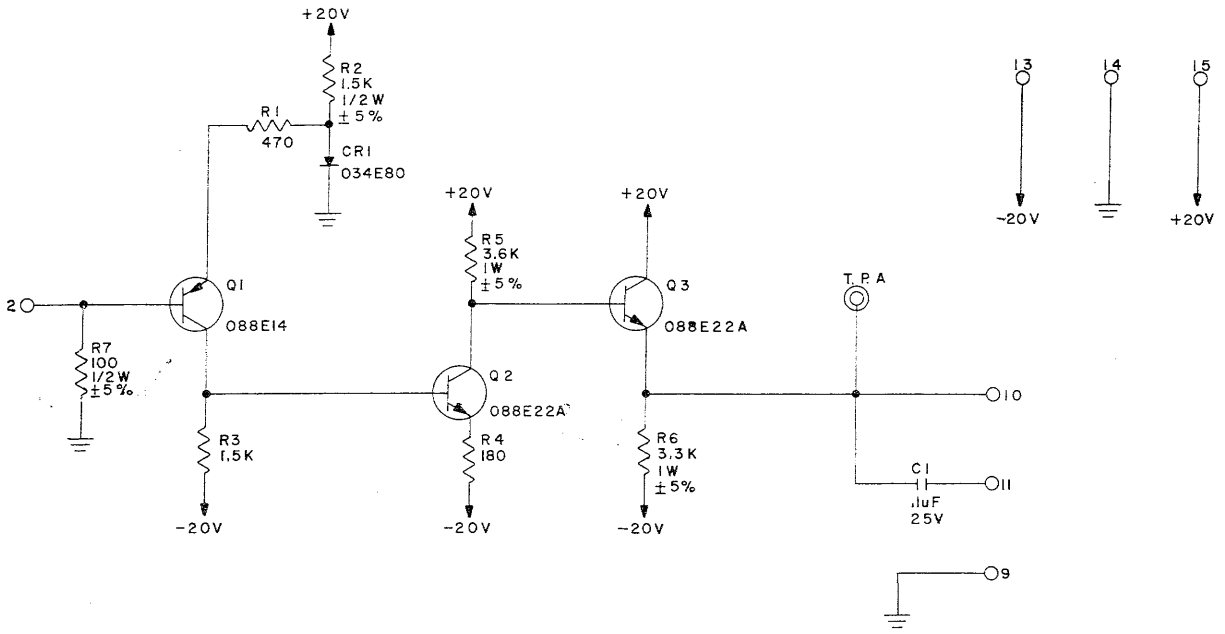


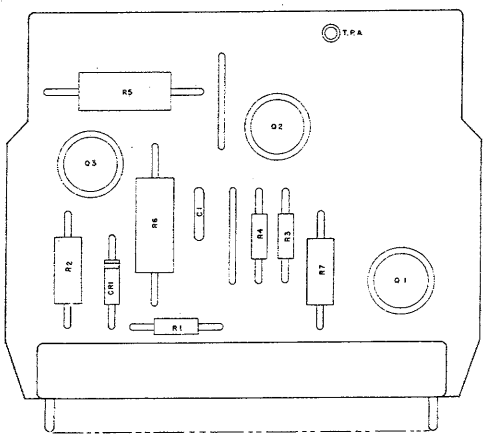


5 volt Series Regulator

REV.
PART NO. 106360
CARD TYPE **443 (W)**

Figure 5-18

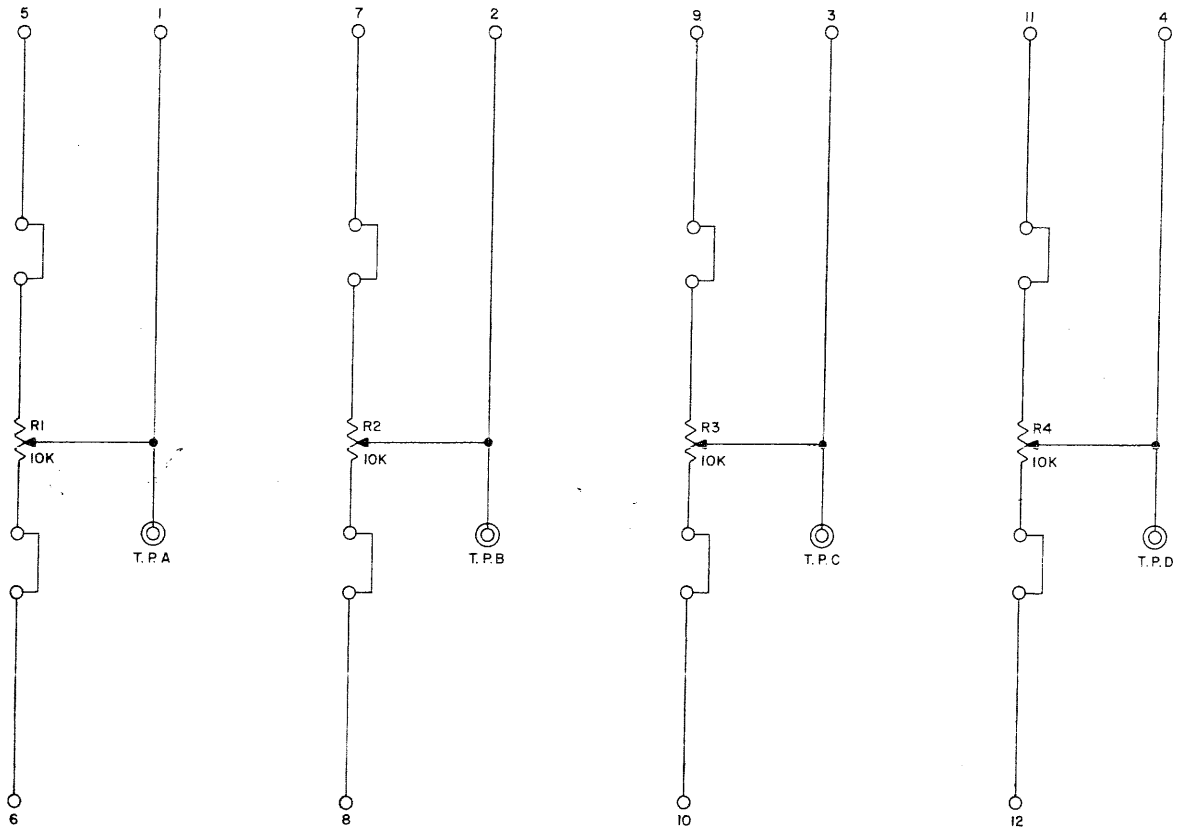


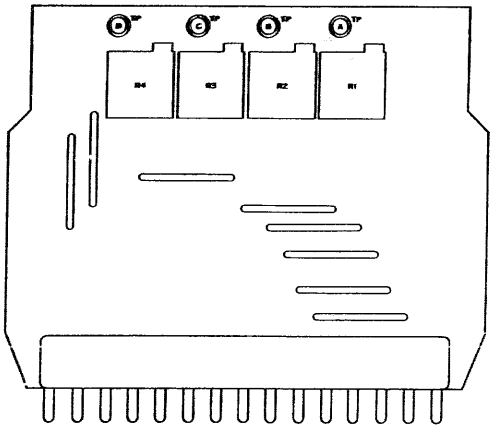


Focus and Astigmatism Amplifier

REV.
PART NO. 106865
CARD TYPE **452A (W)**

Figure 5-19

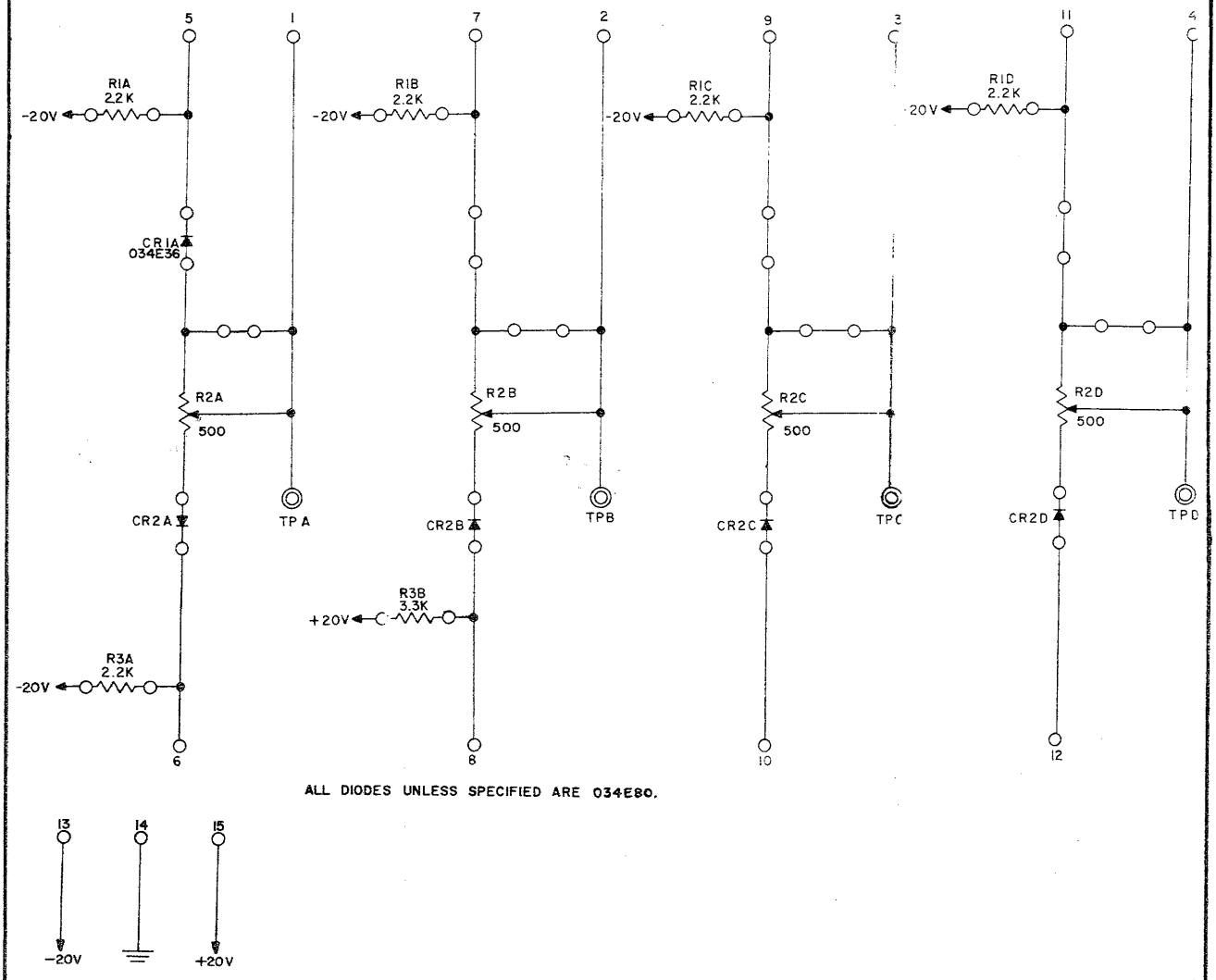


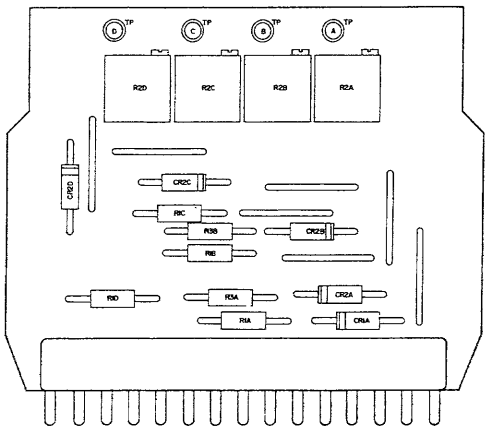


Potentiometer Circuit

REV.
PART NO. 106579
CARD TYPE **456A (W)**

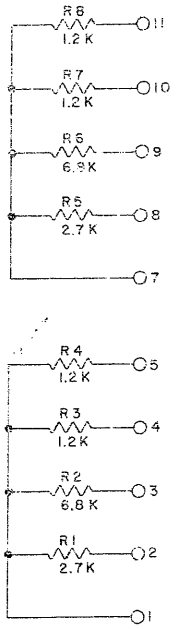
Figure 5-20

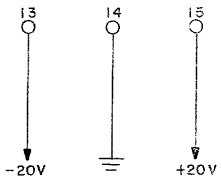


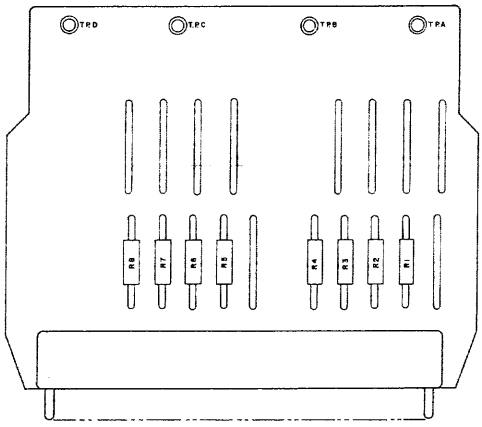


Potentiometer Circuit
REV.
PART NO. 106582
CARD TYPE **456B (W)**

Figure 5-21



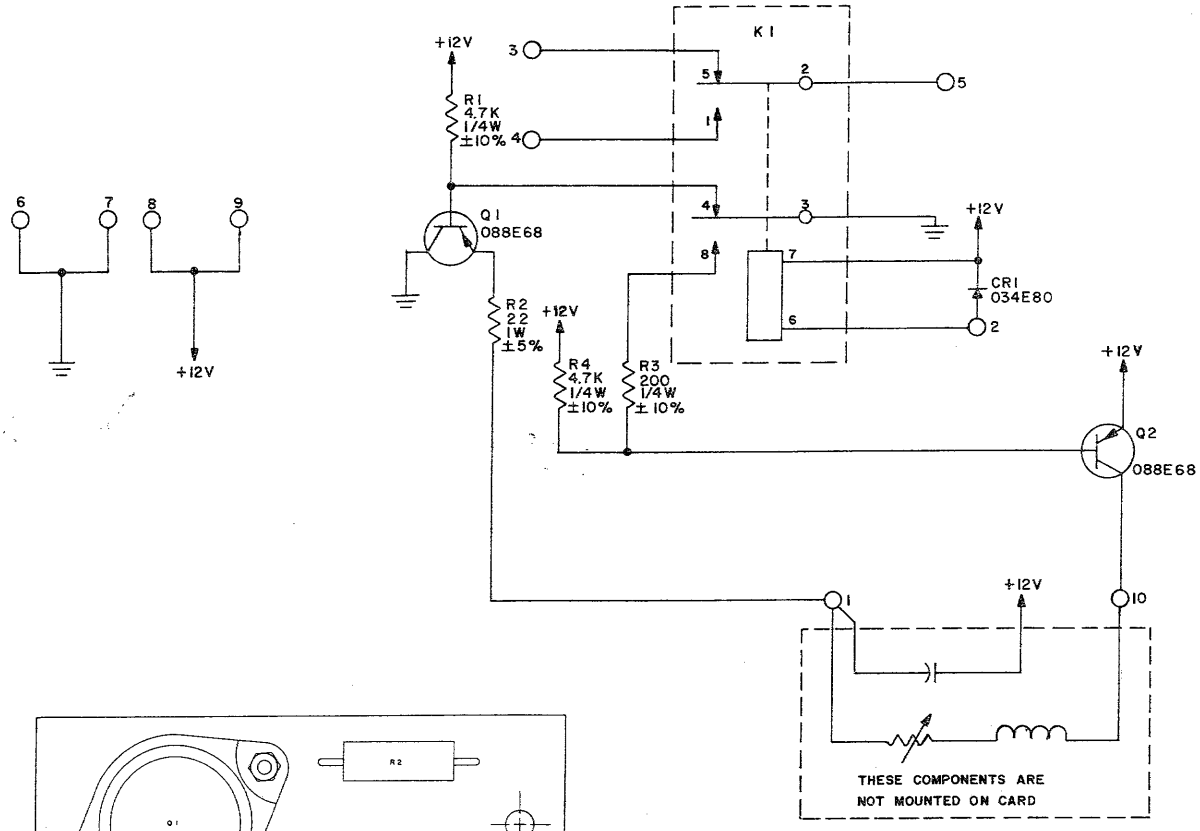


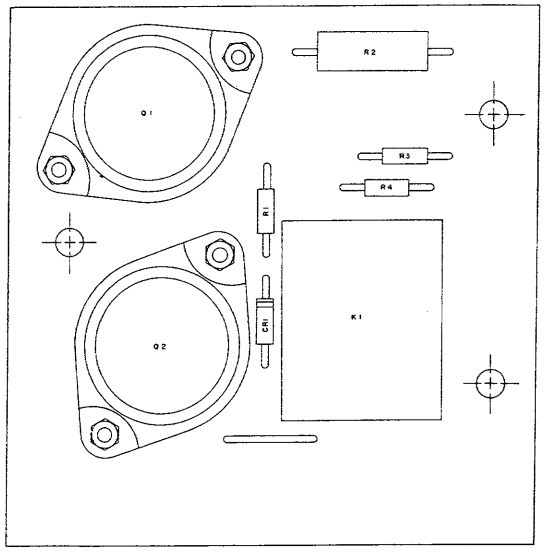


Network Resistor

REV.
PART NO. 106761
CARD TYPE **457A (W)**

Figure 5-22





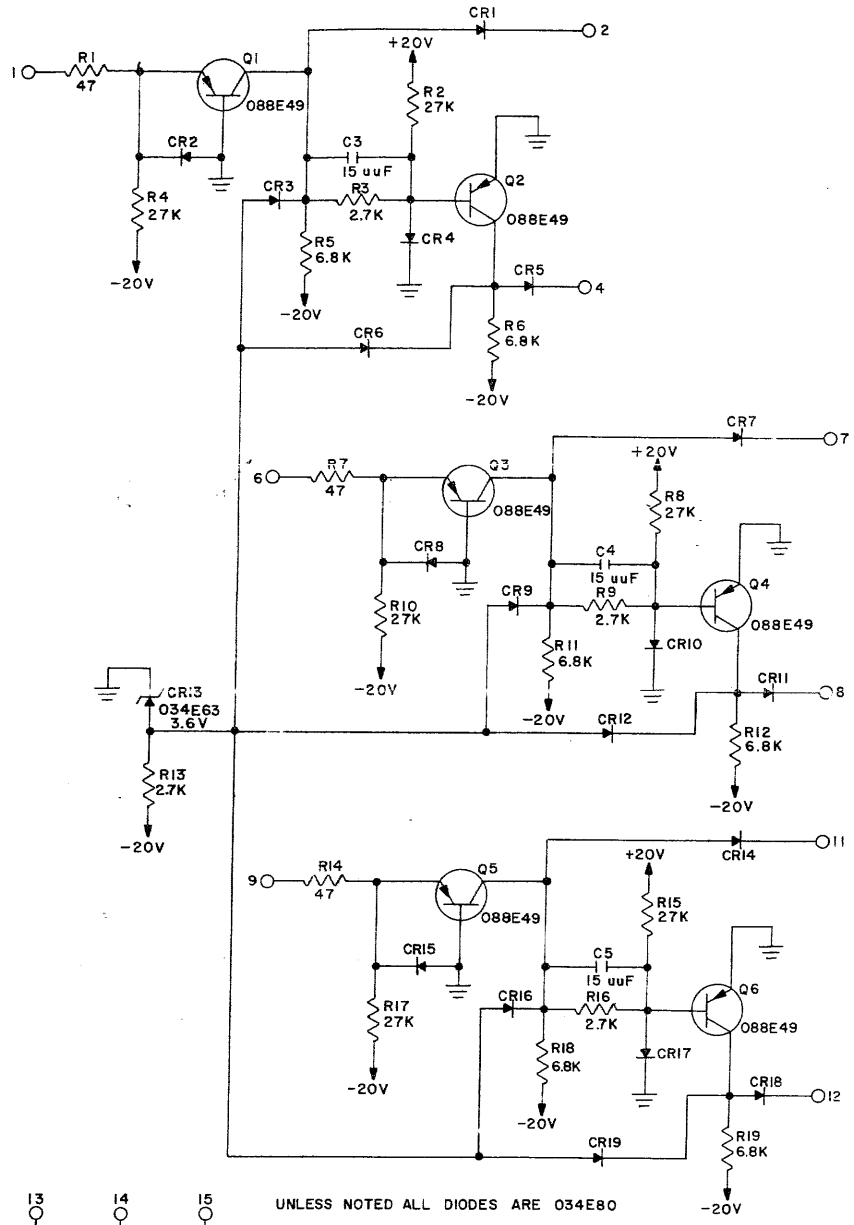
Relay Card

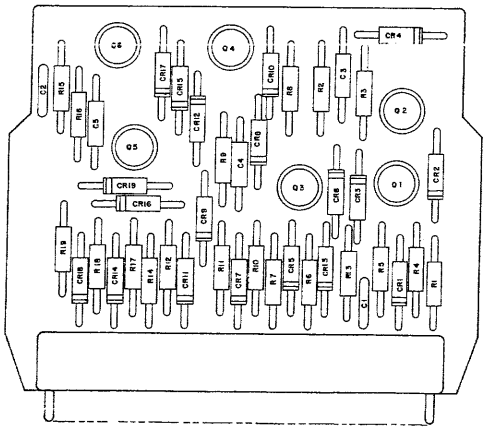
REV.

PART NO. 108984

CARD TYPE **478**

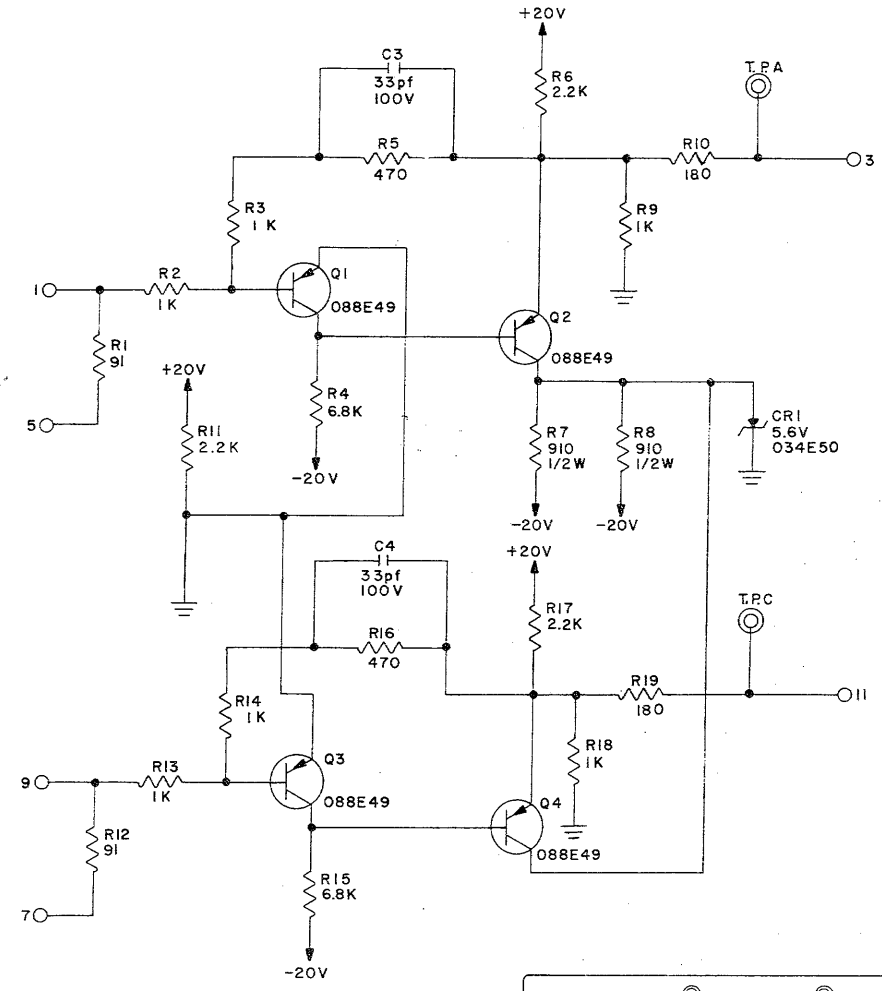
Figure 5-23

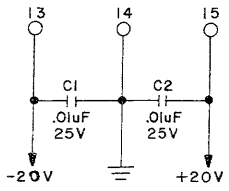


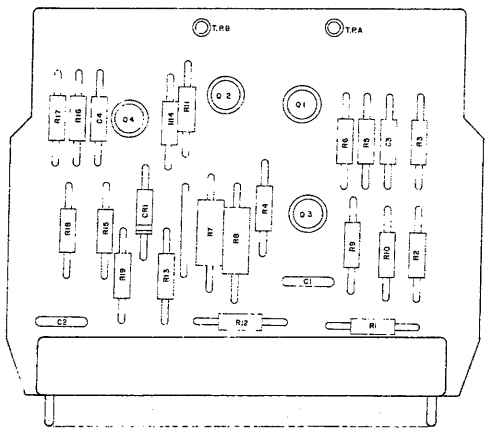


Logic Terminator (CDC 6600)
REV.
PART NO. 106726
CARD TYPE **619 (W)**

Figure 5-24



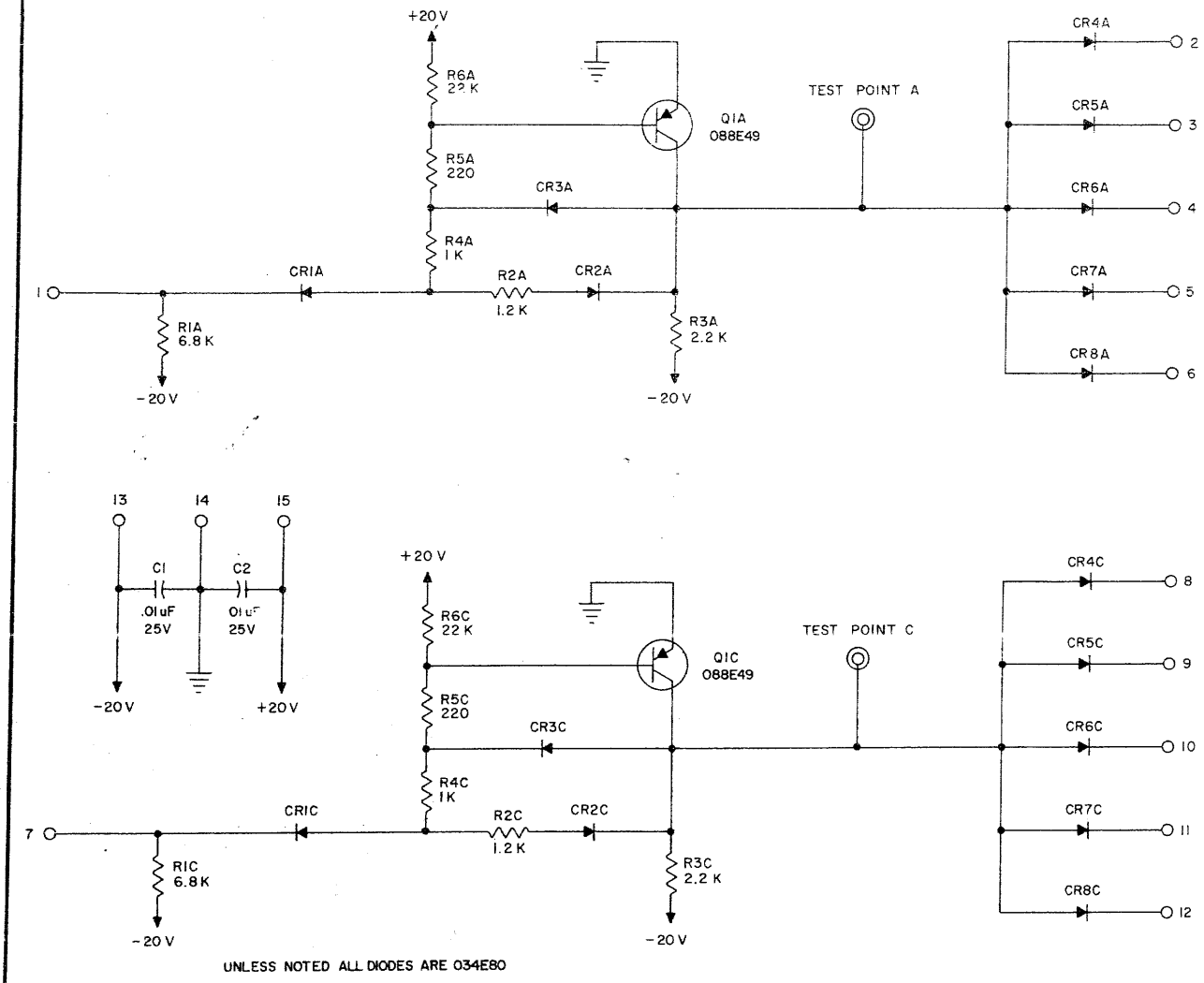


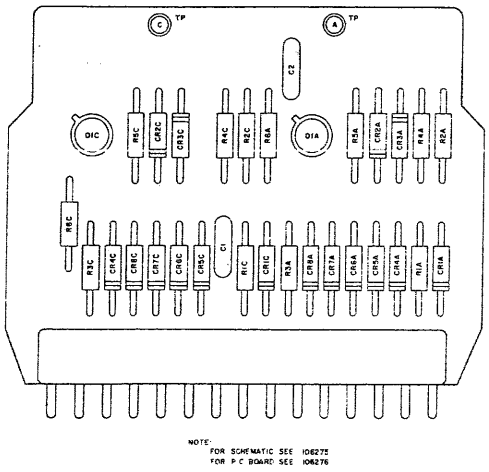


Symbol Signal Terminator (CDC 6600)

REV. B/B
PART NO. 106734
CARD TYPE **620 (W)**

Figure 5-25

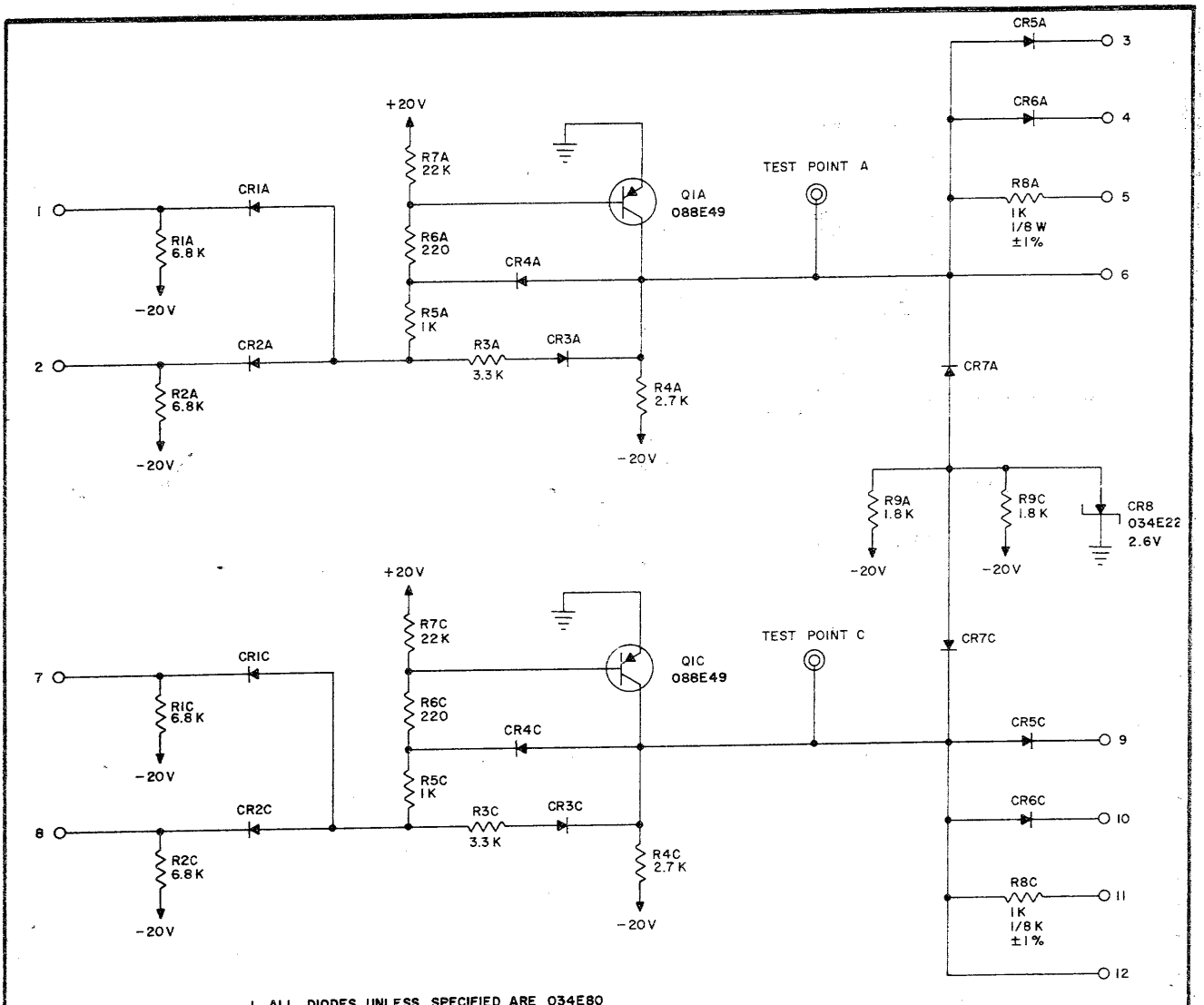




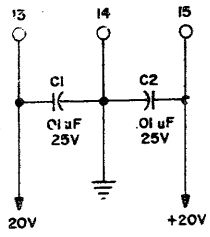
NOTE:
FOR SCHEMATIC SEE 106275
FOR P C BOARD SEE 106276

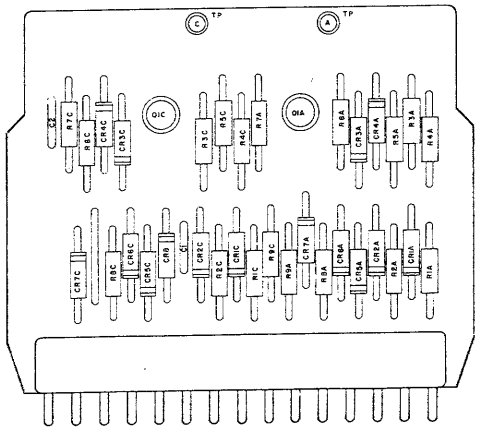
Standard Inverter
REV.
PART NO. 106277
CARD TYPE **1021(W)**

Figure 5-26



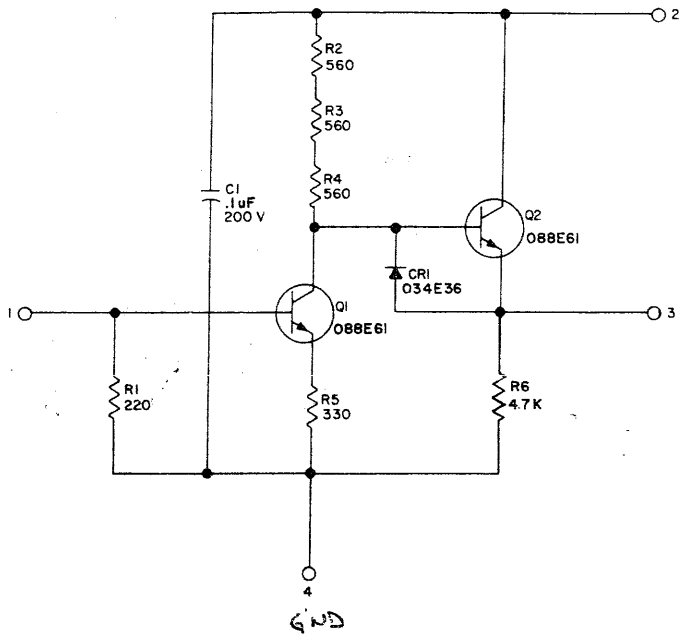
1. ALL DIODES UNLESS SPECIFIED ARE 034E80

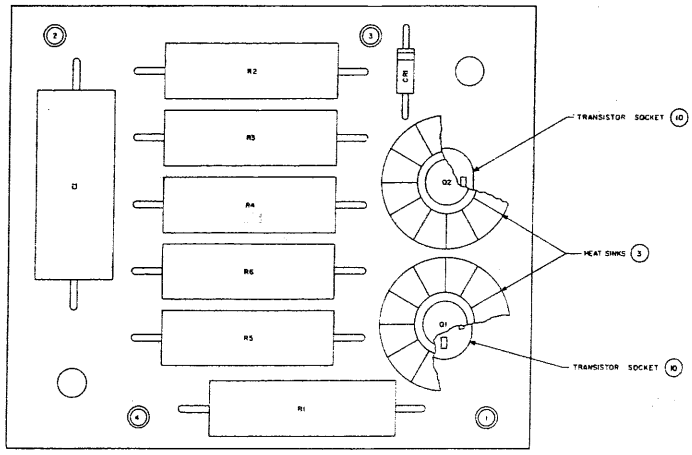




Special Purpose Inverter
REV.
PART NO. 106770
CARD TYPE **1222RS (W)**

Figure 5-27





REV.
PART NO. 106522
CARD TYPE **UA2A**

Figure 5-28

Section VI

PARTS DATA

This section contains the provisioning parts breakdown (PPB) for the dd 60A Display Equipment. Figure 6-1 lists the equipment reference designations. Preceding the PPB, is table 6-1 which is a cross-reference listing of manufacturers' codes, names, and addresses. Figures 6-2 through 6-7, following the PPB, are photographs or drawings showing assembly or component locations for complex assemblies.

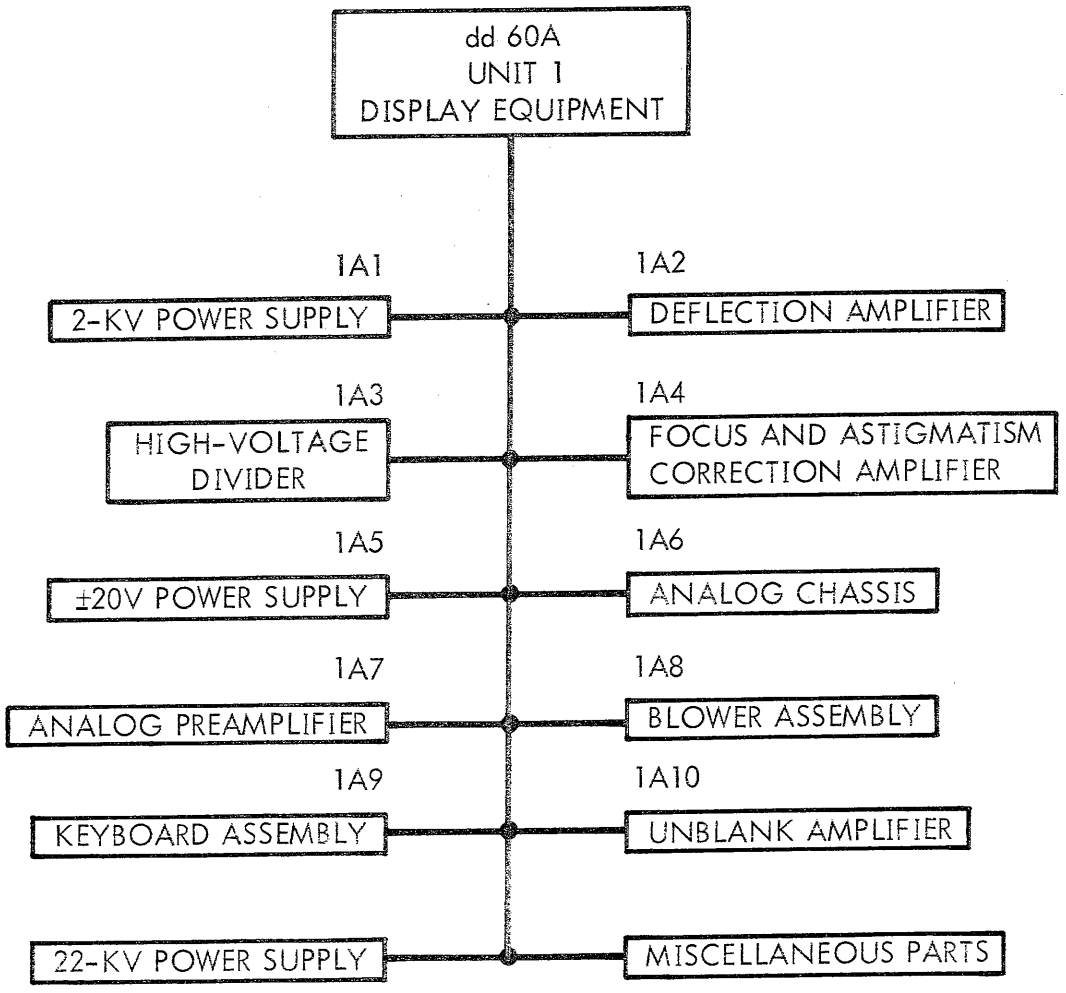


Figure 6-1. Equipment Designations

PROVISIONING PARTS BREAKDOWN

The following paragraphs briefly explain the meanings of the form columns.

1. Assembly Reference - This column lists each assembly and subassembly by reference designation in alphanumeric order.

2. Symbol - The symbol column contains the schematic symbol for parts located on a unit or subassembly.

3. Mfrs. Part Number - This column lists the part number given to a part by the controlling manufacturer.

4. Description - This column contains a brief description of each electrical part, giving all important electrical details of each electrical part.

5. Mfrs. Code - The manufacturers' code column lists the five-digit federal manufacturer's code assigned to each manufacturer supplying the government. Table 6-1 cross-references all manufacturers' codes to the manufacturers.

6. Unit Quantity - The unit quantity column gives the total quantity of each part per next higher order assembly.

7. DDI P/N - This column lists the Data Display part number for each assembly and/or component. Use this number when ordering spare parts.

TABLE 6-1. LIST OF MANUFACTURERS

CODE	NAME	ADDRESS
00656	Aerovox Corp.	New Bedford, Massachusetts
01121	Allen-Bradley Co.	Milwaukee, Wisconsin
01295	Texas Instruments, Inc. Semiconductor-components Division	Dallas, Texas
01364	Allied Radio Corp.	Chicago, Illinois
02111	Spectrol Electronics Corp.	San Gabriel, California

TABLE 6-1. LIST OF MANUFACTURERS (CONT.)

CODE	NAME	ADDRESS
02660	Amphenol-Borg Electronics Corp.	Broadview, Chicago, Illinois
02735	Radio Corp. of America Commercial Receiving Tube and Semiconductor Division	Somerville, New Jersey
03508	Semi-Conductor Products Dept. GECO	Syracuse, New York
04713	Motorola, Inc. Semiconductor Products Division	Phoenix, Arizona
08594	Eitel-McCullough, Inc.	Salt Lake City, Utah
09639	Control Data Corp.	Minneapolis, Minnesota
11711	General Instrument Corp. Semi-conductor Products Group Rectifier Division	Newark, New Jersey
12060	Diodes, Inc.	Chatsworth, California
12697	Clarostat Mfg. Co. Inc.	Dover, New Hampshire
13850	Technipower, Inc.	South Norwalk, Connecticut
14099	Semtech Corp.	Newbury Park, California
14225	Universal Voltronic Corp.	White Plains, New York
14655	Cornell-Dubilier Electric Corp.	Newark, New Jersey
14907	Cramer Division of Giannini Controls Corp.	Old Saybrook, Connecticut
15920	Data Display, Inc.	St. Paul, Minnesota
16512	National Connector Corp.	Minneapolis, Minnesota
16727	Condenser Product Co.	Brooksville, Florida

TABLE 6-1. LIST OF MANUFACTURERS (CONT.)

CODE	NAME	ADDRESS
44655	Ohmite Manufacturing Company	Skokie, Illinois
56289	Sprague Electric Co.	North Adams, Massachusetts
60513	Trade Wind Motorfans, Inc.	Los Angeles, California
71400	Bussmann Mfg. Division of McGraw-Edison Co.	St. Louis, Missouri
71590	Centralab Division of Globe-Union Inc.	Milwaukee, Wisconsin
71744	Chicago Miniature Lamp Works	Chicago, Illinois
73445	Amperex Electronic Co. Div. of North American Philips Co., Inc.	Hicksville, New York
73631	Curtis Development and Mfg. Co.	Milwaukee, Wisconsin
73899	J F D Electronics Corp.	Brooklyn, New York
74199	Quam Nichols Co.	Chicago, Illinois
74545	Hubbell Harvey, Inc.	Bridgeport, Connecticut
74970	Johnson, E. F. Co.	Waseca, Minnesota
75042	International Resistance Co.	Philadelphia, Pennsylvania
75173	Jones Howard B. Division of Cinch Mfg. Co.	Chicago, Illinois
75915	Littelfuse, Inc.	Des Plaines, Illinois
77342	American Machine and Foundry Co. Potter and Brumfield Division	Princeton, Indiana
80023	Schott Oscar A. Co., Inc.	Minneapolis, Minnesota

TABLE 6-1. LIST OF MANUFACTURERS (CONT.)

CODE	NAME	ADDRESS
82170	Fairchild Camera and Instrument Corp. Defense Products Division	Clifton, New Jersey
82877	Rotron Mfg. Co., Inc.	Woodstock, New York
83330	Smith Herman H. Inc.	Brooklyn, New York
84171	Arco Electronics, Inc.	Great Neck, New York
86684	Radio Corp. of America Electronic Components and Devices	Harrison, New Jersey
91637	Dale Electronics, Inc.	Columbus, Nebraska
91662	Elco Corp.	Willow Grove, Pennsylvania
91929	Honeywell Inc. Micro Switch Division	Freeport, Illinois
92702	IMC Magnetics Corp. Eastern Division	Westbury Long Island, New York
94154	Tung-Sol Electric, Inc.	Newark, New Jersey
94696	Magnecraft Electric Co.	Chicago, Illinois
97965	Stancor Electronics, Inc.	Chicago, Illinois
98925	Semiconductor Division of Clevite Corp.	Waltham, Massachusetts
99120	Plastic Capacitors, Inc.	Chicago, Illinois
99515	Marshall Industries Electron Products Division	Pasadena, California

CONTRACT NO:
CONTRACTOR: DATA DISPLAY, INC.
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Assembly Reference	Symbol	Mfrs. Part Number (or FSN)	Description	Mfrs. Code	Unit Quantity	DDI P/N
1	A1	106447	POWER SUPPLY ASSEMBLY, 2000V - WIRED	15920	1	106447
1A1	A1	106451	RECTIFIER ASSY	15920	1	106451
1A1A1	CR1	SA-999	SEMICONDUCTOR DEVICE, DIODE; 2KV .5A Si	14099	12	034E74-2
1A1A1	CR2		SAME AS 1A1A1CR1			
1A1A1	CR3		SAME AS 1A1A1CR1			
1A1A1	CR4		SAME AS 1A1A1CR1			
1A1A1	CR5		SAME AS 1A1A1CR1			
1A1A1	CR6		SAME AS 1A1A1CR1			
1A1A1	CR7		SAME AS 1A1A1CR1			
1A1A1	CR8		SAME AS 1A1A1CR1			
1A1A1	CR9		SAME AS 1A1A1CR1			
1A1A1	CR10		SAME AS 1A1A1CR1			
1A1A1	CR11		SAME AS 1A1A1CR1			
1A1A1	CR12		SAME AS 1A1A1CR1			
1A1	C1	TJU6100	CAP., FXD, PAPER DIELECTRIC; 10uf 600vdcw	14655	2	033E81
1A1	C2		SAME AS 1A1C1			
1A1	C3	LK30-405	CAP., FXD, P DIELECTRIC; 4uf 3,000vdcw	99120	2	033E35-2
1A1	C4		SAME AS 1A1C3			
1A1	E1	2601	INSULATOR, STANDOFF; Cer 3/4" lg 6-32 nc	83330	1	035E10
1A1	J1	718S21	CONNECTOR, RECP, ELECT.; 1 cont female	74545	2	049E50
1A1	J2		SAME AS 1A1J1			
1A1	K1	W22CPX-108	RELAY, SOLENOID; 5 spst cont sets 24 vdc	94696	1	041E12
1A1	K2	6N060	RELAY, THERMAL; 60 sec time delay 6 volt	73445	1	040E14

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1A1	L1	S-3256A	REACTOR; Filter choke, 4 sect. 75mh .25A	80023	2	083E10
1A1	L2		SAME AS 1A1L1			
1A1	R1	MVX-2(1.8 mego)	RESISTOR, FIXED, FILM; HV 1.8 mego 5% 2W	75042	1	032E28
1A1	R2	MVX-2 (.8 mego)	RESISTOR, FIXED, FILM; HV 800K 5% 2W	75042	1	032E415
1A1	T1	S-2839A	TRANSFORMER, POWER STEP-DOWN; 208/6.3vac	80023	1	038E13
1A1	T2	S-3514	XMFR, PWR STEP-UP; Inputs 208 247 624 vac	80023	1	038E15
1A1	TB1	10-141	TERMINAL BOARD; 10 terminals #6-32 screw	75173	2	044E13
1A1	TB2		SAME AS 1A1TB1			
1A1	XK1	77M1P12	SOCKET, ELECTRON TUBE; Bakelite 12 pin	02660	1	042E16
1A1	XK2	338PHSPTD	SOCKET, ELECTRON TUBE; Ceramic octal sdl	91662	1	042E11
1	A2	106729	ASSEMBLY, DEFLECTION AMPLIFIER, WIRED	15920	1	106729
1A2	C1	315	CAP., VAR, MICA DIELECTRIC; 1400-3055uuf	84171	2	033E209
1A2	C2		SAME AS 1A2C1			
1A2	C3	17L084	CAP., VAR, AIR DIELECTRIC; 55-300uuf	01364	2	033E193
1A2	C4		SAME AS 1A2C3			
1A2	C5	VC13GB	CAP., VAR, GLASS DIELECTRIC; .8-13uuf	73899	4	033E176
1A2	C6		SAME AS 1A2C5			
1A2	C7		SAME AS 1A2C5			
1A2	C8		SAME AS 1A2C5			
1A2	E1		NOT TO BE USED IN THIS EQUIPMENT			
1A2	E2		NOT TO BE USED IN THIS EQUIPMENT			
1A2	E3		NOT TO BE USED IN THIS EQUIPMENT			
1A2	E4		NOT TO BE USED IN THIS EQUIPMENT			
1A2	E5	135-44	TERMINAL, FEEDTHRU, INSULATED; 6/16" dia	74970	1	061E11

Assembly Reference	Symbol	Mfrs. Part Number (or FSN)	Description	Mfrs. Code	Unit Quantity	DDI P/N
1A2	R1	EB1051	RESISTOR, FIXED, COMP; 1 mego 10% 1/2W	01121	4	032E234
1A2	R2		SAME AS 1A2R1			
1A2	R3	1770	RESISTOR, FIXED, WIRE WOUND; 40K 5% 10W	44655	4	032E11
1A2	R4	HB1521	RESISTOR, FXD, COMPOSITION; 1.5K 10% 2W	01121	4	032E232
1A2	R5		SAME AS 1A2R3			
1A2	R6		SAME AS 1A2R4			
1A2	R7	0219	RESISTOR, FIXED, WIRE WOUND; 25K 5% 25W	44655	4	032E224
1A2	R8		SAME AS 1A2R7			
1A2	R9	HB3921	RESISTOR, FXD, COMPOSITION; 3.9K 10% 2W	01121	2	032E233
1A2	R10	0416	RESISTOR, FIXED, WIRE WOUND; 15K 5% 50W	44655	4	032E16
1A2	R11	0218	RESISTOR, FIXED, WIRE WOUND; 5K 5% 50W	44655	4	032E498
1A2	R12		SAME AS 1A2R10			
1A2	R13		SAME AS 1A2R11			
1A2	R14		SAME AS 1A2R1			
1A2	R15		SAME AS 1A2R1			
1A2	R16		SAME AS 1A2R3			
1A2	R17		SAME AS 1A2R4			
1A2	R18		SAME AS 1A2R3			
1A2	R19		SAME AS 1A2R4			
1A2	R20		SAME AS 1A2R7			
1A2	R21		SAME AS 1A2R7			
1A2	R22		SAME AS 1A2R9			
1A2	R23		SAME AS 1A2R10			
1A2	R24		SAME AS 1A2R11			

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1A2	R25		SAME AS 1A2R10			
1A2	R26		SAME AS 1A2R11			
1A2	R27	48M-9-5000	RESISTOR, VARIABLE; Comp 1kg 5K 10% 1/5W	12697	2	036E74
1A2	R28		SAME AS 1A2R27			
1A2	R29	1740	RESISTOR, FIXED, WIRE WOUND; 1.5K 5% 10W	44655	4	032E515
1A2	R30	GB4711	RESISTOR, FIXED, COMP; 470 ohms 10% 1W	01121	2	032E177
1A2	R31		SAME AS 1A2R30			
1A2	R32	W0121	RHEOSTAT; 2.5K, 12.5 watts, 0.071 amps	44655	2	037E11
1A2	R33		SAME AS 1A2R29			
1A2	R34		SAME AS 1A2R32			
1A2	R35		SAME AS 1A2R29			
1A2	R36		SAME AS 1A2R29			
1A2	R37	GB2211	RESISTOR, FIXED, COMP; 220 ohms 10% 1W	01121	8	032E235
1A2	R38		SAME AS 1A2R37			
1A2	R39		SAME AS 1A2R37			
1A2	R40		SAME AS 1A2R37			
1A2	R41		SAME AS 1A2R37			
1A2	R42		SAME AS 1A2R37			
1A2	R43		SAME AS 1A2R37			
1A2	R44		SAME AS 1A2R37			
1A2	T1	S3874	TRANSFORMER, PWR, STEP-DOWN; Fil 208/6V	80023	1	038E19
1A2	TB1	GFT-7	TERMINAL BOARD; Feedthru, ins, 7 term	73631	2	044E37
1A2	TB2		SAME AS 1A2TB1			
1A2	TB3	104644	COMPONENT BOARD ASSEMBLY	15920	2	104644

Assembly Reference	Symbol	Mfrs. Part Number (or FSN)	Description	Mfrs. Code	Unit Quantity	DDI P/N
1A2	TB4		SAME AS 1A2TB3			
1A2	TB5	104645	COMPONENT BOARD ASSEMBLY	15920	1	104645
1A2	V1	12BH7A	ELECTRON TUBE; Med-mu twin triode, 9 pin	94154	4	045E37
1A2	V2		SAME AS 1A2V1			
1A2	V3	3CX100A5	ELECTRON TUBE; Pwr grid triode, clip mtg	08594	4	045E16
1A2	V4		SAME AS 1A2V3			
1A2	V5		SAME AS 1A2V1			
1A2	V6		SAME AS 1A2V1			
1A2	V7		SAME AS 1A2V3			
1A2	V8		SAME AS 1A2V3			
1A2	XV1	176PHSPT	SOCKET, ELECTRON TUBE; Cer, 7 pin w/shld	91662	4	042E13
1A2	XV2		SAME AS 1A2XV1			
1A2	XV3		NOT TO BE USED IN THIS EQUIPMENT			
1A2	XV4		NOT TO BE USED IN THIS EQUIPMENT			
1A2	XV5		SAME AS 1A2XV1			
1A2	XV6		SAME AS 1A2XV1			
1A2	XV7		NOT TO BE USED IN THIS EQUIPMENT			
1A2	XV8		NOT TO BE USED IN THIS EQUIPMENT			
1	A3	106593	VOLTAGE DIVIDER ASSY, WIRED	15920	1	106593
1A3	A1	102703	PRINTED CIRCUIT BOARD ASSEMBLY; Type TS1	15920	1	102703
1A3A1	C1	118P10596S2	CAP., FXD, MET-P DIELECTRIC; 1uf 600vdcw	56289	1	033E167
1A3A1	CR1	1N649	SEMICONDUCTOR DEVICE, DIODE; Si, 600V	01295	2	034E52
1A3A1	CR2		SAME AS 1A3A1CR1			
1A3A1	DS1	NE-2E	LAMP, GLOW; 1/10W, T-2 bulb, wire leads	71744	1	116E16

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1A3A1	R1	MVX-1	RESISTOR, FIXED, FILM; 10 megohms 5% 1W	75042	1	032E356
1A3A1	R2	GB2751	RESISTOR, FIXED, COMP; 2.7 mego 10% 1W	01121	1	032E238
1A3A1	R3	GB2251	RESISTOR, FIXED, COMP; 2.2 mego 10% 1W	01121	1	032E430
1A3	A2	106856	PRINTED CIRCUIT BOARD ASSEMBLY; Type TS1B	15920	1	106856
1A3A2	CR1	1N649	SEMICONDUCTOR DEVICE, DIODE; Si, 600V	01295	2	034E52
1A3A2	CR2		SAME AS 1A3A2CR1			
1A3A2	DS1	NE-2E	LAMP, GLOW; 1/10W, T-2 bulb, wire leads	71744	1	116E16
1A3A2	R1	MVX-1	RESISTOR, FIXED, FILM; 10 megohms 5% 1W	75042	1	032E356
1A3A2	R2	GB2751	RESISTOR, FIXED, COMP; 2.7 mego 10% 1W	01121	1	032E238
1A3A2	R3	GB2251	RESISTOR, FIXED, COMP; 2.2 mego 10% 1W	01121	1	032E430
1A3	C1		NOT TO BE USED IN THIS EQUIPMENT			
1A3	C2	X0C12.5C01	CAP., FXD, PLSTC DIELECTRIC; .1uf 12.5vdcw	16727	3	033E156
1A3	C3	P161Y	CAP., FXD, PAPER DIELECTRIC; .01uf 2.5kv	00656	1	033E319
1A3	C4		NOT TO BE USED IN THIS EQUIPMENT			
1A3	C5	104063	CAPACITOR & MOUNT ASSEMBLY; 8kvdc	15920	4	104063
1A3	C6		SAME AS 1A3C5			
1A3	C7	104064	CAPACITOR & MOUNT ASSEMBLY; 12kvdc	15920	2	104064
1A3	C8		SAME AS 1A3C7			
1A3	C9		SAME AS 1A3C2			
1A3	C10		NOT TO BE USED IN THIS EQUIPMENT			
1A3	C11		SAME AS 1A3C2			
1A3	C12		SAME AS 1A3C5			
1A3	C13		SAME AS 1A3C5			
1A3	C14		NOT TO BE USED IN THIS EQUIPMENT			

Assembly Reference	Symbol	Mfrs. Part Number (or FSN)	Description	Mfrs. Code	Unit Quantity	DDI P/N
1A3	C15	DD-403	CAP, FIXED, CERAMIC DIELECTRIC; .04uf 600vdcw	71590	2	033E237
1A3	C16		SAME AS 1A3C15			
1A3	C17	DD-203	CAP., FXD, CERAMIC DIELECTRIC; .02uf 600vdcw	71590	2	033E211
1A3	C18		SAME AS 1A3C17			
1A3	C19	EP32971	CAP., FXD, PLST DIELECTRIC; .1 x .1uf 8kv	99515	1	033E50
1A3	C20		SAME AS 1A3C19			
1A3	CR1	1N649	SEMICONDUCTOR DEVICE DIODE; Silicon 600V	01295	4	034E52
1A3	CR2		SAME AS 1A3CR2			
1A3	CR3		SAME AS 1A3CR2			
1A3	CR4		SAME AS 1A3CR2			
1A3	R1		NOT TO BE USED IN THIS EQUIPMENT			
1A3	R2	MVD-15	RESISTOR, FIXED, FILM; 10 megohm 5% 5W	75042	1	032E264
1A3	R3		NOT TO BE USED IN THIS EQUIPMENT			
1A3	R4	GB7541	RESISTOR, FIXED, COMP; 750K 10% 1W	01121	2	032E519
1A3	R5		SAME AS 1A3R4			
1A3	R6	MVX-3	RESISTOR, FIXED, FILM; 1.7 megohm 5% 3W	75042	1	032E74
1A3	R7		NOT TO BE USED IN THIS EQUIPMENT			
1A3	R8	MVX-3	RESISTOR, FIXED, FILM; 2.2 megohm 5% 3W	75042	1	032E40
1A3	R9	MVX-3	RESISTOR, FIXED, FILM; 3.5 megohm 5% 3W	75042	1	032E45
1A3	R10		NOT TO BE USED IN THIS EQUIPMENT			
1A3	R11	MVX-3	RESISTOR, FIXED, FILM; 6 megohm 5% 3W	75042	2	032E49
1A3	R12		NOT TO BE USED IN THIS EQUIPMENT			
1A3	R13	GB5631	RESISTOR, FIXED, FILM; 56K 5% 1W	01121	1	032E421
1A3	R14	MVX-1	RESISTOR, FIXED, FILM; 500K 5% 1W	75042	2	032E19

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1A3	R15		NOT TO BE USED IN THIS EQUIPMENT			
1A3	R16	CU2052	RESISTOR, VARIABLE; Comp 2 megohm 20% 2W	44655	2	036E49
1A3	R17	CU5041	RESISTOR, VARIABLE; Comp lin 500K 10% 2W	44655	1	036E61
1A3	R18	CU1552	RESISTOR, VARIABLE; Comp 1.5 mego 20% 2W	44655	2	036E29
1A3	R19		SAME AS 1A3R18			
1A3	R20	CU7531	RESISTOR, VARIABLE; Comp lin 75K 10% 2W	44655	2	036E22
1A3	R21		SAME AS 1A3R20			
1A3	R22	GB1051	RESISTOR, FIXED, COMP; 1 megohm 10% 1W	01121	8	032E79
1A3	R23		SAME AS 1A3R22			
1A3	R24		NOT TO BE USED IN THIS EQUIPMENT			
1A3	R25		SAME AS 1A3R22			
1A3	R26		NOT TO BE USED IN THIS EQUIPMENT			
1A3	R27		SAME AS 1A3R22			
1A3	R28		NOT TO BE USED IN THIS EQUIPMENT			
1A3	R29		SAME AS 1A3R14			
1A3	R30		SAME AS 1A3R16			
1A3	R31		NOT TO BE USED IN THIS EQUIPMENT			
1A3	R32		NOT TO BE USED IN THIS EQUIPMENT			
1A3	R33		SAME AS 1A3R22			
1A3	R34		SAME AS 1A3R22			
1A3	R35		SAME AS 1A3R22			
1A3	R36		SAME AS 1A3R22			
1A3	R37		SAME AS 1A3R11			
1A3	R38	HB4741	RESISTOR, FIXED, COMP; 470K 10% 2W	01121	1	032E525

Assembly Reference	Symbol	Mfrs. Part Number (or FSN)	Description	Mfrs. Code	Unit Quantity	DDI P/N
1A3	R39	CU3541	RESISTOR, VARIABLE; Comp lin 350K 10% 2W	44655	1	036E25
1A3	TB1	GFT-7	TERMINAL BOARD; 7 terminals, feedthru	73631	1	044E37
1	A4	104590	FOCUS & ASTIGMATISM CORRECTION AMPLIFIER ASSY	15920	1	104590
1A4	R1	EB1051	RESISTOR, FIXED, COMP; 1 megohm 10% 1/2W	01121	2	032E234
1A4	R2	EB2211	RESISTOR, FIXED, COMP; 220 ohms 10% 1/2W	01121	1	032E296
1A4	R3	3843	RESISTOR, FIXED, WIRE WOUND; 51K 5% 10W	44655	1	032E494
1A4	R4		SAME AS 1A4R1			
1A4	R5	4193	RHEOSTAT; WW, 15 kilohms 12.5W 0.023 amp	44655	1	037E14
1A4	R6	GB1041	RESISTOR, FIXED, COMP; 100K 10% 1W	01121	1	032E384
1A4	R7	EB1041	RESISTOR, FIXED, COMP; 100K 10% 1/2W	01121	1	032E493
1A4	TB1	GFT-7	TERMINAL BOARD; 7 terminals, feedthru	73631	1	044E37
1A4	V1	12BH7A	ELECTRON TUBE; Med-mu twin triode, 9 pin	86684	1	045E37
1A4	V2	6BL7	ELECTRON TUBE; Med-mu twin triode, octal	86684	1	045E19
1A4	XV1	176PHSPTD	SOCKET, ELECTRON TUBE; Cer 9 pin w/shld	91662	1	042E13
1A4	XV2	338PHSPTD	SOCKET, ELECTRON TUBE; Ceramic octal sdl	91662	1	042E11
1	A5	106805	CHASSIS 20 VOLT REGULATED P. S. ASSEMBLY	15920	1	106805
1A5	F1	313.750	FUSE, CARTRIDGE; 0.75 A @ 125 V, 3AG SB	75915	1	043E46
1A5	F2	31301.5	FUSE, CARTRIDGE; 1.50 A @ 125 V, 3AG SB	75915	1	043E20
1A5	PS1	M-21.2-3.0AS	POWER SUPPLY; 105-125vac/20.2-22.3vdc	13850	2	134S16
1A5	PS2		SAME AS 1A5PS1			
1A5	TB1	14-141	TERMINAL BOARD; 14 terminals #6-32 screw	75173	1	044E11
1A5	XF1	HKL-X-90	FUSEHOLDER; Ig, pnl mtg, 100-250V, 20A	71400	2	055E11
1A5	XF2		SAME AS 1A5XF1			
1	A6	106799	D/A CHASSIS ASSEMBLY, WIRED	15920	1	106799

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1A6	C1	823BN	CAPACITOR, VARIABLE AIR DIELECTRIC; 10-100uuf	71590	2	033E126
1A6	C2		SAME AS 1A6C1			
1A6	J1	MS3102A-24-12P	CONNECTOR, RECP, ELEC; Solid shell 5 pin	02660	1	049E306
		MS3102A-24	SHELL, ELECTRICAL CONNECTOR; Size 24	02660	3	049E283
		700-35391	SHELL, ELECTRICAL CONNECTOR; Size 24	02660	3	049E286
		A2259	CONNECTOR, RECP, ELEC; Circuit board 15 soc	16512	26	022S24
			CONNECTOR, RECP, ELEC; Circuit board 15 soc	09639	8	
		107199-1	PRINTED CIRCUIT BOARD ASSY; type 002C-1	15920	2	107199-1
		107199-3	PRINTED CIRCUIT BOARD ASSY; type 002C-3	15920	4	107199-3
		107199-5	PRINTED CIRCUIT BOARD ASSY; type 002C-5	15920	4	107199-5
		107199-7	PRINTED CIRCUIT BOARD ASSY; type 002C-7	15920	4	107199-7
		107199-9	PRINTED CIRCUIT BOARD ASSY; type 002C-9	15920	4	107199-9
		106351	PRINTED CIRCUIT BOARD ASSY; type 003	15920	4	106351
		106785	PRINTED CIRCUIT BOARD ASSY; type 016	15920	2	106785
		106337	PRINTED CIRCUIT BOARD ASSY; type 015A	15920	2	106337
		106343	PRINTED CIRCUIT BOARD ASSY; type 019	15920	2	106343
		106378	PRINTED CIRCUIT BOARD ASSY; type C19	15920	2	106378
		106354	PRINTED CIRCUIT BOARD ASSY; type 027	15920	4	106354
		106798	PRINTED CIRCUIT BOARD ASSY; type 031A	15920	1	106798
		106357	PRINTED CIRCUIT BOARD ASSY; type 401	15920	1	106357
		107068	PRINTED CIRCUIT BOARD ASSY; type 456C	15920	2	107068
		106795	PRINTED CIRCUIT BOARD ASSY; type 429A	15920	1	106795
		106360	PRINTED CIRCUIT BOARD ASSY; type 443	15920	1	106360
		106579	PRINTED CIRCUIT BOARD ASSY; type 456A	15920	2	106579

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		106761	PRINTED CIRCUIT BOARD ASSY; type 457A	15920	2	106761
		106726	PRINTED CIRCUIT BOARD ASSY; type 619	15920	8	106726
		106734	PRINTED CIRCUIT BOARD ASSY; type 620	15920	2	106734
		106289	PRINTED CIRCUIT BOARD ASSY; type 1031	15920	1	106289
		106770	PRINTED CIRCUIT BOARD ASSY; type 1222RS	15920	8	106770
		106865	PRINTED CIRCUIT BOARD ASSY; type 452A	15920	2	106865
		106811	PRINTED CIRCUIT BOARD ASSY; type 205	15920	2	106811
		107084	PRINTED CIRCUIT BOARD ASSY; type 029	15920	2	107084
		107107	PRINTED CIRCUIT BOARD ASSY; type 039	15920	1	107107
		107299	PRINTED CIRCUIT BOARD ASSY; type 040	15920	2	107299
		106334	PRINTED CIRCUIT BOARD ASSY; type 015	15920	1	106334
		106599	PRINTED CIRCUIT BOARD ASSY; type S45	15920	2	106599
		106277	PRINTED CIRCUIT BOARD ASSY; type 1021	15920	1	106277
		106522	PRINTED CIRCUIT BOARD ASSY; type UA2A	15920	1	106522
1	A7	106591	PREAMP ASSEMBLY	15920	1	106591
1A7	C1	467	CAP. VAR, MICA DIELECTRIC; 110-580uuf 175V	84171	2	033E199
1A7	C2		SAME AS 1A7C1			
1A7	J1	12B-32A-15	CONNECTOR, RECP, ELEC; Circuit board 15 soc	16512	5	022S10
1A7	J2		SAME AS 1A7J1			
1A7	J3		SAME AS 1A7J1			
1A7	J4		SAME AS 1A7J1			
1A7	J5		SAME AS 1A7J1			
1	A8	107017	BLOWER ASSEMBLY	15920	1	107017
1A8	B1	BC2918B-11	FAN, CENTRIFUGAL; 115/230V 50/60cps	92702	1	030S10

CONTRACT NO:
CONTRACTOR: DATA DISPLAY, INC.
ISSUE NO: 60A

PROVISIONING PARTS LIST

DATE 3/1/65
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Assembly Reference	Symbol	Mfrs. Part Number (or FSN)	Description	Mfrs. Code	Unit Quantity	DDI P/N
1A8	C1	P30ZN19	CAP, FXD, MET P DIELECTRIC; .4uf 600vdcw	00656	1	033E10
1A8	TB1	141-3	TERMINAL BOARD; 3 terminals 6-32 screw	75173	1	044E18
1	A9	106762	KEYBOARD ASSY, WIRED	15920	1	106762
1A9	A1	106535	CARD ASSEMBLY, DIODE ENCODER	15920	1	106535
1A9A1	CR1	GD460	SEMICONDUCTOR DEVICE, DIODE; 10 volt, Ge	11711	136	034E80
1A9A1	CR2 (thru) CR136		SAME AS 1A9A1CR1.			
1A9A1	TB1	106534	PRINTED CIRCUIT BOARD; Less components	15920	1	106534
1A9	A2	106563	CARD ASSEMBLY, KEYBOARD CIRCUIT	15920	1	106563
1A9A2	C1	TVA-1162	CAPACITOR, FIXED, ELECT.; 500uf 15vdcw	56289	2	033E239
1A9A2	C2		SAME AS 1A9A2C1.			
1A9A2	C3	4C41	CAP., FXD, CER. DIELECTRIC; .22uf 25vdcw	56289	1	033E148
1A9A2	CR1	GD460	SEMICONDUCTOR DEVICE, DIODE; 10 volt, Ge	11711	51	034E80
1A9A2	CR2 (thru) CR51		SAME AS 1A9A2CR1.			
1A9A2	CR52	DI-46	SEMICONDUCTOR DEVICE, DIODE; 600V, Si	12060	1	034E46
1A9A2	Q1	40053	TRANSISTOR, NPN, SILICON; TO5 case	02735	1	088E22A
1A9A2	R1	CB5625	RESISTOR, FXD, COMPOSITION; 5.6K 5% 1/4W	01121	51	032E271
1A9A2	R2 (thru) R51		SAME AS 1A9A2R1			
1A9A2	R52	EB3321	RESISTOR, FIXED, COMP; 3.3K 10% 1/2W	01121	1	032E172
1A9A2	R53	EB3311	RESISTOR, FIXED, COMP; 330 ohms 10% 1/2W	01121	1	032E383
1A9A2	R54	WN-100	RESISTOR, VARIABLE; Lin taper, ww 10Ω 5W	71590	1	036E58

Assembly Reference	Symbol	Mfrs. Part Number (or FSN)	Description	Mfrs. Code	Unit Quantity	DDI P/N
1A9A2	TB1	106562	PRINTED CIRCUIT BOARD; Less components	15920	1	106562
1A9	A3	108984	PRINTED CIRCUIT BOARD ASSEMBLY; Type 478	15920	1	108984
1A9A3	CR1	GD460	SEMICONDUCTOR DEVICE, DIODE; 10 volt, Ge	11711	1	034E80
1A9A3	CR2	DI-46	SEMICONDUCTOR DEVICE, DIODE; 600V, Si	12060	2	034E46
1A9A3	CR3		SAME AS 1A9A3CR3			
1A9A3	K1	FC11D	RELAY, ARMATURE; 12V 210Ω coil, dpdt 3A	77342	1	041E40
1A9A3	Q1	2N1529	TRANSISTOR; PNP germanium power TO3 case	98925	2	088E68
1A9A3	Q2		SAME AS 1A9A3Q1			
1A9A3	R1	CB4721	RESISTOR, FIXED, COMP; 4.7K 10% 1/4W	01121	1	032E206
1A9A3	R2	GB2205	RESISTOR, FXD, COMP; 22 ohms 5% 1 watt	01121	1	032E681
1A9A3	R3	GB1011	RESISTOR, FIXED, COMP; 100 ohms 10% 1W	01121	2	032E295
1A9A3	R4		SAME AS 1A9A3R3.			
1A9A3	R5	CB1025	RESISTOR, FXD, COMPOSITION; 1K 5% 1/4W	01121	1	032E124
1A9A3	TB1	108983	PRINTED CIRCUIT BOARD; Less components	15920	1	108983
1A9	CR1		DELETED			
1A9	CR2	1N608	SEMICONDUCTOR DEVICE, DIODE; 100V, Si	03508	4	034E83
1A9	CR3		SAME AS 1A9CR2.			
1A9	CR4		SAME AS 1A9CR2			
1A9	CR5		SAME AS 1A9CR2			
1A9	K1		DELETED			
1A9	LSL	25A07	LOUDSPEAKER, PERMANENT MAGNET; 2.5" 1.5W	74199	1	062E11
1A9	S1	1PB833-T2	SWITCH, PUSH; Momentary contact, Spdt	91929	51	039E183
1A9	S2 (thru) S51		SAME AS 1A9S1			

CONTRACT NO:
CONTRACTOR: DATA DISPLAY, INC.
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DATE 3/1/65
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Assembly Reference	Symbol	Mfrs. Part Number (or FSN)	Description	Mfrs. Code	Unit Quantity	DDI P/N
1A9	T1	P-8130	TRANSFORMER, PWR, STEP-DOWN; 117V/12.6V	97965	1	038E40
1A9	TB1	3-141	TERMINAL BOARD; 3 terminals, #6-32 screw	75173	1	044E18
1A9	TB2	14-141	TERMINAL BOARD; 14 terminals #6-32 screw	75173	1	044E11
1	A10	107990	PANEL UNBLANK AMPLIFIER ASSY, WIRED	15920	1	107990
1A10	A1	106522	PRINTED CIRCUIT BOARD ASSEMBLY; type UA2A	15920	2	106522
1A10A1	C1	CP08A1KC-104K3	CAP., FXD, P DIELECTRIC; .1uf 200vdcw	56289	1	033E174
1A10A1	CR1	1N3064	SEMICONDUCTOR DEVICE, DIODE; Si 25V 250mw	01295	1	034E36
1A10A1	Q1	2N2405	TRANSISTOR; NPN Silicon power TO5 case	02735	2	088E61
1A10A1	Q2		SAME AS 1A10A1Q1			
1A10A1	R1	HB2211	RESISTOR, FIXED, COMP; 220 ohms 10% 2W	01121	1	032E436
1A10A1	R2	HB5611	RESISTOR, FIXED, COMP; 560 ohms 10% 2W	01121	3	032E435
1A10A1	R3		SAME AS 1A10A1R2			
1A10A1	R4		SAME AS 1A10A1R2			
1A10A1	R5	HB3311	RESISTOR, FIXED, COMP; 330 ohms 10% 2W	01121	1	032E418
1A10A1	R6	HB4725	RESISTOR, FIXED, COMP; 4.7K 5% 2W	01121	1	032E508
1A10	A2		SAME AS 1A10A1			
1A10	CB1	1N3002B	SEMICONDUCTOR DEVICE, DIODE; Si 75V 10W	04713	1	034E87
1A10	R1	RH-50	RESISTOR, FIXED, WIRE WOUND; 10K 1% 50W	91637	2	032E244
1A10	R2		SAME AS 1A10R1			
1	B1	26-3	FAN, CENTRIFUGAL; 115vac 60cps 392cfm	60513	1	030S30
1	F1	MDX-6-1/4	FUSE, CARTRIDGE; 6.25A @ 125V type MDX	71400	3	043E14
1	F2		SAME AS 1F1			
1	F3		SAME AS 1F1			
1	F4	MDX-4	FUSE, CARTRIDGE; 4.00A @ 125V, type MDX	71400	1	043E13
1	F5	313.750	FUSE, CARTRIDGE; 0.75A @ 125V, 3AGSB	75915	1	043E46

Assembly Reference	Symbol	Mfrs. Part Number (or FSN)	Description	Mfrs. Code	Unit Quantity	DDI P/N
1	J1	MS3102A-18-11P	CONNECTOR, RECP, ELEC; Solid shell 5 pin	02660	1	049E32
1	J2	MS3102A-18-11PX	CONNECTOR, RECP, ELEC; Solid shell 5 pin	02660	1	049E33
1	M1	632T100-A0008A	METER, TIME TOTALIZING; 99999 hr 115vac	14907	1	133A10
1	PS1	BPE22-1.5	POWER SUPPLY; 22KV @ 1.5 milliampere	14225	1	016S22
1	R1	830	RES., VAR, LIN PRECISION; 5K, 3%, 4.75W	02111	2	036E37
1	R2		SAME AS 1R1			
1	R3	830C	RES., VAR, LIN PRECISION; .5K, 3% , 4.75W	02111	4	036E41
1	R4		SAME AS 1R3			
1	R5		SAME AS 1R3			
1	R6		SAME AS 1R3			
1	R7	CB1811	RESISTOR, FIXED, COMP; 180 ohm 10% 1/4W	01121	2	032E189
1	R8		SAME AS 1R7			
1	R9	RH-50	RESISTOR, FIXED, WW; 180 ohms 1% 50W	91637	1	032E636
1	S1	2A	SWITCH, AIR FLOW; 5 amp @ 250vac	82877	1	039E14
1	TB1	14-141	TERMINAL BOARD; 14 terminals #6-32 screw	75173	1	044E11
1	TB2	3-141	TERMINAL BOARD; 3 terminals #6-32 screw	75173	1	044E18
1	V1	K2263-P31	ELECTRON TUBE; CRT 12" electrostatic defl	82170	2	014S49
1	V2		SAME AS 1V1			
1	XF1	HKL-X	FUSEHOLDER; Neon ind clr lens 90-300V	71400	4	055E11
1	XF2		SAME AS 1XF1			
1	XF3		SAME AS 1XF1			
1	XF4		SAME AS 1XF1			
1	XF5		SAME AS 1XF1			
1	XV1	3M14	SOCKET, ELECTRON TUBE; Bakelite diheptal	75173	2	042E10

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CONTRACTOR: DATA DISPLAY, INC.
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Assembly Reference	Symbol	Mfrs. Part Number (or FSN)	Description	Mfrs. Code	Unit Quantity	DDI P/N
1	XV2		SAME AS 1XV1			

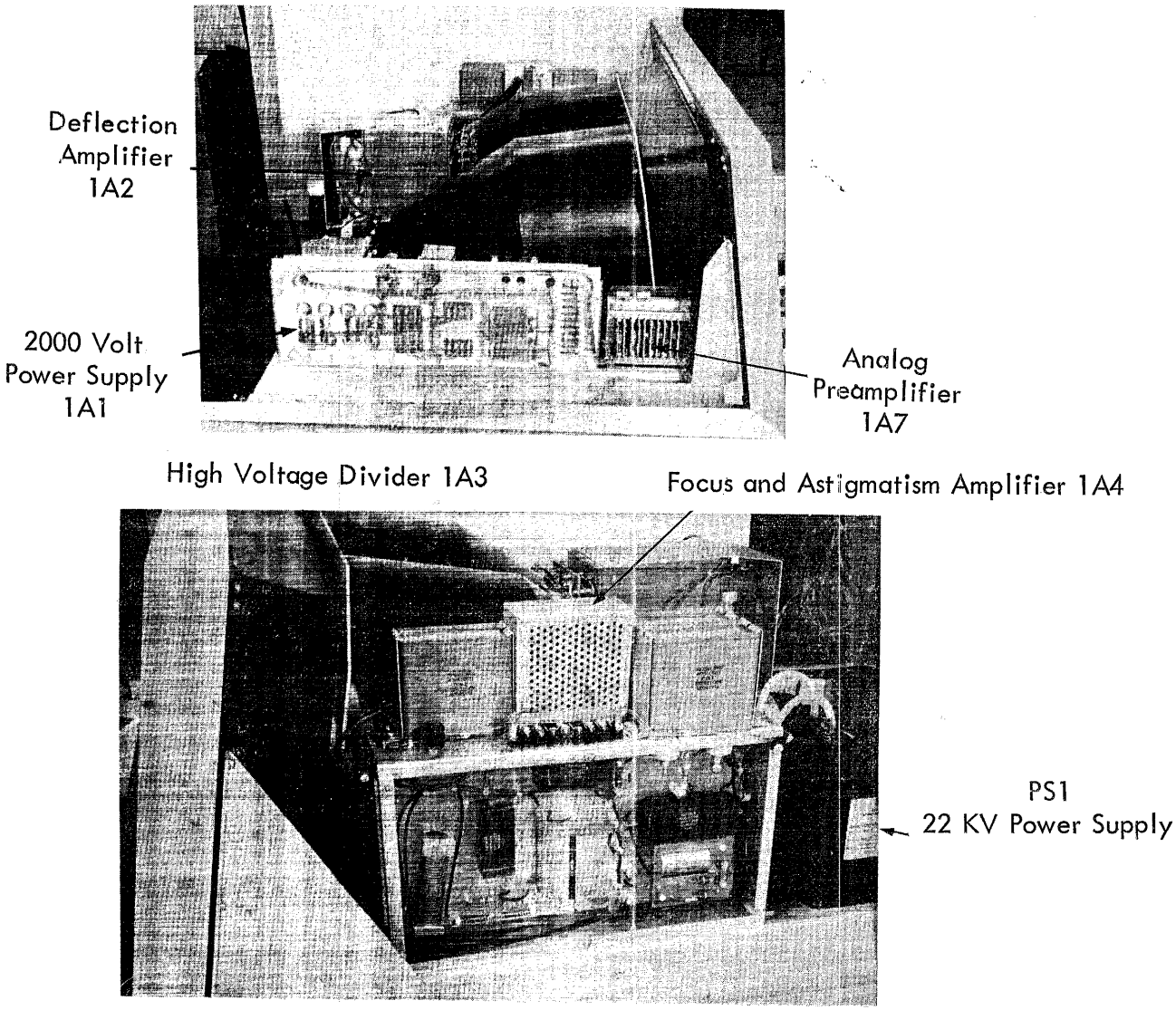


Figure 6-2. dd 60A Display System Assembly Locations

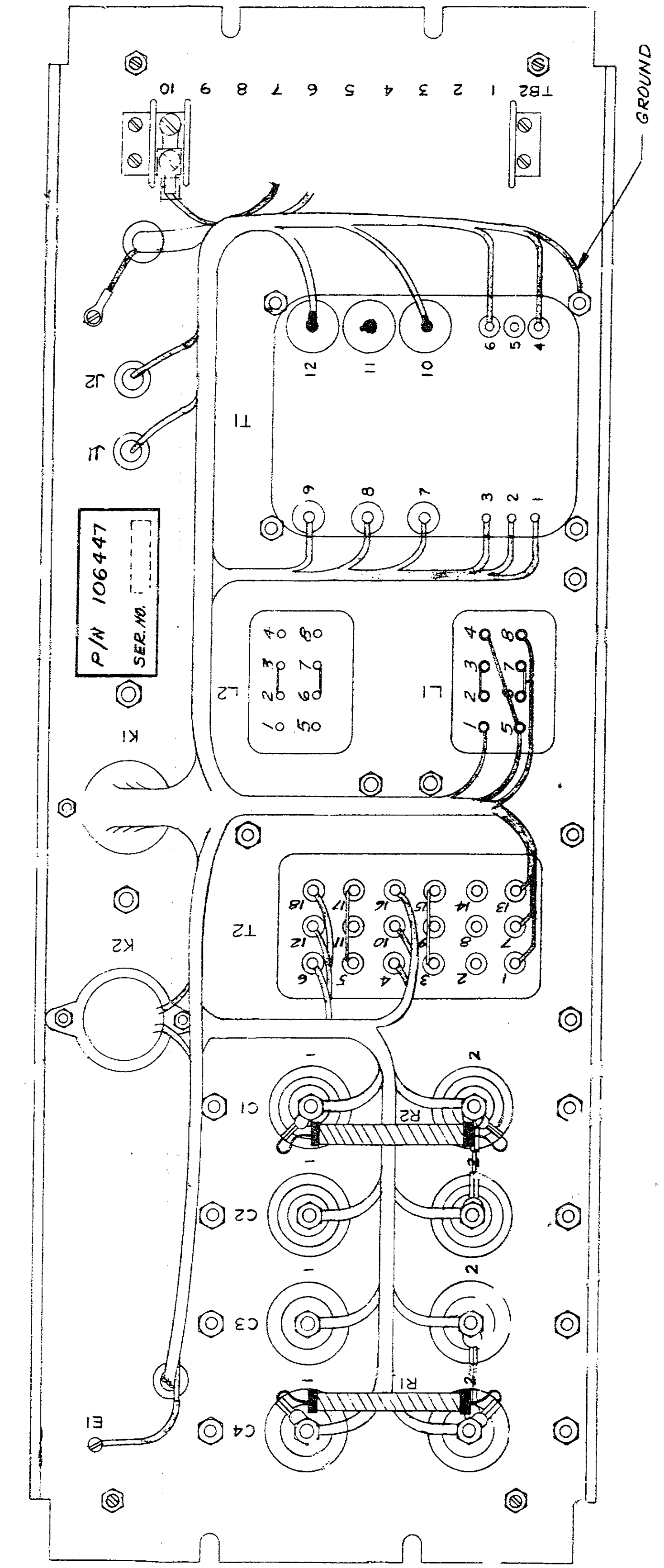


Figure 6-3. 2000 Volt Power Supply (1A1)

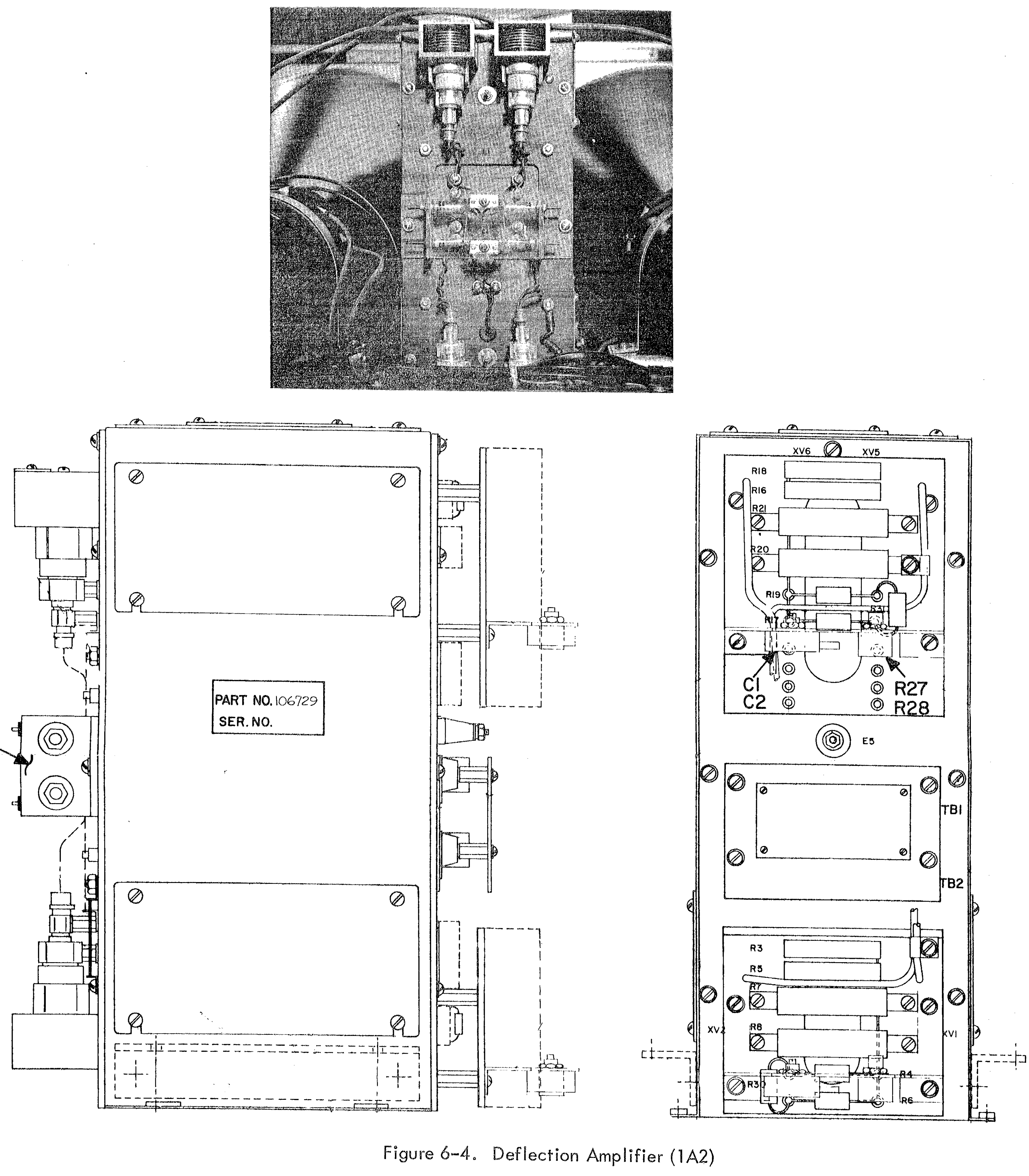


Figure 6-4. Deflection Amplifier (1A2)

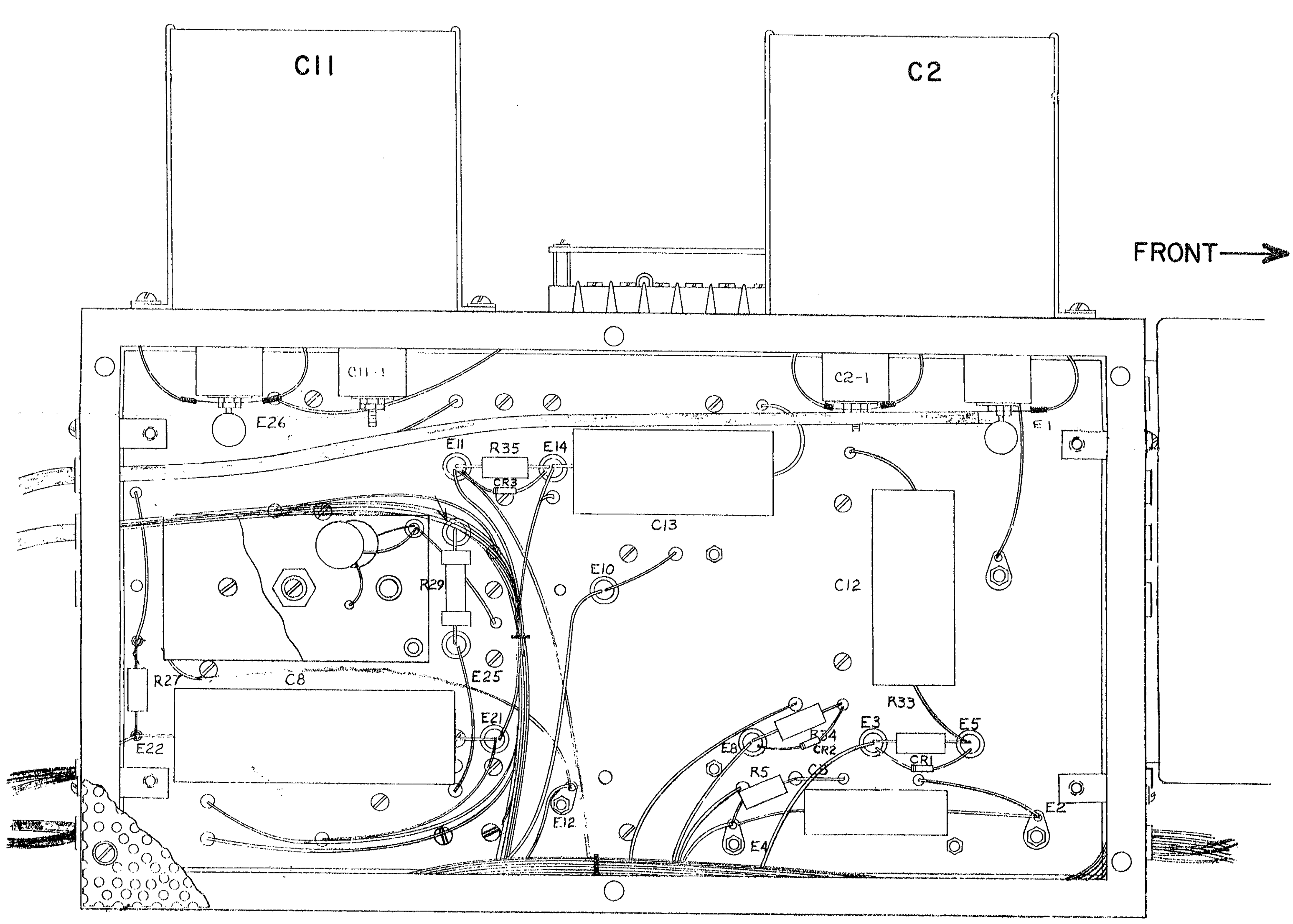


Figure 6-5. High Voltage Divider Inner Side (1A3)

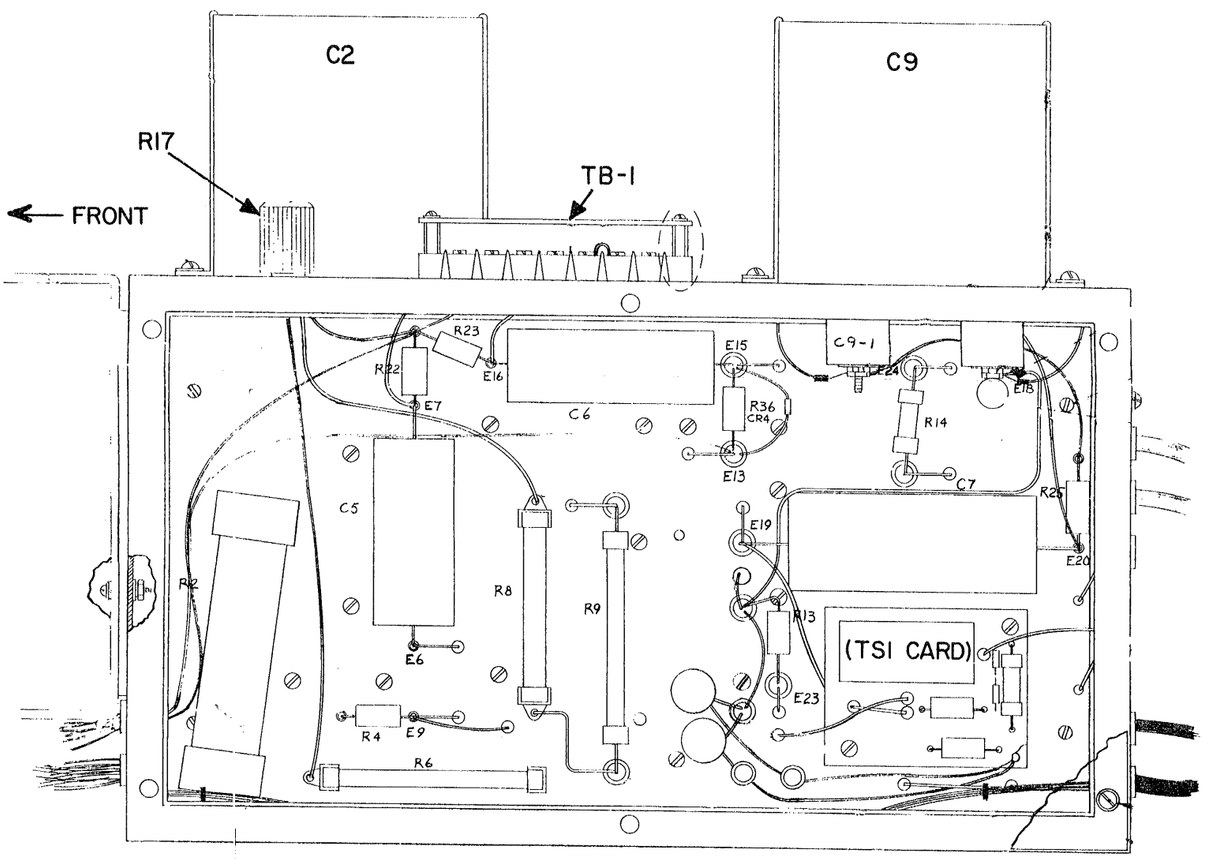


Figure 6-6. High Voltage Divider Outer Side (1A3)

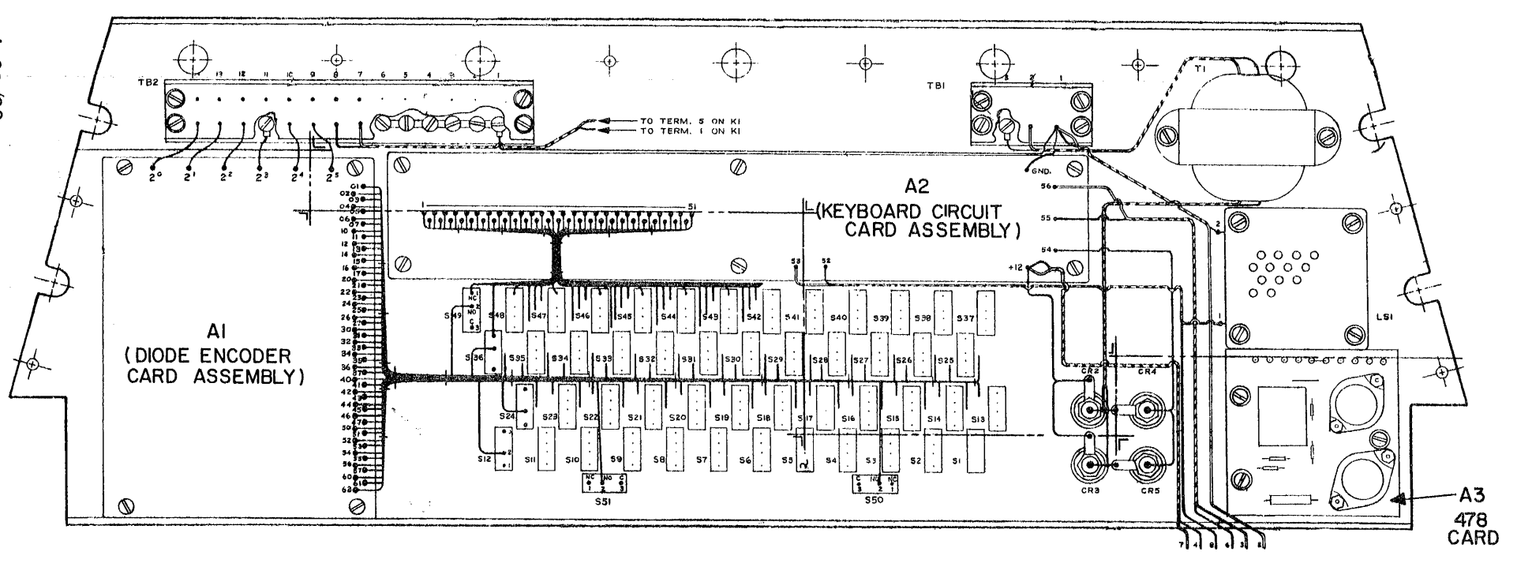


Figure 6-7. Keyboard Assembly (1A9)

Section VII

DRAWINGS

The diagrams of circuits used in the display equipment graphically portray the cable connections, logic connections, and component electrical connections. Figure 7-1 is a system diagram in block form.

The logic diagrams indicate the connections between the logic cards in block diagram form, with each block representing a logic card or a section of a logic card. Section III explains the use and terminology of the logic symbols.

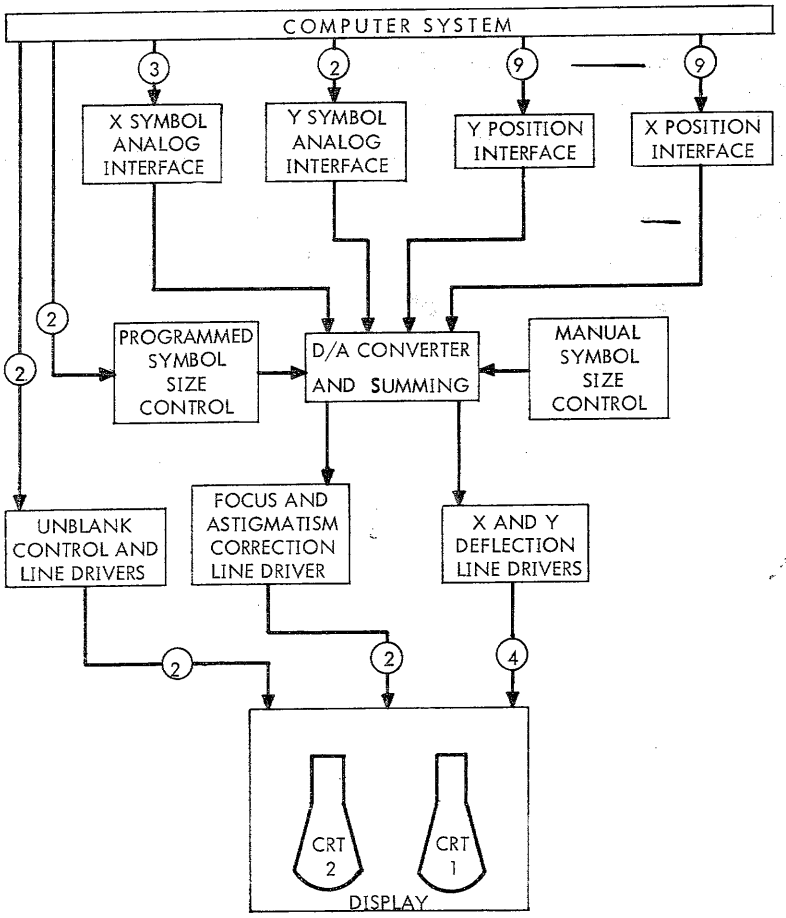
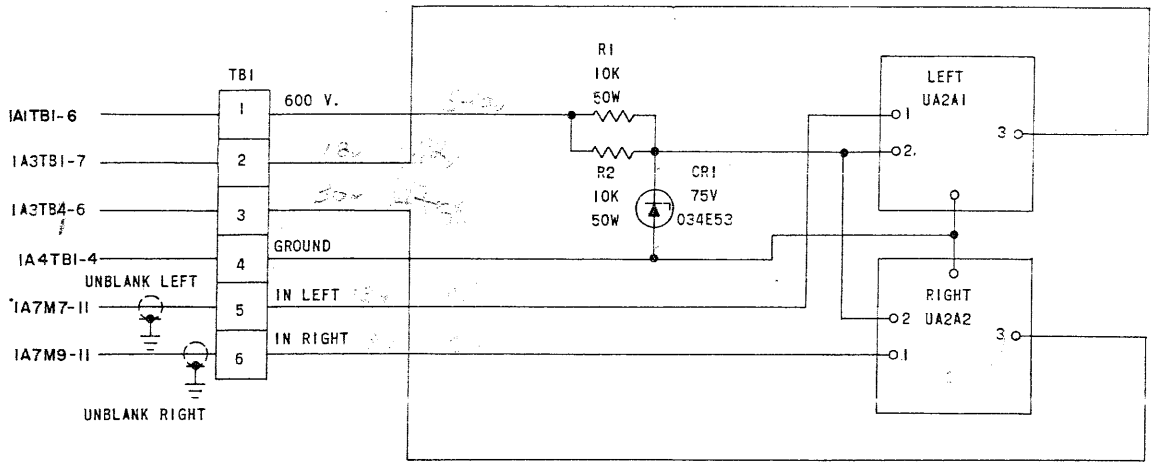


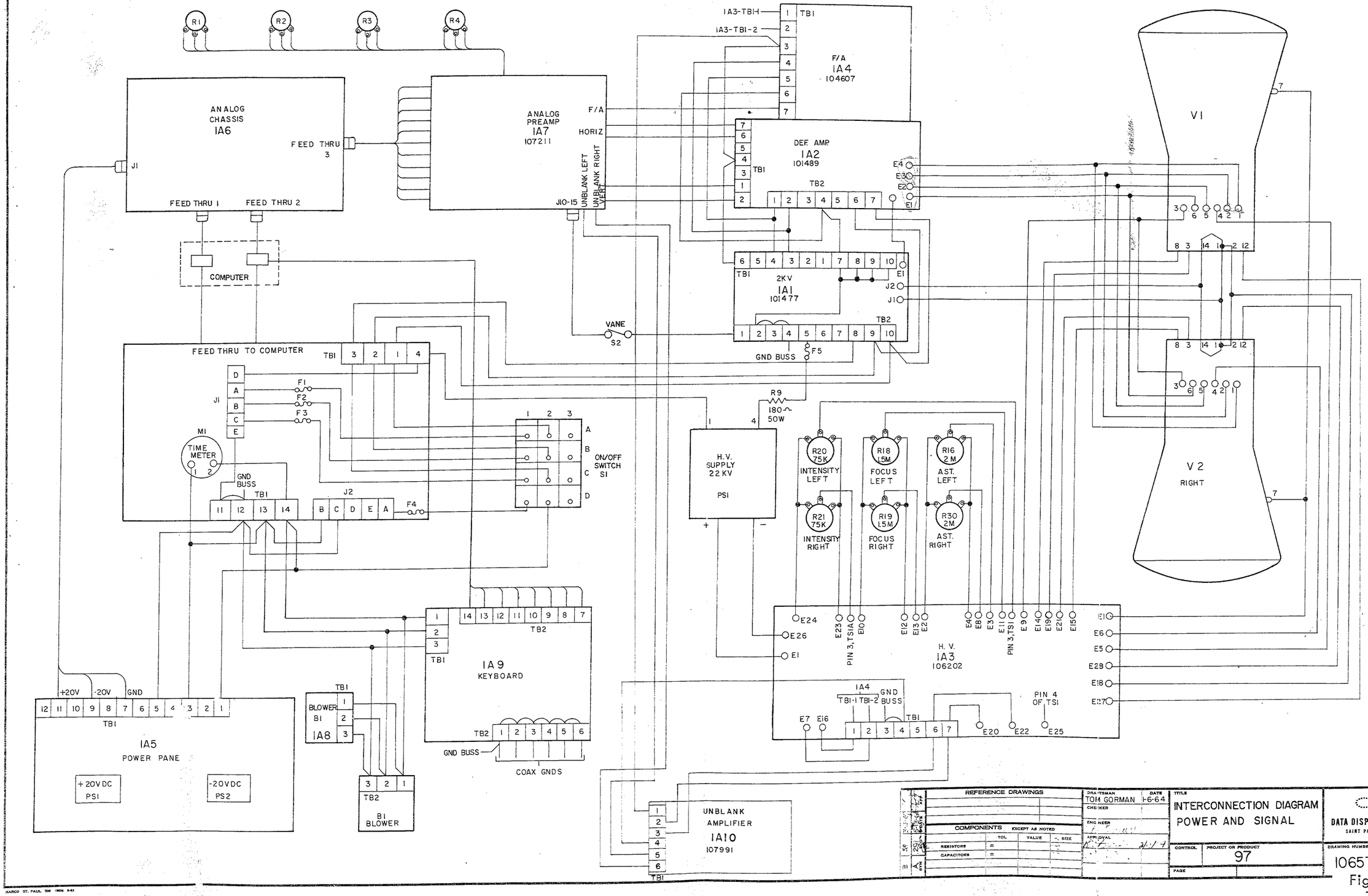
Figure 7-1. System Block Diagram



SCHEMATIC DIAGRAM
UNBLANK AMPLIFIER

REV. A

Figure 7-2



REV B
SWG NO. 106574

REFERENCE DRAWINGS

COMPONENTS EXCEPT AS NOTED

	TOL.	VALUE	+- SIZE
RESISTORS	±		
CAPACITORS	±		

DRAFTSMAN	TOM GORMAN	DATE 16-64
CHECKER		
ENG'NEER		
APPROVAL		

TITLE
INTERCONNECTION DIAGRAM
POWER AND SIGNAL

DATA DISPLAY, INCORPORATED
SAINT PAUL, MINNESOTA

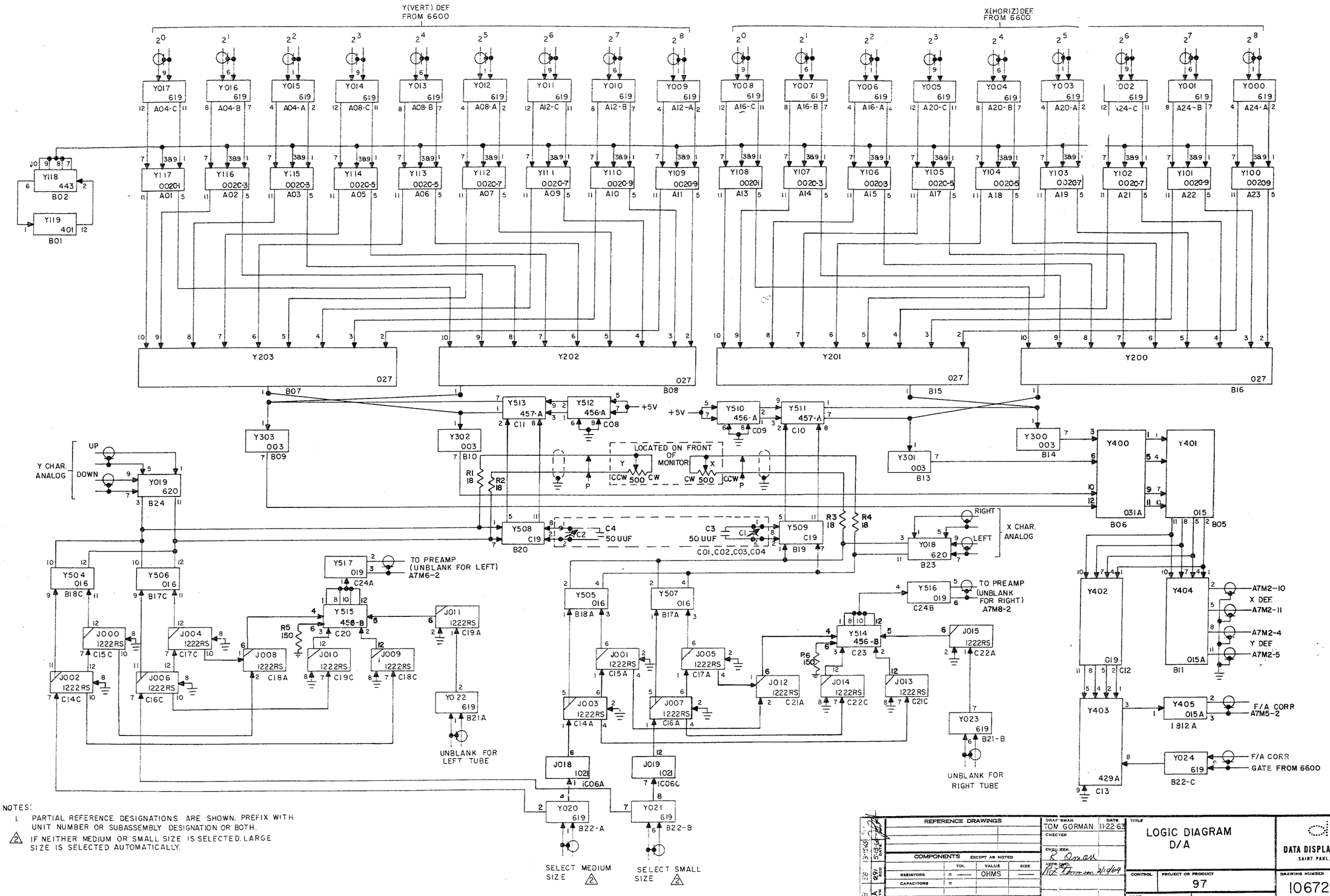
CONTROL | PROJECT OR PRODUCT 97

PAGE

DRAWING NUMBER
106574

Figure 7-3
7-3/4

HARCO ST. PAUL 300 1964 8-63



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION OR BOTH.
2. IF NEITHER MEDIUM OR SMALL SIZE IS SELECTED, LARGE SIZE IS SELECTED AUTOMATICALLY.

REFERENCE DRAWINGS

COMPONENTS EXCEPT AS NOTED

	TOL.	VALUE	SIZE
RESISTORS	±	OHMS	
CAPACITORS	±		

DRAFTSMAN: TOM GORMAN 11-22-63
CHECKER
ENGINEER: R. Omar
APPROVED: R.C. Gorman 2/1/64

TITLE: LOGIC DIAGRAM D/A

DATA DISPLAY, INCORPORATED SAINT PAUL, MINNESOTA

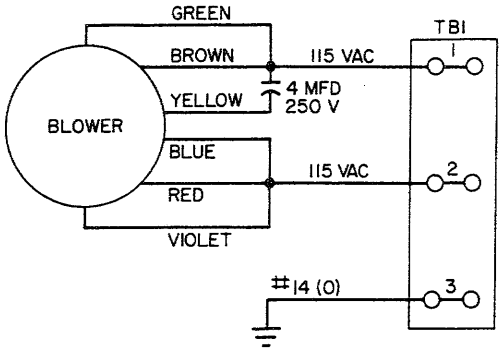
CONTROL | PROJECT OR PRODUCT: 97

PAGE

DRAWING NUMBER: 106721

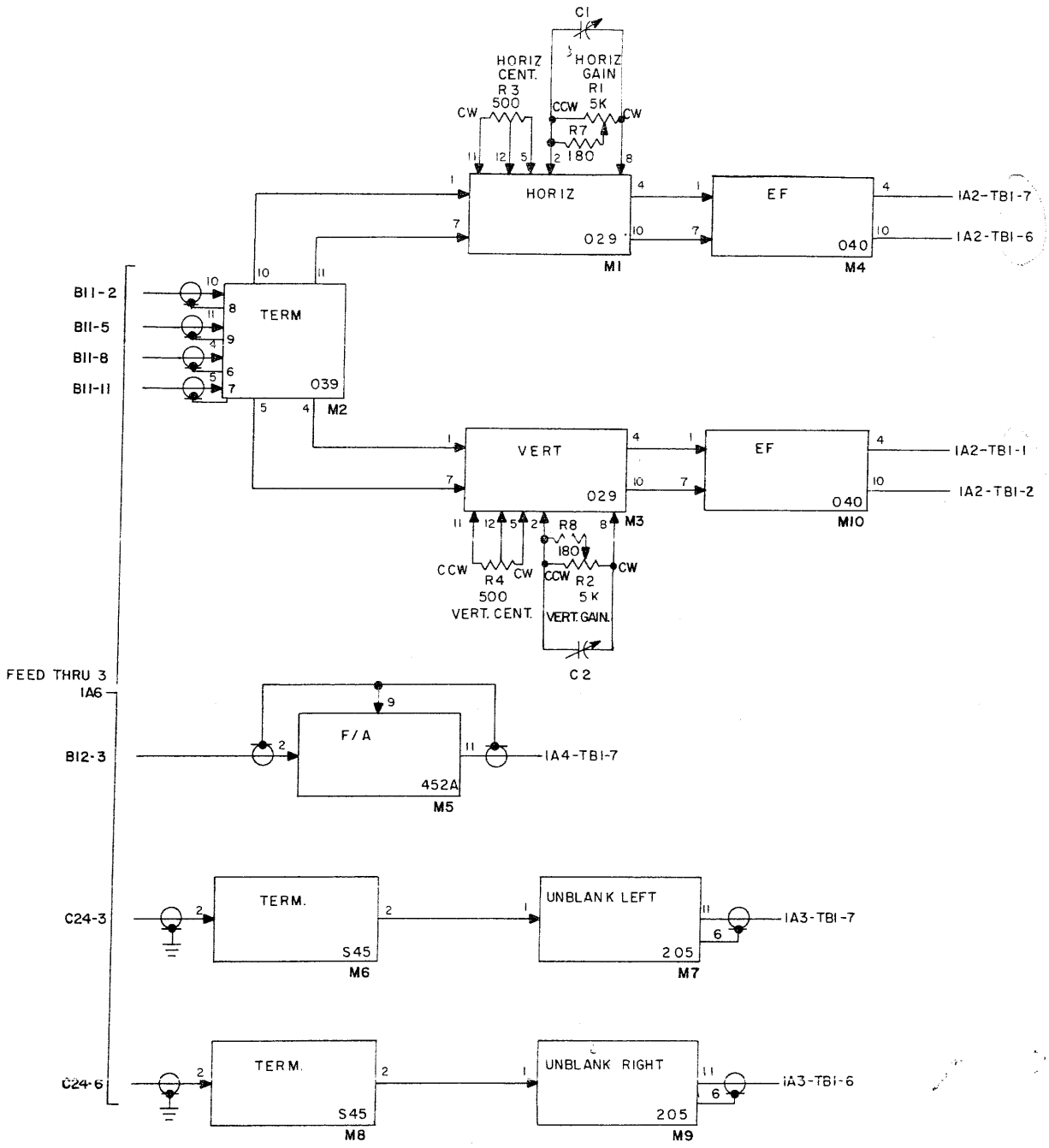
REV. B DWG NO. 106721

Figure 7-4
7-5/6



WIRING DIAGRAM,
BLOWER ASSEMBLY

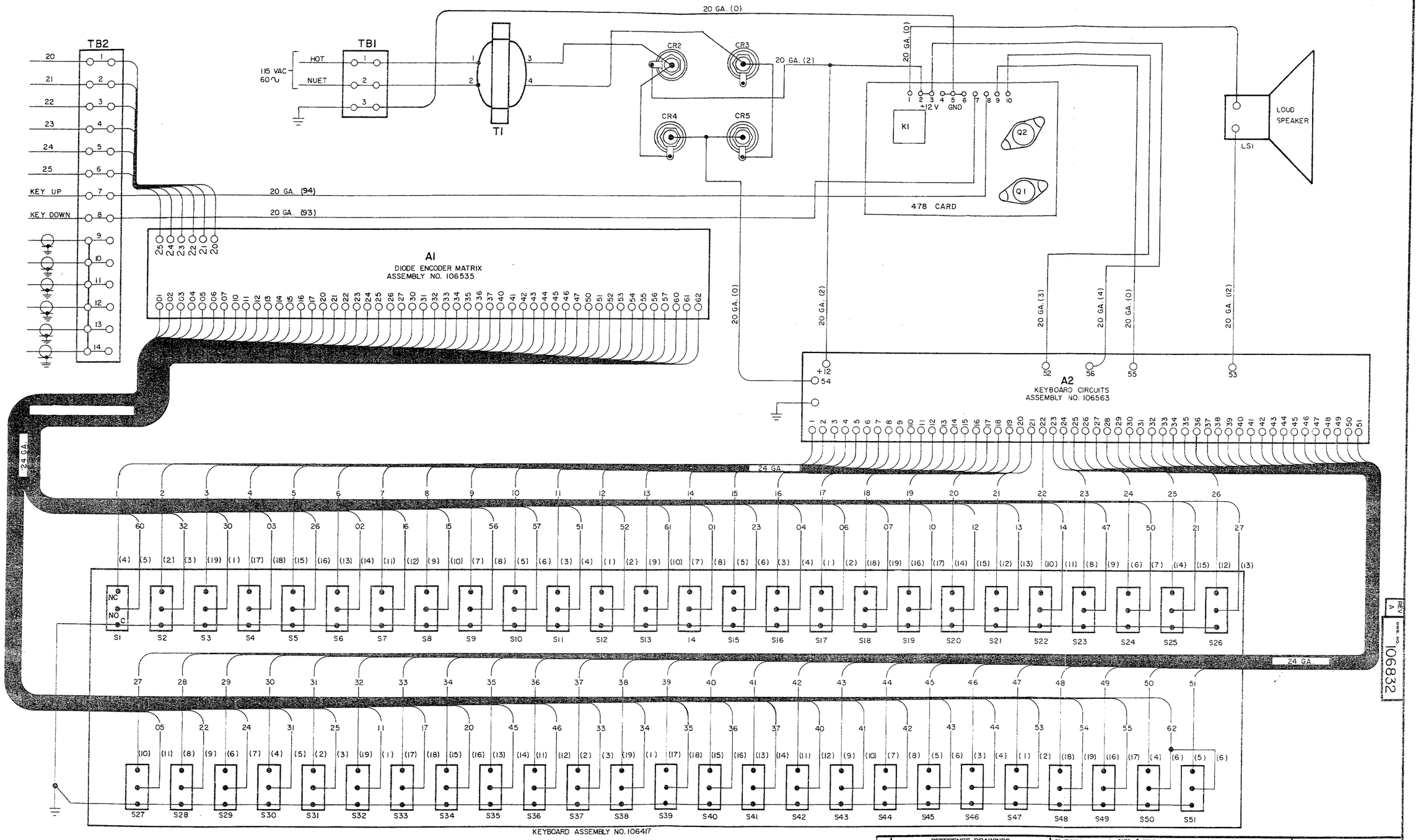
Figure 7-5



LOGIC DIAGRAM
ANALOG PREAMPLIFIER

REV. A

Figure 7-6



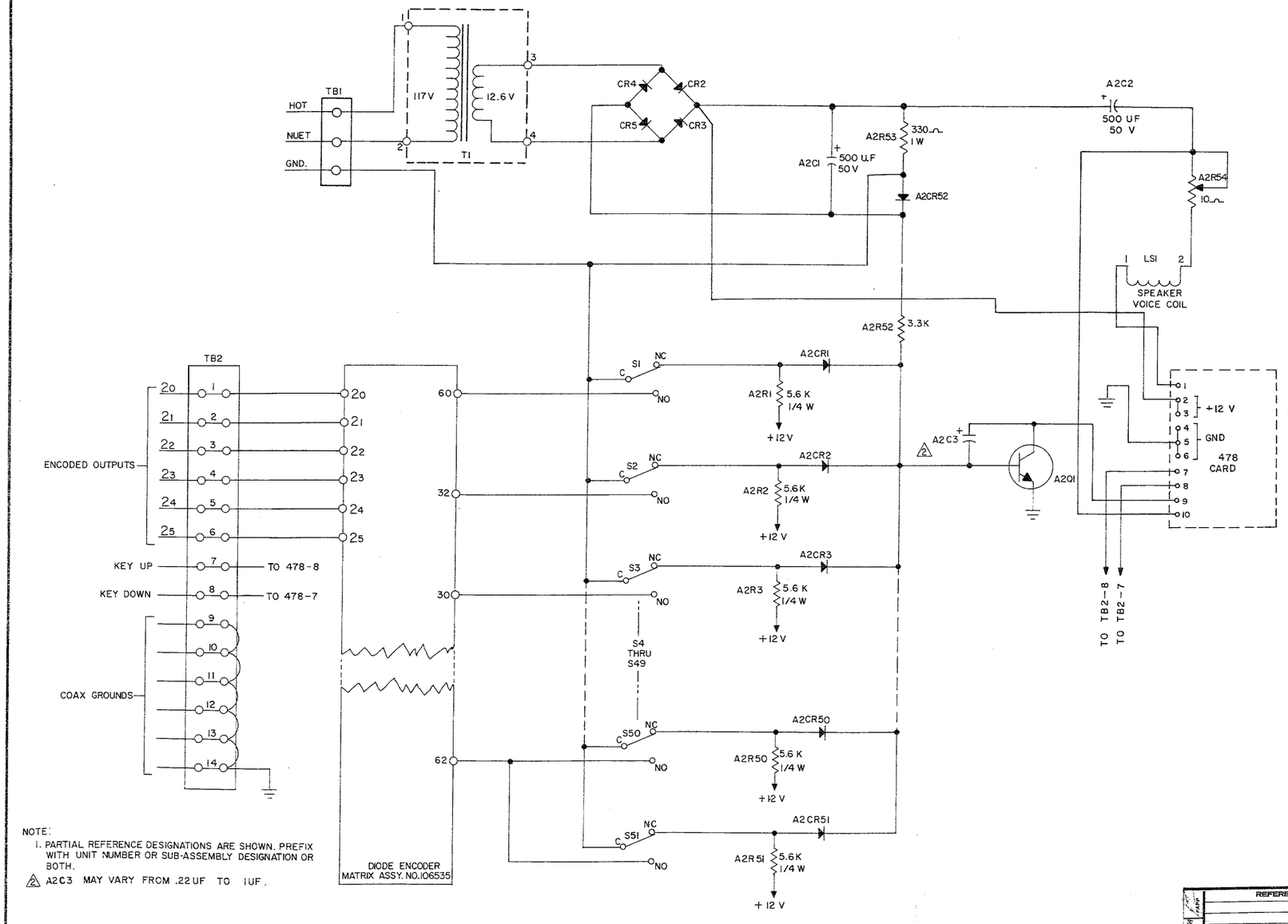
KEYBOARD ASSEMBLY NO. 106417

REFERENCE DRAWINGS	DRAFTSMAN	DATE	TITLE
	G. BONNIWELL	11-5-64	WIRING DIAGRAM, KEYBOARD
COMPONENTS EXCEPT AS NOTED: RESISTORS, CAPACITORS (TOL, VALUE, SIZE)	CHECKER		DATA DISPLAY, INCORPORATED, SAINT PAUL, MINNESOTA
	ENGINEER		CONTROL: 97
	APPROVAL		PROJECT OR PRODUCT
			DRAWING NUMBER: 106832
			PAGE

REV A

DWG. NO. 106832

Figure 7-7
7-9/10



NOTE:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. PREFIX WITH UNIT NUMBER OR SUB-ASSEMBLY DESIGNATION OR BOTH.

△2 A2C3 MAY VARY FROM .22 UF TO 1UF.

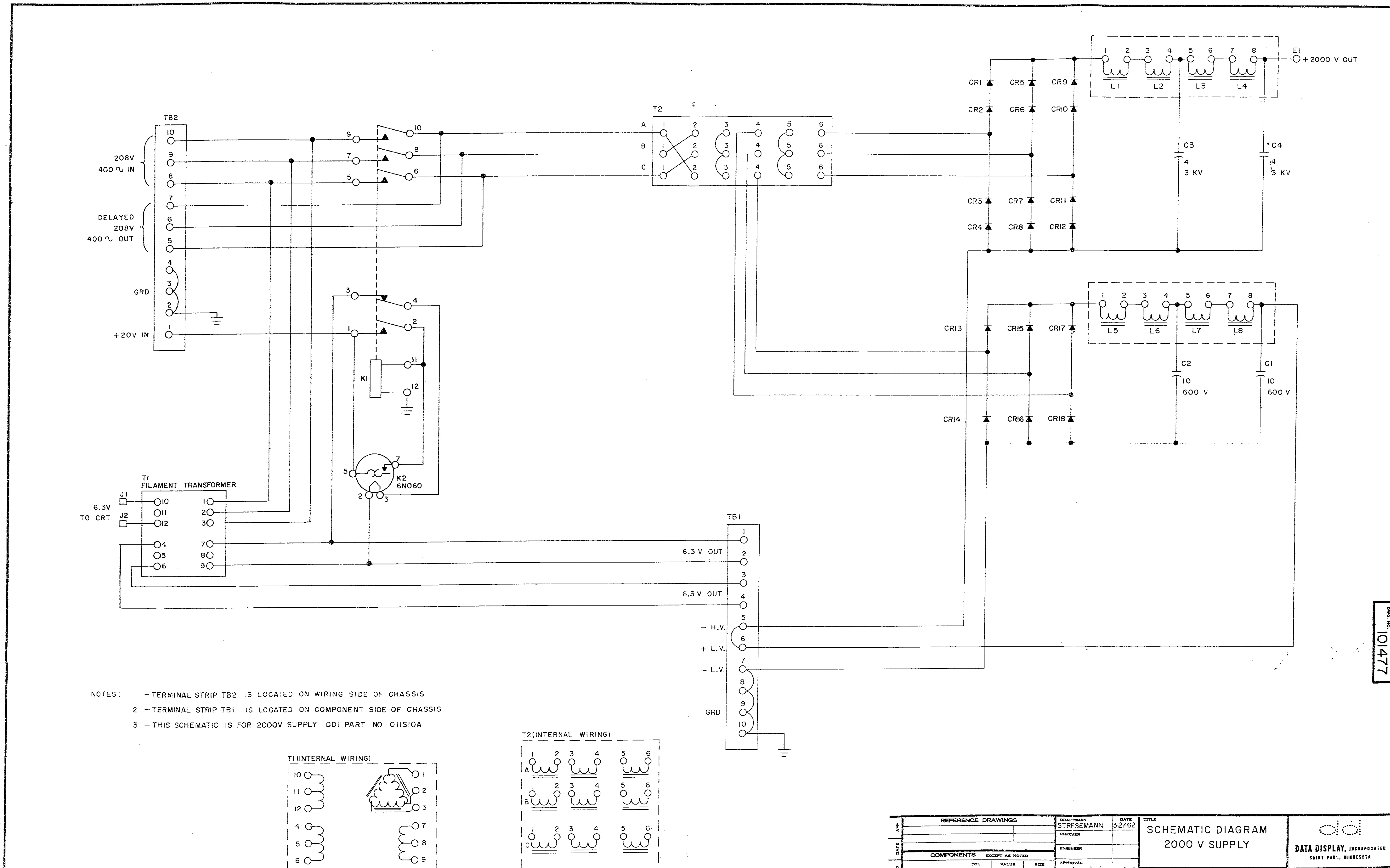
REV A

DWG NO. 107401

REFERENCE DRAWINGS			DRAFTSMAN G. BONNIWELL	DATE 12-30-63	TITLE SCHEMATIC DIAGRAM, KEYBOARD
			CHECKER		
COMPONENTS EXCEPT AS NOTED			ENGINEER		DATA DISPLAY, INCORPORATED SAINT PAUL, MINNESOTA
	TOL	VALUE	SIZE	APPROVAL	CONTROL / PROJECT OR PRODUCT: 97
RESISTORS	±				DRAWING NUMBER: 107401
CAPACITORS	±				PAGE

A 6TH 493 ECO 1/30/64 DATE

Figure 7-8
7-11/12



NOTES:
1 − TERMINAL STRIP TB2 IS LOCATED ON WIRING SIDE OF CHASSIS
2 − TERMINAL STRIP TB1 IS LOCATED ON COMPONENT SIDE OF CHASSIS
3 − THIS SCHEMATIC IS FOR 2000V SUPPLY DDI PART NO. 011510A

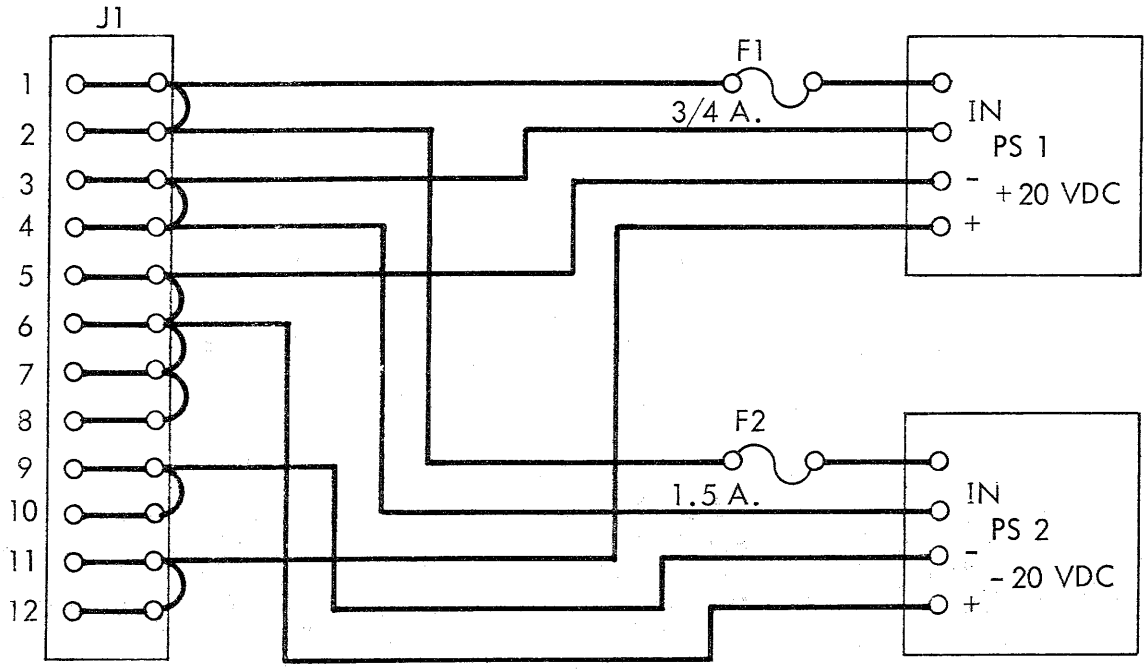
REFERENCE DRAWINGS	DRAFTSMAN	DATE	TITLE
	STRESEMANN	3-27-62	SCHEMATIC DIAGRAM 2000 V SUPPLY
COMPONENTS EXCEPT AS NOTED	CHECKER		
RESISTORS =	ENGINEER		
CAPACITORS = UF	APPROVAL W.C. [illegible]	11-7-62	

DATA DISPLAY, INCORPORATED
SAINT PAUL, MINNESOTA

DRAWING NUMBER 101477

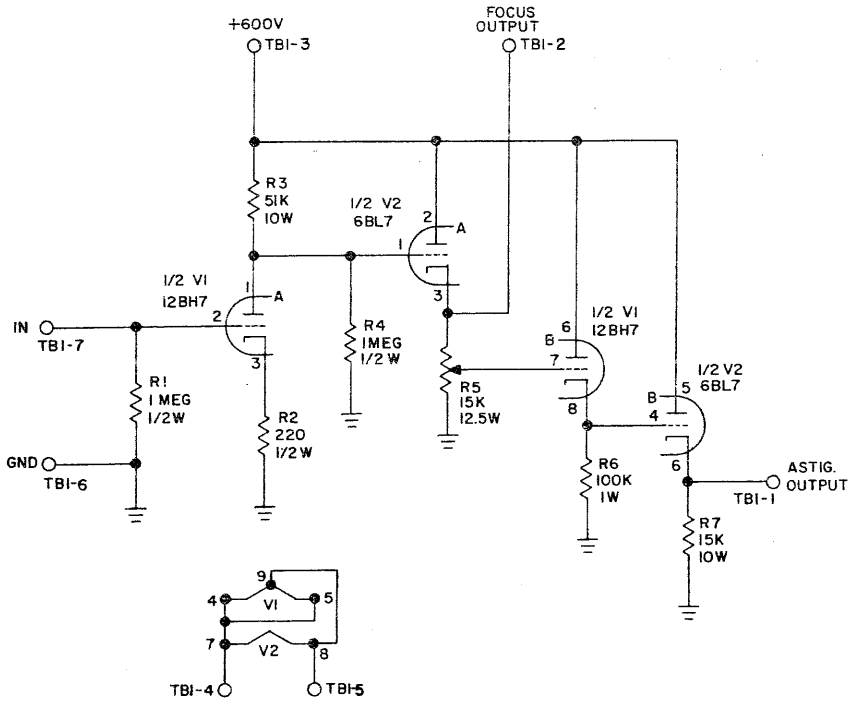
DWG. NO. 101477

Figure 7-9
7-13/14



SCHEMATIC DIAGRAM
± 20 VOLT
POWER SUPPLY

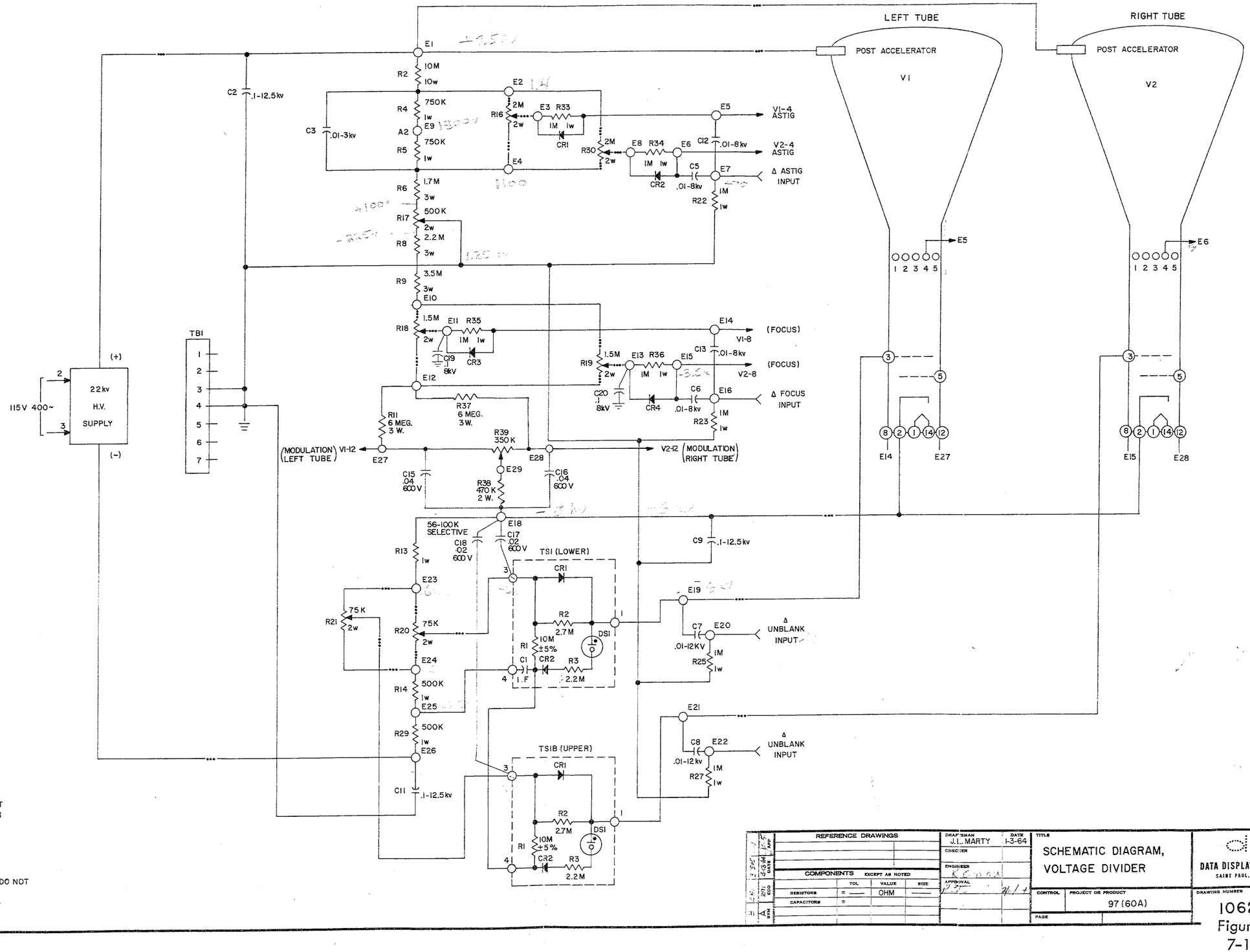
Figure 7-10



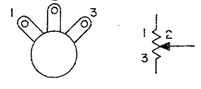
NOTE:
ALL GROUNDS ARE COMMON.

APP	REFERENCE DRAWINGS				DRAFTSMAN D.R. LA CASSE	DATE 5-2-63	TITLE SCHEMATIC DIAGRAM, FOCUS & ASTIGMATISM CORRECTION AMPLIFIER	DATA DISPLAY, INCORPORATED SAINT PAUL, MINNESOTA
DATE					CHECKER			
	COMPONENTS EXCEPT AS NOTED				ENGINEER			
ECO		TOL	VALUE	SIZE	APPROVAL		CONTROL / PROJECT OR PRODUCT	DRAWING NUMBER
	RESISTORS	± —	—	OHMS				104607
	CAPACITORS	± —	—	—			PAGE	

Figure 7-11



4. R16, R17, R18, R19, R20, R21 & R30 TERMINAL NO'S. FOR WIRING REFERENCE ONLY.



3. —•••— DENOTES WIRE TO COMPONENT WHICH DOES NOT LIE PHYSICALLY ON THIS ASSEMBLY.

2. CRT AND POWER SUPPLY ARE NOT PART OF THIS ASSEMBLY, SHOWN FOR CONNECTIONS ONLY.

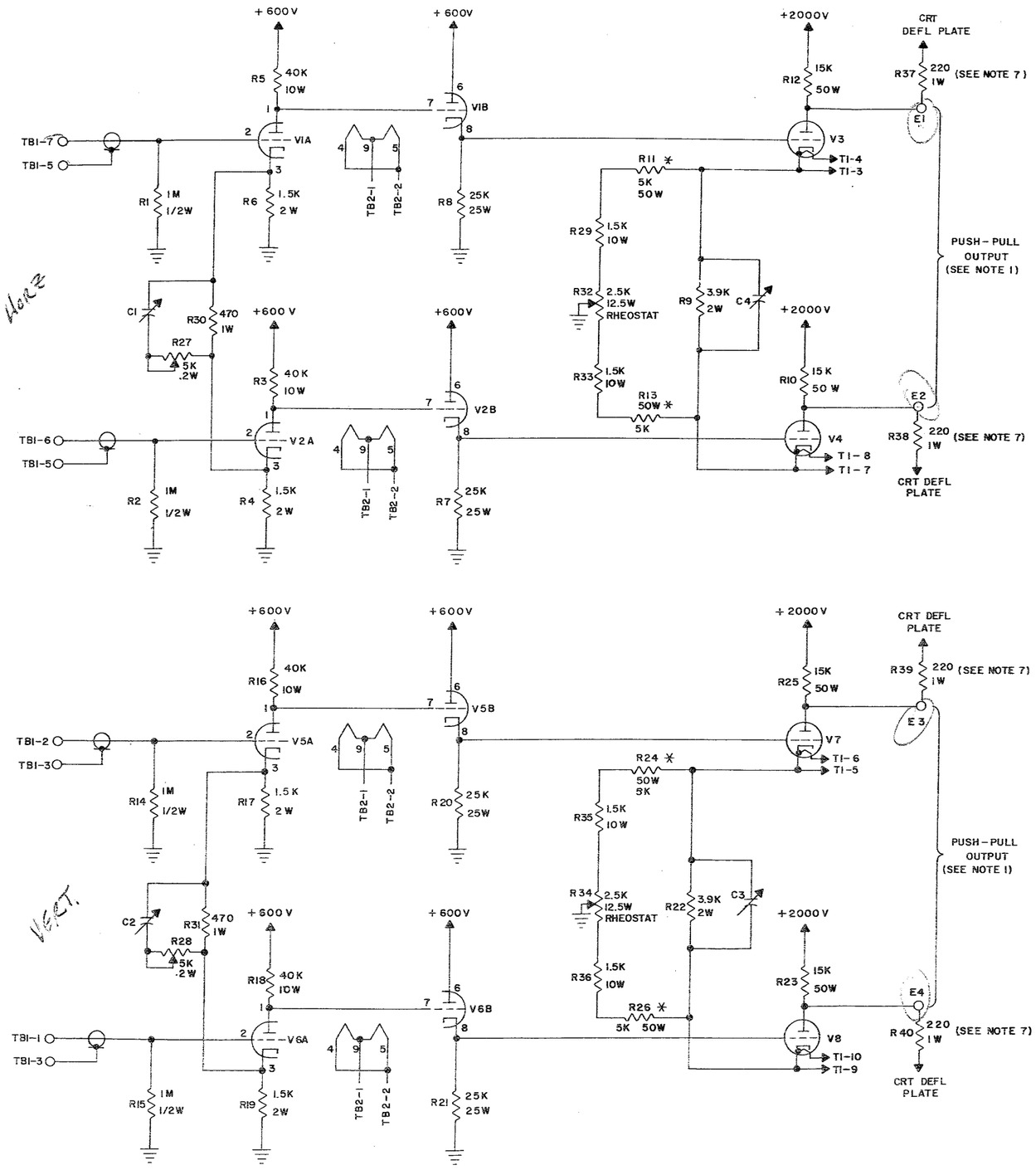
1. R16, R30, R18, R19, R20, R21, R31 & R32 DO NOT LIE PHYSICALLY ON THIS ASSEMBLY.

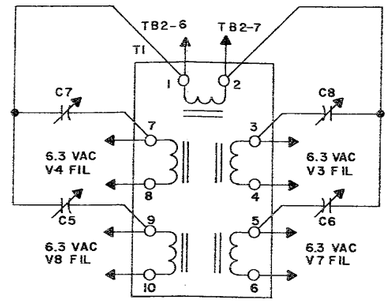
REV. B
DWG NO. 106202

REFERENCE DRAWINGS			DRAFTSMAN J.L. MARTY	DATE 1-3-64	TITLE SCHEMATIC DIAGRAM, VOLTAGE DIVIDER
COMPONENTS EXCEPT AS NOTED	TOL	VALUE	SIZE	CHECKER	DATA DISPLAY, INCORPORATED SAINT PAUL, MINNESOTA
RESISTORS	± ——	OHM		ENGINEER	CONTROL
CAPACITORS	±			APPROVAL	PROJECT OR PRODUCT 97 (60A)
					PAGE

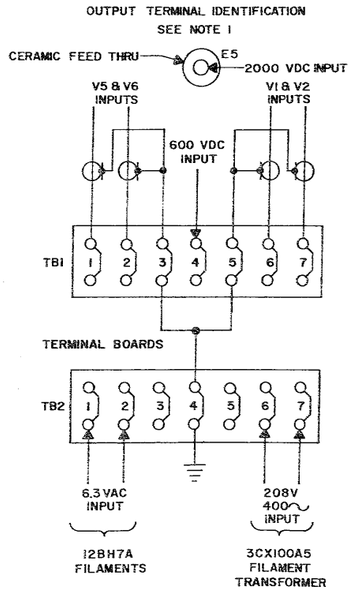
DRAWING NUMBER
106202
Figure 7-12
7-17/18

HARCO ST. PAUL. 500 1M 8-63





TYPICAL ELECTRICAL CONNECTION OF TRIMMER CAPACITORS



TUBE TYPE	V-NUMBERS
12BH7A	1, 2, 5, 6
3CX100A5	3, 4, 7, 8

NOTE:
1. THE OUTPUT TERMINALS E1-E4 OF THE DEFLECTION AMPLIFIER ARE THE SCREWS ON THE COOLING HOODS OF THE 3CX100A5'S.
2. TRIMMERS C1 & C2 ARE 1400MMF TO 3055MMF.
3. TRIMMERS C3 & C4 ARE 55MMF TO 300MMF.
4. TRIMMERS C5, C6, C7, & C8 ARE .8MMF TO 13MMF PISTON CAPS.
5. TIMES # M11193 COAX (4 PLACES).
6. * NON-IND. TYPE
7. R37 THRU R40 ARE PARASITIC SUPPRESSOR RESISTORS IN SERIES WITH THE LEADS TO THE CRT DEFLECTION PLATES.

REV. 106037

REFERENCE DRAWINGS	DRAFTSMAN	DATE
	R. L. HUHN	9-6-63
COMPONENTS EXCEPT AS NOTED	CHECKER	
	ENGINEER	
	APPROVAL	

	TOL.	VALUE	SIZE
RESISTORS	±10%	OHMS	
CAPACITORS	±		

TITLE: SCHEMATIC DIAGRAM DEFLECTION AMPLIFIER

DATA DISPLAY, INCORPORATED SAINT PAUL, MINNESOTA

CONTROL | PROJECT OR PRODUCT | PAGE

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Figure 7-13
7-19/20

GLOSSARY OF TERMS AND DEFINITIONS

AND — A logical function which determines a true or false answer for a combination of statements such as A and B according to the following table.

A	B	A and B
False	False	False
False	True	False
True	False	False
True	True	True

AND Circuit — A circuit which has two or more inputs and an output which results in an output signal only if all the inputs receive signals.

Bit — A contraction of binary digit.

Blanking — Extinguishing the CRT electron beam.

C — Capacitor.

Console — A cabinet which contains a monitor or other unit.

CRT — Cathode ray tube.

D/A — Digital-to-analog.

Data — A plural term used to designate a group of numeric or alphabetic material.

DC — Direct current.

DDI — Data Display, Incorporated

Information — A collection of data.

Input — The data that is transferred into the display unit from an external device.

GLOSSARY OF TERMS AND DEFINITIONS (CONT.)

K	Relay.
KV	Kilovolts.
L	Choke.
Matrix	The area used for formation of a symbol centered on a base positioning point.
Monitor	A CRT assembly including all associated power and driving circuits.
OR	A logical function which determines a true or false answer for a combination of statements such as A or B according to the following table.

A	B	A or B
False	False	False
False	True	True
True	False	True
True	True	True

OR Circuit	A circuit which has two or more inputs and an output which results in an output signal if any input receives a signal.
Painting	The action of the electron beam in forming a symbol on the CRT.
POT.	Potentiometer.
PP	Peak to peak.
Q	Transistor.
R	Resistor.
Raster	Display area on the CRT.

GLOSSARY OF TERMS AND DEFINITIONS (CONT.)

RC	Resistance capacitance.
S	Shorted.
Symbol	Characters, numbers, letters, punctuation marks, or specially formed figures.
T	Transformer.
Trimmers	Variable capacitors.
Unblanking	Intensifying the CRT electron beam.
V	Volts.
VAC	Volts, alternating current.
X	Horizontal.
Y	Vertical.